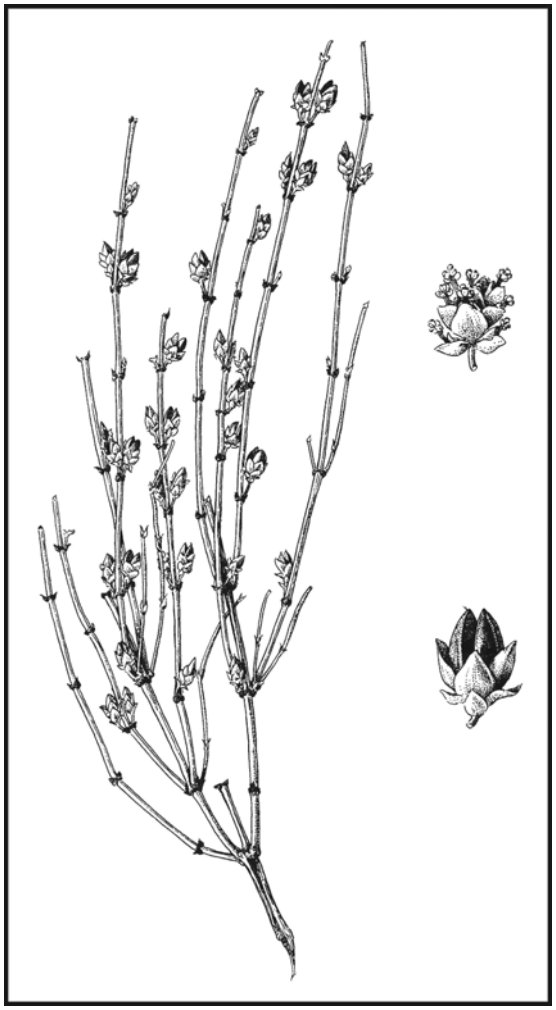
***Ephedra viridis* Coville** green ephedra
EPHEDRACEAE

Synonyms: *Ephedra nevadensis* subvar. *pluribracteata* Palmer ex Stapf.
Ephedra nevadensis var. *viridis* (Colville) M.E. Jones



General Description.—Green ephedra, also known as Mormon tea, or jointfir, is a spreading to erect, coniferous shrub, 0.5 to 1.5 m tall and with a crown 1 to 3 m wide at maturity (Cronquist and others 1972, USDA Forest Service 1976). A fibrous, somewhat fragile root system originating from several, almost parallel, taproots descends deep into the soil profile. Stems are jointed and grooved. Internodes are 1 to 4.5 cm long (Cronquist and others 1972). Lower bark is gray and irregularly fissured (Anderson 2001). Photosynthetic upper branches are thin (1 to 3 mm), bright green to yellow green and broom-like, with opposite or falsely whorled attachment (Welsh and others 1987). Leaves are reduced to 1.5 to 4 mm, deciduous scales, positioned in opposite pairs at nodes. A thickened brown base remains after leaf-shed. Egg-shaped cones are borne at nodes, singly or whirled. Two or more male cones, 5 to 7 mm long, are subtended by opposite membranous bracts, 2 to 4 mm long, while female cones, 6 to 10 mm long, are partially enclosed by thickened bracts, 4 to 7 mm long (Cronquist and others 1972). Brown, three-sided seeds are smooth and 5 to 8 mm long and 2 to 4 mm wide. The combination of small cones, ring porous wood, wide multiseriate rays, and vessels in older stems separate *Ephedra* from other gymnosperms (Stevenson 1993).

Taxonomy.—Two varieties of green ephedra are recognized. Variety *viscida* (Cutler) L. Benson differs from the more widespread var. *viridis* by the presence of short stalks (peduncles) on female cones and the often sticky nature of stems (Welsh and others 1987). Chromosome number is 2n = 28 (Stevensen 1993).

Range.—Green ephedra is closely associated with the Great Basin and Colorado Plateau provinces of western North America (Anderson 2001). Its range extends from California and Oregon east and south to western Texas and Chihuahua, Mexico. In Utah and California its elevational range varies from 900 to 3,000 m (Welsh and others 1987, Anderson 2001).

