EQUISETACEAE HORSETAIL FAMILY

George Yatskievych
Missouri Botanical Garden
P.O. Box 299
Saint Louis, MO 63166-0299

and

Michael D. Windham
Department of Biology
Duke University
Box 90338
Durham, NC 27708

Perennial herbs with branched rhizomes. RHIZOMES deep-seated, often dark brown to purplish black, usually with nodal sheathes similar to the aerial stems, these becoming degraded with age. ROOTS adventitious, often branched. AERIAL STEMS unbranched or with whorls of branches, sometimes irregularly branched following flood damage, hollow (except at nodes), with a larger central longitudinal canal and 2 rings of smaller canals, those under the ridges (carinal canals) and those between the ridges (vallecular canals). the nodes jointed. LEAVES whorled, fused into short sheaths at the stem nodes, the tooth-like free tips brown to black, concolorous or bicolorous with a green to white midvein or white margins, persistent or shed early. STROBILI cone-like, with peltate sporophylls, borne at the stem and/or branch tips, green or the sporangiophores sometimes brownish- to blackish-tinged, the strobilus tip rounded or sharply mucronate. SPORANGIA in a ring of 5-10 along the undersurface of sporophylls, saclike, dehiscing by a lateral slit. SPORES monomorphic, globose, green, bearing 4 linear-spatulate, white structures (elaters). GAMETOPHYTES surficial, irregularly disk-shaped, green, usually fünctionally unisexual. —l genus, 15 spp., nearly worldwide.

The strobili of *Equisetum* are complex structures. The highly modified sporophylls are tightly spiraled and oriented at right angles to the central axis. The outer surface of the strobilus appears as a series of interlocking hexagonal plates, which separate at maturity through elongation of the central axis. The mass of spores appears as minute green globes (visible with a hand lens) immersed in a cottony mass of elaters. The elaters spread as they dry and coil around the spores when wetted. This complex reproductive morphology notwithstanding, much of the reproduction in *Equisetum* species is vegetative from rhizome and aerial stem fragments dispersed by flood-waters or perhaps in mud on the feet and feathers of waterfowl.

Equisetum L. Horsetail, Scouring-rush

Characters of the family. (Latin for “horse” and “bristle” [for the course dark roots]).

Vascular Plants of Arizona: Equisetaceae. *CANOTIA* 4 (2): 41–45, 2008.

Heil and O'Kane (2003) reported *E. pratense* Ehrh. from Apache County (and also from Colorado, New Mexico, and Utah) without supporting data. Steve O'Kane (pers. comm.) was unable to locate any voucher specimens documenting this report and for the present the species is excluded from the Arizona flora. *Equisetum pratense* differs from the closely related *E. arvense* in its fertile stems, which become green and branched after the spores have been shed and in its cuneate rather than attenuate sheath teeth. It is a northern taxon otherwise unknown from the southwestern United States.

Heil and O'Kane (2003) also reported *E. variegatum* Schleich. ex F. Weber & D. Mohr as occurring in Apache and Navajo Counties. Because voucher specimens have not been discovered, this taxon is similarly excluded. *Equisetum variegatum* produces persistent unbranched stems that are usually less than 50 cm tall and have apically banded sheaths with persistent teeth. The stems differ from those of *E. hyemale* and *E. laevigatum* in having only 3–12 ridges. In those species, depauperate plants or those regenerating following floods or wounding might be mistaken for *E. variegatum*. *Equisetum variegatum* has been documented from more northern portions of Colorado and Utah, thus might plausibly occur in Arizona.

1. Aerial stems dimorphic, the strobilus-bearing stems ephemeral, unbranched, tan to pink, the vegetative stems persisting through 1 growing season, green, with regular whorls of branches, these 3- or 4-ridged ……. ***E. arvense***

1' Aerial stems monomorphic, persisting through 1 growing season or evergreen, green, unbranched or with irregular, scattered branching in wound-forms, these with 6–20 ridges …… 2

2. Aerial stems evergreen, the surface somewhat roughened (sand-papery); strobili with a sharp mucro at tips …….. ***E. hyemale***

2' Aerial stems persisting through 1 growing season, the surface smooth; strobili rounded at tips ……... ***E. laevigatum***

Equisetum arvense L. (of the field). Common Horsetail, Field Horsetail (Fig. 2A). —AERIAL STEMS dimorphic, erect, the surface smooth; fertile stems 7–35 cm long, ephemeral, tan to pink, unbranched; vegetative stems 10–60 cm long, 5–14-ridged, persisting through 1 growing season, green, with regular whorls of branches, these 3- or 4-ridged. SHEATHS as long as or longer than wide, lacking bands or markings; teeth 5–14 per sheath (3–4 on branches), 1–3 mm long (-8 mm on fertile stems), mostly black, persistent. STROBILI 5–35 mm long, the tips rounded. SPORES 35–70 µm in diameter. —Wet soil of montane meadows and stream banks, less commonly on moist rock ledges: Apache, Coconino, Gila, Graham, Mohave, Navajo, Pima, Yavapai cos. (Fig. 1A); 1400–2700 m (4500–8800 ft); nearly worldwide.

