

Handbook on Seeds of Browse-Shrubs and Forbs

Prepared by
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Of the
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ACKNOWLEDGEMENTS

This handbook was begun in 1978 with the appointment of the Browse-Shrub and Forb committee by former Association of Official Seed Analysts President James C. DeLouche. The appointment was made on the request of G. Richard Wilson, member of the Executive Board. The Chairperson for the new sub-committee was chosen by Jim Harrington, Chairperson of the research committee.

A species list submitted by state and provincial agricultural departments forms the basis of the handbook. The committee began with a list of 182 species which was reduced to the present data. Ellen Chirco, Pual King, Edward Drummond, David Svik, Kenneth Boatwright, James Young, Lee Hart and Robert Ferguson provided the bulk of the seed and reprint material. C. R. Gunn provided valuable taxonomic review and Andrew Robinson provided the endangered species information. Many other people contributed in various ways to make this handbook possible and the committee is grateful to them.

The sketches were made by the Chairperson and inked by the Georgia Forestry Commission personnel. Photographs were made at the National Tree Seed Laboratory with a 35mm camera with an auto bellows and Panatomic-X film. The herbariums listed in the back of this handbook assisted in establishing seed source.

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Preface to the Electronic Version

The “Handbook on Seeds of Browse-Shrubs and Forbs” was originally published jointly by the U.S. Forest Service and the Association of Official Seed Analysts (AOSA). The material was prepared by the AOSA Browse-Shrub and Forb Committee and published as Technical Publication R8-TP8 by the U.S. Forest Service, Southern Region. This publication was frequently requested until the supply of paper copies was exhausted. Therefore, it was concluded that it was an useful volume. A reprinting was needed. The AOSA Tree, Shrub, and Native Forb Subcommittee of the Research Committee decided to publish the “Handbook of Seeds of Browse-Shrubs and Forbs” electronically and received permission from the AOSA Executive Board to proceed.

This electronic publishing provided the opportunity to improve the quality of the type and the drawings. The “key” to the letters used on the sketches, although retained in the Guide to Species Information, is not used. No revisions of technical material were made beyond changing scientific names to those currently accepted. The names were correct according to information retrieved March 4, 2003 from the Germplasm Resources Information Network (GRIN) (<http://www.ars-grin.gov>). Caution is advised in using the endangered species classification information since it was compiled over a decade ago.

Those who need may request a CD of this volume by contacting the National Tree Seed Laboratory at the following contacts.

Telephone: (478) 751-3551

Fax: (478) 751-4135

US Postal Address: National Tree Seed Laboratory
 5675 Riggins Mill Road
 Dry Branch, GA 31020

Email: bloth@fs.fed.us

INTRODUCTION

The analyst must remember that there may be several subspecies or varieties of each species due to selection, location, and taxonomic grouping; however, only the main species is given in this book.

Seed sources are given in very broad terms. If a plant exists in the state, whether it is natural, planted or cultivated, we may consider the possibility that an analyst could receive it. Therefore, a state or province is listed as a source if the herbarium indicated that the plant exists within the state or province. This leaves room for interpretation and possible error. More information on specific locations can be obtained from personnel at the listed herbariums.

The guides presented here may not always be scientifically correct as some fruits are better known as "seeds". The material is presented from a practical viewpoint to help the user. Thus, terms of common use have been selected over the more scientific. This section is intended to provide the user with selected reference material.

A fruit is the product of a ripened ovary and may be composed of accessory floral or vegetative parts. The fruit is the seed-bearing organ of the plant and is important in the classification and identification of the plant. Knowledge of the fruit type may also provide an insight into seed testing problems. Identified here are the 15 types of fruit found in the species covered by this handbook (Table 1).

Seeds are fertilized mature ovules. They are identified by their exterior and interior characteristics. Some of the definitive characteristics include color of the seed coat, length and width of the seed, whether it contains appendages such as a wing, the 1,000-seed weight, the shape and relative placement of the embryo and cotyledons, and the number and shape of the cotyledons. Knowing the shape of the embryo and where to find the radicle will help in relieving seed coat restrictions that are essential for prompt germination.

Table 1. Types of fruit.

Angiosperms

Multiple – Composed of ovaries or more than one flower

Aggregate – Composed of several ovaries of a single flower

Simple:

Fleshy

Pome – Exterior soft, center of cartilaginous carpels

Drupe – Exterior soft, center with a single stone

Berry – Soft and fleshy throughout

Dry

Indehiscent

Samara – Winged

Achene – Wingless, pericarp thin and adanate to seed or thick and bony, one-loculed ovary

Utricle – Wingless, pericarp thin and loose or free from the seed

Nut – Wingless, pericarp thick and bony, two or more locules (considered a nutlet when composed of one-half a carpel)

Dehiscent

Unicarpellate

Follicle – Dehiscing by one ventral suture

Legume – Dehiscing by two longitudinal sutures

Multicarpellate

Schizocarp – Fruit splitting into two one-seeded, indehiscent mericarps

Capsule – Dehiscence longitudinal (Siliques are specialized types of capsule)

Gymnosperms

Cones – Dry strobili bearing seed

Fleshy: Aril-like – structure enclosing the seed berry-like – fleshy cone

FAMILY CHARACTERISTICS

The General Family Characteristics are provided for each family represented by a species in this handbook.

ADOXACEAE

ANACARDIACEAE (Sumac)

Ovary has 3 carpels but only one is functional in most genera. Fruit is a drupe. Seeds without endosperm, borne on a curved stalk which arises from the base of the locule. Genus represented: *Rhus*

AQUIFOLIACEAE (Holly)

Ovary 4-9 locular producing 4-9 seeded berry-like drupes. Fruit borne only on female trees. Seeds suspended and solitary in each locule, anatropous, with a minute embryo in fleshy endosperm. Corolla imbricated in the bud. Genus represented: *Ilex*

ASCLEPIADACEAE (Milkweed)

Ovary separate, 2 carpels, each forming a follicle. Seeds numerous and often with a tuft of silky hairs at one end. Amphitropous, with a large straight embryo in sparse endosperm. Genus represented: *Asclepias*

ASTERACEAE (Aster)

Ovary is inferior and bicarpellate, contains a single ovule. The calyx is generally represented by bristles or scales arising from the top of the ovary and is termed the pappus. Fruit is an achene. The pappus often persistent. Seed are anatropous, no endosperm. Genera represented: *Agoseris*, *Ambrosia*, *Artemisia*, *Aster*, *Balsamorhiza*, *Chrysanthemum*, *Chrysothamnus*, *Grindelia*, *Helianthus*, *Heliopsis*, *Iva*, *Liatris*, *Ratibida*, *Rudbeckia*, *Wyethia*

BERBERIDACEAE (Barberry)

Ovary of 1 carpel. Fruit is usually a berry or a capsule. Seeds few to several, anatropous, with endosperm. Embryo small except in *Berberis*. Genus represented: *Berberis*.

BETULACEAE (Birch)

Ovary 2-locular, with 2 pendulous anatropous ovules in each locule. Fruit is a 1-seeded nut with or without a foliaceous involucre. Seed without endosperm. Genus represented: *Alnus*.

BRASSICACEAE (Mustard)

Ovary superior, 2-loculed, 4-carpelled with parietal placentation. Fruit a silique or silicle. Seeds campylotropous, without endosperm, filled by a large embryo. Cotyledons may be acumbent, incumbent, con-duplicate or double-acumbent. Arrangement of cotyledon and radicle provide taxonomic characteristics within the family. Genus represented: *Hesperis*

CAPRIFOLIACEAE (Honeysuckle)

Ovary of 2-5 united carpels. Fruit commonly a berry, but sometimes a drupe or capsule. Seeds anatropous, with small embryo in fleshy endosperm. Genera represented: *Lonicera*, *Sambucus*, *Symphoricarpos*, *Viburnum*

CARYOPHYLLACEAE (Pink)

Ovary 1-celled of 2-5 united carpels, free-central placentation and 1 to many ovules. Fruit a utricle or more commonly a capsule opening by valves or apical teeth. Seeds several to many, with a slender embryo coiled or curved around the outside of mealy endosperm. Nearly straight in dianthus. Seeds Amphitropous or Campylotropous. Genus represented: *Saponaria*

CHENOPODIACEAE (Goosefoot)

Ovary mostly superior, 2-3 carpelled, 1-celled, with basal placentation. Fruit is a nutlet, utricle or achene. Seeds from 1 to several, with the embryo curved or coiled around the endosperm, or else con-duplicate or spiral. Genera represented: *Atriplex*, *Ceratoides*, *Grayia*, *Halogeton*, *Salsola*, *Sarcobatus*

CORNACEAE (Dogwood)

Ovary of 2 carpels, adherent to the calyx tube, ovule anatropous hanging from the top of the locule. Fruit is a 2-seeded drupe or a few-seeded berry. Embryo nearly as long as the endosperm, with large foliaceous cotyledons. Genus represented: *Cornus*

CUPRESSACEAE (Cypress)

Fruit is a cone which is dehiscent except in *Juniperus*. Cones require 1, 2, or 3 years for maturity. Each cone produces from 4 to 150 seed per fruit. Seed are winged or wingless, containing a straight embryo surrounded by endosperm. Genus represented: *Juniperus*.

ELAEAGNACEAE (Russian Olive)

Ovary 1-celled and 1-seeded. Fruit is a fleshy achene (berrylike), sometimes becoming very hard when dry. Seeds are erect or ascending. Containing endosperm. Genera represented: *Elaeagnus*, *Shepherdia*

EPHEDRACEAE (Ephedra)

Male cones with several stamen-like structures; female cones with a terminal ovule. Seeds with a fleshy, red, outer coat. Genus represented: *Ephedra*

ERICACEAE (Heath)

Ovary superior or inferior, 4-5 carpels with axile placentation. Fruit is a capsule or berry. Seed with minute embryo in fleshy endosperm. Genera represented: *Arctostaphylos*, *Vaccinium*

FABACEAE (Pea)

Ovary superior, unilocular, unilocarpellate, few to several ovules in parietal placentation. Fruit is a legume. Seeds mostly without endosperm. Contains some poisonous plants. Genera represented: *Amorpha*, *Astragalus*, *Caragana*, *Dalea*, *Hedysarum*, *Onobrychis*, *Robinia*

GROSSULARIACEAE (Gooseberry)

Ovary of 2 united carpels, inferior and 1-celled with parietal placentation. Fruit is a several-seeded berry. Genus represented: *Ribes*

LAMIACEAE (Mint)

Ovary of 2 united carpels, each deeply lobed, thus a deeply 4-lobed and 2-celled ovary with 1 ovule in each lobe. Fruit is 4 1-seeded nutlets or achenes enclosed by the persistent calyx. Nutlets are smooth to roughish and fixed by the base. Almost no endosperm. Each nutlet has a single erect seed with a straight embryo, except *Scutellaria*. Radicle is at the base of the fruit. Genus represented: *Salvia*

LAURACEAE (Laurel)

Ovary probably 3 carpels but only one developing, thus a single ovule. Fruit is a drupe. Seed anatropous, suspended, no endosperm, filled by a large almond-shaped embryo. Genus represented: *Lindera*

LILIACEAE (Lily)

Ovary superior, 3-loculed, with axile placentation. Fruit may be a berry or a capsule, few to many seeded. Seeds anatropous or amphitropous (orthotropous in smilax), small embryo enclosed in copious endosperm. Genus represented: *Zigadenus*

LINACEAE (Flax)

Ovary of 5 united carpels but 10-celled because of a false septum in each carpel, ovule 2 in each carpel. Fruit is a septicidal capsule containing 8-10 seeds. Seeds anatropous, mucilaginous, flattened, containing a large embryo with plano-convex cotyledons, no endosperm. Genus represented: *Linum*

MALVACEAE (Mallow)

Ovary superior, 2 to many-loculed and carpelled with axile placentation. Carpels often forming a ring, each containing one to several seeds. Fruit is a capsule or schizocarp. Seeds reniform, little endosperm, embryo curved with leafy cotyledons variously doubled. Genera represented: *Malva*, *Sphaeralcea*

OLEACEAE (Olive)

Ovary of 2 carpels, ovules few (generally 2 in each cell). Fruit is a capsule, drupe, berry, or samara. Seeds anatropous, with a large straight embryo in hard fleshy endosperm or without endosperm. Genera represented: *Forestiera*, *Fraxinus*

ONAGRACEAE (Evening-Primrose)

Ovary inferior multiovulate with axile placentation, 2-4 celled. Fruit is a capsule, rarely a berry (fuchsia) or indehiscent and nut-like (circaea and gaura). Seeds anatropous, small and without endosperm, sometimes with a tuft of silky hairs. Genus represented: *Oenothera*

PHYTOLACCACEAE (Pokeweed)

Ovary composed of many carpels united in a ring, single seed per locule. Fruit is a berry. Seed containing an embryo curved around the endosperm. Genus represented: *Phytolacca*

POLEMONIACEAE (Phlox)

Ovary of 3 united carpels, 3-celled. Fruit is a loculicidal capsule with several to many seeds, valves usually breaking away from the triangular central column, seeds amphitropous, seed coat frequently mucilaginous when moistened and emitting spiral threads, embryo straight, in the axis of copious endosperm. Genus represented: *Ipomopsis*

POLYGONACEAE (Buckwheat)

Ovary superior, compressed or 3-angled, unilocular with a basal ovule. Fruit is a lenticular or triangular achene, seed with a straight, curved or c-shaped embryo, orthotropous ovule. Genus represented: *Eriogonum*

RHAMNACEAE (Buckthorn)

Ovary of 2-4 carpels, anatropous. Fruit is a drupe, capsule or berry, with one erect seed in each locule. Seed contains large embryo with broad cotyledons, in sparse fleshy endosperm. Genus represented: *Ceanothus*

RUBIACEAE

SARCOBATACEAE

ROSACEAE (Rose)

Ovary superior or inferior, unilocular or multilocular, unicarpellate or multicarpellate, carpels separate or united. Fruit is a group of achenes or drupelets, ovule anatropous. Seeds always without endosperm, embryo straight, large and with thick cotyledons. Genera represented: Amelanchier, Cercocarpus, Cowania, Fallugia, Peraphyllum, Potentilla, Prunus, Purshia, Rosa, Sorbus

SAXIFRAGACEAE (Gooseberry)

Ovary of 2 united carpels, inferior and 1-celled with parietal placentation. Fruit is a several-seeded berry. Genus represented: Ribes

SCROPHULARIACEAE (Figwort)

Ovary of 2 united carpels with axillary placentation and numerous ovules. Fruit is a capsule, sometimes a berry, many-seeded. Seeds anatropous, or amphitropous, with a small embryo in copious endosperm. Genus represented: Penstemon

VERBENACEAE (Vervain)

Ovary deeply lobed of 2 united carpels. Fruit contains 2-4 nutlets, or sometimes a drupe or berry. Seed with a straight embryo and little or no endosperm. Genus represented: Callicarpa

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GUIDE TO SPECIES INFORMATION

The following species pages are alphabetical by genera. Each page is designed to provide maximum information for the analyst. The information includes: scientific and common name, visual presentation, plant source, background material, plant and seed descriptions, laboratory analysis, endangered species classification, and suggested references.

The family name is given first in the upper left corner of the page. The scientific name and the author follows. Synonyms or other names used for this species are given to assist the reader who may have learned it by an earlier name. The nomenclature used in this book was provided by C. R. Gunn, Beltsville. Below the scientific name are several common names. This handbook contains a "common name" index in the back for quick reference. If a species has "weed" status (noxious, prohibited, or other), it is given in the upper right of the front page and elaborated on the second page in the "endangered species" category.

A visual presentation of normal sized, magnified, and a sketch of the internal anatomy of the seed in question appears next. A key to the letters used on the sketches is given here:

A = Awn	M = Membrane
C = Cotyledons	N = Nut or nutlet
E = Embryo	P = Pericarp
EC = Empty cavity	PA = Pappus
EN = Endosperm	POD = Fruit or enclosure
END = Endocarp	R = Radicle
F = Fruit	S = Style
H = Hairs	SC = Seed coat
HI = Hilum	SU = Suture line
HO = Hole	W = Wing

A photograph of the fruit or other key factor is shown when it is important to the knowledge of the analyst. The distribution presented was prepared from the replies of each state and provincial herbarium. The 2-letter state symbol adopted by the U.S. Postal Service and appropriate symbols for provinces are used. If the species occurs anywhere in the state or province it is considered a source of seed, so the state or province is listed. Even though the species may only be cultivated within the state or province boundaries, it was considered a source. No indication of species location within each state or province is presented or implied. A list of the participating state and provincial herbariums is given in the back of this handbook. These herbariums can provide information on specific sources within a state or province if desired. The states are given first followed by a colon and then the provinces.

The description of the plant, flower and fruit, and the seed is provided for reference. The material was obtained through literature and actual measurements.

Next follows a general guide on laboratory analysis. Data provided was derived from preliminary trials and serves only as a starting point. This data is not definitive and in some places even incomplete. The "quick" test results were derived from small samples with limited trials in many cases. Recognizing the limitations, this data should provide the analyst and technologist with a reasonable starting point.

The Endangered Species Act of 1973 provides control on threatened or endangered species. This provision may be important to the seed laboratory because it is unlawful to possess endangered or threatened species without a permit. For current information contact the nearest office of the U. S. Fish and Wildlife Service or contact your state or provincial fish and wildlife agency. Other information relating to the “weed” category may be available through an official seed laboratory.

The suggested references are not meant to be inclusive but rather provide specific findings on the species reported and provide the analyst a reference for further material. This will give you a starting point; the rest is up to you!

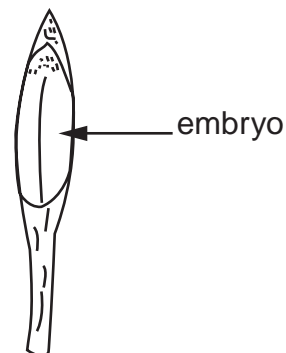
INDIVIDUAL SPECIES

ASTERACEAE

AGOSERIS GLAUCA (PURSH) RAFINESQUE

(FALSE-DANDELION)

Distribution: AZ, CA, CO, ID, MI, MN, MO, MT, ND, NE, NM,
NV, OR, SD,
UT, WA, WY: ALB, BC, MAN, ONT, SAS



Description: Forb, 30-60 cm high when in flower. Perennial with tufted basal leaves of up to 25 cm. Found in the prairies and meadows.

Flower and fruit: Large solitary head produced on a scape 3-6 dm high. Flower yellow, blooms May to July. Fruit is an achene with a purple base and tan top, smooth, 10-ribbed with a long distinct beak which is half as long as the body, pappus at end is longer than achene; white.

Seed: Achene is "seed" to analyst, 640 per g, each seed about 8 mm long and 1 mm wide, inner seed coat tan, papery.

Laboratory analysis:

Purity – No data

Germination – Prechill seed 60 days at 2C, then germinate at 12-17C or 17-22C.

Germination ranges from 40 to 90 percent. Effects of prechill greatly improved by soaking medium with 0.01 molar solution of Gibberellic Acid (GA₃).

Normal seedling – No data

Excised embryo – Soak seed overnight in water, cut 1 mm off rounded end, carefully squeeze out embryo with teasing needles, soak 2 hrs. in water, tease off inner transparent seed coat, place embryo on moist media. Germinate at 20C.

Tetrazolium – Soak 2 hrs. in water, cut radicle end, tease out embryo, nick or scratch inner seed coat, place in 1 percent tetrazolium solution until stained.

Radiographic – 12 KV, 20 sec. for Kodak AA film. Detail loss with Polaroid film or indutrex paper, filled, empty and some developmental problems are clearly visible.

Storage – No data

Endangered species classification: Threatened in MI, special concern species in MN.

Suggested References:

McDonough, W. T. 1969. *Effective Treatments for the Induction of Germination in Mountain Rangeland Species*. Northwest Sci. 43(1):18-22.

McDonough, W. T. 1970. *Germination of 21 Species Collected from a High-Elevation Rangeland in Utah*. The American Midland Naturalist. 84(2):551-554.

BETULACEAE

ALNUS VIRIDIS (CHAIX) DeCANDOLLE (SYNO. ALNUS CRISPA) (AMERICAN ALDER, GREEN ALDER)

Distribution: AK, AL, GA, KY, MA, ME, MI, MN, NC, NH, NY, OR, PA, TN, VT, WI: ALB, BC, MAN, NB, NFLD, NS, ONT, QUE, SAS

Description: Shrub, 3 m in height, flowers developing with the expanding leaves, found on rocky shores, slopes and mountains.

Flowers and fruit: An ament, blooms June to August pistillate aments ovoid, fleshy bracts each subtending 2 flowers. Fruit is a cone, brown, matures in Oct., 1-2 cm long.

Seed: Nutlet, 3 mm wide by 3 mm long, 2820 per g, yellow-brown, winged with one side larger than the other. Embryo completely filling the cavity, no endosperm.

Laboratory analysis:

Purity – Usually high, occasionally with bracts, 1 g for normal purity. No noxious weeds.

Germination – Prechill 30-60 days at 3-5C, then germinate at 20-30C, first count at 14 days, last count at 28 days. Germination is epigeal. Prechill may not be necessary on fresh seed. Germination averages 30-40 percent due to empty seed.

Normal seedling – Vigorous primary root, possibly developing secondary roots during test period. Study but long hypocotyls, two intact cotyledons may develop epicotyl growth during test but not necessary for evaluation.

Excised embryo – No data

Tetrazolium – Soak 24 hrs. in water, clip seed coat to expose embryo, place in 1 percent tetrazolium solution until stained.

Radiographic – 12 KV, 20 sec. for Kodak AA film or industrex paper, no data on poloroid film. Filled, empty and abnormally developed seeds easily visible.

Storage: Air-dried seeds can be stored in sealed containers at 3-5C for 2 or more years.

Endangered species classification: endangered and protected by the state in VT, threatened in NC.

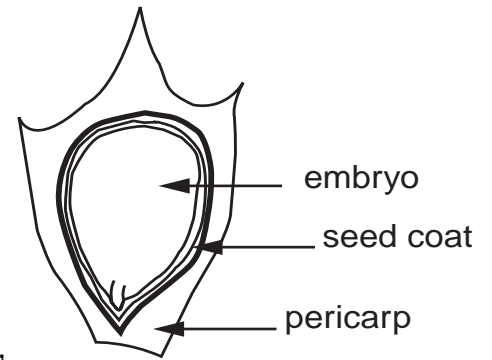
Suggested references:

Swingle, C. F. 1939. *Seed Propagation of Trees, Shrubs and Forbs for Conservation Planting*. SCS-TP-27, 187p. USDA, Soil Conservation Service, Washington, D.C.

ASTERACEAE

AMBROSIA ARTEMISIIFOLIA L. (COMMON RAGWEED)

Distribution: AL, AR, AZ, CA, CO, CT, DE, FL, GA, HI, IA, ID, IL, IN, KS, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY: ALB, BC, MAN, NB, NFLD, NS, ONT, QUE, SAS



Description: Forb, 0.2-2.5 m high, annual with pinnately lobed leaves, 3-7 mm broad, found at beaches, waste land, old pastures, roadsides and vacant lots. A polymorphic and despised weed, one cause of hay fever.

Flowers and fruit: Flowers inconspicuous, greenish, in sessile heads in axile of leaves, contains 5-20 flowers each. Fruit an involucre resembling an achene (an achene in a woody hull), 4-5 mm long and 2 mm wide, awl-shaped beak, 1-2 mm long, fruit coat bearing several longitudinal ridges ending in 4-7 spiny projections. Fruit light brown in color.

Seed: 250 per g. Embryo filling seed cavity.

Laboratory Analysis:

Purity – No data

Germination – Prechill seed 90 days at 5C, germinate at 20-30C with light. Temperatures of 10-20C, and 15-25C were also satisfactory. Germination was also promoted by ethylene (10 ppm) plus oxygen.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Slice across beaked end, turn seed on back and slice down sides to expose embryo, soak 2 hr. in water, remove inner seed coat with teasing needles, or cut or scratch the inner seed coat at the radicle, place in 1 percent tetrazolium solution.

Radiographic – 12kv, 45 sec for Kodak AA film, too small to see detail on Polaroid or industrex paper. Can see filled, empty and abnormally developed seed.

Storage: No data

Endangered species classification: None

Suggested References:

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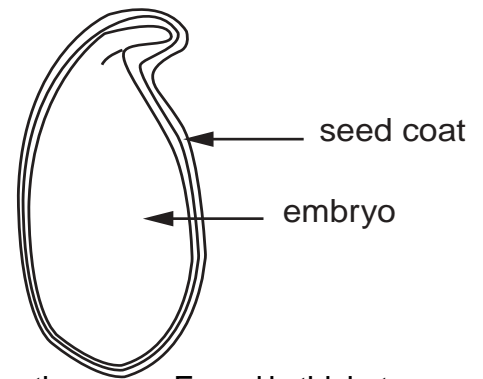
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ROSACEAE

AMELANCHIER ALNIFOLIA (NUTTALL) NUTTALL ex M.Roem. (SASKATOON SERVICEBERRY, JUNE BERRY, AND WESTERN SHADBRUSH)

Distribution: AK, CA, CO, ID, MI, MN, MT, ND, NE, NV, OR, SD, UT,
WA, WI, WY: ALB, BC, MAN, ONT, QUE, SAS



Description: Shrub, 1-7 m high, leaves 2.5-5 cm, coarsely serrate, 2-5 teeth per cm. Found in thickets, borders of woods and banks of streams. Fruit edible, fruit eaten by birds, leaves browsed by animals.

Flower and fruit: White, perfect and in terminal clusters, appearing before leaves in Spring, fruit is a berry-like pome, 5-9 mm diameter, blue-purple, ripens July to Sept., contains 10 locules with 1 seed each.

Seed: 80-250 seed per g, tough, leathery, red-brown seed coat, flat on one side, 3 mm long by 1.5 mm wide, embryo white and filling seed cavity.

Laboratory analysis:

Purity – No data

Germination – Requires prechill of 90 to 120 days at 3-5C followed by germination at 20-30C. First count at 7 days, last count at 35 days. Average germination 50-70 percent. Large percentage of infertile and insect infested seed. Sulfuric acid may reduce need for prechill or at least shorten it. A constant 21C is also satisfactory, no light requirement. Should remove the pulp before germination.

Normal seedling – Vigorous primary root which may develop secondary roots during test duration, sturdy hypocotyls, 2 to 3 times primary root length, two cotyledons intact. Epicotyl may develop during duration of test but not necessary for evaluation.

Excised embryo – No data

Tetrazolium – Soak in water overnight, remove seed coat, soak 4 hrs. in 1 percent tetrazolium solution at room temperature. The seed has a gelatinous seed coat which can best be opened by cutting longitudinally on the suture. Soak the contents for 30 minutes and rub off the inner membrane.

Radiographic – 12KV, 60 sec. for Kodak AA film and industrex paper. Polaroid also useful but no data available. Filled, empty and abnormally developed seed structures visible.

Storage: Air-dried seed in sealed containers at 5C have kept well for 5 years.

Endangered species classification: None

Suggested references:

Peterson, R. A. 1953. *Comparative Effect of Seed Treatments upon Seedling Emergence in Seven Browse Species*. Ecol. 34(4):778-785.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

Weber, G. P. and L. E. Wiesner. 1980. *Tetrazolium Testing Procedures for Native Shrubs and Forbs*. Jour. Seed Tech. 5(2):23-34.

ROSACEAE

AMELANCHIER UTAHENSIS KOEHNE (UTAH SERVICEBERRY)

Distribution: AZ, CA, CO, ID, MT, NM, NV, OR, TX, UT, WA, WY

Description: Shrub, 1-4 m high, browse and ornamental use.

Flowers and fruit: White, perfect, white flowers in terminal clusters, fruit is a berry-like pome, 6-10 mm diameter, orange-red, contains 2-4 seed, matures Sept.

Seed: 63 per g, 5 mm long by 3 mm wide, tough, leathery red-brown seed coat, white embryo filling seed cavity.

Laboratory analysis:

Purity – No data

Germination – Requires 45 days prechill at 3-5C followed by germination at 10-30C with light. First count at 7 days, last count at 21 days. Germination averages 50-70 percent. No germination on nonchilled seed at 20-30C, 20C or 15C and only a slight response at 10-30C. After prechilling, germination at 10-30C was twice that at 20-30C. A constant 6C was also satisfactory. Lots contain a large percentage of infertile and insect infested seed.

Normal seedling – Vigorous primary root, sturdy hypocotyls are twice the length of the primary radicle, two cotyledons intact.

Excised embryo – Nick seed on cotyledon end, soak 2 hrs., remove seed coat by cutting on suture, remove or break inner seed coat at radicle, place on moist medium. Complete in 7-10 days.

Tetrazolium – Soak seed in water overnight, remove seed coat, soak 4 hrs. in 1 percent tetrazolium solution at room temperature. Seed coat is gelatinous. Must break inner seed coat.

Radiographic – 12KV, 60 sec. for Kodak AA film or industrex paper, 12KV, 120 sec. for Polaroid. Filled, empty, insect infestation and abnormal seed development are visible on the radiograph.

Storage: Air-dried, sealed containers at -13C have kept for 5 years.

Endangered species classification: Endangered in TX.

Suggested references:

Heit, C. E. 1955. *The Excised Embryo Method for Testing Germination Quality of Dormant Seed*. Proc. Aosa 45:108-117.

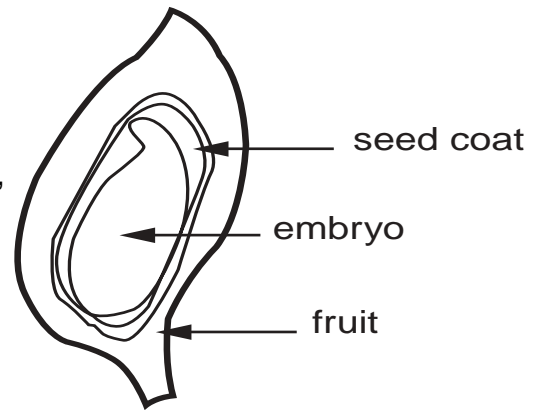
Heit, C. E. 1970. *Germination Characteristics and Optimum Testing Methods for Twelve Western Shrub Species*. Proc. Aosa 60:197-205.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

FABACEAE

AMORPHA CANESCENS PURSH. (LEADPLANT)

Distribution: AR, CO, IA, IL, IN, KS, MI, MN, MO, MT, ND, NE, NM, OK, SD, TX, WI, WY:MAN, ONT, SAS



Description: Shrub, 30-100 cm high, gray, leadlike color foliage and crowded sessile leaflets 4-10 mm wide and 5-13 cm long. Found on upland prairie and dry hillsides. Associated with bluestem grasses. Range plant used as a condition indicator.

Flower and fruit: Small dark purple with a single petal appearing as a cluster on terminal branches, 0.8-2.5 dm long. Flowers appear June to August. Fruit is a 2-seeded legume (most often 1 seed), densely covered with short, white hairs. Pods 5 cm long. Commercial seeds often consist of the dried pods which are grayish in color. Matures August – September.

