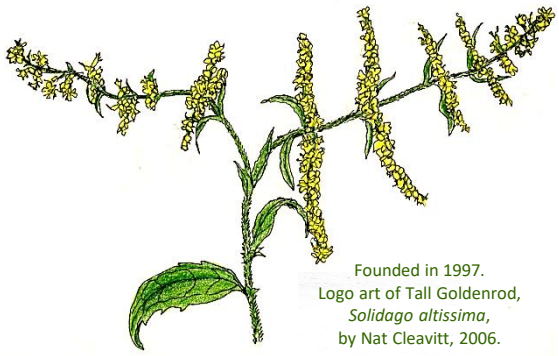


Founded in 1997.
Logo art of Tall Goldenrod,
Solidago altissima,
by Nat Cleavitt, 2006.

Solidago

Newsletter of the
Finger Lakes Native Plant Society

Volume 20, No. 3 September 2019

PLANT PROFILE

SLENDER GRACE

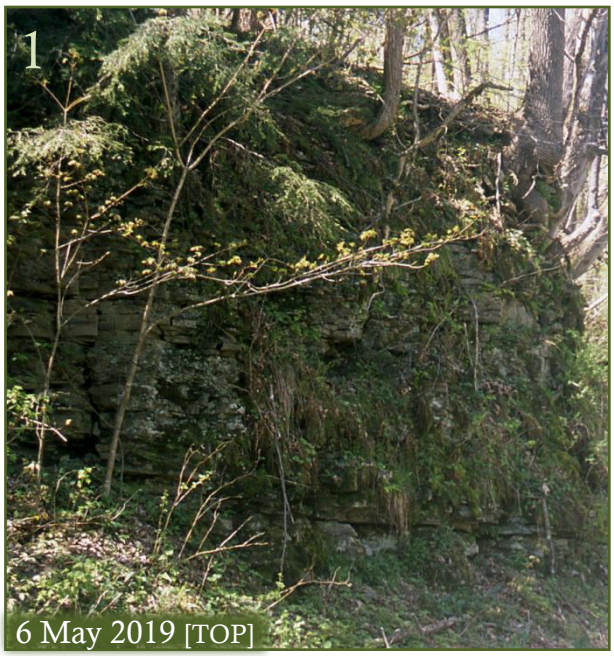
Mackay's Fragile Fern (*Cystopteris tenuis*) Through the Year, with Notes on Its Identification

by Robert Dirig

IN A RECENT ARTICLE ON CATSKILL FERNS [*Solidago* 19(2), June 2018, pp. 12, 24, & 26], I discussed and illustrated **Mackay's Fragile Fern**, and indicated some difficulties I encountered while trying to identify it. It is not surprising that this effort occupied an entire year, since *Cystopteris* has been described as "one of the taxonomically most difficult fern genera" by MORAN (1983, p. 218), and "perhaps the most formidable biosystematic problem in the ferns" by ROTHFELS *et al.* (2014). In the meantime, I have studied a population of this subtle fern in Tompkins County, N.Y., from early May to mid-October 2018, and from early April to late August 2019, with the goal of documenting its seasonality and life history in the Finger Lakes Region.

This fern is small and delicate (as its common name "Fragile Fern" suggests), and occurs in damp, shaded habitats, so it is not always easy to find. Each spring since 2005, I had unknowingly walked by the population I eventually studied, finally noticing it on 11 May 2018. This was partly due to focusing on rare spring butterflies that land on the dirt road that runs alongside; but in 2017-2018, I had watched several Catskill populations of *C. tenuis*, and just had finished writing about them, so they were on my mind. What a thrill, finally to find an accessible population in the Ithaca area, where I could follow it more closely! Below is a calendar of my field dates, with a summary of notes, and associated photographs that unfold the annual pattern of its spring sprouting and early growth, spore production, summer die-down, regrowth after summer's heat has passed, and its decline as autumn progresses [*see* **Table I**, *p. 11*]. At the end is a discussion of how to separate it from other *Cystopteris* species that grow in New York.

TO STUDY THIS FERN, I selected two sites: an east-facing, seepy, exposed, 20-ft.-tall rock out-crop **[Fig. 1]**, near the top of a steep slope that was shaded after canopy closure [labeled TOP on photos]; and another, ca. 360 ft. downhill, on a damp, north-facing, 18-foot cliff face that was deeply shaded by overhanging branches of Hemlock (*Tsuga canadensis*), Mountain Maple (*Acer spicatum*), and Yellow Birch (*Betula alleghaniensis*), plus masses of Pale Jewelweed (*Impatiens pallida*) and other luxuriant herbs [labeled BOTTOM throughout]. Because of shady conditions between late May and early October, most photographs were made using flash, but a few earlier- and later-season exposures were made with natural light. General first-year observations were recorded between May and October, while second-year efforts more thoroughly documented spring sprouting and development. A planned visit in mid-November 2018 was precluded by the very early descent of ongoing snowy winter conditions in the *second week* of that month.


1
6 May 2019 [TOP]

11 May 2018

The fern station was discovered! Sterile spring fronds of *Cystopteris tenuis* were abundant on shaded, dripping cliffs of calcareous shale. (No photos were taken on 11 May; but see **Fig. 38** & page 12).

12 June 2018 [TOP]

I inventoried the cliff, finding lots of *C. tenuis* [Fig. 2]! Some of the spring fronds have already withered, and some fertile fronds have sori. Very young plants have tiny, sterile spring fronds [Figs. 3-4].

Stipes of sterile (green) and new fertile fronds (dark brown) ➤

Fertile fronds arching out to the sun, 12 June 2018 [BOTTOM]

13 July 2018

I inventoried *C. tenuis* along the road. Early fronds are already declining **[Fig. 7]**. The oval shows a pair of basal pinnae that have turned to face the sun (see DISCUSSION). **Figs. 8-10** show development of fronds and sori on this date.

13 July 2018 [BOTTOM]

Upper side of curved frond tip, 13 July 2018 [BOTTOM]

Sori, 13 July 2018 [BOTTOM]

Young sori, 13 July 2018 [BOTTOM]

25 August 2018

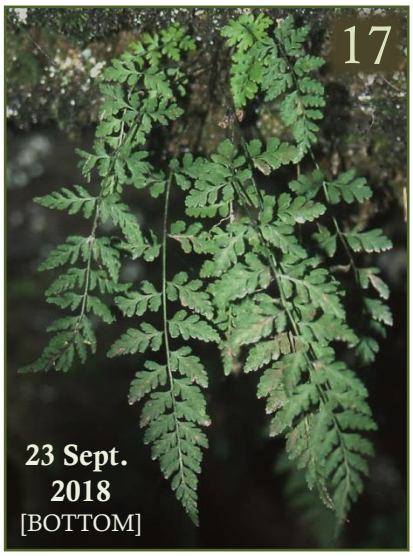
I photographed ferns at the top site and bottom cliff, as marked **[Figs. 11-14]**.

