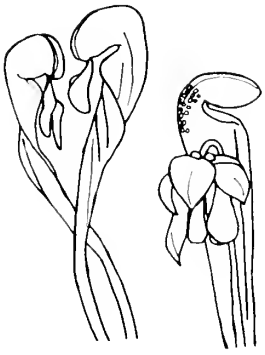
CARNIVOROUS PLANT NEWSLETTER

VOLUME 11, Number 1 MARCH 1982



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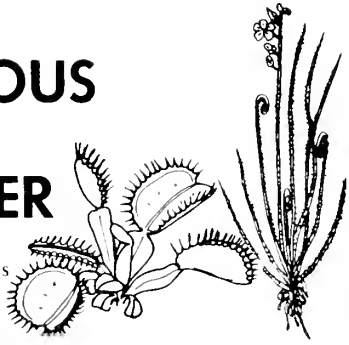

Official Journal of the
International Carnivorous
Plant Society

Volume 11, Number 1
March, 1982

COVER

N. x *oisoensis* = *(mixta sanderiana* x *maxima superba),* hybrid made by N. Ikeda about 1935. Raised by Japan Horticulture Co., Ltd., Oiso, Kanagawa Pref. President was N. Ikeda. Messrs. Katagiri and Gojima were superintendents. (CPN 8:14). Plant on cover grown and photographed by Joe Mazrimas.

The co-editors of CPN would like everyone to pay particular attention to the following policies regarding your dues to the ICPS.

All correspondence regarding dues, address changes and missing issues should be sent to Mrs. Kathy Fine, c/o The Fullerton Arboretum, Dept. of Biology, California State University, Fullerton, CA 92634. DO NOT SEND TO THE CO-EDITORS. Checks for subscriptions and reprints should be made payable to CSUF FOUNDATION-ARBORETUM.

All material for publication, comments and general correspondence about your plants, field trips or special noteworthy events relating to CP should be directed to one of the co-editors. We are interested in all news related to carnivorous plants and rely on the membership to supply us with this information so that we can share it with others.

Views expressed in this publication are those of the authors, not necessarily the editorial staff.

Copy deadline for the June issue is May 1, 1982.

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Editor's Corner

By Don Schnell

Carnivorous Plant Newsletter is now entering its eleventh year, and those who have been with us all the way or at least of for a greater part of those ten previous years have watched this publication grow from a small offset looseleaf format to our present fine journal with wide-ranging articles and features serving many interests worldwide. CPN is widely respected, is now being carried by more libraries, and even crops up now and then in formal journal or book bibliographies.

One of the most popular services we offer is the CPN Seed Bank, which is quite capably and generously run by Patrick Dwyer. Patrick receives no remuneration for his efforts and gives time from a very busy schedule to keep things running smoothly. It does not take much imagination to realize that the Seed Bank operation is not at all an easy matter, but Patrick has welded order and promptness out of this most difficult challenge.

The Seed Bank belongs to every ICPS member, of course. Obviously, the seeds must come from somewhere, from members who are willing to take the time to carefully pollinate and then collect seed. For donating seed, the member receives at least two rewards: credits for drawing seed from the Seed Bank at no charge, and the satisfaction of his contribution to CPN and other members.

The seventy-five cents per packet charge for seeds requested by non-contributors is fair and appropriate. It helps cover Patrick's cost for containers, wrapping and mailing. Any money in excess of that required by Patrick for expenses is turned over to CPN and used to cover the costs of printing and mailing. Last year, there was sufficient money from the Seed Bank alone to cover the text printing costs of nearly one whole issue.

The unrelenting rise in printing and postage costs have been your editors' most nettling problem these past years, and we anticipate no less of a problem for the forseeable future. This year we are able to hold membership fees to last year's level by increasing efficiency of operations, and by anticipating Seed Bank returns. No small journal of this kind can exist for long on membership dues alone, for it would soon price itself out of the market.

So, help yourself out as a member who wants this journal to remain at its high level and to grow still more in order to best serve your purpose. Set aside a few minutes to produce seed from your plants to donate to the CPN Seed Bank. The Seed Bank needs a constant influx of increasingly varied material to continue to be a service to all of you.

SPECIAL NOTICE

In the December, 1981 issue of CPN on p. 101, we mentioned an Australian CP newsletter called CP NEWS, giving subscribing information. We have since been informed that issues of this newsletter have been issued irregularly at best, with none recently, and that subscribers with subscriptions outstanding have been unable to contact the editor/publisher of the newsletter either by mail or by directly visiting his residence, which has been vacated. The editors of CPN therefore advise that you do *not* subscribe to CP News. Please be certain to distinguish this newsletter from that of the Brisbane Carnivorous Plant Society, which is a fine newsletter and publishes a fine newsletter on time. DES

News and Views

HARRY L. ABEL (3431 Landrum Dr., Smyrna, GA 30080) is interested in trying to organize a local CP chapter in the Atlanta and north Georgia area. Those also interested should write him at the above address. He also sent his very kind compliments on CPN and wishes the annual photo series on *Sarracenia* variants continued.

WALTER BARNETT (195 East Faith Terrace, Maitland, FL 32751) writes: In reference to numerous past articles concerning an appropriate title for one who studies carnivorous plants, I propose the term phytocarnivologist: fī-tō-kär-nĭv-ŏl-ō-jĭst (from the Greek *phyton* — meaning plant) (from the Latin *carnis* — meaning flesh) (from the Latin *voro* — meaning to devour) and, of course, -ologist (one who studies). Hence, one who studies flesh-eating plants, regardless of the plants' supplementary animalian phylogenetic nourishment (i.e., Insecta, Arachnida, etc.). Also the forms phytocarnivology — the study of; phytocarnivological — in such a study; and phytocarnivologically — adjectivally speaking.

SEED BANK

Patrick Dwyer (St. Michael's Episcopal Church,
49 Killean Park, Albany, NY 12205)

To send seed: Please remove seed from the seed capsules and place it in small envelopes (preferably paper so that they dry out enough to prevent mold.) Label with the origin and date of collection, including habitat if it is exotic. Fold the envelope once or twice before taping so that the seeds don't stick to the tape. After the seed is received it will be placed in smaller packets; donors will be informed of how many packets they have donated. A donation of 10-19 packets earns one free seed packet of comparable rarity, with one additional free packet for each additional 10 packets.

Do not ask to trade for seed from the bank. Everyone will have to buy all but the free packets.

To order seed: Please enclose payment. List the seeds desired and an equal number of substitutes in order of preference. If requested, Patrick will add any cultural instructions of which he is aware. Patrick will answer all letters and orders as quickly as possible; if you receive no response within two weeks (U.S.) to a month (outside U.S.), please write again. Each issue of CPN will include an update of the inventory. Cost per packet: $.75. (Number of packets is listed if less than 15 are available.)

Byblis liniflora (3), *Cephalotus follicularis* (8), *Darlingtonia californica, Drosera aliciae* (pale fl.) (5), *D. arcturi* (10), *D. auriculata* (5), *D. binata* (2), *D. binata multifida* (5), *D. brevifolia* (1), *D. burkeana* (10), *D. burmanii* (3), *D. capensis, D. capensis* (narrow lf.), *D. capillaris* (3), *D. dielsiana* (5), *D. filiformis filiformis* (5), *D. intermedia, D. linearis* (15), D. macrophylla (3), *D. montana* (6), *D. montana* (white fl.) (15), *D. natalensis* (3), *D. peltata* (7), *D. rotundifolia, D. rotundifolia* (Oregon) (7), *D. spathulata* (Formosa) (1), *D. spath.* (Kansai) (4), *D. spath.* (white fl.) (2), *D. stenopetala* (1), *D. whittakeri* (4), *Dionaea muscipula, Nepenthes ampullaria* (13), *N. gracilis, N. khasiana, N. mirabilis, N. rafflesiana* (7), *Pinguicula alpina* (3), *P. caerulea* (15), *P. leptoceras* (4), *P. primuliflora* (8), *P. vulgaris* (10), *Sarracenia alata* (2), *S. flava, S. leucophylla, S. minor, S. purpurea purpurea, S. purp. purp. heterophylla, S. purp. venosa* (5), *S. rubra* (6), *S. rubra jonesii* (15), *S. alata* × *rubra* (1), *S. ex, S. flava* × *leuco.* (3), *S. flava* × *oreo.* (6), *S. flava* × *purp.* (3), *S.* × *harperi* (1), *S.* × *mitchelliana* (1), *S. psitt.* × *minor* (15), *S. rubra* × *purp.* (1), *S.* × *swaniana* (1), *Sarr.* hybrid mix (2), *Sarr.* mix (3), *Utricularia subulata.*

I support J.W. Kent's observations (CPN 10:4 N/V, p. 88) on adventitious (not spelled adventitous) radicle and plumuellic development from the leaves of the genus *Utricularia*. My inquisition is limited to *U. longifolia*. Though my correlative studies are in a formulative state, there appears a proportional relation of adventitious development to levels of ultraviolet radiation (CPN Vol VI, No. 3, N/V, p. 45). I encourage others to test this hypothesis by exposing fluorescent grown *Utricularia* to variant angular intensity of direct sunlight. Treat latitude and time factors as independent variables.