Seed: When grayish hairy coating is rubbed off, the fruit is yellow-tan at the top and reddish-purple at base with purple dots as much as 2/3 distance from base of fruit. True seed inside has a waxy, green-brown seed coat and a greenish embryo. Seed is 4 mm long by 2 mm wide. 194 to 650 seed per g.

Laboratory analysis:

Purity – No data

Germination – No pretreatment, germinate at 20-30C. First count at 7 days, last count at 21 days. Seeds may develop dormancy after prolonged storage. Constant 20C also successful. Germination averaged 20-80 percent. Scarification of the seed coat will improve germination. This can be accomplished by placing the seed between two sheets of sandpaper and lightly rubbing.

Normal seedling – Vigorous primary root, sturdy hypocotyls twice the length of the primary root, two cotyledons intact.

Excised embryo – No data

Tetrazolium – Soak 24 hrs. in water, clip cotyledon end, soak in 1 percent tetrazolium solution, cut longitudinally to evaluate.

Radiographic – 12KV, 45 sec. for Kodak AA film or industrex paper, 12KV, 90 sec. for Polaroid film. Can identify filled, empty seed and abnormal seed development.

Storage: Air-dried, sealed in containers at 3C or -13C proven successful.

Endangered species classification: Rare in MI, special concern species in MN, rare in Ontario.

Suggested references:

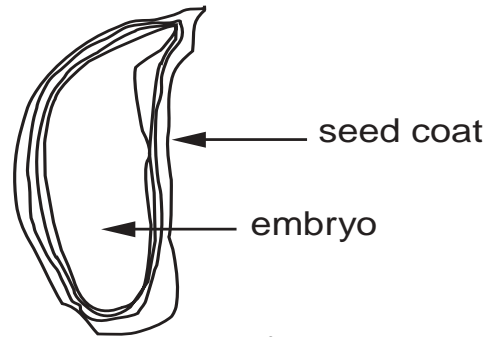
Sorensen, J.T. and D.J. Holden. 1974. *Germination of Native Prairie Forb Seeds*. Jour. Range Mgt. 27(2):123-126.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

FABACEAE

AMORPHIA FRUTICOSA L. (INDIGOBUSH, FALSE-INDIGO)

Distribution: AL, AR, AZ, CA, CO, CT, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, ND, NE, NH, NJ, NM, NY, OH, OK, PA, RI, SC, SD, TN, TX, UT, VA, VT, WI, WV, WY:MAN, NB, ONT, QUE



Description: Shrub, 2-4 m high, leaves alternative, pinnately compound, 15-35 oblong leaflets, 1-6 cm long each. Found in low moist ground and streambanks. Provides game food and livestock forage.

Flower and fruit: Small blue to purple flowers are produced May to June in terminal spikelike heads. The fruit is a 1 or 2 seeded legume, 7-8 mm long, brown, often curved, dotted with large resinous glands, matures August – September.

Seed: Commercial “seed” often consist of dried pods. Actual seed within the pod is waxy, brown with a yellowish embryo filling the seed cavity. 120-180 seed per g, each seed 4 mm long by 2 mm wide.

Laboratory analysis:

Purity – 15 g for routine analysis, no noxious weed seed. Sample may be either fruits or true seed.

Germination – Averages 45-50 percent, 10 min. soak in water at 80-90C, 90-120 days prechill may also be necessary. Germinate at 20-30C, first count at 7 days. Final count at 10 days, germination is epigeal. May also remove seed from pods, soak in sulfuric acid 5-8 min, wash, prechill 30 days at 3-5C.

Normal seedling – Radicle, strong with rootlets clustered about the base, hypocotyls long and slender (about 3.8 cm), cotyledons elliptical, 1 cm long and 6 mm wide, green, short-petioled.

Excised embryo – Nick seed coat to expose cotyledons, soak in tap water for 2-4 hrs., remove the seed coat on the swollen seed (seed should be removed from the pod).

Tetrazolium – Remove seeds from the pods, chip seed coat, soak 16-20 hr. in 1 percent tetrazolium solution at room temperature, clear with lactophenol. Chip distal end. Straining is very slow.

Radiographic – 12KV, 45 sec. for Kodak AA film or industrix paper, 12KV, 90 sec. for Polaroid. Shows filled, empty and abnormal seed development.

Storage: Air-dried, sealed in containers, at 3C seed remained viable for 3-5 years.

Endangered species classification: None

Suggested references:

USDA. 1979. *Native Shrub Production Project: Coeur D’Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

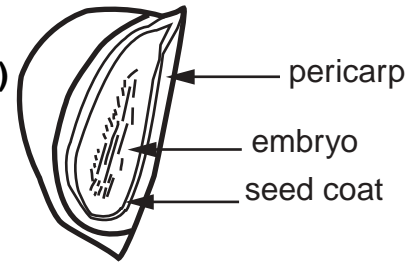
Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

Weber, G. P. and L. E. Wiesner. 1980. *Tetrazolium Testing Procedures for Native Shrubs and Forbs*. Jour. Seed Tech. 5(2):23-34.

ERICACEAE

ARCTOSTAPHYLOS PATULA GREENE (GREENLEAF MANZANITA)

Distribution: AZ, CA, CO, MT, NV, OR, UT, WA



Description: Spreading, multibranched, evergreen shrub, 1-2 m high, bright green leaves, 5 cm long. Found in colonies in pinyon pine and spruce belts, at 741 to 1,500 m in the Sierra Nevada. Provides winter forage for deer, ornamental in CA.

Flower and fruit: Perfect, pink flowers bloom in April – June, flowers are scaly-bracted, in terminal racemes or clusters. Fruit is a berry-like drupe, 8-10 mm diameter with 4-10 stony, fused or partially fused nutlets. Drupe is dark brown to black and maturity in July to September.

Seed: 40 nutlets per g, 4 mm long by 3 mm wide, brown, very thick seed coat, open at periole, light brown inner seed coat, white embryo folded or wrinkled and filling seed cavity.

Laboratory analysis:

Purity – 60 g for routine analysis, will be mixed single and fused seed with fleshy coat removed. Occasionally, samples may be total fruit with dried fleshy coat. Very little trash either way and no noxious seed.

Germination – Soak in sulfuric acid 4 hrs., then wash thoroughly, prechill in moist sand for 90 days at 2-3C, germinate at 20-30C. First count at 14 days, final count at 35 days. Care must be taken in acid soaks to only dissolve the tissue plugging the periole and not damage the embryo. Average germination is 20 percent.

Normal seedling – Vigorous primary root as long or longer than hypocotyl, sturdy hypocotyl, 2 intact small round cotyledons, epicotyl development may be present during germination period.

Excised embryo – No data

Tetrazolium – Soak 48 hrs., separate individual seed with knife, cut at point of wedge and twist to open, remove or scratch inner seed coat, place in 1 percent tetrazolium solution, slice lengthwise to evaluate embryo. More difficult to open than A. Uva-Ursi.

Radiographic – 12KV, 120 sec. for Kodak AA film and Industrex paper, 12KV, 4 min. for Polaroid film. Filled, empty and multiple cavities clearly visible.

Storage: No data

Endangered species classification: None

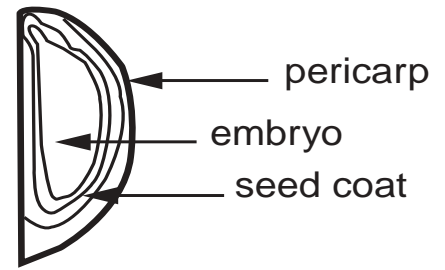
Suggested references:

Emery, D. 1964. *Seed Propagation of Native California Plants*. Leaflets of the Santa Barbara Botanic Gardens 1(10):81-96.
Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

ERICACEAE

ARCTOSTAPHYLOS UVA-URSI (L.) SPRENGEL (KINNIKINICK, COMMON BEARBERRY, MEALBERRY)

Distribution: AK, AZ, CA, CO, CT, IA, ID, IL, IN, MA, ME, MI, MN, MT, ND, NE, NH, NJ, NM, NY, OH, OR, PA, RI, SD, UT, VA, VT, WA, WI, WY: ALB, BC, MAN, NB, NFLD, NS, ONT, QUE, SAS



Description: Evergreen prostate shrub, creeping with rooting branches to 15 cm long leathery leaves, species is circumpolar. Found on hillsides, woods, and sandy soil, tundra, and rocky or sandy open areas, disturbed sites. 1,500 to 3,000 m elevation. Leaves used for medicine and for tanning leather, making dyes. Berries eaten by grouse and bears. Used as an ornamental and for erosion control and disturbed land reclamation.

Flower and fruit: Perfect, urn-shaped, white or pink flowers in March to May, terminal racemes. Fruit is a mealy, berry-like drupe, 6-10 mm diameter, bright red to pink when mature in June to September, contains 4-10 stony seeds or nutlets fused or partially fused together.

Seed: Nutlet, 60 per g, 3 mm long by 2 mm wide, light brown color, very thick seed coat with opening at periole, inner seed coat very thin.

Laboratory analysis:

Purity – 40 g for routine analysis. May be single seed or cluster. Very little trash and no noxious weeds.

Germination – Prechill 60 days warm followed by 60 days cold (20C & 5C), germinate at 25C. First count at 7 days and last count at 21 days. Average germination is 40-60 percent. Seed may also be soaked in sulfuric acid for 3 hr. and then prechilled after being washed. Care should be taken in acid soaks to only dissolve the plug of tissue in the periole and not long enough to damage the embryo. Very little is known about optimum conditions for this species but once the periole is open, the resistance of a hard seed coat must be overcome and then a possible embryo dormancy. Tetrazolium may be the best test although very time consuming. Another alternative is to store in damp moss for 140 days at 10C.

Normal seedling – Vigorous primary root and secondary root growth, sturdy hypocotyl and 2 intact cotyledons, evidence of epicotyl development.

Excised embryo – Germinate very slowly and incompletely (Giersbach, 1937).

Tetrazolium – Soak 48 hrs., separate individual seed with knife, cut at peak of wedge and twist to open, remove or scratch inner seed coat, place in 1 percent tetrazolium solution, slice lengthwise to evaluate.

Radiographic – 12KV, 90 sec. for Kodak AA film and Industrex paper, 12KV, 3 min for Polaroid film. Shows filled, empty, and multiple cavities.

Storage: Dry at room temperature.

Endangered species classification: Endangered in IL, rare in IA, protected in UT.

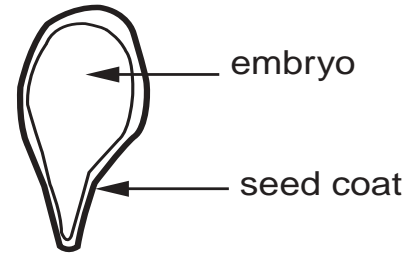
Suggested references:

- Berg, A.R. 1974. *Arctostaphylos* Adans. Manzanita. In: Schopmeyer, C.S. (Ed.) *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, p.228-231. USDA, Forest Service, Washington, D.C.
- Giersbach, J. 1937. *Germination and Seedling Production of Arctostaphylos UVA-URSI*. Contrib. Boyce Thompson Inst. 9:71-78.
- King, P., G. Grainger and A. Straka. 1983. *Testing of Seed Pre-germination Treatments for Selected Native Shrub Species*. ENR Report No. T/43, 80P. Alberta Energy and Natural Resources, Edmonton, Alberta, Canada.

ASTERACEAE

ARTEMISIA CANA PURSH (SILVER SAGEBRUSH, HOARY SAGEBRUSH, MOUNTAIN SILVER SAGEBRUSH)

Distribution: CA, CO, ID, MT, ND, NE, NM, NV, OR, SD, UT, WY:ALB, BC, MAN, SAS



Description: Evergreen shrub with silver-gray pubescent leaves, 0.3-2 m high, found on dry plains and hills at 2,100 to 3,000 m elevation and on internally drained basins. Important as a livestock and big game browse shrub, used as fuel by settlers and as an ornamental in England. Crushed leaves have a turpentine odor. Grows best on deep loam. Leaves will fluoresce creamish-blue in methanol solution under longwave, ultraviolet light.

Flower and fruit: Numerous heads in leafy panicles, each head contains 4-20 disc flowers, ray flowers lacking, flowers bloom August-September, fruit is an achene, ripening October – November, dark brown to black, 2.3 mm long, ribbed, bearing glands, 4,900 clean seed per g.

Seed: Achene is “seed” received by analyst, papery seed coat filled with white embryo.

Laboratory analysis:

Purity – 1 g for routine analysis

Germination – No pretreatment required. Germinate at 10-30C with light, first count at 7 days, final count at 14 days. Average germination 90-100 percent.

Normal seedling – No data

Excised embryo – No benefit

Tetrazolium – Remove or cut through transparent covering. Place in 1 percent tetrazolium solution.

Radiographic – Not useful.

Storage: Air-dried at 20C

Endangered species classification: Rare and endangered in MN, rare in MAN.

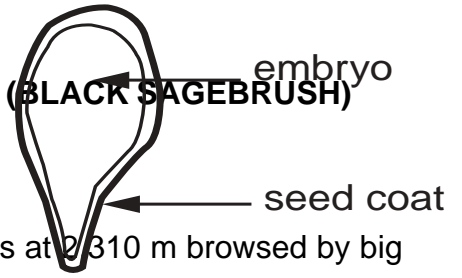
Suggested references:

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

Young, J.A. and R.A. Evans. 1982. *Identification of Seeds of Big Sagebrush Taxa*. AOSA Newsletter 56(2):26-29.

ASTERACEAE

ARTEMISIA NOVA A. NELSON (SYNO. ARTEMISIA ARBUSCULA) (BLACK SAGEBRUSH)



Distribution: AZ, CA, CO, ID, MT, MN, NV, UT, WY

Description: Evergreen shrub, 10-30 cm high, found in the high plains at 2310 m browsed by big game. The leaves do not fluoresce creamish-blue in methanol solution.

Flower and fruit: Tubular, yellow flower, blooms August-September. Fruit is a tan to brown achene, ripens October – November, 2,000 per g.

Seed: Thin waxy seed coat, embryo filling seed cavity.

Laboratory analysis:

Purity: 2 g for routine analysis. Usually contains a lot of trash and floral parts (see photo above).

Germination: Requires 10 days prechill at 2C for maximum germination, germination at 3C with light. First count 21 days, last count 100 days. Greenhouse tests indicate 18C after prechill may shorten germination period to about 45 days. Average germination 80-90 percent.

Normal seedling – No data

Excised embryo – No benefit

Tetrazolium – Remove or cut through covering exposing embryo, place in 1 percent tetrazolium solution.

Radiographic – No particular benefit

Storage: Reported good for 2 years

Endangered species classification: None

Suggested references:

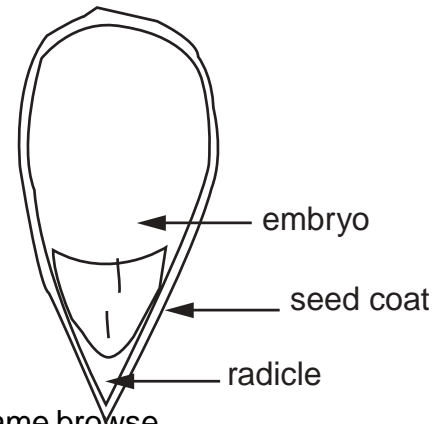
Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

Young, J.A. and R.A. Evans. 1982. *Identification of Seeds of Big Sagebrush Taxa*. AOSA Newsletter 56(2):26-29.

ASTERACEAE

ARTEMISIA SPINESCENS D.C. EATON (SAGEBRUSH)

Distribution: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WY



Description: Evergreen shrub of dry plains and hills, 5-50 cm tall, big game browse.

Flower and fruit: Tubular, yellow flowers blooms April – June, fruit is a hairy achene, brown to black, ripens August – September.

Seed: 2,250 per g, 1.5 mm long by 1 mm wide, seed coat papery, embryo fills seed cavity.

Laboratory analysis:

Purity – 2 g for routine analysis, usually contains a lot of trash and floral parts.

Germination: No pretreatment required, germinate at 20-30C. Trails with gibberillin solution were fruitless.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Remove or cut through embryo covering and place in 1 percent tetrazolium solution.

Radiographic – No data

Storage: No data

Endangered species classification: None

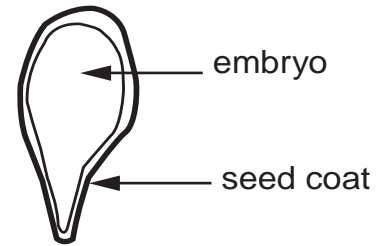
Suggested references:

USDA. 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

ASTERACEAE

ARTEMISIA TRIDENTATA NUTTALL (BASIN BIG SAGEBRUSH, PARISH SAGEBRUSH, BASIN SAGEBRUSH)

Description: AZ, CA, CO, ID, MT, ND, NE, NM, NV, OR, SD, TX, UT, WA, WY:ALB, BC



Description: Evergreen shrub with silvery leaves with 3 blunt apical teeth. Great variability in height from 0.4 to 4 m. Found on deep soils on valley bottoms, semi-arid lands and up to timberline in mountains, somewhat intolerant of alkali soil. Highly polymorphic species with numerous ecotypes. Important to western winter livestock and game ranges, cover for upland birds, and useful for stabilizing eroded areas. The leaves of subspecies *vaseyana* and *spiciformis* will fluoresce creamish-blue in methanol solution under longwave, ultraviolet light. Subspecies *wyomingensis* and *tridentata* fluoresce brownish-red.

Flower and fruit: Tubular, yellow flower in open panicles with drooping branches, blooms July to October, matures November – December. Fruit is a dark brown to black achene, 3,000-5,500 seed per g.

Seed: The commercial “seed” is the achene, seed coat paper thin, seed 0.7 mm wide by 1.5 mm long, embryo filling seed cavity.

Laboratory analysis:

Purity: 1 g for routine analysis.

Germination: Requires 10 days of prechill at 3C then germinate at 18.5C with light, first count at 7 days, last count at 14 days. Great variability in seed production and germination. Other favorable germination temperatures: 10-25C, 15-30C and 15-25C for 14 days. Early maturing seed germinate best, germination may be improved by soaking seed in dilute (N/1000) hydrochloric acid, germinates best in high substrate moistures. Constant 25C inhibits germination.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – No preconditioning required, soak 16 hrs. in 1 percent tetrazolium solution, clear 2 hrs. with lactophenol or the pericarp can be removed by pressing on the cotyledonary end.

Radiographic – No particular use.

Storage: Reported good for 2 years.

Endangered species classification: Rare in ALB.

Suggested references:

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

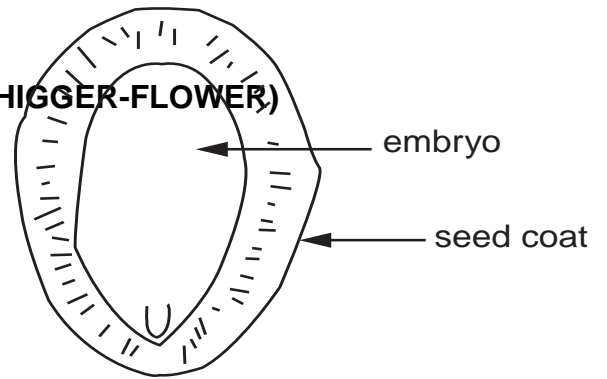
Weber, G. P. and L. E. Wiesner. 1980. *Tetrazolium Testing Procedures for Native Shrubs and Forbs*. Jour. Seed Tech. 5(2):23-34.

Young, J.A. and R.A. Evans. 1982. *Identification of Seeds of Big Sagebrush Taxa*. AOSA Newsletter 56(2):26-29.

ASCLEPIADACEAE

ASCLEPIAS TUBEROSA L. (BUTTERFLY MILKWEED, CHIGGER-FLOWER)

Distribution: AL, AR, AZ, CO, CT, DE, FL, GA, IA, IL, IN, KS, KY, MA, MD, MI, MN, MO, MS, NC, NE, NH, NJ, NM, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, WV:ONT, QUE



Description: Forb, 30-90 cm tall, leaves rough, narrow and hairy, 11 cm long, waxy pollen mass. Found in open, dry, sandy soils, pastures, and roadsides. Roots used medicinally.

Flower and fruit: Orange-red or yellow with hooded stamens, flowers in terminal corymb or umbel, blooms June – September, fruit is a green to brown follicle, matures August – October. Two seed per pod, one often abortive, seed are blown out when pod splits.

Seed: About 150 per g, brown, darker in center, usually bearing a long tuft or silky hairs at the hilum, embryo large with leafy cotyledons surrounded by thin endosperm, yellowish in color, anatropous, flat.

Laboratory analysis:

Purity – 15 g for routine analysis

Germination: Data scarce, no treatment, germinate at 20-30C.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – No data

Radiographic – 12KV, 30 sec. for Kodak AA film or Industrex paper, 12KV, 60 sec. for Polaroid film. Shows filled, empty and abnormal seed development.

Storage: No data

Endangered species classification: Protected by state in NY and NM, rare and endangered in SD, rare in QUE. Noxious weed in Hawaii.

Suggested references:

Smith, J. R. and B. S. Smith. 1980. *The Prairie Garden*. University of Wisconsin Press, Madison, WI. 219P.

ASTERACEAE

ASTER NOVAE – ANGLIAE L. (NEW ENGLAND ASTER)

Distribution: AL, AR, CO, CT, DE, IA, ID, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NY, OH, OK, PA, RI, SD, TN, VA, VT, WA, WI, WV, WY:MAN, NB, NS, ONT, QUE

Description: Forb, up to 2.5 m tall, base of leaves clasp stem, leaves dry feeling and slightly hairy, 5-10 cm long. Found in damp thickets, shores and meadows. Used as an ornamental and decoration (either fresh or dried).

Flower and fruit: Flowers in terminal heads, 8-10 mm high, purple to rose with yellow centers, blooms August to October. Fruit is an achene, densely hairy, gray-brown to tan with white ribs, matures October to November.

Seed: Achene is considered the "seed" for analysis, 2.5 mm long by 1 mm wide.

Laboratory analysis:

Purity – 1 g for routine analysis.

Germination – Moist stratification improves germination. Prechill 20 to 30 days at 3-5C, germinate at 20-30C.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak in water 24 hrs., remove seed coat, place in a 1 percent tetrazolium solution.

Radiographic – 12KV, 30 sec. for Kodak AA film. Detail loss too great on paper or Polaroid film. Filled, empty and abnormal development visible.

Storage: No data

Endangered species classification: Special concern species in MN; rare in OK.

Suggested references:

Smith, J. R. and B. S. Smith. 1980. *The Prairie Garden*. University of Wisconsin Press, Madison, WI. 219P.

FABACEAE

ASTRAGALUS CICER L. (CICER MILKVETCH)

Distribution: CO, IA, ID, MT, WY:MAN

Description: Forb with odd-pinnate leaves.

Flower and fruit: Typical legume flower, white in racemes, corolla 13-16 mm. Fruit a legume, inflated, 8-10 ovules.

Seed: 350 per g, tan to dark brown, 3.2 mm long 2.5 mm wide.

Laboratory analysis

Purity – 7 g for routine analysis.

Germination – Scarify lightly between two sheets of sandpaper, germinate at 20-30C, first count at 3 days, final count at 14 days.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak 24 hrs. in water, clip cotyledon end, place in a 1 percent tetrazolium solution, cut lengthwise to evaluate.

Radiographic – 12KV, 60 sec. for Kodak AA film and Industrex paper, 12KV, 2 min. for Polaroid film. Filled, empty and abnormal development visible.

Storage: No data

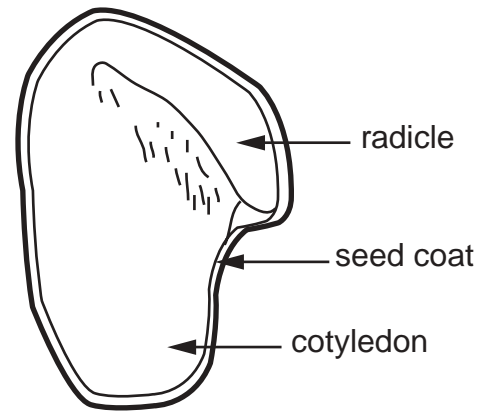
Endangered species classification: None. Noxious weed in Hawaii.

Suggested references:

Townsend, C. E. and W. J. McGinnies. 1972. *Mechanical Scarification of Cicer Milkvetch (Astragalus Cicer L.) Seed*. Crop Sci. 12(3):392-394.

Townsend, C. E. and W. J. McGinnies. 1972. *Temperature Requirements for Seed Germination of Several Forage Legumes*. Agron. Jour. 64(6):809-812.

Watson, L. E., R. W. Parker and D. F. Polster. 1980. *Manual of Species Suitability for Reclamation in Alberta*. Vol. II: Forbs, Shrubs and Trees. Report No. RRTAC 80-5, 541P. Alberta Land Conservation and Reclamation Council, Edmonton, Alberta, Canada.

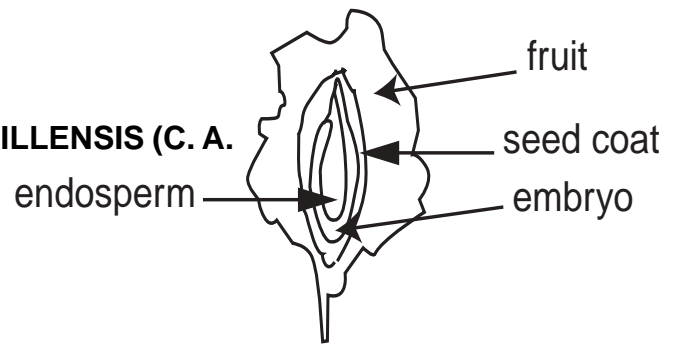


CHENOPODIACEAE

ATRIPLEX GARDNERI (Moq.) D.Dietr. var. BONNEVILLENSIS (C. A. HANSON) S.L. Welsh (BONNEVILLE SALT BUSH)

Distribution: NV, UT

Description: Shrub



Flower and fruit: Flowers tan to greenish-yellow, in panicles, blooms May to June. Fruit is a utricle, cream to white, 5-10 mm long and 3-5 mm wide, irregular shape with pointed knobs, matures in fall and winter.

Seed: 114 per g, brown papery seed coat, embryo yellowish and curved around white endosperm.

Laboratory analysis:

Purity – 22 g for routine analysis

Germination – Soak 24 hrs. in water, place on media and germinate at 15C, first count at 3 days, last count at 21 days.

Normal seedling – Vigorous primary root, at least twice as long as hypocotyl, sturdy hypocotyl either pink or white in color, 2 intact, long, green cotyledons.

Excised embryo – No data

Tetrazolium – Soak 24 hrs. in water, clip end and remove embryo from seed coat, place in 1 percent tetrazolium solution.

Radiographic – 12KV 60 sec. for Kodak AA film and Industrex paper. 12KV, 2 min. for Polaroid film. Filled, empty and abnormal development visible.

Storage: No data

Endangered species classification: Possibly threatened in UT.

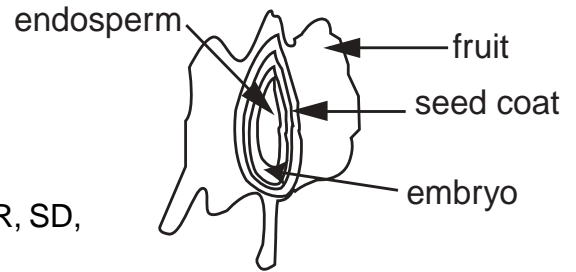
Suggested references:

None

CHENOPODIACEAE

ATRIPLEX CANESCENS (PURSH) NUTTALL (FOURWING SALTBUSH, SHADSCALE)

Distribution: AZ, CA, CO, ID, KS, MT, ND, NE, NM, NV, OK, OR, SD, TX, UT, WY



Description: Shrub, 0.2-2.5 m high, gray, scruffy appearance, narrow leaves, 10 cm long. Found on dry mesas and alkaline valleys, 1,200 to 2,100 m elevation. Used for road stabilization, browse on game and livestock range.

Flower and fruit: Flowers tan to greenish-brown, blooms May to July, naked pistil enclosed in a pair of foliaceous bracts. Fruit a 4-winged utricle, 5-23 mm wide, cream to white in color, matures August – September. In North and October – March in South.

Seed: Utricle is the “seed”. 17-120 per g (mean about 85), 3-10 mm long and 5-10 mm wide. Brown papery inner seed coat, embryo yellowish, curved around white endosperm.

Laboratory analysis:

Purity – 40 g for routine analysis.

Germination – Early collections may require a 60 min. soak in sulfuric acid or prechill at 5C for 12 weeks. Stored seed seldom need this. A high substrate moisture is desirable. The Utah source may require longer germination. High percentage of empty seed. Smallest fruit have the highest percent of filled seed. Germination is inhibited by any lack of aeration, dewinging improves germination, but potassium nitrate does not. First count at 7 days, last count at 21 days. Best germination temperatures are 18-24C for CA source; 18-16C for NM source; 0-3C for UT source.

Normal seedling – Vigorous primary root which is twice the length of the short hypocotyl, 2 intact cotyledons.

Excised embryo – No data

Tetrazolium – Soak seed 24 hrs. in water, clip seed and remove embryo, place embryo in 1 percent tetrazolium solution. Empty and abnormal development stains.

Radiographic – 12KV, 60 sec. for Kodak AA film and Industrex paper, 12KV, 2 min. for Polaroid film. Filled, empty and abnormal development visible.

Storage: Reported good for 5-7 years in sealed containers at 21C. Dewinging may increase storability, refrigeration did not improve germination.

Endangered species classification: None

Suggested references:

Graves, W. L., B. L. Kay and W. A. Williams. 1975. *Seed Treatment of Mojave Desert Shrubs*. Agron.

- Jour. 67(6):773-777.
- Springfield, H. W. 1964. *Some Factors Affecting Germination of Fourwing Saltbush*. Res. Note RM-25, 8P. USDA, Forest Service, Ft. Collins, Co.
- Springfield, H. W. 1969. *Temperature for Germination of Fourwing Saltbush*. J. Range Mgt. 22(1):49-50.
- Springfield, H. W. 1970. *Germination Characteristics of Atriplex Canescens Seeds*. IN: International Grassland Congress, 11th Proc. P586-589.
- Twitchell, L. T. 1955. *Germination of Fourwing Saltbush Seed as Affected by Soaking and Chloride Removal*. Jour. Range Mgt. 8(5):218-220.

CHENOPODIACEAE

ATRIPLEX CONFERTIFOLIA (TORREY & FREMONT) WATSON (SHADSCALE SALTBUSH, SALTSAGE)

Distribution: AZ, CA, CO, ID, MT, ND, NM, NV, OR, SD, TX, UT, WA, WY

Description: Shrub, 20-100 m, spiny, scruffy-gray, leaves crowded, 18 mm long, subsessile. Found on hard stony, alkaline soils with a high clay content at elevations of 1,200-1,800 m. Provides browse for big game and livestock.

Flower and fruit: Flowers tan to greenish-yellow, blooms June to July, pistil naked, enclosed by pair of foliaceous bracts. Fruit is a utricle with foliose bracts, 5-12 mm long, cream to white, matures in October to November.