The fertile stems of *E. arvense* are produced in April and May before the vegetative ones and wither soon after the spores are shed. They tend to be stouter than the vegetative stems, with fewer ridges and larger sheaths. The vegetative stems have regular whorls of branches, these with only 3–4 ridges. Care must be taken not to confuse these branches with those of wound-forms of other Arizona species, which develop following damage by flood-waters, and which occur

irregularly and generally have more ridges.

Equisetum hyemale L. (of winter). Common Scouring-rush. —AERIAL STEMS monomorphic, evergreen, 30–220 cm long, 14–50-ridged, erect (to prostrate after flooding), the surface somewhat roughened (sand-papery), usually dark green at maturity, unbranched or with irregular, scattered branches in wound-forms, these with 6–20 ridges. SHEATHS as long as or slightly shorter than wide, variously marked with a dark basal band, a light gray to brown central band, and a dark tip, sometimes more or less uniformly darkened; teeth 14–50 per sheath (6–20 on branches), 2–4 mm long, gray to black. STROBILI 8–25 mm long, the tips sharply mucronate. SPORES 35–70 µm in diameter. $2n = 216$. 2 subspp. [often treated as vars.]; N. Amer., C. Amer., Eur., Asia.

Subsp. **affine** (Engelm.) Calder & Roy L. Taylor (allied to; Figs. 2B–C). —STEMS with minute tubercles in 1 row along the ridges. TEETH irregularly persistent. [*E. hyemale* var. *affine* (Engelm.) A.A. Eaton, var. *pseudohyemale* (Farw.) C.V. Morton, var. *robustum* (A. Braun) A.A. Eaton; *E. prealtum* Raf.] —Banks of streams and rivers, marshy meadows, roadside ditches: Apache, Cochise, Coconino, Gila, Graham, Maricopa, Mohave, Navajo, Pima, Santa Cruz, and Yavapai cos. (Fig. 1B); 900–2600 m (2850–8500 ft); June–Sep; U.S., Can. Mex., Guatemala.

Equisetum ×ferrissii Clute [*E. hyemale* var. *elatum* (Engelm.) C.V. Morton, *E. h.* var. *intermedium* A.A. Eaton] is the hybrid between *E. hyemale* and *E. laevigatum*, which is relatively common and widespread in Arizona. It has been reported from Apache, Cochise, Coconino, Gila, Greenlee, La Paz, Mohave, Navajo, Pima, Santa Cruz, and Yavapai cos., including sites where one or both parental species are absent. It either persists after extirpation of the parents or more probably colonizes such sites vegetatively. This sterile hybrid is most easily identified by the indehiscent strobili, which may be broken open to reveal the cottony mass of elaters, but no mature, green, globose spores (the spores are white and misshapen). The morphology of the more-or-less evergreen aerial stems is quite variable, but they are generally at least slightly rough to the touch and the stem sheathes sometimes resemble those of *E. hyemale* toward the stem base and those of *E. laevigatum* toward the tip. The strobili are at least somewhat mucronate.

Equisetum laevigatum A. Braun (smooth; Fig. 2D). Smooth Scouring-rush. —AERIAL STEMS monomorphic, persisting through 1 growing season, 20–110 cm long, 10–32-ridged, erect (to prostrate after flooding), the surface smooth, usually bright green at maturity, unbranched or with irregular, scattered branches in wound-forms, these with 6–15 ridges. SHEATHS longer than wide, green with a narrow, dark tip; teeth 10–32 per sheath (6–15 on branches), 2–3 mm long, gray to black, shed early. STROBILI 8–25 mm long, the tips rounded. SPORES 35–70 µm in diameter. [*E. funstonii* A.A. Eaton, *E. kansanum* J.H. Schaffn.]. —Banks of streams and rivers, marshy meadows, wet, sandy areas: Apache, Cochise, Coconino, Gila, Greenlee, Maricopa, Mohave, Navajo, Pima, Santa Cruz, and Yavapai cos. (Fig. 1C); 1000–2600 m (3500–8400 ft); May–Aug; w U.S. e to OH, Can. n Mex.

For a discussion of the hybrid with *E. hyemale*, see the treatment of that species.