The knowledge gained from the understanding of the organic chemical nature of adventitious formation should be applied to fruiting body development in edible plants, solving the world hunger equation.

BRUCE LEE BEDNAR (25 Lake Court Loop, Ocala, FL 32672) writes: A few summers ago I located an obscure population of *Sarracenia* in the Florida Panhandle, some 40 miles west of Perry on the Gulf. *Sarracenia minor* makes up about 20 percent of the plants; only a few *psittacina* can be found there, say 5 percent. The rest of the plants are × *formosa* and back crosses. The unusual thing about the population is that few of the plants are pure, if any, and they all seem to be dwarfed. Adult flowering minor have pitchers only 5-6 inches tall; they are found in good growing conditions but tall grass makes it quite hard to find them. They seem so meek compared to their counterparts in southern Georgia. The few *psittacina* I found are little, not very colorful and have small globosa hoods. The area nearby is wooded and the plants seem quite safe.

MARC DeLOACH (P.O. Box 682, Hydesville, CA 95547) has tried the feeding of dried fish foods to CP in cultivation as first suggested by Jeff Del Col (CPN 6:9). He uses tubifex worms manufactured by Blue Ribbon Products. The food comes in dried cube form which must be broken up to feed. This is specified as fresh water fish food; salt water foods may have too high a salt content for CP. Marc simply sprinkles the ground cubes on Droseras, removing the excess material on the medium in order to prevent fungus growth. *Dionaea* are first misted in order to moisten the trap linings, then "fed" pieces. About 60% of the traps seal, indicating active digestion and absorption. Marc has noted a markedly increased growth rate of all plants and seedlings tried so far. Sundew spp. so far tried have been *D. capensis, D. rotundifolia, D. burmanni, D. intermedia* and *D. binata*. About forty plants of *Dionaea* have been so fed.

Twin pitchers of Nepenthes (possibly *N. rafflesiana*).

Sent by Isamu Kuskabe
Photo by Mr. Pereira

THOMAS CAROW (Singener Weg 14, 1000 Berlin 37, West Germany) sends some slides:

Pinguicula cyclosecta, summer state. Leaves spoonlike, red color of plant according to light.

Same plant three months later in winter state. Leaf rosette grows slowly and produces thin succulent leaves (same size as the summer leaves).

Same plant two months later after winter state. In the center of the plant without roots many young plants grow out. Now the roots start growing and the young plants produce summer leaves.

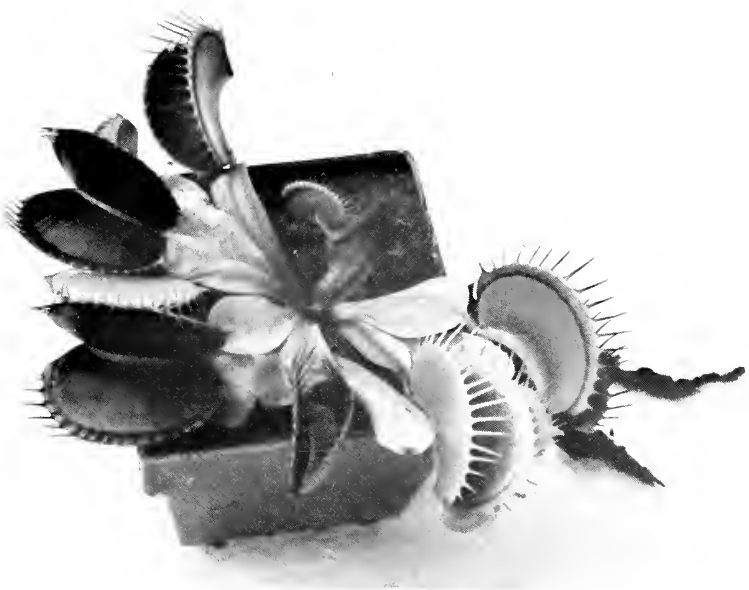
Drosera caledonica in culture.

Photos by Thomas Carow

Pinguicula lusitanica, growing in northwest Scotland in a wet meadow.

Drosera rotundifolia, growing in middle Norway at an elevation of 1000 meters.

Dionaea muscipula, 10-week old plants growing from bulbs under artificial light: Sylvania neon tube, warmwhite, 400-watt/square meter, 15 inches above plant.



(Miss) K. SHAILER, Secretary, Brisbane Carnivorous Plant Society (P.O. Box 283, Paddington, 4064, Brisbane, Australia) advises that subscription rates to the newsletter are $7.00 (Australian) overseas and $5.00 within Australia. *Sundew*, the official Brisbane Carnivorous Plant Society bulletin, will be posted monthly to all Society members. *Sundew* will contain news, views and articles on carnivorous plants. It will also have a first aid section as well as provide a seed bank.

LARRY MELLICHAMP (Biology Dept., UNCC, Charlotte, NC 28223) writes: The University of North Carolina at Charlotte will be sponsoring a garden tour to London, Southern England and Amsterdam May 14-29, 1982. The tour will especially emphasize cultivated plants at famous public and private gardens. We will spend at least a day at world-famous Kew Gardens, where cultivation and hybridization of CP began in the early 1800s. A highlight of the trip will be a day at the Chelsea Flower Show, where spectacular CP displays have been arranged in the past. The cost of the tour is $1400.00 and includes all transportation (air and ground), hotels, baggage handling, breakfasts, several dinners, some entrance fees and some theater tickets. It is a very reasonable price for such a tour. Tour will originate in Charlotte, NC, and leave from New York to fly to London. Larry Mellichamp, botanist and horticulturist at UNCC, will lead the tour. Academic credit will be available to students. For further information contact: Continuing Education Dept., Univ. of N.C. at Charlotte, UNCC Station, Charlotte, NC 28223.

SPECIAL NOTICE

The Missouri Botanical Garden in St. Louis is having its second annual carnivorous plant exhibit April 24 to May 16 in the Climatron. Over fifty different species will be on display.

As I was reading back over old issues of CPN (which I do regularly, and each time I notice something I missed before) I ran across a note in CPN, Vol. VI, No. 3, pages 46-47 where Bill Cook of Reseda, CA reported the use of Truban fungicide and Orthene insecticide on CP. He says that these are new applications and he will advise as results are observed. Then, in a footnote, he reports significant damage from Orthene. I would like to report that in the spring of 1981 I lost over 60% of a group of *Sarracenia* seedlings (some were 1-2 years old) by the use of Truban fungicide. I am pretty sure it was the Truban that did the damage since plants that were not treated (they were actually inadvertantly omitted!) were not damaged. Therefore, we would like to hear from anyone who has used Truban fungicide with good or bad results. Perhaps the Truban contributed to some of the damage in Bill Cook's case earlier.

One can never be sure about any chemical effects on plants until they are tested; always proceed with caution when using chemicals on CP since they are apparently more sensitive than most other plants. Perhaps if enough readers sent in results (successes and failures, or catastrophes, as the case may be) of their use of chemicals of all kinds on CP (insecticides, fungicides, miticides, fertilizers, soil conditioners, powders, sprays, etc.) we could compile them and have a major article on effective and damaging chemicals. Any observations, no matter how slight, could be useful; but when sending in observations, you must be fairly sure about the accuracy of what you report. We can draw conclusions and make explanations later, but first we must compile data, including names of chemicals, form in which they were mixed and applied, and especially concentration of application.

From

SINNESORGANE IM PFLANZENREICH

by Gottlieb Haberlandt

Insectivores: *Dionaea muscipula*

Translated by Carla R. Powell
Departments of Chemistry and Foreign Language
Lebanon Valley College, Annville, PA 17003

The tactile bristles on the upper sides of the leaf of *Dionaea muscipula* (Fig. b) were noted by Ellis, who first described the plants, named them, and also guessed that they trapped insects for food. However, he had not recognized their function. In the translation by Schreiber (1780), the passage reads as follows: "Although the small animal struggles to save its life, it cannot free itself because of three small upright spines located in the middle of the lobe between the glands, which frustrate all of its efforts." It would seem that Ellis believed that the insect is pierced by the "spines." Sydenham Edwards (1804) and Nuttal (1818) recognized the sensitivity of those small bristles to stimulation by contact. Edwards described his discovery, so very significant for the sensory physiology of the plants, as follows: "The small spines mentioned and figured by Ellis, are the only irritable points." Curtis (1834) and Lindley (1848) subsequently concurred. Meyen (1839), on the other hand, designated the upper side of the median nerve as the irritable part of the leaf.

