



Corispermum pallidum (pale bugseed)

Historical and Current Status of a Potentially
Extinct Washington State Endemic Plant Species

Prepared for U.S. Fish and Wildlife Service Region 1

Prepared by

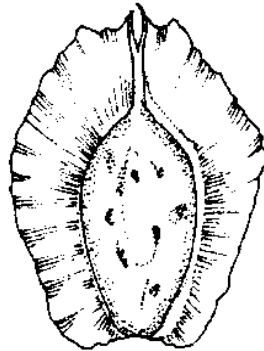
Joseph Arnett
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Prepared for:

U.S. Fish and Wildlife Service
Western Washington Office
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by

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Executive Summary

In 1994, several new species of *Corispermum* (bugseed), flowering plants in the Goosefoot Family (Chenopodiaceae), were formally described in the botanical literature; four of these species are considered to be native to Washington. Since the time when they were first collected in the state, in the 1800s, these plants had all been regarded as recent introductions of Eurasian weeds. Recognition of their native origin has necessitated the annotation of essentially all of the specimens of *Corispermum* collected in Washington, and it has led to re-evaluation of the distribution and rarity of these species.

Among the native bugseeds is a narrow Washington endemic, *Corispermum pallidum* (pale bugseed), a species that has only been historically collected at four locations, all in Grant County, Washington. To our knowledge these four sites represent the global extent of the species; it has not been observed or collected since 1953.

Field surveys were made between 2005 and 2007 in an effort to relocate pale bugseed. These efforts were unsuccessful. At the present time this species is considered to be extinct, and the global ranking of GX, and the subnational ranking of SX, remain as our best assessment of its status.

The inland dunes or other sandy sites that comprise bugseed habitat have declined by over 75% in the past thirty years, and remnants continue to be threatened by invasive species, agricultural and residential conversion, off-road vehicle use, intentional dune stabilization, mining, and grazing. While the species may have been rare at the time of first European contact, the loss of habitat has likely contributed to its decline and possible extinction.

However, it is not possible to confirm that this species does not exist. While the sandy habitats of pale bugseed are fragmented and degraded, they are scattered throughout the Columbia Basin, often on private land, and it has not been possible to survey all of the potential sites. Because the identification references typically used by botanists in Washington do not include these species, a key to identification of documented or potential Washington *Corispermum* species was prepared as part of this report. With adequate tools for identification, it may be that an alert botanist will one day stumble again upon this species, currently presumed to be extinct.

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Acknowledgements

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And we offer a special thanks to those early botanists who made the historical collections of pale bugseed and left specimens as an indispensable resource for our use: John H. Sandberg, John B. Leiberg, J.W. Thompson, Harold St. John, W.D. Courtney, Charles S. Parker, and J.W. Menzies.

Introduction

In the spring and summer of 1893, John H. Sandberg and John B. Leiberg made a botanical collecting trip across the Columbia Plateau (Leiberg 1893, Mack 1988), and among the many significant botanical finds of that expedition were two collections of *Corispermum* (bugseed) (Chenopodiaceae). These plants were identified by Sandberg and Leiberg as an introduced Eurasian species, *C. hyssopifolium*.

Then, in 1995, *Corispermum* species in Washington gained greater conservation significance when Sergei L. Mosyakin described several native North American taxa (Mosyakin 1995). One of the *Corispermum* specimens collected by Leiberg and Sandberg was designated as the type collection for one of these new species, *C. pallidum*. This species was historically known from four locations, all in Grant County, Washington. Collections from two of those sites were made by Leiberg and Sandberg in 1893. The last known collection of this species was made by J.D. Menzies near Moses Lake in 1953. It is possible that this species, apparently rare at the time of first European contact, is now extinct. An extant occurrence of the species would be a high conservation priority in Washington and globally.

