Studies in Indiana Bryophytes

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The mosses used in this study are Indiana collections in herbaria in the following institutions: Indiana University, Purdue University, DePauw University, Field Museum of Natural History, University of Illinois, University of Wisconsin, and University of Chicago, and in personal herbaria of the following: Chas. C. Deam, J. P. Naylor, Seville Flowers, Betty L. Wilson, and the author. Chas. C. Deam, William D. Gray, Earl L. Harger, Jr., and Harriet Gragg Winch have kindly presented many collections to the writer.

The nomenclature of Tetraphis, Bryoxiphium, and Fissidens is that of "The Moss Flora of North America north of Mexico," A. J. Grout; of Polytrichum, "The Polytrichaceae of Western North America," T. C. Frye; of Pogonatum, Catharinea, (except *C. plurilamellata* which is according to "Manual of Mosses of Western Pennsylvania," O. E. Jennings), Buxbaumia, and Webera, of "Mosses with Hand-Lens and Microscope," A. J. Grout.

The distribution of each species is based largely upon Indiana specimens examined by the author and is shown by the list of counties in which collected. The asterisk preceding the name of a county indicates that the species has been reported from that locality according to published records but not studied by the author.

The asterisk following the name of a species or a variety is an indication that, according to available literature, this is the first published record for Indiana.

TETRAPHIDACEAE

Tetraphis pellucida Hedw. (*Georgia pellucida* Rabenh.) (Figs. 1, 2.) Stems 1-2 cm. high, always some bearing terminal gemmiferous cups; peristome teeth 4, narrowly triangular. *Hamilton, Jasper, Lake, Laporte, Marshall, Montgomery, Orange, Parke, Porter, Putnam, and Steuben counties.