The work of Oudemans, published in 1859, first pointed out an important step toward the solution of this question. Independently of those prevously mentioned, this researcher also established that the irritability is mainly centered in the si bristles (Fig. b). He investigated their anatomical structure further and found that the lower, more swollen part is separated from the footpiece by a definite construction (Fig. 10). But Oudemans is not only the discoverer of the "hinge" of the tactile bristles; he also determined the footpiece to be the most sensitive part of the entire bristle. However, he seems not to have understood the significance of the hinge.

In contrast to this, what Charles Darwin (1876) said about the tactile bristles constituted a step backwards, because he believed that the bristles were sensitive to an instantaneous contact over their entire length. Thus he could not help but fail to understand the function of the hinge in the perception of stimuli. He believed that its sole purpose was to prevent the bristles from breaking off when the halves of the leaf closed.

The detailed work of H. Munk, published in the year 1876, was introduced by an anatomical examination of the *Dionaea* leaf, which F. Kurtz carried out. What this said about the anatomical structure of the tactile bristles is very incomplete. Kurtz entirely overlooked the hinge; therefore, his illustration of the base of the bristle is incorrect. Nevertheless, Munk arrives at the same view as Oudemans regarding the localization of the irritability, although he did not know Oudeman's work. "Pieces may be cut off from the point down to the base with fine, sharp scissors, without causing the motor response, until one approaches the button-shaped protrusion of the alar parenchyma: contact to this area immediately causes the leaf to close.* Also the upper portions of the hair itself are easily bent without causing the leaf to move. While any similar bending, any impulse, any pulling on the hair, which results in a distortion of the base causes the leaf

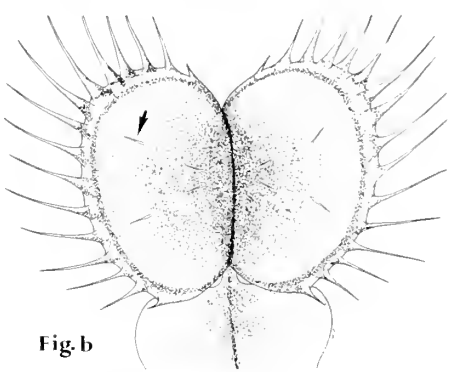


Fig. b

*Footnotes will appear at the end of the article, which will be continued in the June issue.

Field Studies on CP at UMBS

by Larry Mellichamp

This past July my wife Audrey and I were privileged to spend five days at the University of Michigan Biological Station (UMBS). The station, one of the country's largest and most famous, is located near Pellston in the extreme upper tip of the lower peninsula of Michigan. It is just 25 miles south of the Straits of Mackinaw. The station will be celebrating its 75th year in 1983 and has had an illustrative history of teaching and research in this highly interesting part of the Great Lakes region. Dr. David Gates, who has been director since 1972, has done an outstanding job in improving the quality of the overall program of UMBS.

The climate at the station is wonderful — usually cool nights and mild days. Sometimes it is cold and wet. I remember one night when I was a student there in 1972 and it got down to 39° F in mid-July! This of course reflects the location, and perhaps contributes to the unique and unusual flora of the northern Great Lakes region. There are many exciting habitats and interesting plant species to be found there. On this particular visit we accompanied Dr. Edward G. Voss on field trips to bogs and lake shores, and saw beds of *Drosera rotundifolia, D. linearis,* and a few *D.* × *anglica*! (See CPN, Vol. 9, p. 16.) These lush sundews with their glistening sticky tentacles were surrounded by hundreds of *Sarracenia purpurea*. All of these CP may be found growing in marly (alkaline), moist beach flats along the edges of pools or on rotten logs; and, with the exception of *Drosera linearis*, in acid sphagnum bogs. The pH does not seem to matter as much as constant moisture and lack of competition from other plants. The pitcher plants can be quite spectacular as they literally carpet the sandy beach flats along the shores of Lakes Huron and Michigan in the Straits region. Many are now preserved at Grass Bay, a large lakeshore tract recently acquired by the Nature Conservancy.

Those of you who like more subtle CP will not be disappointed, either. In those wet beach pools may be found *Utricularia vulgaris, U. intermedia, U. minor,* and *U. cornuta*; and the very rare *U. resupinata* has been found in the UMBS region by Dr. Voss (see H.W. Rickett's *Wildflowers of the U.S.*, Vol. 1, Northeastern States, p. 518 for photos). *Pinguicula vulgaris*, one of the gems of the rocky shores and boreal habitats, is frequent also in the region. Much research could be done on the ecology and distribution of CP here. Aspects of the pollination, seed dispersal, habitat specificity, pH and moisture relationships, and other ecological aspects of *Drosera* and *Utricularia* would be especially lucrative endeavors. The pollination biology of CP in general has been terribly neglected and this area offers many opportunities.

UMBS has many excellent facilities, including a fine reference herbarium, many unique and varied field habitats, and well-equipped modern laboratories. The faculty encourages independent research projects as well as conducting some very educational and exciting courses. Dr. Voss, who is an expert on the flora of the Great Lakes region, teaches courses in boreal (northern) flora and aquatic plants. Other courses in the well-rounded curriculum include ecology, physiology, mammals, birds, insects, and nature photography; and there is a new and growing naturalists program. The modern dining room mixes plenty of good food with rustic living; and ample opportunity is provided to encounter nature face

(Please turn to page 13)

Sarracenia purpurea
UMBS — Tr. End Bay

Drosera linearis
Marly Beach, Charlevoix Co.

Photographs by Larry Mellichamp

Pinguicula vulgaris
Waugoshance Point

Dionaea (continued from page 9)
to close, whether the stimulus is applied on the point or lower down." Munk, like Darwin, did not believe the sensitivity was confined only to the tactile bristles. He believed that the motor response would also occur when strong pressure was applied on the epidermis of the upper side of the leaf. Therefore, his interpretation of the importance of the bristles was merely "that it is possible to stimulate portions of the sensitive parenchyma by means of a long, flexible lever arm." Had Kurtz correctly described the structure of the footpiece with its hinge, then Munk certainly would have recognized that this provides a much more specific adaption for the purpose of sensory perception.[2]

Almost simultaneously Batalin (1877), who knew Oudemans' work, arrived at the conclusion, which he offered only as a possibility, "that the upper part of the small hair up to the constriction is not at all irritable, and if it appears to be sensitive to contact, then it is because pressure is placed on the lower parts of the hair when it is bent, thereby causing stimulation."

Goebel (1891) drew the now obvious conclusion, that it is the hinge cells of the bristle which perceive the stimulation, since they undergo the most severe deformation when the bristle is bent. He was, however, unable to supply a more detailed explanation for this view, because the appropriate research material was not available to him at the time. Goebel was also the first who gave an essentially correct, although very brief, description of the more approximate structural relationships of the bristles, particularly of their hinges.

Macfarlane's (1892) work basically agrees with Goebel's conception of the function of the hinge. A few errors in reference to the histological structure of the bristle, especially the hinge, will be discussed later.

Finally, I have given a brief description of the structure of the bristles and the related experimental evidence (Haberlandt 1896). Contact to the stiff upper part of the bristle initially causes bending only at the constricted hinge point. On the convex side, the membrane fold is stretched, and on the concave side it becomes even narrower and deeper. In one particular case, the extension of hte hinge after bending amounted to 21 percent on the convex side. It is obvious that very severe deformations of the protoplasts occur in connection with this.

I will now proceed to my more recent investigations into the structure and function of the tactile bristles of *Dionaea*. In so doing, I will assume that the approximate morphological relationships of the leaf and the distribution of the bristles are known (Fig. b).

The tactile bristle, from the tip to the insertion, has four parts (Plate VI, Fig. 10); these are:

1. The stiff, roughly 1 mm long, sharply tapering endpiece, which represents the mechanically active part of the entire apparatus, the lever arm which functions as a stimulator. It consists of living, elongated, prosenchymatous cells, whose walls are only moderately thickened and are neither lignified nor cuticularized (one cannot really call these cells, as Goebel did, "thick walled." Goebel himself (1891) illustrates them as rather thin-walled, by the way, see his Fig. 12). When treated with zinc chloride-iodine[3], they take on a muddy greenish-blue color. The cuticle is delicate, and very finely striated lengthwise at the point of the bristle. Because the pointed apical cells often split apart, the tips of the bristles become, as Darwin noted, bi- or tripartite. Often the basal cells are very short.

