VOL. 19 NO. 1 **JAN / FEB 1996**

CALENDAR OF EVENTS

Jan 3
Wed
7:00 pm

Salt Lake Chapter Meeting. Glen Beagle from Lone Peak Nursery will be our guest speaker. Lone Peak Nursery is associated with the Utah State Prison and they raise trees for reforestation and plants for reseeding. Also a project of interest is the ponds and riparian plants they use at the nursery to clean the run-off water. University of Utah, Law Bldg. Watch for your blue card to give a room and directions.

Jan 24
Wed
7:00 pm

Red Butte Garden and Arboretum will present guest speaker Lauren Springer author of *The Undaunted Gardner*. The program is held at the Cottam Visitor Center, Red Butte Garden and Arboretum, 300 Wakara Way, Salt Lake City. Fee is charged.

Feb 1
Thur
12:00 noon -
1:30 pm

Red Butte Garden and Arboretum Thursday Garden Get Togethers' topic is Bald Mountain Wildflowers, Uintas. This is one of the free lecture series presented by Red Butte and will be given by William King, Uintas Tour Coordinator of the Wasatch Rock Garden Society. Garden Admittance fee is required. Red Butte Garden and Arboretum, 300 Wakara Way, SLC.

Feb 7
Wed
7:00 pm

Salt Lake Chapter Meeting. Brian Getzelman from Arbor Care will speak on the topic of *Brian's Favorite Shade Trees for Utah.* Brian says his favorites change, but you will get his pick at present.

BOARD OF DIRECTORS

LATEX IN PLANT DEFENSE

by Robert Fitts

White erupted from the broken dandelion stem. I was back at my old sport of pulling apart plants and watching latex come out. I did this as a preschool child and it still tempts me. What is the white stuff in many plants, and why does it squirt out upon injury? Why is it more abundant in some parts of the plant, especially the influorescence? Old questions, and I wasn't the first to ask them.

Latex is in a pressurized system of tubes, and it coagulates on the surface of an injury. The analogy with blood in the arteries of animals was so strong that botanists 200 years ago gave it a term then used for animal fluids, latex. Many of the biologists of that day were also physicians, so the name latex seemed natural. They also were interested because the latex of some plants had medicinal properties. When it was later learned that the latex system did not function to circulate the essential nutrients for life as blood does, the function question remained. Some thought the special latex cells (laticifers) were like a garbage dump for metabolic waste. Others thought on more ecological lines and speculated that they were a defense system.

Latex of most plants is found in specialized cells called laticifers. Laticifers form an extensive interconnecting network within some plants. In other plants they parallel the vascular system in multiple or elongate single cells. The cells are specialized to secrete the many chemicals found in the latex. One researcher found the secretory power of the laticifers of the rubber tree. DNA for making a protein was added to a rubber tree cells. When the cells were propagated and grown into rubber trees, the protein was found in abundance in the laticifers, but was rare throughout the rest of the plant.

The chemical in plant latex that first comes to mind is rubber. This is an organic chain that gives the property of coagulation to this type of plant fluid. Dropping milkweed latex into an acid solution will coagulate the rubber into tiny balls. Molecules that break down bacterial cell walls are found in latex, but specially adapted bacteria live in the laticifers of rubber trees. Chitinase is a chemical that breaks down the cell walls of fungi and the skeletons of insects. It is found in several forms in the latex of many plants. The alkaloids of plant latex are noteworthy in the opium poppy. The Handbook of Plant Alkaloids lists many plants as sources of drugs, including morphine in our native prickly poppy. Cardenoloids are the chemicals that protect monarch butterflies from predators. Milkweeds contain cardenoloids throughout the plant, but they are highly concentrated in the latex and accumulate in the bodies of monarch butterfly caterpillars as they feed.

Imagine being an insect herbivore on a latex bearing plant. How will you make a meal of a plant that may glue your jaws together, or permanently stick you to the surface? You might also be poisoned by toxic alkaloids, have your body parts digested by an enzyme, or have your digestive tract turn to solid rubber.

Lettuce plants have laticifers very close to the surface. They are especially abundant on the flower buds, bracts and pedicels. Aphid legs are glued down by the erupting latex, or they may.have their wings stuck together. White flies are somewhat better off, with a coating of powdery, waxy scales on their bodies. Many more of them will escape than aphids, but they still prefer to feed on the lower parts of the plant where they are less likely to be trapped. Aphids and whiteflies avoid the laticifers when feeding by piercing their mouth parts into the phloem in between the laticifers. But what about insects that chew rather than suck plant juices?

Insects adapted to eat plants with latex may cut the laticifers below the point where they wish to feed and release the pressure. The nasty latex will drain and the insect can feed above. If the plant has laticifers along the veins, the insect will chew there, but if the plant has an interconnecting network of latex ducts, the insect must cut a trench at the base of a leaf where it wishes to feed and release the latex. Woolly bear caterpillars can sense the presence of latex in a leaf and will refuse to eat if it is present. However, if a monarch caterpillar is placed on the same leaf and does its vein cutting activity to release the latex pressure, the woolly bear will sense that it's safe and have a meal. Experimenters have placed drops of latex in front of a feeding monarch caterpillar, which will return to the base of the leaf to do some vein cutting.

The presence of a defensive ductwork of laticifers is important in the natural selection of plants. Botanists studying the importance of laticifers have found greater speciation among groups of plants with this defensive mechanism than among closely related groups of plants without them.

Look for plants with latex in the grocery store (lettuce, bananas and onions), while in your garden (periwinkles, poinsettias), or in many wild plants. Families with latex include many of the Asteraceae, Apocinaceae, Euphorbiaceae and Asclepiadaceae.

Further reading

Farrell, B., D. Dussourd, C. Mitter. 1991. Escalation of plant defense: Do latex/resin canals spur plant diversification? American Naturalist 138:881-900.

Dussourd, D. , R. F. Denno. 1991. Deactivation of plant defense; correspondence between insect behavior and secretory canal architecture. Ecology 72: 1383-1396.

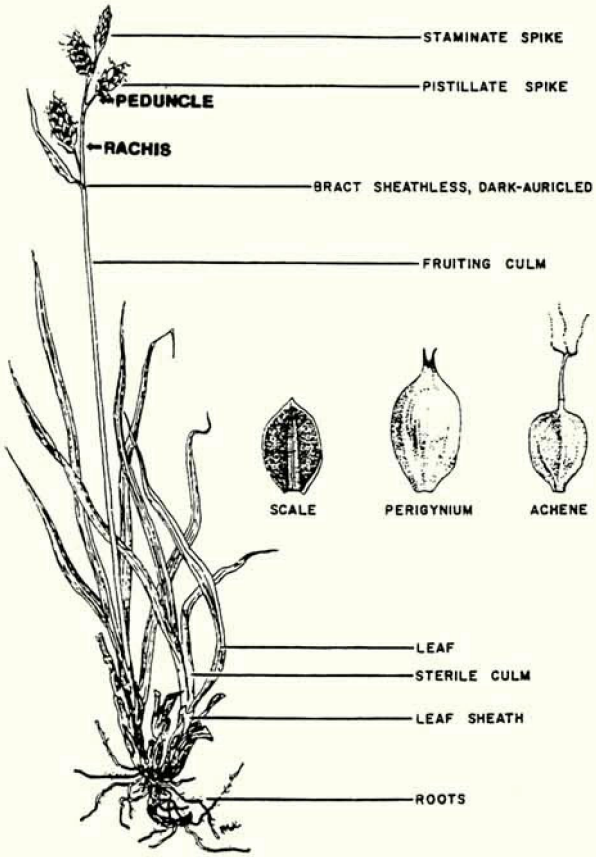
CAREX (Sedge)

Morphological Features

	Grass	Sedge
Stems	With jointed nodes, often hollow, rounded or somewhat flattened in cross section.	Without jointed nodes, not hollow, often triangular in cross section, but rounded in many species.
Spikelets or Spikes	Spikelets usually of 2 glumes and 1 or more florets. Florets staminate, pistillate or commonly bisexual with 3 stamens and an ovary with 3 stigmas that ripens into a caryopsis (seed). Each floret usually with a lemma, and a palea.	Spikes of unisexual flowers each subtended by a small flower bract often called a scale. Staminate flowers of usually 3 stamens. Pistillate flowers of an ovary with 2 or 3 stigmas. The ovary ripening into an achene (single seed) which is enclosed in a sac or perigynium.

Useful Terminology

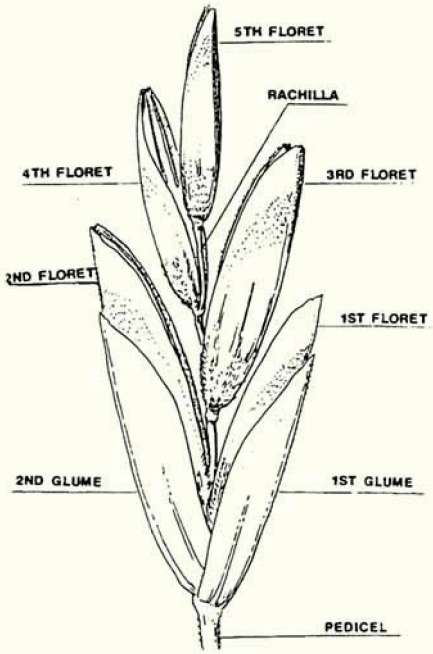
androgynous An inflorescence with the staminate flowers borne above the pistillate flowers.
auricle. A small ear-like appendage.
bract / glume A reduced leaf-like structure at the base of a spikelet.
culm A stem
floret A small flower or a flower in a dense cluster of flowers.
gynaecandrous An inflorescence with the pistillate flowers borne above the staminate flowers.
monoecious Flowers imperfect, with pistillate and staminate flowers on the same plant.
perigynium a scalelike bract enclosing the pistil
pistillate Having pistils (female reproductive organs) but no stamens (male reproductive organs).
rachis A stem-like structure that supports the inflorescence.
rachilla A small rachis.
spike An unbranched inflorescence with flowers maturing from the bottom upward.
spikelet A flower cluster.
staminate..Having stamens (male reproductive organs) but no pistils (female reproductive organs).



Carex raynoldsii

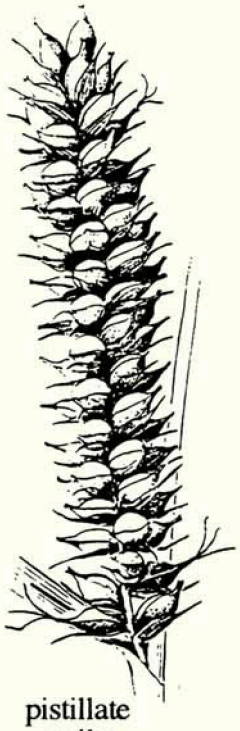
floret

spike



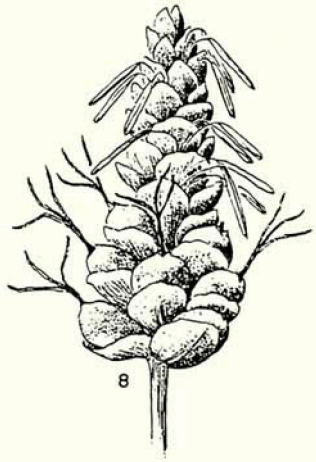
spikelet

staminate spike



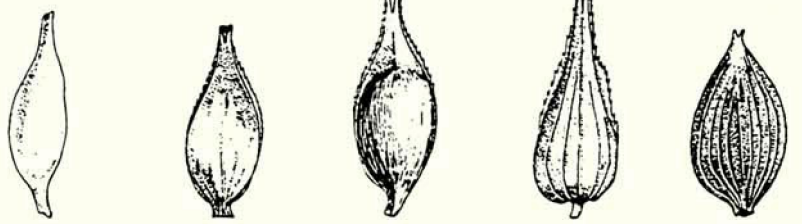
pistillate spike

gynaecandrous spike

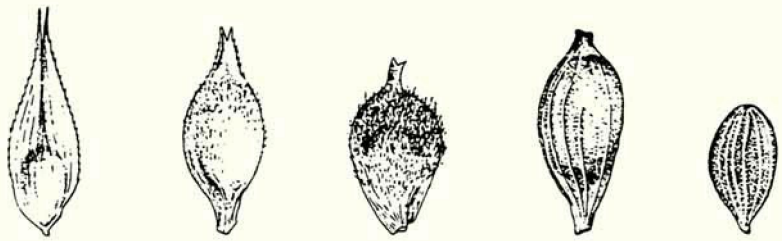


androgynous spike

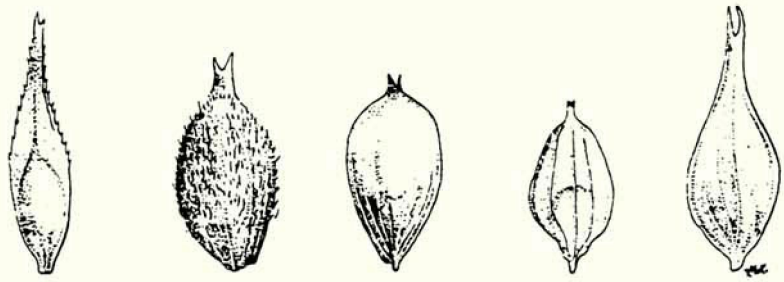
REPRESENTATIVE PERIGYNIA OF CAREX



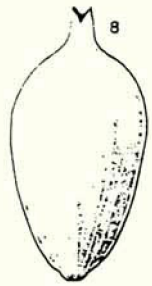
C. nigricans C. eleocharis C. hoodii C. stipata C. canescens



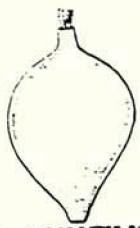
C. microptera C. rossii C. pseudoscirpoidea C. drummondiana C. hassei



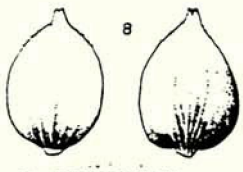
C. misandra C. lanuginosa C. atrata C. kelloggii C. rostrata



C. NEBRASKENSIS



C. AQUATILIS



C. SIMULATA

CAREX L. Sedge UTAH

1 Spikes solitary, the perigynia attached directly to the rachis ..... **KEY 1**
1 Spikes more than one, sometimes densely congested into a head that resembles a solitary spike, the perigynia attached to a rachilla and the rachilla attached to the rachis
  2 Terminal spike staminate
    3 Lower spikes staminate or androgynous; inflorescence mostly spikelike or headlike ..... **KEY 2**
    3 Lower spikes pistillate; inflorescence often not particularly spikelike or headlike
      4 Stigmas 2; achenes lenticular; pistillate scales often black or black-purple or with blackish lines flanking a greenish or pale midstripe, often contrasting with the greenish or stramineous perigynia ..... **KEY 6**
      4 Stigmas 3; achenes trigonous; pistillate scales often greenish or brownish, of if blackish then usually about the same color as the perigynia ..... **KEY 7**
  2 Terminal spike androgynous or gynaecandrous; lower spikes also androgynous or gynaecandrous
    5 Stigmas 3; achenes trigonous; inflorescence with 3-5 (rarely more) spikes, these often subtended by a leaf-like bract; terminal spike gynaecandrous; lateral spikes mostly all pistillate; pistillate scales black or blackish purple ..... **KEY 5**
    5 Stigmas 2; achenes lenticular; inflorescence commonly with more than 5 spikes or else the pistillate scales paler than above, not subtended by a leaflike bract (except in C. athrostachya); spikes mostly all androgynous, all gynaecandrous, or some or all of them unisexual.
      6 Spikes androgynous or unisexual ..... **KEY 2**
      6 Spikes gynaecandrous
        7 Perigynia round-margined, not winged, not conspicuously flattened, mostly less than 3.5 mm long; scales pale green to brown; inflorescence commonly less than 2 cm long and/or less than 1 cm wide; plants mostly of wet places ..... **KEY 3**
        7 Perigynia wing-margined, often conspicuously flattened, sometimes longer than above; scales commonly brown to dark brown, often with a green midrib; inflorescence often longer and/or wider than above (a large section of the genus with many look-a-likes **KEY 4**

Keys referred to above are those of A Utah Flora (Welsh et al. 1987, 1993). Numbers of keys are also the same as those in Uinta Basin Flora (Goodrich & Neese 1986). Illustrated treatments of the genus that included species of Utah are found in Cronquist et al (1977) and Hermann (1970).

References

Cronquist, Arthur; Holmgren, Arthur H; Holmgren, Noel H; Reveal, James L; Holmgren, Patricia K. 1977. Intermountain flora. Vol 6. New York. NY: Columbia University Press. 584 p.

Goodrich, Sherel; Neese, Elizabeth; 1986. Uinta Basin Flora. Ogden, UT: U.S. Department of Agriculture, Forest Service, Region Four. 320 p.

Hermann, Frederick J. 1970. Manual of the Carices of the Rocky Mountains and Colorado Basin. Agriculture Handbook No. 374. US. Department of Agriculture, Forest Service. Washington DC: U.S. Government Printing Office. 397 p.

Welsh, Stanley L.; Atwood, N. Duane; Goodrich, Sherel; Higgins, Larry C. 1987. A Utah Flora. Great Basin Naturalist Memoirs No. 9. 894 p.

Welsh, Stanley L.; Atwood, N. Duane; Goodrich, Sherel; Higgins, Larry C. 1993. A Utah Flora, second ed, revised. Provo, UT: Print Services, Brigham Young University. 986. p.

The following is a test. This is a drawing taken from the Intermountain Flora. Use the key which has been provided to determine which key (1 -7) should be used next. If this part was easy you can get out your Utah Flora and attempt to speciate this *Carex*. The answer will be on the last page of the newsletter.

A special thanks to Sherel Goodrich, botanist for the Ashley National Forest District, for providing pictures, information and keys. This was meant to be only an introduction to the genus Carex, more terminology and stem and root characteristics would be necessary for speciation of most plants.

NAVAJO SEDGE
(*CAREX SPECUICOLA*)

Members of the Inscription House Chapter of the Navajo Nation know this plant as "yellow hay" and "food for the animals" and are aware that it is a riparian plant. They say that the species was once widespread, even in the lowlands, wherever water was abundant. (Navajo Sedge Recovery Plan).