Seed: Utricle is "seed", bracts are usually removed leaving a utricle 6 mm by 6 mm. 140 seed per g, brown papery inner seed coat, embryo yellowish and curved around a white to translucent endosperm.

Laboratory analysis:

Purity – 20 g for routine analysis.

Germination – Germinate at 12C with light, first count at 7 days, last count at 14-21 days. Very hard seed coat, remove or expose embryo by scarifying for 2 min. or more. Seed are temperature sensitive, germination is reduced at most high temperatures, viability varies with source. Seed contain a strong chemical germination inhibitor which is water soluble. Another procedure is to soak the seed 72 hrs. in water at 30C followed by a 90 day prechill at 5C.

Normal seedling – Vigorous, sturdy root, long as hypocotyl, thick and with root hairs, 2 intact cotyledons, long and slender.

Excised embryo – No data

Tetrazolium – Cut across or at angle to pointed end to expose embryo, pry apart seed coat with needles, soak 2 hrs. in water, tease off inner transparent seed coat or cut at radicle end, place in 1 percent tetrazolium solution. Only embryo stains.

Radiographic – 12KV, 60 sec. for Kodak AA film and Industrex paper. 12KV, 2 min for Polaroid film. Filled, empty and abnormal development visible.

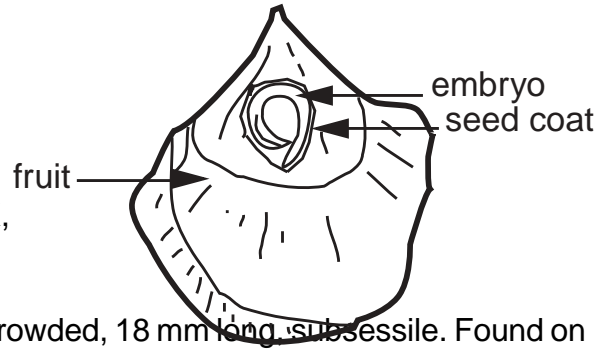
Storage: Store in cloth bags, good for 5-7 years

Endangered species classification: None

Suggested references:

USDA. 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.



CHENOPODIACEAE

ATRIPLEX CORRUGATA WATSON (SALTBUSH)

Distribution: CO, NM, UT

Description: Shrub 10-20 cm, found on arid plains.

Flower and fruit: Tan to greenish-yellow flowers in June and July, pistil naked and enclosed in foliaceous bracts. Fruit is a utricle with 4-6 mm wide bracts, cream to white, bracts irregular shaped and compressed making utricle appear more round, matures May to August.

Seed: 200 per g, brown papery white inner coat, curved yellowish embryo surrounding white endosperm.

Laboratory analysis:

Purity – 12 g for routine analysis.

Germination – Soak seed overnight in water, place on media and germinate at 20-30C, first count at 7 days, last count at 21 days.

Normal seedling – Vigorous primary root as long as hypocotyl, sturdy pinkish hypocotyl, 2 intact green cotyledons.

Excised embryo – No data

Tetrazolium – Soak seed overnight in water, remove seed coat and puncture inner seed coat, place in a 1 percent tetrazolium solution, cut lengthwise to evaluate.

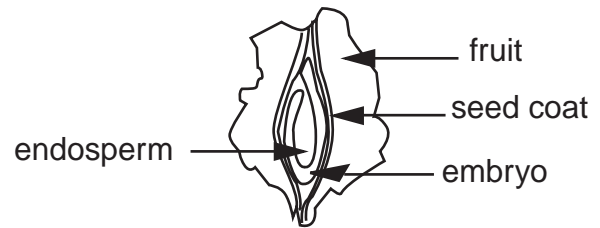
Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper, 12 KV, 2 min. for Polaroid film, filled, empty and abnormal development visible.

Storage: No data

Endangered species classification: Rare in WY.

Suggested references:

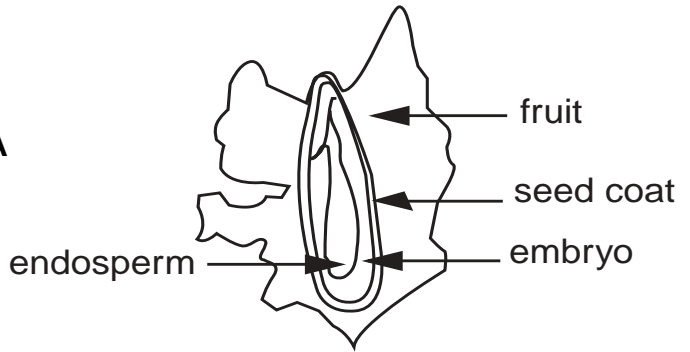
Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.



CHENOPODIACEAE

ATRIPLEX gardneri (Moq.) D.Dietr. var. CUNEATA (A. NELSON) S.L. Welch (SALTBUSH)

Distribution: CO, NM, NV, UT



Description: Shrub, 20-30 cm tall, leaves covered with gray flakey particles. Found on arid plains and hillsides of the grassbelt.

Flower and fruit: Flowers forming spikes. Fruit is a utricle, irregular shape with foliose bracts, 5-10 mm long and 4-6 mm wide, cream to white.

Seed: Utricle is "seed", brown papery inner seed coat, yellowish embryo curved around white endosperm.

Laboratory analysis:

Purity – 80 g for routine analysis.

Germination – No data

Normal seedling – No data

Excised embryo – No data

Tetrazolium – One of the most difficult to open, soak overnight in water, slice lengthwise off center and remove the seed, puncture center and place in 1 percent tetrazolium, only embryo stains.

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper, 12 KV, 2 min. for Polaroid film. Filled, empty and abnormal development visible.

Storage: No data

Endangered species classification: None

Suggested references:

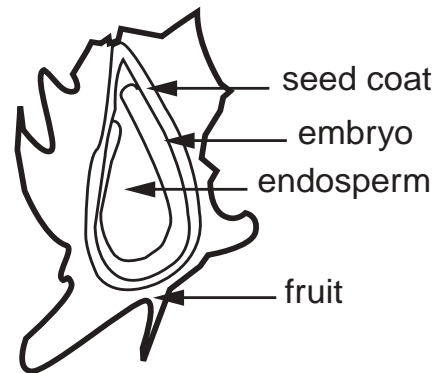
None

CHENOPODIACEAE

**ATRIPLEX GARDNERI (MOQUIN) D. DIETRICH
(GARDNER SALT BUSH)**

Distribution: CO, UT, WY

Description: No data



Flower and fruit: Fruit is utricle, irregularly shaped with foliose bracts, cream to white.

Seed: 210 per g, 5 mm by 5 mm, brown papery inner coat, embryo yellowish and curved around white endosperm.

Laboratory analysis:

Purity – 12 g for routine analysis.

Germination – Averages 60-80 percent, soak seed in water at 30C for 16 hr. and then prechill for 30 days at 3-5C, germinate at 18C. Prechill can be replaced by removal or cutting of seed coat. No germination without treatment.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak 2 or more hr. in water, cut 3-4 mm off base (stem end) of fruit, remove embryo and puncture inner seed coat or cut at radicle end, place in 1 percent tetrazolium solution; only embryo stains.

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper, 12 KV, 2 min. for Polaroid film. Filled, empty and abnormal development are visible.

Storage: No data

Endangered species classification: None

Suggested references:

Ansley, R. J. and R. H. Abernathy. 1982. *Seed Dormancy and Germination Enhancement of Gardner Saltbush (Atriplex Gardneri)*. Soc. For Range Mgt. 35th Annual Meeting. Calgary, Alberta, Canada. 52P.

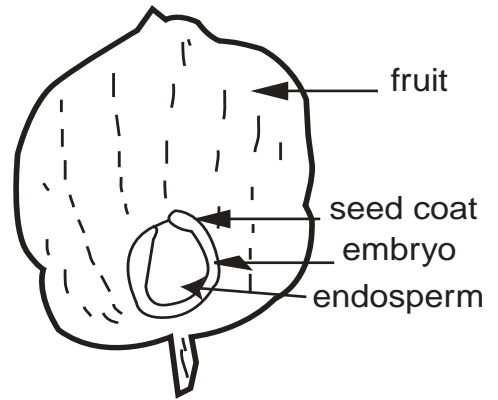
USDA. 1979. *Native Shrubs Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

CHENOPODIACEAE

ATRIPLEX LENTIFORMIS (TORREY) WATSON (QUAILBUSH)

Distribution: AZ, CA, HI, NV, UT.

Description: Shrub, 1-3 m tall, gray scruffy, leaves short-petioled, 1.5 to 4 cm long. Found in salt desert vegetation, mostly below 600 m. Alkali sink. Important browse to wildlife species.



Flower and fruit: Dioecious, cream, in profuse terminal panicles in August. Fruit is a utricle, bracts flatish, round to oval, 3-4 mm long, cream to reddish, matures in October.

Seed: Utricle is "seed", 900-2000 per g, inner seed coat reddish-brown, embryo yellowish and curved around white endosperm.

Laboratory analysis:

Purity – 5 g for routine analysis.

Germination – No pretreatment required, first count 7 days, last count 14 days. Germinate at 10-25C. Germination can be enhanced by washing the fruits in fresh water and blotting the excess moisture.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – The fruit appears as two leaves attached at the base, separate the two sides and push out seed, soak 2 hrs. in water, puncture or rupture brown seed coat or remove the curved embryo, place in 1 percent tetrazolium solution; only embryo stains.

Radiographic – 12 KV, 30 sec. for Kodak AA film. Too much detail lost on Industrex paper and Polaroid film. Filled, empty and some seed development are visible.

Storage: Stored in laboratory for 5 years in sealed containers.

Endangered species classification: None

Suggested references:

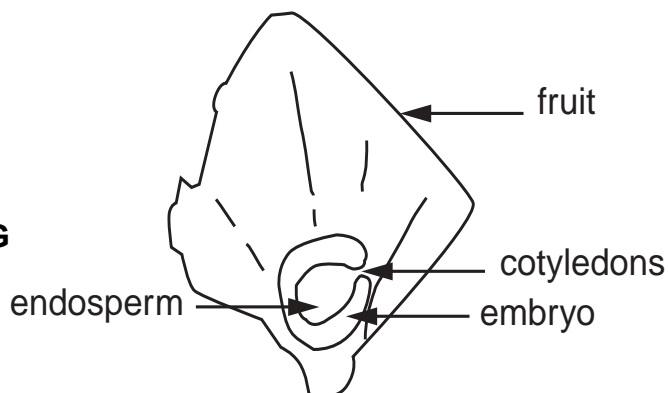
USDA. 1979. *Native Shrubs Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

Young, J. A., B. L. Kay, H. George and R. A. Evans. 1980. *Germination of Three Species of Atriplex*. Agric. Jour. 72:705-709.

CHENOPODIACEAE

ATRIPLEX SEMIBACCATA R. BROWN (TRAILING SALT BUSH, AUSTRALIAN SALT BUSH)

Distribution: AZ, CA, HI, NM, TX, UT



Description: Naturalized shrub, 2-12 dm long, leaves 1-3 cm long, prostrate, frutescent perennial, found in saline waste places, along roads, and marshes. Used as forage species and roadside cover.

Flower and fruit: Monoecious, fruiting bracts fleshy, becoming red. Fruit is a utricle, cream to red in color flowers in July and matures in August, bracts united at base, compressed and entire.

Seed: 165-317 per g, reddish-brown to black inner seed coat, embryo yellowish and curved around white endosperm. Seed 1.5-2 mm.

Laboratory analysis:

Purity – 7 g for routine analysis.

Germination – First count at 7 days, last count at 14 days, germinate at 10-25C. Washing fruit in fresh water and blotting the excess water may enhance germination.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Fruit forms an envelope which is only open at the top, pull the sides apart with needles and pry out the seed, soak 2 hrs. in water, puncture in center and place in 1 percent tetrazolium solution; curved embryo can be removed if desired; only embryo stains.

Radiographic – 12 KV, 45 sec. for Kodak AA film or Industrex paper, 12 KV, 1.5 min. for Polaroid film. Filled, empty and abnormal development visible.

Storage: In sealed containers for 5 years.

Endangered species classification: None

Suggested references:

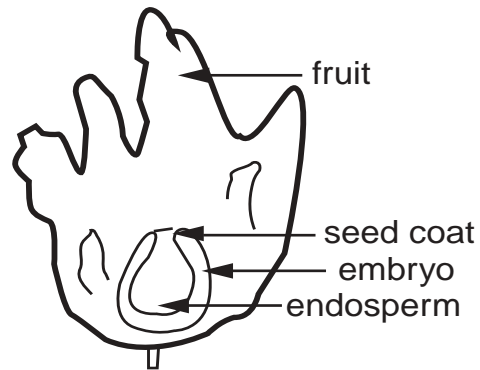
Young, J. A., B. L. Kay, H. George and R. A. Evans. 1980. *Germination of Three Species of Atriplex*. Agric. Jour. 72:705-709.

CHENOPODIACEAE

ATRIPLEX gardneri (Moq.) D.Dietr. var. utahensis (M.E. Jones) Dorn(SALTBUSH)

Distribution: CO, NV, UT, WY.

Description: None



Flower and fruit: Fruit is a utricle, cream to white, irregular shape, foliose bracts with large points like fingers.

Seed: 120-350 per g, inner seed coat light brown to tan, large yellowish embryo, curved around white endosperm.

Laboratory analysis:

Purity – 12 g for routine analysis.

Germination – No data

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water. The fruit looks like a small globe which is only open at the top; pull the sides apart with teasing needles and pry out the seed, puncture in the middle and place in 1 percent tetrazolium solution. Only embryo stains.

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper, 12 KV, 2.5 min. for Polaroid film. Filled, empty and abnormal development visible.

Storage: No data

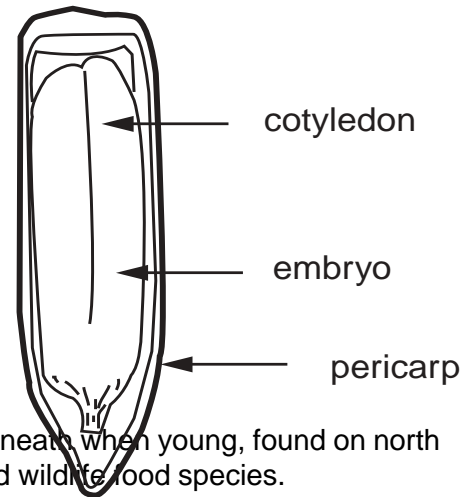
Endangered species classification: None

Suggested references: None

ASTERACEAE

BALSAMORHIZA SAGITTATA (PURSH) NUTTALL (ARROWLEAF BALSAMROOT)

Distribution: CA, CO, ID, MT, NV, OR, SD, UT, WA, WY:ALB,
BC



Description: Forb, 20-75 cm tall, basal leaves triangular, entire, hairy beneath, when young, found on north facing slopes in upper sagebush zone, 1,290-2,400 m, revegetation and wildlife food species.

Flower and fruit: Yellow ray flowers in a head 5-10 cm across, solitary, blooming in June, fruit is an achene, 4-sided, large like sunflower, 19 mm long by 2 mm wide, brown to black, ripens in July.

Seed: Achene is the "seed", 120-300 per g, inner seed coat thin and papery.

Laboratory analysis:

Purity – 10 g for routine analysis.

Germination – Requires 60-90 days prechill, germinate at 5C, first count at 7 days, last count at 28 days, germination reduced by increases in temperature but care must be taken to watch for germinate in the prechill to evaluate seedlings before the temperature adversely affects growth, the best response of nonprechilled seed is at 20 percent at 10C, 5-10C is also effective, average germination is 60-80 percent.

Normal seedling – No data

Excised embryo – Slice achene down ridges with razor blade, pull hull away, soak seed 5 min., tease off papery seed coat, place on moist paper.

Tetrazolium – Soak overnight in water, slice lengthwise through seed coat, pull seed coat apart with teasing needles and embryo will fall out. Remove transparent inner seed coat, place embryo in 1 percent tetrazolium solution.

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper, 12 KV, 2 min. for Polaroid film. Filled, empty and abnormal development visible.

Storage: No data

Endangered species classification: None

Suggested references:

Easi, D. N. Book and J. A. Young. 1982. *Quadratic Response: Surface Analysis of Seed Germination Trails*. Weed Sci. 30(4):411-416.

Young, J. A. and R. A. Evans. 1979. *Arrowleaf Balsamroot and Mules Ear Seed Germination*. Jour. Range Mgt. 32(1):71-74.

BERBERODACEAE

MOHONIA FREMONTII (TORREY) FEDDE (BARBERRY)

Distribution: AZ, CA, CO, NM, NV, UT

Description: Shrub, 3 m high, odd-pinnately compound, leaves to 10 cm long with 2-3 pairs of leaflets with 3, 4, or 6 spiny teeth. Found in dry rocky places at 900-1,500 m elevation.

Flower and fruit: Yellow flowers in a fascicled or racemose inflorescence, basal bracts short and deciduous. Fruit is a berry, yellow to red in color, ovoid with blue bloom, inflated and spongy, 10-15 mm diameter.

Seed: 94 per g, thick seed coat, red to black, ovoid to flat, 4-5 mm long by 2.5 mm wide, embryo white in elongated cavity.

Laboratory analysis:

Purity – 25 g for routine analysis.

Germination – No pretreatment required but some lots will be improved by 45 days prechill, average germination 60-80 percent.

Normal seedling – Sturdy, vigorous root, half the length of the hypocotyl; hypocotyl bright green with 2 intact oblong cotyledons.

Excised embryo – Slice off center of the narrow width in a lengthwise cut and remove the embryo.

Tetrazolium – Slice 1 mm from radicle end of the seed to expose the endosperm and embryo, soak 2 hrs. in water either before or after cutting, place cut seed in 1 percent tetrazolium solution for 16 hrs., slice lengthwise on narrow edge to evaluate stained embryo.

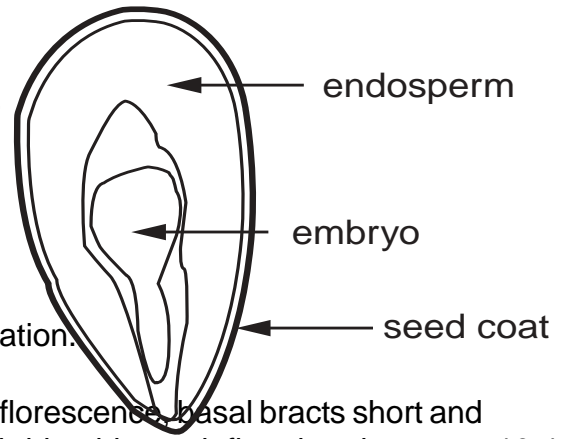
Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper, 12 KV, 75 sec. for Polaroid film. Filled, empty and abnormal development visible.

Storage: No data

Endangered species classification: None

Suggested references:

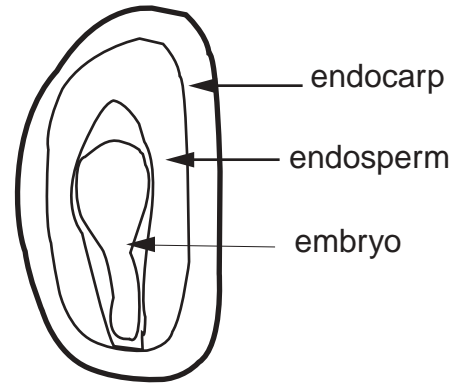
USDA. 1979. *Native Shrubs Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.



LAMIACEAE

CALLICARPA AMERICANA L. (FRENCH-MULBERRY, AMERICAN BEAUTYBERRY)

Distribution: AL, AR, FL, GA, HI, LA, MO, MS, NC, OK, RI, SC, TN,
TX, VA



Description: Deciduous shrub to 3 m tall, leaves 8-23 cm long. Found in woods, moist thickets, low rich bottomland, fence rows and the edge of swamps. Fruits are an important quail food; frequently eaten by deer, also consumed by squirrel, raccoon, opossum, fox and domestic livestock.

Flower and fruit: Bluish (may be pink or reddish) flowers borne in leaf axils during June on many flowered cymes. Fruit is a rose-pink to purple berry-like drupe, 3-6 mm diameter, densely clustered, matures August to September, contains up to 4 seeds.

Seed: 190-600 per g, flattened or wedge shaped, cream colored, smooth on outside but rough textured on inside, very thick seed coat and very thin, translucent embryo in thick endosperm, seed about 2 mm long.

Laboratory analysis:

Purity: 12 g for routine analysis.

Germination: If pulp is still attached, the fruits should be soaked and rubbed over a coarse screen to remove the seed. A 10 min. soak in concentrated sulfuric acid is necessary for germination. First count at 10 days, last count at 21 days. Germinate at 20-30C. Prechill was not effective in removing seed coat dormancy.

Normal seedling – Vigorous primary root sufficient to anchor seedling in soil; well developed hypocotyl with no open breaks or lesions extending into central conducting tissue; two intact cotyledons and epicotyl present.

Excised embryo – Soak seed 8-10 days in water, slice edges on longitudinal axis, place a needle on one end and a knife on the other end and push down. Remove remaining seed coat with needles, place contents on moist blotters.

Tetrazolium – Precondition 16 hrs. on moist blotters, cut the seed longitudinally on the rounded side to approximately $\frac{3}{4}$ depth; pry two halves slightly apart but keep intact; stain at 30C for 16 hrs. in 0.1-0.2 tetrazolium solution.

Radiographic – 12 KV, 30 sec. for Kodak AA film or Industrex paper, 18 KV, 45 sec. for Polaroid film. Filled, and empty seed are visible but no precise detail of embryo can be seen.

Storage: No data but seed should store well under a wide variety of conditions due to hard seed coat.

Endangered species classification: Probably extirpated in MO.

Suggested references:

Grelen, H. E. and V. L. Duvall. 1966. Common Plants of Longleaf-Bluestem Range. Res. Pap. S0-23. 96P. USDA, Forest Service, New Orleans, LA.

Halls, L. K. 1977. Southern Fruit-Producing Woody Plants Used by Wildlife. Gen. Tech. Report S0-16, 235P. USDA, Forest Service, New Orleans, LA.

FABACEAE

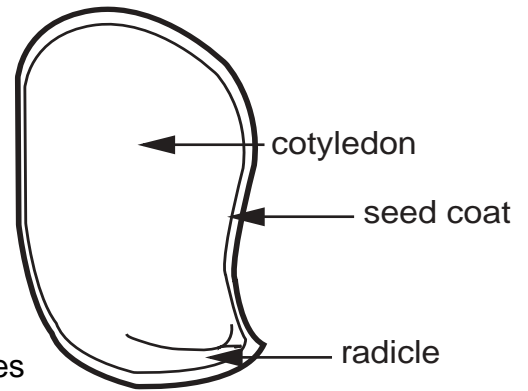
CARAGANA ARBORESCENS LAMARCK (SIBERIAN PEASHRUB)

Distribution: CO, ID, IA, IL, MI, MT, ND, NE, RI, SD, UT, WY:ALB, BC, MAN, NB, NFLD, SAS

Description: Deciduous shrub, 6 m tall, stipules usually spiny, leaves 5-8 cm long, even-pinnately compound, 3-6 pairs of leaflets. Used for windbreaks, ornamental.

Flower and fruit: Typical legume flowers, yellow, 1-4 together, 22 mm long. Fruit is a legume matures June to July, stalked to 5 cm long, linear, straight and cylindrical.

Seed: 36-60 per g., smooth, shiny, reddish-brown, round to oblong with point at one end, 3 mm diameter hard seed coat, yellowish embryo which fills cavity, radicle distinct at one end.



Laboratory analysis:

Purity – 70 g for routine analysis.

Germination – Prechill for 45 days at 3-5C required. Average germination 80-100 percent at 20-30C.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak in water overnight, clip cotyledon end being sure that embryo tissue is exposed; place in 1 percent tetrazolium solution; cut lengthwise to evaluate.

Radiographic – 12 KV, 60 sec. for Kodak AA film or Industrex paper, 12 KV, 2.5 min. for Polaroid film. Filled, and empty seed and insect damage visible, no embryo detail.

Storage: No data

Endangered species classification: None

Suggested references:

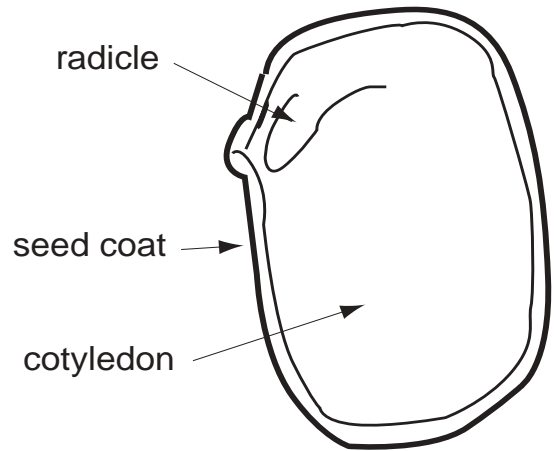
Nikolaeva, M. G., E. N. Polyakova, M. V. Razumova and N. A. Askochenskaya. 1978. *Mechanism Governing Inhibition of Germination in Seeds of Siberian Pea Tree (Caragana Arborescens)*. Soviet Plant Physiol. 25(6): Part 2:991-999. Komarov Bot. Inst., Acad. Sci., USSR. (Russian) – English Trans.

USDA. 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

FABACEAE

CARAGANA PYGMAEA (L) DECANDOLLE (CARAGANA)

Distribution: MT, SD:NFLD (Present in U.S., only in plantings)



Description: Deciduous shrub, 1.2 m high occasionally prostrate, golden yellow bark, leaves nearly sessile, even-pinnately compound, leaflets in 2 pairs to 6 mm long, spine tipped.

Flower and fruit: Flowers solitary, 18 mm long, wing petals very short, auricled, blooms in late spring. Fruit is a legume.

Seed: 60 per g, 2-3 mm diameter, smooth, shiny, marbled black-tan to brown and mostly tan, embryo yellowish filling seed coat, pea-shaped.

Laboratory analysis:

Purity – 70 g for routine analysis.

Germination – Soak overnight in water, place on media and germinate; first count at 7 days; last count at 21 days.

Normal seedling – Primary root stout and short, one-half length of hypocotyl; hypocotyl thick, sturdy and green; 2 intact thick, green cotyledons; primary leaves of 3 leaflets.

Excised embryo – No data

Tetrazolium – Soak in water overnight, clip cotyledon end being sure embryo tissue is exposed; place in 1 percent tetrazolium solution; cut lengthwise to evaluate.

Radiographic – 12 KV, 60 sec. for Kodak AA film or Industrex paper, 12 KV, 2.5 min. for Polaroid film. Embryo detail not visible, filled and empty seed can be seen as well as split between embryos.

Storage: No data

Endangered species classification: None

Suggested references:

None

RHAMNACEAE

CEANOTHUS CUNEATUS (HOOKER) NUTTALL ex TORREY & GRAY (BUCKBRUSH, WEDGELEAF CEANOTHUS)

Distribution: CA, NV, OR

Description: Rigid, erect, evergreen shrub up to 2.5 m tall, leaves opposite, 2.5 cm long. Common on dry slopes and fans below 1,800 m elevation. Used as an ornamental and for wildlife food and shelter.

Flower and fruit: Small, bisexual flowers with hooded and clawed petals; white, lavender or blue, blooms March to May. Fruit is a 3-lobed capsule, matures April to June.

Seed: 120 per g., maroon to black, shiny, round-oblong; 4 mm long by 2-3 mm wide, thin seed coat; yellow embryo pressed between thin layers of white endosperm.

Laboratory analysis:

Purity – 25 per g for routine analysis.

Germination – Soak seed in water 3 min. at 82C, then prechill 90 days at 3-5C, germinate at 20-30C; first count at 7 days, last count at 21 days. Average germination is 60-90 percent. Water soaking may be replaced with soak in concentrated sulfuric acid; another successful method is to dip the seed in boiling water for 1 min., soak in 400 ppm gibberillin for 13 hrs., dry 4 days, soak in 3 percent thiourea for 14 hrs. and germinate.

Normal seedling – Vigorous primary root, sturdy hypocotyl as long as the primary root, and 2 cotyledons intact with evidence of an epicotyl.

Excised embryo – No data

Tetrazolium – Soak overnight in water, clip cotyledon end being sure embryo tissue is exposed, place in 1 percent tetrazolium solution, cut lengthwise to evaluate.

Radiographic – 12 KV, 90 sec. for Kodak AA film or Industrex paper, 12 KV, 3.5 min. for Polaroid film. Filled, empty, and abnormal development are visible.

Storage: Air dry, sealed containers at 5C.

Endangered species classification: None

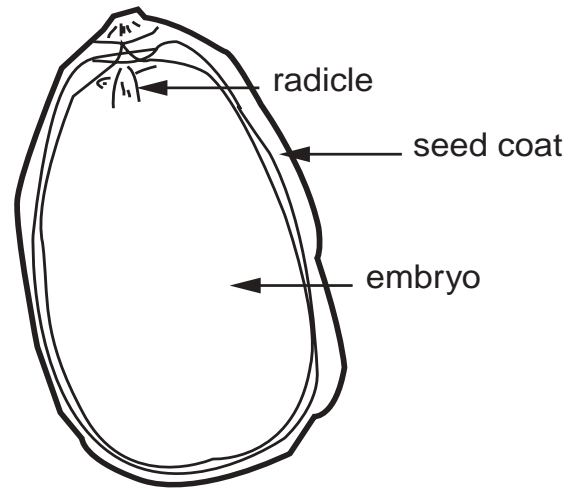
Suggested references:

Heit, C. E. 1970. *Germinative Characteristics and Optimum Testing Methods for Twelve Western Shrub Species*. Proc. Aosa. 60:197-205.

Quick, C. R. 1935. *Notes on Germination of Ceanothus Seeds*. Madrono 3:135-140.

Quick, C. R. and A. S. Quick. 1961. *Germination of Ceanothus Seeds*. Madrono 16:23-30.

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.



RUBIACEAE

CEPHALANTHUS OCCIDENTALIS L. (BUTTON BUSH)

Distribution: AL, AR, AZ, CA, CT, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NE, NH, NJ, NM, NY, OH, OK, PA, RI, SC, TN, TX, VA, VT, WI, WV:NB, NS, ONT, QUE

Description: Deciduous shrub, 1 to 3 or rarely 6 m high, growing in swamps, shallow ponds and along streams. Leaves opposite or in 3's. Seed eaten by birds, some value as a honey plant, often cultivated as ornamental shrub.

Flower and fruit: Creamy white perfect flowers borne in terminal or axillary clusters from May to September. Fruit is a tight ball-shaped head composed of 2-seeded, light brown capsules, matures September to October. Ready to collect when it turns red-brown.

Seed: Usually in 2's, each 5-9 mm long, wedge shaped, endosperm cartilaginous, cotyledons linear oblong. About 600 2-seeded capsules per gram, capsule light brown to tan in color.

Laboratory analysis:

Purity – (About 11 g basic purity, 110 g noxious weed) Normally 95 percent or better. Trash composed of fruit parts.

Germination – No pretreatment required, epigeal, at 20-30C first count 14 days, last count 35 days, seed will germinate in water at room temperature within 30 days.