2. Bordering on this is a tissue layer consisting of crosswise lamellar cells which contain 2-3 cell layers in the middle, and 3-4 at the edges, where the epidermis forms part of the structure. All of the cells contain living protoplasts. According to Goebel, their walls are suberized. Although I have found only the walls of the middle cell layer to be suberized, on thin microtome sections these suberized walls appear as a pair of sharp, dark brown lines, which traverse the bristle at the aforementioned place (Plate VI, Fig. 10k)[4]. The lateral walls also exhibit this quality. It is quite possible, under different growing conditions than those enjoyed by the plants I examined, that the cell layer in question is suberized all the way through. What this "suberization" has to do with the function of the tactile bristles remains uncertain.[5]. In any case, it does not prevent water and soluble nutrients from being supplied to the terminal piece of the bristle above it. The cells of the terminal piece are, after all, alive.

(Continued on page 21)

*See plates pages 21-22.

An Introduction to *Genlisea*

By Glenn Claudi-Magnussen, 26861 Quevedo Ln, Mission Viejo, CA 92691

Genlisea was discovered in 1833 by Auguste de Sainte-Hilaire in Brazil. It belongs to the family *Lentibulariaceae*, along with *Utricularia, Pinguicula,* and *Polypompholyx*. Its range is more extensive than that of most other carnivorous plant genera and includes South America, Africa, Madagascar, and the West Indies. Its trap is unique, most closely resembling that of *Sarracenia psittacina*, but substantially different from even that species. *Genlisea* is, however, probably the least well-known genus of carnivorous plants.

Like *Utricularia*, *Genlisea* is a rootless, aquatic or semi-aquatic herb. This perennial plant grows from a slender, occasionally branching rhizome. There are two leaf types which grow simultaneously: foliage leaves and traps. The foliage leaves are linear or spathulate, and often grow in a dense cluster (less dense in the larger species), forming a hemisphere of leaves.

The traps vary in size (depending on the species) from 2.5 to 15 centimeters in total length. The trap consists of a bulb-shaped cavity atop a long footstalk. From the end of the cavity there is a long cylinder with the trap's mouth at the end. On each side of the mouth, there is a spiral "arm." The trap is attached to the rhizome by the footstalk, and usually hangs in an inverted position with the arms reaching downward. Copepods, nematodes, water spiders, and other small prey apparently follow the spiral arm to the trap's mouth. Once inside the mouth, long, pointed hairs which line the cylinder prevent the prey from backing out. Eventually the prey makes its way to the bulb, where it is decomposed and its nutrients absorbed.

The scape is simple, slender, erect, and often very tall. There are several to many evenly spaced flowers. The calyx has five parts, but the corolla is bilobed. The lower lip of the flower is large and trilobed, and the spur is incurved.

Genlisea africana. This species is found in wet grasslands in much of tropical Africa, including Guinea, Sierra Leone, Angola, Zimbabwe, and the Ivory Coast. It has numerous, spathulate leaves which range from 0.5 to 3 centimeters in length. It has from two to twelve violet (or, rarely, white or yellow) flowers on a scape which may reach 35 centimeters in height. The 0.6 to 0.8 centimeter flowers are densely covered with gland-tipped hairs. The lower lip of the flower is deeply incised, forming three distinct lobes. This species has two subspecies: *Genlisea africana* ssp. *africana (= G. subviridis)* and *Genlisea africana* ssp. *stapfii (= G. stapfii).*

Genlisea filiformis (= G. luteo-viridis or *G. anfractuosa).* This small species is found in swampy areas of Brazil, Venezuela, Guyana, Cuba, Colombia, Guatemala, and Belize. There are few to many spathulate foliage leaves in a rosette. The leaf blades are about three to five millimeters long and rounded at the apex. The leaf stalk is about as long or somewhat longer than the leaf blade. Two to four greenish-yellow or yellow flowers are found on a wiry scape which may be up to 20 centimeters

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UMBS (continued from page 10)
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If you are a junior or senior undergraduate student, graduate student, or post-graduate researcher and have a serious interest in field biology, then you would certainly profit from a summer at UMBS. The experience is invaluable for meeting other students from all over the country in the fascinating environment of northern Michigan. Financial aid grants are available. For further information on course offerings and admission write: Dr. David M. Gates, Director, University of Michigan Biological Station, Ann Arbor, MI 48109.

tall. The spur is rounded and extends below the lower lip of the flower. The pedicel is covered with long, gland-tipped hairs.

Genlisea glabra. This species is found in swampy areas of Venezuela. the narrowly spathulate leaves form a dense rosette. The leaves are one to four centimeters in overall length (including a long leaf stalk), and about 1.2 millimeters wide at their widest point. There are two to four flowers atop an erect scape which is about 18 centimeters in height. The lilac flower is about seven millimeters long, and has a deep purple ring along the edge of the lower lip. The spur is about as long as the lower lip.

Genlisea guianensis. This species is found in wet savannas in Guyana, Brazil, Venezuela, and Belize. It has lanceolate leaves, and violet or purple flowers with a long spur. New plants may sprout from the ends of the leaves.

Genlisea hispidula. This species is found in tropical Africa. Its foliage leaves may reach five centimeters in length. There are two to six violet flowers atop a scape which may reach 30 centimeters in height. The lower lip of the flower is slightly incised, forming three lobes. This species has two subspecies: *Genlisea hispidula* ssp. *hispidula* and *Genlisea hispidula* ssp. *subglabra* (= *G. subglabra*). The latter subspecies is found in eastern Africa.

Genlisea pygmaea (= G. exmeraldae, G. nigrocaulis, or *G. oxycentron)*. This small species is found in damp savannas in Brazil, Venezuela, Guyana, Colombia, Belize, and Trinidad. The leaves are spathulate. The yellow flowers are densely covered with both short hairs and long, gland-tipped hairs, and they are found on a slender scape which is usually over ten centimeters long. The conical spur extends below the lower lip.

Genlisea repens (= *G. pulchella* or *G. pusilla*). The trap of this small species is about three centimeters in total length. The foliage leaves are spathulate with a somewhat long leaf stalk. The flower is yellow, atop a tall scape (usually over ten centimeters tall). The lower lip of the corolla is slightly trilobed. The spur is conical and extends below the lower lip. This species is distinguished from *Genlisea pygmaea* primarily by the lack of (or small number of) hairs on the flower. *Genlisea repens* is found in Brazil, Venezuela, Guyana, and Paraguay.

Genlisea roraimensis. This species is found along stream banks in Venezuela. It has spathulate leaves. The yellow flowers are on a thick scape which is less than ten centimeters tall. The flowers are densely covered with short hairs and long, gland-tipped hairs. The spur is no longer than the corolla's lower lip.

Genlisea sanariapoana. This species is found in wet, sandy areas of Venezuela. Its leaves are lanceolate. The flowers are violet or purple with a long spur. The lower lip is slightly trilobed, and the scape and calyx of this species are densely covered with gland-tipped hairs.

Other species:

Genlisea angolensis — Angola, Zaire.

Genlisea aurea — (= *G. minor* or *G. ornata*) — a large species from Brazil.

Genlisea glandulosissima — Zambia.

Genlisea margaretae (= *G. recurva*) — Zambia, Tanzania, Madagascar.

Genlisea violacea (= *G. biloba, G. cylindrica,* or *G. reflexa*) — Brazil.