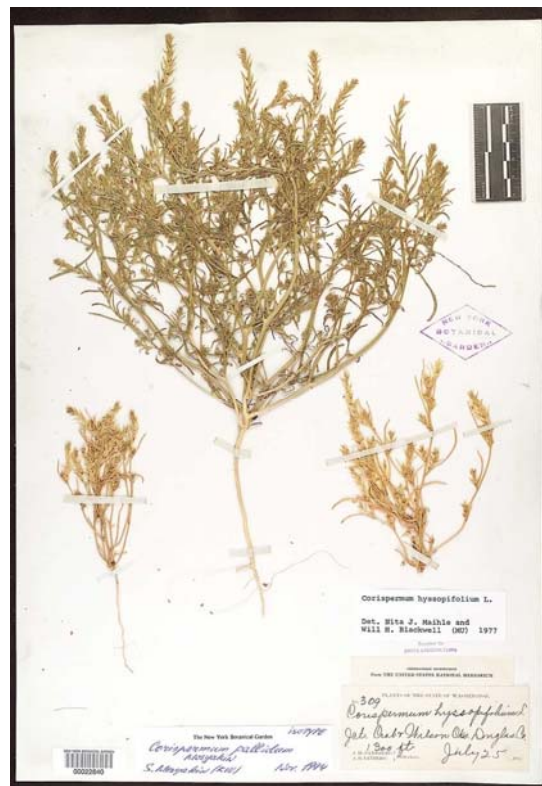


Figure 1. Photograph of the type collection of *Corispermum pallidum*. The July 25 date and the collecting location at the junction of Crab and Wilson Creeks are inconsistent with Leiberg's journal, as described below.

The purpose of this project was to document the historical occurrence of *Corispermum pallidum*, to focus inventories in 2005-2007 to determine whether the species may still exist, and to review its global and subnational ranking. The key to identification of *Corispermum* species in Washington, presented in Appendix 1, was developed to provide botanists working in the state with a reference for identifying these species.

As alluded to in the caption for Figure 1, the date and collection location on the label on the type specimen is likely incorrect. While traveling in Washington D.C., Pam Camp, botanist for the Spokane District of the Bureau of Land Management, had the opportunity to view John Leiberg's original field journals (Leiberg 1893) at the Smithsonian Institution. Figure 2 below gives a view of a page of that notebook.

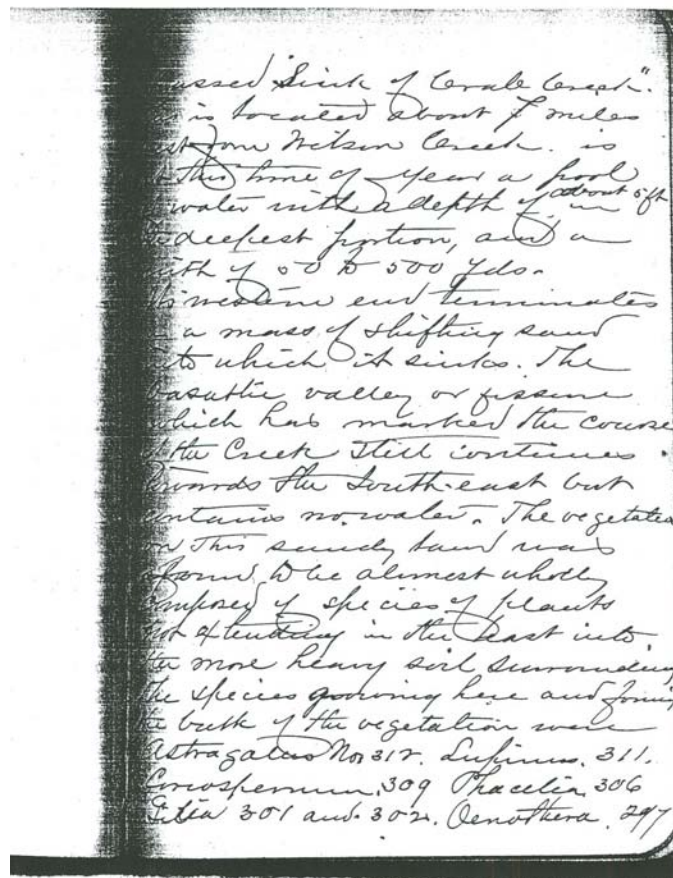


Figure 2. A page from Leiberg's field journal from June 25, 1893. Note the reference near the bottom of the page to "*Coriospermum* [sic] 309", the type collection for *C. pallidum*.

That primary record of the 1893 collecting trip with Sandberg specifically noted the place and time of collecting the specimen for *Corispermum pallidum*, Sandberg and Leiberg collection #309, as noted below in a transcript of that portion of the journal (transcribed by Pam Camp).

At noon June 25 passed "Sink of Crab Creek". This is located about 7 miles west from Wilson Creek, is at this time of year a pool of water with a depth of about 5 feet in the deepest portion, and a width of 50 to 500 yds.

The western end terminates in a mass of shifting sand into which it sinks. The basaltic Valley or fissure which has marked the course of the Creek still continues towards the south-east [southwest?] but contains no water. The vegetation on this sandy _____ was found to be almost wholly composed of species of plants not extending in the least into the more heavy soil surrounding. The species growing here and forming the bulk of the vegetation were Astragalus No. 312, Lupinus 311, Coriospermum [sic] 309, Phacelia 306, Gilia 301 and 302, Oenothera 297, and Arenaria 296. The grasses were sparse and represented by an Agropyron No. 310 in small tufts. Stipa No. 240, the predominating species, and Poa No. 207. This latter species clinging close to the shade and protection afforded by the few individuals of Artemisia tridentata and Purshia tridentata scattered at intervals over the plain.