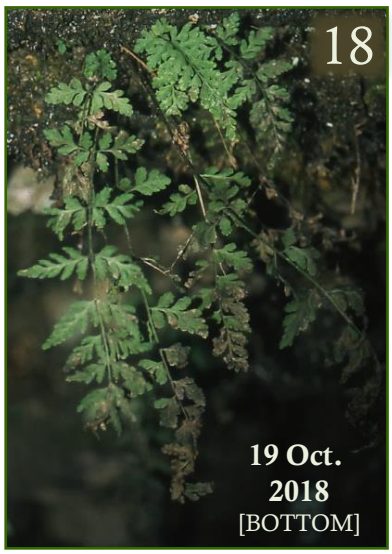
New sterile fronds, growing in soil at the cliff base, 25 Aug. 2018 [BOTTOM]

25 August 2018

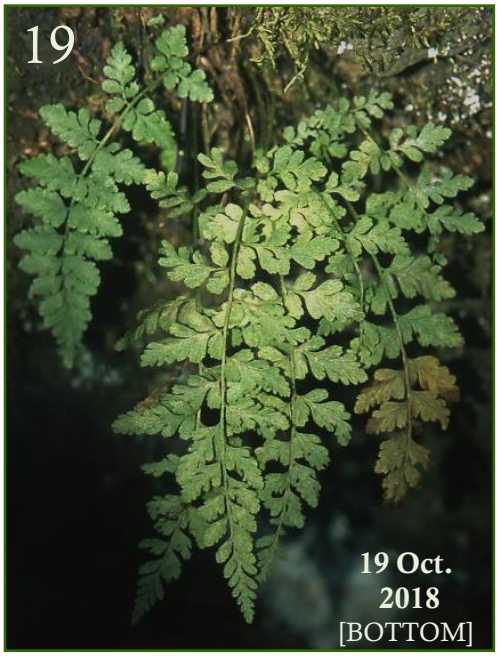
23 September 2018

A few fronds were still green on the top ledge, with many withered stems **[Fig. 15]**. The ovals show raised basal pinnae **[Figs. 15-16]**.



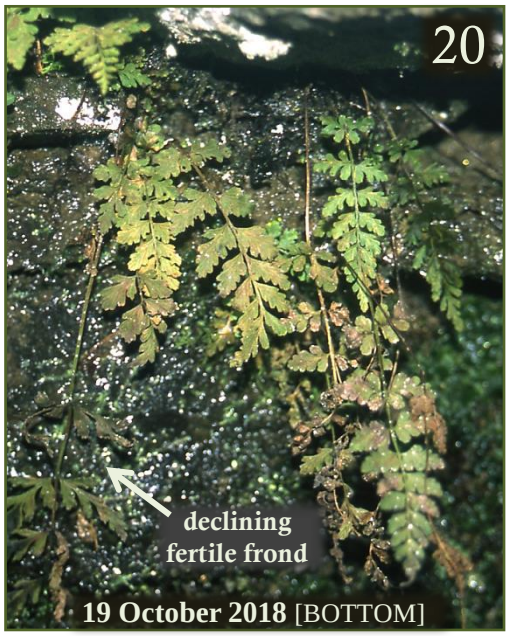


Figs. 17 & 18 are nearly the same view on 23 Sept. & 19 October 2018, showing decline.



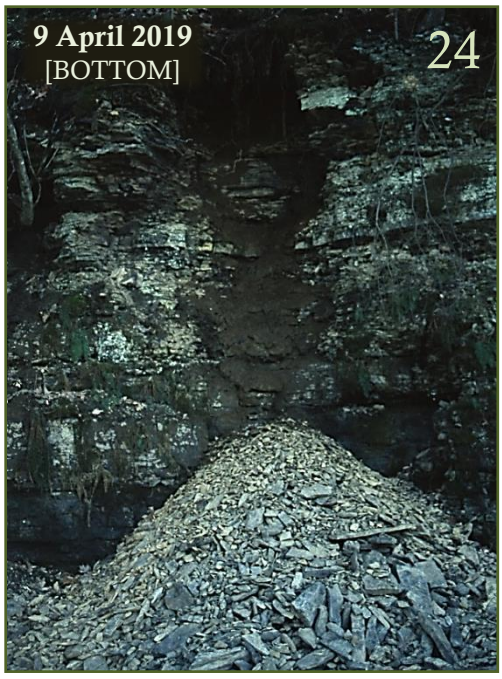
19 October 2018

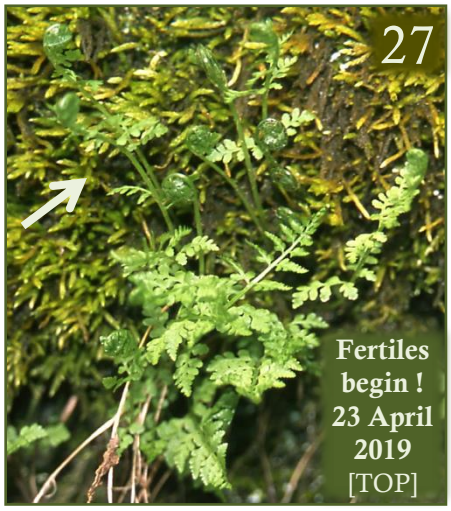
Although it is late in the season, some fronds persist: Luxuriant sterile fronds start to turn yellow **[Fig. 19]**, while other clumps are withering **[Figs. 20-21]**. A fertile frond declines in a damp spot (lower left corner of **Fig. 20**).



9 April 2019

I inspected the cliffs at the top and bottom for *C. tenuis*. No new fronds were noticed on this date. Rachises and withered fronds from autumn 2018 showed along the crack at the top, indicating clumps **[Fig. 22]**. With the exception of one ½-in.-long autumn frond that still had a vestige of green, alongside hanging dried fronds **[Fig. 23]**, this fern did not appear to overwinter green or sprout this early. A shale slide, due to heavy ice or frost-heaving, indicates the instability of this sort of habitat **[Fig. 24]**.





23 April 2019

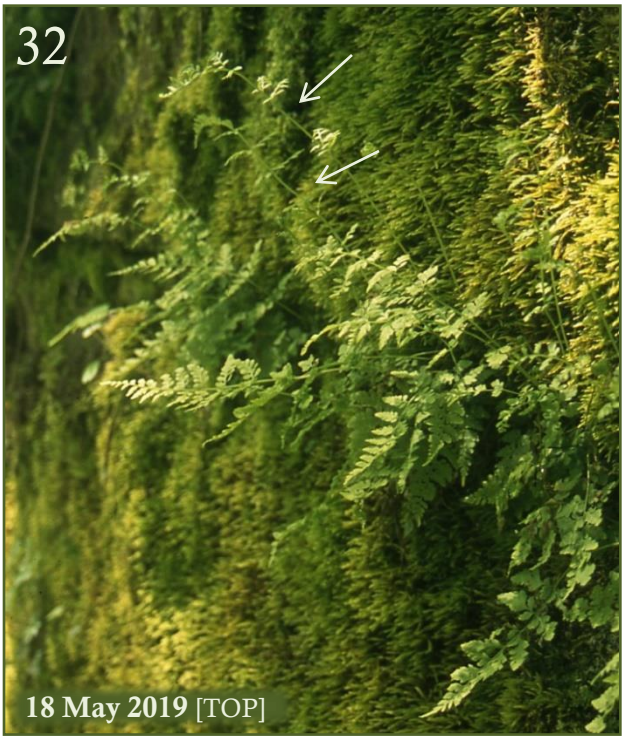
C. tenuis has sprouted! New sterile fronds are 2-3 inches long at the top crack, with last year's rachises for context (compare **Figs. 22** & **26**). Early fertile fronds are unrolling above the mat of sterile ones **[Fig. 27**, *arrow*]. The surge in growth coincided with warming temperatures in late April. Pale circles around lichens **[Figs. 26** & **28]** show the context.