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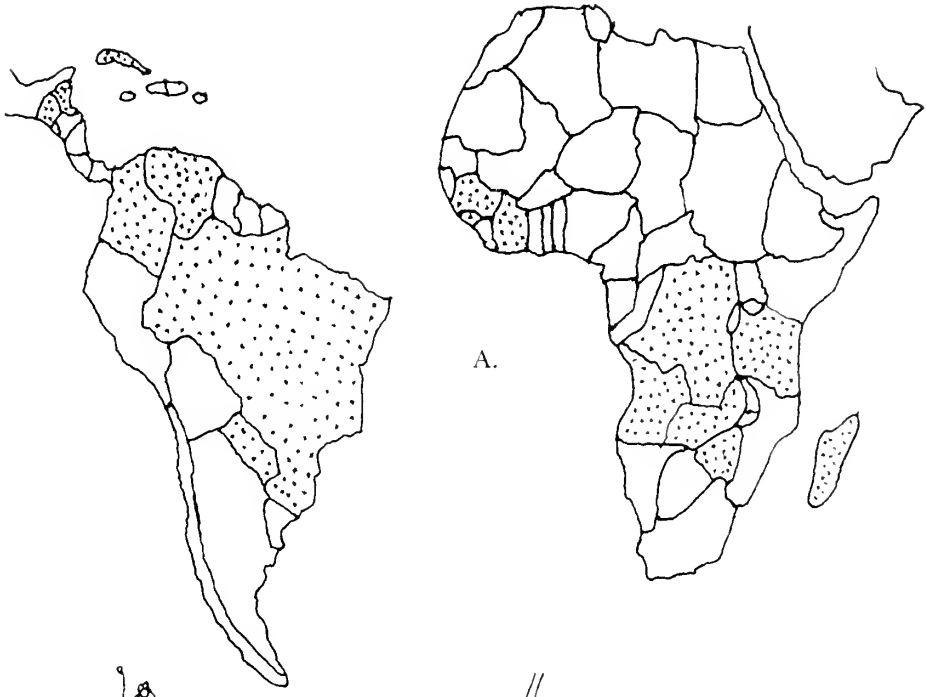

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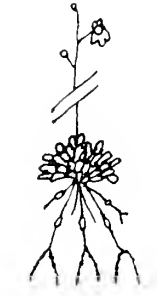

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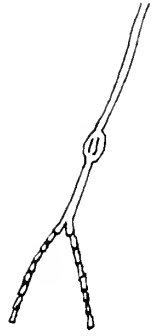


C.

D.

E.

KEY:

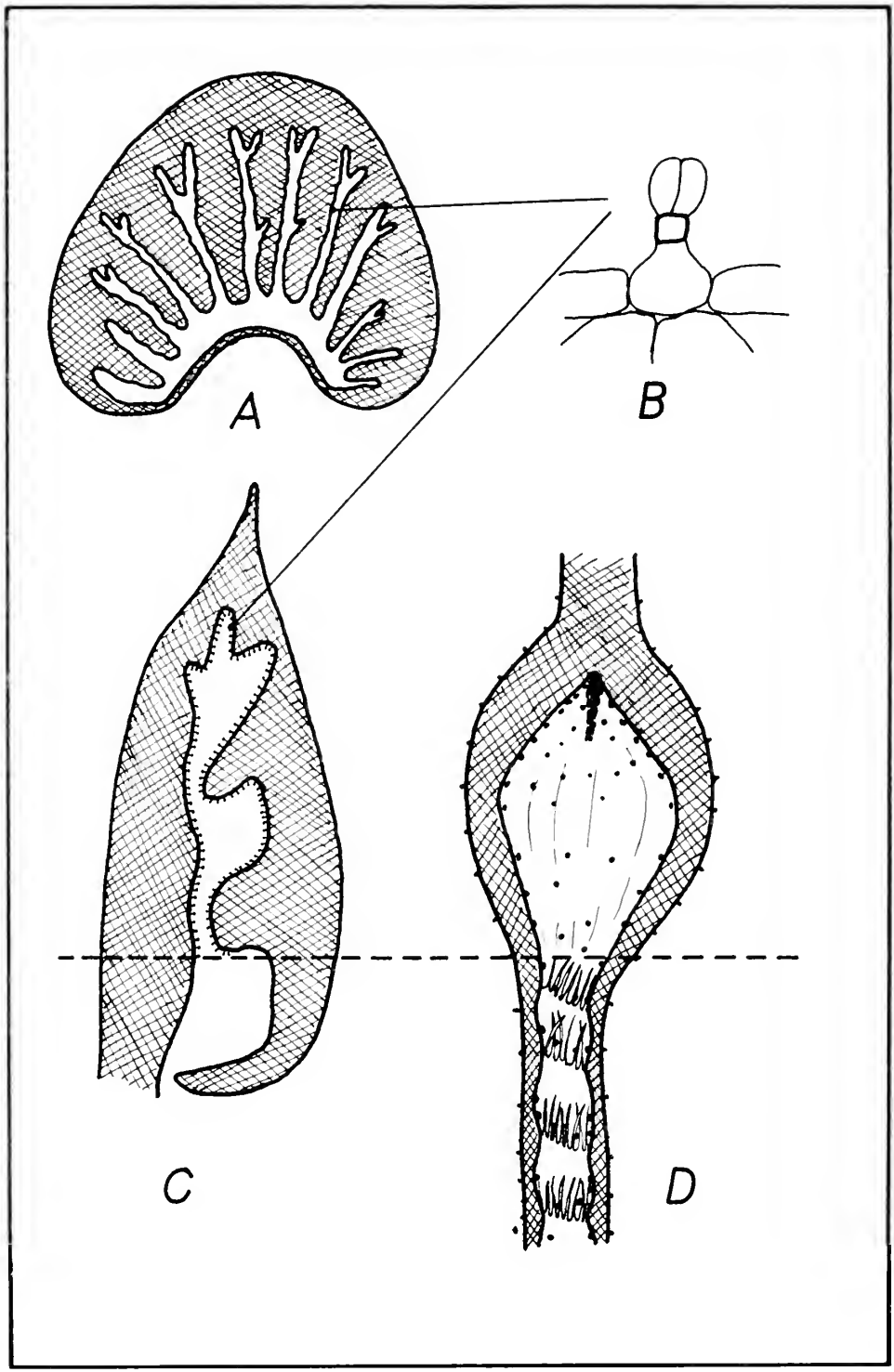
A. Distribution — shaded areas are those in which *Genlisea* can be found. Map may not be complete, particularly in Africa.

B. generalized plant

C. typical trap

D. cross section of "arm"

E. generalized flower


A
B
C
D

The Problem of Carnivory in the Common Toothwort (*Lathraea squamaria* L.)

by M. Studnička, Liberecká 36, 466 01 Jablonec n. N., Czechoslovakia

The genus *Lathraea* of the family Scrophulariaceae is distributed over Europe and Asia and comprises five species. All are parasitic. The most widespread is the Common Toothwort, which is parasitic on the roots of hazel, poplar, alder and other trees. It has an extensive underground network of stems with white, fleshy leaves. In April to May it shoots up inflorescence 4 to 8 inches high above the ground.

It is the underground leaves of the Toothwort which particularly interest admirers of carnivorous plants. Some botanists offer the opinion that these leaves may act as capture organs (Maniagetta 1897, Heslop-Harrison 1976, and others). Heslop-Harrison writes, "A strange example indeed is seen in root parasites of the genus *Lathraea* of the Scrophulariaceae, where the much reduced leaves of the rhizome have cavities lined with enzyme-synthesizing glands. Insects and other small soil organisms are readily caught in the cavities, suggesting the possibility of a form of carnivory not unlike that of *Genlisea*."

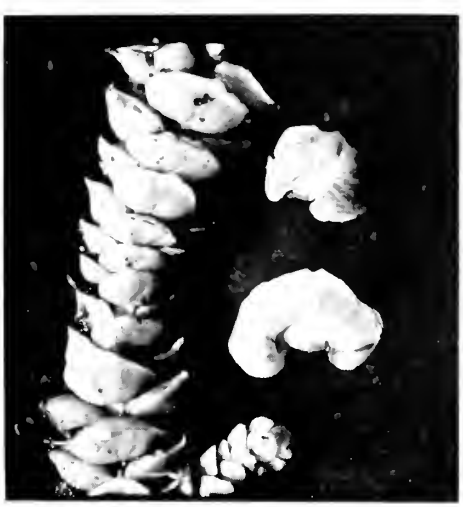
Let me describe the inner arrangement of the leaves of *Lathraea*. Under the epidermis, which is without stomata, there is a thick layer of reserve tissue with starchy grains. There is a richly articulated cavity inside the leaf which ends in a perforation in the lower side. The epidermis at the perforation is smooth but further inside the leaf the walls of the cavity are covered with pestle-shaped glands."

If we dip the cut end of an underground stalk into coloured water, the water is absorbed into the vascular system. The veins carry the coloured solution to the interior of the leaf and the glands expel it into the cavity. In the growing plant the water or water solution expelled by the glands soaks into the earth close to the leaves. This simple experiment demonstrates that the main work of the glands is to eliminate surplus water from the plant. This is essential to enable the plant to absorb constantly new supplies of nutrition (Danert et al. 1973: 270). In most plants water is evaporated from the stomata, but plants growing in a very damp atmosphere often eliminate water in drops by means of glands (so-called hydathodes) like the Toothwort. Tropical plants of the family Piperaceae have the same hydathodes as the Toothwort.