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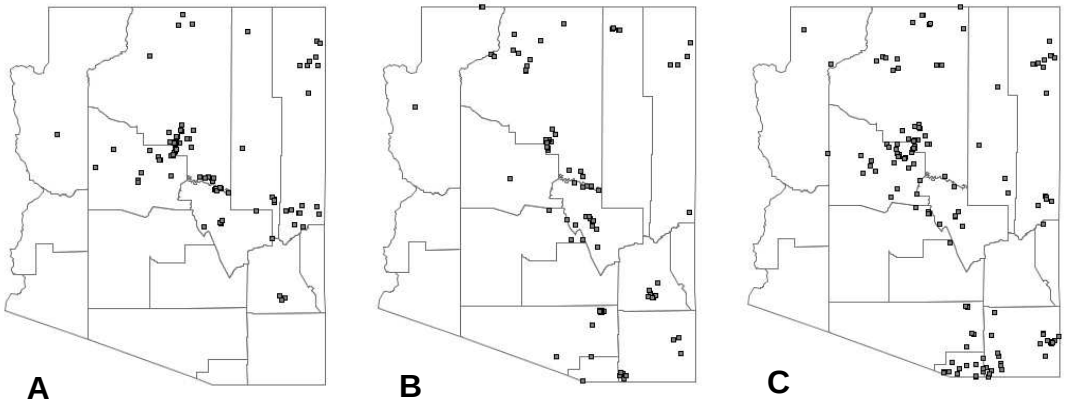
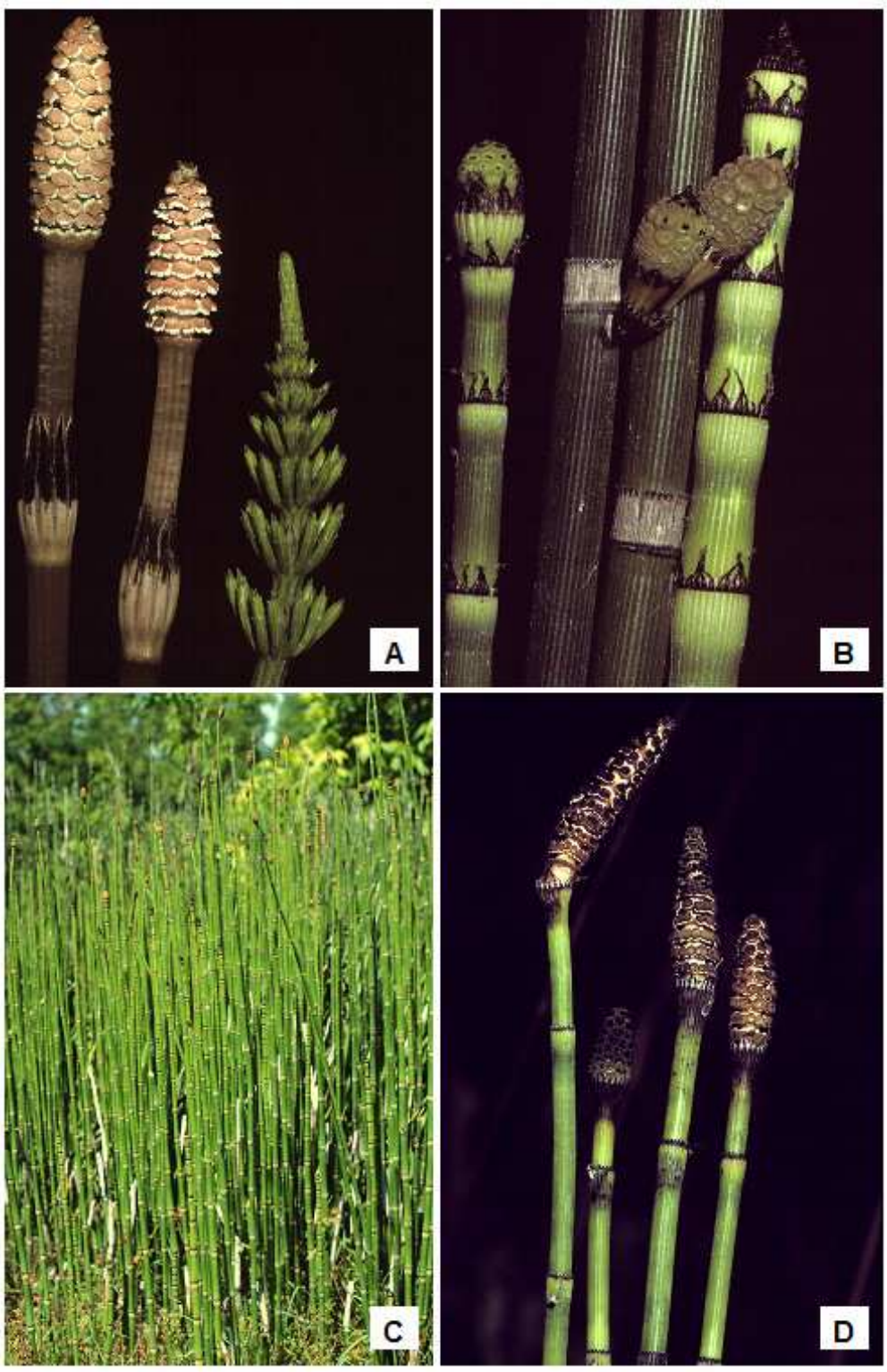


Equisetaceae Figure 1. Distributions of: (A) *Equisetum arvense*; (B) *Equisetum hyemale* subsp. *affine*; (C) *Equisetum laevigatum*.



Equisetaceae Figure 2. Comparison of species: (A) *Equisetum arvense*, close-up; (B) *Equisetum hyemale* subsp. *affine*, close-up; (C) *Equisetum hyemale* subsp. *affine*, habitat; (D) *Equisetum laevigatum*, close-up.