Journal of John B. Leiberg, June 25, 1893

A catalogue of collections noted elsewhere in Leiberg's journal gives the full name of several of the species collected at the site and provides at least a partial list of associated sand-loving species: 312 *Astragalus sclerocarpus*, 311 *Lupinus aridus*, 309 *Corispermum hyssopifolium* (now *C. pallidum*), 306 *Phacelia ivesiana* (now *P. glandulifera*), 301 *Gilia leptomeria*, as well as species of *Oenothera*, *Agropyron*, *Stipa*, and *Poa*. The location described in Leiberg's journal as the collection site for the specimen that was later designated at the type collection of *Corispermum pallidum* is apparently near what is now Brook Lake, approximately seven miles west of the town of Wilson Creek, just north of State Highway 28. It may be that irrigation in the area has altered the hydrology of the lake, but its location and description closely corresponds to Leiberg's June 25, 1893 description in (Leiberg 1893).

This area is mostly privately owned, and permission for access has not been obtained for inventory of the site. Though heavily impacted by road building, agricultural activities, a nearby irrigation canal, and the dam for Billy Clapp Lake, deposits of sand remain here, and this appears to be the type location for the species.

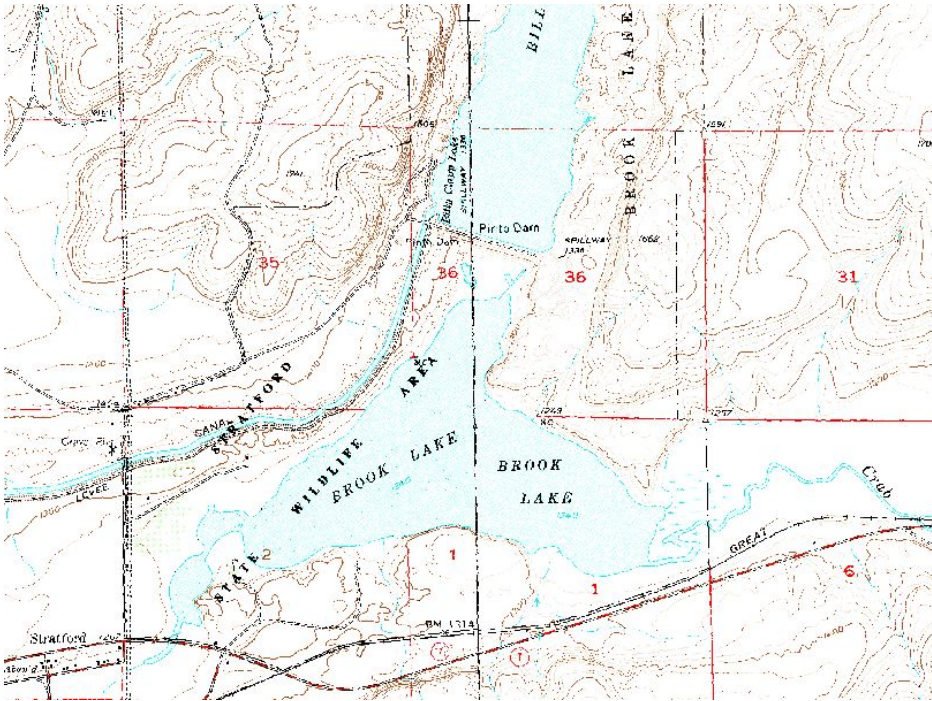


Figure 3. Map of Brook Lake, seven miles west of Wilson Creek. This appears to have been the location of the first collection of *Corispermum pallidum*, by Sandberg and Leiberg (#309) on June 25, 1893.



Figure 4. Aerial photograph of the west end of Brook Lake. This is likely the “Sink of Crab Creek” in Leiberg’s 1893 journal (Leiberg 1893).

***Corispermum pallidum* in Washington**

Field Surveys for *Corispermum pallidum*

Prefield GIS-based evaluation

Prior to field inventories, potential survey areas were prioritized by a Columbia Basin-wide review of historical collection locations and potential habitats, based on historical records, topographic maps, aerial photographs, and geological maps. GIS coverages of suitable sandy habitat were generated and superimposed on Columbia Basin maps. This pre-field work enabled botanists to prioritize survey areas.