Ecology.—Green ephedra is found on sedimentary, volcanic, and metamorphic substrates in sandy, gravelly, or rocky, well-drained, underdeveloped soils (Anderson 2001). Populations are found on a variety of landforms including: plains, alluvial fans, mesa tops, washes, and canyon walls on all aspects. Salt tolerance is limited. Plants tolerate partial shade but do best in full sun. Although rarely considered a dominant, green ephedra is associated with a wide variety of plant community types including: big sagebrush-bunchgrass, black sagebrush, blackbrush, desert grassland, pinyon-juniper, mountain mahogany, oak woodland, mountain shrub, mixed conifer, and

ponderosa pine (Anderson 2001). It is present in early, mid, and late successional stages (Young and Evans 1973, Koniak 1985). Mean annual precipitation varies from 200 to 430 mm (Anderson 2001). Plants sprout from crown or roots following top-kill by fire (USDA Forest Service 1976, Young and Evans 1978, Koniak 1985, Everett 1987). Reported survival following fire is variable (Anderson 2001). Sprouting response following fire may vary by season of burn, fire severity, or among population variation in fire tolerance. Green ephedra is found in communities for which a wide range of fire frequencies is known. It also establishes on disturbed sites from seed (Koniak 1985). Green ephedra is used as winter forage by big game and livestock but receives only limited use during other seasons (Jameson and others 1962, Kufeld and others 1973). Palatability and nutritive quality of young stems are generally ranked as fair to good for most wildlife species and classes of domestic livestock (Dittberner and Olson 1983, Anderson 2001). Seeds are eaten by birds and rodents and appear to be moderately prefered (Everett and others 1978). Rodents probably play an important role in seed dispersal.

Reproduction.—Green ephedra is dioecious. Spatial segregation of the sexes results from high male plant representation on dry ridges and slopes and high female plant representation on microsites with relatively favorable soil moisture conditions (Freeman and others 1976, Brunt and others 1988) providing for greater reproductive efficiency. Plants are wind-pollinated. Timing of cone maturation, or coning, and seed maturation is dependent upon variation in weather, elevation, aspect, and geography. Coning and pollination occur for approximately 2 weeks, usually between April and June. Seeds mature between June and September. Cones are not produced each year, and good seed crops may be several years apart (Plummer and others 1968). There are approximately 45,000 seeds per kg (Meyer and others 1988).

Growth and Management.—In years of good seed crops, significant quantities are easily harvested by hand (Plummer and others 1968). Ripened cones are easily dislodged by gently shaking or striking cone-bearing branches over tarps or hand-held hoppers. Timing of harvest is critical as thunder storms can cause considerable shattering after seeds ripen. After drying, seeds are cleaned to high purity and viability levels using conventional milling equipment. Freshly-harvested seed may be partially dormant (Meyer and others 1988). Dormancy can be broken with a 4-week moist prechill or stratification (Meyer and others 1988). Germination for after-ripened or prechilled seed is relatively rapid. Germination of non-dormant seeds occurs over a range of cool temperatures (Young and others 1977). Seed viability remains high for at least 5, and perhaps as long as 15 years (Stevens and others 1981). Seedling growth rate is slow. Seedlings may require 5 to 10 years to reach 60 cm in height (Anderson 2001). In restoration plantings, seedlings are susceptible to competition from weeds and faster-growing grasses and forbs in the seed mix (Ferguson and Frischknecht 1981). Plants establish well from direct seeding and transplants (USDA Forest Service 1976, Plummer 1977, Everett 1980, Luke and Monsen 1984). Stem cutting are capable of root development in greenhouse conditions (Wieland and others 1971). Green ephedra was toxic to domestic cattle and sheep during pregnancy in a controlled diet study (Keeler 1989). No detrimental effects were observed for developing calves and lambs. Conflicting reports have been published on the possible presence of ephedrine alkaloids in green ephedra. While Anderson (2001) suggests the presence of this group of compounds in this species, Caveney and others (2001) failed to find these compounds common to Old World ephedras in any New World species. Tannin content is high.

Benefits.—Green ephedra is valuable for restoring vegetation structure and diversity and for erosion control on disturbed lands, including roadsides, minelands, and degraded rangelands (USDA Forest Service 1976, Everett 1980, Ferguson and Frischknecht 1981, Ferguson and Frischknecht 1985, Herbel 1986), in areas in which it is adapted. When competition is controlled, it establishes well from seed and persists after wildfire. It provides important winter forage for wildlife and domestic livestock (USDA Forest Service 1976). Green ephedra has had limited use as an ornamental (Anderson 2001). Native Americans made both medicinal and nonmedicinal teas brewed from stems and used seeds and roasted seeds (nutlets) for food (Steward 1938, USDA Forest Service 1976). Mormon settlers were also known to use it in the production of a beverage, a cause for the frequently used moniker, ‘mormon tea’. Undetermined medicinal applications for a group of unique secondary compounds associated with members of the genus have not been fully determined, including possible antimicrobial applications for kynurenates (Caveney and others

2001).

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