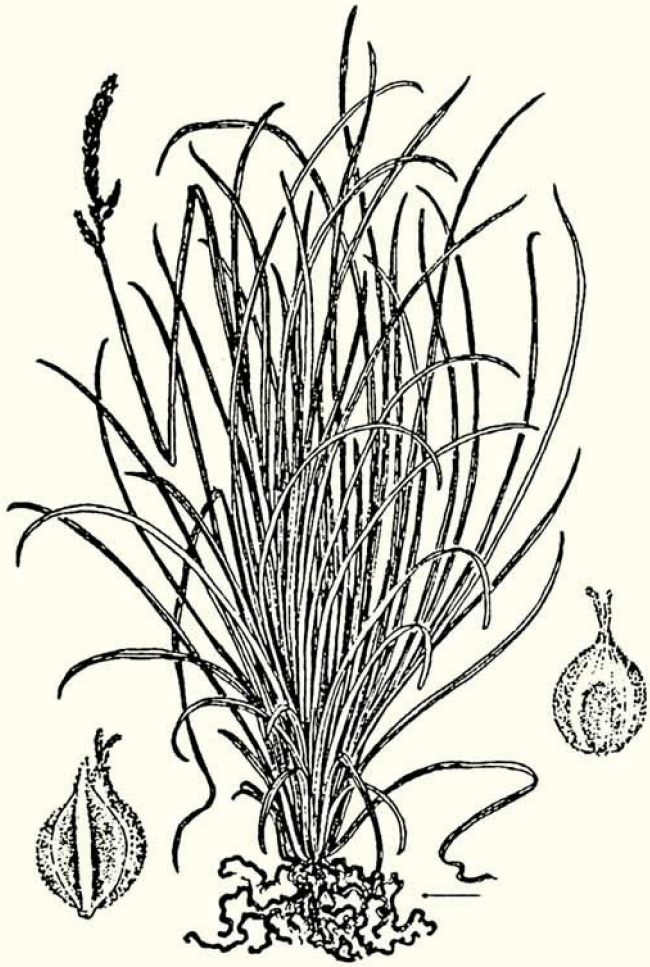
What happened to the Navajo sedge to put it on the endangered species list? A couple of word clues are given in the preceding quotation. 1) "Food for animals". Increased grazing pressure has greatly reduced plant numbers at accessible sites. The sedge grows in hanging gardens, wet alcoves and Navajo Sandstone seeps. A wet spot in an otherwise arid country attracts grazing animals which then forage on the carex. In one of these sites a corral had been built enclosing the animals with the sedge. 2) "Riparian". The Navajo sedge requires water and is at times in a losing competition for water with animals. Water had been diverted for cow troughs at one of the sites.

The Navajo Sedge is endemic to the Navajo Nation and was first collected along the Inscription House Ruin Trail in Coconino County, Arizona in 1948 by J.T. Howell. Other small populations in the vicinity were located in the 1980s and one of these was across the Utah border in San Juan County, Utah. This *Carex* is found in hanging gardens ranging from sheer cliff walls to alcoves. Some of the associated species found with it are monkey flower (*Mimulus eastwoodiae*), helleborine (*Epipactis gigantea*), water bentgrass (*Agrostis semiverticillata*), sand bluestem (*Andropogon hallii)*, thistle (*Cirsium sp.*), and a reed (*Phragmites communis*).

Carex specuicola is a slender, perennial forb, 2.5 to 4.5 dm (10-18 inches) high. The triangular stem extends from an elongate, slender rhizome. The leaves are pale green, 1-2 mm (<0.1 inch) wide, 12-20 cm (5-8 inches) long, and are clustered near the plant's base. The flowers are concentrated in 2 to 4 groups or spikes. The terminal spike has both male and female flowers, with the female flowers situated above the male flowers (gynaecandrous). The flowers are reduced and inconspicuous; they consist of small green-brown, scale-like parts 2-3 mm (0.1 inch) long and 1-1.5 mm (<0.06 inch) wide. Flowering and fruit set occur from late June through July. This species is unusual but not unique in having both two-branched styles, with lenticular achenes, and three-branched styles, with trigonous achenes. Bill Hevron, at the time botanist for the Navajo Natural Heritage Program, has observed a lot of size variation in the plant with the plant appearing to grow taller in areas where it remained shaded much of the day.

References

USFW, Navajo Sedge Recovery Plan, 1987
Utah Endangered, Threatened, and Sensitive Plant Field Guide, 1991.



Carex specuicola

UNPS HORTICULTURAL COMMITTEE

Four UNPS members (Rod Hardy, Marty Steitz, D.X. Ross and Tom Srenka) have expressed interest in joining with Dick Page to form a horticultural committee. Marty, Rod, D.X., and Dick have met and initiated selected native plant trial seedings at their individual residences. They plan on reporting planting successes etc. following seedling establishment this coming spring. For this initial planting small quantities of native seed previously obtained by UNPS were used. This seed was rather old and germination may be questionable. Committee members were agreeable to using this seed for their initial trial plantings. The committee will be obtaining native seed catalogs and other references for background in deciding on species to use in future plantings.

UNPS SEGO LILY
c/o Jo Stolhand
Utah Native Plant Society
P.O. Box 520041
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VOLUNTEERS

The UNPS is looking for volunteers. We need a new chapter president for the Salt Lake Chapter. The main duty is to conduct meetings and arrange for speakers for the meetings. The job can be further expanded according to interest . The Salt Lake Chapter is also seeking an individual to organize field trips, but not necessarily to lead them. Anyone interested in filling one of these posts or any other should contact Brent Shipley (801-268-2601).

Brent as President of UNPS is also making his goal this year to add new chapters to the UNPS. So lets hear from some of our members in Provo, Moab, St George/Cedar City, and other places throughout the state. We need your help.

Volunteers need not be professional botanist. Many of our chapter presidents have not been. If you have some organizational skills, like people and plants, you are probably just who we are looking for.

Red Butte Garden and Arboretum is also looking for volunteers as educational docents, horticultural aides, and visitor center assistants. Contact Susan Fox (801-585-5688).

Answer to the test
Key 7 *Carex rostrata*

Membership Application

☐ New Member ☐ Renewal ☐ Gift

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Zip _____ Phone _____

If Gift, from: _____

Check Membership category desired:

- ☐ Student $6.00
- ☐ Senior $10.00
- ☐ Individual $12.00
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☐ Please send a complimentary copy of the **Sego Lily** to the above individual.

Please enclose a check, payable to **Utah Native Plant Society**, and send it to:

Membership
Utah Native Plant Society
P.O. Box 520041
Salt Lake City, Utah 84152-0041

(If you prefer not to cut this out of your **Sego Lily**, feel free to copy the membership form or simply write the information down and mail it with payment for the category of membership.)

VOL. 19 NO. 2 MARCH/APRIL 1996

CALENDAR OF EVENTS

No meetings or functions scheduled.

Update: Society Members Plot a Species' Comeback

By **Nick Van Pelt**
The Nature Conservancy of Utah

Spanish Fork Canyon, in Utah County between Provo and Price, has one of the country's rarest plants. It's the clay phacelia, or *Phacelia argillaceae,* in the waterleaf family (Hydrophyllaceae). Dr. **Duane Atwood** rediscovered it in 1980. Just a few dozen plants cling to shale hillsides at three locations west of Soldier Summit. The Nature Conservancy has protected two of the populations at its 70-acre preserve near the highway rest stop.

Following an alarming drop in numbers to less than 10 a few years ago, this lovely, purple-flowered phacelia has rebounded inside a high fence. It also is federally listed as Endangered. However, professional surveys haven't turned up more than a handful of new plants anywhere else. None of those grow on the Uinta National Forest, whose employees are friends of rare and endangered species.

Members of the species' "Recovery Team" and the UNPS think it's time to try growing seeds or seedlings at new locations in the canyon. **Lori Armstrong** studied some likely spots for her Master's degree research at Brigham Young University. She and staff of the Red Butte Garden and Arboretum have a lot of seed on hand. **Therese Meyer** of the Red Butte staff has gotten some of those to take root and flower in the greenhouse. Dr. **Kim Harper** of BYU has shared his thoughts about careful experimental plantings. He'd like to recruit a conservation biology student for this exciting initiative.

A January meeting in Provo brought most of the important players together for a strategy session. The Uinta's staff awaits a proposal for National Environmental Policy Act clearance and wants to help out in the coming months and years. Fish and Wildlife Service Botanist **Larry England** continues his dedication to the phacelia by seeking funds for the reintroduction project.

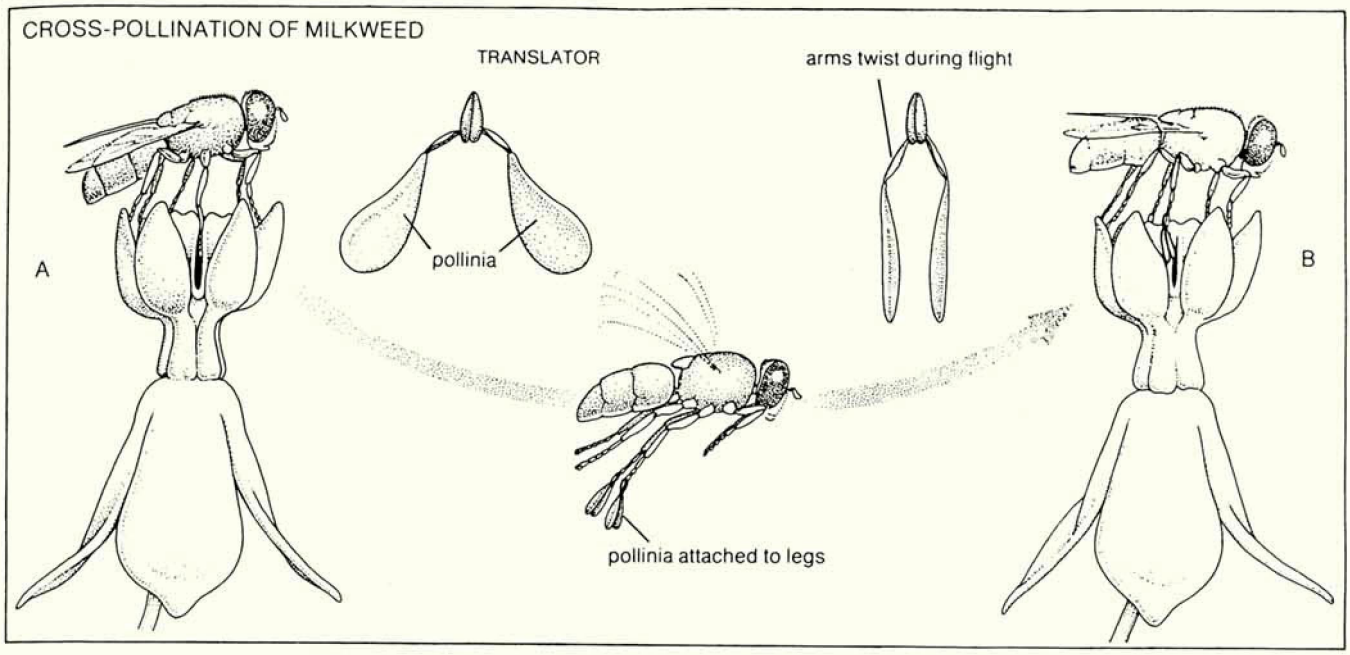
The clay phacelia won't be off the emergency list anytime soon, but with luck and determination it will again be a prosperous, abundant "citizen" of the busy Highway 6 corridor. Thanks to Forest Service ecologist **Dea Nelson** and Spanish Fork District Ranger **Tom Tidwell** for lining up the meeting and pledging vital support!

Milkweeds in Utah: The Incest Taboo, Where They Live, And How to Eat Them

by **Dr. Ty Harrison**
Assoc. Professor of Biology
Westminster College, January 1996

When we study the methods by which flowers attract their pollinators and then reward them for this service, we assume that the pollinator's task is to transfer pollen from one plant to another. Scientists call it outbreeding and this provides important genetic variation, so important in a world of changing environments. This allows natural selection to mold the genetic basis of a species to cope better with the problems of survival and reproduction.

When the flower ploy was invented by the forerunners of today's flowering plants and the male and female organs were for the first time brought together within one structure, a major problem was created. The animal visitors to those flowers were as likely to pollinate the female parts of that flower with pollen from the same flower as they were to bring in and deposit pollen from a flower visited previously. If a flower is fertilized by sperm from its own pollen, or indeed by that from pollen coming from another flower on the same plant, many of the advantages of sexual reproduction are lost as the offspring exhibit very little variation. So plants have evolved all kinds of mechanisms for promoting outbreeding. One of these is to set up barriers between the male and female structure in one flower. Excellent examples of this spatial separation of male and female flower parts are found in the orchid family (*Orchidaceae*).



Drawings by Michael Woods in Sex Life of Flowers, 1984. Oxford Sci. Films.

However you don't have to travel to the tropics to study or observe this in the exotic orchids. All you have to do is find some milkweeds (genus *Asclepias* in the family *Asclepiadaceae*) here in Utah. In both these groups, pollen is packed into fairly hard masses with a wax-like appearance called pollinia. In the milkweeds these are stored away safely in the central column of the flower which is formed by the fused anthers and the style, and they can only be pulled out by a very special procedure. The central column of the separate milkweed flower is broad and flattopped (see the accompanying drawing). The anthers are fused into a ring with vertical slits between. At the top of each slit there is a clasp, the translator, which is attached to the pollinia. A bee, butterfly, or milkweed beetle, may insert a leg or proboscis into the slit (labeled A in the accompanying drawing) and become entangled in the clasp. Only a powerful insect species such as a bumble bee or butterfly will have the strength to pull itself free, dragging with it the pollinia. Weaker insects may not escape from the clasp and will die on the flower. As I have been collecting milkweeds for cooking I have seen dead honey bees trapped by the leg on the flowers. Once extracted, the arms of the pollinia automatically twist and the pollen parcels are ready to be deposited on the stigma of another flower. The pollen grains in the packet will ultimately fertilize several hundred ovules in the milkweed pod to become the numerous seeds later released with their parachutes.

Some Utah Milkweeds

Utah has several interesting species of milkweeds scattered around the state. In this article I will discuss only two of the most common species and two relatively rare or infrequent species. The most common by far is the showy milkweed or common milkweed (*Asclepias speciosa*). As the name implies this species has a number of very large, spherical flower clusters toward the top of the plant. These flower clusters are the largest of any of the milkweed species. The showy milkweed is found throughout western North America and the Great Plains states from northern Texas to southern British Columbia. The plants are often found in moist areas along streams, ditchbanks and old irrigated fields throughout our state. Because of its rhizomatous habit it spreads and sprouts profusely and can become weedy. However this species is one of the most delightful and abundant for collecting and eating through the year, first early in the spring as a green, later in the summer as flowers, and then later when the pods are young. But be careful. They must be boiled to extract the cardiac glycoside poison in the shoots and leaves. Also you must be extremely careful no to confuse the

milkweeds with their relatives the dogbanes (*Apocynum*) which are too poisonous to eat.

In addition, *Asclepias spesiosa* is one of the famous milkweeds which attracts the Monarch butterfly to lay her eggs in the summer. We have a fairly sizeable clump growing in our backyard herb garden that I enjoy watching each year. It magically appeared, probably out of the sky, in our yard a number of years ago and my wife, Judy, has been protecting it ever since. She has an extreme empathy for foundings, both plant and animal. Last summer a lone female Monarch butterfly found this isolated plant in the middle of Sandy City. Carefully, she tasted with her front legs to see if this was the proper plant to lay her eggs on, and then placed on the undersides of ten to twelve leaves, perfectly spherical, white pearl eggs tinged with green. I carefully marked the leaves having butterfly eggs with plastic twist ties, intending to watch the young caterpillars hatch, eat and grow. I distinctly remember such an exercise done over forty years ago in my first grade class in a small rural school called Crescent Elementary. Our teacher, Mrs. Peterson, had us draw with crayons the life cycle of the Monarch butterfly from firsthand observation, complete with a written story of our field trip down the country lane to find the milkweed and the beautiful yellow, white and black striped caterpillar. We fed it every day, and then watched the astounding transformation of the chrysalis into the elegant orange and black Monarch butterfly. This is powerful stuff for a first grader. Very possibly this memorable event could have had something to do with my becoming a biologist. But back to the story of last summer. Alas, none of the eggs hatched and in fact most of them disappeared from under the milkweed leaves, probably eaten by various other scavenging insects like lady bugs or lacewings. But there is always next year. The milkweed sprouts will be even more abundant in the garden. The more important question will be whether the Monarch will fly over.

A second species of some interest is the Spider Milkweed or Antelope-horns (*Asclepias asperula*). Unlike the Showy Milkweed, this native species is found in dry upland areas along the western foothills of the Wasatch and in almost all of the low elevation counties of Utah. It grows from northern Mexico and southern California, east to Kansas and Oklahoma, and north to southeastern Idaho. The populations along the Wasatch are therefore near the northern limits of its distribution in the Western U.S.. With its deep taproot it grows in the desert shrub, mountain brush and pinyon-juniper communities. The name antelope horns comes from the pairs of slender seed pods which stand upright on the stems growing in small clumps amoung the rock and grasses. It has small clusters of fairly large,unique greenish flowers whose petals are not reflexed as in most other milkweeds.

Another much less common Utah milkweed is one which I first observed in Lincoln, Nebraska, growing near springs on a tallgrass prairie preserve. This is the Swamp Milkweed (*Asclepias incarnata*). As the Latin name implies, the flowers which top the five to six foot stems are a beautiful rose-red. The common name tells us that it is only found in marshes and often considered semi-aquatic. This mainly eastern milkweed species is found throughout the Eastern and Midwestern states from Texas to Nova Scotia. In Utah it is found only in the northern wetlands west of the Wasatch Front from Cache Valley and Brigham City to Provo. It is in scattered locations in southern Idaho and Wyoming. This is what we would call a disjunct species, hundreds of miles away from the main continuous populations and found here in Utah at the extreme limit of its western distribution in North America. (See also the similar distribution pattern for the butterfly weed, below). How and when did a clearly eastern species get here in Utah? These are important unanswered plant biogeographic questions. I was happy to rediscover the swamp milkweed recently in an ungrazed pasture along the Jordan River near 9000 South in Salt Lake County. I think it may be more abundant in the marshes of Utah County around Utah Lake and in the fresh water springs and marshes of Davis and

Weber County. But given the heavy impact of grazing and draining on our native marsh flora it may be less common now than what our herbarium collections show. This species may have horticultural value, but I have never seen it in cultivation. The stems may be too tall and weak and need the support of surrounding marsh vegetation.