Field surveys

Washington Natural Heritage Program (WNHP) botanists conducted focused field inventories in 2005 and 2006 in several locations for *C. pallidum*. Table 2 presents the location of these focused surveys.

In addition to surveys specifically conducted for *Corispermum pallidum*, the WNHP participated in a collecting foray along the Columbia River in 2007 that included adjacent dune habitats. In 2005-2007, the WNHP conducted a broad study on inland dune systems in interior Washington (Hallock et al. 2007). In surveys for this study WNHP biologists searched specifically for these plants, collecting numerous samples of *Corispermum* for later identification.

Field efforts between 2005 and 2007 to relocate *Corispermum pallidum* were not successful. Consequently, it remains unknown whether the species has indeed become extinct since its last documented occurrence in 1953 south of Moses Lake.

Recommendations for Further Searches

According to Mosyakin (2003), *Corispermum* species in western North America have not been adequately studied, and neither field nor garden studies have been conducted. It appears likely that further revision of the classification within this genus will be made as our plants are studied more carefully. That said, it appears that *C. pallidum* is distinct and can be confidently distinguished from other species in the genus if mature fruit is present. It is our hope that if this species is still extant in Washington, the keys and descriptions presented in Appendix 1 of this report will enable botanists working in the field to identify it.

Although the likelihood of its persistence appears low, it is not possible to confirm that *Corispermum pallidum* does not exist. The sandy habitats of this species are fragmented and degraded, but they are scattered throughout the Columbia Basin, and it has not been possible to survey all potential habitat.

In 2006, another sand dwelling annual, *Abronia umbellata* var. *breviflora*, was rediscovered in Washington, after not being seen in the state since 1950 (WNHP database). Removal of a section of ocean dunes to create habitat for federally threatened snowy plovers presumably brought buried seed to the surface, where it germinated and grew. It is possible that *Corispermum pallidum* seed is also able to remain dormant for long periods of time, and then to germinate and grow when it comes to the surface.

Because the identification references typically used by botanists in the field in Washington (Hitchcock and Cronquist 1973, Hitchcock et al. 1964, Parish et al. 1999, Hickman 1993, Douglas et al. 1998, etc.) do not include native *Corispermum* species, a key to identification of documented or potential Washington *Corispermum* species was prepared as part of this report. With adequate tools for identification in hand, it may be that botanists studying Columbia Basin species will one day again find this species, currently presumed to be extinct.

Status of *Corispermum pallidum*

Because this project and other inventory efforts have failed to locate extant populations of *Corispermum pallidum*, the appropriate global rank for this species is GX. The appropriate subnational rank is SX.

Based on the paucity of collected material, it appears that *Corispermum pallidum* was rare at the time of European settlement. The inland dunes and other sandy sites that comprise bugseed habitat constitute a relatively uncommon substrate. Dune systems have been documented to have declined by over 75% in the past thirty years (Hallock et al. 2007), and remnants continue to be threatened by invasive species, agricultural and residential conversion, off-road vehicle use, intentional dune stabilization, mining, and grazing. While *Corispermum pallidum* may have been rare at the time of first European contact, the loss of habitat due to human activity has likely contributed to its decline and possible extinction.

Table 1. Sections surveyed for *Corispermum pallidum* by WNHP botanists in 2005, 2006, and 2007

Township N	Range E	Section	Surveyor	Date	Notes
16	23	36	Arnett	June 15, 2006	Crab Creek ORV area
16	23	4	Arnett	June 16, 2006	proposed natural area
16	24	23	Caplow and Kemper	July 13, 2005	<i>Cryptantha leucophaea</i> occurrence
16	24	24	Caplow and Kemper	July 13, 2005	
16	24	26	Caplow and Kemper	July 13, 2005	
16	24	34	Caplow and Kemper	July 13, 2005	
16	24	35	Caplow and Kemper	July 13, 2005	
17	26	8	Kemper	July 2005	
17	26	9	Kemper	July 2005	dunes, <i>Cryptantha leucophaea</i> occurrence
18	23	31	Kemper	July, 2005	bank of Columbia River
18	26	27	Caplow and Kemper	July 14, 2005	<i>Corispermum villosum</i>
18	26	28	Caplow and Kemper	July 14, 2005	<i>Corispermum villosum</i>
18	27	13	Kemper	July, 2005	dunes, <i>Cryptantha leucophaea</i> occurrence
18	27	18	Kemper	July, 2005	
18	27	24	Arnett	June 14, 2006	south of Moses Lake, adjacent to Potholes Reservoir
18	28	16	Arnett	June 15, 2006	Moses Lake ORV area
23	30	16	Arnett	June 14, 2006	north of Wilson Creek