Normal seedling – Vigorous primary root or set of secondary roots sufficient to anchor seedling in soil; vigorous, well-developed hypocotyl with no open breaks or lesions extending into central conducting tissue: two intact cotyledons; epicotyl present.

Excised embryo – Fruit is hard and brittle when dry. Soak seed 8-10 days in water, changing daily. Separate fruits of two seed by slicing longitudinally. Work may require a 5x lens. Slice across large end removing only enough pericarp to see food tissue then slice lengthwise near edge of seed to expose a white embryo covered with a thin brown seed coat tease entire structure out and break seed coat at radicle end. Place on moist blotter. Count at 5 and 10 days when held at 20-30C.

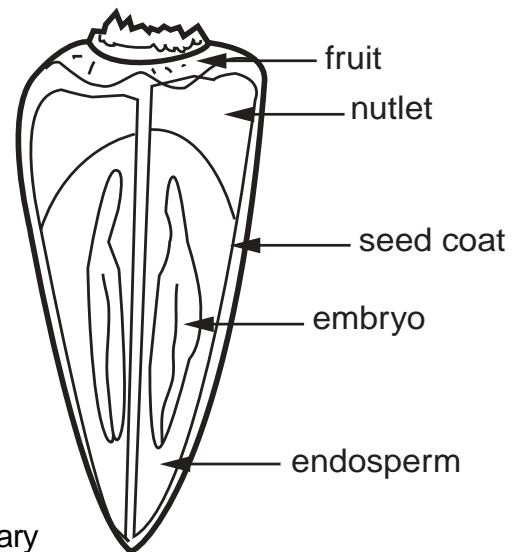
Tetrazolium – Precondition 16 hours on moist substrata; cut fruit laterally at radicle to expose tip (leave both ends of fruit attached by a segment of uncut tissue) Stain at 30C approx. 16 hrs.; in a 0.1-0.2 percent tetrazolium solution.

Radiographic – 12 KV, 80 sec. for Polaroid or 12KV, 45 sec. for Kodak Industrex paper. A 3x-5x lens permits visualization of the two cells, empty, filled seed and partially filled seed, and pro-embryo strands which are connected to the mother plant. Embryo often lies against one side making x-rays very difficult to read, no embryo detail seen.

Storage: Seed store well with moisture content of 9 percent or less, in moisture proof container when held at 3-5C.

Endangered species classification: Rare in QUE. Suggested references:

Bonner, F. T. 1974. *Cephalanthus Occidentalis* P. 301-302. IN: Schopmeyer, C. S. (Ed.) *Seeds of Woody Plants in the United States*. USDA Handbook No. 450. Washington, DC.

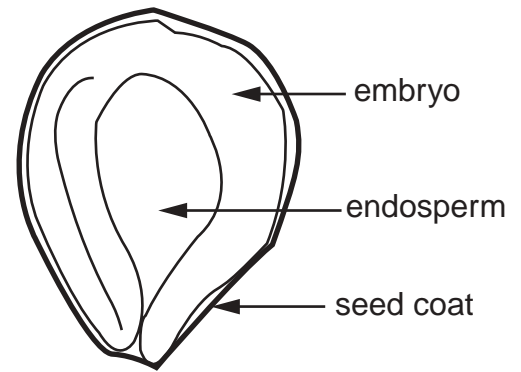


CHENOPODIACEAE

KRASCHENINNIKOVIA LANATA (PURSH) A.D.J. MEEUSE & A. SMIT(SYNO: EUROTIA LANATA) (WINTERFAT, WHITE-SAGE)(SYNO: CERATOLBES LANATA)

Distribution: CA, CO, ID, KS, MT, ND, NE, NM, NV, OR, SD, TX, UT, WY

Description: Erect shrub, 30-100 cm tall, hairy white, narrow leaves, 1.5-5 cm long, fruiting bracts 5-7 mm long with dense spreading tufts of long silvery or rusty hairs. Found on hillsides and sage plains, saline or alkaline areas 600 to 2,400 m elevation. Important as forage plant and as ornamental.



Flower and fruit: Female flowers without calyx, gray-green in color, blooms in August. Fruit is a one-seeded utricle with bracts 4-8 mm long, borne on compound spikes, nutlet enclosed in two bracts with fluffy white hairs giving a gray appearance; matures September to November.

Seed: 330-680 per g., nutlet 1-2 mm wide and 2-3 mm long, thin brown seed coat, seed appearing gray due to fluffy white hairs. Embryo yellowish-green, curved around white endosperm.

Laboratory analysis:

Purity – 7 g for routine analysis, 70 g for noxious weed count.

Germination – No pretreatment required, germinate at 15C, 13C, 16-25C, or 15-25C, first count 3-7 days, last count 7-14 days. Average germination 60-100 percent, temperatures below 7C inhibit germination, seed requires after ripening of 10 to 25 weeks from maturity, fresh seed may require prechill white stored seed does not. Bracts should be removed, it is moisture sensitive and does best on a moist media, large seed germinate faster than small seed, no benefit found with potassium nitrate. Seedling vigor is related to source and age.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Remove bracts, lay seed on moist blotters overnight, puncture seed, soak 4 hrs. in 0.1 percent tetrazolium solution at room temperature.

Radiographic – 12 KV, 45 sec. for Kodak AA film or Industrex paper, 12 KV, 2 min. for Polaroid film. Filled, empty and embryo detail clearly visible.

Storage: With bracts at 4C in sealed containers for up to 8 yrs. Clean seed, store 3 yrs. at 10 percent moisture in sealed containers at 5C to –20C. Storage at room temperature decreased viability in one season.

Endangered species classification: Uncommon peripheral in KS.

Suggested references:

Moyer, J. L. and R. L. Lang. 1976. *Variable Germination Response to Temperature for Different Sources of Winterfat (Krascheninnikovia lanata (Pursh) A.D.J. Meeuse & Smit) Seed.* Jour. Range Mgt. 29(4):320-321.

Springfield, H. W. 1968. *Age and Year of Collection Affect Germination of Winterfat Seeds.* Res. Note Rm-112, 2P. USDA, Forest Service, Ft. Collins, CO.

Springfield, H. W. 1973. *Larger Seeds of Winterfat Germinate Better.* Jour. Range Mgt. 26(2):153-154. Weber, G. P. and L. E. Wiesner. 1980. *Tetrazolium Testing Procedures for Native Shrubs and Forbs.* Jour. Seed Tech. 5(2):23-34.

Weber, G.P. and L.E. Wiesner. 1980. *Tetrazolium Testing Procedures for Native Shrub and Forbs.* Jour. Seed Tech. 5(2):23-34.

ROSACEAE

CERCOCARPUS LEDIFOLIUS NUTTALL ex Torr. & A. Gray (CURLLEAF MOUNTAIN-MAHOGANY)

Distribution: AZ, CA, CO, ID, MT, NV, OR, UT, WA, WY

Description: Shrub, 0.5-8 m high, thick, tough leaves, 1-3 cm long. Found in the foothills and mountains with pinyon-juniper and mountain brush. Shelter and browse for big game, erosion control on arid mountain slopes.

Flower and fruit: Small, bisexual flowers, greenish-white to reddish-brown, no petals, borne in 1, 2, or 3's in axil of leaves in May to June. Fruit is an achene, tan to light brown, 8-10 mm long with hairy style 4-7 mm long, ripens August to September. (Earliest on west coast), sharp tipped.

Seed: Achene is the "seed", often with the style broken, 90-115 seed per g., dark brown inner seed coat, white embryo.

Laboratory analysis:

Purity – 25 g for routine analysis, 250 g for noxious weed count. Usually 90 percent or better. Hairs on styles are called "hells feathers", they are very nasty.

Germination – Soak 10-30 min. in concentrated sulfuric acid, prechill 30 days, germinate at 15C, first count at 7 days, last count at 28 days. Will only germinate after extremely long aerated prechill. About 50 percent of sources will respond to 6 hours presoaking in hydrogen peroxide, others report that it is temperature sensitive and will not do well at constant temperatures, recommend 10-30C, KN03 did not stimulate germination.

Normal seedling – Vigorous primary root red to mahogany colored hypocotyl, dark green, linear cotyledons.

Excised embryo – Very difficult.

Tetrazolium – Difficult to perform. Soak seed in water overnight, cut 1 mm below style being sure inner seed coat is broken, place in 1 percent tetrazolium solution, cut lengthwise to evaluate.

Radiographic – 12 KV, 90 sec. for Kodak AA film or Industrex paper, 12 KV, 3.5 min. for Polaroid film. Filled, empty and abnormal development visible.

Storage: Dry in ventilated containers in unheated warehouses for 5-10 years.

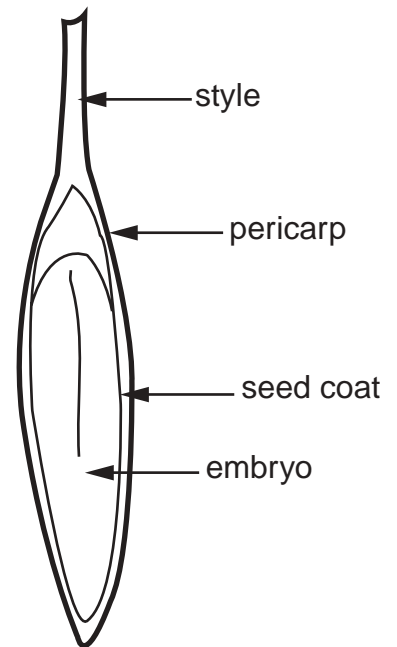
Endangered species classification: None

Suggested references:

Heit, C. E. 1970. *Germinative Characteristics and Optimum Testing Methods for Twelve Western Shrub Species*. Proc. Aosa. 60:197-205.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

Young, J. A., R. A. Evans and D. L. Neal. 1978. *Treatment of Curlleaf Cercocarpus Seeds to Enhance Germination*. Jour. Wildlife Mgt. 42(3):614:620.

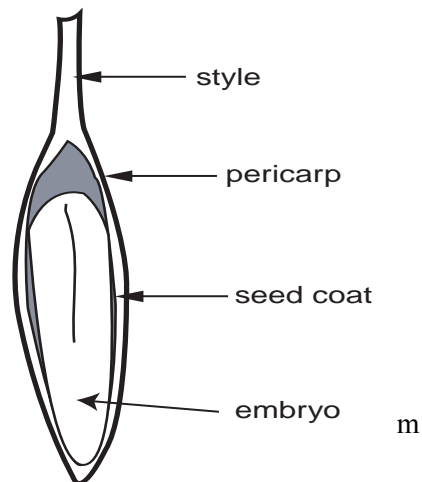


ROSACEAE

CERCOCARPUS MONTANUS RAFINESQUE (TRUE MOUNTAIN-MAHOGANY)

Distribution: AZ, CA, CO, NE, NM, OK, OR, SD, TX, UT, WY

Description: A persistent-leaved shrub, up to 3 m, leaves with coarse ovate teeth. Found on dry, rocky bluffs or mountain sides at 1,050-2,700 elevation. Provide shelter for big game, food and revegetation in arid zones.



Flower and fruit: Small bisexual flowers appear in May to June, greenish-white to reddish-brown, no petals, borne in 1, 2, and 3's in the axil of leaves. The fruit is a achene, tan to light brown, 8-10 mm long with a plumose style 6-10 cm long, matures August-October.

Seed: 90-130 per g, brown papery inner seed coat, achene is the "seed" of the analysis, tough fruit wall, embryo long and cylindrical, filling seed cavity.

Laboratory analysis:

Purity – 25 g for routine analysis, usually 90 percent or better, styles may be full length or any length down to totally removed due to processing.

Germination – Soak 48 hrs. in running water, germinate at 10-30C or 20-30C, first count at 7 days, last count at 21 days, some may require 28 days. Not as temperature sensitive as curleaf, acid treatment did not improve germination and may even injure seed, 30 day prechill was helpful. 25C, 10-25C also gave good results. Germination may be 2-3 times greater with seed produced in wet than in dry years, germinates best on moist substrate and large seed germinate best. Seed contains a water soluble inhibitor in the seed coat.

Normal seedling – No data

Excised embryo – Very difficult

Tetrazolium – Not satisfactory

Radiographic – 12 KV, 90 sec. for Kodak AA film or Industrex paper, 12 KV, 3.5 min. for Polaroid film. Filled, empty and abnormal development visible.

Storage: Sealed containers in refrigerator or freezer for 5-10 years. Viability in storage reduced by hammermilling the seed. Moisture content should be below 10 percent.

Endangered species classification: Rare in OK.

Suggested references:

Heit, C. E. 1970. *Germinative Characteristics and Optimum Testing Methods for Twelve Western Shrub Species*. Proc. Aosa. 60:197-205.

Piatt, J. R. 1973. *Seed Size Affects Germination of True Mountain Mahogany*. Jour. Range Mgt. 26(3):231-232.

Springfield, H. W. 1973. *Cliffrose and Mountain Mahogany Seeds Retain Viability 6 Years in Cold Storage*. Res. Pap. Rm-236, 2P. USDA, Forest Service, Albuquerque, NM.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

ASTERACEAE

LEUCANTHEMUM VULGARE LAM. (OX-EYE DAISY)

Distribution: AL, AK, AR, AZ, CA, CO, CT, DE, FL, GA, HI, IA, ID, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NY, OH, OK, OR, PA, RI, SC, SD, TN, UT, VA, VT, WA, WI, WV, WY:ALB, BC, MAN, NB, NFLD, NS, ONT, QUE, SAS.

Description: Erect Forb, 30-100 cm, simple or forked toward top, basal leaves spatular-shaped and on long slender petioles. Found in fields, meadows, and roadsides.

Flower and fruit: Yellow or brown disc and white or yellow ray flowers in a head, 4-6 cm across, usually single, terminal, blooms June to August. Fruit is an achene, striate, narrowly obovate, 1-1.5 mm long, bearing a tubercle at the apex.

Seed: Achene is the "seed" of the analysis, 4,550 per g, inner seed coat brown and adhering to the fruit wall, seed is black with 8-10 light-gray ribs, no pappus, embryo yellowish.

Laboratory analysis:

Purity – 5 g for routine analysis, is a noxious weed in many states.

Germination – No data

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, remove seed coat by trimming edge and prying open, scratch or break inner seed coat, place in 1 percent tetrazolium solution.

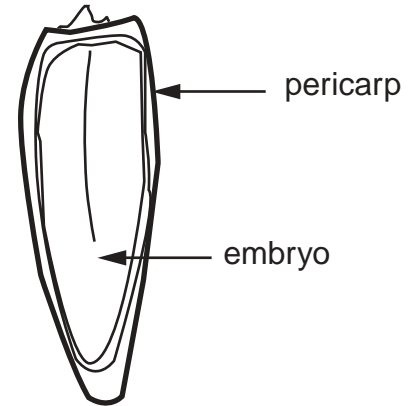
Radiographic – 12 KV, 30 sec. for Kodak AA film considerable loss of detail with Industrex paper and Polaroid film. Filled and empty seed visible.

Storage: No data

Endangered species classification: None, Noxious weed in: IL, IN, KS, KY, MO, MT, TN, WV, WY

Suggested references:

None

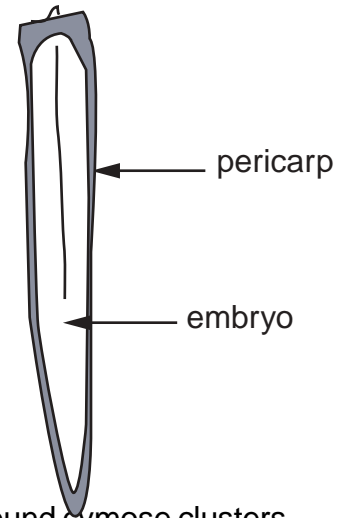


ASTERACEAE

CHRYSOTHAMNUS NAUSEOSUS SSP NAUSEOSUS (PALLAS EX PURSH) BRITT. (RUBBER RABBITBRUSH)

Distribution: AZ, CA, CO, ID, KS, MT, ND, NE, NM, NV, OK, OR, TX, UT, WA, WY:ALB, BC, SAS

Description: Densely leafy shrub, up to 2 m tall, often strong scented, with feltlike persistent, gray or whitish hairs, leaves 6.5 cm long. Found along or in saline washes or arroyo; on dry sites. Used for erosion control, animal browse, plant is poisonous to stock under certain conditions.



Flower and fruit: Yellow ray flowers in heads, clustered at ends of the branches, round cymose clusters. Usually 5 flowers per cluster, blooms in September. Fruit is achene, yellow-brown, 5-5.5 mm long with a pappus of hair 5-6 mm long, soft and white, matures October-December.

Seed: Achene is the "seed" of the analysis, 980-1,640 seed per g, normally narrow and hairy but hairs may get rubbed off in processing.

Laboratory analysis:

Purity – 3 g for routine analysis, sample usually contains pappus and fruit particles, 8-10 percent purity common.

Germination – No pretreatment needed, optimum temperature varies by subspecies; consimilis is best a 13-23C, subspecies Bigelovii is best at 20-30C. Other temperatures include: 13-30C, 17-25C and 23-30C. Light is not essential. Subspecies Bigelovii germinates faster than subspecies consimilis. First count at 7 days, last count at 14 days.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak seed 24 hrs. in water, cut 1-2 mm off flat end and squeeze out embryo with teasing needles, tease off inner seed coat, soak in 1 percent tetrazolium solution.

Radiographic – 12 KV, 30 sec. for Kodak AA film or Industrex paper, 12 KV, 75 sec. for Polaroid film. Filled and empty seed visible, also seed easily identified from trash.

Storage: Dry in cloth bags in unheated warehouse, viability good for 2 years.

Endangered species classification: Rare in OK, Subspecies Bigelovii endangered in TX.

Suggested references:

USDA, 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

ASTERACEAE

CHRYSOTHAMNUS VISCIDIFLORUS (HOOKER) NUTTALL (DOUGLAS RABBITBRUSH)

Distribution: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY:BC

Description: Small shrub usually less than 1 m, brittle twigs, white bark, minutely velvety with stiff spreading hairs, polymorphic species. Found along r in saline washes, open plains, foothills from sea level up to 3,300 m. Used for erosion control and animal browse.

Flower and fruit: Yellow ray flowers in a head, heads are clustered at ends of branches, broad cymes, each 5 flowered, blooms September. Fruit is achene, tan to golden brown, rigid pappus, 5 mm long, tawny, densely hairy, matures October-December.

Seed: Achene is the “seed” of the analysis, 1,720 per g, fruit coat thin, inner seed coat brown and papery, seed 3-4 mm long, different shapes.

Laboratory analysis:

Purity – 3 g for routine analysis, sample usually contains pappus and fruit or flower parts, 8-10 percent purity common.

Germination – Germinate at 30C, first count at 7 days, last count at 28 days, light may be beneficial, other temperatures used: 20C, 25C, and 17-22C. Average germination 60-90 percent.

Normal seedling – No data

Excised embryo – No benefit

Tetrazolium – Soak seed 2 hrs. in water, cut off 1-2 mm of flat end, squeeze out embryo with teasing needles, tease off inner seed coat or make cut near radicle, soak in 1 percent tetrazolium solution.

Radiographic – 12 KV, 30 sec. for Kodak AA film great loss of detail on Industrex paper and Polaroid film. Filled and empty seed visible, also seed easily identified from trash.

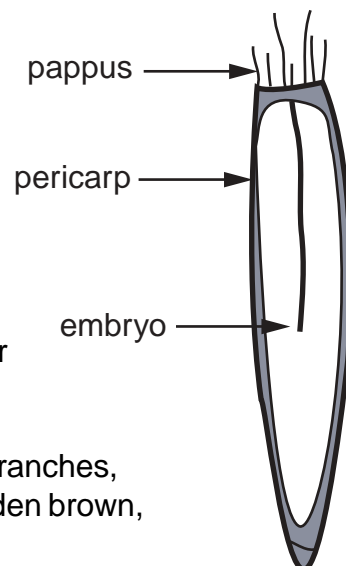
Storage: In cloth bags in unheated warehouse for up to 2 years.

Endangered species classification: None

Suggested references:

McDonough, W. T. 1969. *Effective Treatments for the Induction of Germination in Mountain Rangeland Species*. Northwest Sci. 43(1):18-22.

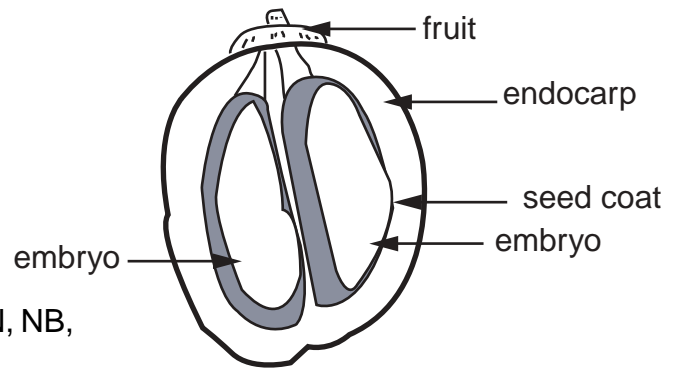
Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.



CORNACEAE

CORNUS SERICEA (L.) (SYNO: C. STOLONIFERA) (RED-OSIER DOGWOOD)

Distribution: AK, AZ, CA, CO, CT, IA, ID, IL, IN, MA, MD, ME, MI, MN, MT, ND, NE, NH, NJ, NM, NV, NY, OH, OR, PA, RI, SD, UT, VA, VT, WA, WI, WV, WY:ALB, BC, MAN, NB, NFLD, NS, ONT, QUE, SAS



Description: Small shrub, up to 4 m, leaves opposite, 13 cm long with 4-7 pairs of lateral veins, simple. Found along riverbanks from 1,200 to 3,000 m elevation. Used as an ornamental, birds feed on seed.

Flower and fruit: Small perfect white flowers are borne in terminal clusters and are surrounded by conspicuous enlarged involucre or 406 white petal-like bracts which most people think of as the flower. Blooms May-July. Fruit is a 2-celled, 2 seeded drupe, 7-9 mm diameter, lead white or slightly bluish in color, matures July to September.

Seed: 2-celled bony stone is the "seed", 30-48 per g, contains brown inner seed coat and an embryo surrounded by endosperm, embryo white but radicle may appear yellowish. Usually depulped but occasionally submitted with pulp dried onto a stone.

Laboratory analysis:

Purity – 50 g for routine analysis, usually very clean, 95+ percent purity, no noxious weeds.

Germination – Requires 120-160 day prechill at 3-5C followed by germination at 20-30C. First count at 7 days, last count at 28 days. Average germination 80-90 percent.

Normal seedling – Vigorous primary root, stout hypocotyl twice length or radicle, 2 cotyledons intact.

Excised embryo – Very difficult

Tetrazolium – Difficult but possible, cut end of stone to expose embryo cavities, soak in 1 percent tetrazolium solution for 24-48 hrs., cut lengthwise to evaluate.

Radiographic – 12 KV, 90 sec. for Kodak AA film or Industrex paper, 18KV, 150 sec. for Polaroid film. Filled, empty, and multiple cavities are easily visible.

Storage: Air dried stones stored in sealed containers at 3-5C for 2-4 years.

Endangered species classification: Var. Bailey is rare and endangered in IN.

Suggested references:

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA Forest Service, Washington, DC.

USDA. 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

ROSACEAE

COWANIA MEXICANA (D. DON) S.L. Welsh var. mexicana (SYNO: C. STANSBURIANA) (CLIFFROSE, QUININEBUSH)

Distribution: AZ, CA, CO, NM, NV, UT

Description: Spreading evergreen shrub up to 8 m, average 3.5 m, leaves deeply 3-cleft and wedge-shaped. Found on exposed rocky, well-drained areas, south facing slopes of mesas and canyons. Winter range browse for domestic livestock and big game animals and for landscaping.

Flower and fruit: Perfect, white to sulfur-yellow flowers from May to June (even into August in wet areas), floral tube 5 mm long, petals 8 mm long, 1 cm wide. Fruit is achene, tan to light brown, 3 mm long with a plumose style 25-50 mm long; borne in clusters of 4-10 on a flat disc, single seeded; matures July–August.

Seed: 140-210 per g, brown papery seed coat but tough, embryo white and not filled cavity, surrounded by thin endosperm.

Laboratory analysis:

Purity – 10 g for routine analysis, dry flower parts usually attached to fruit which were not removed in the processing. 100 g for noxious weed count.

Germination – Prechill 30 days at 3-5C, germinate at 10-25C, 10-30C or constant 13C, first count at 7 days, last count at 14 days, average germination is 80-100 percent, high germination also obtained by washing seed in water for 48 hrs. then a 30 min. soak in 30 percent hydrogen peroxide (contamination reduced to zero). Late developing crops are usually of poor quality. Fresh seed may not need prechill but germination will be slow without it.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Clip end, soak 2 hrs. in a 0.5 percent tetrazolium solution at 40C.

Radiographic – 12 KV, 30 sec. for Kodak AA film or Industrex paper, 12KV, 60 sec. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: Sealed containers at 4-6C, viability good for 5-7 years, no advantage of low temperature freezing, moisture content should be below 10 percent, viable up to 15 years in Utah experiment.

Endangered species classification: None

Suggested references:

Piatt, J. R. and H. W. Springfield. 1973. *Tetrazolium Staining of Cliffrose Embryos*. Proc. Aosa. 63:67-75.

Springfield, H. W. 1973. *Cliffrose and Mountain Mahogany Seeds Retain Viability 6 Years in Cold Storage*. Res. Pap. Rm-236, 2P. USDA, Forest Service, Albuquerque, NM.

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA

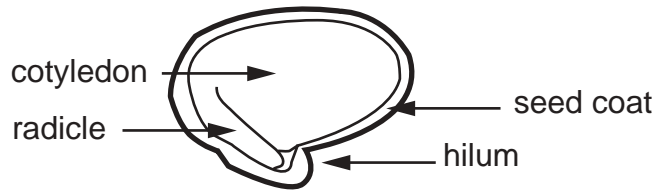
Forest Service, Washington, DC.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

Young, J.A. and R.A. Evans. 1981. *Germination of Seeds of Antelope Bitterbrush, Desert Bitterbrush and Cliffrose*. Agric. Rept. Apr-17. USDA, SEA, Oakland, CA

FABACEAE

DALEA PURPUREA VENTENAT (SYNO: PETALOSTEMON PURPUREUS) (PURPLE PRAIRIECLOVER)



Distribution: AL, AR, AZ, CO, IA, IL, KS, MI, MN, MO, MS, MT, ND, NE, NM, NV, NY, OK, SD, TN, TX, UT, WI, WY:ALB, MAN, ONT, SAS.

Description: Slender perennial forb, 30-60 cm tall, short branch-like leaves resembling tea leaves, compound with 3-5 narrow leaflets. Found in plains and prairies, mostly tall grass upland prairies 1,200-2,100 m. Livestock forage, boiled leaves used as a tea for creating constipation and relieving fever in measles, sprouts are edible.

Flower and fruit: Small purple to crimson flowers in dense cylindrical heads, terminal, blooms July-August. Fruit is legume, brown, matures August-September. Conotype purple seed head, 1-10 heads per plant, 1-2 seeded legume.

Seed: 660-770 per g, typical legume, tan, 1 mm by 1.5 mm embryo yellowish.

Laboratory analysis:

Purity – 4 g for routine analysis, 40 g for noxious weed count, samples contain broken seed and chaff and possibly the following weeds: chess, hedgemustard, bracted plantain, fescue, tumble grass, wild barley and nutgrass. Usually 80-90 percent pure.

Germination – Germinate at 20-30C or 15-25C, moist prechill for 10 days beneficial, also KNO₃, constant temperature of 20C also satisfactory, but will be slow germinating (3 or 4 months). Prechill can be replaced with 10-15 min. soak in concentrated sulfuric acid. First count at 7 days, last count at 21 days.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak in water overnight, clip cotyledon end exposing embryo tissue, place in a 1 percent tetrazolium solution, cut lengthwise to evaluate.

Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper, 12KV, 1.5 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: Endangered in MI, Rare in IA and ONT, special concern species in MN, Rare and endangered in MS.

Suggested references:

Smith, J. R. and B. S. Smith. 1980. *The Prairie Garden*. The University of Wisconsin Press, Madison, WI. 219P.

ELAEAGNACEAE

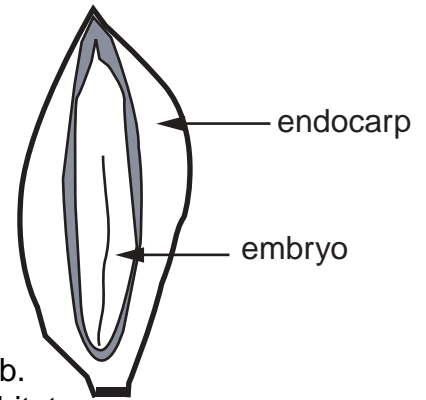
ELAEAGNUS COMMUTATA BERNHARDT (EX. RYDBERG) (SILVERBERRY, WOLFBERRY, WOLF WILLOW)

Distribution: AK, CO, ID, MN, MT, ND, OK, SD, UT, WY:ALB, BC,
MAN, ONT, QUE, SAS

Description: Deciduous shrub, 3.6 m high, alternate leaves with minute silvery scale on both surfaces giving a silvery-gray appearance to the shrub.

Found on gravel benches and in water courses; a species of disturbed habitats.

Used as an ornamental, erosion control, wildlife food and found as a rangeland weed. An important nitrogen-fixing shrub.



Flower and fruit: Small perfect inconspicuous flowers, fragrant, 1-3 in leaf axils, blooms June-July. Fruit is a drupaceous achene, on very short stalks. Mealy, 12 mm diameter, silvery. Achene striated, 1-seeded, matures August-September.

Seed: 8-10 per g, 9 mm long, very thick pericarp with lining of fine white hairs, inner seed coat brown and papery, embryo filling cavity, large cotyledons.

Laboratory analysis:

Purity – 250 g for routine analysis, no noxious weed seed, usually very clean.

Germination – Soak 96 hours in running water, germinate at 20C, first count at 7 days, last count at 21 days, average germination 80-90 percent. The endocarp possess a germination inhibitor, prechill has not been shown to be beneficial. Germination is proportional to the duration of leaching. 20-30C also satisfactory.

Normal seedling – Vigorous primary or secondary root, as long as hypocotyl; hypocotyl stout, green; 2 intact cotyledons, thick and green.

Excised embryo – Soak in running water for 96 hrs., cut radicle end and germinate, test complete in 10 days; can also remove embryo completely and avoid water soak.

Tetrazolium – Soak seed in water 48-96 hrs., cut both ends until the embryo is visible, put seed in 1 percent tetrazolium solution for 2-3 days; excised embryo stains in 16 hrs. or less.

Radiographic – 12 KV, 120 sec. for Kodak AA film and Industrex paper, 18KV, 3 min. for Polaroid film. Filled, empty, and abnormal development visible, not much detail on embryo.

Storage: Dry in sealed containers at 3-10C for 1-2 years.

Endangered species classification: Watch list in ID, possible extirpated in UT, Rare in QUE.

Suggested references:

Corns, W. G. and R. J. Schraa. 1962. *Dormancy and Germination of Seeds of Silverberry (Elaeagnus Commutata)*. CAN. J. Bot. 40:1051-1055.