6 May 2019

At the top crack, very luxuriant foliage has developed, with new fertile fronds partly expanded on top **[Fig. 28]**. The dominance of sterile fronds in early spring emphasizes their photosynthetic role. **Figs. 29-31** on the next page show further development, as fronds approach full size.

6 May 2019

Fern development proceeds **[Fig. 29**; compare **Fig. 25** *on p. 5***]** at the bottom, and **Figs. 30-31** near the top. Note evergreen fronds of *Dryopteris marginalis* in the background **[Fig. 30]**.



18 May 2019

Some atmospheric photos were taken with natural morning light at the top crack: **Figs. 32-34** show fertile fronds (*arrows*) elongating above the early mat of photosynthesizing foliage.

7 June 2019

The ferns are in fine development at the top crack! Foot-long fertile fronds exhibit young sori **[Fig. 35]**. Some basal, sterile fronds are already yellowing and browning **[Figs. 36-37]**. All taken with flash.

Photo Summary

Compare **Figs. 22** (9 April), **26** (23 April), **28** (6 May), **33** (18 May), and **36-37** (7 June) for the ***2019 developmental sequence***, and **Fig. 2** for the 12 June 2018 appearance.

Figs. 3-4 & **11** illustrate ***very young plants***.

Figs. 9-10 (13 July 2018), **12** (25 Aug. 2018), & **35** (7 June 2019) depict ***sori***.

Figs. 14 (25 Aug. 2018), **25** (23 April 2019), & **29** (6 May 2019) show ***new and developing sterile fronds***.

Fertile frond development is recorded in **Figs. 2** & **6** (12 June), **9-10** (13 July), **12** (25 Aug.), & **20** (19 Oct.) in 2018; and **Figs. 26-27** (23 April), **28** (6 May), **32-34** (18 May), **35-37** (7 June), & **38** (1 Aug.) in 2019.

Bases of stipes are shown in **Fig. 5** (12 June 2018), a ***rhizome*** in **Fig. 40**.

Very early growth is depicted in **Figs. 25-27** (23 April) & **Fig. 29** (6 May) in 2019.

Frond decline and withering are illustrated in **Figs. 7** & **9** (13 July), **11** (*left*)-**13** (25 Aug.), **15-17** (23 Sept.), & **18-21** (19 Oct.) in 2018; & **Fig. 23** (9 Apr. 2019).

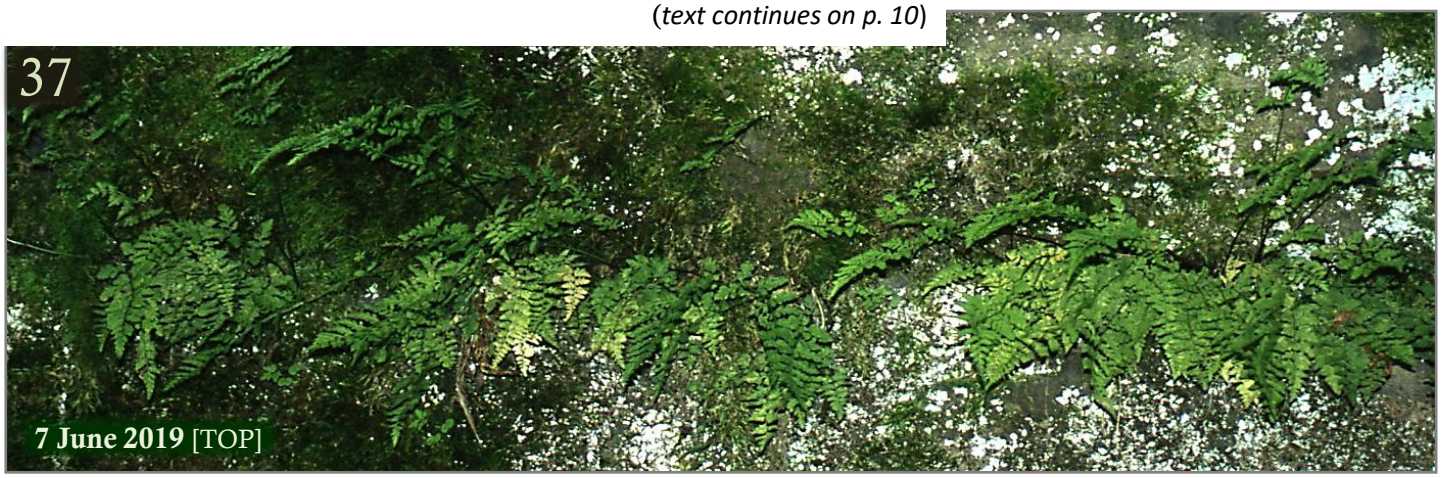
Figs. 1 (6 May 2019, TOP) and **24** (9 April 2019, BOTTOM) show ***habitats***.

Discussion

My photos reveal a wide array of seasonal, functional, and morphological frond variations in *Cystopteris tenuis* (see **Fig. 38** for explanation of terms). Although informal, this study provided some interesting observations:

(1) Luxuriant, usually entirely ***sterile early fronds with a photosynthetic function***, which display their full upper surfaces to available sunlight, appear first. Then the curved, more slender, much taller and longer-stiped ***reproductive fronds***, with more widely-spaced lower pinnae, unroll, standing erect or arching out from the early foliage mat, holding the developing sori in air currents that will disseminate the spores in due course. This obvious ***frond dimorphism*** has apparently not been described or illustrated before in *Cystopteris tenuis* **[Fig. 38]**; it is nearly as distinct as that of the regionally

(*text continues on p. 10*)



38

Frond Dimorphism and Structure in Mackay's Fragile Fern *Cystopteris tenuis*

The striking *dimorphism* of *Cystopteris tenuis* fronds is displayed here at the same scale (life-size in 8½ ×11 inch printed format). Fresh *sterile fronds* can be found from late April to June, lingering into July and August in wetter years. New steriles may sprout in August-September, and persist until frost. *Fertile fronds* usually sprout in May, and remain until August-September, withering as autumn proceeds. In droughty summers, they may dry up by late July and August [*see* Table I, *p. 11*].

1 inch

Sori are clusters of sporangia that produce spores

Apical pinnae

Cuneate base

Pinna (*pl.* **pinnae**)

Rachis

Pinnule

Upward-arching pinnae and curved frond tips (*) are characteristic of *C. tenuis*.

Basal pinnae of sterile and fertile fronds are often awry when pressed, due to their raised orientation.

See explanations of morphological terms In Cobb *et al.* (2005), pp. 21-26.

Blade (leafy part of fern)

Basal (lowest pair of) **Pinnae**

Stipes are much longer in fertile fronds.

Summer (fertile) frond, 1 Aug. 2019

Spring (sterile) fronds, 11 May 2018

Rachis (stem from lowest pinnae to top)

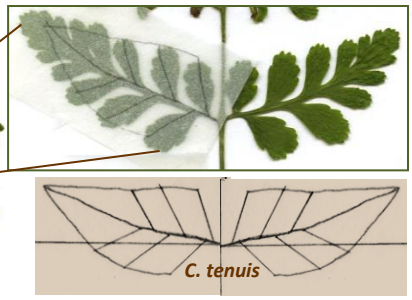
Pinnule

Cuneate (wedge-shaped) **base of pinnule**

Stipe (stem from lowest pinnae to rhizome)

Crenulate margins & scales at base of stipe (*lower left*)

Enlargement of second basal pair of pinnae with angle overlay on pinnules



Outlines and pinnule angles from costa of *C. tenuis* & *C. fragilis*, after Paler & Barrington (1995).