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Appendix 1: Identification Key and Descriptions of *Corispermum* species known or potentially occurring in Washington

Botanists attempting to identify *Corispermum* in Washington have been hampered by sparse or contradictory reference material and by the historical mis-application of names of Eurasian taxa to native species. The Flora of North America (Mosyakin 2003) includes four species of *Corispermum* in Washington, all native (of eleven species, native and introduced, in the flora): *C. americanum* var. *americanum*, *C. pacificum*, *C. pallidum*, and *C. villosum*. Hitchcock and Cronquist (1973) had regarded northwest *Corispermum* species as introductions of Eurasian species *C. hyssopifolium* and *C. nitidum*; Mosyakin considers these names to be mis-applied to native species. For example, the type specimen for *C. pallidum* was historically identified as *C. hyssopifolium*. Mosyakin (2003) reports that he has not seen unquestionable specimens of either *C. hyssopifolium* or *C. nitidum* in North America.

The following key includes the four native species that Mosyakin (1995, 2003) reports in Washington, two Canadian species that could potentially occur here, and the two non-native species that Hitchcock and Cronquist (1973) included. This key is adapted from Mosyakin (1995, and 2003), communication between him and Peter Zika (Mosyakin 2001), and examinations of herbarium specimens at the University of Washington. **This key should be considered provisional, to be revised as more material is examined in the field and the herbarium.**

The *Corispermum* species in Washington key fairly well, but a few specimens do not conform closely to the published descriptions, and differences perceived among Washington plants are not always reflected in the taxonomy. For example, Cathy Maxwell's collection (#1311) from White's Island in 1994, identified as *C. americanum*, appears very different from another specimen identified as this species, collected by Suksdorf (#33675) at Bingen in 1895. Although warty and spotted, typical *C. americanum* traits, Maxwell's collection has broad fruit, firm and entire wing margins, and dense clavate inflorescences. In many ways this specimen resembles *C. pacificum*, except for the large size and wartiness of the fruit. These characteristics conform fairly well with the description of *C. pallasii*, a species of northern Canada and northeast North America. Likewise, a Zika collection (18022) from Hayden Island in 2002 appears to differ from collections by Thompson (3843 and 3915) from the same island in 1927. Zika's collection has shorter, narrower leaves, shorter bracts, and dull dark green (rather than shiny black) fruit. Thompson's collections look more like Piper's (#1770 in 1893) and Ownbey's collection (s.n. in 1939) from Wawawai on the Snake River. It is possible that the color and even shape of the fruit changes as the herbarium specimen ages, complicating identification.

Mature fruit is essential for accurate identification. In addition to its morphological distinctness, *C. pallidum* is further distinguished by its earlier fruit maturation (late spring and early summer); other species typically mature in late summer and fall.

1a. Fruits more or less distinctly broadest above the middle, narrowly to broadly obovate-elliptic, shiny or dull, often with dark spots and/or warts when mature; margins of the wings of the fruit entire or erose

***Corispermum* species native to North America**

2a. Fruits 2.5 - 4.5 (-5) mm long, wingless, or with a narrow, entire-margined wing up to 0.2 mm wide

3a. Fruits 2.5 – 3.1 x 1.9 – 2 mm, sometimes spotted and/or warty, often with a triangular, beak-like stylar base, usually wingless but occasionally with a narrow wing less than 0.1 (-0.4) mm wide; known from Washington, Oregon, and Idaho

C. villosum



Figure 5. Fruit of *C. villosum* (from Mosyakin 2003)

3b. Fruits elongate, (3.2-) 3.5 - 4.5 (-5) x 2.2 – 3.3 (-3.5) mm, occasionally spotted but generally with neither spots nor warts, apex rounded or indistinctly triangular, wingless or with wing up to 0.2 mm, semi-transparent, reported from BC., associated with the Fraser River

C. hookeri* var. *pseudodeclinatum (not illustrated)

2b. Fruits 3-4 mm long, with pronounced wings 0.2-1 mm wide

4a. Wing margins mostly entire, firm, generally translucent only at the outer edge or half, though in older specimens the wings appear more transparent; fruits dark, black to olive green; inflorescences usually compact, rather dense, clavate, condensed at least near the apex

5a. Fruits shiny, without spots or warts, black or dark green, broadly orbiculate-obovate to almost orbiculate; reported in Washington near the Columbia and Snake Rivers.