King, P., G. Grainger and A. Straka. 1983. *Testing of Seed Pre-Germination Treatments for Selected Native Shrub Species*. ENR Report No. T/43. Alberta Energy and Natural Resources Information Centre, Edmonton, Alberta, Canada.

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDS, Forest Service, Washington, DC.

EPHEDRACEAE

EPHEDRA NEVADENSIS S. WATSON (NEVADA MORMAN-TEA, GRAY EPHEDRA)

Distribution: AZ, CA, ID, NM, NV, OR, TX, UT

Description: Spreading erect shrub, 1.2 m tall, scale-like leaves and jointed stems, leaves in twos common on dry slopes and hills mostly below 1,350 m, margin of salt deserts. Serves as ground cover, browse species, and source of drug ephedrine.

Flower and fruit: Female flowers 3-4 mm long, yellow to light brown; male flowers 3-5 mm long, light brown to yellowish-green, blooms in Spring. Fruit is a cone, light brown, roundish, 5-11 mm long, matures in summer.

Seed: 58 per g, paired, smooth, brown, 6-9 mm long, flat on one side, humped on other, inner seed coat brown and leathery.

Laboratory analysis:

Purity – 55 g for routine analysis.

Germination – Requires 21 days prechill at 3-5C germinate at 20C, first count at 7 days, last count at 21 days. Average germination 80-100 percent. Other effective temperatures: 5C, 10C, 15C, 20-25C. Also recommended is a 24 hr water soak at 30C prior to prechill.

Normal seedling – Vigorous root, sturdy hypocotyl with no breaks or lesions, gray-green color and linear cotyledons like conifer seedling, no breaks.

Excised embryo – No data

Tetrazolium – Soak overnight in water, clip cotyledon end or cut longitudinal; place in 1 percent tetrazolium solution; cut lengthwise to evaluate.

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper, 12KV, 2.5 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data, very short in laboratory.

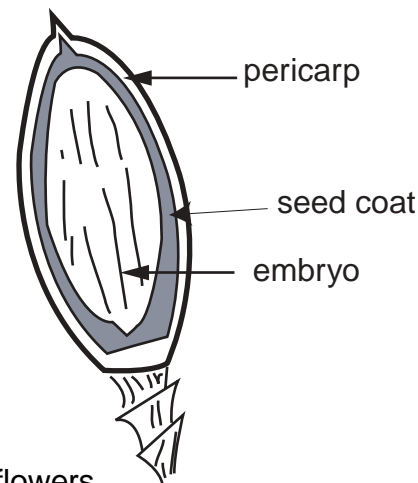
Endangered species classification: Special concern in OR.

Suggested references:

Graves, W. L., B. L. Kay and W. A. Williams. 1975. *Seed Treatment of Mojave Desert Shrubs*. Agron. Jour. 67(6):773-777.

USDA. 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

Young, J. A., R. A. Evans and B. L. Kay. 1977. *Ephedra Seed Germination*. Agron. Jour. 69:209-211.

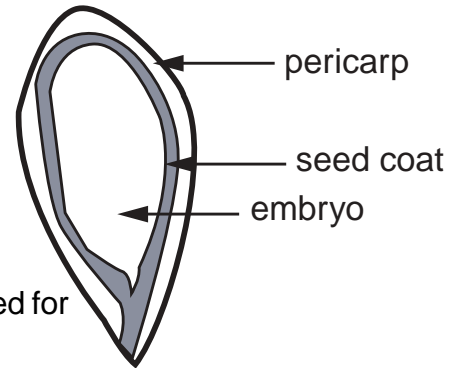


EPHEDRACEAE

EPHEDRA VIRIDIS COVILLE (GREEN MORMAN-TEA)

Distribution: AZ, CO, NM, NV, OR, UT, WY

Description: Evergreen shrub 50-100 cm high with numerous broom-like yellow-green scabrous slender branchlets, leaves opposite, 4 mm long. Found on rocky slopes and canyon walls (900-2,250 m) used for landscaping and disturbed land revegetation.



Flower and fruit: Blooms in June and July producing a cone, brown 6-10 mm long with 4-8 pairs of ovate bracts. Seed matures July-September.

Seed: 35-55 per g, brown trigonal, smooth, 5-8 mm long.

Laboratory analysis:

Purity – 55 g for routine analysis.

Germination – Germinate at 5-15C or 5-25C, first count at 7 days, and last count at 14 days, average germination 50-70 percent, germination may be increased by a period of afterripening following maturity, 30 day prechill may improve some lots.

Normal seedling – Vigorous root, sturdy hypocotyl with no breaks or lesions, green color, multiple cotyledons, looks like a conifer seedling.

Excised embryo – No data

Tetrazolium – Soak overnight in water, clip cotyledon end or cut longitudinal; place in 1 percent tetrazolium solution; cut lengthwise to evaluate.

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper, 12KV, 2 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: Dry at 2C for up to 5 years, stored 15 years in Utah experiment without loss of viability but found fairly fast loss of viability at room temperature.

Endangered species classification: Special concern in OR, rare in WY.

Suggested references:

Emery, D. 1964. Seed Propagation of Native California Plants. Leaflet of the Santa Barbara Botanic Garden 1(10):81-96.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

Young, J. A., R. A. Evans and B. L. Kay. 1977. *Ephedra Seed Germination*. Agron. Jour. 69:209-211.

POLYGONACEAE

ERIOGONUM CORYMBOSUM BENTHAM (BUCKWHEAT)

Distribution: AZ, CO, NM, NV, OR, UT, WY

Description: Forb, 1 m high, leaves in basal rosettes, branches hairy. Found on the dry plains and foothills of the grass and pinyon belts, 1,500-2,100 m elevation.

Flower and fruit: Small perfect flowers May to July, Inflorescences 5-20 cm long, along and near end of branches, perianth campanulate. Fruit is an achene, brown to black, 3-angled, shining and enclosed by a persistent calyx, ripens June-August.

Seed: Achene is "seed" of analysis, embryo is bright yellow, embedded in endosperm, cotyledons are curled, long radicle. Seed is 2-3 mm long and 1 mm wide. About 2000 per g.

Laboratory analysis:

Purity – 2 g for routine analysis, 20 g for noxious weed count.

Germination – 20-30C, first count at 7 days, last count at 21 days. Average germination is 20-40 percent.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, remove seed coat, place in 1 percent tetrazolium solution. Cut lengthwise to evaluate.

Radiographic – 12 KV, 30 sec. for Kodak AA film, Industrex paper and Polaroid film lose too much detail. Only filled and empty determination can be made.

Storage: No data

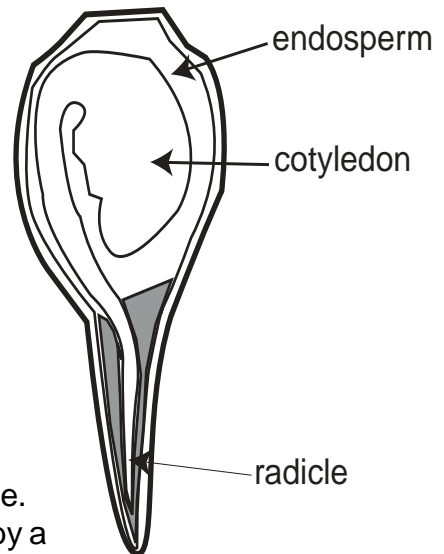
Endangered species classification: Rare in WY.

Suggested references:

Emery, D. 1964. *Seed Propagation of Native California Plants*. Leaflet Santa Barbara Bot. Garden

ROSACEAE

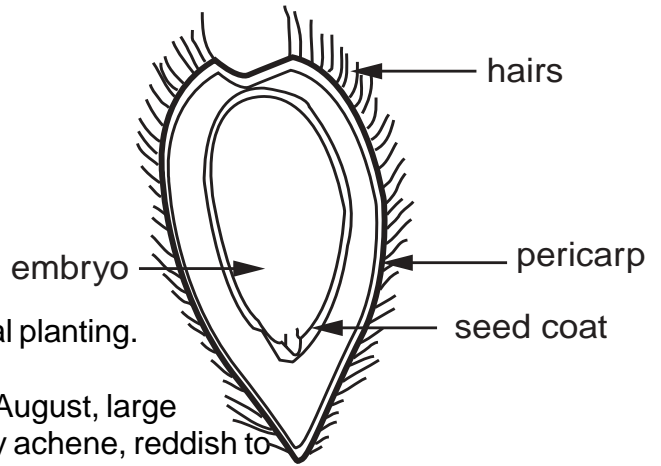
(10):92.



**FALLUGIA PARADOXA (D. DON) ENDLICHER
(APACHE-PLUME, PONIL)**

Distribution: AZ, CA, CO, NM, NV, OK, TX, UT

Description: Many-branched evergreen shrub 50-150 cm high, found along dry arroyos of desert or on rocky or gravelly slopes at 2,400 to 2,700 m. It is a forage plant for domestic and wild animals, erosion control and ornamental planting.



Flower and fruit: Perfect white flowers are produced April-August, large rose like, singly or in clusters on long stalks. Fruit is a hairy achene, reddish to black in color, flat with fine hairs around the edge, 3-5 mm long and 3 mm wide, with a plumose style 25-38 mm long, matures June-July in CA, August-November in NV.

Seed: Achene is the “seed” of analysis, the real seed is loose in the fruit, gray-brown seed coat containing a flat embryo. 925-1,280 achene per g.

Laboratory analysis:

Purity – 1 g for routine analysis. Styles are usually broken in processing, samples are often 90+ percent purity.

Germination – Constant 20C or 22C, first count at 7 days, last count at 14 days, other temperatures: 16-20C, 16-25C, 11-16C, and 16-30C. Light not essential, moist prechill for 30 days at 3-5C may be helpful, usually none required. Average germination 80-100 percent.

Normal seedling – About 2 mm tall, hairy, moderately large green cotyledons and epicotyl evident, radicle more than twice length of hypocotyl, long and thin with occasional long laterals, hypocotyl hairy.

Excised embryo – No data

Tetrazolium – Soak in water overnight, clip seed coat to expose embryo, place in 1 percent tetrazolium solution, cut lengthwise to evaluate.

Radiographic – 12 KV, 30 sec. for Kodak AA film. Too much detail lost on Industrex paper and Polaroid film. Only determination is filled and empty seed. Can also separate seed from trash.

Storage: Store dry in cloth or burlap bag in ventilated warehouse, viability good for 2-3 years. 7-12 percent moisture recommended.

Endangered species classification: Rare in OK.

Suggested references:

Emery, D. 1964. *Seed Propagation of Native California Plants*. Leaflet Santa Barbara Botanic Garden 1(10):81-96.

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDS, Forest Service, Washington, DC.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

OLEACEAE

FORESTIERA NEOMEXICANA A. GRAY (DESERT-OLIVE)

Distribution: AZ, CA, CO, NM, NV, TX, UT

Description: Deciduous shrub, 1-3.5 m high, leaves 4 cm long, opposite. Found on slopes and ridges below 2,010 m.

Flower and fruit: Flowers developing before leaves, no petals, yellowish, in clusters or racemes, axillary on the branches of the preceding year, blooms March-April. Fruit is a drupe, blue-black, 6-8 mm long, ellipsoid, stone grayish with cream to white vein-like longitudinal stripes. Matures in summer.

Seed: Stone 4-5 mm long by 3 mm wide, embryo straight in cavity in endosperm, inner seed coat brown. 80 per g.

Laboratory analysis:

Purity – 30 g for routine analysis, no noxious weeds present.

Germination – Prechill 30 days at 3-5C, germinate at 20-30C. Average germination is 50-70 percent.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak seed 24-48 hours, cut lengthwise off-center (the seed coat is hard), soak embryo with inner seed coat overnight, scratch or cut inner seed coat to expose embryo and place in a 1 percent tetrazolium solution, slice lengthwise to evaluate.

Radiographic – No data

Storage: Dry

Endangered species classification: None

Suggested references:

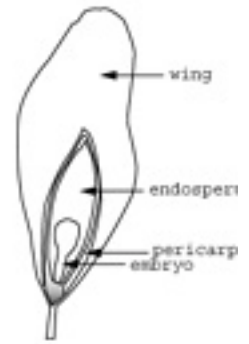
Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

OLEACEAE

FRAXINUS ANOMALA TORREY (EX. S. WATSON) (SINGLELEAF ASH, DWARF ASH)

Distribution: AZ, CA, CO, ID, NM, NV, UT

Description: Shrub, 2-8 m high, branchlets slightly winged, leaves usually of one broad-ovate leaflet, 6 cm long. Found in dry canyons and gulches from 900 to 3,300 m. Used in landscaping.



Flower and fruit: Small inconspicuous flowers, no petals, blooms in the spring. Fruit is a samara, golden-brown, 12-25 mm long and 5-8 mm wide, single-seeded, matures July-September.

Seed: Samara is "seed" of analysis, 50 per g, large white embryo embedded in bluish-gray endosperm, inner seed coat rough, thick and brown.

Laboratory analysis:

Purity – 50 g for routine analysis.

Germination – Prechill 60-90 days at 3-5C, germinate at 20-30C.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, cut across base of wing and gently squeeze out embryo, cut embryo lengthwise off-center, place in 1 percent tetrazolium solution, slice lengthwise for evaluation.

Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper; 12KV, 75 sec. for Polaroid film. Filled, empty, insect infestations and abnormal development visible.

Storage: Viability reported to last 2-3 years with air dried storage.

Endangered species classification: Variety *Lowellii* classified 3C on federal list.

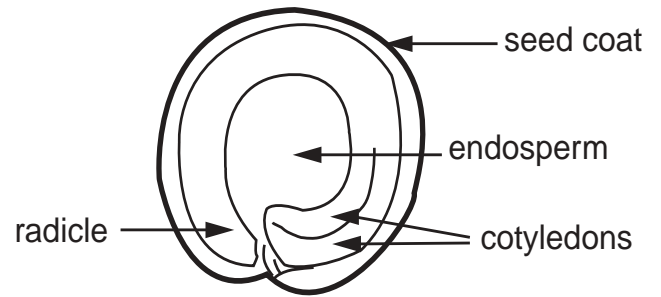
Suggested references:

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

CHENOPODIACEAE

GRAYIA SPINOSA (HOOKER) MOQUIN (SYNO: CHENOPODIUM SPINOSUM) (SPINY HOPSAGE, HORSEBRUSH)

Distribution: AZ, CA, CO, ID, MT, NV, OR, UT, WA, WY



Description: Low shrub, 30-100 cm, alternate, fleshy, entire leaves, spine-tipped branches, gray-green in color. Found in alkaline soils from 750 to 2,100 m, margin of salt desert. Associated with *Yucca Brevifolia*. Important browse species for winter forage for deer, livestock and sheep.

Flower and fruit: Male and female flowers on separate plants in terminal and axillary spikelike clusters from April to June. Fruit is a utricle, whitish tinged with red, winged bracts pressed very thin, 5-12 mm long contains a single nutlet, matures July-August.

Seed: 340-930 seed per g (avg. 500), flat, reddish-brown to black, 2 mm diameter, embryo white with yellowish cotyledons curved around translucent endosperm, brown inner seed coat adheres to outer seed coat.

Laboratory analysis:

Purity – 5 g for routine analysis, 50 g for noxious weed count.

Germination – Germinate at 5-15C, first count at 7 days, last count at 14 days. Germinates easily with high percentages. Other temperatures reported include: 5-30C, 5-10C, 5-20C and 5-25C. Prechill may be needed for some sources of fresh seed, prechill needs decrease with age of seed.

Normal seedling – Hypocotyl thin, 1-1.5 cm high with small green cotyledons, evidence of an epicotyl, root as long as hypocotyl, no branch or lateral roots but may possess root hairs.

Excised embryos – No data

Tetrazolium – No data

Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper, 12KV, 60 sec. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: Store cool and dry, viability good for 2-6 years.

Endangered species classification: Rare in AZ.

Suggested references:

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDS, Forest Service, Washington, DC.

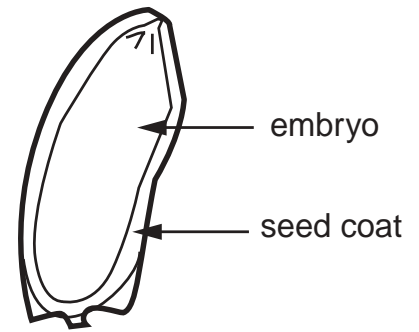
Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

Wood, M. K., R. W. Knight and J. A. Young. 1976. *Spiny Hopsage Germination*. Jour. Range Mgt. 29(1):53:56.

ASTERACEAE

GRINDELIA SQUARROSA (PURSH) DUNAL (CURLYCUP GUMWEED)

Distribution: AL, AR, AZ, CA, CO, CT, DE, IA, ID, IL, IN, KS, MA, MI, MN, MO, MS, MT, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, SD, TX, UT, WA, WI, WY:ALB, BC, MAN, NFLD, ONT, SAS



Description: Erect forb branching near the top, stiff and somewhat sticky plant, leaves oblong, tooth-edged, thick, coarse, alternate and folding around the stem, 3-7 cm long. Found on the plains and prairies, invader of native ranges up to 1,800 m, pest in tame pastures, secretions used by Indians for medicine, boiled tops used to cure saddle sores, provides modern medicine ingredients for whooping cough and asthma. Considered a compass plant.

Flower and fruit: 2 cm head of many florets, heads surrounded by small pointed bracts that curl outward and give off a sticky substance, the disc is 0.8-2 cm broad, dark center and yellow ray flowers, blooms June to September. Fruit is an achene, tan to straw in color, short, thick, truncate, glabrous, oblong, 2-3 mm long and 0.7-1.5 mm wide, striate, awns 2-8, 3-5 mm long, matures July to October.

Seed: 1,670 per g., achene is "seed" of analysis, inner seed coat golden brown and papery, embryo yellowish and filling cavity.

Laboratory analysis:

Purity – 2 g for routine analysis, 20 g for noxious weed count.

Germination – No pretreatment necessary, germinate at 20-30C or 17-22C, first count at 3 days, last count at 7 days, seed in the central part of the head germinate best, the peripheral seed do best at 17-22C, but are usually lower in viability.

Normal seeding – No data

Excised embryo – No benefit

Tetrazolium – Cut across flat top or lengthwise on edge of seed, open seed coat and remove embryo, cut or remove inner seed coat, place embryo in 1 percent tetrazolium solution.

Radiographic – 12 KV, 20 sec. for Kodak AA film and Industrex paper, 12KV, 45 sec. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: Rare and endangered in IN; Var. Serrulata rare in SAS.

Suggested references:

McDonough, W. T. 1969. *Effective Treatments for the Induction of Germination in Mountain Rangeland Species*. Northwest Sci. 43(1):18-22.

CHENOPODIACEAE

HALOGETON GLOMERATUS (M. Bieb.) C.A. MEYER (HALOGETON)

Distribution: CA, CO, ID, MT, NM, NV, OR, UT, WY

Description: Annual forb, 0.5-5 dm much branched leaves, sessile, 1-2 cm long, fleshy, cylindrical to slightly angled. Found on saline plains, burned-over areas and overgrazed ranges, roadsides. Poisonous to stock due to soluble oxidates in plant tissue. Noxious weed in most states.

Flower and fruit: Inconspicuous greenish-yellow flowers in 2-forms, sepals of some enclosing seed by their claws, the other leathery with tips reduced to tooth-like appearances, blooms June-September. Fruit is a utricle, ovoid, thin-walled, numerous seeds of two types. Matures July-October.

Seed: 4,000 per g, vertical, black seed of late summer have winged bracts, brown seed of early summer are flattened, with coiled embryo, 1 mm across, embryo waxy, yellowish-green and coiled in 3-tier, appearing as dark center.

Laboratory analysis:

Purity – 1 g for routine analysis.

Germination – Black seed all germinate the first season after production; brown seed are dormant and remain viable in soil for years. Germination can be improved with a 20-day prechill, germinate at 20-30C, first count at 3 days, last count at 7 days. Without prechill germination will take 90 days plus.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Puncture center with sharp needle, soak overnight in water, place in 1 percent tetrazolium solution. Hold seed on edge with forceps and slice lengthwise to evaluate.

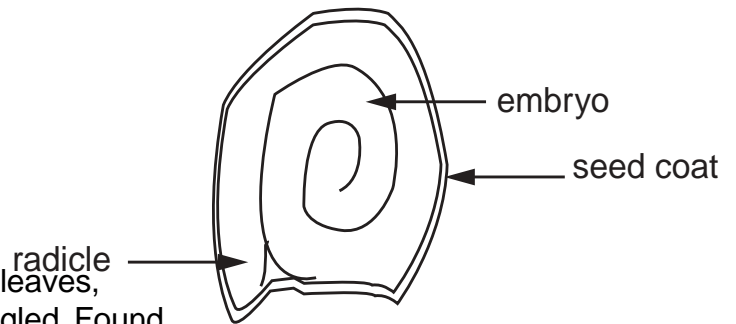
Radiographic – 12 KV, 20 sec. for Kodak AA film, too much loss of detail for Industrex paper or Polaroid film. Filled and empty seed and coils of embryo easily seen.

Storage: No data

Endangered species classification: None, Noxious weed in: CA, CO, HI, ID, MT, NM, NV, OR, UT, WA.

Suggested references:

Cronin, E. H. 1973. *Pregermination Treatment of Black Seed of Halogeton*. *Weed Sci.* 21(2):125:127.
Robocker, W. C., M. C. Williams, R. A. Evans and P. J. Torell. 1969. *Effects of Age, Burial, and Region on Germination and Viability of Halogeton Seed*. *Weed Sci.* 17(1):63-65.

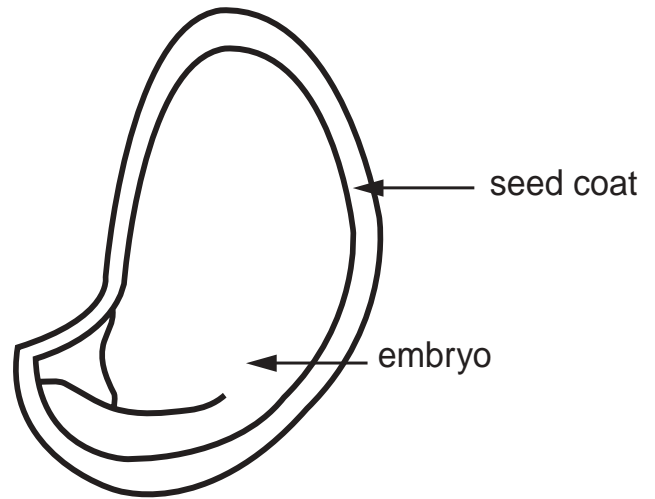


FABACEAE

HEDYSARUM BOREALE NUTTALL (NORTHERN SWEETVETCH, BOREAL SWEETVETCH)

Distribution: AK, AZ, CO, ID, MT, ND, NM, OK, OR,
SD, TX, UT, WA, WY:ALB, BC, MAN, NFLD, QUE, SAS

Description: Forb with odd-pinnate leaves, produces many stems from a heavy crown; highly variable species subdivided on quantity of pubescence and flower size. Found on calcareous rocks and gravel.



Flower and fruit: Typical legume flowers, pink or magenta, 1-1.5 cm long, in racemes, 5-50 flowered flowers longer than broad, blooms June-August, fruit is a legume, straw colored, matures September, flattened, composed of several equal-sided separable roundish articles connected in the middle.

Seed: Red-brown to black, typical legume, 3 mm diameter, 113 seed per g.

Laboratory analysis:

Purity – 20 g for routine analysis, 200 g for noxious weed count.

Germination – Germinate at 15-25C, first count at 7 days, last count at 21 days.

Normal seedling – Cotyledons egg-yellow, ovate 6-8 mm long, thickened; hypocotyl thickened, white, radicle vigorous and white.

Excised embryo – No data

Tetrazolium – Clip end of seed exposing embryo, soak overnight in water, place in 1 percent tetrazolium, slice lengthwise through hilum to evaluate.

Radiographic – 12 KV, 20 sec. for Kodak AA film and Industrex paper, 12KV, 60 sec. for Polaroid film. Filled, empty, and abnormal development visible in winged fruit.

Storage: 16 percent germination after 15 years in Utah tests.

Endangered species classification: Review list in OR, Var Gremiale possibly threatened in UT.

Suggested references:

Redente, E. F. 1982. *Sweet-Vetch (Hedysarum Boreale Var. Boreale) Seed Germination*. Jour. Range Mgt. 35(4):469-472.

Watson, L. W., R. W. Parker and D. F. Polster. 1980. *Manual of Species Suitability for Reclamation in Alberta: Vol. 2-Forbs, Shrubs, and Trees*. Report No. RRTAC 80-5, 541P. Alberta Land Conservation and Reclamation Council, Edmonton, Alberta, Canada.

ASTERACEAE

HELIANTHUS MAXIMILIANII SCHRADER (MAXIMILIAN SUNFLOWER)

Distribution: AR, CA, CO, CT, IA, IL, IN, KS, MA, ME, MI, MN, MO, MT, NC, ND, NE, NY, OH, OK, PA, SD, TN, TX, UT, VA, WI, WV, WY:ALB, BC, MAN, ONT, QUE, SAS

Description: Simple stem forb, leaves numerous, alternate, thick and firm, scabrous. Found in rich prairies and river valleys, 1,200-2,100 m. Provides game browse.

Flower and fruit: Yellow flowers, involucre bract longer than height of disk, disk 2-3 cm broad, ligules concave 2.5-4 cm long. Fruit is an achene, black to black and gray mottled, narrow, glabrous, 4-5 mm long by 1.5 mm wide.

Seed: Achene is "seed" of analysis, 445 seed per g, inner seed coat thin and papery, adheres to fruit coat, embryo filling cavity.

Laboratory analysis:

Purity – 6 g for routine analysis, 60 g for noxious weed count.

Germination – Germinate at 20-30C, first count at 7 days, last count at 14 days, constant 15C proved beneficial in some lots. Average germination 70-80 percent.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Slice seed lengthwise at edge of seed, turn cut edge up and pry apart with fingernails or teasing needles, remove embryo, soak 2 hrs. in water, tease off inner seed coat, place in 1 percent tetrazolium solution.

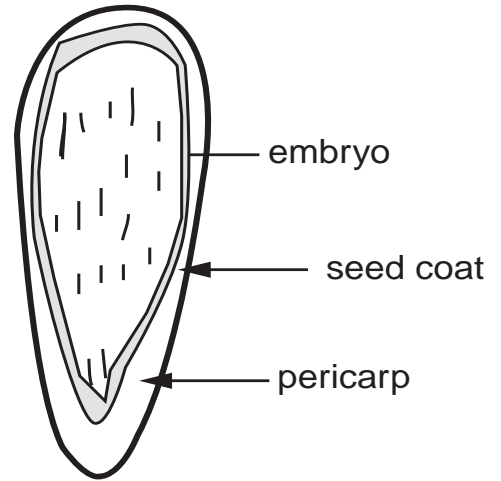
Radiographic – 12 KV, 20 sec. for Kodak AA film or Industrex paper, 12KV, 60 sec. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: Rare and endangered in IN; special concern species in MN.

Suggested references:

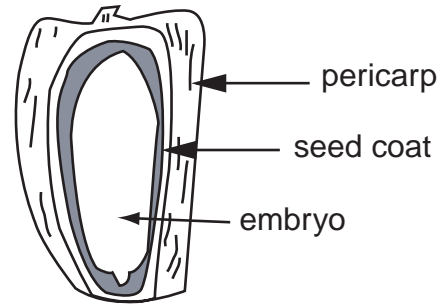
None



ASTERACEAE

HELIOPSIS HELIANTHOIDES (LINNAEUS) SWEET (SUNFLOWER HELIOPSIS, OX EYE)

Distribution: AL, AR, CT, DE, GA, IA, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NJ, NM, NV, NY, OH, OK, PA, SC, SD, TN, TX, VA, VT, WI, WV:BC, MAN, NFLD, ONT, QUE, SAS



Description: Forb, tall upright perennial similar to sunflower in general appearance, rough stems, leaves simple, opposite, short-petioled or nearly sessile, distinctly dentate on margin. Found on prairies, glades, dry woods and waste ground. Forage for livestock when young and tender growth.

Flower and fruit: Ray flowers yellow, center brown to gold, many heads on plants each singular and terminal, involucre bract 3-6 mm, disk 1-1.6 cm high and 1.7-2.5 cm broad, ligules linear-oblong, 5-8 mm board, blooms July-September. Fruit is an achene, black, glabrous, 4-5 mm long, 2-4 obscure teeth, 4-angular, truncate.

Seed: About 500 per g, achene "seed" of analysis, inner seed coat adhering to fruit coat, embryo waxy.

Laboratory analysis:

Purity – 5 g for routine analysis, 50 g for noxious weed count.

Germination – No data

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Cut 1-2 mm off flat end of seed or slice lengthwise at edge, soak 2 hrs. in water, remove embryo and tease off transparent inner seed coat, place in 1 percent tetrazolium solution.

Radiographic – 12 KV, 20 sec. for Kodak AA film and Industrex paper, 12KV, 60 sec. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: Var. Scabra is rare in SAS.

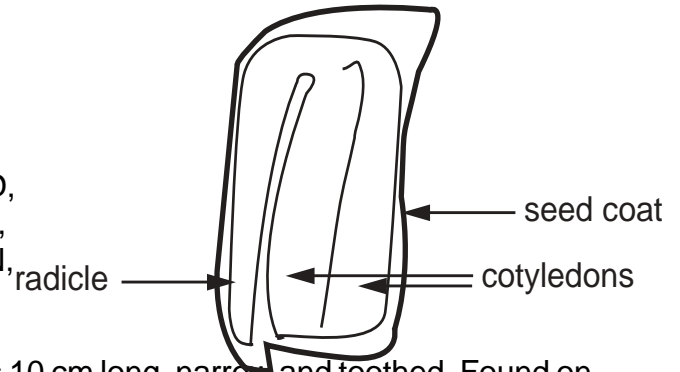
Suggested references:

Crawford, H. S., C. L. Kucera and J. H. Ehrenreich. 1969. *Ozark Range and Wildlife Plants*. Agri Handbook No. 356, 236P. USDA, Forest Service, Washington, DC.

BRASSICACEAE

HESPERIS MATRONALIS L. (DAMES ROCKET, DAMES-VIOLET)

Distribution: AR, CO, CT, DE, IA, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MT, NC, ND, NE, NH, NJ, NY, OH, OR, PA, RI, SD, TN, UT, VA, VT, WI, WV, WY:ALB, BC, MAN, NB, NFLD, NS, ONT, QUE, SAS



Description: Tall biennial or perennial forb, 9 dm, leaves 10 cm long, narrow and toothed. Found on roadsides, thickets and in open woods. Cultivated as an ornamental, escaped cultivation.

Flower and fruit: Large purple flower, 12 mm across, blooms May-August. Fruit is a slender and nearly cylindrical silique 5-14 cm long, matures July-September.

Seed: Red-brown, 3-4 mm long by 1-1.5 mm wide, in one row in each locule, oblong, marginless, 500 per g, cotyledons incumbent, embryo bent over, completely filling the cavity.