A fourth native Utah milkweed species which does have important horticultural value is the Butterfly Weed or Pleurisy Root (*Asclepias tuberosa*). Again I learned this milkweed as a wildflower of the midwestern tallgrass prairie. It grows throughout the eastern half of the U.S. and from southeastern Canada to northern Mexico. The Intermountain Flora (1984, vol. 4) says: "Butterfly weed is one of the most widely dispersed and frequent, as well as on of the most beautiful wild flowers of temperate North America." I concur. Its wonderful, large, flat topped clusters of smallish yellow-orange to red-orange flowers attract innumerable pollinating bees and butterflies. It is one of the few milkweeds which lacks the characteristic milky white latex in vessels of the leaves and stem. Apparently no one knows why. Growing among the clumps of tall grasses, it is a summer favorite of prairie restorationists in the Midwest. Ten years ago I was shocked to find out that it was a native Utah species but found only in the far tier of counties across southern Utah along the Virgin, San Juan and Colorado River drainages. It apparently grows in desert shrub communities on rocky slopes as well as in moist to moderately sandy or gravelly soils in open ponderosa pine, oak, or pinyon/juniper habitats. What is a tallgrass prairie wild flower doing in the desert of southern Utah? I have never seen it growing wild in Utah. However I do have one cultivated plant purchased from a nursery growing in my yard in Sandy. It hasn't flowered and probably coming from a praire seed source probably doesn't like the Utah climate very much. I suspect that our native butterfly weed would grow much better in cultivation, but I have never seen its flower color variations and have never been able to collect seed from the southern Utah plants. If anyone sees this plant, please let me know, or collect seed later in the year. It is apparently quite easy to germinate and grow. The ethnobotany of the butterfly weed is quite interesting. The enlarged tuberous root of older plants has been used extensively by tribes of native Americans for lung related illnesses, hence the common name of pleurisy root. The dried root was often smoked for this purpose and some books say the root was chewed for bronchitis and other respiratory problems.

Eating Milkweeds

If you are interested in early spring wild greens, and since wild asparagus in increasingly rare as county ditchbanks disappear underneath subdivisions, milkweed greens are for you. The taste is worth the trouble. It's difficult to describe, something like green beans but with a taste all of their own. All you have to do is locate and collect the newly emerged six to eight inch shoots with several pair of young expanding leaves. The shoots are boiled for several minutes each in three changes of boiling water. It helps to have an extra pot of boiling water handy when you drain and change the water. Since these are gathered early in the spring you must be positive that they are indeed the showy milkweed. The shoots of the hemp dogbane (*Apocynum cannabinum*) which are very poisonous, possibly even when cooked, look similar to milkweed in the early stage of spring growth. So be sure you can positively identify both species at all the growth stages before you try to eat them.

The following milkweed recipe is one of my favorite wildfood recipes. The pods can be gathered in quantity in June or July after locating a sizeable patch of the showy milkweeds in a pasture or along a ditchbank. Be sure that pesticides have not been used in the vicinity. They can be cooked and used as described or can be frozen for mid-winter use. I use the smallest pods for the Pod Pickles. They are much like capers but better. Enjoy!

Milkweed Pod Pickles
3 quarts fresh young milkweed pods
6 small chilies

6 cloves garlic, peeled
1/4 cup celery seed
1/4 cup mustard seed
6 teaspoons dill seed
2 cups apple cider vinegar
2 cups water
2 to 3 teaspoons salt
2 tablespoons granulated sugar
Place pods in a pot, cover with boiling water, boil gently 5 min., drain (discard water), repeat process. Cool pods. Sterilize 6 pint jars. Remove chili seeds under running water, wear gloves. Into each jar put 1 garlic, 1 chili, 2 tsps. each mustard seed and celery seeds, 1 tsp. dill seed. Pack pods tightly into jars. Stir vinegar, water, salt and sugar in large pot, heat to boiling, continue cooking 2-3 minutes until sugar is dissolved. Pour over pods immediately with 1/2 inch headspace. Seal with lids and bands, process 10 minutes in boiling water bath. Allow to mellow one week.
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THE THREATENED SPECIES *ASCLEPIAS WELSHII*

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Welch's milkweed, *Asclepias welshii* N. & P. Holmgren, which is federally listed as threatened, was recognized and described in 1979 based on a collection from the Coral Pink Sand Dunes made in 1978. Eleven years earlier, in 1967, the species was prominently displayed in a scene from the movie, "The Long Ride Home", starring Glenn Ford and George Hamilton. The movie was filmed near Kanab, and included the Coral Pink Sand Dunes as part of the setting. The scene featured a gunfight in which the victims rolled down the face of a sand dune over a healthy population of *A. welshii*. This setting, on the brow and face of the sand dunes, is characteristically the habitat for the largest, most vigorously growing colonies of *A. welshii*.

In the mature state *A. welshii is* a robust plant that could be mistaken for one of the other broad-leaved milkweeds, hence its rather recent recognition as a distinct species. In addition to distinctive morphological features of the plant itself, its habitat also serves to set *A. welshii* apart from other similar species.

A. welshii is a pioneer herbaceous perennial species that is apparently restricted to sand dunes in Southern Utah and Northern Arizona at elevations above 5000 feet. Four known locations where the species exists include an area West of Page, Arizona; two adjacent populations straddling the Utah-Arizona border in the Paria Wilderness area; the Sand Hills near Kanab Creek North of U.S. Highway 89; and the nearby Coral Pink Sand Dunes West of Kanab. The populations at the first three locations are small and seem to be diminishing or barely holding their own. On the Coral Pink Sand dunes, however The population is large and healthy. The species occurs on dunes within the Coral Pink Sand Dunes State Park, but it is much more abundant on the BLM administered portion of the dunes Northeast of the Park. It is here that an ongoing study funded by the BLM through a challenge cost-share agreement has been conducted since 1989. Some of the findings of this study are summarized below.

The chief means of dispersal of the species is by rhizomes. The rhizomes colonizing unoccupied territory are slender, and produce aerial branches bearing long narrow juvenile leaves similar to those of other narrow-leaved species of *Asclepias*. As the rhizomes age and enlarge they will eventually produce typical aerial branches bearing broad leaves, and in many cases, flowers. The aerial stems die back each autumn. Based on field observations and experimental plantings the maturation process may vary from two to more than six years. Once a rhizome becomes large enough to provide sufficient food reserves it will produce clumps of mature stems from buds

near its apex for an indefinite number of years, even in the face of competition from willows, rabbit brush, and other perennial species. In areas with a good cover of other species the spread of A. *welshii is* severely restricted, and stems growing in close proximity to other species rarely flower or bear fruit. Eventually these plants will succumb to the competition of other species. On the other hand, if a few stems of A. *welshii* survive a blowout that removes competing vegetation, the milkweed rapidly spreads to occupy the devegetated area. Thus it is well adapted to the continually changing environment of active sand dunes.

In the long run seeds play an important part in survival and dispersal of the species, but spreading rhizomes are more important overall. Fruit production fluctuates a great deal from year to year. It is largely dependent upon prevailing conditions at pollination time. Most flowers are not pollinated and a stem usually bears from one to six fruits. Each fruit contains approximately 50 large, winged seeds that mature from late August through early October. The wings do not aid in dispersal but rather help the seed to be caught and buried in the sand. The seeds remain viable for many years. The germination rate under experimental conditions has been as high(>70%) after six years as after one year. The seeds do not need a ripening period or other special conditions for germination. In fact it is not unusual when collecting seeds to find some that have germinated inside the fruit before it has begun to open. The combination of sufficient moisture and relatively warm temperatures (25°-30° C) induce the highest rates of germination. During six years of observation on the sand dunes emerging seedlings have only been seen in three of those years, and in significant numbers only twice. In both cases the seedlings emerged during a period from late June to early July, and coincided with early summer rains that kept the upper levels of the dunes moist as the temperature increased sufficiently. Seed germination does not normally occur in the early spring because even though there is enough soil moisture, the temperatures are not high enough. This is probably one of the reasons that seeds seem to play a minor role in the propagation of the species. Most of the seedlings appear within a few inches of the base of the previous year's fruiting stems. This again indicates that the wings on the seeds play no significant role in dispersal.

As discussed above, the single most important factor affecting the survival of A. *welshii is* the stabilization of the dunes by the growth of such species as rabbit brush, oak, willow, juniper, and sagebrush. Permanent study plots established more than six years ago, as well as observations at the Sand Hills and Stateline sites confirm this. The milkweed thrives where the dunes are in a state of flux. On the other hand the movement of large amounts of sand by prolonged periods of strong winds such as occurred in the spring of 1994 has a detrimental affect by burying some stems, and exposing old deeply buried rhizomes to the extent that they dry out and die. Another factor affecting the survival of A. *welshii is* drought. When the sand dries out to a depth of a foot or more young stems, especially seedlings, become dehydrated and die.

The impact of ATVs on A. *welshii is* mixed. The sand is loosened by the vehicles and consequently wind erosion is accelerated so that the removal of vegetation, including the milkweed along ATV trails is enhanced. At the same time surviving milkweed plants in the vicinity are able to rapidly spread into these denuded sites where previously competition from other vegetation was keeping their growth in check. A. *welshii* is often found in or alongside heavily used ATV trails where the dunes are continually being disturbed in this manner and where other species do not become established.

Data on ATV usage has been collected by Coral Pink Sand Dunes State Park personnel for the entire sand dune area for more than 20 years. These data show that from a peak usage in the 1986-87 fiscal year of 34,519 ATVs the number has declined to 13,139 in the 1994-95 fiscal year, a decrease of 62%. During the decade of the 80's the average annual number of ATVs utilizing the dunes was approximately 21,000.

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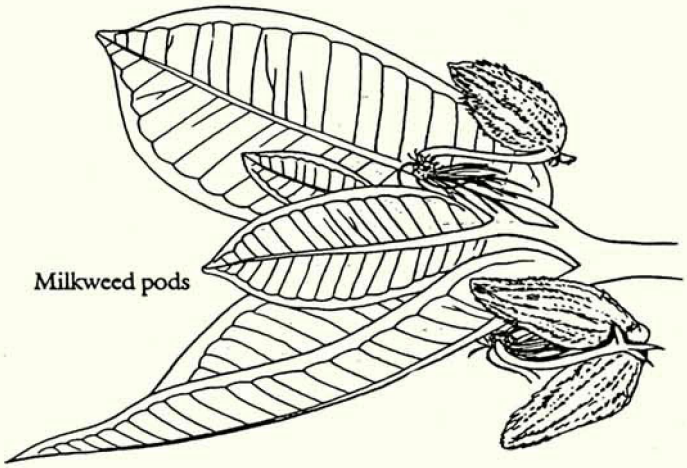
So far in the 90's the number has fluctuated between about 12,000 and 13,000. The majority of ATV users come on the major holidays of Easter, Memorial Day, and Labor day. Stems of A. *welshii* have not emerged by Easter and are already beginning to senesce by Labor day. So during two of the three major use periods ATVs have little or no impact on the milkweed. During the rest of the year usage is light. While data on *A.welshii* populations have not been kept during the same period it is likely that there is no correlation between ATV usage and milkweed numbers. On the other hand there is data to show that specific colonies are diminishing in areas where it is doubtful that an ATV has ever been. Eliminating ATV's from the Coral Pink Sand Dunes is not the solution for saving *Asclepias welshii* from extinction.



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VOL. 19 NO. 3 **MAY/JUNE, 1996**

CALENDAR OF EVENTS

May 11 Saturday	Fish Springs Migratory Bird Outing See Notice Inside
May 17-18 Friday-Saturday	Moss Identification Workshop Utah State University See Notice Inside
May 18 Saturday 9:00-4:00	Celebrate Wildfowers UNPS will have a booth at the Monte L Bean Museum, Brigham Young University
May 29 6:30 PM Red Butte Office, Ft. Douglas	UNPS Board of Directors Meeting

Notes on the reproductive ecology of Jones cycladenia

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If you wander by the east side of the San Rafael swell this spring, or through the circle cliffs area near the waterpocket fold, you might be lucky enough to see one of Utah's rarest and most beautiful wildflowers, Jones cycladenia. You'd need to be off the beaten path, though, because this plant often lives in remote places. It would also help to know a little about the geology of southern Utah, because Jones cycladenia is restricted to soils formed from only a few geologic layers: Near the San Rafael swell, for example, it is found only on parts of the Summerville formation, a rich chocolate-brown mudstone well-marbled with crystalline gypsum. Further south, in the circle cliffs area of Garfield county, it occurs on the Chinle formation, sandwiched between the red Wingate sandstone that forms the cliffs, and the purple-mottled Moenkopi, whose treacherous slopes protect Jones cycladenia from would-be intruders (recreationists, cows, or field biologists) (1).

My experience with Jones cycladenia, *Cycladenia humilis* var. *jonesii* (Apocynaceae), began five years ago when I came to work as a graduate student for entomologist Vince Tepedino (USDA/ARS Bee Lab), who has a long term project to study the pollination biology of rare plants in the southwestern U.S. Many plants, including rare ones, depend on insect pollinators for seed production. Thus, pollinators of rare plant species must also be considered if conservation strategies are to be successful. The objectives of our studies are to determine the degree to which these rare plants depend upon pollinators for reproduction, and to discover which animal species carry out pollination. Here I have summarized some of our findings on Jones cycladenia, as well as some conservation concerns I have for this taxon.

Jones cycladenia is a perennial endemic known only from Southern Utah and Northern Arizona. It reproduces mainly through the spreading of underground rhizomes. Although populations often flower heavily in April through June, fewer than 5% of the flowers typically mature fruit, and no seedlings have ever been observed (2). Fruit set from hand pollinations is also very low, so determining the breeding system of this taxon has been a real challenge. We do know that Jones cycladenia requires a pollinator for fruit set: Flowers that are bagged prior to opening and left unmanipulated never commence fruit set. However, hand-pollinated flowers, whether selfed or crossed, often appear to commence fruit set but almost always abort. Of over one hundred flowers subjected to hand-pollination during 1991 to 1993, only two selfed flowers and two cross-pollinated flowers produced mature fruit. Addition of water to open pollinated plants in 1992 did not result in higher fruit set (2).

Like most members of the Apocynaceae, Jones cycladenia exhibits a complex floral morphology (Figure 1). The anthers, which form a tight cone over the stigma, produce pollen only in their upper half. Pollen dehisces into the chamber formed by the anther cone and the top (unreceptive) portion of the sigma. In this way, the flower avoids automatic self-pollination. The sides of the stigma exude a sticky substance. Oddly enough, studies of some other members of the Apocynaceae suggest that only the ventral surface of the stigma is receptive to pollen (3). The pollination mechanism is a "tar and feather" process in which an insect, while withdrawing its tongue after probing the flower for nectar, 1) scrapes pollen from previously visited flowers onto the ventral receptive area of the stigma, 2) draws its tongue through the sticky exudate on the sides of the stigma, and 3) coats its tongue with pollen as it passes through the pollen chamber on top of the stigma. This pollination mechanism appears to be responsible for one of the most unusual characteristics of Jones cycladenia: the carnage of dead insects found in the flowers. Each year we have observed, in a small percentage of flowers, bees, flies, and butterflies that have died apparently after becoming gummed up in the sticky secretions of the flower! The significance (if any) of this entrapment to the reproduction of Jones cycladenia remains a puzzle (2).

Each year, we have collected strikingly different assemblages of bees, flies, and lepidopterans visiting Jones cycladenia. Visitors to the flowers are extremely rare, and we are, to date, unable to establish the relative importance of any of these as pollinators. The Apocynaceae is generally considered to be adapted to pollination by butterflies and long-tongued bees, insects which are not at all abundant on Jones cycladenia. An interesting (but probably untestable) hypothesis is that the original pollinator of Jones cycladenia is no longer found within the plants' distribution, perhaps due to climate change. If this is the case,

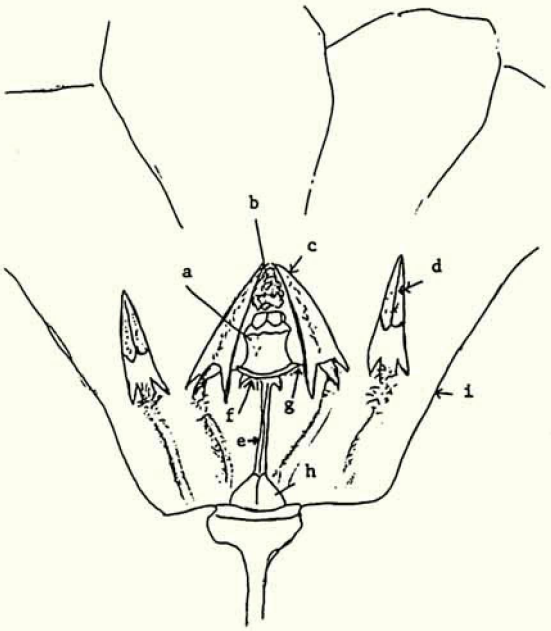

Figure 1. Floral morphology of Jones cycladenia. a = Secretory sides of stigma; b = chamber for secondary polon presentation; c = anther; d = pollen sacs of anther; e = style; f = ventral surface of stigma; g = tissue connecting anther to stigma; h = ovary composed of two partially separate carpels; I = corolla, split here and spread for viewing

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then the taxon may be persisting through its clonal reproduction (2)

In search for possible causes of the low reproductive rate for this taxon, I worked with geneticist Paul Wolf (USU) to study the clonal structure and patterns of genetic diversity in Jones cycladenia. We found that populations are composed of multiple genetic individuals, exhibit levels of genetic diversity as high or higher than other plant species that have been studied, and show no signs of severe inbreeding (1,4). The mystery of Jones cycladenia remains, and further research is needed to address other possible reasons for the low sexual reproduction in this taxon.

Jones cycladenia is currently listed as threatened under the federal Endangered Species Act. There are numerous reasons why this taxon should be a priority for conservation efforts. First, the genus *Cycladenia* is represented by only one species. Although Jones cycladenia is currently considered only a variety of *C. humilis*, evidence suggests that it is ecologically and perhaps genetically distinct from the rest of the species (5). The two other varieties of *C. humilis* are known only from California; these taxa are not currently listed on any sensitive plant lists, but they appear to be uncommon. Most members of the Apocynaceae are tropical, and the closest relative of *Cycladenia* is likely a South American genus such as *Mandevilla* (6). Thus, Jones cycladenia possesses a high degree of genetic uniqueness despite its varietal status.

Second, Jones cycladenia is not as abundant as it may appear by casual observation. The plants are clonal, and genetic studies have shown that the number of genetic individuals in populations is between one and two orders of magnitude less than the number of ramets present. Sexual reproduction is infrequent or nonexistent, so the taxon may have little ability to colonize suitable habitat.

Finally, it is worth mentioning that Jones cycladenia may have value even to those among us with little interest in environmental conservation. The Apocynaceae is known for the amazing diversity of secondary chemical compounds produced by its members. Much research is being carried out on the biochemical and pharmacological properties of these compounds. A relative of Jones cycladenia, the rosy periwinkle, is already being used successfully as a treatment for cancer (7). What potential treatments for our ailments may lie undiscovered in Jones cycladenia we can only guess.

Today, the main threat to the survival of Jones cycladenia is recreational impact. Populations near Moab are favorite stomping grounds for those making the pilgrimage to the "mountain bike Mecca of the West." ORV use in these areas is also common. East of the San Rafael swell, the largest known population of Jones cycladenia has been experiencing increasing recreational usage over the last few years. There are no simple solutions to these problems. As national parks become more crowded, people are turning their attention to southern Utah's previously unnoticed treasures. The half dozen or so small populations in Garfield county are so remote and inaccessible that recreational impacts seem unlikely. However, with the paving of the Burr Trail increasing the accessibility of the area, even this remote wilderness may not remain unspoiled by progress.