C. pacificum

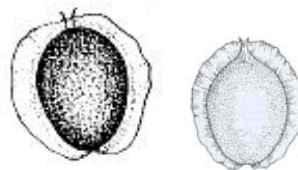


Figure 6. Fruits of *C. pacificum* (from Mosyakin 1998, 2003)

5b. Fruits often with warts and spots, light to dark brown or deep olive green, narrowly obovate; known from northeast and north central North America

C. pallasii

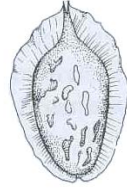


Figure 7. Fruit of *C. pallasii* (from Mosyakin 2003)

4b. Wing margins erose and thin, mostly translucent; fruits generally light brown, yellowish, reddish, or green, or olive green (very rarely almost black, then more elongate, not orbiculate-ovate or orbiculate), shiny or dull, occasionally spotted or/and warty; inflorescences generally lax

6a. Wings of the fruit pronounced, 0.7-1.0 mm wide; fruit flattened or only slightly convex abaxially; plants 5-25 cm; bracts similar in size and generally narrower than fruits; historically known only from Grant County, Washington.

C. pallidum

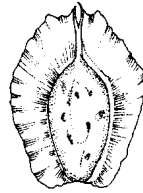


Figure 8. Fruit of *C. pallidum*

6b. Wings of fruit absent or 0.2-0.6 (0.7) mm wide; fruits somewhat to strongly convex abaxially; plants 10-55 (-70) cm; distal bracts often much shorter than proximal bracts, and at least as wide as mature fruits (proximal leaflike bracts may be narrower than fruits); widespread in North America.

C. americanum

Washington plants are *C. americanum* var. *americanum*



Figure 9. Fruit of *C. americanum* var. *americanum*

1b. Fruits broadest near the middle or slightly above the middle (almost elliptic or broadly elliptic), shiny, normally without warts, very seldom with dark spots; margins of the wings of the fruit entire.

***Corispermum* species native to Eurasia**

7a. Leaves linear-lanceolate, usually plane; fruits brown or dark brown to deep olive green; wing of the fruit 0.1 (– 0.15) mm; inflorescence compact; bracts ovate to ovate-lanceolate, to 0.7 cm wide, wider than the fruit.

C. hyssopifolium



Figure 10. Fruit of *C. hyssopifolium* (from Mosyakin 2003)

7b. Leaves narrowly linear or filiform, usually convolute or folded; fruits yellowish or light brown to deep olive green; wing of the fruit 0.1 - 0.3 mm; inflorescence lax; bracts narrowly ovate to linear, up to 0.3 (-0.4) cm wide, usually narrower than the mature fruits.

Some specimens resembling this species in North America appear more like *C. americanum*, based on fruit, and may be the result of introgression from the introduced *C. nitidum* into the native *C. americanum* (Mosyakin 2003).

C. nitidum



Figure 11. Fruit of *C. nitidum* (from Mosyakin 2003)

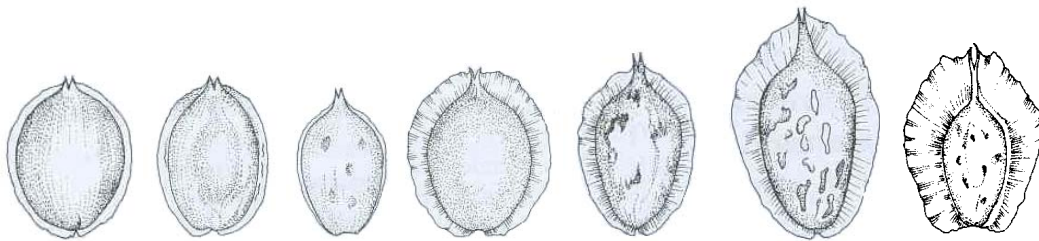


Figure 12. Comparative drawings of *Corispermum* fruits (left to right): *C. hyssopifolium*, *C. nitidum*, *C. villosum*, *C. pacificum*, *C. americanum* var. *americanum*, *C. pallasii*, and *C. pallidum*.

Descriptions of Corispermum species native to Washington

The following descriptions are adapted from Mosyakin (1995, 2003). Following each description is a list of occurrences of the species, primarily in Washington.

Corispermum americanum var. *americanum* is widespread in North America, often misidentified as *C. nitidum*. **Inflorescences** are usually lax, interrupted, rarely somewhat condensed distally, linear, narrowly linear, or occasionally narrowly clavate. **Fruits** are yellowish brown, greenish brown, light brown, or brown, often with reddish brown spots and whitish warts, slightly convex abaxially, usually plane or slightly concave adaxially, obovate or obovate-elliptic, usually broadest beyond the middle, (2.3)2.5-3.5 mm, shiny or dull. **Wings of the fruit** are translucent, thin, (0.15) 0.2-0.3(0.4) mm wide, with margins entire or rarely indistinctly erose, apex broadly triangular, less commonly truncate or rounded. **Habitat:** sand dunes, sandy and gravelly shores. **Phenology:** flowers in late summer and fall.