Laboratory analysis:

Purity – 5 g for routine analysis, 50 g for noxious weed count.

Germination – No data

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak seed overnight in water, remove seed coat or puncture with a needle, place in 1 percent tetrazolium solution (in trials, the ends of the cotyledons would not stain).

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper, 12KV, 2 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: None

Suggested references:

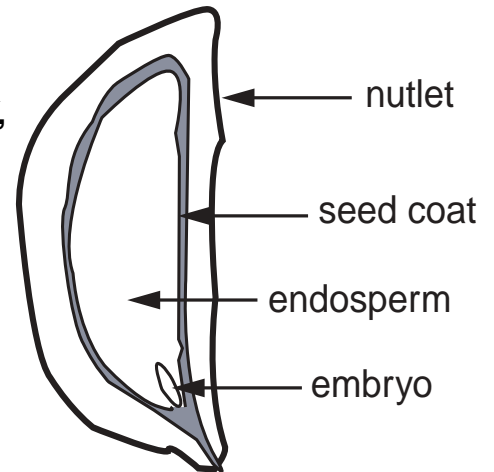
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AQUIFOLIACEAE

ILEX VOMITORIA SOLIEX AITON (YAUPON, CASSENA HOLLY, CHRISTMASBERRY)

Distribution: AL, AR, FL, GA, LA, MS, NC, OK, SC, TX, VA

Description: Evergreen shrub, leathery, dark green and lustrous above, pale below, 13-51 mm long, 8-15 mm wide, toothed, 7.6 m tall. Grows in moist sandy soils of coastal-plain forests. Food for deer, small game and songbirds, considered a weed by cattle growers because it competes with forage grasses, tea is prepared from leaves for emetic properties.



Flower and fruit: Small flowers in nearly sessile clusters, white, blooms in April on previous years growth, fruit is a bright red drupe, 6 mm diameter with 4 pale amber seeds, each 4 mm long, matures October-December.

Seed: 80 per g, amber to cream color with 5 striate lighter colored stripes on one side, wedge-shaped, inner seed coat light brown, outer coat very hard, bony, embryo very small, embedded in endosperm.

Laboratory analysis:

Purity – 30 g for routine analysis, no noxious weeds

Germination – There is no good direct germination test, prechill seed 6 months or longer prior to germination, seed germinate second year in the nursery.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak 24-48 hrs. in water, seed coat is very hard but it can be cut after soaking, cut across seed to remove one-third to one-half of cotyledon end of the seed, place in 1 percent tetrazolium solution, cut lengthwise to expose tiny embryo for evaluation.

Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper, 12KV, 3 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: Dry storage at 3-5C recommended.

Endangered species classification: Rare in OK.

Suggested references:

Hall, L. K. 1977. *Southern Fruit-Producing Woody Plants Used by Wildlife*. Gen. Tech. Report SO-16, 235P. USDA, Forest Service, New Orleans, LA.

Muir, J. 1965. *The Holly Growers*. Farm Q. 20(4):44-45, 133-134.

USDA. 1974. *Seeds of the Woody Plants of the United States*. Agri. Handbook No. 450, 883P. USDA,

POLEMONIACEAE

IPOMOPSIS AGGREGATA (PURSH) V. GRANT (SYNO: GILIA AGGREGATA) (SCARLET GILIA, SKYROCKET)

Distribution: AZ, CA, CO, IA, ID, MT, NM, NV, OR, TX, UT,
WA, WY:ALB, BC

Description: Forb, 6 dm high, leaves 5 cm long, pinnate
ly dissected into linear segments. Found on open sandy
flats, rocky ridges at 1,050 to 3,090 m.

Flower and fruit: Long thyrse-like panicles or red, yellow, pink or white flowers, corolla campanulate. Fruit
is a capsule, 3-celled.

Seed: 1,200 per g, long slender, curved, gray-brown, irregular-shaped, embryo waxy appearing,
surrounded by grainy endosperm.

Laboratory analysis:

Purity – 2 g for routine analysis.

Germination – No data

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, clip cotyledon end of seed (soaking will make the
covering of the seed coat gelatinous), soak in 1 percent tetrazolium solution, gently squeeze out
embryo for evaluation. Only embryo stains.

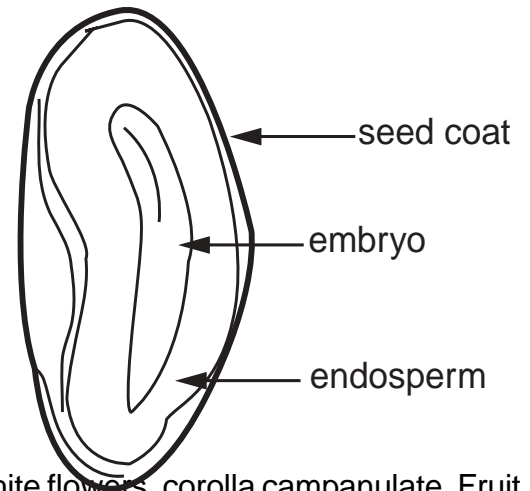
Radiographic – No data

Storage: No data

Endangered species classification: Protected by state in NM.

Suggested references:

None

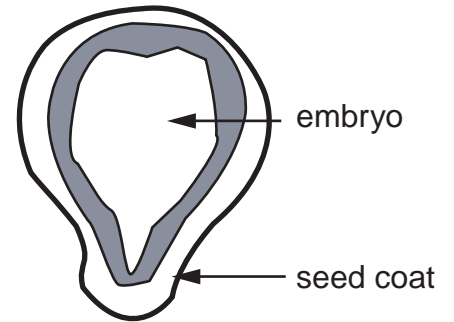


ASTERACEAE

IVA ANNUA (L.) (SYNO: I. CILIATA) (SUMPWEED)

Distribution: AR, FL, IA, IL, IN, KS, KY, LA, MO, MS, ND, NE, NM, OH, OK, SC, TX, WI, WV

Description: Annual forb, hairy, upright, freely branching, leaves opposite with short stems, egg-shaped, pointed edges, coarsely toothed, has a ragweed odor. Found on wet to moist areas. Indicator of abused native range and weed on low-vigor tame pasture, eaten by livestock under heavy grazing pressure.



Flower and fruit: Heads in dense spikes with conspicuous rough involucre bracts, several flowers, not radiate. Fruit is an achene, greenish, seed heads 5-20 cm long on terminal branches, floret enclosed by harsh hairy bracts, matures August-October.

Seed: Black, shaped like a seashell, 3 ribs, 1,300 per g, seed coat thick.

Laboratory analysis:

Purity – 2 g for routine analysis.

Germination – No data

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Slice off 1 mm or less of pointed edge and each side of point, turn seed on back and separate seed coat with a pair of teasing needles, soak 2 hrs. in water, tease off transparent inner seed coat or break at radicle, soak in 1 percent tetrazolium solution.

Radiographic – No data

Storage: No data

Endangered species classification: None

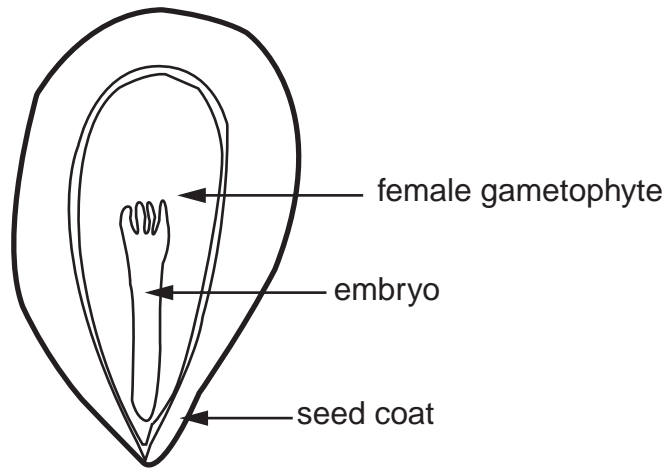
Suggested references: None

CUPRESSACEAE

JUNIPERUS OSTEOSPERMA (TORREY) LITTLE (UTAH JUNIPER, BIGBERRY JUNIPER, WESTERN JUNIPER)

Distribution: AZ, CA, CO, ID, MT, NM, NV, UT, WY

Description: Evergreen shrub, sometimes a tree, leaves small, scalelike, appressed, produces cones that require 2 years to mature. Used for timber production, habitat and food for wildlife, shelterbelt planting and ornamental.



Flower and fruit: Female flowers yellow, male flowers green, short catkins, blooms March-April, female composed of 3-8 pointed scales bearing 1 or 2 ovules each. Fruit is an indehiscent strobile called a “berry”, reddish-brown, glaucous, scales fused to form a berrylike fruit, leathery or mealy when mature, September of second year.

Seed: 10 per g, buff colored with reddish-brown coating on one end, angled with longitudinal pits, 4-7 mm long by 4 mm wide, round on one end and beveled to the suture on the other, very hard seed coat, requires a hammer to crack, dark brown inner seed coat, leathery, endosperm covered by a light brown papery seed coat, embryo embedded in endosperm, many seed have no embryo, only an empty cavity in the endosperm.

Laboratory analysis:

Purity – 250 g for routine analysis, no noxious weed present, usually very clean.

Germination – 45 days stratification at room temperature followed by 120 days prechill at 3-5C, then germinate at 15C, first count at 14 days, last count at 35 days, Juniper seed germination is inhibited at temperatures above 15C.

Normal seedling – Short vigorous root, sturdy green hypocotyl, 2-3 times length of root, cotyledons dark green and intact, typical of conifer.

Excised embryo – No data

Tetrazolium – Soak overnight in water, clip seed coat at broad end to expose seed tissue, place in 1 percent tetrazolium solution, cut longitudinally to evaluate. Requires about 5 days to stain at room temperature.

Radiographic – 12 KV, 200 sec. for Kodak AA film and Industrex paper, 18KV, 4 mins. for Polaroid film. Filled, empty, insect damaged or abnormal development visible. Embryo very clear.

Storage: Store with 10-12 percent moisture in sealed containers at -7C to 5C, viability high after 9 years.

Endangered species classification: None

Suggested references:

Johnsen, T. N. 1959. *Longevity of Stored Juniper Seed*. Ecol. 40:487:488.

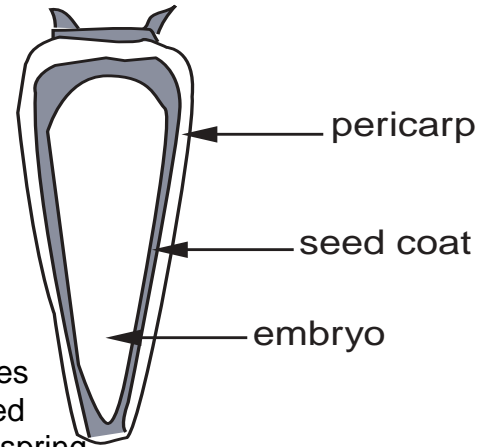
USDA. 1974. *Seeds of the Woody Plants of the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.

ASTERACEAE

LIATRIS PYCNOSTACHYA MICHAUX (THICKSPIKE GAYFEATHER)

Distribution: AR, CO, IA, IL, IN, KS, KY, LA, MA, MN, MO, ND, NE,
NY, OH, OK, PA, SD, TX, WI:QUE

Description: Perennial forb, 2 m high, stems several, stiff and hairy, lower leaves 10-30 cm long and drooping, leaf size gradually diminishes up the stem, upper leaves pointed stiffly skyward. Found on well-drained sandy soils in forest openings. Cattle graze sparingly, deer browse on spring and summer foliage, tubers once used to treat rattlesnake bite. Flowers used in fresh arrangements and dried bouquets.



Flower and fruit: Flowers 10-11 mm long, rose magenta, in spike-like inflorescence, 15-30 cm long, 5-12 flowers per head, floral bracts numerous, tips curl away from the head and are purple tinged. Blooms June-August. Seed is achene, gray to black, 4-6 mm long, ribbed, 1.5 mm wide, tapering with pappus (often removed in cleaning). Matures September-October.

Seed: 435 per g, embryo surrounded by brown, papery seed coat, loosely fit in achene; achene is "seed" of analysis.

Laboratory analysis:

Purity – 6 g for routine analysis, 60 g for noxious weed count.

Germination – 20-30C, first count at 7 days, last count at 28 days, average germination 60-70 percent, constant 20C produced equal results in limited trials, moist prechill may be beneficial to some lots.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, clip wide end, gently squeeze out embryo, clip cotyledon end of embryo to break inner seed coat, place in 1 percent tetrazolium solution, slice lengthwise to evaluate.

Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper, 12KV, 1.5 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: Rare in IA, special concern species in MN.

Suggested references:

Grelen, H. E. and V. L. Duvall. 1966. *Common Plants of Longleaf Pine-Bluestem Range*. Res. Pap. SO-23, 96P. USDA, Forest Service, New Orleans, LA.

Smith, J. R. and B. S. Smith. 1980. *The Prairie Garden*. The University of Wisconsin Press, Madison, WI. 219P.

LAURACEAE

LINDERA BENZOIN (L.) BLUME (COMMON SPICE BUSH)

Distribution: AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, NH, NJ, NY, OH, OK, PA, RI, SC, TN, TX, VA, VT, WV:ONT

Description: Small shrub, 2-5 m, leaves oblong, tapering at base, 8-13 cm long, alternate, spicy fragrance when crushed; branches also fragrant when broken; found in damp woods, and brooksides; bark used medicinally, leaves used for tea. The dried, powdered fruits are used as a substitute for allspice, fruit eaten by birds, twigs browsed by deer and rabbits.

Flower and fruit: Small yellow flowers appearing March-May in sessile lateral umbel-like clusters, appearing before the leaves at nodes. Umbels are made up of smaller groups of umbels, each of 4-6 flowers surrounding by an involucre of 4 deciduous scales. Fruit is a red or sometimes yellow drupe, obovoid, stalked but not thickened, 1-seeded, 9 mm diameter, matures July-September, aromatic when crushed.

Seed: 8-10 per g, 8 mm long, 6 mm wide, reddish-brown to black thin seed coat, embryo yellowish, filling cavity with 2 large cotyledons.

Laboratory analysis:

Purity – 300 g for routine analysis.

Germination – No data

Normal seedling - No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, cut longitudinal off-center, place in 1 percent tetrazolium solution, cut lengthwise to evaluate.

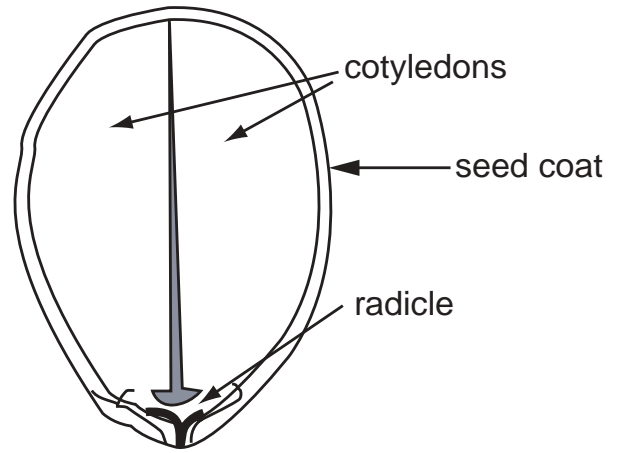
Radiographic – 12 KV, 80 sec. for Kodak AA film and Industrex paper, 18KV, 2 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: Endangered in ME & TX, uncommon peripheral in KS.

Suggested references:

None



LINACEAE

LINUM LEWISII PURSH (SYNO: LINUM PERENNE SUBSP. LEWISII) (LEWIS FLAX)

Distribution: AK, AZ, CA, CO, IA, ID, IL, KS, MN, MT, ND, NE, NM, NV, OK, OR, PA, SD, TX, UT, WV, WY: ALB, BC, MAN, ONT, QUE, SAS

Description: Perennial forb, 15-75 cm tall, several densely leafy stems, leaves simple and sessile, bearing glands instead of stipules, a variable plant, found in prairies and calcareous rocky banks at 1,200-3,300 m. A released cultivar for revegetation of range, forest and disturbed lands.

Flower and fruit: Blue flowers scattered in 1-sided leafy racemes, petals 1-1.5 cm long, blooms July-August, fruit is a capsule, 5-8 mm in diameter, carpels quickly separating and splitting into 2 valves, 5-united carpels with 2 seeds each.

Seed: Black, shining, 3.5-4.5 mm long, mucilaginous, flattened, contains a large embryo, anatropous, 640-930 seed per g. (mean about 730). Seed beaked.

Laboratory analysis:

Purity – 3 g for routine analysis, 30 g for noxious weed count.

Germination – 20-30C or 10-25C, first count at 7 days, last count at 14 days.

Normal seedling – Thin, vigorous root, one-third to one-half length of hypocotyl, hypocotyl thin and white, 2 intact cotyledons.

Excised embryo – No data

Tetrazolium – Soak seed in water overnight, remove seed coat, soak 4 hr. in 1 percent tetrazolium solution at room temperature. Seed coat can be removed by applying pressure to distal end after soaking.

Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper, 12KV, 1.5 min. for Polaroid film. Filled, empty, and abnormal development visible.

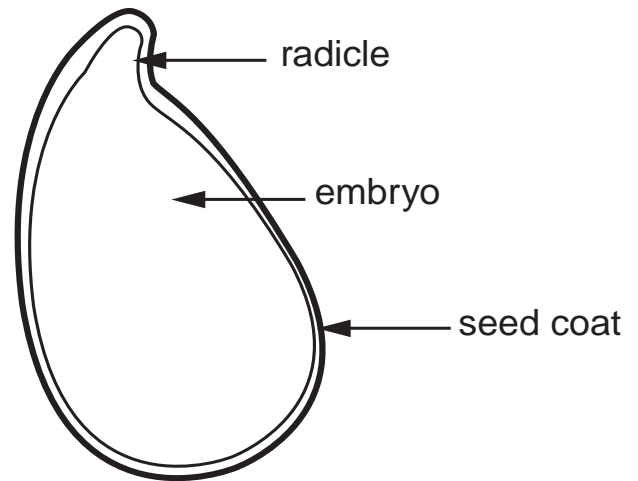
Storage: No data

Endangered species classification: Rare and endangered in MN, rare in ONT.

Suggested references:

Emery, D. 1964. Seed Propagation of Native California Plants. Leaflets of the Santa Barbara Botanic Garden 1(10):81:96.

Weber, G. P. and L. E. Wiesner. 1980. Tetrazolium Testing Procedures for Native Shrubs and Forbs. Jour. Seed Tech. 5(2):23-34.



CAPRIFOLIACEAE

LONICERA TATARICA L. (TARTARIAN HONEYSUCKLE)

Distribution: AZ, CO, CT, IA, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MT, ND, NE, NH, NJ, NY, OH, PA, RI, SD, TN, UT, VA, VT, WI, WV, WY:ALB, MAN, NB, NFLD, NS, ONT, QUE, SAS

Description: Shrub, 1.5-3 m tall, branches hollow, leaves thin, glabrous, heart-shaped, 3-6 cm long; found in thickets, border of woods, shores, etc.; habitat and food for wildlife, watershed plantings and shelterbelt planting, ornamental.

Flower and fruit: Small perfect flowers in axillary pairs or stemless whorls, blooms May to June, pink, Corolla Bilabiate, 1.5-2 cm long. Fruit a berry, red or yellow, globose, united at base, matures June to August.

Seed: 275-400 per g (mean of 300), 2-3 mm diameter, tan to reddish-brown seed coat, irregular shape with a ridge on the seed coat at the location of the embryo, embryo 1 mm long, embedded in grainy endosperm.

Laboratory analysis:

Purity – 8 g for routine analysis.

Germination – Prechill 30 days at 5C, germinate at 20-30C, first count at 7 days, last count at 21 days, average germination is 70-80 percent.

Normal seedling – Hypocotyl 5 cm long and sturdy, small green cotyledons with evidence of epicotyl root $\frac{1}{2}$ to 1 times the length of hypocotyl, tapering, practically no laterals.

Excised embryo – No data

Tetrazolium – Soak overnight in water, clip cotyledon end of seed or puncture with needle in center, place in 1 percent tetrazolium, slice lengthwise through flat axis to evaluate.

Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper, 12KV, 1.5 min. for Polaroid film. Filled, empty, and abnormal seed development visible.

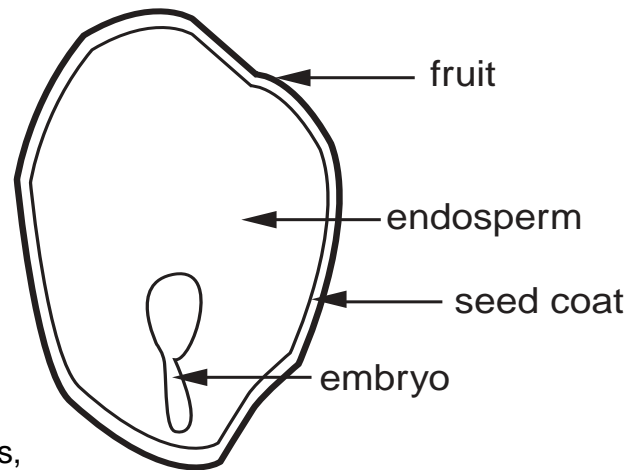
Storage: Dried and stored in sealed containers at 3-5C, viable for 15 years.

Endangered species classification: None

Suggested references:

Hard, C. G. and M. E. Smith. 1967. *Woody Plants of Minnesota*. Univ. Minn. Agric. Ext. Serv. Bull. 267, 35P.

USDA, 1974. *Seeds of Woody Plants of the United States*, Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.



MALVACEAE

MALVA MOSCHATA L. (MUSK-MALLOW)

Distribution: CT, DE, HI, IL, IN, MD, ME, MO, MS, NC, NH, NJ, NY, OH, PA, RI, TN, VA, VT, WA, WI, WV:BC, MAN, NB, NFLD, NS, ONT, QUE, SAS

Description: Perennial forb, 20-70 cm tall, ascending firm stems, basal leaves simple and rounded, upper leaves shallowly 5-lobed, faintly musk-scented. Found in fields and roadsides, old gardens. Blooms June-July.

Flower and fruit: Pink or white flowers on jointed stalks in terminal inflorescence, petals 2-3 cm long. Fruit is a several-locular capsule, downy, depressed, separating at maturity into 1-seeded, indehiscent, round-reniform blunt carpels, matures in October.

Seed: 680 per g, gray, c-shaped, inner seed coat tan and papery, attached tightly to seed, embryo curved around endosperm, cotyledons folded double.

Laboratory analysis:

Purity – 5 g for routine analysis, 50 g for noxious weed count.

Germination – No data

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, puncture seed in center with a needle or clip seed coat at hilum, place in 1 percent tetrazolium solution, slice lengthwise in flat axis for evaluation.

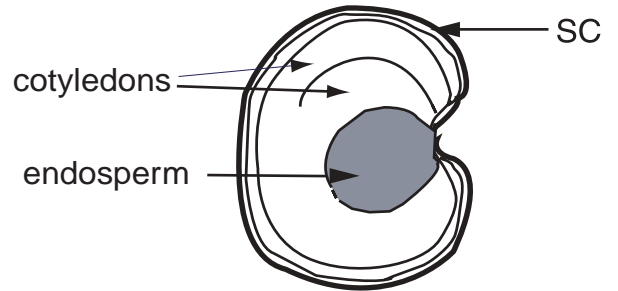
Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper, 12KV, 1.5 min. for Polaroid film. Filled, empty, and abnormal seed development visible.

Storage: No data

Endangered species classification: None

Suggested references:

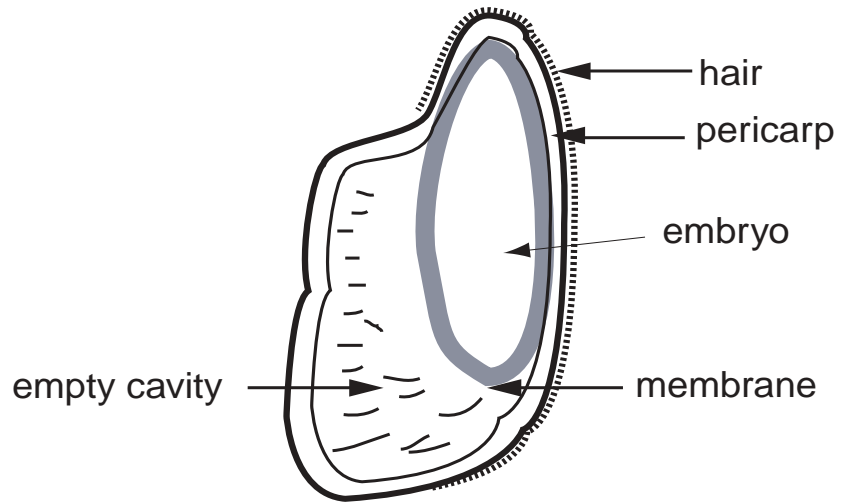
None



ONAGRACEAE

OENOTHERA CAESPITOSA NUTTALL (DESERT EVENING PRIMROSE)

Distribution: CA, CO, ID, MT, ND, NE, NM,
NV, OR, SD, TX, UT, WA, WY:ALB, SAS



Description: Forb with basal rosette first year, 2.5-10 cm long, scape up to 20 cm. Found on dry rock, crevices, desert slopes 2,250-3,000 m.

Flower and fruit: Yellow, white or roseate, fragrant, petals 2.5-5 cm long, leathery, tubercled on the angles.

Seed: 420 per g, 2.5 mm by 2 mm, brown with short, stiff hairs on back (top), seed has an empty cavity next to the embryo.

Laboratory analysis:

Purity – 6 g for routine analysis; 60 g for noxious weed count.

Germination – No data

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, clip cotyledon end to expose seed tissue, place in 1 percent tetrazolium solution, slice lengthwise to evaluate.

Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper, 12KV, 1.5 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: Endangered in TX, subspecies Crinate rare in CA.

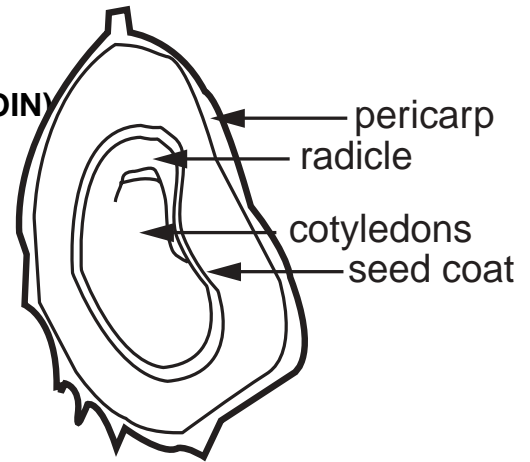
Suggested references: None

FABACEAE

ONOBRYCHIS VICIIFOLIA SCOPLI (VETCH-LEAVED SAINFOIN)

Distribution: CO, IA, ID, IL, MO, MT, NM, UT, WA, WV,
WY:BC, MAN, ONT, QUE

Description: Perennial forb, 90-120 cm tall, usually branching although occasionally creeping, leaves are much like vetch, compound with 8-10 pairs of oblong leaflets, introduced from Europe, susceptible to soil-borne diseases. In pastures, used for hay and grazing, source of honey, less favored by livestock than alfalfa.



Flower and fruit: Salmon-pink to lavender flowers in clusters in upper half of long flowering stems, fruit is a tan capsule, reticulate, 5-8 mm long by 4-5 mm wide covered with short hairs, teeth on edge, 1-seeded.

Seed: 50 per g, brown, reniform, embryo filling seed coat.

Laboratory analysis:

Purity – 50 g for routine analysis; 500 g for noxious weed count.

Germination – No treatment, germinate at 5-20C, 15-25C, 25-30C or constant 20C. First count at 7 days, last count at 28 days. Germination inhibitor in seed pod which is destroyed at temperatures above 40C.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, puncture seed in center with needle or clip cotyledon end to expose embryo tissue, place in 1 percent tetrazolium solution, slice lengthwise through flat axis to evaluate.

Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper, 12KV, 1.5 min. for Polaroid film. Filled, empty, seed coat thickness and abnormal seed development visible.

Storage: No data

Endangered species classification: None

Suggested references:

Smith, G. S. 1979. *A Note on the Presence of Water Soluble Germination Inhibitors in the Seed Pod of Sainfoin (Onobrychis Viciifolia Scop.)* New Zealand Jour. Exp. Agri. 7(4):365-367.

Townsend, C. E. and W. J. McGinnies. 1972. *Temperatures Requirements for Seed Germination of Sveral Forage Legumes.* Agron. Jour. 64(6):809-812.

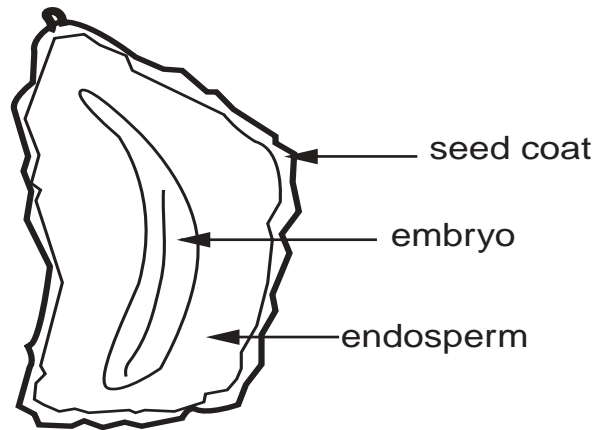
Watson, L. E., R. W. Parker and D. F. Polster. 1980. *Manual of Species Suitability for Reclamation in Alberta.* Vol. II: Forbs, Shrubs and Trees. Report No. RRTAC 80-5, 541P. Alberta Land Conservation and Reclamation Council, Edmonton, Alberta, Canada.

SCROPHULARIACEAE

PENSTEMON PALMERI A. GRAY (PALMER PENSTEMON)

Distribution: CA, CO, ID, NM, NV, UT

Description: Forb, 1.5 m high robust, gray-glaucous, leaves oblong, stem leaves 15 cm long, clasping. Found in dry rocky gullies, 1,200-1,800 m. Used for revegetation of disturbed lands and for wildlife habitat.



Flower and fruit: Whitish with pink to lilac flowers in July, Corolla tubular, 3 cm long, abruptly inflated. Fruit is a many seeded capsule, shaggy, bearded, 10-14 mm long, brown, matures in August.

Seed: Black warty seed coat, 1-2 mm long by 1 mm wide, bright yellow embryo in grainy translucent endosperm, 650-1,330 seed per g (mean is 850).

Laboratory analysis:

Purity – 30 g for routine analysis, 300 g for noxious weed count.

Germination – Requires no pretreatment

Normal seedling – Short, hairlike hypocotyl, 4 mm long, sharply recurved, cotyledons 1 mm, linear, white.

Excised embryo – No data

Tetrazolium – Soak overnight in water, puncture seed in the center with a needle or clip cotyledon end to expose seed tissue, place in 1 percent tetrazolium solution, slice lengthwise through flat axis to evaluate.

Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper, 12KV, 1.5 min. for Polaroid film. Filled, empty, and abnormal seed development visible.

Storage: 50 percent germination after 15 years storage in Utah tests.