Note: Others involved in our research include bee systematist Terry Griswold (USDA/ARS Bee Lab), and soil scientist Janis Boettinger (USU),

who has collaborated on studies of the edaphic relationships of Jones Cycladenia.

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JONES CYCLADENIA

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One of the most unusual and interesting plants of the southern Utah plateau country is the Jones Cycladenia (*Cycladenia humilis* var. *jonesii* or *C.jonesii*). Marcus E. Jones first collected the species on May 19, 1914, at the San Rafael Swell population. The species was named after Jones by Alice Eastwood when she described it in 1942. Jones Cycladenia is a narrowly restricted endemic in the central and western parts of the Colorado Plateau. It occurs on rather salty clay and gypsum soils derived from the Chinle, Cutler and Summerville formations, at elevations between 4,400 and 6,000 feet.

Currently, the Jones Cycladenia is known from four disjunct localities, three in Utah and one in Arizona. The three Utah locations are in Castle Valley, the San Rafael Swell (both on Bureau of Land Management land), and the Purple Hills in Glen Canyon National Recreation Area and capitol Reef National Park. The fourth locality is near Pipe Springs National Monument on BLM land, in extreme northern Arizona. This location was first discovered in 1882. Attempts to locate this population in subsequent years were unsuccessful until in 1993, 111 years later. In 1986 the species was officially listed as federally threatened, primarily because of the threats associated with oil and mineral exploration and mining and tar sands development.

The Jones Cycladenia is a member of the Dogbane Family (Apocynaceae). It is a perennial, somewhat succulent, herbaceous plant with round opposite leaves, and relatively showy pink-magenta or rarely white tubular flowers. Stems range from 1-2 inches up to about a foot in length, with up to 6-8 pairs of leaves. Fruits consist of rather long (3-6 inch) follicles that split open to release large black seeds, each equipped with a conspicuous coma. The plant is apparently self-compatible, and is rarely visited by insects despite the showy flowers. Jones Cycladenia is strongly rhizomatous, and above-ground shoots are in fact "ramets" of an extensive underground clone rather than being distinct genetic individuals (or "genets"). Hence counts of shoots generally gives one little information on the number of physiologically and genetically distinct individuals in the population.

The Colorado Plateau is rich in endemic plant species. Most are presumably 'neoendemics', as they are in large actively evolving genera like *Astragalus, Cryptantha, Erigeron, Eriogonum, Phacelia*, and *Penstemon. Cycladenia*, however, is a small genus with two taxa and is strongly isolated with no known close relatives. The genus is not very close to the other two genera in the region, *Amsonia* and *Apocynum*. Neotropical genera such as *Mandevilla* or *Mesechites* show some morphological similarities to *Cycladenia*,

although they are predominantly vines. It appears that the affinities of *Cycladenia* lie in the Neotropics, but that the relationship is probably an ancient one dating to the Tertiary. The genus probably evolved in the region during the Tertiary, and has subsequently undergone range contraction and splitting into two relictual centers, one in California and the second on the Colorado Plateau.

Jones Cycladenia is closely related to *C. humilis*, which consists of three rather weak varieties all endemic to California. There are only minor morphological differences between the Utah and California plants, but recent genetic work done by researchers at Utah State University shows that the two are genetically very distinct. Ecologically, the two taxa are also very different. Although all varieties are currently placed in *C. humilis*, it is likely that two species will be recognized in the future.

Since 1992 I have been monitoring the population at the Purple Hills. I established four 25 m long transects, one on each of the four principal aspects at the summit of the Purple Hills, where the main population occurs. Once a year in June all ramets within 0.5 m to either side of the transects are recorded. Data is collected on leaf size, flower and fruit number, and signs of herbivory. So far, the number of shoots along these transects has fluctuated between 202-267, with an increase in 1994 and 1995 coinciding with dry years. The ramet population size is estimated to be about 2,500.

Fruit set is extremely low in most years (3-4% of flowers), possibly related to inbreeding depression or low levels of pollination. Fruit abortion is relatively rare, possibly related to herbivory damage, while mean seed abortion rates vary between of 5-25% per year. Often, insects are found dead trapped in the throat of the corolla, which is sticky. Signs of herbivory are common, although the culprit (or culprits) remains unknown. Currently this population appears to be stable. Because of the plants' location on steep shifting talus, there is currently little threat of disturbance by livestock grazing or recreational activities.

In addition to the Purple Hills site, seven additional populations are known in the area, mostly from near Deer Point in Capitol Reef National Park, or in Middle Moody Canyon. Total numbers of ramets at all eight sites is estimated to be between 5,000-7,000.

Although currently secure from most anthropogenic threats, the future of the Jones Cycladenia is precarious. Increased ORV activity has the potential to damage populations, while any future oil and mineral exploration and mining could destroy some populations. At present only the Purple Hills population is secure from most of these threats due to its isolation. Probably the most serious problem looming on the horizon, however, is global warming. Jones Cycladenia produces very few seeds, and to date no success has been achieved in germinating them. Hence the dispersal potential of the species appears to be very low. Future global warming could potentially eliminate the species from portions or all of the Colorado Plateau if its climate "envelope" is exceeded. Luckily. a sample of Purple Hills seeds from 1992 has been archived in long-term storage at the National Seed Storage Laboratory in Ft. Collins. It is still possible to collect more accessions from other wild populations. Hopefully, with continued research on germination and cultivation, and with proper protection, the future existence of this remarkable species on the Colorado Plateau will be ensured.

A Message from the Chairman of the Board

Doug Stone

Let me share with you my views concerning the status of the Utah Native Plant Society, along with areas where I think we could improve in 1996 and beyond. It is well understood, at least among the current Board of Directors, that UNPS is in need of some kind of revitalization. The danger signs are clear: Membership is stagnant or even slightly declining. More importantly, attendance at chapter meetings, field trips, and other functions has been very sparse over the past year. More recently, the schedule of activities for members has all but disappeared.

A big part of the problem, as I see it, is that many of our past activities were planned merely for their recreational value or as social gatherings. Even our annual rare plant field trips have been designed not to gather information or contribute to monitoring efforts, but rather so that members could see as many different species as possible. The solution that I am proposing involves three basic themes:

- Continuing with efforts to educate both our membership and the public about Utah's native plants and their habitats
- Organizing field trips to involve members in gathering data on rare plant species and to collect baseline information on poorly known botanical "hot spots" around the state
- Becoming more actively involved on native plant conservation issues.

It is my strong belief that interest and participation in UNPS will grow as members begin to feel involved in a larger cause and that their efforts are contributing to scientific understanding. The members of UNPS can make a difference! Our educational programs are already well underway and include sales of our popular native wildflowers poster; participation in annual Celebrating Wildflowers events sponsored by the U.S. Forest Service; support of the Red Butte Gardens wildflower hotline; and articles and other information published in this newsletter. We still need to locate effective outlets for our new poster depicting Utah's twenty federally listed Threatened and Endangered plants. And more could be done to plan workshops and field trips on how to identify difficult plant groups (grasses, sedges, composites, etc.), proper methods for collecting herbarium specimens, and the ethics of botanical collecting. For a description of our new program to inventory botanical "hot spots," see the article by Dr. Kim Harper in this issue of *Sego Lily*.

Now to the issue of UNPS becoming more involved in plant conservation. Consider the situation: Reauthorization of the Endangered Species Act is on hold, and the bill that eventually emerges from Congress may be significantly "watered down." Operating budgets for the federal land and resource management agencies are being drastically cut. And no real authority yet exists in state government for protecting and managing our native plants. My fear is that even established programs for conserving threatened, endangered, or otherwise sensitive species will erode or evaporate unless there is a strong, consistent showing of public interest and support. For wildlife and wilderness issues, there are other organizations already playing this role. But for native plants and their habitats, there is absolutely no other organization in the state that can be a strong and independent voice for conservation. In short, if we don't do it, nobody else will.

Our Articles of Incorporation and By-laws contain some inconsistent provisions with regard to conservation activities. My own interpretation of these documents is that we are free to become more involved as long as we don't endorse candidates for elected office, contribute to their campaigns, or file lawsuits. Through our Conservation Committee, I think we can and should become far more active in reviewing and providing comments on pending legislation and on proposed federal, state, and private actions with potential for adverse impacts on native plants and plant communities. Further, I believe that it is possible for us to be "active" on these issues without being perceived as "activist."

In conclusion, I appreciate that some of our members may feel that this new direction for the Conservation Committee is not in the best interests of the organization as a whole. If you do have any comments or concerns, I hope you will share them with me, with the other members of the Board of Directors, and with the rest of the society.

NEEDED PROJECT

Kimball T. Harper
Botanist, BYU

There is a pressing need for checklists of the flora at many sites in Utah. The need is immediate, since factual reports on areas excluded from the recently defeated Utah Congressional delegation's wilderness bills must be assembled quickly. If we are to have an impact on the next round of legislation, we must assemble good data quickly. Two excluded areas, the Beaver Dam Slopes in Washington County and the Newfoundland Mountain Range in Box Elder County, seem worthy of preservation as wilderness for biological reasons.

Beaver Dam Slopes

The Beaver Dam Slopes proposed wilderness area is habitat for a variety of species (plant and animal) that enter Utah only in that area. Many of the species are best represented in the Virgin Mountains of northwestern Arizona and southern Nevada. Some are endemic to those mountains only, while others are more widespread in the Mojave Desert but enter Utah in the extreme southwestern corner only as components of the foothill vegetation of the Virgin Mountains. Should Utah's Beaver Dam Slopes become

popular ORV playgrounds, many of those unusual species would eventually be lost from the state. Valori (Lori) Armstrong, BLM botanist, and Larry Higgins (one of the authors of *A Utah Flora*) would be natural leaders for collections on the Beaver Dam Slopes. Bob Douglas, BLM Dixie Resource Area biologist, is also very knowledgeable about that area.

Newfoundland Mountains

The Newfoundland Range is Utah's most isolated habitat. It was a small island in Lake Bonneville for over a million years. When Bonneville finally dried up leaving the Great Salt Lake as its remnant, the Newfoundland Range was left stranded in a huge expanse of saltflat that must be every bit as uninhabitable as Lake Bonneville was. Thus the Newfoundlands are an orphaned landscape that has been isolated from the "mainland" vegetation for hundred of thousands of years. Without free migration, the flora and fauna of the range has, no doubt, experienced local extinctions. Other species that are uncommon, but still survive there, have probably lost much of the genetic diversity that keeps mainland populations healthy and competitive. With luck, we will find woodrat middens that will reveal something about former inhabitants of the area. A variety of genetic tests of carefully selected "island" and "mainland" species populations should help us anticipate the consequences of fragmenting more-or-less continuous populations into a series of isolated, small subpopulations. Undoubtedly, such fragmentation will become commonplace in the next century or millennium. Wouldn't it be great to be able to predict the genetic and ecological consequences of such fragmentation? Kim Harper and Doug Stone know something about the Newfoundland Mountains. If you want to help out, call them!

Abajo Mountains

Finally, we need to know more about the floristics of two fascinating habitats on the Abajo Mountains of southeastern Utah: the *Festuca thurberi* grasslands that clothe the snow avalanche tracks on the high peaks of the Abajos and the shallow ponds that occur here and there across the top of Elk Ridge. Rick Collins has agreed to lead and/or advise UNPS members desiring to help us learn more about these areas.

The idea is to make checklists that are as complete as possible for each of the foregoing areas. We need good specimens (roots, stems, leaves, flowers, and fruits) for all species observed. Collect every species in flower and make sight records of nonflowering plants. Reports of individual collecting trips will be published in the UNPS newsletter. Eventually, formal publications will be produced to inform others of your efforts. Let's make some history!

Plant Resins, Inside and Out

Robert Fitts

A million bitterbrush plants were planted to improve wildlife habitat after a fire. The next spring the leaves were speckled with little white spots. The wildlife biologist was distraught about his plants. Was it a disease? Someone had told him it was and infestation of scale insects. Would the plants, that had cost so much to raise in a nursery and to plant die? To the wildlife biologist's relief, the spots were not a disease or insect parasite, but part of the plants system of self-defense against such maladies.

Bitterbrush and cliff-rose plants have glands that excrete a waxy resin that can form spots on the surface of the leaves. Many other plants have resin that is in tiny balls on the end of hairs. Resins are also found inside of many plants in pressurized duct works.

Resin ducts are formed in plants as channels in between cells (Schizogenous development). The surrounding cells become specialized to secrete the resin and the special compounds that plants put into it. This is very different from the way that plant rubber, or latex is found. Latex is found inside of special cells called laticifers that may form an interconnecting network. A general rule is that nature's rubber (latex) is formed inside of special cells, while nature's plastics and resins are in ducts enclosed by cells.

Resin ducts are formed as a response to wounding in cedar, juniper, and larch. The size of ducts is related to the amount of trauma of the wound. Many plants also have resin ducts as a part of their normal growth.

The cells around the resin ducts are chemical factories that produce the resin, acids, proteinase inhibitors that deter insects from feeding, and insect juvenile hormone to keep them from becoming adults and reproducing. The resin

glands on plant surfaces likewise make many compounds. Most people are familiar with the chemical made by the poison ivy plant.

The celery family has many pleasant smelling chemicals. Fennel, parsley, and many wild plants such as *Cymopterus* and *Lomatium* attract human herbivores. But the resins in this family also have toxic substances (furanocoumarins) in plants like poison hemlock. Specialized herbivores may not be deterred by some of the things we think of as being nasty, and may even use them to locate their next meal.

The pressure of the resin in Douglas fir ranges from 0-150 psi. The pressure fluctuates seasonally and daily. In times of drought, the trees lose their internal pressure (OEP or oleoresin exudation pressure), and become susceptible to attack. Trees scarred by fire are located by bark beetles while their defenses are limited. They carry *Trichosporum* fungus in a special structure on their head call a mycangia. The weakened trees may me overwhelmed by the beetles and the fungus without the resin pressure which carries antifungal compounds and engulfs beetles and larvae with sticky resin.

The antifungal properties pine oil extract has been used to control athlete's foot. Pine resin is smeared around wounds in traditional veterinary medicine to keep flies from visiting while healing takes place.

Amber is a natural plant plastic. It is formed by plants with a chemical in the resin that interconnects the molecules into a polymer. The polystyrene in a plastic ruler is like the resin of *Liquidambar styraciflua* or sweetgum of the eastern states. Many tropical legumes produce amber.

Extinct seed ferns and conifers produced amber that is now found as a plastic fossil (modern conifers lack the polymerizing agent). As the resin exuded from the plant, it may have enveloped bacteria and preserved them. Some of these ancient microbes have been recovered and studied for possible antibiotic compounds against modern diseases.

Take a look at the many native plants that have a strong scent. The plant you pick will probably have resin with unknown properties.

Gorgeous Posters!

UNPS Utah Wildflowers posters are still available, and the recently completed Threatened and Endanger Plants of Utah are also available; each is $12.00. Send orders with check to Jo Stolhand.

Cottam's Hybrid Oak Trees!

Available: Hybrid oak trees,Cottam's grove type, in pots. Contact Robert Fitts: 277-1568.

Moss Identification Workshop

Sponsored by:
Intermountain Herbarium and
Department of Biology
Utah State University
Geology Bldg. 301
Logan, Utah

Instructor: Dr. Alma Hanson, Forest Botanist, Payette National Forest. Dr. Hanson studied mosses in Central Idaho.

Date: May 17-18, 1996. Friday 1 pm-6 pm, Saturday 8 am-5 pm.

Learn to identify mosses using technical references, and learn to identify a few genera in the field.

$60 registration includes barbeque Friday, lunch Saturday and transportation for fieldtrip. Make check payable to the Dept. of Biology, Utah State University. Send to program organizer: Dr. Mary Barkworth, Dept. of Biology, Utah State University, Logan, Utah 84322-5305, tel.(801) 797-1584.

International Migratory Bird Day

Fish Springs National Wildlife Refuge, May 11, 1996.

The public is invited to celebrate International Migratory Bird Day at Fish Springs NWR on May 11th from 10 am-6 pm. Fish Springs was established in 1959 as a resting and nesting place for migratory birds in a harsh desert environment. Over 250 different species of birds have been seen at the refuge. May 11th coincides with the peak spring migration at Fish Springs and thousands of birds will be present. Activities will include birding tours with expert Utah birders, and day-long mist netting and banding of songbirds. Visitors will have the rare opportunity to capture and band birds. For more information call the refuge staff at 801-831-5353.

Subcribe to Desert Plants

Botanical journal published by the University of Arizona for Boyce Thompson Southwestern Arboretum. Intended for amateur and professional desert plant enthusiasts, this semi-technical journal is devoted to broadening knowledge and encouraging the appreciation of indigenous and adapted arid-land plants. First published in 1979, **Desert Plants** is now a biannual publication featuring informative, extensively researched articles complete with color photographs. Topics range from desert plant ecology, morphology, physiology and horticulture to landscape architecture and history of desert plant explorers.

Desert Plants is a non-profit, tax-exempt journal which relies solely on subcriptions, grants and donations. Your support is vital to keeping this outstanding publication in print. Rates: Individual $20, Institution and Foreign $25. Send name, address, check to Dr. Margaret Norem, **Desert Plants**, 2120 E. Allen Road, Tucson, AZ 85719 (520) 318-7046.

Editor's Note

Larry Meyer

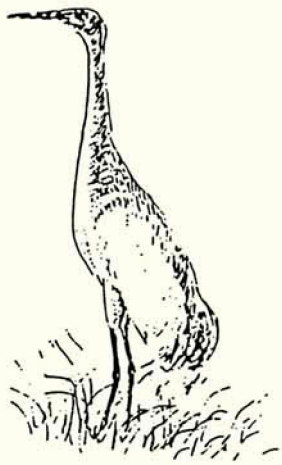
This is the second issue of *Sego Lily* which I have edited. I would first like to thank Jo Stolhand and the previous editors for their work and enthusiasm. The authors of articles also deserve thanks for their efforts.

I would like to encourage all members to feel free to submit material to the *Sego Lily*. I feel there is a place for comments, questions and a free exchange of ideas in these pages. In this issue, Doug Stone proposes a new focus for our organization. This is a diverse group, and I am sure some will have a reaction to those comments. Given the geographic separation of our group, the Sego Lily can provide a forum for exchange of ideas, which would otherwise be difficult.

Whether you have a letter, opinion piece or article in mind, consider submitting it. Notices of upcoming events are always welcome for our calendar. Send material to:

Larry Meyer
2931 Tolcate Lane
Salt Lake City, UT 84121
(801) 272-3275
meyer@med.utah.edu

If possible, articles and long notices are appreciated on disc. Either PC or Macintosh formatted 3 1/2" disks are acceptable. I use Microsoft Word, but I can import most other formats. However, if you are using a different text program (such as WordPerfect), please save it as "text only" or ASCII. It saves a great deal of editing. E-mail also works well for submission.