What remains unexplained, however, is the similarity between the leaves of the

(Continued on page 20)

Anatomy of leaves of *Lathraea and Genlisea*. A: Longitudinal section of a leaf of *Lathraea*. B: Gland of the inside of the leaf. C: Transverse section of the leaf. D: Interior view of a leaf of *Genlisea*. Below the dashed line: the smooth entrance of *Lathraea* in comparison with the neck of *Genlisea* with detentive hairs. (left)



Underground stem of *Lathraea squamaria* and lower side of two leaves. (right)

Utricularia dusenii

Utricularia dusenii

UTRICULARIA

Photos by Michel Depaz

Utricularia tricolor

Utricularia dichotoma

Cultivating Drosera Linearis (Goldie)

by Jim Korolas, 36 Eastlea Cr., Agincourt, Ontario, Canada M1T 3A6

Before I discuss cultivation and propagation techniques, it would be most beneficial to discuss my observations of *D. linearis* in natural habitat.

The habitat preferred by most carnivorous plants is acid conditions but *D. linearis* is usually found in soil of pH 8.0, although there are some exceptions. Schnell, in his book *Carnivorous Plants of the United States and Canada*, discusses in brief *D. linearis* and its preference for alkaline soil. I have seen large colonies of *D. linearis* along the western shore of Bruce Peninsula of Georgian Bay in Lake Huron which were growing in slightly to moderately acidic soil. In the same locality were an abundance of *D. rotundifolia* and large *S. purpurea* ('terraenovae'). In cultivation, *D. linearis* grows well in acid soil as it does in alkaline soil.

The surrounding vegetation in a typical bog are *Sarracenia purpurea purpurea var. ripicola* (a nomenclature preferred by some Ontario botanists for the specimens found in the Georgian Bay area) and *Drosera rotundifolia* and *D. anglica* as well as various small grasses and non-sphagnum mosses which are all important as competitors to *D. linearis*. In alkaline bogs, the population of *D. linearis* is so large that it is difficult to walk without crushing them. The alkaline medium gives a competitive edge to these plants where other CP are scarce.

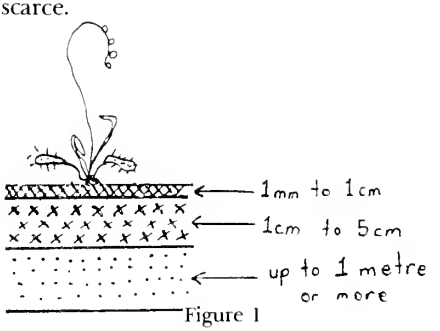


Figure 1

The soil composition where *D. linearis* is commonly found is made up of three distinct layers (Fig. 1). The top layer is peat, where most of the roots are. The second layer is peat and sand, where some roots are found. The bottom layer is sand. At this time I do not have have any data on the pH of each layer but I intend to acquire this in the future.

The temperature conditions where these plants grow naturally vary from extremely cold to very hot: 30 to 40 degrees Celsius in summer, and -5 to -15 degrees Celsius in the winter. (See Fig. 2.) Precipitation in this area is high es-

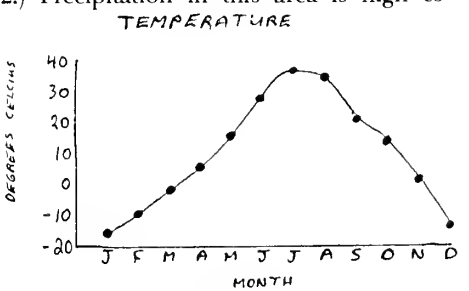


Figure 2

Utricularia

Micheal Depaz (18, Rue J. Henduchx, 4391 Berloz, Belgium) sends these slides of various *Utricularia*. The flower scapes of *U. tricolor* were initiated during the cold winter temperatures in the greenhouse (5° C) and 12 hours of light a day. They form as early as February but they grow very slowly, and the flowers open in July-August *U. dusenii* undergoes the same conditions, but the flower scape appears much later. However, it grows much faster and flowers about the same time. Plants are growing in German peat.

U. tricolor: flower height about 1 cm
U. dusenii: flower height about 2.5 cm
U. dichotoma: flower height about 1 cm

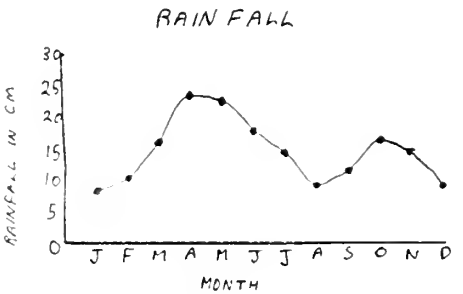


Figure 3

pecially along the shores of Bruce Peninsula so that a rainfall of 15 cm per month during summer is normal. The winter dormancy lasts anywhere between six to eight months.

In cultivating this *Drosera* in my house, *D. linearis* is kept with all my other CP. The plant receives direct sunlight in summer of about 6 hours. The plants are grown in living sphagnum moss in clear plastic cups containing two plants per cup and no drain holes. I keep the medium very wet, to the point where the water is clearly visible at the surface. One can also use peat moss or dried sphagnum as alternatives.

The medium used for seed germination is made up of a 50/50 mixture of sand and peat with a layer of fine chopped sphagnum on the surface. The seeds are sown on the medium, and then placed in the refrigerator for 4 weeks followed by a freezer treatment for 4 months and finally a two week refrigerator treatment before being placed in an area receiving a minimum of 6 hours of sunlight.

The most difficult factor in dealing with *D. linearis* is the dormancy period. I found that beginning in September, one must place the plants in an area where sunlight is limited to 4 or 5 hours per day, and temperatures are below 18° C. After two weeks of this, the plants can be placed in the refrgerator in their pots which should be only damp, and covered with a plastic bag. This dormancy period should last until late April. The refrigerator temperature is approximately 38° F, and the freezer is about 10° F.

Lighting conditions for seed are the same as for adult plants: full sun in a southern window. The seeds are sealed in a cup with a plastic bag on a damp peat medium. I have not had fungus

(Continued on page 27)

Toothwort (continued from page 17)

Genlisea and those of the *Lathraea* and the question of the secretion of enzymes and the catching of prey. I examined over 100 leaves of the *Lathraea* but nowhere did I find the remains of any prey or living organism. The absence of the ubiquitous protozoa, mites, nematodes and other organisms in the cavities of the leaves is not favourable for animal life and the Toothwort thus protects the inner surface against the harmful influence of organisms from the soil. Maybe the enzyme mentioned by Heslop-Harrison has an effect here.

The trap of *Genlisea* would then differ in principle from the "trap" of *Lathraea* only in the fact that *Genlisea* has a mechanism preventing its prey from escaping which *Lathraea* does not have. Therefore, the inner part of the hollow leaves of *Genlisea* kills the prey whilst that of *Lathraea* probably repels it.

Despite the similarity between the leaves of *Lathraea* and those of *Genlisea* and the fact that both belong to the related families Scrophulariaceae and Lentibulariaceae, I have not found any signs of carnivory in the Toothwort.

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(Received 8/17/81)

3. The irritable hinge of the bristle is externally characterized primarily by a severe constriction running all around it (Plate VI, Fig. 10g). It consists of a ring of peculiarly transformed epidermal cells and a central cell bundle (Plate VII, Fig. 2). The epidermal cells, which obviously function as the sensory cells, possess a radial-laminar, or more precisely, a wedge-shaped form, because their width naturally decreases from the outside toward the inside. Their length, on the other hand, increases considerably from outside to inside, such that their outline at the median longitudinal section resembles a trapezoid.

These sensory cells contain a strongly developed, heavily reticulated protoplast with a centrally located, rounded nucleus, which is somewhat larger than the nuclei of the remaining cells of the bristle and of the mesophyll.