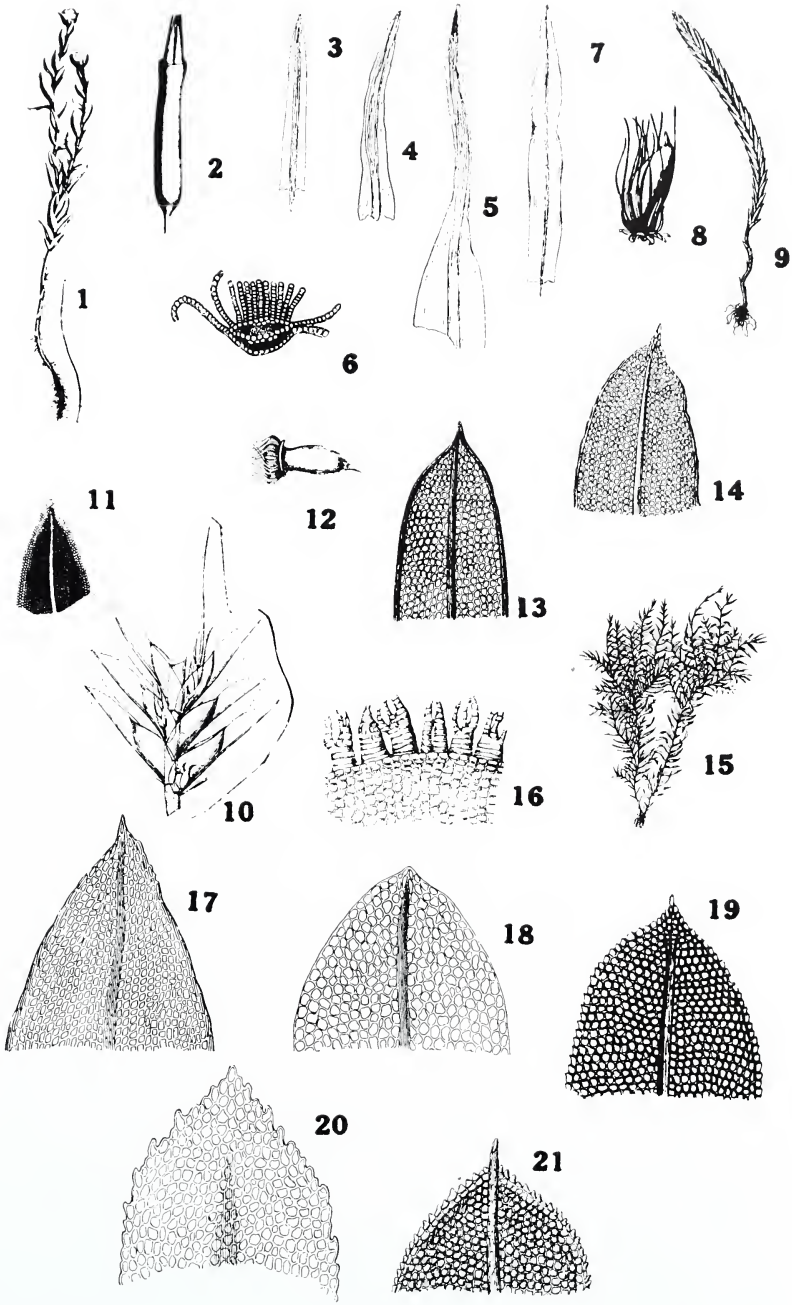
POLYTRICHACEAE

Leaves usually narrow, with lamellate costa; capsule on a long seta, large, cylindrical, or prismatic with 4-6 angles; calyptra spinulose at apex, or with few to many hairs.

1. Leaves bordered, lamellae on upper surface 18 or less; capsule terete; calyptra with few or no hairs; peristome teeth 32 ..... *Catharinea*
   Leaves not bordered, lamellae on upper surface 20 or more; capsule cylindrical, or prismatic with 4-6 angles; calyptra densely hairy; peristome teeth 32-64 2
2. Capsule terete; peristome teeth 32 ..... *Pogonatum*
   Capsule 4-6 angled; peristome teeth generally 64 ..... *Polytrichum*

Catharinea

1. Costa and lamellae covering about $\frac{1}{5}$-$\frac{1}{4}$ of upper leaf-width; lamellae 3-6 in number, 3-6 cells in height; upper leaf cells 15μ-25μ in diameter ..... *C. undulata*
   Costa and lamellae covering $\frac{1}{4}$ or more of upper leaf-width; lamellae usually more than 6, more than 6 cells in height; upper leaf cells 7μ-15μ in diameter 2
2. Lamellae covering $\frac{1}{4}$-$\frac{1}{2}$ of upper leaf-width, 5-8 in number, 6-8 cells high; upper leaf cells 10μ-15μ in diameter ..... *C. angustata*
   Lamellae covering about $\frac{2}{3}$-$\frac{3}{5}$ of upper leaf-width, 7-12 in number, 8-14 cells high; upper leaf cells 7μ-13μ in diameter ..... *C. plurilamellata*



Figs. 1-21

C. **angustata** Brid. (Fig. 3.) Carroll, Clark, Crawford, Delaware, Elkhart, Floyd, Gibson, Henry, Jackson, Jasper, *Jefferson, Knox, Kosciusko, Lawrence, Madison, Marshall, Martin, Monroe, Montgomery, Owen, Parke, Porter, Posey, Pulaski, Putnam, Scott, Steuben, Vermillion, *Vigo, *Wayne, Wells, White, and Whitley counties.

C. **plurilamellata** Jennings.* (Fig. 3.) Carroll county.

C. **undulata** (L.) Web. & Mohr. (Fig. 7.) Allen, Brown, Carroll, Decatur, DeKalb, Delaware, Elkhart, Floyd, Jasper, Jefferson, Lagrange, Laporte, Lawrence, Monroe, *Noble, Orange, Parke, Porter, Posey, *Pulaski, Putnam, Shelby, Steuben, Wabash, Washington, *Wayne, Wells, and Whitley counties.

Pogonatum

1. Leaves lanceolate-subulate, serrate; capsules usually more than 2:1, usually straight, occasionally inclined or drooping; calyptra gray.....*P. brevicaule*
   Leaves lingulate, blunt, entire; capsules less than 2:1, usually curved, and unsymmetric at base; calyptra tawny-red-brown.....*P. brachyphyllum*