Specimens in Wyoming and Oregon are reported by Mosyakin to be transitional toward *C. villosum*. The University of Washington herbarium includes collections labeled as this species from Bingen, in Klickitat County, and from White's Island in the Columbia River in Wahkiakum County. The latter specimen differs markedly from the former and the species description. The plant is upright with little branching; the inflorescence is clavate and compacted distally, with strongly imbricate bracts; the fruit is strongly convex abaxially, 4 mm long; the wing of the fruit is rounded with entire margins.

Washington collections

Klickitat Co: "Klickitat County: Bottomlands, Bingen, July 16, 1895," *W.N. Suksdorf* 3675 (WTU).

Wahkiakum Co: "Recent sandy dredge spoils, White's Island, Columbia River, elevation 5 m, 18Sept1994," *Cathy L. Maxwell* 1311 (WTU). This species appears quite different from Suksdorf's earlier collection from Bingen, and the identification should be confirmed.

Corispermum pacificum is known from Oregon and a broad swath across southern Washington into Idaho. **Inflorescences** are usually compact and rather dense, but may be lax and condensed only near the apex. **Fruits** are black or nearly so (immature fruits usually deep olive green), orbiculate-obovate to almost orbiculate, broadest near or slightly above middle, 3-4 x 2.7 – 3.8 mm, shiny, without spots or warts. **Wings of the fruit** are generally thin and translucent, though appearing thicker in more recent collections, (0.2-)0.3-0.6 mm wide, with margins lightly undulate or indistinctly erose-denticulate, apex rounded or occasionally indistinctly notched. **Habitat:** sandy shores, dunes. **Phenology:** flowers in late summer and fall.

Sterile hybrids with *C. villosum* have been reported (Mosyakin 2003).

Washington collections

Asotin County: “Ten Mile Rapids, near powerline crossing, 1Oct2001, *Zika 16656* (WTU); “1Oct2001, Snake River downstream from Buffalo rapids, *Zika 16658* (WTU);
Clark Co:

Clark County: Frenchmans Bar Waterfront Park on shore of Columbia River, west of Vancouver, common in sand of swim area, 21Sept2005, *B. Legler 3087*;

Whitman County: “October 15, 1939, Wawawai”, *Marion and Ruth Ownbey sn.* (WTU);
isotype: Wawawai, Oct. 1893, *C.V. Piper 1770* (WTU).

Oregon collections

Multnomah County: Hayden Island, September 16, 1927, *J.W. Thompson 3843* (WTU);
Hayden Island, October 8, 1927, *J.W. Thompson 3915* (WTU); Hayden Island, October 3, 2002, *Zika 18022* (WTU).

Corispermum pallidum is a narrow endemic species, possibly extinct, known only from Washington. **Inflorescences** are lax or slightly condensed, interrupted only near the base, linear. **Fruit** is flattened, pale, usually straw colored, or yellowish brown, occasionally with reddish brown spots, flattened or slightly convex abaxially, plane or slightly concave adaxially, rounded-obovate or obovate, distinctly broadest beyond middle (rarely closer to middle), 2.8-3.5(3.8) x 2.4-2.8 (3.3) mm, slightly shiny or dull. **Wings of the fruit** are pronounced, together wider than the body of the achene, translucent, thin, usually 0.7-1.0 mm wide, margins erose or irregularly erose-denticulate (rarely almost entire), apex emarginated (notched) or rounded, style bases long, 0.7 to 1 mm, including parts adnate to the wing, distinctly divided in their upper parts to below the edge of the wing. **Young bracts and distal leaves** are often papillose on margins and veins, in combination with typical branched trichomes. The combination of characteristics of this species is very distinctive. **Habitat:** sandy shores of lakes and rivers, inland open sands; **Phenology:** flowers and sets fruit in late spring and early summer. Mosyakin describes the species as maturing in late summer or fall, but the date on the type specimen, July 25, was an error. Leiberg and Sanberg, according to Leiberg’s field journal, made the collection on June 25.

Washington collections, all from Grant County

Seven miles west of Wilson Creek, in sand west of the “Sink of Crab Creek” (Leiberg 1893), June 25, 1893, WNHP *Corispermum pallidum* 03, EO ID 927. This specimen was identified as *C. hyssopifolium* in 1977 by Nita J. Maihle and Will H. Blackwell (MU); annotated as *C. pallidum* by S. Mosyakin in 1994. *Sandberg and Leiberg 309* (holotype,

MO; isotypes, CAN, F, OSC, PH, UC, US). This site is mostly privately owned; land just to the north is owned by the Washington Department of Natural Resources. The site has been fairly impacted by agriculture, road construction, and hydrologic changes, but small areas of sand remain. The label on the type specimen describe the location of this collection at the confluence of Crab and Wilson Creeks on July 25; however, Leiberg's field notebook from 1893 explicitly describes this collection on June 25 at a location seven miles west of Wilson Creek (Leiberg 1893).