As Goebel previously noted, the outer walls of the hinge and sensory cells are very thick, and thin out only at the base of the hinge furrow (Plate VI, Fig. 10 and Plate VII, Fig. 1). They are covered by a strongly developed cuticle, which is also described in the illustration by Goebel. Macfarlane, on the other hand, mistakenly argues that the cuticle over the "irritable joint" is completely absent, or at least extremely delicate[6]. In the surface view the outer walls of the sensory cells are very finely and closely perforated (Plate VI, Fig. 11). Macfarlane considers these spots to be pores, and leaves the question open as to whether they are completely open, or are sealed by a fine membrane. Of course, he is inclined toward the latter hypothesis, because he is of the opinion that the water eliminated during a motor response escapes through these supposed pores. He has not succeeded in directly observing such a discharge of water, however. What Macfarlane now considers to be pores are none other than very small nodules, or small tooth-shaped thickenings on the inner side of the cuticle, which protrude into the adjacent cell wall layers. This can easily be observed on longitudinal and surface sections. When examining such sections, one focuses on the edge of the hinge furrow, such that one can see the optical cross-section of the cuticle. Here, the delicate denticulation of the inner side of the cuticle is very clearly perceptible with sufficiently strong magnification[7]. After the addition of zinc chloride-iodine[3], the small points appear as more darkly colored spots on the yellowish-brown cuticle. Upon swelling and disintegration of the hinge cells with sulfuric acid, the cuticle is preserved together with its nodule-shaped sculpture. The even, dense perforation of the cuticle extends only up to the epidermal cells adjoining on both sides. Those adjoining on the upper side exhibit only sparse perforation when seen from the surface; those adjoining the underside, i.e., the uppermost epidermal cells of the base, exhibit somewhat larger cuticular denticulation, as do those which may be observed over the radial walls of the epidermis right up to the base of the pedestal. They also occur over the radial walls of the hinge cells themselves. The extensive fine meshing of the cuticle with the underlying wall layers of the hinge cells probably is for the purpose of increasing the tightness of the connection, and for preventing the connection between the cuticle and the underlying cell wall layer loosening or releasing due to the severe stretching to which the outer walls of the hinge cells are exposed when the bristle is bent.

To be continued

SPECIAL ANNOUNCEMENT

There have been some problems with people requesting missing issues several times. The following policy will now be observed with respect to missing issues.

1. After two requests for the same issue, any further requests for that issue must be accompanied by a $2.00 per issue and mailing charge.
2. No requests for a missing issue can be honored after six months past the date of issue.

Coming in June issue:

"A Photographic Primer of Variants of *Sarracenia rubra* Walt."
by Donald E. Schnell

PLATE VII LEFT SIDE

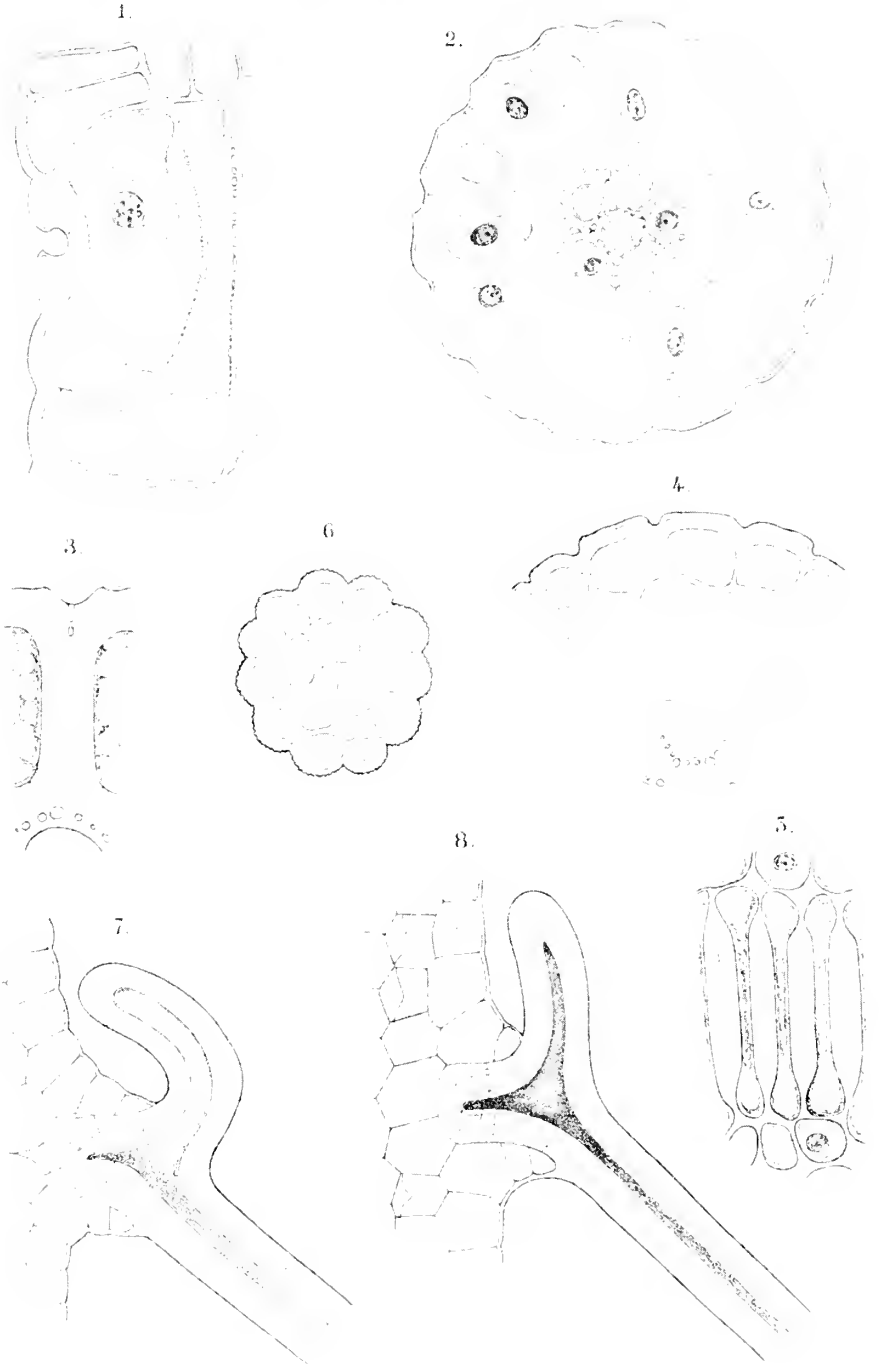
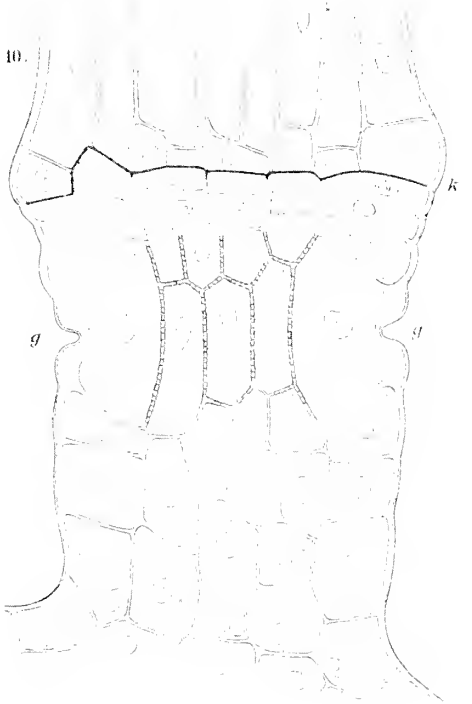
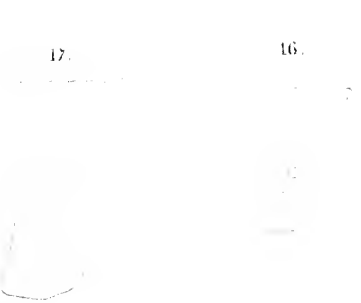
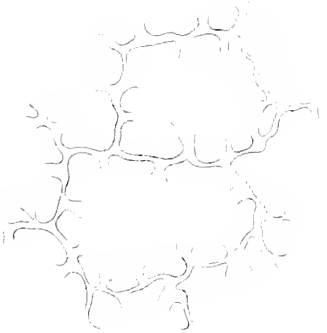
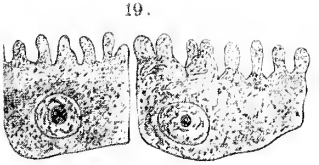


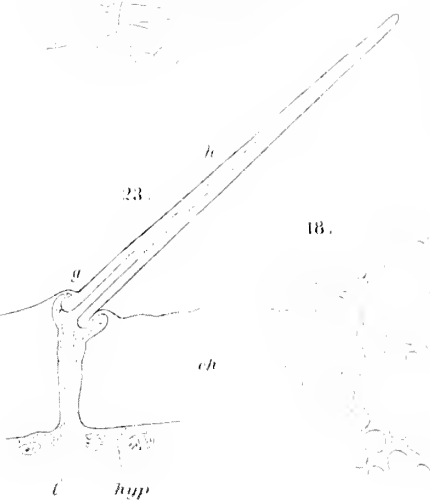
PLATE VI RIGHT SIDE











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Review of Recent Literature

Carlquist, S. 1981. Wood anatomy of Nepenthaceae. Bull. Torrey Bot. Club 108: 324-330.

Wood anatomy of this family is herein described for the first time. Details of wood anatomy are consistent with thealean (order Theales) relationship for the family as suggested by other studies, although the wood studies are not specific.