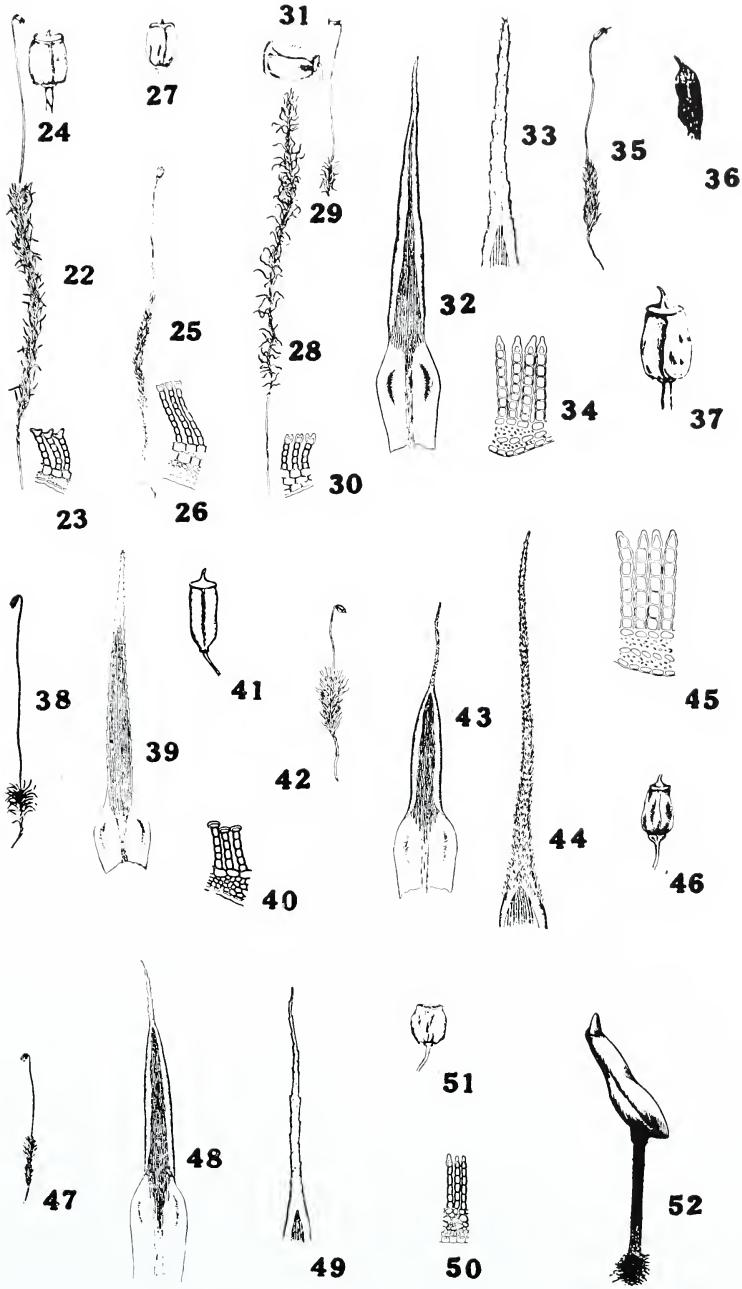
P. brachyphyllum (Michx.) Beauv. Monroe and Putnam (?) counties.

P. brevicaule (Brid.) Beauv. Brown, Floyd, Laporte, Monroe, and Putnam counties.

Polytrichum

1. Leaf margin serrate to sheath or nearly so, plane or erect; leaves sharply pointed, costa excurrent in a red dentate point about 1 mm. in length.....2
   Leaf margin entire, incurved; leaves sharply pointed, costa excurrent as an arista 5
2. Plants 3-6 cm. high; leaves spreading when moist, erect-flexuous when dry, cells in middle of sheathing base longer than wide as 3-4:1; lamellae about 50, 5-7 cells high, marginal cells oval or flattened, thickened, much larger than the others, broader than long as 1½-2:1; capsule sharply 4-5 angled, rarely 6-angled, longer than wide as 2-2½:1.....*P. ohioense*
   Plants 5-45 cm. high; upper leaves squarrose or recurved when moist, erect and appressed when dry (with exception of var. *uliginosum*), cells in middle of sheathing base linear as 10-20:1; lamellae about 60, 4-6 cells high, marginal cells notched or bicuspidate in cross section, broader than others; capsule sharply 4-angled, more or less cubical as 1¼-1¾:1.....3