Although **pinnule angles** from the pinna's costa (midvein) usually work with fertile and sterile fronds in *C. tenuis*, they may be more reliable in fertile fronds.

Scales at base of stipe

×1/3

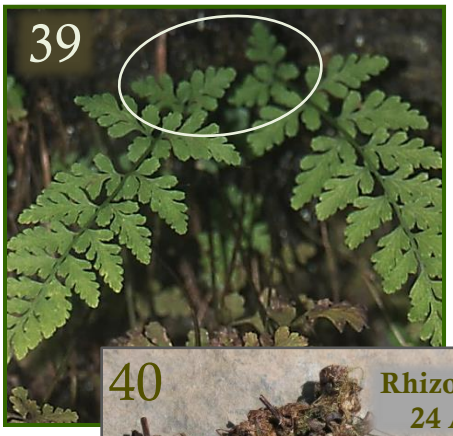
(*from p. 8*) rare **SLENDER CLIFF BRAKE (*Cryptogramma stelleri*)**. These two frond types may cause confusion in identifying *C. tenuis*, as the sterile spring and late-summer fronds can resemble the similar, closely related **FRAGILE FERN (*Cystopteris fragilis*)**, but grow from the same rhizome. Very young plants with widely expanded pinnae **[Figs. 3-4 & 11]** may also suggest ***fragilis***. Mature fertile fronds are probably best to use for identification.

(2) ***Basal pairs of pinnae of photosynthesizing sterile fronds are often held at right angles to the plane of the frond***, to maximally capture sunlight as the frond begins to grow in early spring **[Fig. 7]**, persisting into late summer and autumn **[Figs. 15-16, 39]**. This behavior shows up in dried specimens as an apparently sloppy pressing job, when it actually is a corollary of frond morphology **[Fig. 38]**. It impacts using angles of the lowest set of pinnae for specimen identification, as defined by **PALER & BARRINGTON** (1995) in their discussion of how to distinguish ***C. tenuis, C. fragilis***, and their hybrid (*see below*). Understanding these aspects of frond development may aid in the difficult process of identifying ***Cystopteris***.

Botanists tend to collect and press these ferns with the ***rhizome*** **[Fig. 40]** ***and fertile fronds***, capturing a moment in the plant's annual cycle, while effectively destroying the opportunity for further study of the clump in nature. Watching the full variety of fronds that emerge from one rhizome throughout the year is the best way to understand and know this fern.

Those of us who wrestle with taxonomic keys, trying to shake out a name, may discover that some couplets distill two idealized ends of a continuum of variation. This is true of ***C. tenuis*** and its couplet-pair, the **FRAGILE FERN (*C. fragilis*)**, in treatments of this genus in N.A. ***Cystopteris fragilis*** is a ***slightly smaller fern*** with a ***worldwide distribution*** that grows in ***more northern*** sites or ***higher elevations*** in the Northeast. It has sessile, more closely-spaced lower pinnae that are ***perpendicular*** to a ***straighter rachis***, and ***sharply-toothed pinnules***. ***Cystopteris tenuis*** has ***longer fronds***, occurs in the ***Northeast and Upper Midwest*** in N.A., has short-stalked ***pinnae at acute angles to a curving rachis*** with a gracefully arched tip, and ***pinnules with rounded or creulate margins*** that ***curve upward toward the top of the frond***. I have noticed apparent confusion of ***C. tenuis*** and ***C. fragilis*** in herbaria — likely due, at least in part, to an earlier interpretation of ***tenuis*** as "***C. fragilis***, var. ***mackayi***" (hence its current common name) that lingers from identifications that preceded its rise to species status (**MORAN** 1983). These two ferns are also known to hybridize (**PALER & BARRINGTON** 1995). Occasional pinnules deviate from the norm, showing a few pointed teeth in ***tenuis***, *vs.* the usual ***crenulate*** (scalloped, rounded) margins **[Figs. 5 & 38**, *inset***]**; whereas ***fragilis***'s pinnules are deeply and sharply toothed (**COBB *ET AL.*** 2005, p. 109). **PALER & BARRINGTON** (1995) described and illustrated differences of this hybrid.

Part of my difficulty with identifying specimens came from having collected individual fronds as a teenager (not yet knowing that keys would ask for details of the rhizome). The ***FNA*** treatment (**HAUFLER *ET AL.*** 1993) is at times confusing, with no illustrations of North American ***fragilis***, and an incorrect declaration that the fronds are "monomorphic" in ***tenuis*** — probably due to the predominance of fertile fronds in herbaria. Other keys and comparative tables have echoed these characters, with minor variations (**MORAN** 1983, **CODY & BRITTON** 1989, **HAUFLER *ET AL.*** 1993, **PALER & BARRINGTON** 1995, **COBB *ET AL.*** 2005, **RHOADS & BLOCK** 2007, **HAINES** 2011 [and the similar ***Go Botany*** website], and **ROTHFELS *ET AL.*** 2014), most with insufficient figures. These authors frequently state how challenging it is to identify this pair of ***Cystopteris*** species.



Erect pairs of pinnae at frond base (*oval*) **in late summer, 25 Aug. 2018** [BOTTOM]

In 2017, I compiled identification checklists for ***tenuis*** and ***fragilis*** from these sources that summarized the details **[Figs. 41- 42**, *p. 11***]**. In the end, **PALER & BARRINGTON'S** (1995, p. 538, Fig. 8) paper on hybridization of ***fragilis*** and ***tenuis*** proved to be the most useful reference, providing a workable technique of examining angles of the ***pinnules*** from the ***costa*** (midvein of a pinnule) — *see diagram, p. 9*. This paper included statistically based models of pinnal curvature, and angles of the three basal pairs of pinnae and of the three lowest pinnule-pairs.

The ***pinnule angles*** worked very well to gather all my Catskill frond variations into ***tenuis***. To do this, I traced the authors' computer-generated diagrams of the angles and curvature onto translucent (tracing) paper, and placed them over the pinnules **[Fig. 38]**. The ***pinnule angles*** lined up for all six pinnules on the bottom three pairs of pinnae. Paler & Barrington (1995, p. 537, Fig. 7) also provided ***angles of the three basal pairs of pinnae*** from the rachis — nearly perpendicular in ***fragilis***, but acutely angled in ***tenuis***. I found this unreliable with the lowest pair of pinnae, which are often awry from the rest of the blade; the second and third pairs worked better, but in general this character was not very useful.

The other two N.Y. species of ***Cystopteris*** are more easily identified. (*text continues on p. 12*)

41 *Cystopteris tenuis* Character Checklist

Fronds: Small, bright green, 6-14 in. long, 1-3 in. wide; growing in asymmetrical clumps

Blade: Lanceolate, narrow tip, widest at/just below the middle.

Pinnae: Ca. 12 pairs, offset or opposite, lower ones stalked

Basal Pinnae (3 pairs): Short-stalked, at acute angles (60°- 80°) to rachis, arching upwards; distant from each other on a curved rachis.