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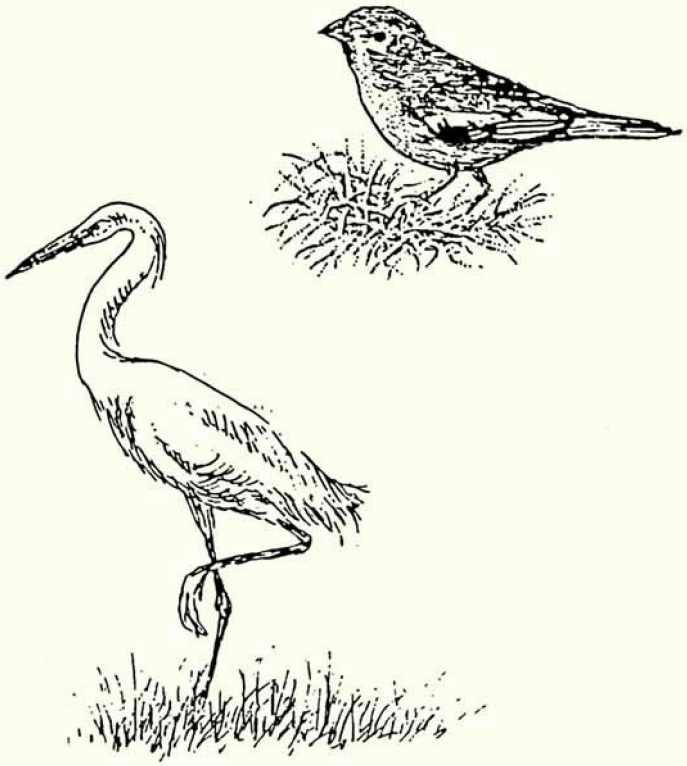

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(If you prefer not to cut this out of your **Sego Lily**, feel free to copy the membership form or simply write the information down and mail it with payment for the category of membership.)

Sego Lily

Newsletter of the Utah Native Plant Society

VOL. 19 NO. 4 **JULY/AUG, 1996**

CALENDAR OF EVENTS

July 28 Sunday	Uintah Field Trip. Jo Stolhand and Ben Franklin will lead a wildflower and plant identification hike in the high Uinta Mountains. Call Jo Stolhand for information and to arrange carpools. (801) 521-0069.
September 6, 7 and 8 Friday, Saturday, Sunday	The 1995 Mushroom Society Of Utah foray will be held at Camp Tuttle near Brighton, Utah, September 6, 7 and 8. Dr. Kent McKnight will head our team of mycologists. Contact Ardean Watts, 660 So. University St., Salt Lake City, UT 84102; (801) 581-1931. More Information inside.

ASTRAGALUS MONTII

by Joel Tuhy, Director, Moab Office — The Nature Conservancy

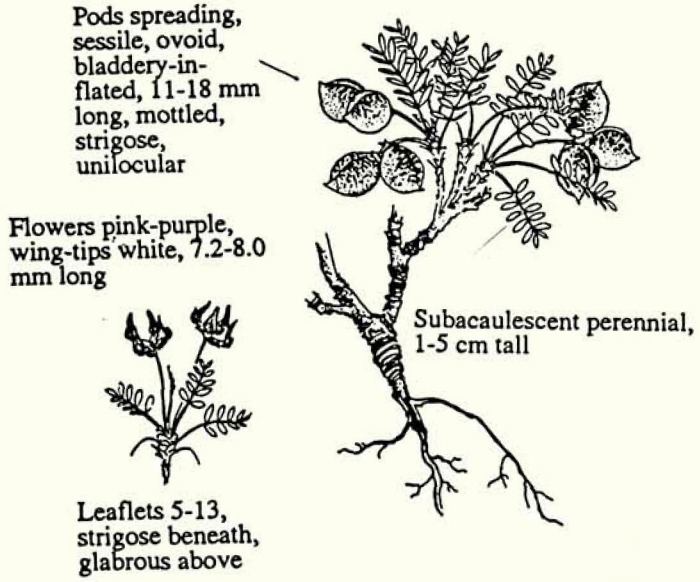
Looking off the south rim of White Mountain, the world falls away beneath your feet. Here at the southern end of the Wasatch Plateau there are no highpoints between you and Capitol Reef, the San Rafael Swell and the Henry Mountains. Ben Franklin and I were enjoying this view from our campsite on the evening of July 11, 1989. Lightning within distant thunderheads flickered visibly as dusk deepened. I thought about some of the scarce plants that lay in the vast country spread out below us: a curious yellow *Townsendia*, a pretty pale-blue *Gilia*, a tiny *Pediocactus* that barely shows itself above the ground surface.

We had chosen our campsite carefully because we were right amongst a population of another scarce plant: *Astragalus montii* Welsh, the Heliotrope milkvetch. It is a federally listed Threatened plant that is known only from the southern Wasatch Plateau in Sanpete and Sevier Counties. Because of its rarity and protected status, it has been the subject of research and management attention by the Forest Service and U.S. Fish and Wildlife Service (USFWS) for about the past fifteen years. In 1995 the USFWS published a draft Recovery Plan for the Heliotrope milkvetch that aims for recovery and de-listing within about ten years.

DESCRIPTION AND TAXONOMY

Astragalus montii is a diminutive perennial with ascending to erect stems barely 5 cm tall that arise from a branching caudex. The pinnately compound leaves vary from 1.3 to 4.8 cm long. The 5-13 leaflets per leaf are clothed with sharp, stiff appressed hairs (strigose) beneath, and are hairless (glabrous) above. At the base of each leaf are joined (connate) stipules sheathing around the stem. The inflorescences are racemes with 2-8 ascending to spreading flowers apiece. The flowers have the characteristic structure of the bean family; they are 7.2 to 8 mm long and pink-purple in color except for contrasting white tips on the wing petals. Flowering begins from late June to mid July, depending on duration of the snowpack. The spreading pods are egg-shaped (ovoid) and bladdery-inflated, being 11-18 mm long and 8-12 mm thick. They have red mottling on a pale green background and strigose hairs on the surface. Seeds are shed starting in July and continuing into August.

The Heliotrope milkvetch is a close relative of *Astragalus limnocharis* . The latter has two recognized varieties, according to Dr. Stan Welsh in A Utah Flora: *A. limnocharis* var. *limnocharis* grows on the Markagunt Plateau, and differs from *A. montii* primarily by having yellowish-white (ochroleucous) flowers. *A. limnocharis* var. *tabulaeus* grows on the Table Cliff Plateau and has entirely pink-purple flowers (i.e. without contrasting white wing-tips) that are perceptibly smaller than those of *A. montii* . Further, *A. limnocharis* var. *tabulaeus* has elongate caudex branches (i.e. is soboliferous) in response to its habitat of steep, loose slopes. In contrast, the caudex branches of *A. montii* are short in accord with its occurrence on level, stable surfaces.



Now that you have that straight, consider that Dr. Rupert Barneby does not recognize *A. montii* as a legitimate taxon in the Intermountain Flora. Rather, he combines the plants of the Wasatch Plateau (Welsh's *A. montii*) and Table Cliff Plateau (Welsh's *A. limnocharis* var. *tabulaeus*) into *A. limnocharis* var. *montii* . The plants of the Markagunt Plateau he retains as A. *limnocharis* var. *limnocharis* . Whatever the case, Barneby's description of these plants as "an elegant little astragalus" is a statement on which all can agree.

DISTRIBUTION AND ABUNDANCE

Despite some rather concerted searching efforts, the Heliotrope milkvetch is so far known only from three relatively small areas, all on the top of the Wasatch Plateau. It is apparently restricted to these locations mainly because little potential habitat exists elsewhere on the Wasatch or adjacent Plateaus. The most extensive stand of Heliotrope milkvetch is on White Mountain, where Ben and I surveyed its occurrences during our July 1989 trip. We mapped many discontinuous patches of the plant covering about 110 acres total – a challenging task given White Mountain's featureless terrain and some shrouding fog during the morning hours. We found that old estimates of 2000-3000 plants on White Mountain were probably way too low. By extrapolating from density figures in a monitoring plot, we conjectured that there could be as many as 1.3 million Heliotrope milkvetch plants on White Mountain. The 1995 Recovery Plan gives a far more conservative estimate of 60,000 plants there.

A second group of plants occupies about 30 acres of habitat on the ridgecrest where Heliotrope Mountain merges into Ferron Mountain. Old estimates of 1500-3000 plants again appear too low; our extrapolation yielded a potential presence of up to half a million *Astragalus montii* plants at this site. The Recovery Plan is more conservative, with an estimate of 100,000 plants there.

The third cluster of *Astragalus montii* occupies two separate patches of habitat on the southern end of the big flat on top of Heliotrope Mountain. This is where the taxon was first discovered by Mont Lewis and Bob Thompson of the Forest Service in July 1976. The occupied habitat covers no more than 30 acres, probably less. Old estimates of 1500-2000 plants were again revised upward by extrapolation to as many as 179,000 plants at this site. The Recovery

Plan's more conservative estimate is 40,000 plants there.

HABITAT FEATURES

The three occurrences of the Heliotrope milkvetch share a number of common habitat characteristics. The plants grow on level to very gently sloping south- and southwest-facing exposures, ranging from about 10,600 to 10,900 feet in elevation. Microtopography varies from flat to somewhat convex. Soils are shallow and very rocky, derived from the Flagstaff Limestone. At least 85 percent, usually 90 percent or more, of the ground surface is covered with a pavement of limestone rocks or gravel (up to about 20 cm in size), with rarely more than 5 percent exposed bare mineral soil. The mineral fraction of the soil ranges in texture from silt to silty clay loam to clay loam. Soil pH varies from 7.5-8.0+, and colors include light gray, grayish brown, brown and dark brown. In general, the Heliotrope milkvetch is restricted to small, very gravelly microhabitats that are scattered within more extensive areas of deeper, less rocky soils.

Astragalus montii grows in association with subalpine cushion plants and other low-growing species that are all mostly restricted to these areas with high concentrations of surface gravel. The more abundant plants in these communities include *Phlox pulvinata*, *Cymopterus lemmonii*, *Senecio canus*, *Hymenoxysacaulis*, *Astragalus kentrophyta*, *Eriogonum brevicaule*, *Erigeron ursinus*, *Potentilla ovina*, *Potentilla concinna* and *Arenaria rubella*. Total vegetation cover of these communities is low, with considerable bare ground exposed.

The limestone gravel-pavement communities that contain *Astragalus montii* are scattered within extensive, much more densely-vegetated stands of conifers, tall forbs and grasses that are widespread on the crest of the Wasatch Plateau. Common species of these widespread communities, such as *Picea engelmannii*, *Abies lasiocarpa*, *Ribes montigenum*, *Astragalus miser*, *Achillea millefolium* and *Agropyron trachycaulum*, are absent or very scarce in Heliotrope milkvetch habitats.

As an interesting side note, both varieties of the closely-related *Astragalus limnocharis* also grow in high-elevation limestone habitats. Adjacent highlands south and southwest of the Wasatch Plateau are capped largely by volcanic rocks. Highlands on which the limestone reappears, such as the Table Cliff and Markagunt Plateaus, are host to *A. limnocharis*. Another limestone endemic with a similar distribution is *Silene petersonii*.

ECOLOGICAL SITUATION

There are two possible interpretations for the ecological situation of *Astragalus montii*. The first is that this milkvetch is part of the climax vegetation in the cushion-plant, gravel pavement communities where it grows. It ranks fairly high in the structure of these communities. Based on quantitative measures such as square inches of basal cover and percent of total vegetation composition, *Astragalus montii* ranks anywhere from 2nd to 8th out of around twenty species.

A second interpretation is that the special gravel-pavement habitats are disturbed, seral stages of the more common grassland, for bland and forest communities on the Wasatch Plateau. In this case, the Heliotrope milkvetch and its cushion-plant associates would be pioneer species that are destined not to be maintained in any one location indefinitely.

The first interpretation seems more likely overall, especially where the gravel-pavement habitats occur in areas that are exposed to wind -- such as along the edges of Heliotrope and White Mountains. Mineral soil accumulation probably never proceeds very far in these locations where wind is so prevalent and strong.

In some areas, as on the interior of White Mountain, the second interpretation may apply. Gravel-pavement habitats there may once have supported deeper, less-rocky soils occupied by forb or grass communities. Disturbance severe enough to have caused massive soil loss has been attributed to abusive overgrazing by sheep on the Wasatch Plateau about 100 years ago. But even if this is the case, succession of cushion-plant communities toward the more common grass or tall-forb communities (via accumulation of mineral soil) would probably be very slow.

Regardless of their origin, the gravel-pavement sites that contain the Heliotrope milkvetch will probably remain as they are for a long time by human standards, at least longer than several human life-spans.

TREND

Four permanent monitoring transects have been established in *Astragalus montii* occurrences. Two of these are in the Heliotrope (western) site, established in 1982 and 1986, respectively. Transects were emplaced at the Heliotrope Ferron Mountain site and on White Mountain, both in 1988.

The Heliotrope Mountain transects have been re-read regularly since their establishment. Return visits to the other sites have been more sporadic. Data from the Heliotrope Mountain site generally show that *Astragalus montii* had a slight upward trend from 1982 to 1988, as measured by numbers of individuals and percent cover. Since that time the trend has been essentially stable -- there have been minor fluctuations but no large changes up or down.

FACTORS THAT AFFECT ASTRAGALUS MONTII

Several types of factors may have significant effects on the numbers and viability (or even survival) of *Astragalus montii* populations.

One factor, over which there is no control, is the region's climate. Fluctuations in precipitation amounts could affect population levels of the Heliotrope milkvetch and, perhaps more importantly, levels of other competing plants in the communities where the milkvetch grows. Some influence of this type may have been happening at the Heliotrope (western) site in the 1980s. *Astragalus montii* declined there, relative to its associated species, from 1984 to 1985, and then had a slow upward trend through 1989. One explanation for this is that abundant moisture in the early 1980s allowed all species in the milkvetch's habitat to flourish. Species that were already abundant (*Phlox*, *Eriogonum*, *Senecio*, etc.) may have registered large increases and thus been stronger competitors within the community, to the detriment of the milkvetch.

A second factor with potentially significant effects on *Astragalus montii* is disruption of the gravel pavement, especially if it leads to increase in the percentage of surface mineral soil. The *Astragalus* appears to be restricted to sites that are armored by a limestone gravel pavement, with very little mineral soil exposed. Where mineral soil exceeds about 15% of the ground surface area, plant species composition tends to shift toward dominance of species such as *Astragalus miser*, *Achillea millefolium* and *Agropyron trachycaulum* -- and decline or exclusion of *Astragalus montii* and other gravel-pavement plants.

Increase in surface mineral soil can result from a number of causes. Natural causes include burrowing animal activity and frost heaving. *Astragalus montii* has co-existed with such natural factors for millennia. It seems unlikely that either of these factors pose any significant threat to the species, unless the *Astragalus* populations have been first reduced or stressed by other causes.

Disruption of the gravel pavement can also result from trampling by domestic livestock. Of particular concern would be bedding or a few days' concentrated grazing by bands of sheep. *Astragalus montii* could suffer serious negative effects from just two or three days of such trampling or bedding. Grazing management that avoids such practices directly on the milkvetch's habitats may thus be compatible with long-term maintenance of this species. On sites that are subject to frequent winds, increases in surface mineral soil content (from whatever cause) may be short-lived and have little long-lasting effect on the *Astragalus* .

The relationship between these factors and the increase or decrease of the milkvetch is certainly complex. For example, a possible positive effect of livestock grazing could be reduction of native plant species that compete with *Astragalus montii*, particularly during periods of abundant moisture. It is thus possible that sheep grazing may have two opposite effects that tend to mitigate each other: (1) consumption of competing species, which would have a positive effect on the milkvetch, and (2) surface disturbance from trampling, which would have a negative effect by exposing more mineral soil.

RECOVERY

The draft Recovery Plan published by the USFWS lists three criteria for removing *Astragalus montii* from Threatened status, along with action items whose implementation would satisfy these recovery criteria. The Plan estimates that recovery can be accomplished by the year 2005.

De-listing of *Astragalus montii* may be considered when the following three conditions are met:

1. A total population of 200,000 individuals is documented for five consecutive years. [This

may be easy to achieve, if estimates of numbers based on plot-density extrapolations (nearly two million plants total) are anywhere close to being accurate.]

2. All three populations/occurrences have been maintained at minimum viable population levels for five consecutive years.
3. Formal habitat management plans and land management designations have been established that will provide for long-term protection for *Astragalus montii* and its habitat.

Actions needed to accomplish these recovery objectives would largely be the responsibility of the Forest Service (the surface management agency) and the USFWS. Some tasks involve managing land uses, such as minerals exploration and grazing, so that they are not detrimental to the Heliotrope milkvetch. Other tasks call for studies to determine accurate population numbers, biological/ecological factors, and minimum viable population features of the milkvetch. Still other actions would implement the habitat management plan and one or more special designations (e.g. research natural area, botanical area, essential habitat) referenced above.

A final action is to develop public awareness, appreciation and support for the conservation of *Astragalus montii*. Among all the action items, this may be the most difficult one for knowing when success has been achieved. In my view, any bit of good publicity is helpful. My hope is that by reading this article, you now have a heightened awareness and appreciation of central Utah's elegant little astragalus.

RARE PLANTS AND PETROGLYPHS IN DINOSAUR NATIONAL PARK AND NW COLORADO

by Lucy Jordan

On the weekend of May 10-13 I had the opportunity to join 15 members of the Colorado Native Plant Society on a two day field trip to explore plants and petroglyphs in Dinosaur National Park and Raven Ridge Natural Area in northwestern Colorado. The trip leader was Tamara Naumann, Resource Specialist with Dinosaur National Park.

At Tamara's invitation, the group convened Friday evening for a potluck dinner at her home in the Park. I arrived around 6:00 p.m. to find the party in full swing. Colorado Native Plant Society members from Pagosa Springs, Delta, the Front Range, and other locations in Colorado had arrived with plenty of outstanding food. We had an opportunity to become acquainted and eat more than we needed.

We convened the next morning at the Park visitor center where Tamara, with the aid of maps, gave us a brief lecture describing why she considers the Uinta Basin, and Dinosaur National Park in particular, the "center of the universe" botanically speaking. She pointed out that the Uinta Basin, and its close neighbor the Piceance Basin, are bordered by mountains on all sides, only breached by the Green River as it enters the Basin from the north and exits to the south. North of the Basin lies the Wyoming cold sagebrush desert, west is the Bonneville Basin, south is the Colorado plateau, and east lies the Great Plains, all with different and diverse floras. For plants from those regions to "communicate" with those in the Basin, they would have to cross alpine and subalpine habitats, a feat beyond the capability of most aridland plants. Also, there are more geologic strata exposed at the surface in Dinosaur National Park than in the Grand Canyon, thus providing many specialized substrates for plants to inhabit. As a result, the flora of the Uinta Basin includes elements from many areas of west, a number of which have evolved into unique species through genetic isolation and adaptation to unusual substrates.