Figs. 1-21. Figs. 1, 2. *Tetraphis pellucida* (From Bry. Eur., pl. 196). Fig. 1. Sterile plant bearing gemmiferous cups, enlarged. Fig. 2. Capsule and peristome of four teeth, enlarged. Fig. 3. *Catharinea angustata* (From Grout, M. H. M., fig. 14). Leaf, x 4.5. Figs. 4-6. *Catharinea plurilamellata* (From Jennings, Mosses W. Pa., pl. 27). Figs. 4-5. Leaves, x 7.1. Fig. 6. Cross section of stem leaf, x 47.5. Fig. 7. *Catharinea undulata* (From Grout, M. H. M., Fig. 14). Leaf, x 4.5. Fig. 8. *Webera sessilis* (From Grout, M. H. M., fig. 20). Capsule surrounded by perichaetial leaves, x 2.8. Fig. 9. *Bryoxiphium norvegieum* (From Bry. Eur., pl. 195). Sterile plant, enlarged. Figs. 10-12. *Fissidens adiantoides* (From Bry. Eur., pl. 105). Fig. 10. Section of stem, showing the split appearance of basal portion of leaves, enlarged. Fig. 11. Leaf apex, enlarged. Fig. 12. Capsule and peristome, enlarged. Fig. 13. *Fissidens bryoides* (From Bry. Eur., pl. 101). Leaf apex enlarged. Fig. 14. *Fissidens bryoides*, var. *incurvus* (From Bry. Eur., pl. 99). Leaf apex, enlarged. Figs. 15, 16. *Fissidens Julianus* (From Bry. Eur., pl. 108). Fig. 15. Sterile plant, x 0.6. Fig. 16. Portion of peristome, enlarged. Fig. 17. *Fissidens minutulus* (From Sull. Icones Musc., pl. 24). Leaf apex, enlarged. Fig. 18. *Fissidens obtusifolius* (From Sull. Icones Musc., pl. 22). Leaf apex, enlarged. Fig. 19. *Fissidens osmundoides* (From Bry. Eur., pl. 103). Leaf apex, enlarged. Fig. 20. *Fissidens subbasilaris* (From Sull. Icones Musc., pl. 26). Leaf apex, enlarged. Fig. 21. *Fissidens taxifolius* (From Bry. Eur, pl. 104). Leaf apex, enlarged.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Figs. 22-52

3. Leaves appressed when dry; capsule 1¼-1½:1 4
   Leaves spreading-recurved when dry, lamellae 4-6 cells high; inner perichaetial leaves not exceeding the foliage leaves; capsule 1½-1¾:1, beak of operculum slightly curved ..... *P. commune*, var. *uliginosum*
4. Lamellae 4-6 cells high; inner perichaetial leaves not exceeding the foliage leaves; beak of operculum slightly curved ..... *P. commune*
   Lamellae 6-9 cells high; inner perichaetial leaves very long, exceeding the foliage leaves; beak of operculum straight ..... *P. commune*, var. *perigoniale*
5. Arista red, rarely somewhat colorless at tip, rough, ½-1½ mm. long; lamellae 4-7 cells high, marginal cells longer than wide, ovate or flask-shaped 6
   Arista hyaline, rough, up to 3 mm. in length; lamellae 4-7 cells high, marginal cells longer than others, ovate or flask-shaped, thickened, longer than wide as 1½-2:1; plants 2.5-4 cm. high, glaucous green; capsule sharply 4-angled, 1¼-1½:1 ..... *P. piliferum*
6. Stems usually covered for greater portion of length with dirty-white tomentum; plants 6-20 cm. high, rigid, almost terete when dry; leaves closely appressed; capsule sharply 4-angled, more or less cubical as 1¼:1, 2-3 mm. long .. *P. strictum*
   Stems without dense covering of tomentum; plants 2-10 cm. high, glaucous green; leaves spreading when moist, erect when dry; capsule sharply 4-angled, 1½-1¾:1, 3-5 mm. long ..... *P. juniperinum*

P. commune L. (Figs. 22-24.) Jasper, *Jefferson, Johnson, Lagrange, Martin, *Monroe, Putnam, Spencer, Starke, and Steuben counties.

P. commune L., var. **perigoniale** (Michx.) B. & S.* (Figs. 25-27.) Jasper, Lawrence, Monroe, Porter, Starke, and White counties.