Apical Pinnae: Ovate to narrowly elliptic, the fern tip curved

Pinnules (3 basal "pairs"): Offset, angled 36° - 60° from *costa* (midvein), arching upward; margins *crenulate* (mostly rounded or scalloped); with *cuneate* (wedge-shaped) bases

Veins: Simple or forked, running to teeth and notches

Sori: Round, between costa & margin

Indusia: To ½ mm long, without glandular hairs

Stipe: Shorter or same length as blade, and brittle; dark brown base, green or straw-colored above; with a few basal scales

Rhizome: Robust, short-creeping, no hairs; with narrow tan to light brown scales; fronds growing from tip

Habitats: Mostly damp, shaded rock & cliff faces; occasionally on forest floor, or soil atop or under cliffs

42 *Cystopteris fragilis* Character Checklist

Fronds: Smaller than *C. tenuis*, light to dark green, 4-10 in. long, 1-3 in. wide; growing in clusters

Blade: Smaller than *tenuis*, lanceolate with pointed tip, widest at/just below middle.

Pinnae: Ca. 12 pairs, opposite, perpendicular to rachis; lowest ones widely spaced & stalked, others sessile

Basal Pinnae (3 pairs): Widely spaced and stalked, angled nearly perpendicular (82°- 90°) to a straight rachis; bases tapering or rounded

Apical Pinnae: Denticular or ovate, the frond not curved at the top

Pinnules (3 basal "pairs"): Mostly opposite, angled 47° - 82° from costa; margined with sharp teeth

Veins: Ending at tip of toothed margin

Sori: Few, scattered on veins

Indusia: To 1 mm long, lacking glandular hairs

Stipe: Shorter than blade; brittle, breaking near base, deep reddish-brown near rhizome, green or straw-colored above, with a few basal scales

Rhizome: Slender, short-creeping, no hairs; with narrow brown scales; fronds growing from tip

Habitats: Shaded cliff faces & thin soil over rocks, in acidic or basic sites; also in small mats among moist, shaded boulders below ledges

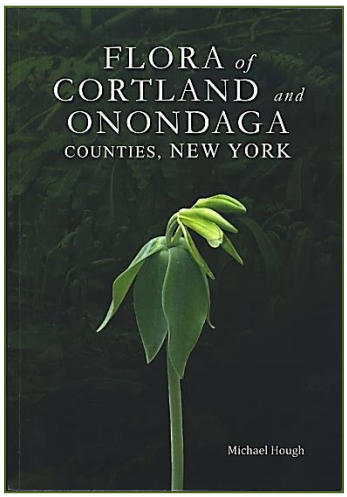
Table I: *Cystopteris tenuis* Calendar, 2018-2019

Months	April	May	June	July	Aug.	Sept.	Oct.	Nov.
fronds sprout	●	● ●	●		●			
new sterile fronds	●	●			●			
fertile fronds	●	● ●	● ●	●	●	●	●	
sori			●	●	●			
very young plants			●		●			
frond decline	●		●	●	●	●	●	
winter dormancy	●					●	●	●

(*continued from p. 10*) The **Lowland** or **Southern Fragile Fern (*Cystopteris protrusa*)** has an elongated rhizome tip covered with yellow hairs that "protrudes" beyond the first fronds (it is known from Erie, Richmond, Tompkins, and Suffolk Counties). The locally familiar **Bulblet Fern (*C. bulbosa*)** of Finger Lakes gorges usually has much longer fronds with gland-tipped hairs, produces vegetative bulblets (**COBB *ET AL.*** 2005), and has been recorded from most upstate counties in N.Y. (**WELDY *ET AL.*** 2017).

I hope that these thoughts and images, however informal, will help others discover and know this fascinating and beautiful denizen of shaded wet cliffs.

Review: New Book



Michael Hough's *Flora of Cortland and Onondaga Counties, New York* is a most welcome addition to the literature of Central New York botany! An 8½-year project, its 489 pages are packed with information about the wild plants of these two counties on the northeastern rim of the Finger Lakes Region.

The book includes a brief history of botanical exploration in this area; complete taxonomic keys for identifying local plant families, genera, species, and lower taxa; detailed descriptions of each taxon (including scientific and common names and taxonomic synonyms, phenology, ecology, localities, wetland indication, state legal status, state and global rarity rank, and coefficient of conservation); also, a glossary; a summary of the plants in both counties; literature cited; and indices to common and scientific names. Altogether, 1,952 plants have been recorded in this region (1,273 in Cortland and 1,860 in Onondaga Counties), with 1,324 natives, and 628 introduced plants. Michael writes very well — the text I have studied is concise, intensely informative, and helpful. Except for a color photograph on the cover (above) and a map of the counties, there are no illustrations.

The book may be obtained from Amazon, following this link: **https://www.amazon.com/dp/1087266017**, @ $35.00 + shipping (paperback, ISBN 978-1-0872-6601-5). It is intended for skilled amateur and professional botanists, ecologists, and conservation biologists who are familiar with the use of dichotomous keys.

— ROBERT DIRIG

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Please Contribute to *Solidago*

We welcome contributions that feature wild plants of the Finger Lakes Region of New York and nearby. We include cryptogams (bryophytes, lichens, fungi, and algae) as "flora," and recognize that green plants provide habitats and substrates for these and many animals, especially insects. We are interested in zoological associations as long as plants are an integral part of the story.

We can use a wide spectrum of material in a variety of writing styles. Our regular columns include **Local Flora** (plant lists or details of species from specific sites), **Outings** (reports of FLNPS-sponsored excursions), and **Plant Profiles** (on specific local plants). We also occasionally publish **Appreciations** (memorials to local botanists and naturalists), **Reviews** (of books, talks, meetings, workshops, and nurseries), **Letters** (commentaries and letters to the editor), **Essays** (on botanical themes), **Verse** (haiku, limericks, sonnets, and poems of less formal structure), **Art** (botanical illustrations, plant designs, pencil sketches, decorations), and **Photographs** (stand-alone images, photo essays, and full-page composite plates, or originals that can be scanned and returned). We also can always use **Fillers** (very short notes, small images, cartoons) for the last few inches of a column.

Solidago

Newsletter of the
Finger Lakes Native Plant Society

Volume 20, No. 3 September 2019

Published quarterly at Ithaca, New York, USA.

FLNPS (founded in 1997) is dedicated to the promotion of our native flora. We sponsor talks, walks, and other activities related to conservation of native plants and their habitats. *Solidago* is published as a colorful online version, and a B&W paper version that is mailed. The online format is posted 3 months after publication. Please see ***www.flnps.org*** for details of membership, past *Solidago* issues, and updates about our programs.

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Thank You!

MANY THANKS to all who contributed to ***Solidago,* Volume 20, No. 3**! We thank the **WRITERS** (listed above). **ILLUSTRATIONS** were loaned by David Werier (p. 14), Norm Trigoboff (pp. 15-18), & Robert Dirig (pp. 1-12). **CALENDAR ITEMS** were organized by Rosemarie Parker, Anna Stalter, & Audrey Bowe. Special thanks to *Teresa Iturriaga*, who graciously shared computer facilities at the Cornell Plant Pathology Herbarium. **LAYOUT and DESIGN** by the Editor. **PROOFREADING** by Rosemarie Parker, Robert Wesley, & David Werier. **PRINTING** of paper copies by Gnomon Copy, Ithaca, N.Y. **ONLINE POSTING** by Audrey Bowe & Rosemarie Parker. And **MAILING** by the Editor.

Best Wishes to FLNPS members (and all others in our reading audience) for a wonderful autumn, replete with joyous outdoor revels with the colorful wild flora!
— ***Robert Dirig***

***Please send *Solidago* contributions & correspondence to Robert Dirig, Editor, at editorofsolidago@gmail.com**

Deadline for the December 2018 issue is November 15th !