Egburt Springs, near Ephrata, "altitude 2 a 3000", July, 1893, WNHP *Corispermum pallidum* 01, EO ID 2197, Sandberg and Leiberg 9010? [number written on the edge of the herbarium label]. The precise location of Egburt Springs is not known. Several springs northwest of what is now Ephrata were used in the early days of European settlement for irrigation of orchards, and it may be that Egburt Springs was one of them. Ephrata now is a large town, with heavy impacts from development and agriculture.

"from dry sand one mile south of Moses Lake and southwest of Moses Lake, June 25, 1921", WNHP *Corispermum pallidum* 04, EO ID 6502, Harold St. John, W.D. Courtney, and Charles Parker 4948. While the construction of Sullivan Dam and the Potholes Reservoir has inundated a large area here, this area retains extensive sand dunes, with a mixed ownership of private and public land, including an off-road vehicle park and a wildlife refuge. Many sand-dwelling species persist, and this remains as a potential site for remnant *Corispermum pallidum*.

"Sandy sagebrush plain, near Quincy, June 15, 1931", J.W. Thompson 6764.

"Grant County, Potholes area, 1 mile south of Moses Lake, June 16, 1953." WTU, GH, UC. WNHP *Corispermum pallidum* 04, EO ID 6502, J.D. Menzies sn. As is the case with Ephrata, Quincy has grown into a large town with extensive irrigated agriculture throughout the area.

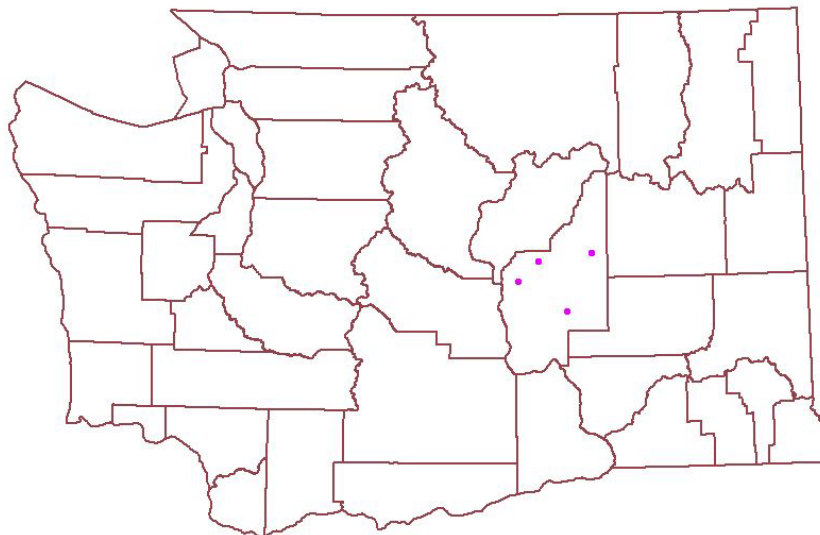


Figure 13. Map of Washington State showing historical collection sites of *Corispermum pallidum*

Corispermum villosum is a relatively common species in the northwest and north-central U. S. and adjacent Canada. **Inflorescences** are rather compact, dense, condensed in distal half, occasionally interrupted in proximal half, usually clavate or clavate-linear. **Fruits** are yellowish brown, light brown, or dark brown, usually with reddish brown spots and occasionally whitish warts, strongly convex abaxially, plane or slightly convex (occasionally slightly concave) adaxially, elliptic or obovate-elliptic, usually broadest beyond middle, 1.8-3(3.2) x 1.5-2 mm, dull, with a triangular stylar beak that extends beyond the wings. **The wings of the fruit** are absent or up to 0.1 (0.15) mm wide, with entire margins. **Habitat:** sand dunes, sandy and gravelly shores. **Phenology:** flowers in late summer-fall.

Washington collections

Grant County: Dunes east of Dodson Rd. T18NR26E Section 27, July 14, 2005, *Caplow 200504*; Beverly off-road vehicle area, 7Oct2002, *Zika 18064*;

Okanogan Co: T30NR25E S 15, on SR 17 ½ mile from US 97, *M. Arnot with G. Patrick, 560*.