P. commune L., var. **uliginosum** Hueb.* (Figs. 28-31.) Carroll, Elkhart, Jasper, Marshall, and Starke counties.

P. juniperinum Willd.* (Figs. 32-37.) Carroll, Jasper, Lagrange, Laporte, St. Joseph, Steuben, and Washington counties.

Figs. 22-52. Figs. 22-24. *Polytrichum commune* (From Frye, Polytrichaceae W. N. Am., fig. 23). Fig. 22. Dry plant, x 0.37. Fig. 23. Cross section of a few lamellae, showing their height and depth of notch in apical cells, x 93.5. Fig. 24. Capsule, x 1.9. Figs. 25-27. *Polytrichum commune*, var. *perigoniale* (From Frye, Polytrichaceae W. N. Am., fig. 23). Fig. 25. Dry Plant, x 0.37. Fig. 26. Cross section of a few lamellae, showing their height and depth of notch in apical cells, x 93.5. Fig. 27. Capsule, x 1.9. Figs. 28-31. *Polytrichum commune*, var. *uliginosum* (From Frye, Polytrichaceae W. N. Am., fig. 23). Fig. 28. Dry plant, x 0.37. Fig. 29. Tip of plant, showing perichaetial leaves and capsule, x 0.37. Fig. 30. Cross section of a few lamellae, showing their height and depth of notch in apical cells, x 93.5. Fig. 31. Capsule, x 1.9. Figs. 32-37. *Polytrichum juniperinum* (From Frye, Polytrichaceae W. N. Am., Fig. 27.) Fig. 32. Leaf, showing incurved margin and lamellae on upper surface, x 6.9. Fig. 33. Leaf tip, x 30. Fig. 34. Cross section of a few lamellae, showing smooth, flask-shaped apical cells, x 115. Fig. 35. Dry plant with capsule, x 0.46. Fig. 36. Calyptra covering immature capsule, x 2.3. Fig. 37. Capsule, x 2.3. Figs. 38-41. *Polytrichum ohioense* (From Frye, Polytrichaceae W. N. Am., fig. 20). Fig. 38. Moist plant with capsule, x 0.38. Fig. 39. Leaf, showing lamellae on upper surface, x 5.7. Fig. 40. Cross section of a few lamellae, showing common form of apical cells, x 95. Fig. 41. Capsule, x 1.9. Figs. 42-46. *Polytrichum piliferum* (From Frye, Polytrichaceae W. N. Am., fig. 30). Fig. 42. Moist plant with capsule, x 0.46. Fig. 43. Leaf, showing involute margin and lamellae on upper surface, x 6.8. Fig. 44. Leaf tip, x 30. Fig. 45. Cross section of a few lamellae, showing flask-shaped, somewhat thickened apical cells, x 115. Fig. 46. Capsule, x 2.3. Figs. 47-51. *Polytrichum strictum* (From Frye, Polytrichaceae W. N. Am., fig. 28). Fig. 47. Moist plant with capsule, x 0.38. Fig. 48. Leaf, showing incurved margin and lamellae on upper surface, x 5.6. Fig. 49. Leaf tip, x 24. Fig. 50. Cross section of a few lamellae, showing flask-shaped apical cells, x 93. Fig. 51. Capsule, x 1.9. Fig. 52. *Buxbaumia aphylla* (From Grout, M. H. M., fig. 19). Mature plant, x 2.6.

P. ohioense R. & C. (Figs. 38-41.) Allen, Carroll, Clark, DeKalb, Delaware, Elkhart, *Hamilton, Hancock, Jackson, Jefferson, Kosciusko, Lagrange, Laporte, Lawrence, Marshall, Martin, *Monroe, Montgomery, Noble, Orange, Owen, Parke, Porter, Putnam, Ripley, Steuben, *Wayne, Wells, and White counties.

P. piliferum Schreb. (Figs. 42-46.) *Monroe and Porter counties.

P. strictum Banks.* (Figs. 47, 48.) Steuben county.

BUXBAUMIACEAE

Buxbaumia aphylla L. Plants very small, rarely recognized unless in fruit; seta stout, about 1 cm. high; capsule oblique to almost horizontal, about 5-7 mm. long, upper surface flattened. Monroe, Porter, and *Putnam counties.

WEBERACEAE

Webera sessilis (Schmid.) Lindb. (Fig. 8.) Plants small, producing a general appearance of a grain of wheat (capsule) sitting in a tuft of bristles (perichaetial leaves). Brown, Floyd, Monroe, Parke, and Putnam counties.

FISSIDENTACEAE

Leaves in one plane, in two opposite rows, vertically placed, with bases appearing split along the upper edge, clasping the stem.

1. Stems radiculose-bulbiform at base; peristome none.....*Bryoxiphium*
   Stems not radiculose-bulbiform at base; peristome teeth cleft.....*Fissidens*

Bryoxiphium norvegicum (Brid.) Mitt. (Fig. 9.) Pendent upon shaded vertical faces of sandstone cliffs. Laporte, Parke, Porter, and Putnam counties.