Name That Plant Contest

The photo from last issue's ***Name That Plant Contest*** [*Solidago* 20(2), page 3] was of **Trailing Arbutus (*Epigaea repens*)**. Many people commented on its sweet fragrance. Bend down and give it a sniff next spring when it's blooming, you won't be disappointed. Bob Dirig noted that it is a rare alternate larval foodplant for Hoary Elfin butterflies (Bearberry, *Arctostaphylos uva-ursi*, is preferred). Nancy Reynolds shared that there is quite a lot of it along the road where she lives in Greene, N.Y., and that it survives the yearly roadside mowing. Charlie Smith wrote, "It's a special plant to me. When I was a teenager, beginning to study botany, I found one near my home in Tennessee and identified it all by myself." Thanks to all who entered the contest, and congratulations to contest winners: *Bob Dirig, Susanne Lorbeer, Ashley Miller, Gin Mistry, Rosemarie Parker, Nancy Reynolds, Charlie Smith, Marie Terlizzi*, and *Robert Wesley*.

This issue's mystery plant is shown above. Hints and suggestions are often provided to contest participants who try. Common and/or scientific names are acceptable, and more than one guess is allowed. Please submit your answers to **David Werier** at .

The photographs were taken by David Werier in Schuyler Co., N.Y., on 18 August 2007.

Beware the Lovely Lanternfly!

The **Spotted Lanternfly (*Lycorma delicata*)**, a recently introduced Asian insect that feeds on native and cultivated trees and grapevines, is poised to enter N.Y.! **Please report any sightings to: www.NYiMapInvasives.org**

FLNPS Calendar, 2019 - 2020

As summer lingers, then merges into autumn, we welcome members and guests to our new season of presentations! Here is a list of the dates and guest speakers (and other activities):

Sept. 18th: ***Andrea Davalos*** will speak about Passenger or Driver? Pale Swallowwort Associations with Native Vegetation.

Oct. 16th: ***Akiva Silver*** will celebrate Hickories!

Nov. 20th: ***Brigitte Wierzbicki*** & ***Dave Rutherford*** will discuss the New York State Parks Plant Materials Program.

Dec. 18th: The annual **FLNPS Solstice Party** will be held in the monthly meeting space. See details on our website† and in the December issue of *Solidago*.

➤**Looking ahead to 2020**, the following events have been scheduled:

Jan. 15th: The annual "**Members' Night**" (perhaps with a name change) will feature a medley of presenters on various botanical topics.

Please save these dates for spring 2020: Feb. 19th, Mar. 18th, April 15th, & May 20th (presenters & topics to be confirmed). Please see our website† for details of all of these events, and others that may be scheduled.

FLNPS evening Talks, the Solstice Celebration, and Members' Night begin on Wednesdays at 7:00 p.m. at the Unitarian Church Annex (second floor; enter on East Buffalo St.) in Ithaca, N.Y. An elevator is available.

†Please check our website (flnps.org.) for updates and details.

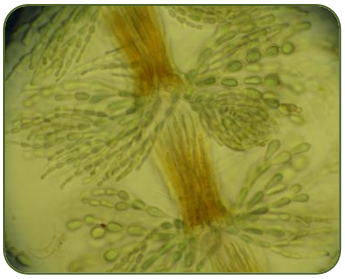
We appreciate suggestions for speakers or topics, walks, outings, and rambles.

LOCAL FLORA

RED ALGAE IN CENTRAL NEW YORK

by Norm Trigoboff
Photos by the Author

Batrachospermum helminthosum



ALGAE CAN BE SLIPPERY TO DEFINE. The American Waterworks Association (Gray 2010) says, "The organisms we think of as algae are not a natural group in terms of their genetic relatedness. They are, rather, a loose group of largely aquatic organisms with a few unifying characteristics:

(1) though they exhibit a wide range of reproductive complexity, they all lack the type of reproductive structures that set apart higher plants and animals, that is, gametangia lined with nonfertile (sterile) cells;

(2) they have simple vegetative structures without a vascular system;

(3) they generally contain light-harvesting pigments…;

(4) thus, most are capable of conducting photosynthesis as higher plants do…"

Plant enthusiasts will find the freshwater red algae (Rhodophyta) a good off-season hobby. Reds live in attractive sites, such as bogs and shady creeks. Our reds get to be largest in late winter through spring. They are larger and more complex than most freshwater algae. Otherwise well cultured people (like you and me) are often surprised by how complex and beautiful the reds are when they see them under a microscope for the first time.

The fast way to learn to spot reds (and other algae) in the field is to have an expert point them out. A harder route is to hike in late winter and bring back all algae-like growths to check with a scope until you know them cold. I've done some of both. I sat in on a phycology class at SUNY Cortland. On field trips, the students collected, then set up scopes. The teacher, Larry Klotz, had the unnerving habit of exclaiming "Outstanding!" every time a student showed him something the class had yet to see, but which he, we suspected, had seen enough times. At any rate, this got the students to line up to see the new algae.

Technical features of the Rhodophyta include "eukaryotic cells, lack of flagella, floridean starch, phycobiliprotein pigments (red and blue), unstacked thylakoids, and chloroplasts lacking an external endoplasmic reticulum" (Wehr *et. al.* 2015). A major feature used to ID algae is color. Beware, most freshwater red algae have varying amounts of various pigments and so are some color other than red. Our local reds are more often dark blue than some shade of red. Under a scope, their chloroplasts may look reddish, pinkish, grey green, violet green or bluish. The blue-greens (formerly algae, now bacteria, tomorrow something else) also have a variety of pigments (which are dispersed rather than in chloroplasts). You should also know that iron oxidizing bacteria, such as *Sphaerotilus*, may form delicate rust colored growths in stagnant or slowly flowing water **(Fig. 8**, *p. 18***)**; and the so called "green" algae often have red pigments that mask the green ones, as in *Haematococcus lacustris*, the blood red film that lines garden birdbaths **(Fig. 1***, p. 16***)**, and *Trentepohlia spp.*, the orange fuzz that coats damp rock and tree trunks. However, the off-color bacteria and greens are much smaller and simpler than true reds, so true confusion is truly unlikely. Algae that die and turn brown, or are brown in life, such as diatoms, may give you pause, but those browns have much less red.

The following key, based mostly on features visible with a hand lens, encompasses the handful of reds that live in Central New York. It should point you to the most likely page in a technical manual. If you like to be sure about names, you will want to scope out the primary literature. Before using the key, go online and peruse a few pictures of the included taxa at macroscopic and microscopic scales.