Endangered species classification: None

Suggested references:

Unpublished data, USDA, ARS, RENO, NV.

SCROPHULARIACEAE

PENSTEMON STRICTUS BENTHAM (BEARD TONGUE)

Distribution: CO, NM, UT, WY

Description: Forb, 70-80 cm high leaves entire, basal leaves up to 15 cm long, stem leaves linear. Found on hills, 1,800-2,700 m, mountain sides, and canyons of grassbelt.

Flower and fruit: Deep blue flowers, corolla up to 2.5 cm long. Fruit is a many seeded capsule.

Seed: 1,670 per g, reddish-brown with lines of warty growth, 2 mm long by 1 mm wide, yellow embryo embedded in grainy, translucent endosperm.

Laboratory analysis:

Purity – 2 g for routine analysis, 20 g for noxious weed count. There may be problems with unfilled or immature seed and extra fine dust may be lost in the seed blower, thus affecting sample weight. Screening over a .686 dodder sieve first will salvage the fine dust. A 7x or 10x microscope is recommended.

Germination – 20C, first count at 7 days, last count at 21 days. Blotters proved better than Kimpak in trials, light not essential, no benefit of KNO₃ found.

Normal seedling – No data

Excised embryo – No data

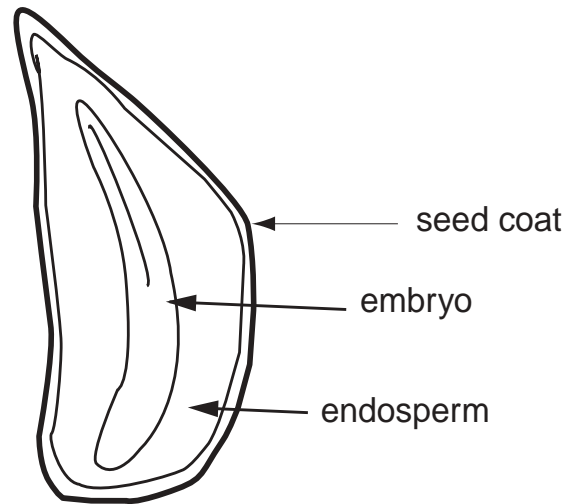
Tetrazolium – Soak overnight in water, puncture seed in center with needle or clip cotyledon end, place in 1 percent tetrazolium solution, slice lengthwise through flat axis to evaluate.

Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper, 12KV, 1.5 min. for Polaroid film. Filled, empty, and abnormal seed development visible.

Storage: No data

Endangered species classification: None

Suggested references: None



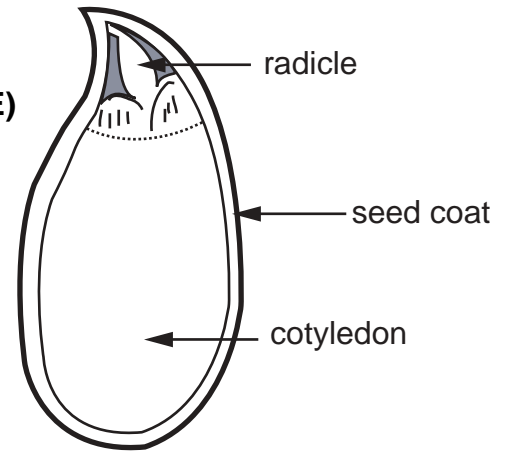
ROSACEAE

PERAPHYLLUM RAMOSISSIMUM NUTTALL (SQUAW-APPLE)

Distribution: CA, CO, ID, MT, NM, NV, OR, UT

Description: Shrub, 2 m high, leaves 4 cm long. Found on dry washes and slopes, 1,200 to 2,400 m.

Flower and fruit: Pale pink flowers from April to May, 7-8 mm long. Fruit is a fleshy pome, yellow, 10-15 mm diameter with 4 seeds, matures July-August.



Seed: 55-100 per g, reddish-brown, flat on one side and curved on the other, 3-5 mm long by 3 mm wide, thick semi-hard seed coat, light brown papery inner seed coat only over the radicle, embryo filling cavity large radicle.

Laboratory analysis:

Purity – 30 g for routine analysis.

Germination – Prechill 45 days at 3-5C, germinate at 20-30C, first count at 14 days, last count at 35 days, average germination 50-60 percent. Another treatment suggested is 24 hours soak in Gibberellic acid solution (3.46g in 1,000cc water) followed by prechill for 60 days at 3C.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, clip cotyledon end (seed coat is semi-hard), place in 1 percent tetrazolium solution, gently squeeze out embryo for evaluation or slice lengthwise.

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper, 12KV, 2.5 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: Store dry in cool ventilated metal container, viability good for 5 years.

Endangered species classification: None

Suggested references:

USDA. 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

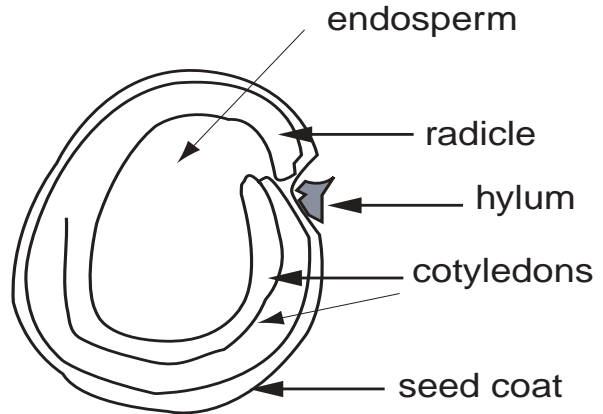
Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

PHYTOLACCACEAE

PHYTOLACCA AMERICANA L. (POKEWEED)

Distribution: AL, AR, CA, CT, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, ND, NE, NH, NJ, NM, NY, OH, OK, PA, RI, SC, TN, TX, VA, VT, WA, WI, WV:ONT, QUE

Description: Coarse branching perennial forb, strong smelling with thick, glabrous reddish-purple stems, leaves simple, large and oval, old plants may contain a poison; found in fields, waste places, disturbed ground, and clearings; used as game-bird food, deer browse on early growth, human consumption of young shoots, ripe berry juice was used as an ink substitute.



Flower and fruit: Small, white flowers in elongated racemes, terminal, 10-20 cm long, becoming lateral and opposite to leaves, flowers 6 mm wide, blooms July-August. Fruit is a depressed, globose, 5-12 locular berry with a single vertical seed in each locule, dark purple, in long racemes, matures August-September.

Seed: 260 per g, lens-shape, glossy, black, 2.7 mm by 3.1 mm, with a prominent hilum, light brown papery inner seed coat, embryo curved around grainy endosperm.

Laboratory analysis:

Purity – 10 g for routine analysis, 100 g for noxious weed count.

Germination – Scratch or cut seed coat, germinate at 24C. The scratch should break the seed coat and show white color. Nonscratched seed requires 5 months prechill in sphagnum moss. Scarification with acid and sandpaper were not beneficial. Average germination is 70-80 percent.

Normal seedling – Short, vigorous root, half as long a hypocotyl; hypocotyl red and stout; 2 intact cotyledons; epicotyl often present during germination period.

Excised embryo – No data

Tetrazolium – Soak overnight in water, clip cotyledon end of seed coat or puncture in center with needle, place in 1 percent tetrazolium solution, slice lengthwise on flat axis for evaluation, only embryo stains.

Radiographic – 12 KV, 90 sec. for Kodak AA film and Industrex paper, 12KV, 3.5 min. for Polaroid film. Filled, empty, and abnormal development visible, embryo details clear.

Storage: Dry in sealed containers at 3C.

Endangered species classification: Rare in Que

Suggested references:

Crawford, H. S., C. L. Kucera and J. H. Ehrenreich. 1969. Ozark Range and Wildlife Plants. Agri. Handbook No. 356, 236P. USDA, Forest Service, Washington, DC.

Krochmal, A. 1970. Germinating Pokeberry Seed. Res. Note NE-114, 4P. USDA, Forest Service, Upper Darby, PA.

ROSACEAE

POTENTILLA FRUTICOSA L. (SHRUBBY CINQUEFOIL, GOLDEN-HARDHACK, WIDDY)

Distribution: AK, CA, CO, CT, IA, ID, IL, IN, KY, MA, ME, MI, MN, MO, MT, ND, NH, NJ, NM, NV, NY, OH, OR, PA, RI, SD, UT, VT, WA, WI, WY:ALB, BC, MAN, NB, NFLD, NS, ONT, QUE, SAS

Description: Shrub, 30-100 cm, silky compound leaves, leaflets 5-7, narrow, oblong, entire, 2-9 mm broad and 1-3 cm long. Found in wet or dry open ground, 1,850-3,600 m in west, in canyons and on mountain sides, wildgame browse.

Flower and fruit: Expanded yellow flower, 1.5-3.0 cm broad, calyx 0.8-1.5 cm high and villous, blooms June-October. Fruit is a densely hairy achen, 2 mm long, many achene are collected in a head on a hairy receptacle.

Seed: 2,360 per g, teardrop shaped, golden tan in color, very thin seed coat, papery inner seed coat, hilum scar on side of large portion of the seed coat, embryo filling the cavity.

Laboratory analysis:

Purity – 1 g for routine analysis, 10 g for noxious weed count.

Germination – No pretreatment required, Average germination 80-90 percent. A water soak at 30C for 18 hours is helpful.

Normal seedling – Seedling very small, vigorous root, as long as hypocotyl; hypocotyl thin; 2 intact cotyledons.

Excised embryo – No data

Tetrazolium – Soak overnight in water, cut seed longitudinally off-center, place in 1 percent tetrazolium solution (some seed stained without clipping), slice lengthwise to evaluate.

Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper, 12KV, 1 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: Undetermined in PA, rare in IA.

Suggested references:

Harrington, H. D. 1964. Manual of the Plants of Colorado. 2nd Edition, 666P. Sage Books, Denver, CO.

Meshinev, T. A. 1973. The Effect of Light on the Germination of *Potentilla Fruticosa* L. Seeds. C. R. Acad. Bulgaria Sci. 26(5):691-693.

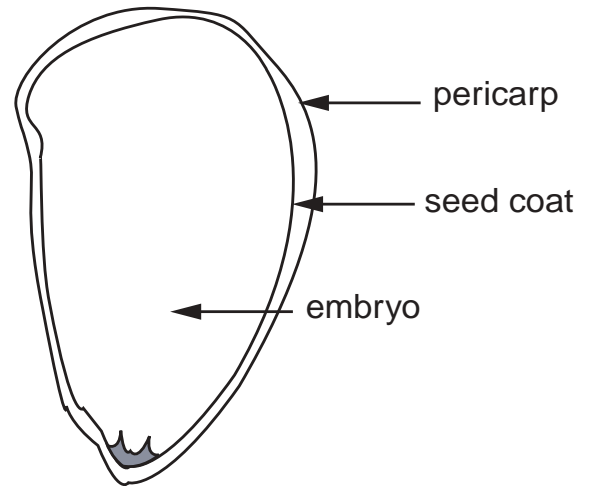
USDA. 1979. Native Shrub Production Project: Coeur D'Alene Nursery. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

ROSACEAE

POTENTILLA GLANDULOSA LINDLEY (POTENTILLA)

Distribution: CA, CO, ID, MT, NM, NV, OR, SD, UT, WA, WY:ALB, BC

Description: Shrub, 30-80 cm, branching above, often reddish, basal leaves pinnate, leaflets 5-9, 1-4 cm long, serrate, stem leaves reduced. Variable species. Found on dryish to moist open places at low elevation (some to 2,400 m), many plant communities in coast and foothills. Wildlife habitat.



Flower and fruit: Pale yellow to cream flowers making up a many-flowered cyme, flowers very small, blooms in June. Fruit is a achene, brown 1 mm long, matures in July.

Seed: 3,170 per g, teardrop shaped, golden tan, embryo covered with bluish-purple papery inner seed coat, embryo filling cavity.

Laboratory analysis:

Purity – 1 g for routine analysis, 10 g for noxious weed count.

Germination – Germinate at 25C with light, final count at 14 days.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, slice lengthwise off-center, place in 1 percent tetrazolium solution, slice lengthwise to evaluate.

Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper, 12KV, 1 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: Uncontrolled laboratory for 5 years.

Endangered species classification: Var. Glandulosa rare in BC; Var. Globosa threatened in OR.

Suggested references:

McDonough, W. T. 1969. Effective Treatments for the Induction of Germination in Mountain Rangeland

Species. Northwest Sci. 43(1):18-22.

Unpublished Data, USDA, Ars, Reno, NV.

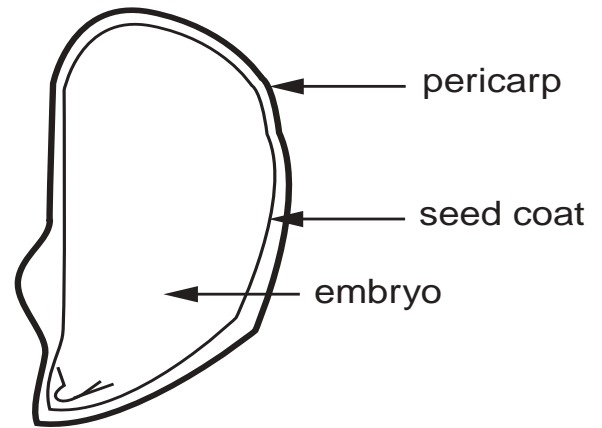
ROSACEAE

POTENTILLA GRACILIS DOUGLAS ex HOOKER (SLENDER CINQUEFOIL, FAN-LEAVED CINQUEFOIL)

Distribution: CA, CO, ID, MI, MN, MT, ND, NV, OR,
SD, UT, WA, WY:ALB, BC, MAN, ONT, QUE, SAS

Description: Low forb, basal leaves long-petioled,
digitate, 5-7 narrow leaflets, white hairy beneath and
green above with distant elongate teeth 5-15 mm long,
extending from base to apex, floral stem up to 70 cm.

Found on dry slopes, fields, plains and gravel, 450 to 900 m. Wildlife browse.



Flower and fruit: Yellow flowers, 1.5-2 cm broad, many-flowered cymes on slender stems. Blooms
June - July. Fruit is a achene, smooth, 1-1.3 mm long, matures July – August.

Seed: 2,770 per g, teardrop shaped, tan to light brown, inner seed coat reddish, embryo filling cavity.

Laboratory analysis:

Purity – 1 g for routine analysis, 10 g for noxious weed count.

Germination – 20-30C, first count at 3 days, last count at 10 days. Average germination 90-
100 percent.

Normal seedling – Very small seedling; vigorous root, as long as hypocotyl; 2 intact
cotyledons; epicotyl often present during test period.

Excised embryo – No benefit.

Tetrazolium – No benefit.

Radiographic – 12 KV, 20 sec. for Kodak AA film, Industrex paper and Polaroid film lose much
detail. Filled, empty, and some abnormal development visible.

Storage: No data

Endangered species classification: Rare in ONT.

Suggested references:

McDonough, W. T. 1969. Effective Treatments for the Induction of Germination in Mountain Rangeland

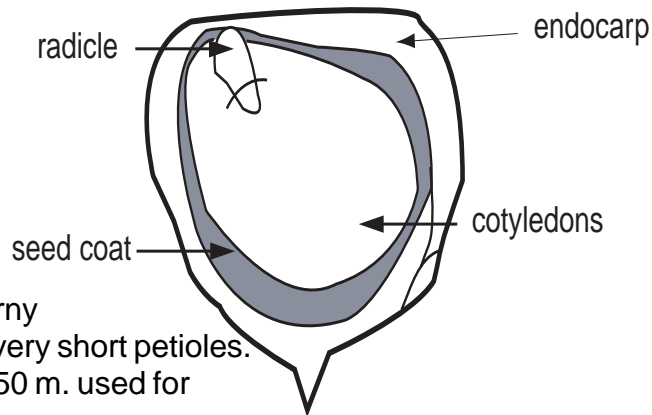
Species. Northwest Sci. 43(1):18-22.

ROSACEAE

PRUNUS ANDERSONII A. GRAY (DESERT PEACH)

Distribution: CA, NV, UT

Description: Diffusely branched spreading shrub, 0.5-2 m tall, short, stiff, thorny branches, leaves fascicled, 1-2 cm long on very short petioles. Found on dry slopes and mesas, 1,050-2,250 m. used for landscape planting.



Flower and fruit: Typical prunus flower, solitary, pink, tube 2.5 mm high, blooms May – June. Fruit is a drupe, 12 mm long, thin pulp, rough stone, often mummified because pulp was not removed, peachlike in color, matures June – July.

Seed: 5 per g, heart-shaped stone, 10 mm long and wide, 5 mm thick, very thick coat but opens easily along the suture, has an added wing-like appearance on one suture, inner seed coat dark brown and rough, embryo lays angled almost sideways, in the seed.

Laboratory analysis:

Purity – 500 g for routine analysis. No noxious weed.

Germination – Stratify in activated charcoal for 30 days at 2C then put in sand at 15C for 15 days. Germinate at 20-30C, first count at 14 days, last count at 28 days, Avg. germination 80-100 percent.

Normal seedling – No data.

Excised embryo – Crack seed in vise, soak 2 hrs. in water at room temperature, remove inner seed coat, germinate at 20-30C.

Tetrazolium – Soak overnight in water, remove seed coat by cutting along the suture with pressure, slice strip off side of seed exposing embryo tissue, place in 1 percent tetrazolium solution, cut lengthwise to evaluate.

Radiographic – 12 KV, 150 sec. for Kodak AA film and Industrex paper; 18 KV, 3 mins. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data, In University of CA storage test.

Endangered species classification: None

Suggested references:

Emery, D. 1964. *Seed Propagation of Native California Plants*. Leaflets of the Santa Barbara Botanic Gardens 1(10):81-96.

Kay, B. L., J. A. Young, C. M. Rose and W. L. Graves. 1977. Desert-Peach. Monograph No. 21. Mojave Revegetation Notes. Agron. and Range Sci. Dept. Univ. of CA, Davis, CA

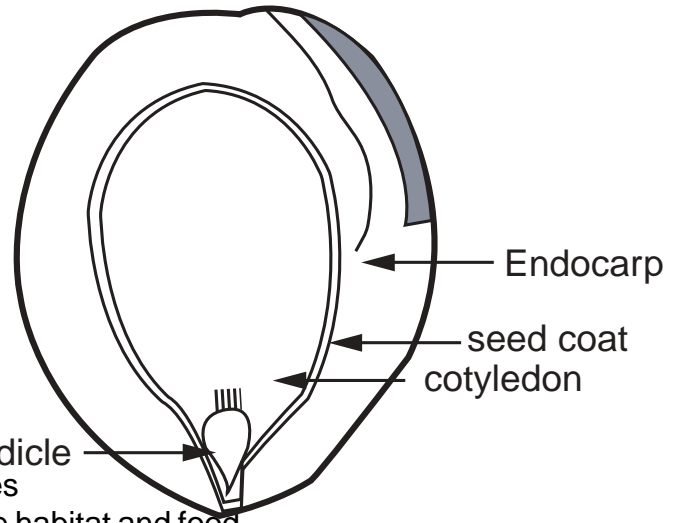
USDA. 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

ROSACEAE

PRUNUS PENNSYLVANICA L.f. (PIN CHERRY, BIRD CHERRY, FIRE CHERRY)

Distribution: CO, CT, DE, GA, IA, ID, IL, IN, KY, MA, MD, ME, MI, MN, MT, NC, ND, NH, NJ, NY, OH, PA, RI, SD, TN, UT, VA, VT, WI, WV, WY:ALB, BC, MAN, NB, NFLD, NS, ONT, QUE, SAS

Description: Shrub, sometimes a tree, up to 32 m, leaves alternate, simple, oblong, gradually pointing, radicle finely and sharply serrate, found in rocky woods, hillsides and along streams, 1,500 to 2,850 m. Serves as wildlife habitat and food.



Flower and fruit: Flowers white and solitary, with leaves, umbellate or corymbose, blooms March – July. Fruit is a drupe, light red, globose, 8 mm diameter, with thin acid flesh, usually 1-seeded, matures July – September.

Seed: 50 per g, cream colored, 6 mm diameter, ridge on one side of suture, seed coat very thick requiring a hammer to open, inner seed coat brown and papery, embryo filling cavity.

Laboratory analysis:

Purity – 50 g for routine analysis. No noxious weeds.

Germination – Prechill 60-90 days at 3-5C, germinate at 20-30C, first count at 14 days, last count at 35 days.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Very difficult to open, can be opened by using a hammer with the seed turned on the suture, soak 1-2 hrs. in water, slice edge exposing seed tissue, place in 1 percent tetrazolium solution, slice lengthwise to evaluate.

Radiographic – 12 KV, 150 sec. for Kodak AA film and Industrex paper; 18 KV, 3 mins. for Polaroid film. Filled, empty, and abnormal development visible, seed coat thickness also clear.

Storage: Air dry, sealed containers at 3-5C for 3-5 years.

Endangered species classification: Rare and endangered in IN; rare in IA.

Suggested references:

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.

Heit, C. E. 1955. *The Excised Embryo Method for Testing Germination Quality of Dormant Seed*. Proc. Assoc. Off. Seed Anal. 45:108-117.

ROSACEAE

PRUNUS VIRGINIANA L. (CHOKECHERRY)

Distribution: CA, CO, CT, DE, IA, ID, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY:ALB, BC, MAN, NB, NFLD, NS, ONT, QUE, SAS

Description: Shrub, sometimes becoming a tree, 2-9 m tall, leaves simple, alternate, elliptic, sharply serrulate, 5-10 cm long, petioles with glands at summit, below 2,460 m in West. Found along woods, borders, fence rows, and wayside thickets. Important as wildlife habitat and food, watershed and shelterbelt plantings.

Flower and fruit: Flowers solitary, white, with leaves, 5 mm across, in racemes, strong scented, blooms April – June. Fruit is a one-seeded drupe, red-purple becoming dark purple, acid, astringent, 6-7 mm diameter, matures July – September.

Seed: 7-18 per g. (avg. 10), stone 6 mm long and 4 mm wide, cream to white in color, possessing a ridge on one side of the suture, inner seed coat light brown and papery, embryo 4 mm by 2.5 mm.

Laboratory analysis:

Purity – 250 g for routine analysis. No noxious weeds.

Germination – Prechill 60-90 days at 3-5C, germinate at 20-30C, first count at 7 days, last count at 28 days.

Normal seedling – vigorous primary root, sturdy hypocotyl, twice length of root, 2 green intact cotyledons, evidence of an epicotyl.

Excised embryo – No data

Tetrazolium – Very difficult to open, soak 24-48 hrs. in water, turn on edge and tap suture with hammer, soak kernel 1-2 hrs., slice edge to expose embryo tissue, place in 1 percent tetrazolium solution, slice lengthwise to evaluate.

Radiographic – 12 KV, 150 sec. for Kodak AA film and Industrex paper; 18 KV, 3 mins. for Polaroid film. Filled, empty, and abnormal development visible, seed coat thickness also clear.

Storage: Air dry, sealed containers, at 3-5C for 3-5 years. Warm, moist storage detrimental to viability.

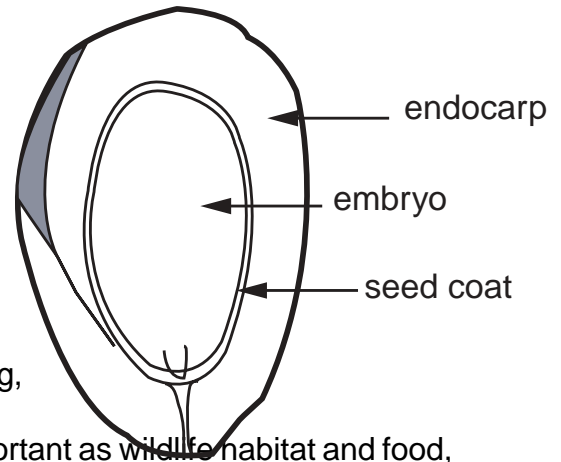
Endangered species classification: Endangered in NC.

Suggested references:

Lockley, G. C. 1980. *Germination of Chokecherry (Prunus Virginiana) Seeds*. Seed Sci. Technol. 8(3):237:244.

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.



ROSACEAE

PURSHIA GLANDULOSA CURRAN (ANTELOPE BUSH, DESERT BITTERBRUSH)

Distribution: CA, NV, UT

Description: Shrub, 0.5-2 m tall, leaves up to 1 cm long with narrow petiole-like base divided into 3 lobes, smooth twigs, prominently glandular. Found on dry slopes, 840-2,700 m. Very important browse species.

Flower and fruit: Light cream to white flowers, floral tube 3-4 mm long, blooms July-August. Fruit is an achene, brown to gray, papery flower parts including style surround achene, but they may be removed in cleaning, matures in August.

Seed: 90 per g, 4-6 mm long by 3 mm wide, pear-shaped, rough textured, embryo filling cavity, achene is "seed" of analyst.

Laboratory analysis:

Purity – 25 g for routine analysis, 250 g for noxious weed count.

Germination – Prechill 14 days at 3-5C, germinate at 5C, first count at 7 days, last count at 14 days, constant 10C or 15C equally effective.

Normal seedling – vigorous primary root, red hypocotyl and dark green truncated cotyledons.

Excised embryo – No data

Tetrazolium – Soak overnight in water, clip cotyledon end to expose seed tissue, place in 1 percent tetrazolium solution, slice lengthwise to evaluate.

Radiographic – 12 KV, 120 sec. for Kodak AA film and Industrex paper; 12 KV, 3 mins. for Polaroid film. Filled, empty, and abnormal development visible.

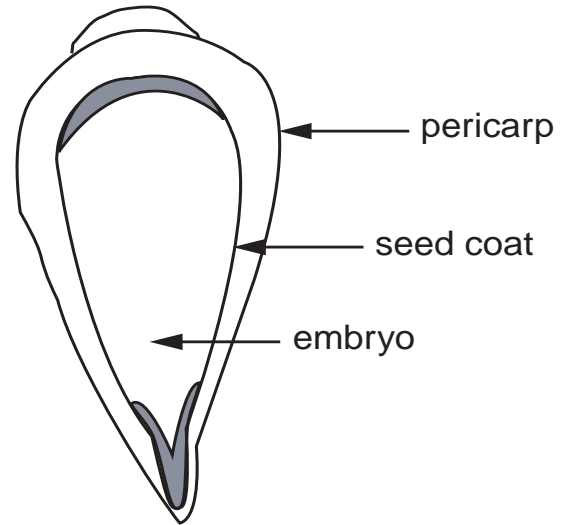
Storage: 65 percent after 15 years.

Endangered species classification: None

Suggested references:

USDA. 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

Young, J. A. and R. A. Evans. 1981. *Germination of Seeds of Antelope Bitterbrush, Desert Bitterbrush and Cliff Rose*. Agric. Res. Rept. Apr-17. USDA, Sea. Oakland, CA.



ROSACEAE

PURSHIA TRIDENTATA (PURSH) DeCANDOLLE (ANTELOPE BITTERBRUSH)

Distribution: CO, ID, MT, NM, NV, OR, UT, WA, WY:BC

Description: Grayish shrub, 1-3 m tall with gray or brown bark and glandular young twigs, leaves 0.5 – 3 cm long, found on dry slopes, 900-3,000 m. Most important browse shrub on the western range, used to revegetate mule deer winter range.

Flower and fruit: Cream-yellow, funnellform flowers in June, petals 7-8 mm long. Fruit is a achene, brown, 8-12 mm long, fusiform, surrounded by papery floral parts, matures July-August, pubescent.

Seed: 30-45 per g. achene is “seed” of analyst, smooth embryo radicle heavy and distant. Seed teardrop shaped, 5-10 mm long.

Laboratory analysis:

Purity – 50 g for routine analysis, usually very clean, 95+ percent.

Germination – Prechill 4 weeks at 3C, germinate at 15C, first count at 7 days, last count at 14 days. Germination can be enhanced with hydrogen peroxide soak (1 percent soak for 6 hrs.). Seed will germinate at 5-25C and 5-30C without prechill but germination will be incomplete and slow. Another method calls for moistening the substrate with 0.5 percent Thiourea and testing at 15C. Germination should be complete in 14 days. 0.2 percent potassium nitrate solution may improve germination. Mold in test is a sign of weak seed. Dark colored areas or spots on the seed are weak. Only one-third stained in TZ test.

Normal seedling – Vigorous root growth, often twisted, 1-1.5 times hypocotyl length; hypocotyl 2 cm high and red with large green, thick cotyledons with truncated ends.

Excised embryo – Soak in water 1-2 days, remove the seed coat, place on blotters, keep at temperature above 13C. 90-100 percent of all viable seed will germinate in 7 days. To remove seed coat, cut across large end and gently squeeze embryo out.

Tetrazolium – Soak in water overnight, remove seed coat, soak 4 hrs. in 1 percent tetrazolium solution at 20C. Carefully cut seed coat longitudinally along edge and remove the seed coat.

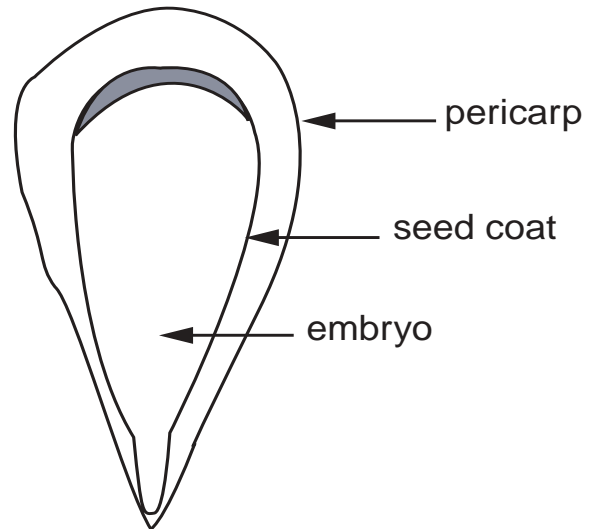
Radiographic – 12 KV, 90 sec. for Kodak AA film and Industrex paper; 12 KV, 3 mins. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: Store dry and cool, 4C in burlap bags or sealed containers. Viability good for 5-14 years.

Endangered species classification: None

Suggested references:

Evans, R. A. and J. A. Young. 1977. *Bitterbrush Germination with Constant and Alternating*



- Temperatures*. Jour. Range Mgt. 30(1):30-32.
- Ferguson, R. B. 1967. *Relative Germination of Spotted and Nonspotted Bitterbrush Seed*. Jour. Range Mgt. 25(5):330-331.
- Weber, G. P. and L. E. Wiesner. 1980. *Tetrazolium Testing Procedures for Native Shrubs and Forbs*. Jour. Seed Tech. 5(2):23-34. E. Mgt. 9(4):193-194.
- Young, J. A. and R. A. Evans. 1981. *Germination of Seeds of Antelope Bitterbrush, Desert Bitterbrush and Cliff Rose*. Agric. Res. Rept. Apr-17. USDA, Sea. Oakland, CA.