Fissidens

1. Plants aquatic, floating, slender, flaccid; stems fasciculately branching; leaves distant, spreading, bases clasping the stem; peristome teeth 16, short, irregularly cleft .....*F. Julianus*
   Plants terrestrial, or, if submerged, not floating; stems simple or branching, not fasciculate; leaf bases clasping the stem and the lower edges of adjacent leaves above; peristome teeth 16, regularly cleft.....2
2. Leaves bordered (marginal cells unlike other leaf cells).....3
   Leaves not bordered, outermost row of cells sometimes slightly lighter in color.....8
3. Leaves, at least the sheathing base, bordered by one or more rows of linear cells....4
   Leaves bordered, sometimes more or less obscurely, by several rows of paler thick-walled cells similar in size and shape to other leaf cells.....7
4. Leaf border strong, reaching apex, usually confluent at apex with the percurrent costa; leaves oblong-lingulate, usually abruptly short-acuminate; plants 5-25 mm. high; seta terminal, 4-9 mm. long; capsule typically erect and symmetric, sometimes inclined.....*F. bryoides*
   Leaf border narrow, not strong, not confluent with costa at apex; leaves oblong-lanceolate, apices obtuse-apiculate to acute; plants 0.8-6 mm. high.....5
5. Leaves usually bordered only on the sheath; plants 1-2 mm. high; leaves 3-6 pairs, uppermost ascending to erect, up to 1 mm. in length, narrowly oblong-lanceolate; apices acute to rounded-obtuse; seta terminal; capsule erect and symmetric or slightly inclined.....*F. exiguus*
   Leaves bordered on blade as well as sheath; plants 0.8-6.0 mm. high; leaves usually 3-7 pairs, uppermost incurved-erect, up to 2.5 mm. in length.....6

6. Leaf border narrow, extending almost to the apex; leaves broadly oblong-lanceolate; apices obtuse-apiculate; plants 2-6 mm. high; seta terminal; capsules curved and cernuous.....*F. bryoides*, var. *incurvus*
   Leaf border narrow, usually ending some distance below the apex; leaves narrowly oblong-lanceolate; apices acute, often apiculate; plants 0.8-5.0 mm. high, often less than 3 mm.; seta terminal; capsules erect or inclined.....*F. minutulus*
7. Leaf cells distinct, approximately 12-16μ x 15-25μ; border often indistinct; seta lateral, 1-2.5 cm. in length.....*F. adiantoides*
   Leaf cells rather indistinct, approximately 6-10μ x 6-14μ border very distinct; seta lateral, up to 1 cm. in length.....*F. cristatus*
8. Costa excurrent into a short mucro; leaves finely and evenly crenulate above; seta lateral, 8-15 mm. long.....*F. taxifolius*
   Costa ending in the apex or below.....9
9. Costa ending considerably below the apex; leaves minutely and irregularly serrulate above, more or less obtuse but apiculate with a pointed cell; leaf cells more or less rounded, approximately 8-11μ; seta lateral, 3-5 mm. long...*F. subbasilaris*
   Costa ending shortly below the apex.....10
10. Leaf margins entire; apices rounded-obtuse; seta terminal, 1.5-3.0 mm. long; capsule erect and symmetric.....*F. obtusifolius*
    Leaf margins finely and evenly crenulate above; apices rounded-obtuse and often apiculate; seta terminal, 5-10 mm. long, capsule erect and symmetric.....*F. osmundoides*

F. adiantoides Hedw. (Figs. 10-12.) Henry, *Jefferson, Laporte, Porter, Putnam, Steuben, and *Wayne counties.

F. bryoides Hedw. (Fig. 13.) *Monroe county.

F. bryoides Hedw., var. **incurvus** (Starke) Monkem. (Fig. 14.) Jasper, Parke, and Putnam counties.

F. cristatus Wils. Clark, Delaware, *Jefferson, Lake, Madison, Monroe, Porter, Tippecanoe, Washington, and Wayne counties.

F. exiguus Sull. Monroe county.

F. Julianus (Mont.) Schimp. (Figs. 15, 16.) *Monroe and Putnam counties.

F. minutulus Sull. (Fig. 17.) Jasper, Madison, Monroe, Parke, Putnam, and Warren counties.

F. obtusifolius Wils. (Fig. 18.) Jasper, *Putnam, and Owen counties.

F. osmundoides Hedw.* (Fig. 19.) Delaware, Jasper, Laporte, Madison, Parke, Porter, and Steuben counties.

F. subbasilaris Hedw. (Fig. 20.) Delaware, Henry, *Jefferson, Lawrence, Madison, Parke, Putnam, Washington, and *Wayne counties.

F. taxifolius Hedw. (Fig. 21.) Carroll, Delaware, Floyd, Lawrence, Madison, Monroe, Parke, Putnam, Washington, *Wayne, and Whitley counties.