

ISOETACEAE QUILLWORT FAMILY

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Per, aquatic to terrestrial. **ST** buried, corm-like, 2–3-lobed, corky, brown. **LVS** simple, in grass-like tufts, spirally arranged on st top, erect to spreading, < 25 cm, linear above base. **SPORANGIA** solitary, embedded in wide lf base, < 1 cm, ± covered by a translucent membrane, either male or female; male spores > 10,000, < 0.045 mm, ± bean-shaped, gray or brown in mass; female spores 20–200, 0.2–0.7 mm, spheric, white, ± smooth, ridged, tubercled, or prickly. 1 genus, 150 spp.: worldwide. [Pfeiffer 1922 Ann Missouri Bot Gard 9:79–233]

ISOETES QUILLWORT

(Greek: evergreen, from the habit of some spp.) Perhaps most poorly known pteridophyte genus. Mature female spores, found in decaying lf bases or soil, critical for identification; hand lens for texture when dry, microscope with micrometer for size. Hybrids (spores flattened, highly variable) common between aquatic spp., making them less distinct.

- 1 . Pl terrestrial (or becoming so), of seasonally wet soil, lake margins, temporary streams, vernal pools; gen < 1500 m
- 2 . Translucent membrane covering < 75% of sporangium *I. howellii*
- 2' Translucent membrane covering > 75% of sporangium
- 3 . Pl of wet soil; lf gen > 8 cm, > 1 mm wide at middle, rigid, almost brittle *I. nuttallii*
- 3' Pl of vernal pools; lf gen < 8 cm, < 1 mm wide at middle, soft, flexible *I. orcuttii*
- 1' Pl underwater in persistent lakes or pools; > 1500 m
- 4 . Female spore prickly *I. echinospora*
- 4' Female spore ridged or tubercled
- 5 . Lf abruptly tapered to tip; female spore 0.3–0.5 mm wide *I. bolanderi*
- 5' Lf gradually tapered to tip; female spore 0.5–0.7 mm wide *I. occidentalis*

I. bolanderi Engelm. (p. 97) Pl underwater. **LVS** deciduous, < 20 cm, rigid, not brittle, abruptly tapered to tip, bright green; bases white to brownish. **SPORANGIUM**: membrane covering < 30%; male spores 0.02–0.03 mm, brown in mass; female spores 0.3–0.5 mm diam, ridged, tubercled. $2n=22$. Persistent lakes, pools; > 1500 m. KR, NCoRH, CaRH, SNH, SnBr, Wrn; to B.C., WY, NM. Hybridizes with *I. echinospora*, *I. occidentalis*. Spores mature late summer. Small pls of c SNH, NV, AZ (lf < 2.5 cm) have been called var. *pygmaea* (Engelm.) Clute.

I. echinospora Durieu (p. 97) Pl underwater. **LVS** ± evergreen, < 20 cm, soft, flexible, gradually tapered to tip, bright green; bases white to brownish. **SPORANGIUM**: membrane covering < 50%; male spores 0.02–0.03 mm, gray in mass; female spores 0.4–0.5 mm diam, prickly. $2n=22$. Persistent lakes, pools; > 1500 m. KR, n SNH; to AK, e N.Am, Eurasia. [*I. braunii* Durieu; *I. muricata* Durieu] Hybridizes with *I. bolanderi*, *I. occidentalis*. Spores mature late summer.

I. howellii Engelm. (p. 97) Pl becoming terrestrial. **LVS** deciduous, < 30 cm, rigid, not brittle, gradually tapered to tip, bright green; bases brownish to black. **SPORANGIUM**: membrane covering < 75%; male spores 0.025–0.035 mm, brown in mass; female spores 0.3–0.5 mm diam, ridged. $2n=22$. Vernal pools, lake margins; gen < 1500 m. NCoR, CaRF, SNF, SnFrB, SCoR, SCo, PR; to WA, MT, UT. Spores mature late spring, summer. Small pls of SCo, WA, Baja CA (lf < 10 cm, female spore < 0.42 mm) have been called var. *minima* (A.A. Eaton) Pfeiffer.

I. nuttallii Engelm. (p. 97) Pl terrestrial. **LVS** deciduous, gen > 8 cm, > 1 mm wide at middle, rigid, almost brittle, gradually tapered to tip, light green to gray-green; bases white to brownish, outermost sterile, often surrounded by several black scales. **SPORANGIUM**: membrane covering > 75%; male spores 0.02–0.03 mm, brown in mass; female spores 0.35–0.6 mm diam, ± shiny, ± tubercled. $2n=22$. Seasonally wet soil, temporary streams; gen < 1500 m. NCoR, CaRF, SN, n SnJV, SnFrB, SCoRO, SCo, PR; to B.C. Spores mature late spring, summer.

I. occidentalis L. Henderson (p. 97) Pl underwater. **LVS** evergreen, < 20 cm, rigid, brittle, gradually tapered to tip, dark green; bases brownish white. **SPORANGIUM**: membrane covering < 50%; male spores 0.035–0.045 mm, gray in mass; female spores 0.5–0.7 mm diam, ridged, tubercled. $2n=66$. Persistent lakes, pools; > 1500 m. KR, SNH; to B.C., Colorado. [*I. lacustris* var. *paupercula* Engelm.; not *I. lacustris* L.] Hybridizes with *I. bolanderi*, *I. echinospora*. Spores mature late summer.

I. orcuttii A.A. Eaton Pl becoming terrestrial. **LVS** deciduous, gen < 8 cm, < 1 mm wide at middle, soft, flexible, gradually tapered to tip, bright green, bases white to brownish, outermost fertile, often surrounded by several black scales. **SPORANGIUM**: membrane covering > 75%; male spores 0.02–0.025 mm, brown in mass; female spores 0.2–0.4 mm diam, ± shiny, ± smooth. $2n=22$. Vernal pools; < 1700 m. n SNH, GV, SCo, PR; Baja CA. Spores mature spring.