Tamara provided the group with a 'hot off the press' list of the flora of the Park, as well as a bird list. We were invited to help her add to the list of plants during our field trip, as the list is considered to be a "work in progress".

We were also joined on this trip by Rusty Roberts, a BLM range conservationist from Meeker who is very knowledgeable about the flora of the region and who has been instrumental in protecting and monitoring many rare plants in northwestern Colorado.

Tamara then led us along the Harpers Corner Scenic Drive. Our first stop was on a low mesa in the pinon-juniper zone. Besides locating and identifying several flowering plants, Tamara gave us a discussion about the various types and ecological importance of cryptobiotic crusts in desert habitats. She also demonstrated how quickly desert mosses can turn green when given a squirt of water.

Our next stop was at a higher elevation grassland/low shrub zone with outstanding scenery in all directions

as well as many interesting plants. We then went on to our lunch stop, which was on a higher mesa in a ponderosa pine/ curlleaf mountain mahogany zone. I have never seen curlleaf mountain mahogany so large - trunks 8-10 inches in diameter. Really beautiful. Again, plenty of flowering plants to observe (and birds of interest too). We had a long and relaxing lunch including leftovers from the potluck.

We then visited a site with rare examples of petroglyphs on horizontal, rather then vertical, rock surfaces. Rock crevices also included interesting plant species, including a fern.

Our final stop was at the end of the Harpers Corner Scenic Drive. We made the 1 mile hike (by then it felt like more) to the Green River overlook, with views along the way of incredible geology including Echo Park and the confluence of the Green and Yampa Rivers. In between taking pictures of the scenery, we botanized (or maybe it was the other way around).

That evening, Tamara's husband Peter hosted a slide show and discussion of petroglyphs and pictographs of the area. He discussed the distribution and history of the Fremont and Anasazi cultures and differences in their rock art. He also provided us with information on locations to visit nearby so that those returning home could visit sites if they were interested. The discussion was fascinating enough to keep us awake despite our long day.

The next day we first visited a sandstone cave site with petroglyphs on BLM land in northwestern Colorado right next to the highway (yes, there were also many interesting plants). We then went to Raven Ridge, an escarpment with several strata of exposed shales which are inhabited by rare, endemic plant species. Rusty gave us a brief discussion about the species that occur there and BLM management of the area. He also provided results of monitoring that he and the Colorado Natural Areas Program have been conducting for some years. We then dispersed in exploration of the many plants in the area. I am always amazed and awed by how many plant species have adapted to survive in those shale habitats. The surface is composed of nearly impermeable wafers of white or light-colored shale. Besides not being "soil", the chemical composition of the shale is beyond the tolerance of most plant species. The white or light colors make the light and heat environment extreme as well. Yet, somehow a very diverse and specialized flora has evolved to take advantage of that hostile environment. The plants even make beautiful flowers!

I left the group at about noon to return home. Altogether it was a very satisfying, educational, and fun occasion. I no longer work with plants much as a profession, and this was an excellent opportunity to renew my "plant eyeballs".

Several trip participants kept a list of all the plants we saw. If you are interested, I will provide you with a copy of the list.

During the trip, many of the Colorado contingent expressed enthusiasm for a joint Utah-Colorado plant field trip. We discussed the possibility of visiting the southeast Utah-southwest Colorado area. There are many knowledgeable botanists working in the area in both Colorado and Utah who could serve as trip leaders. If you are interested, please contact Board members or the president of your local chapter. With sufficient interest, we will try to organize a trip or two, probably next spring when the desert is flowering.

I encourage Utah Native Plant Society members to organize and participate in field trips like the one I recently participated in. First, the people are interesting, lively, fun, and knowledgeable. Second, I had an opportunity to sharpen my keying and other identification skills by working with others to identify plants. Third, I reawakened what I call my "plant eyeballs", that particular gestalt that allows naturalists to understand what they are seeing and why it is there. And last but not least, we discovered several plants that were not yet on Tamara's list, therefore we had the opportunity to add to the body of knowledge that contributes to our understanding and ability to conserve and protect our botanical heritage.

FOREST SERVICE FILLS REGIONAL BOTANIST POSITION

The USDA Forest Service's Region 4 office in Ogden has filled the Regional Botanist position that was vacated by Duane Atwood when he became the Assistant Curator of the BYU herbarium in July 1995. The Regional Botanist is an important position from UNPS' perspective since it administers the Sensitive plant program on all of the National Forest lands in Utah. I hope the rest of the Society will join

me in expressing appreciation to the Forest Service for its commitment to this position and to the continuity of its Sensitive plant program. At the same time, I think we can give ourselves a pat on the back for communicating to the Forest Service our interest in seeing this position filled. This is a good example of how UNPS can help make a difference!

By way of introduction, the new Regional Botanist is Teresa Prendusi. Before coming to Utah in mid-May 1996, Teresa was based in Albuquerque, New Mexico, where she was the Forest Service's Region 3 Botanist for the past four years. But Utah is not terra incognita for her since she started her career as a federal employee here in 1979 as a Phenologist with the BLM Price Resource Area. Teresa was born in Yugoslavia where her parents had fled during the Communist takeover of Albania. She later grew up in Switzerland, France, and Italy before her family emigrated to the United States. She earned her Botany degrees from Humboldt State University and Sonoma State University in California, and she has also worked as a botanist for the BLM in Susanville and later in Bakersfield, California, and for the National Park Service at Point Reyes National Seashore. Teresa is planning to return to Albania this fall to visit her 98-year-old grandmother who shares her love and knowledge of plants. Her grandmother is the local expert on plants; she knows which ones can be used for medicines, clothing dyes, etc. Please join me in welcoming Teresa back to Utah and wishing her every success in her new position.

BLM WORKING TO DESIGNATE SENSITIVE PLANT SPECIES ON PUBLIC LANDS IN UTAH

The USDI Bureau of Land Management (BLM) is currently working to compile a Sensitive plant species list for public lands in Utah. The need for such a list came about because of a recent change in USDI Fish and Wildlife Service (FWS) policy with respect to Candidate species for possible listing under the federal Endangered Species Act (ESA). In the recent FWS publication "Review of Plant and Animal Taxa That Are Candidates for Listing as Endangered or Threatened Species" (61 Federal Register 7596-7613; Feb. 28, 1996), the FWS announced that the term "Candidate" now refers only to species that in past Notices of Review had been called Category 1 Candidates. The notice also states that the Service will no longer maintain a list of those species formerly known as Category 2 Candidates. This policy shift by the FWS has created a peculiar situation whereby a large number of Utah's rare plant species, which until now have received management consideration by the BLM, will no longer be considered "special status species" because they are no longer considered Candidates for possible listing under the ESA. As a result, the BLM Utah State Office has determined that a need exists to create a formal Sensitive plant species list for public lands in Utah. The necessary authority and policy regarding the development of such a list is found under BLM Manual 6840, Special Status Species Management. Additional information on this process will be published in future issues of the Sego Lily as it becomes available.

1996 BRIGHTON MSU FORAY

The 1996 Mushroom Society of Utah foray will be held at Camp Tuttle near Brighton, Utah, September 6, 7 and 8. We are fortunate to have Kent and Vera McKnight head our distinguished professional team which will include Dr. Brad Kropp, USU; Dr. Darrell Weber, BYU; Dr. Brent Palmer, SUU; Dr. Sherman Brough, Dr. Mike Treshow, Frank Anderson, and hopefully Larry Evans, Paul Harding, and Larry Pearson. Camp Tuttle is on the right of highway 152 just before entering the town of Brighton in Big Cottonwood Canyon.

The foray will gather on Friday afternoon, and there will be a potluck on Friday night. Orientation sessions will be held hourly beginning at 8:00 a.m. Saturday and Sunday as needed. Collections of specimens not already on display will be received any time after 9:00 a.m. Exhibits will be open through Sunday afternoon. There will be a dutch-oven dinner ala Dave Okelberry at 6:00 p.m. Saturday prior to presentations by our mycologists, ending in a sing-a-long.

Attendees will be responsible for their own food except for dinner Saturday evening at 6:00 p.m. There are restaurants and a store within a mile. The foray will focus on basic training in gathering and identifying local mushrooms. Attendees are expected to bring proper mushroom gathering gear including baskets, wax paper, paper bags, knife, brush, hand lens, notebooks, field guides, etc. Field guides will be on sale. Beginners will be asked to attend orientation sessions on Saturday and Sunday mornings led by experienced members of MSU before going into the field. Experienced MSU members will be asked to

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spend some time on Friday afternoon gathering specimens in areas a few miles distant from Brighton to provide material for display at the orientation sessions. Collections should arrive at Camp Tuttle Assembly Hall between 5:00 and 6:00 p.m. Please bring a contribution to the potluck dinner at 7:00. Following the feast we will prepare for the foray's training sessions and exchange mushroom stories.

For reservations send your name, address and phone with your check to:

MSU, c/o Arthur Dyck
847 E. Canyon Breeze Lane
Draper, UT, 84020
(801) 553 1697

Preregistration fees are $15 for MSU members and $20 for nonmembers, $10 for new members (with membership). Family membership is $30. On site registration is $2 more. Saturday dinner is $5 per person. Make check payable to MSU.

Forest Service camping facilities are available at the following National Forest facilities. Redman Campground about 1/2 -mile south of Camp Tuttle: 12-car limit, no dogs or horses, bring wood, no hook-ups. Spruces Campground about 5 miles down the canyon from Camp Tuttle. Flush toilets, no hook-ups.

Native Plant Exchange

For sale or trade- 6 14" high green Ephedra (Mormon Tea). Also 15 6" high pinyon trees. All grown from seed in pots. Wanted: Large (2' plus) single leaf pinyon pine and Utah juniper (any size). Call: Randall W. Nish, (801) 374-5621, Provo.

Membership Application

☐ New Member ☐ Renewal ☐ Gift

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(If you prefer not to cut this out of your **Sego Lily**, feel free to copy the membership form or simply write the information down and mail it with payment for the category of membership.)

Sego Lily

Newsletter of the Utah Native Plant Society

VOL. 19 NO. 5 **SEP/OCT 1996**

CALENDAR OF EVENTS

Thursday, October 10 6:30 p.m.	UNPS Board Meeting. Board members, please mark your calendars! A blue card providing additional details will be sent at a later date.
Wednesday, November 6	Annual Members' Meeting and New World Potluck Come share in the traditional food fest from throughout the Americas, learn about what UNPS has been up to and where we're headed, and help elect the 1997 Board of Directors. A blue card providing additional details will be sent at a later date, but mark your calendars now.

Faith in the Mustards: BRASSICACEAE Identification Made Easy

Pam Poulson
Manager of Environmental Education
Red Butte Garden

There are about 3,000 species of Mustards world-wide, mostly in the northern hemisphere. Stanley Welsh discusses over 160 species and an incredible number of varieties in Utah Flora. Mustards are known for their distinctive flower, fruit and pungent watery sap. A few food plants are included in the family: mustard, broccoli, cauliflower, cabbage, Brussels sprouts, cress, radish, horse radish, nasturtium, etc.. There are also many weed species among the mustards: shepherds purse, whitetop, dyer's woad, money plant African mustard, etc..

As a family, Mustards, or BRASSICACEAE (pronounced brass-i-KAY-see-ee) is one of the most easily recognizable. Both the flowers and the fruit are unique to the family. Mustard flowers are always identified by four clawed petals arranged in the form of a cross. There are always 6 stamens: 4 with long filaments and 2 with short filaments. The closest relative Family of the Mustards is the Caper Family or CAPPARACEAE which contains the familiar Rocky Mountain Bee Plants. The main difference between these families being that in the Caper Family, all 6 stamens are the same length and are often showy and protruding from the flower.

The fruit of the Mustards is a seed capsule that takes one of two forms: silicle (roundish) or silique (long and skinny.) These are usually dry dehiscent at maturity. Once seeds are dispersed, the structure of the seed capsule usually remains behind, and is another useful tool in identification. Since Mustards are early bloomers, it is imperative that fruit characteristics be familiar to you.

OK, so far so good. We've got the family down pat. Distinguishing between genera is the next step. There are several genera of BRASSICACEAE, 45 (only 26 native genera) discussed in Utah Flora. Around urban and agricultural areas, the most common Mustards you will run across are Capsella, Cardaria, Chorispora, Isatis and Malcomia because of their weedy natures. In the outback, you will run across more natives. The 18 native genera that you are most likely to see are listed below, with number of species and varieties in parentheses. Genera with weedy species are noted with (W.)

Arabis (17 + 5 varieties) - rock cress
Capsella (1) (W) - shepherd's purse
Cardamine (5) - bittercress
Caulanthus (4) - wild cabbage
Descurainia (4 + 9 varieties) (W, 1 species) - tansy mustard
Dithyrea (1) - spectacle pod
Draba (24 + 6 varieties) - Whitlow grass
Erysimum (4) - wallflower
Lepidium (12 + 11 varieties) (W, 2 species) - peppergrass
Lesquerella (18 + 4 varieties) - bladderpod
Physaria (3 + 6 varieties) - twinpod
Rorippa (7 + 5 varieties) - fieldcress
Schoenocrambe (4) - schoenocrambe
Stanleya (3) - prince's plume
Streptanthus (1) - twistflower
Thelypodiopsis (6 + 2 varieties) little thelypodium
Thelypodium (6 + 4 varieties) - thelypodium
Thlaspi (2) (W, 1 species) - pennycress

For further breakdown and identification of native species, take the list above and divide it into 7 groups with the following flowering characteristics, then use the simplified keys to determine differences among genera:

Group 1
Leaves clasping; petals yellow (Lepidium, Rorippa, Stanleya, and Thelypodiopsis.)

1a. Basal leaves finely divided, sometimes lacking at blooming. Lepidium
1b. Basal leaves not finely divided. (2)

2a. Basal leaves pinnately divided, but not finely. Rorippa
2b. Basal leaves not divided. (3)

3a. Stamens protruding. Stanleya
3b. Stamens not protruding. Thelypodiopsis

Group 2
Leaves clasping; petals not yellow; herbage glabrous (Arabis, Caulanthus, Lepidium, Streptanthus, Thelypodiopsis, Thelypodium, and Thlaspi.)

1a. Leaf tips rounded; flowers brown. Streptanthus
1b. Leaf tips pointed; flowers not brown. (2)

2a. Blade of petal 4-7 millimeters long. Fruit a silique. Thelypodiopsis
2b. Blade of petal less than 4 millimeters long. (3)

3a. Fruit a silique. (4)
3b. Fruit a silicle. (6)

4a. Flower stems 8-12 millimeters long, erect. In mountains. Arabis
4b. Flower stems 2-7 millimeters long. (5)

5a. Plants 10 decimeters tall or more. Thelypodium
5b. Plants 4 decimeters tall or less. Only in Washington County. Caulanthus

6a. Seeds 3 to many per silicle. Thlaspi
6b. Seeds 2 per silicle. Lepidium

Group 3
Leaves clasping; petals not yellow; herbage pubescent (Arabis, Capsella.)

1a. Siliques flattened. Arabis
1b. Siliques triangular. Capsella

Group 4
Leaves not clasping; flowers yellow; herbage glabrous (Draba, Stanleya, Rorippa, and Schoenocrambe.)

1a. Leaves entire or sparingly toothed. (2)
1b. Leaves (at least some) toothed or pinnatifid. (4)

2a. Plants less than 1 decimeter tall. Draba
2b. Plants greater than 1 decimeter tall. (3)

3a. Plants growing in moist sites. Rorippa
3b. Plants not growing in moist sites. (5)

4a. Stamens obviously protruding. Stanleya
4b. Stamens not obviously protruding. Schoenocrambe

Group 5
Leaves not clasping; flowers yellow; herbage pubescent (Descurainia, Draba, Erysimum, Lesquerella, and Physaria.)

1a. Leaves pinnately lobed or divided. Descurainia
1b. Leaves not pinnately lobed or divided. (2)

2a. Leaves all at the base, no leaves on the stem. Draba
2b. Leaves present on stem. (3)

3a. Fruit a silique. Erysimum
3b. Fruit a silicle (4)

4a. Silicle more than 2 times as long as wide. Draba
4b. Silicle less than 2 times as long as wide. (5)

5a. Basal leaves more than 20 millimeters wide. Physaria
5b. Basal leaves less ht 20 millimeters wide. Lesquerella

Group 6
Leaves not clasping; flowers not yellow; herbage glabrous (Arabis, Cardamine, Caulanthus, Draba, Lepidium, Rorippa, Thelypodium, and Schoenocrambe.)

1a. Plants less than 1 decimeter tall. Draba
1b. Plants greater than 1 decimeter tall. (2)

2a. Two seeds per capsule. Lepidium
2b. More than two seeds per capsule. (3)

3a. Plant growing in moist places. Cardamine
3b. Plant not growing in moist places. (4)

4a. Flowers minute, less than 1.2 millimeters long. Rorippa
4b. Flowers 2 to 6 millimeters long. (5)

5a. Flowers brown. Caulanthus
5b. Flowers not brown. (6)

6a. Plants biennial. Thelypodium
6b. Plants perennial. (7)

7a. Petals with purple veins. Only in Emery and Uinta Counties. Schoenocrambe
7b. Petals without purple veins; found throughout Utah. Arabis

Group 7
Leaves not clasping; flowers not yellow; herbage pubescent (Arabis, Draba, and Dithyrea.)

1a. Plants less than 1 decimeter tall. Draba
1b. Plants greater than 1 decimeter tall. (2)

2a. Flower stems more than 1 centimeter long. Dithyrea
2b. Flower stems less than 1 centimeter long. Arabis

We've made it this far together. For a different approach to the genera, try Lois Arnow's keys, one for the flowers and one for the fruits, below. To determine the species, get yourself a good plant key, like Utah Flora, or Flora of the Central Wasatch Front. Do not hesitate to look up a word because you think you should know it. Even advanced taxonomists rely heavily on glossaries. A Mustard Family specific one is printed below.

Three interesting members of the Mustard Family are Isatis, Stanleya, and Schoenocrambe.

Isatis tinctorum, Dyers Woad, is a federally listed noxious weed. It is a winter annual, biennial or short lived perennial; 12 to 48 inches tall. Its leaves are bluish green, with a white vein that shows clearly on the top surface. The leaves are alternate, simple, basal, and do not clasp the stem. The inflorescence is flat topped with yellow flowers. It produces an indehiscent fruit which produces only one seed. Dyer's Woad was introduced from Europe during colonial times. It has a thick taproot that reaches 5 feet deep or more. When leaves are removed by weeding the plant regenerates from the roots. It has been approaching Utah from the north for several years now and has developed a beautiful, dense stand within the highway right-of-way near Lagoon. It entered the Salt Lake Valley just about 3 years ago. ERADICATE IT WITH HERBICIDE WHEREVER YOU SEE IT.