1. Plants reddish, large (introduced) .....*Bangia atropurpurea*
1. Plants other colors, or small (native) **2**
2. Plants small (under 1 cm long) **3**
2. Plants larger **4**
3. Plants reddish, at least in mass ...*Audouinella hermannii*
3. Bluish, growing with or near other reds .....Chantrasia
4. Filaments unbranched or little branched, thick and coarse to the touch ..*Lemanea*
4. Filaments much branched, flexible and gooey to the touch **5**
5. Cortical cells of main axis of two types: rectangular and inflated .....*Sheathia americana*
5. Cortical cells all rectangular (*Batrachospermum*) **6**
6. Main axis brownish, contrasting with the rest of the plant .....*B. helminthosum*
6. Main axis the same bluish as the rest of the plant ..**7**
7. In rocky creeks through woodlands .....*B. gelatinosum*
7. In still or flowing water of Sphagnum wetlands .....*B. keratophyllum*

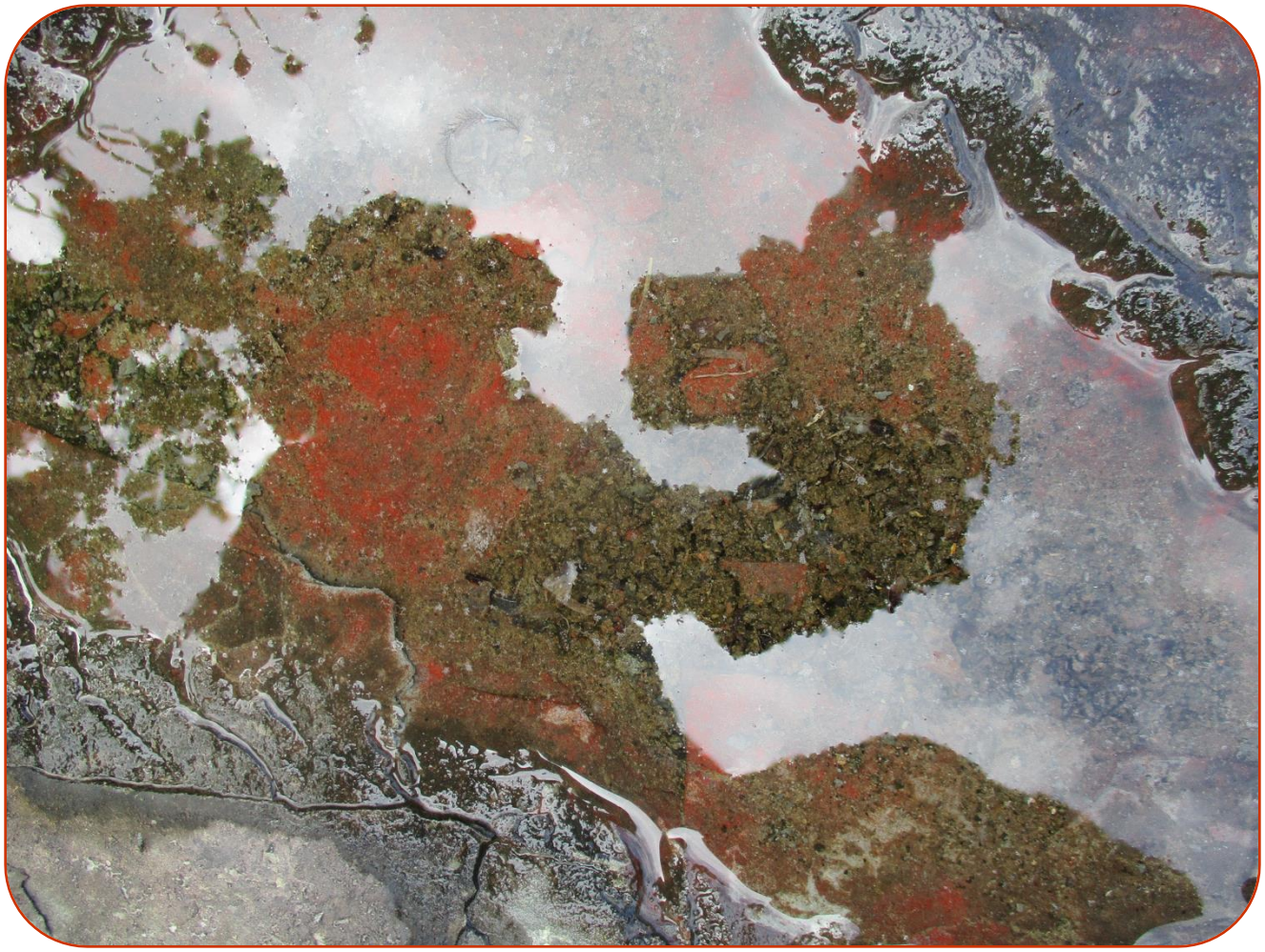


FIG. 1: SELF PORTRAIT WITH *HAEMATOCOCCUS* ~ Creek rock at Taughannock Falls State Park
[Although appearing bright red, this is actually a green alga.]

Audouinella hermannii **(Fig. 2)** looks — if you tilt your head, squint, and maybe hold your thumb out — like the hairs of a tiny, reddish brown paint brush. It likes stable rock in the swiftest parts of creeks. Most often, only one small part of a creek will have the plant, though it may get abundant, as on the flat creek rock in the ***600 Ravine***. Much of red algae taxonomy is unsettled. It's in worse shape than elevator door-hold button symbols. For plants that look like *Audouinella*, you may need DNA analysis and a technical manual from the future to tell if you have *A. hermannii*, or chantrasia of *Lemanea*, or *Batrachospermum.*