Chapman, A.D. 1981. The propagation of *Drosera binata*. Australian Plants 11:175, 182.

This is actually a summary of an 1866 article by the author (Trans. Bot. Soc. Ediborgh 8:542-544) in which the author describes propagation of the species by root cuttings in detail. An interesting aside is how the species was introduced to Kew by accident in 1823 (!) when it came up in some soil shipped from Australia. (DES)

Dixon, K.W. 1981. Drosera. Australian Plants 11:170-173.

A review of the biology and phenology of tuberous Droseras in general with special emphasis on *D. erythrorhiza*. There is a drawing of the plant's anatomy and tuber/rhizome/dropper terminology, a phenology diagram, and three color photos of other tuberous species. Some comments on flowering and culture are included. (DES)

Dudley, T.R. 1981. Taxonomic and nomenclatural notes on the flora of Isla de los Estados (Staten Island), Tierra Del Fuego, Argentina. Rhodora 83:477-519.

Along with a large number of non-CP species collected (herbarium) by the author, he lists two CP species: *Drosera uniflora* and *Pinguicula antartica*.

Estey, R.H. and S.S. Tzean. 1981. An ultrastructural examination of nematode-trapping fungi. Can. J. Plant Sci. 61:785-789.

Species of *Arthrobotrys, Dactylaria* and *Monacrosporium* penetrate captured nematodes by chemical dissolution of the cuticle. The nematodes show no physiological response to this penetration. The three cells of the constriction rings of *A. dactyloides* do not share equally in the production of hyphae that penetrate nematodes.

Schnell, D.E. 1981. *Sarracenia purpurea* L. ssp. *venosa* (Raf.). Wherry: Variations in the Carolinas coastal plain. Castanea 46:225-234.

The main variation consists of all red/purple leafed, red-veined on green leaf, and intermediates. The red/purple character is only expressed in full light but this is genetic since not all plants have this capacity. There is a discussion of flower petal and sepal coloration variation as well, and a brief discussion of the fragrance of ssp. *venosa* flowers versus that of ssp. *purpurea* flowers in northern ranges. Finally, possible values of anthocyanin pigments are discussed, and it is concluded that under present habitat conditions, the variation is probably non-adaptive. (Reprints (N/C): D.E.

(Continued on page 27)

THE 1982 LIST OF CP BOOKS

Not available through CPN. Order direct from publisher or your local bookshop.
*=books intended primarily for children.

1. Insectivorous Plants, Charles Darwin, AMS Press, 1893, 56 E. 13th St., N.Y., NY 10003, $27.50.
2. Plants that Eat Insects: A Look At Carnivorous Plants*, Anabel Dean, Lerner Publications, 1977, 241 First Avenue, Minneapolis, MN 55401. $5.95.
3. Plants of Prey in Australia, Rica Erickson, Univ. of W.A. Press, 1968, World Insectivorous Plants, P.O. Box 303, Grant, FL 32949, Cloth, $15.00.
4. Animals & Plants That Trap*, Phillip Goldstein, Holiday, 1974, Holiday House, Inc., 18 E. 53rd St., N.Y., NY 10022, $5.95.
5. Nepenthes of Mt. Kinabalu (in English), Kurata, S., Sabah National Park, World Insectivorous Plants, Box 283, Grant, FL 32949, $7.00.
6. Carnivorous Plants, F.E. Lloyd, Dover Publications, Inc., 1976, 180 Varick St., N.Y., NY 10014, soft cover $5.00.
7. The World of Carnivorous Plants, J. and P. Pietropaolo, R.J. Stoneridge, Peter Paul Nurseries, 1974, $6.30.
8. Insect-Eating Plants*, L. and G. Poole, T.Y. Crowell, 1963, 666 Fifth Avenue, N.Y., NY 10003, $4.50.
9. Plants that Eat Animals*, J.H. Prince, Thomas Nelson, 1978, 407 Ave. S, Nashville, TN 37203, $7.95.
10. CP of the U.S. and Canada, D.E. Schnell, John F. Blair, Publisher, 1976, 1406 Plaza Dr., SW, Winston-Salem, NC 27103, $19.95 plus shipping.
11. Carnivorous Plants, Randall Schwartz, Avon Books, 1975, 959 Eighth Ave., N.Y., NY 10019, soft cover $1.25.
12. Carnivorous Plants, Adrian Slack, MIT Press, 1979, 28 Carleton St., Cambridge, MA 02142, $19.95.
13. Cultivating Carnivorous Plants, Allen Swenson, Doubleday & Co., 1977, Garden City, NY 11535, $7.95.
14. Carnivorous Plants*, John F. Waters, Franklin Watts, Inc., 1974, 845 Third Avenue, N.Y., NY 10022, $4.90.
15. Carnivorous Plants*, Cynthia Overbeck, Lerner Publications, 1981, 241 First Avenue, Minneapolis, MN 55401, $7.95.
16. Secrets of the Venus's Fly Trap*, Jerome Wexler, Dodd, Mead & Co., 1981, 79 Madison Ave., N.Y., NY 10016, $6.95.

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Schnell, Rt. 4, Box 275B, Statesville, NC 28677.)

Thompson, J.N. 1981. Reversed animal-plant interactions: The evolution of insectivorous and ant-fed plants. Biol. J. Linnean Soc. 16:147-155.

In this interesting article, the relative ecologic strategies of plant carnivory and another insect-plant relationship, the mutualistic one of tropical ant-plants, are discussed in evolutionary terms. It is concluded that while both guilds have similar environmental stresses in terms of soil nutrient deficiencies, CP are primarily adapted for "what they do" because they are mainly herbs growing in wet soils, or vines in close, wet forests (e.g., *Nepenthes*), whole ant-plants are mainly vines or other kinds of plants in open areas or canopies, often reasonably dry. The theory that such plant-insect relationships occur in evolution multiply suggests that plants as a whole have limited responses to nutrient lack in soils or water.

Dionaea muscipula
Photo by Thomas Carow

WANT ADS

When submitting Want Ads, please be sure to print clearly for best results and to eliminate mistakes. Please circle the correct letter before each item (Want, Trade, Sell or Buy). Want ads are limited to carnivorous plants, terrariums, greenhouses and moss. There is a charge of ten cents per item, with no limit to the number of items you may submit per issue.

Send coin or check to:
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Fullerton, CA 92634

Bruce Lee Bednar (25 Lake Court Loop; SSS Ocala, FL 32672) [TS] red tube *flava*, giant Okee *minor, rubra gulfensis, rubra wherryi, rubra* × *alata, rubra* × *leuco, rubra* × *psitt, rubra* × *purp, psitt* × *leuco, psitt* × *minor, purp* × *leuco, purp* × *flava, purp* × *alata, alaata* × *leuco,* and many more. [WT] *Nepenthes* plants or cuttings, *Heliamphora.*

Grant Birmingham (88 Sturocks Rd.; Christ-Church 5; New Zealand) [WTB] *N. rajah, N. villosa, N. northiana,* any New Caledonian CP, any *Heliamphora, P. vallisnerianaefolia, D.* × *collinsiae, D. alba, D. ramentaceae, D. banksii, D. indica, D. arenicola,* plus any other uncommon CP. [T] *D. arcturi* (NZ), *D. stenopetala, D. spathulata* (NZ), *D. adelae, P. mexicana, U. monathos,* plus other NZ and Australian *Drosera.*

Joseph P. Cantasano (2717 Jerusalem Ave.; North Bellmore, NY 11710) [WB] *Cephalotus.*

Mark Forster (c/o Buckley Hutton; 167 Collins St.; Melbourne; VIC 3000; Australia) [BT] seed of *Nepenthes spp.* (except *mirabilis, khasiana*), *Byblis gigantea, Drosera regia, Heliamphora,* Mexican pinguiculas, *Polypompholyx.* [T] seeds of *Drosera auriculata, D. peltata,* small seedlings of *Darlingtonia californica* (Australia only).

Steve Smith (Rd. #1, Box 296; Kirkwood, NY 13795) [ST] rooted *Nepenthes* cuttings, Mexican pinguiculas, *Drosera,* and *Utricularia* plants. Send SASE for current list of species available. Include your list if interested in trading.

Drosera (continued from page 20)

problems, as the full sun and low moisture level seem to keep this problem to a minimum. The seeds should germinate in four weeks with a 60% success rate (lower if the plant is self-fertilized). When seedlings are three weeks old, they are placed in plastic pots in the same medium as adults and treated as mature specimens.

Utricularia cornuta, which can be found at the University of Michigan Biological Station.

Photograph by Larry Mellichamp