Stanleya pinnata, Prince's Plume is a familiar, billowy plant of red rock country, but grows throughout Utah. It is an interesting plant because it can tolerate soils containing selenium. Selenium is a toxic element that always occurs with Uranium (it can also occur by itself.) Uranium prospectors of the 1940s and 50s always scouted an area for Prince's Plume before they put any money into further efforts.

Schoenocrambe argillacea, S. barnebyi, and S. suffrutescens, Three of our four Schoenocrambes are either listed or proposed for federal listing as endangered. They are soil specific endemics on Green River Shale and the Chinle Formations. (See article by Ben Franklin in this issue.)

A special "Thanks" to Lois Arnow, who taught me to understand and use this material and gave permission to reprint keys and handouts from her Advanced Plant Identification Graduate Seminar.

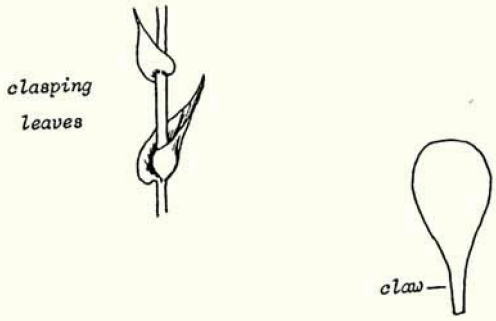
Glossary

appressed - pressed closely against another part.

ascending - directed or curving upward; not totally erect (compare decumbent and prostrate.)

centimeter - 10 millimeters; 1/100 of a meter; (there are 2.4 of them in an inch.)

clasping - joining or partly surrounding another structure (see illustration.)



claw - the narrow basal portion of a petal (see illustration.)

CRUCIFERAE - (pronounced croo-SIF-er-ee) the old name for the Mustard Family; meaning cross in Latin, referring to the shape of the flower: four petals in the form of a cross (a good mnemonic device for remembering basic characteristic of the Family.)

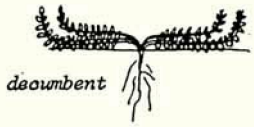
deciduous - falling off after its normal function has been completed, not necessarily a seasonal occurrence (ie: calyx on a poppy flower; contrast persistent.)

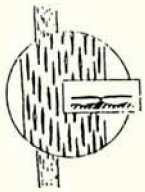
decimeter - 10 centimeters (100 millimeters).

decumbent - lying along the ground, but with an ascending tip (see illustration; compare ascending.)

dehiscent - opening at maturity, exposing or discharging contents, most often seeds.

dolabriform - shaped like the head of a pick (see illustration.)





elliptic/ellipsoid - same as in English
entire/subentire - no teeth, lobes or divisions/almost no teeth, lobes or divisions.

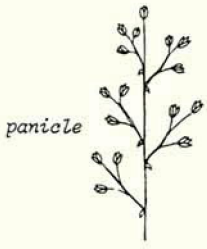
glabrous - no hair; bald (contrast pubescent.)

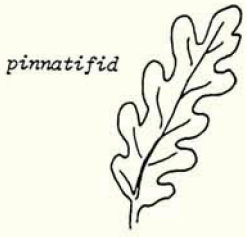
inflated - same as in English.
inflorescence - the flower cluster of a plant.

many - more than ten.
millimeter - 1/10 of a centimeter; 1/1000 of a meter; (there are 24 of them in an inch.)
mnemonic device - (pronounced new-MON-ick) a trick used to aid memorization.

obsolete - said of a regular structure that through evolution has reduced in size so as to be difficult to see-- sometimes having entirely disappeared.
oval/ovate - same as in English.

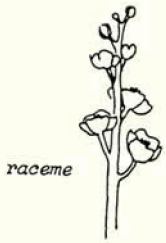
panicle - a type of branched inflorescence that could also be called a compound raceme (see illustration; compare raceme.)
pedicel - a stalk supporting a single flower within the inflorescence.
persistent - remaining attached after its normal function has been completed (ie: a calyx on mature fruit; compare deciduous.)
petiole - leaf stem.
pinnate/pinnatifid - veined, lobed or divided symmetrically along a central axis, as in the shape of a feather (see illustration.)





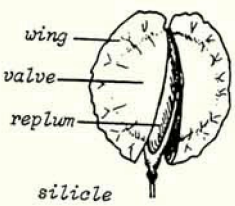
prostrate - lying flat on the ground (compare decumbent and ascending.)
pubescent - hairy or fuzzy (contrast glabrous.)

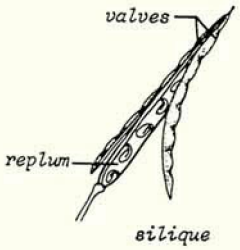
raceme - a type of inflorescence that holds flowers on simple pedicels branching from the main stem only once; could also be called a simple panicle (no compound branching; see illustration; compare panicle.)

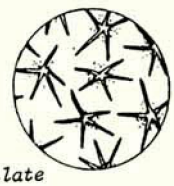


replum - the frame of the seed capsule which persists after seeds are dispersed, a structure unique to Mustard Family (ie: Money or Silver Dollar Plant, Lunaria; see illustration.)

septum - a dividing wall between two cavities; in the case of the Mustard Family between the two valves of the seed capsule; usually part of a replum (see illustration.)
sessile - no stem.
silicle - (pronounced SIL-ick-le) one of two types of seed capsules of the Mustard Family, usually roundish, not more than three times as long as wide; significant in differentiation among genera (see illustration; compare silique.)







silique - (pronounced sill-EEK) one of two types of seed capsules of the Mustard Family, usually long and legume-like, more than three times as long as wide; significant in differentiation among genera (mnemonic device: sleek; see illustration; compare silicle.)
stellate - star shaped (see illustration.)

ultimate - said of the extreme ends or divisions of a structure.

valve - In the case of the Mustard Family, one of the two sides of a capsule dividing from

the whole at maturity and dehiscence (see illustration.)

UINTA BASIN'S REED-MUSTARDS

Ben Franklin

Schoenocrambe is a genus in the Mustard Family (Brassicaceae or Cruciferae) that contains only five species (as here interpreted). Three of these are rare, local endemics known from the lower elevations in the northern and western portion of the Colorado Plateau within Utah; they are clay reed-mustard (Schoenocrambe argillacea), Barneby reed-mustard (Schoenocrambe barnebyi) and shrubby reed-mustard (Schoenocrambe suffrutescens). These three plants are federally listed under the Endangered Species Act: clay reed-mustard as threatened and Barneby and shrubby reed-mustards as endangered. The two remaining species, Schoenocrambe linearifolia and Schoenocrambe linifolia, are abundant and wide-ranging. S. linearifolia ranges from southern Colorado and northern Arizona southward to western Texas and Durango and Sonora, Mexico, and S. linifolia ranges from southeastern British Columbia, Canada, and western Montana southward (throughout Utah) to eastern Nevada and northern New Mexico.

The Uinta Basin of northeastern Utah and northwestern Colorado is an area of high endemism. This endemism is due, in part, to both its distinctive geology and the low-elevation isolation of the basin's desert habitats. Shrubby (S. suffrutescens) reed-mustard and clay (S. argillacea) reed-mustard, the two plants to be discussed here are both endemic to desert habitats within the Uinta Basin. Barneby reed-mustard (S. barnebyi) is a central Utah endemic at the south end of the San Rafael Swell and in Capital Reef National Park.

Shrubby reed-mustard

In the early thirties Edward H. Graham completed an extensive botanical study of the Uinta Basin. During his final field expedition into the basin, on 23 May 1935, Graham discovered shrubby reed-mustard on the lower east flank of Big Pack Mountain in the southern Uinta Basin, Uintah County, Utah. Its range has since been extended into Duchesne County (a single location), but, it remains a Uinta Basin endemic. It was originally described by Reed C. Rollins as Thelypodium suffrutescens; the following year he named a new, monotypic genus into which it was placed, the genus Glaucocarpum. Stanley L. Welsh and L. Matthew Chatterley subsequently placed it in the genus Schoenocrambe, however, Rollins and others still maintain the genus Glaucocarpum. The specific name, suffrutescens, refers to the woodiness of the lower portion of the plant.

Shrubby reed-mustard is a clump forming herbaceous plant with perennial stems and a stout, woody base. Its stems are numerous, unbranched and stand 4-12 inches tall. The stem leaves are elliptic to lance shaped, glabrous, usually entire, alternate on the stem and attached with or without a short petiole; basal leaves are not present. Yellow flowers are arranged in an elongated, loose inflorescence and are about the size of a dime. The fruit is a silique.

Shrubby reed-mustard grows in mixed desert shrub communities and, at some locations, in pinyon-juniper-desert shrub communities. It is found along semi-barren, white-shale layers of the Evacuation Creek member of the Green River Formation. The species populations are commonly on level to moderately sloping ground surfaces. Soils are dry, shallow, and fine textured and usually overlain by shale fragments; the fragments are small chips to long, narrow "bricks" which are collected commercially for building stone. It ranges in elevation from 5,100 to 6,500 feet.

A narrow endemic, shrubby reed-mustard is limited to only a small portion of Uintah and Duchesne counties. It is associated with place names such as Nine Mile Canyon, Gray Knolls, Dog Knoll, and Big Pack Mountain. Nearly 42 miles south and only slightly west of Vernal is Big Pack Mountain, the eastern limit of the species; it is known here, both, from the slopes of Big Pack Mountain and Little Pack Mountain to its south. Skipping from here over

Hill Creek to the vicinity of Gray Knolls and Dog Knoll and then over the Green River, the north slope benches of Nine Mile Canyon are reached, the plants most outlying location. The range of the species is approximately 26 miles, east to west and 20 miles, north-to-south. Lands that it grows on are administered by Vernal District of the Bureau of Land Management, Uinta and Ouray Indian Reservation, U.S. Department of Energy, and Utah School Institutional Trust Lands Administration, and it grows on some private land owned by various mining concerns. It was listed as endangered by the U.S. Fish and Wildlife service because of the ongoing and potential surface disturbing threats related to energy development and the mining of building stone within its habitat.

Clay reed-mustard

On May 11, 1976, clay reed-mustard was discovered by Duane Atwood on the upper east slope of Big Pack Mountain in the southern Uinta Basin, Uintah County, Utah. The location of his discovery was only 1 mile from the type location of shrubby reed-mustard (S. suffrutescens). In 1977 Stanley L. Welsh and Duane Atwood described this new species as Thelypodiopsis argillacea. Reed C. Rollins later placed in the genus Schoenocrambe. *Argillacea* is from the Latin word for clay, Argilla, and refers to the clay soils on which it grows.

Clay reed-mustard is a perennial herb with several stout, somewhat woody, unbranched stems 6-12 inches tall. Its narrow, fleshy leaves are covered with a white, waxy surface, are alternate on the stem and attached without a petiole. The flowers are about the size of a dime, with four pale lavender to whitish petals that exhibit conspicuous purple veins. The fruit is a very narrow silique.

Mixed desert shrub communities on precipitous, typically north facing slopes of the Evacuation Creek Member of the Green River Formation that consist of at-the-surface bedrock, scree, and fine-textured soils characterize its habitat. Vertical ledges of the more resistant Uinta Formation cap the Green River Formation at all locations. Clay reed-mustard grows at and down-slope of their contact zone, sometimes, nearly to the slope's base. It grows in both exposed and protected sites; the protected sites, however, often produce more robust plants. It ranges in elevation from 4,800 to 5,800 feet.

Place names such as Wild Horse Bench, Broome Canyon, Big Pack Mountain, The Wrinkles, Rays Bottom, and others together plot out the entire, discontinuous range of this very local endemic. Nearly 40 miles south and only slightly west of Vernal is Broome Canyon, the eastern limit of the species. Traveling from Broome Canyon west-northwest across Willow Creek, over Big Pack Mountain, over Wild Horse Bench and the Green River, the western most limits of clay reed-mustard are reached in the canyons above Rays Bottoms, 15 miles away. Its north-to-south distribution is even shorter, only 7 1/2 miles. Habitats of clay reed-mustard are on lands administered by the Vernal District of the Bureau of Land Management and Utah School and Institutional Trust Lands Administration. Clay reed-mustard was listed as threatened by the U.S. Fish and Wildlife service because of the ongoing and potential surface disturbing threats related to energy development within its habitat.

Continuing Concern

Both the shrubby and clay reed-mustards were listed because of ongoing and potential threats to their habitats in the Uinta Basin. Though some threats, such oil shale development, are temporarily on hold others remain. Oil exploration is on the increase as is the mining of building stone. Both the Bureau of Land Management and the U.S. Fish and Wildlife Service are to be commended for their current efforts to safeguard these species. However, as an organization and as individuals we need to remain aware and be involved in their conservation.

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Franklin, M.A. 1995. Field inventory of Schoenocrambe suffrutescens (R.C. Rollins) S.L. Welsh and L.M. Chatterley in the Book Cliffs Resource Area, Uinta Basin, Utah. Final report for 1994 Challenge Cost Share project. UDNR Division of Wildlife Resources, Utah Natural Heritage Program and USDI Bureau of Land Management, Vernal District. 9 pp. + appendices.

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Sego Lily

Newsletter of the Utah Native Plant Society

VOL. 19 No. 6 **NOV/DEC 1996**

CALENDAR OF EVENTS

UNPS Annual Meeting/Potluck

UNPS Annual Meeting
6:30 PM
Wednesday, November 6
Red Butte Garden and
Arboretum

Mark your calendars!
The Annual Members' Meeting and New World Potluck will be at the Red Butte Garden and Arboretum Visitor Center, at the top of Wakara Way in Research Park, near the U of Utah. There will be the traditional American foods potluck, with turkey provided. Bring your favorite New World food. Dinnerware will be provided.

SELECTED NATIVE UTAH CACTI

by Marv Poulson

The plant kingdom produces fabulous variety, but few members of the realm match cacti in their remarkable array of forms, spectacular flowers, and amazing adaptations for survival. Adaptation marks cacti as tenacious survivors from mountain to desert to tropical climates.

Among Utah's most interesting alpine and desert plants, cacti certainly rank highly. These remarkable succulent plants do populate favorable desert areas with a wide variety of species having growth forms ranging from small shrubs to tiny niche dwellers. Utah has awonderfully rich cactus flora, with many that comfortably fit into the garden setting. These plants lend unique interest to the garden so long as the location receives nearly full sun and limited moisture. Soils should be gritty, though not necessarily scree in texture. Cacti seem rugged and yet create stunning floral displays in nature. These qualities have endeared cacti to the hearts of many enthusiasts. Several Utah native cacti adapt well to horticulture and now may be obtained from reputable growers dedicated to protecting natural populations from exploitation. Collecting wild cacti, as any wild-growing plant, is strictly taboo, if not illegal.

Cacti in Utah grow from 9,000' in the central and northern mountains to as low as 2,800' in a finger of the Mojave Desert in the southwest corner of the state. A broad elevational range is only one aspect of cactus habitat diversity. The complex geology of Utah also provides unique habitats. Some cacti are endemic, found nowhere else in the world, and so very rare that they are listed on the Federal Threatened and Endangered Plant List.

Opuntia: Prickly Pear and Cholla

Of our native cacti, several *Opuntia* species, or prickly pears, make easy-to-grow garden candidates, though only one remains small and compact enough for my garden. *Opuntia fragilis*, the fragile prickly pear, performs in a broad range of garden conditions. These cute cacti have bulbous pads with spines that grab and hold fast to anything that might brush by. The pads detach easily from the plant, suggesting the fragile quality that gave it its name. A detached pad may be carried on the fur of an antelope, or on one's pant cuff, to later fall in a new location to root and grow. Normally, a few yellow flowers will unfurl during early summer, and, like the other *Opuntia* species, open for only a day or two before fading. The flower color on the second day usually darkens before the flower withers.

While we think of *Opuntia* as prickly pears, another section called *Cylindropiintia*, or cholla, comprises a group with cylinder-shaped branches. Only a few of these are hardy enough for cold areas, and the added protection of a solid fence or wall is advised. My favorite of these is *Opuntia ramosissima*, the diamond pencil cholla. This low, sprawling summer bloomer has small, simple, greenish-yellow flowers tucked at the ends of the stems. Long, stiff, white spines poke straight out along the stems, and a pattern of small diamonds gives the plant its common name.

Opuntia whipplei, the plateau cholla, grows at the highest elevation of the upright chollas. Greenish-yellow flowers crown the stems of this shrub-like, green plant. The fruits ripen late to a yellow color and remain fleshy until falling. This and the creeping cholla, *Opuntia pulchella*, are the most cold-hardy of the group. Though I have yet to see the creeping cholla in cultivation, it would, no doubt, make a worthy addition with its curious low habit and enchantingly simple, pink flowers.

Echinocereus: Hedgehog Cactus

Commonly called hedgehog cactus, *Echinocereus* forms clumps of stems among the rocks. The strawberry or claret cup cactus (*Echinocereus triglochidiatus* var. *melanacanthus*) represents our most cold-hardy native hedgehog cactus. This low-growing cactus can form tight clusters of more than 200 stems, creating an impressive display of red flowers attractive to migrating hummingbirds. Usually found among weathering rocks, the claret cup cactus grows from low altitudes in southern Utah to the foothills of the mountains. Planted among rocks in well-drained soil, these cacti do well in the garden, possibly even in relatively humid climates.

Sclerocactus: Devil's Claw Cactus

Commonly called fishhook or devil's claw cactus, *Sclerocactus* is closely related to the generally smaller plains cactus *Pediocactus*. Forming small, single globes or oblong-globe-shaped stems, *Sclerocactus* is popularly referred to as "small barrels." Utah has several exceptional fishhook cacti well suited to the garden, though most are rare and not currently being propagated. The most common, largest, and most available is *Sclerocactus parviflorus*. This spiny, single stemmed cactus may grow to 12" tall and 4-5" in diameter. Flower color varies from soft yellow to brilliant pink or magenta. As with most cacti, young specimens will likely prove most successful in well drained garden situations.

Pediocactus: Plains Cactus

Cacti are known for beautiful flowers, and the miniature blossoms of *Pediocactus* are particularly intriguing for their simplicity and delicate coloration. As is common among cacti, the flowers only open in bright sunshine and close soon after clouds or the setting sun bring shade. Such a system assures the greatest opportunity for pollination during periods when pollinators are most likely active. Harsh desert conditions demand that precious plant moisture be conserved at other times of day.

After flowering, a "top-shaped" seed capsule develops from each pollinated flower and soon dries to a hard, brown shell. As the capsule becomes hard, it splits down one side and around the top. Glossy, tiny black seeds are released and roll to the ground.

The first *Pediocactus* described was discovered in a southem Utah valley. The relatively flat local terrain suggested to the discoverers a "plain." They chose the Greek word "pedio," meaning "a plain," for the name of this group of plants. With many more members of this genus of cactus now known, "pedio" stretches things a bit. Most *Pediocact i* actually prefer growing on hilly terrain or even open badlands. Such is the way of plant names.