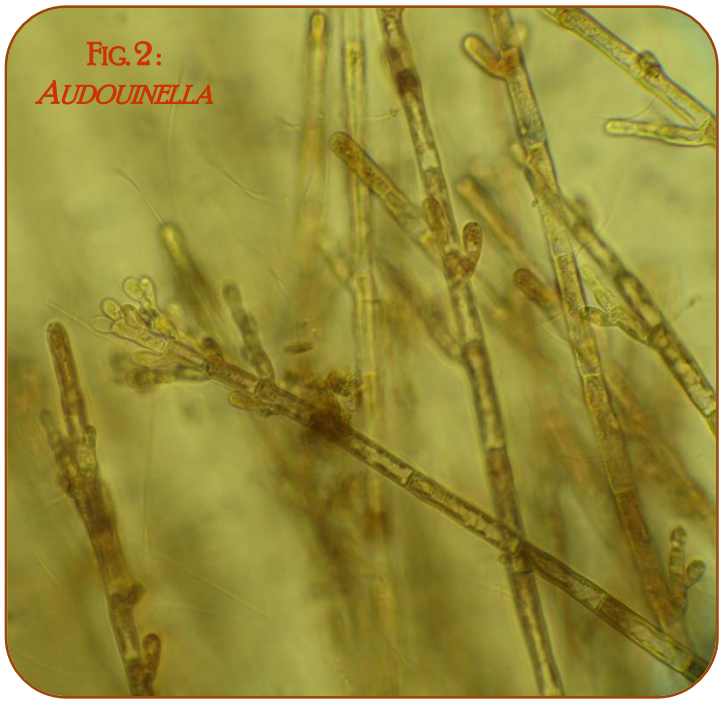


FIG. 2: *AUDOUINELLA*

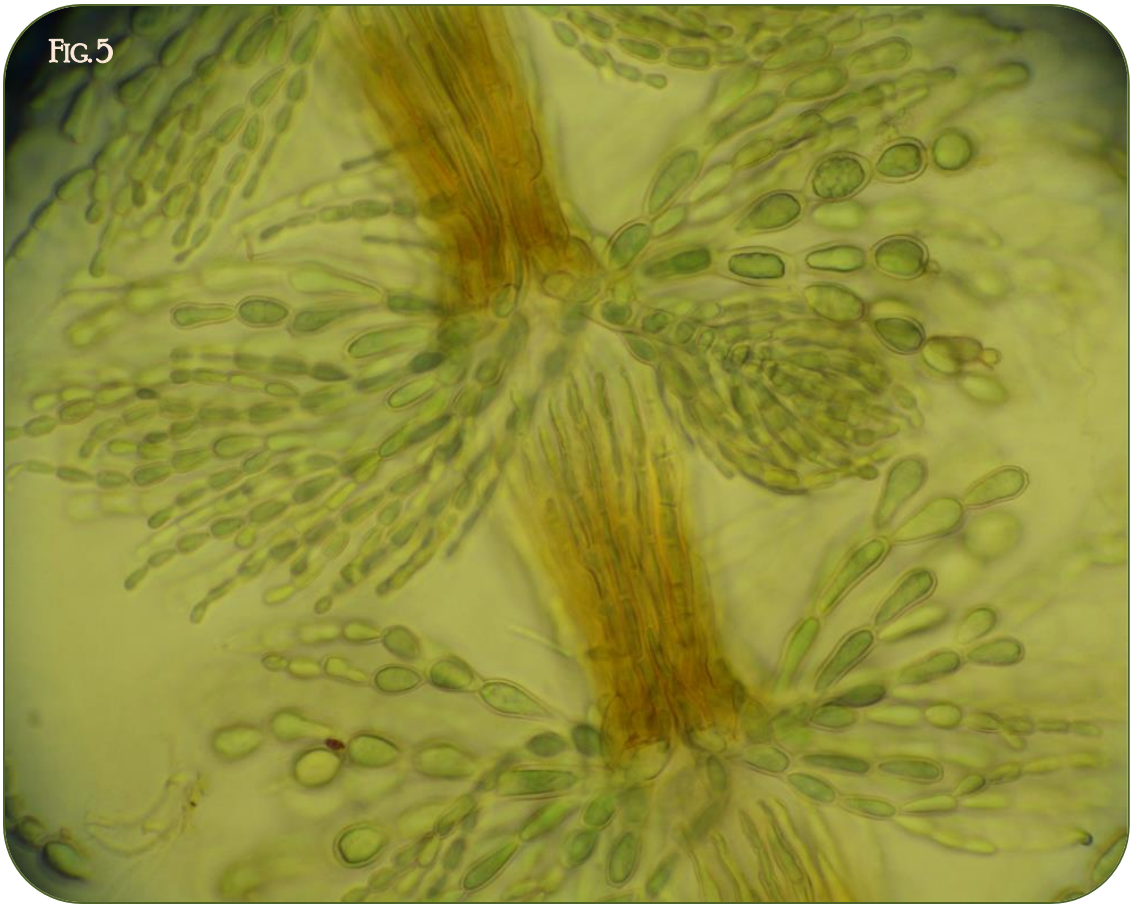
Bangia atropurpurea **(Figs. 3-4**, *p. 17*) looks like rusty red wigs abandoned on wet rock. Multiple species of reds may grow side-by-side, but I have yet to see *Bangia* growing with another red. I have seen much *Bangia* in the last year on creek rocks at ***Buttermilk Falls State Park*** and ***Robert H. Treman State Park***, and scraps of it on rock at the ***shore of Cayuga Lake***. It is a common marine alga (seaweed) found on coasts through much of the world. It has been introduced inland in many parts of the world. It is probably spreading, often abundant, and easy to see at local waterfalls. In North America, it was noticed in the Great Lakes in 1964. It likely came in on ship hulls or in ballast water from a European freshwater

source (Great Lakes Fact Sheet 2019). I think *Bangia* is new to the Ithaca area and has yet to hit its stride here. *Bangia* makes a good weed. It reproduces fast, lives in a broad range of salinities, survives drying, and we lack good control methods. On the positive side, the form and bright color of *Bangia* are striking under the scope. The filaments are uniseriate below and multiseriate above, where they look like curved brickwork **(Fig. 3)**. Artfully arranged microscope images of the plants would make good psychedelic posters. Time will tell whether large, rusty growths of *Bangia* **(Fig. 4)** will improve Finger Lakes Region waterfall photographs and increase tourism.

FIG. 3: *BANGIA* magnified

FIG. 4: *BANGIA* with ballpoint pen at Treman State Park

FIG. 5: *BATRACHOSPERMUM HELMINTHOSUM*



Batrachospermum **(Fig. 5)** is the most common red locally. It wiggles in a distinctive way in flowing water, like Jello with an agenda (of staying stuck to a cobble or stick). When you go to collect it, the combative Jello wants to slip through your fingers. It feels an oddly pleasant, interesting sort of halfway between slimy and gooey. At least three species live here. They (and *Sheathia*) may be abundant on cobbles in small creeks at ***Danby State Forest***, the ***Roy H. Park Preserve***, and many other places.

Chantrasia means a juvenile stage of *Lemanea* or *Batrachospermum*.

Lemanea* (Fig. 6)** is the least common red locally. The flat creek rock of the ***600 Ravine and the irregular rocky waterfalls at ***Businessman's Lunch*** (***Wells Falls***) have lots of it. Scraps of perhaps the same species are in at least one small creek in Ithaca's ***Cayuga Heights*** neighborhood — on concrete. I'd be lying if I claimed to understand the multi-celled structure of *Lemanea*. Still, the thick filaments are distinctive. A quick feel will tell you whether a dark mass of inch or two long filaments twitching in the current is *Lemanea*, as opposed to, say, moss or other algae. You can search for the plant just by feel in places of rough water and poor visibility. *Lemanea* taxonomy is almost settled. Still, species ID is best left to experts of the future.

***Sheathia americana* (Fig. 7)** was recently split from *Batrachospermum*. It has the same look and feel and lives in the same shady, rocky creeks. Look for these and other reds where trails and especially bridges cross creeks. Here creeks generally are narrower, faster, and wetter in dry times (Eloranta & Kwandrans 2012). To see the two cell types referred to in the key, smear a small bit of plant between two slides and scan at 100×. Around here, *Sheathia* and *Batrachospermum* vanish around June, while *Bangia* and *Lemanea* may stay the summer, but look rather seedy. *Sheathia* and *Batrachospermum* like a somewhat movable substrate, such as cobbles on dirt. *Lemanea*, *Audouinella*, and *Bangia* like bedrock and large boulders. Despite these minor differences in philosophy, reds generally like year-round water.

FIG. 6: *LEMANEA* sp., dry, Roy H. Park Preserve

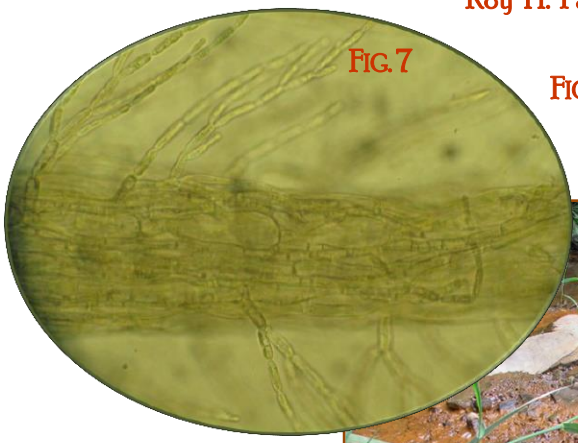


FIG. 7: *SHEATHIA* cortex cells

FIG. 8: IRON OXIDIZING BACTERIA (not a red alga) in slow flowing water at Connecticut Hill Wildlife Management Area.

I thank Larry Klotz for his outstanding phycology class; Adrianna Hirtler (Biomonitoring Coordinator for the Community Science Institute) and Jim Rolfe for help with collecting; Morgan Vis and Jerry Oemig for help with naming stubborn plants; and Anna Stalter and Cornell's Bailey Hortorium for lending my old collections to Jerry, a retired elevator inspector who now inspects algae. If you have reds or bluegreens of interest — both may be dried and stored in paper envelopes or kept damp at least a short while in plastic bags — you can send them to Jerry. His email is dgoemig, then that symbol that goes in the middle, then yahoo.com.

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