Adaptation to soil extremes is striking for all but one species of*Pediocactus*. Most are restricted to very specific soils in isolated niches of the geologically complex Colorado Plateau. This is why most of these tiny cacti have such limited habitats and small populations. *Pediocactus* have long been widely sought by collectors. Some rare species now face extinction because of the unscrupulous.

Only one species, *Pediocactus simpsonii* or Simpson's plains cactus, could be considered common in nature, with suitable habitat ranging from

the western slopes of the Rocky Mountains into many Great Basin mountain ranges and the Columbia Basin. Simpson's plains cactus adapts to many soil types and exposures, making it particularly well suited to the garden. Small creamy white, yellowish, or pinkish flowers open in early spring.

Neolloydia: Pineapple Cactus

This genus of medium sized bee-hive-shaped or pineapple-like cacti extends north in the Mojave Desert into Utah's southwest corner. Here the prevailing climate contrasts with the rest of the state by being warmer. Our only *Neolloydia* cactus is a species called *N. johnsonii*. It favors rocky limestone outcrops. Johnson's beehive cactus blooms during late April or May with a crown of vivid pink, tightly formed flowers. The spiny stems can easily be seen on open hillsides or silhouetted along low ridges.

In the garden, careful placement for favorable exposure should afford this moderately hardy cactus an opportunity to thrive. Attention to providing rocky clay loam with infrequent moisture will suit *Neolloydia johnsonii*, though flowering will be a lucky treat in colder climates.

Coryphantha: Pincushion Cactus

Along with *Pediocactus*, the *Coryphantha* cactus are my favorites for the garden. Like *Pediocactus*, *Coryphantha* tend to be cold-hardy, compact, and very floriferous. To my eye the flowers are as vivid as those of any plant.

While *Coryphantha vivipara* var. *desertii* (snowball cactus) may not exhibit extreme cold tolerance, this round, silver-spined cactus makes a wonderful addition to a favorable nook. The snowball cactus lends unique stature and texture among the rocks and sports a cluster of light yellowish flowers in early spring.

The hardiest and most widespread of the pincushion cactus, *Coryphantha vivipara* var. *vivipara* ranges from Utah north into southern Canada. Of the spectacular blooming cacti, this species offers the most dependable results in cold climates. The closely related, slightly larger *Coryphantha vivipara* var. *arizonica* also forms tight, low clusters of bubble-like stems producing striking displays of purple-pink to vivid pink or magenta flowers. Though only open for a couple of days, these disproportionately large flowers can almost obscure the plant.

Of all the diminutive, common cacti, *Coryphantha marstonii* var. *missouriensis* presents beauty and unique interest virtually all year. In nature, these tiny, lumpy-looking cacti favor hiding among grasses on gentle hillsides or the edge of flats. Spring brings softly yellow flowers that can nearly obscure the plant beneath. Later, fruits ripen as round nodules, changing from green to striking red. The bright fruits may linger through winter. These characteristics make Martin's cactus a worthy addition to northern gardens.

Several other Utah cacti would make excellent garden specimens but, alas, they are so rare or so unsuited to northern climates that successful cultivation would require extraordinary measures such as a cactus house. As for the rare plants, they are either protected under the Endangered Species Act or simply not available from commercial propagators.

Several spectacular hot desert cacti also occur in southern Utah, including the large barrel cactus, *Ferocactus acanthodes* var. *lecontei* and *Echinocactus polycephalus* var. *xeranthemoides*, and the small, barrel-like cactus, *Mammillaria tetrancistra*. While each of these offers unique interest, planting in northern gardens would not be successful. Only hot desert gardens or gardens in a cactus house would be suitable for hot desert cacti.

Cacti make fine garden candidates. Most hardy species offer long life, easy care, and unique flowers. Soils should be without supplemental fertilizers and reasonably well drained with infrequent watering. Try a few cacti: you will like them.

Nursery-Grown Cacti Sources:

Hillview Gardens Products, 5405 W. Metaline Avenue, Kennewick, WA 99336-1422
Intermountain Cactus, 2344 South, Redwood Road, Salt Lake City, UT 84119
Cactus by Mueller, 10411 Rosedale, Highway, Bakersfield, CA 93312
Desert Nursery, 1301 South Copper, Deming, NM 88030
Sdiultz Cactus Growers, 1095 Easy Street, Morgan Hill, CA 95037

Distribution, Ecology and Monitoring of Siler's Pincushion Cactus (Pediocactus sileri) Endemic to the Moenkopi Formation of Southern Utah

by Alyce M. Hreha, Conservation Botanist
Red Butte Garden and Arboretum
University of Utah

Introduction

Siler's pincushion or Gypsum cactus (Pediocactus sileri) has been listed as endangered since 1979 under the Endangered Species Act of 1973 by the U. S. Fish and Wildlife Service (USF&WS, 1979). Based on a review of current information for the species, the U. S. Fish and Wildlife Service has proposed to downlist this species to threatened (USF&WS, 1993). The cactus' habitat is managed by the Cedar City Bureau of Land Management (BLM) District. It is BLM

policy to implement conservation programs for endangered, threatened and sensitive plant species that occur on their lands.

Bureau of Land Management efforts are directed towards restoring habitat and populations to the point that the provisions of the Endangered Species Act will no longer be necessary (USF&WS, 1986; BLM 1987). Even if the species is downlisted, the BLM will continue to monitor cacti populations for five years. At the end of the monitoring period, population viability will be assessed and the previous endangered designation may be reinstated.

Although some studies (Woodbury, 1985; Gierisch, 1980, 1989) have been conducted on the cactus in Utah, it was felt that a more in-depth survey was necessary to ascertain the distributional range and demographic data of all Utah populations on BLM lands for the purposes of the downlisting proposal.

A Challenge Cost Share Agreement between the BLM (Utah State Office) and Red Butte Garden and Arboretum (RBG&A) was signed in September of 1992. Project objectives include: surveying Washington and Kane Counties for new cactus locations, evaluating population size and age classes, recording cactus vigor, phenology, habitat, geological and soil information, establishing monitoring plots where appropriate, providing photos of both vegetative and flowering stages, identifing and photographing any threats to the species (i.e., trampling, collection, herbivory, insect predation) and providing management recommendations to the BLM. RBG&A has been studying the species since the 1993 field season. We have recently completed our fourth field season of monitoring the Kane County population near Kanab, Utah and we will prepare a final report on our findings this winter.

Species Distribution

Pediocactus sileri (Engelm.) L. Benson was first collected in 1883 by A. L. Siler at the type location at Pipe Springs, Arizona in Mohave County (Benson, 1982). It was later described by Engelmann in 1896 from that type specimen which is housed at the Missouri Botanical Garden Herbarium in St. Louis. The species is known from several sites along the Arizona-Utah border. The cactus' center of distribution is in Mohave County, Arizona. The eastern edge of its range is near Fredonia, Arizona (Coconino County) directly south of Kanab, Utah and the western edge is just southwest of St. George, Utah (Hughes, 1991). However, a few sites occur in southeastern Washington County and one site occurs in southwestern Kane County, Utah about 10 miles east of Kanab. These Utah locations form the northern limit of its distribution. The majority of the cacti populations are located in Arizona with plants occupying approximately 42,100 acres of suitable habitat of the total 330,000 - 400,000 estimated acres of Moenkopi Formation which occurs along the Arizona Strip BLM District (Hughes, 1991; USF&WS, 1993).

Vegetation and Associated Species

According to the U. S. Fish and Wildlife Service (1993), Pediocactus sileri populations occur in a variety of plant communities such as warm desert shrublands, sagebrush-grasslands and pinyon-juniper woodlands. However, the species is most often found in the warm desert shrub community (USF&WS, 1993). At lower elevations associated species include: creosote bush (Larrea divaricata), white burrobush (Hymenoclea salsola), cholla (Opuntia sp.), and wolfberry (Lycium sp.) which are components of the warm desert shrub vegetation type. Components of the salt desert shrub vegetation type such as shadscale (Atriplex confertifolia), four-wing saltbush (Atriplex canescens), rabbitbrush (Chrysothamnus sp.), Mormon tea (Ephedra sp.), snakeweed (Gutierrezia sarothrae) and shrubby buckwheat (Eriogonum corymbosum) are also present (USF&WS, 1986; Welsh et al, 1987). At higher elevations the cactus is often associated with pinyon (Pinus edulis), Utah juniper (Juniperus osteosperma), cliffrose (Cowania mexicana) and Yucca baccata (USF&WS, 1986; BLM, 1987).

Description of Habitat: Geology and Soils

The clay hills on which the plants seem to be restricted have a rolling topography and badlands appearance (USF&WS, 1986). The species is found on all aspects at elevations between 2,800 -5,400 feet (805-1,650 m) with slopes ranging from 0-80 degrees (USF&WS, 1986; Welsh et al., 1987). The cactus grows on gypsiferous sandy or clay soils derived from the Moenkopi Formation. Most soils within the cactus' habitat are derived from the grayish Shnabkaib member of the formation which contains gypsum lenses. According to Gierisch (1989), about 90% of the known cacti plants are found on the Shnabkaib member. In recent years, plants also have been found on the middle red member of the Moenkopi which is a reddish siltstone with gypsum layers of various thickness (Gierisch, 1981).

Cook (1960) reports that the Moenkopi Formation is one of the most conspicuous sedimentary units in Washington County. It outcrops extensively along the northern flanks of the Beaver Dam Mountains and west of the Hurricane fault along the Virgin anticline. Most of these outcrops are located west of the Cockscomb area in the southwestern portion of Kane County from the Paria River Valley to the Shinarump Flats near Kanab where they extend into Arizona (Doelling and Davis, 1989).

Threats to the Species

The U.S. Fish and Wildlife Service (1986) lists potential mining activities in Arizona, off-road vehicles (ORVs) near Fredonia, Arizona and St. George, Utah, grazing activities and collecting as possible threats to this species. Other impacts may include: 1) human encroachment on cactus habitat in the vicinity of St. George, Utah (USF&WS, 1986) and 2) damage to stems, fruits and roots due to herbivory by insect larvae, rabbits, burrowing rodents and disease (BLM, 1987; Gierisch and Anderson, 1980; Hughes; 1991).

Population location, accessibility by the public, ORV use of the habitat and grazing activities may influence population viability and effect species survival. In general, easily accessible habitat areas where use is heavy are more disturbed and degraded than areas which are more remote and receive less use. Additional monitoring activities may be necessary to assess impacts at heavily used sites and protect these populations from decline.

Conclusions

Seven locations of Pediocactus sileri occur within a two mile- wide band just north of the Arizona-Utah Border. The Washington Fields site (Washington County) is the farthest to the northwest while the Muggins Flat site (Kane County) is the farthest to the southeast. The Vermillion Cliffs, which divide the Washington County sites from the Kane County site, may serve as an effective barrier to the cacti's northward migration. Cacti dispersal may be impeded by Moenkopi outcrops with an east-west orientation (such as the White Hills and the Vermillion Cliffs which appear not to support the cactus) in comparison to outcrops with a north-south orientation (such as Warner Ridge and the Hurricane Cliffs which support cacti populations).

In general, the Washington and Kane County survey sites that were searched for the presence of P. sileri are similar in plant community components and soil type. The Utah locations of this endangered cactus are relatively similar geographically, floristically and geologically to the predominant sites in northern Arizona and most likely represent the northernmost distributional limit of this cactus species.

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San Rafael Footcactus, *Pediocactus despainii*

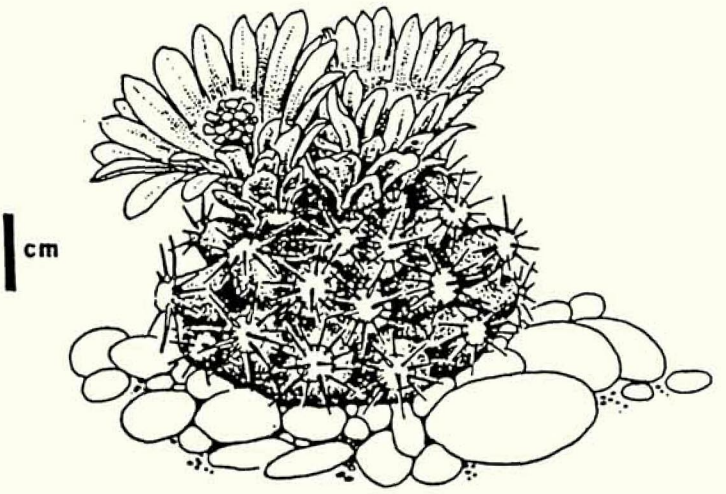
by Therese Meyer

The San Rafael Footcactus, Pediocactus despainii, was first discovered in 1978 by a graduate student from Brigham Young University, Kim Despain. Despain and his mother were exploring the San Rafael Swell in Emery County, Utah, when they noticed a very small cactus with peach-colored flowers. Upon reporting their observations to plant taxonomists in Utah and New Mexico, more visits were made to the site, and it was determined that the Despains had discovered a new species of Pediocactus, one of eight species in the genus. All are from the Four Corners region (Utah, Colorado, Arizona and New Mexico), and most of the species are rare endemics; restricted to a small habitat by ecological features such as specific soil types, elevations or geologic formations. P. despainii is found on fine textured soils in desert shrub vegetation type in the Colorado Plateau, primarily on lands administered by the Bureau of Land Management. P. despainii is listed as Endangered.

P. despainii is distinguished from several other members of the genus by its larger stem size, naked (hairless) areoles and the bronze tint of the flowers. Stem size of P. despainii tops out at 3 3/4 inches diameter, compared to some of the other Pediocacti, such as P. peeblesianus var. peeblesianus which reaches a maximum diameter of 1 3/4 inches, or P. papyracanthus which grows to 3/4 inches in diameter! P. simpsonii and P. sileri are the largest members of the genus, reaching 8 and 4 inches in diameter, respectively.

One of the most curious features of P. despainii is that the plants are only visible during the spring and summer. During late summer they shrink down, withering as the habitat dries, and remain hidden under the soil surface until spring arrives again. They flower in late April and May, at which time they are above-ground and very beautiful. The flower buds form in the fall and overwinter essentially under the soil surface.

A closely related species is the Winkler cactus, P. winkleri, whose range overlaps somewhat with that of P. despainii. They differ mainly in detailed aspects of their morphology, such as the hairs on the areoles (P. winkleri has more wooly hairs on the areoles, which are the points at the tips of the protrusions or bumps on the cactus) and the flower color. Some people see a more bronze tint to P. despainii flowers and more yellow and pink tint to P. winkleri flowers, but I have looked at both on the same day and seen a range of colors in both from yellow-pink to bronze-peach. The wooliness of P. winkleri areoles may be a more decisive criterium for distinguishing these two species. P. winkleri has also been listed as endangered.



Pediocactus despanii, illustration by Kay Thorne from Welsh et.al. Plant Novelties, Great Basin Naturalist, March 1980

The Recovery Plan for these two small Pediocacti (the management plan which U.S. Fish and Wildlife compiled for future downlisting of the cacti to Threatened status) calls for continued examination of likely habit in the hope that more populations will be discovered, so that a viable population size can be demonstrated. The plan states that even with such future discoveries, the nature of the restricted population sizes and the vulnerability of these cacti due to possible illegal collection essentially preclude delisting.

Steve Brach of Mesa Garden (PO Box 72, Belen, New Mexico 87002) was successful growing many Pediocacti (and other high desert cacti) by sowing the seed in coarse sand and placing them in unheated greenhouses so that the flats were exposed to very low temperatures. Alternating wet and dry and freezing and thawing seemed to break dormancy of the seed. Mesa Gardens sells greenhouse grown plants with verification that they are not wild-collected; a very important aspect of protecting our rare wild plant species.

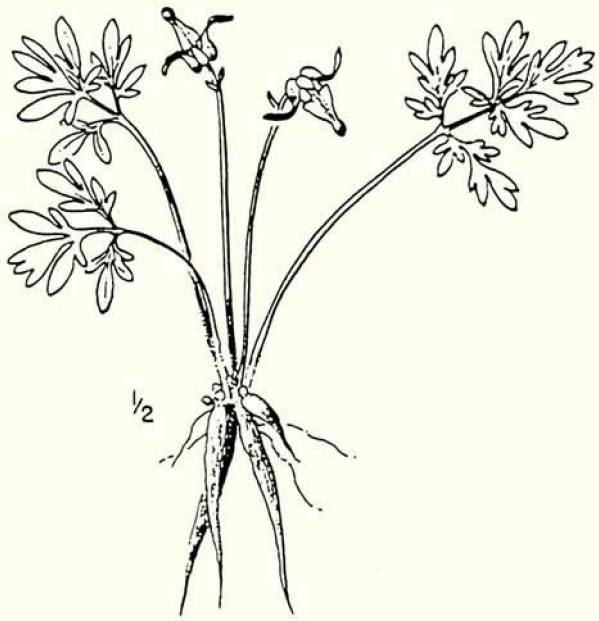
Dicentra uniflora, Steershead

by Jo Stolhand

Observations of *Dicentra uniflora* again this year have led me to believe that this plant's flower is budding underground. But first a little background on the plant itself.

Steershead is most easily found by looking for the small ternately compound leaves which originate from a tuber below the ground. The flower also originates from the tuber but not jointly with the leaves, so that above ground the leaves and single flower appear to be two different plants. The flower is small enough to be rather inconspicuous and is comprised of a solitary head of four white to pinkish-white petals. The two enlarged inner petals enclose the stamens and pistil and have the shape of a cow's skull. The two outer petals are more slender and recurved so that they give the appearance of horns on the skull.

Several years ago while photographing Steershead in Big Cottonwood Canyon I observed a few Steershead where the flower stem was bent in an arch and the flower was beneath the ground. No one with whom I talked had an explanation for this until I mentioned it to Kimball Harper who suggested that some plants bury their flowers to prevent cross pollination. He suggested that the observation could be published in the Sego Lily, but I was hesitant about doing so until someone else could make the same observation.



Dicentra uniflora
Steershead

Over the next couple of years it seemed that I usually found little patches of Steershead near the end of their blooming season, but none that were underground. This spring while botanizing with Robert Fitts in the Oquirrh Mountains we found a patch of Steershead and in this group there were at least four plants with flowers underground. However, we observed that when the flowers were removed from the dirt the outer petals were not yet recurved, but were lying against the two inner petals totally enclosing the stamens and pistil (it appears that as the outer petals turn outward and away from the two inner petals they leave an opening whereby the stamens and pistil are accessible). Flowers that were above ground were open (i.e. the outer petals were recurved) except for a few which were just starting to recurve. There were no visible flowers which one could assume to be in a budding stage.

Robert Fitts and I have observed the buried flowers of Steershead and believe that they may be budding below ground. Can any of our readers confirm this observation or shed some light on the matter?

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