ASTERACEAE

RATIBIDA COLUMNIFERA (NUTTALL) WOOTEN & STANDLEY (SYNO. R. COLUMNARIS) (PRAIRIE CONEFLOWER)

Distribution: AL, AR, CO, IA, IL, IN, KS, KY, LA, MN, MO, MT, ND, NE, NM, NY, OK, SD, TX, UT, WI, WV, WY:ALB, MAN, ONT, SAS.

Description: Perennial Forb with slender hairy stems, rounded, leaflets 5-9, entire, alternate pinnately divided leaves. Found in meadows and protected areas, 1,200-1,800 m, slopes and hillsides of the prairies. Serves as livestock browse in the early growing stage.

Flower and fruit: Yellow flowers with elongated petals located at base of a brown cone, about 2.5 cm long, fruit is a achene, black and white, flattened and margined, matures August-September.

Seed: 1,200 per g, 2-3 mm long by 1.5-2 mm wide, oval, black, often inserted in or covered by floral and stem components which has a black eye design on the side. Seed coat rough and thin, embryo filling cavity.

Laboratory analysis:

Purity – 2 g for routine analysis, 20 g for noxious weed count.

Germination – Puncture seed, germinate at 20C, first count 7 days, last count at 21 days. Average germination 90-100 percent. Seed will not germinate if inner seed coat is not ruptured.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Lay on moist blotters overnight, remove seed coat or puncture seed, soak 4 hrs. in a 1 percent tetrazolium solution at room temperature. Remove seed coat by applying pressure to the distal end. Be sure inner membrane is ruptured or staining will not occur.

Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper; 12 KV, 1 min. for Polaroid film. Filled, empty, and abnormal development visible.

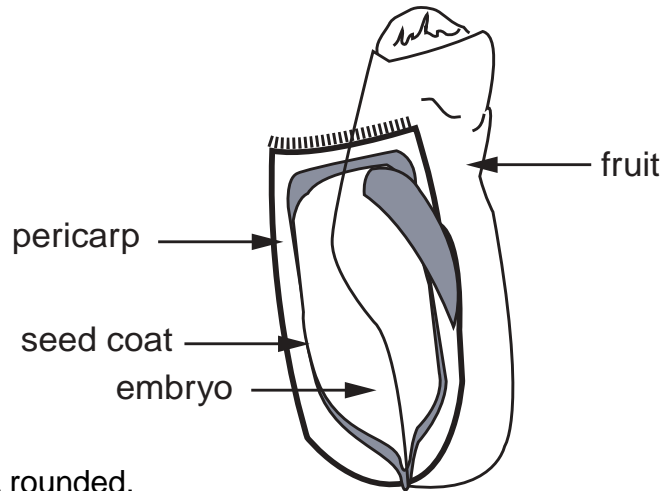
Storage: No data

Endangered species classification: Rare and endangered in IN; special concern species in AL & MN; rare in IA & ONT.

Suggested references:

Sorensen, J. T. and D. J. Holden. 1974. *Germination of Native Prairie Forb Seed*. Jour. Range Mgt. 27(2):123-126.

Weber, G. P. and L. E. Wiesner. 1980. *Tetrazolium Testing Procedures for Native Shrubs and Forbs*. Jour. Seed Tech. 5(2):23-34.

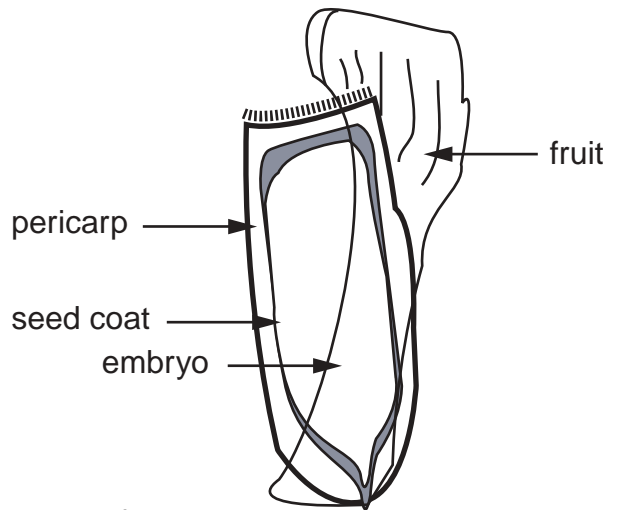


ASTERACEAE

RATIBIDA PINNATA (VENTENAT) BARNHARDT (GREYHEAD PRAIRIE CONEFLOWER, YELLOW CONEFLOWER)

Distribution: AL, AR, CO, CT, FL, GA, IA, IL, IN, KS, MA, MI, MN, MO, MS, ND, NE, OH, OK, PA, TN, SD, WI, WY:ONT

Description: Hairy forb, 0.5-1.5 m tall, covered with appressed hairs, alternate pinnately divided leaves, leaflets 3-7, plant slender and branching, bruised fresh receptacle give off an anise odor. Found on dry soil to wet prairie soils in areas greater than 19 sq. m., roadsides. Used as cut flowers and ornamentals.



Flower and fruit: Large 5 cm drooping yellow ray flowers surrounding a shorter gray center that darkens with maturity, blooms June to September, fruit is a achene, flattened, black to brown and margined, inserted in or surrounded by a straw colored floral or stem part, unlike *R. Columnifera* there is no “eye” design, matures October-November.

Seed: The achene is the “seed” of the analyst, 1,130 per g, seed surface is rough and blocky in a magnified view, looks like burnt wood, embryo fills cavity.

Laboratory analysis:

Purity – 2 g for routine analysis, 20 g for noxious weed count.

Germination – 15-25C, first count at 7 days, last count at 14 days, Avg. germination is 90 percent constant 25C and 20-30C gave similar results on some lots. Moist prechill may promote germination.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Slice seed lengthwise at edge, pull seed coat apart with teasing needles, remove embryo, soak 2 hrs. in water, scratch or remove inner seed coat, soak in 1 percent tetrazolium solution. Also can puncture seed and place in TZ solution overnight, slice to evaluate.

Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper; 12 KV, 1 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: Special concern species in MN, rare and endangered in MS, rare in ONT.

Suggested references:

Smith, J. R. and B. S. Smith. 1980. *The Prairie Garden*. The University of Wisconsin Press, Madison, WI. 219P.

ANACARDIACEAE

RHUS GLABRA L. (SMOOTH SUMAC)

Distribution: AL, AR, CA, CO, CT, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY:BC, MAN, ONT, QUE, SAS

Description: Short-lived shrub, 1-6 m tall, alternate, pinnately compound with 11-30 leaflets, sharply serrate, leaflets 6-12 cm long, 1-3 cm wide. Found in fields and abandoned sites, disturbed areas; provides food for songbirds and game birds, deer, squirrel and rabbit browse, erosion control, ornamental, medicines and dyes.

Flower and fruit: Small, compact terminal panicles, petals white, blooms June to August. Fruit is a drupe, reddish, 4 mm long with a single, smooth bony nutlet, fruit is covered with short, red velvety hairs. Matures September – October.

Seed: 25-40 per g, approximately 2,000 seed per panicle, yellow-brown seed coat, smooth, thin but hard seed coat surrounding a thick waxy coat which surrounds a thin layer of white endosperm, embryo yellowish, embedded in endosperm, radicle very large.

Laboratory analysis:

Purity – 25 g for routine analysis, no weeds

Germination – Prechill 60 days at 3-5C, germinate at 20C with light, first count at 7 days, last count at 28 days, average germination is 60-80 percent. 1-3 hrs. soak in sulfuric acid may replace the prechill treatment or the seed may be cracked by hand. Seed should not be allowed to completely dry out. Dormancy is only in seed coat.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Cut through small end exposing the embryo tissue, soak 2 hrs. in water, place in 1 percent tetrazolium solution, slice lengthwise through flat axis to evaluate.

Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper; 12 KV, 1.5 min. for Polaroid film; Filled, empty, and abnormal development visible, thickness of seed coat can also be measured.

Storage: Stored in sealed containers at 3-4C has kept viability for 2-5 years.

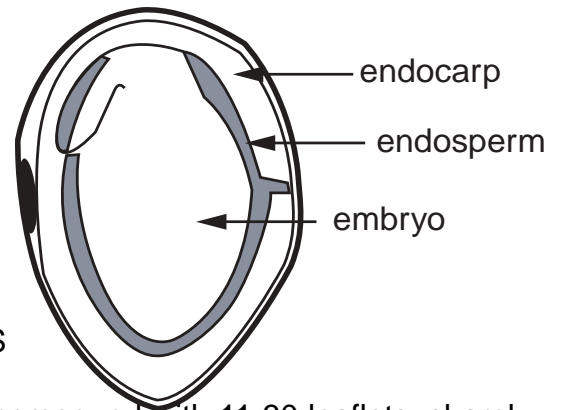
Endangered species classification: Rare in QUE & SAS

Suggested references:

Hall, L. K. 1977. *Southern Fruit-Producing Woody Plants Used by Wildlife*. Gen. Tech. Report SO-16, 235P. USDA, Forest Service, New Orleans, LA.

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.



ANACARDIACEAE

RHUS TRILOBATA NUTT. ex Torr. A. GRAY (OAKBRUSH SUMAC, SKUNKBRUSH SUMAC)

Distribution: CA, CO, IN, KS, MO, MT, ND, NM, NV, OK, OR, SD, UT, WI, WY:ALB, SAS

Description: Short-lived shrub, 50-200 cm tall, leaves compound, leaflets ovate, 2.5 cm long, usually coarsely toothed. Found on disturbed areas, wildlife habitat and food, watershed and shelterbelt planting.

Flower and fruit: Small inconspicuous green flowers borne in terminal or axillary clustered spikes, appearing before the leaves, blooms March – April. Fruit is a red, hairy drupe, 6-7 mm long with a single bony nutlet, matures August-October.

Seed: 20-110 per g (mean is 50), tan to brown, smooth, outer layer of seed coat hard and thin with compressed cells, next layer thick and waxy, inner seed coat is brown and papery, embryo large.

Laboratory analysis:

Purity – 50 g for routine analysis, no weeds.

Germination – 90 min in sulfuric acid plus 30 days prechill at 3-5C, germinate at 20-30C; first count at 7 days, last count at 21 days, average germination is 60-80 percent. Has a hard seed coat and a dormant embryo, some lots may require longer acid and or prechill treatments. A 120 day prechill may be substituted for the acid treatment and prechill combination; dormancy varies with seed source. GA3 and KNO3 were not effective.

Normal seedling – Short, thick root; vigorous hypocotyl, 3-times length of root; 2 intact green cotyledons.

Excised embryo – No data

Tetrazolium – Soak seed 24 hrs. in water, bisect laterally, soak 4 hrs. in 0.1 percent tetrazolium solution. Removing the cotyledonary end of the seed results in extensive damage, however, the distinction between living and dead seed is still possible.

Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper; 12 KV, 1.5 min. for Polaroid film; Filled, empty, and abnormal development visible; also insect larvae.

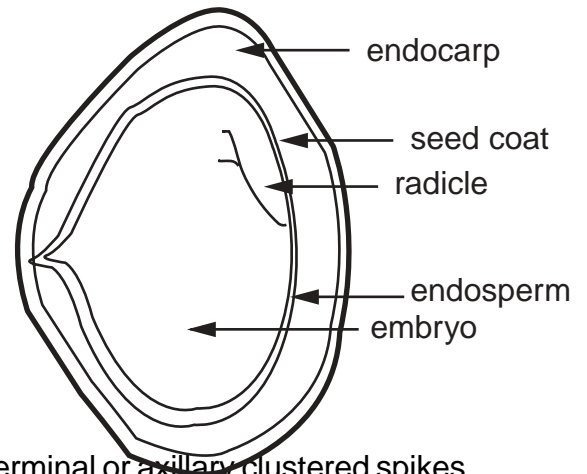
Storage: Store dry in sealed containers at 3-5C, viability good for 5 years.

Endangered species classification: None

Suggested references:

Heit, C. E. 1970. *Germination Characteristics and Optimum Testing Methods for Twelve Western Shrub Species*. Proc. Aosa 60:197-205.

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.



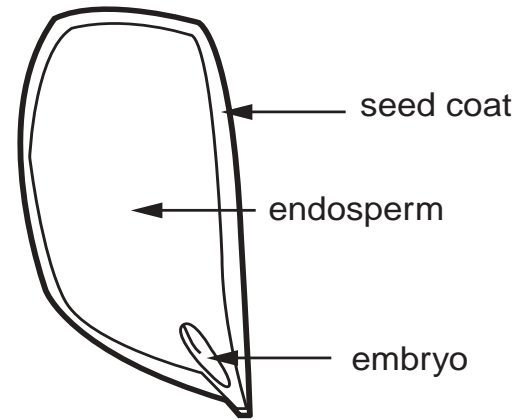
- Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.
- Weber, G. P. and L. E. Wiesner. 1980. *Tetrazolium Testing Procedures for Native Shrubs and Forbs*. Jour. Seed Tech. 5(2):23-34.
- Weber, G. O., L. E. Wiesner and R. E. Lund. 1982. *Improving Germination of Skunkbrush Sumac and Serviceberry Seed*. Jour. Seed Tech. 7(1):60-71.

GROSSULARIACEAE

RIBES AUREUM PURSH (GOLDEN CURRENT)

Distribution: CA, CO, ID, IL, MT, ND, NM, NV, OR, SD, TX, UT, WA, WY:ALB, BC, NS, ONT, QUE, SAS

Description: Unarmed shrub, 1-3 m, leaves alternate, simple, palmately-veined and lobed. Found on rocky bluffs and slopes, spreading from cultivation; wildlife habitat and food, edible fruit, shelterbelt planting, ornamental.



Flower and fruit: Golden-yellow salverform flower, 5-15 flowered racemes with spicy odor, sepals as long as the calyx tube, blooms April-May; fruit is a berry, black, 6-10 mm diameter, glabrous, matures July-August.

Seed: 520 per g, black with reticulate surface, 1-2 mm long by 1 mm wide, flat on one side, round on the other, embryo at lower end of grainy grayish endosperm, small.

Laboratory analysis:

Purity – 5 g for routine analysis

Germination – Prechill 60-90 days at 3-5C, germinate at 20-30C; first count at 7 days, last count at 28 days, average germination 60-80 percent.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, remove 1 mm of cotyledon end of seed, place in 1 percent tetrazolium solution, slice lengthwise to expose tiny embryo for evaluation.

Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper; 12 KV, 1.5 min. for Polaroid film; Filled, empty, and abnormal development visible.

Storage: Store dry in sealed containers at 20C, viability good for 17 years.

Endangered species classification: None

Suggested references:

Emery, D. 1964. *Seed Propagation of Native California Plants*. Leaflets of the Santa Barbara Botanic Gardens 1(10):81-96.

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

GROSSULARIACEAE

RIBES CEREUM DOUGLAS (WAX CURRENT, GOOSEBERRY)

Distribution: CA, CO, ID, MT, ND, NE, NM, NV, OK, OR, SD, TX, UT, WA, WY:BC

Description: Unarmed shrub, 50-200 cm tall, glandular pubescent, leaves alternate, simple, mostly palmately-veined and lobed. Found in dry rocky place, 1,500-3,780 m; wildlife food and habitat, ornamental.

Flower and fruit: Few-flowered drooping racemes, flowers white, blooms April-June; fruit is a berry, bright red, 6-8 mm wide, surface glandular, matures in August.

Seed: 550 per g, reddish-brown, reticulate surface, 2 mm long by 1-1.5 mm wide, embryo small, embedded in grainy endosperm at the base of the seed.

Laboratory analysis:

Purity – 5 g for routine analysis, no weeds

Germination – Prechill 120-150 days at 3-5C, germinate at 20C, first count at 7 days, last count at 28 days (some lots 35 days). Average germination is 60-70 percent.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, remove 1 mm of the cotyledon end of the seed, place in 1 percent tetrazolium solution, slice lengthwise to expose the tiny embryo for evaluation.

Radiographic – No data

Storage: Store dry in sealed containers at 20C, viability reported good for 27 years.

Endangered species classification: Rare in OK.

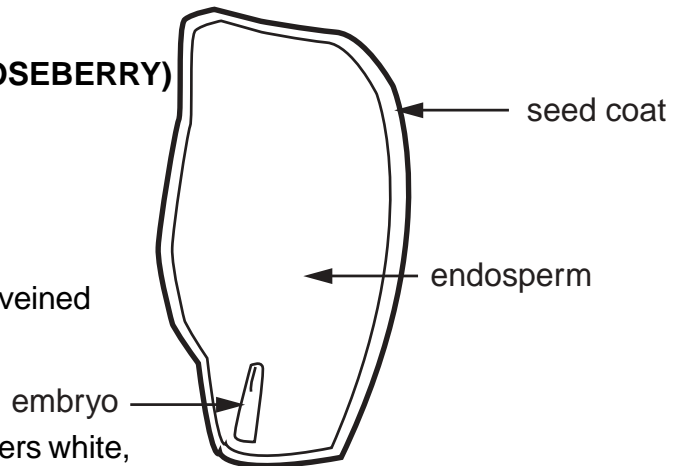
Suggested references:

Quick, C. R. 1941. *Experimental Germination of Ribes Seed, Serial No. 111, 29P.* USDA, Bur. Entomol. and Plant Quar., Berkeley, CA.

Quick, C. R. 1947. *Experimental Germination of Ribes and Pine Seed, Serial No. 135, 35P.* USDA, Bur. Entomol. and Plant Quar., Berkeley, CA.

USDA. 1974. *Seeds of Woody Plants in the United States.* Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs.* Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.



GROSSULARIACEAE

RIBES MONTIGENUM McClatchie (GOOSEBERRY CURRENT, MOUNTAIN GOOSEBERRY)

Distribution: CA, CO, ID, MT, NM, NV, OR, UT, WA, WY:BC

Description: Prickly shrub, 30-60 cm high, glandular-pubescent with 3-5 nodal spines, leaves 5-cleft almost to the base, glandular-pubescent on both surfaces. Found on dry rocky places, 2,100-3,750 m. Wildlife habitat and food, edible fruit, jams made from fruit.

Flower and fruit: Purple, few-flowers racemes, blooms June-July. Fruit is a red berry, 6-10 mm long, surface glandular-bristly, matures August-September.

Seed: 300 per g, 3 mm long by 1.5 mm wide, reddish, reticulate surface or seed coat, seed several irregular shapes, embryo 1 mm long, embedded in grayish, grainy endosperm at the base of the seed.

Laboratory analysis:

Purity – 8 g for routine analysis.

Germination – Prechill 200-300 days at 3-5C, first count at 14 days; last count at 35 days, germinate at 20-30C, average germination is 20 percent. Germination also obtained by placing seed on filter paper moistened with 0.001 molar solution of GA3 in darkness at 2C for 8 weeks. Ungerminated seed were transferred to water moistened filter paper at 17-22C with 8 hrs. light.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, remove 1 mm of the cotyledon end of the seed, place the seed in 1 percent tetrazolium solution, slice lengthwise to expose the tiny embryo for evaluation.

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper; 12 KV, 1.5 min. for Polaroid film; Filled, empty, and abnormal development visible.

Storage: Store dry in sealed containers.

Endangered species classification: None

Suggested references:

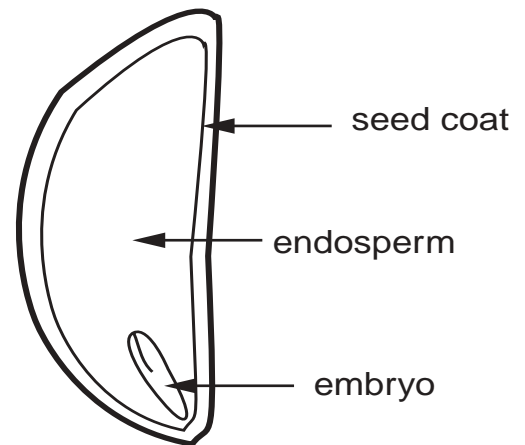
McDonough, W. T. 1969. *Effective Treatments for the Induction of Germination in Mountain Rangeland Species*. Northwest Sci. 43:18-22.

McDonough, W. T. 1970. *Germination of 21 Species Collected from a High-Elevation Rangeland in Utah*. The American Midland Naturalist. 84(2):551-554.

Quick, C. R. 1943. *Experimental Germination of Ribes Seed, Serial No. 116*, 23P. USDA, Bur. Entomol. and Plant Quar., Berkeley, CA.

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.



FABACEAE

ROBINIA NEOMEXICANA A. GRAY (NEW MEXICAN LOCUST)

Distribution: CO, NM, NV, TX

Description: Tall shrub, sometimes a tree, 3-7 m, compound leaves, leaflets in 4-7 pairs, 4 cm long. Grows along streams, canyons, wildlife habitat and food, watershed and shelterbelt.

Flower and fruit: Perfect, rose colored flowers in racemes in axils of current years leaves, inflorescent pubescent and glandular, hispid. Blooms May-June. Fruit is a legume, brown, 4-10 seed, 4-6 mm long, nearly smooth.

Seed: 50 per g, seed coat olive drab with black specks, smooth and shiny, no endosperm in seed, embryo yellow, typical legume.

Laboratory analysis:

Purity – 50 g for routine analysis, very clean, expect 97+ percent.

Germination – Scarify seed coat, germinate at 20-30C; first count at 7 days; last count at 28 days; average germination is 90-100 percent; dormancy is due to impermeable seed coat, seed can be treated with hot water, concentrated acid or cut with a knife.

Normal seedling – Vigorous primary root with secondary braching; sturdy hypocotyl of about 4 cm; 2 intact, thick, green cotyledons.

Excised embryo – No data

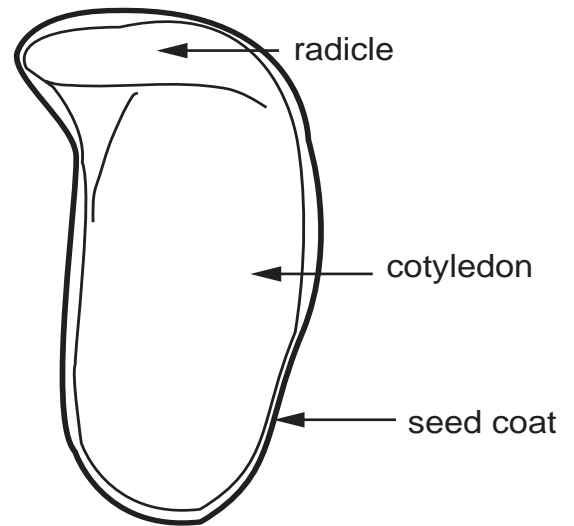
Tetrazolium – Soak seed overnight in water, remove 1 mm of cotyledon end, place in 1 percent tetrazolium solution, cut lengthwise to evaluate.

Radiographic – No data

Storage: Dry seed retain viability 10 years or more if placed in sealed containers and stored at 3-5C.

Endangered species classification: Population rare in CA; possibly rare and threatened in UT.
Suggested references:

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.

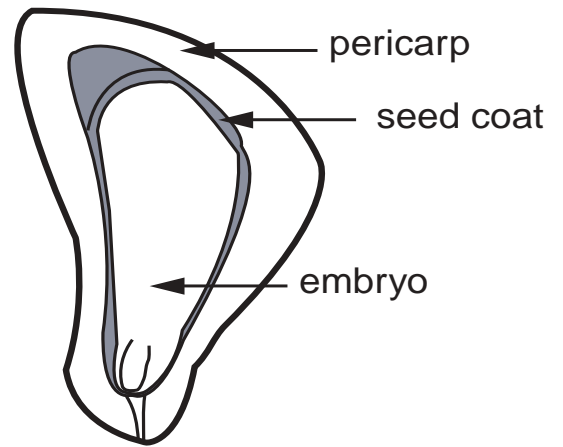


ROSACEAE

ROSA ACICULARIS LINDLEY (PRICKLY ROSE)

Distribution: AK, CO, CT, ID, MA, ME, MI, MN, MT, ND, NE, NH, NM, NY, SD, UT, VT, WI, WV, WY:ALB, BC, MAN, NB, ONT, QUE, SAS

Description: Densely bristly shrub, 30-120 cm tall, leaves odd pinnate, leaflets 3-7, 2.5-5 cm long, serrate, stipules adnate to the petiole, glandular-ciliate; prickles from base to flowering summit. Found in thickets and rocky slopes, 1,800-3,000 m. Wildlife food, habitat and reclamation. It is highly adapted to disturbed area.



Flower and Fruit: Dark red, solitary flowers, fragrant, 5 cm across, blooms June; fruit is a smooth pear-shaped achene, 1.5 cm long, hairy, pale brown, borne several to many in a fleshy berrylike hip.

Seed: 36-40 per g, achene is “seed” of analyst, coat straw colored, rough textured, very thick and bony, can be opened by cutting on suture but with difficulty, inner seed coat brown and papery.

Laboratory analysis:

Purity – 60 g for routine analysis

Germination – Maximum levels of germination are obtained with 60 days warm stratification followed by 120 days of cold stratification. Germinate at 20C with 16 hrs. light, first count at 7 or 10 days, last count at 28 days (10-20C also satisfactory). Ripeness of the hip will affect germination (those collected yellow-orange will give higher germination). Best to use surface sterilization before warm stratification. Another treatment is: 48 hrs. soak in GA3 solution (3.46g/1000cc water) followed by 60 days stratification at 20C and then 90 days at 3-5C.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, open seed coat by cutting with pressure on the suture (very difficult to open), scratch or cut inner seed coat, place in 1 percent tetrazolium solution, tease embryo out for evaluation.

Radiographic – 12 KV, 90 sec. for Kodak AA film and Industrex paper; 12 KV, 3.5 min. for Polaroid film; Filled, empty, and abnormal development visible, can also measure thickness of seed coat.

Storage: Dry to about 6 percent, place in sealed containers and freeze at –7C; may also be stored at +3C.

Endangered species classification: None

Suggested references:

Densmore, R. and J. C. Zasada. 1977. *Germination Requirements of Alaskan Rosa Acicularia*. Can. Field Naturalist 91(1):58-62.

King, P., G. Grainger and A. Straka. 1983. *Testing of Seed Pre-germination Treatments for Selected Native Shrub Species*. ENR Report No. T/43, 80P. Alberta Energy and Natural Resources, Edmonton, Alberta, Canada.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

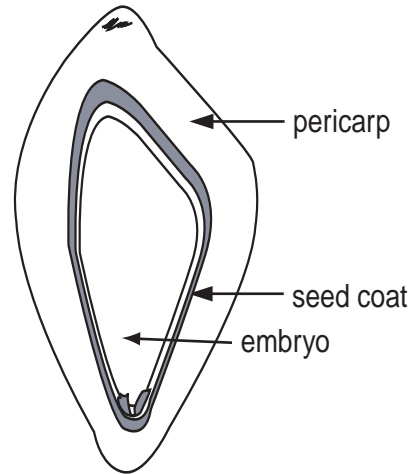
ROSACEAE

ROSA WOODSII LINDLEY (WOODS ROSE)

Distribution: AK, CA, CO, IA, ID, KS, MN, MO, MT, ND, NE, NM, NV, OK, OR, SD, TX, UT, WA, WI, WY: ALB, BC, MAN, ONT, QUE, SAS

Description: Bristly shrub, 50-300 cm, prickles straight or slightly curved, leaflets 5-7, 3 cm long, simply serrate.

Found in damp places, 1,050-3,300 m, in northern range it grows on bluffs, dry slopes, and sand hills in the prairies, as well as riverbanks and forest clearings. Odor unusually pleasant, wildlife habitat and food, watershed planting, disturbed land reclamation and soil stabilization.



Flower and fruit: 1-3 flowers, pink or white, 4.5 cm across, blooms May-August. Fruit is a stony achene, straw yellow to white, 3-4 mm long, several to many within a fleshy, berrylike hip, 6-15 mm wide; matures July-August in SD, September-November in UT.

Seed: 110 seed per g, embryo surrounded by brown papery seed coat inside thick bony sutured pericarp. Achene is "seed" of analyst.

Laboratory analysis:

Purity – 20 g for routine analysis

Germination – Prechill 30 days at 3-5C with light, first count at 7 days; last count at 28 days, average germination is 40-60 percent, 30 day warm stratification followed by a 90 day cold stratification has proved helpful. Canadian research recommends 60 days warm stratification followed by 90-120 days cold stratification. Total germination was proportional to the duration of the cold stratification. All germination was at 20C with 16 hrs. of light.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak seed overnight in water, remove seed coat by applying pressure with a knife on suture or use a hammer to crack the seed open, scratch or cut inner seed coat, place in 1 percent tetrazolium solution, tease embryo out for evaluation.

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper; 12 KV, 2 min. for Polaroid film; Filled, empty, and abnormal development visible, also insect larvae.

Storage: Store dry (6 percent) in sealed containers at 3-5C, viability good for 5 years.

Endangered species classification: Uncommon peripheral in KS; rare in OK & QUE.

Suggested references:

King, P., G. Grainger and A. Straka. 1983. *Testing of Seed Pre-germination Treatments for Selected Native Shrub Species*. ENR Report No. T/43, 80P. Alberta Energy and Natural Resources,

Edmonton, Alberta, Canada.

Stewart, R. N. and P. Semeniuk. 1965. *The Effect of the Interaction of Temperature with After-Ripening Requirements and Compensating Temperature on Germination of Seeds of Five Species of Rosa*. AM. J. Bot. 52:755:760.

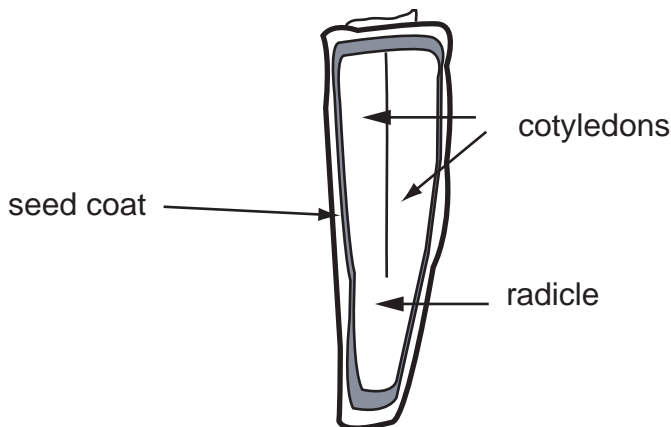
USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

ASTERACEAE

RUDBECKIA HIRTA L. (BLACKEYED SUSAN)

Distribution: AL, AR, CA, CO, CT, DE, FL, GA, IA, ID, IL, KS, KY, LA, MA, MD, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NY, OH, OK, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY: ALB, BC, MAN, NB, NFLD, ONT, QUE, SAS



Description: Perennial or biennial forb, 30-90 cm, bristly haired stems with few branches, lower leaves oblong, broad, thick and coarsely-toothed, upper leaves more narrow, somewhat pointed, attached directly to the stem. Found in open woods, thickets, barrens and fields. Leaves dried and steeped for a kidney stimulant with early settlers, extracts, shown to have antibiotic properties.

Flower and fruit: Yellow flowers with brown centers, 5-8 cm across, borne on upper branches. Blooms July-August. Fruit is a head of achenes, 4-angled, smooth, not margined, flat at top. Matures September-October.

Seed: 3,850 per g, black, achene is "seed" of analyst, striate, 2 mm long, 0.5 mm wide, thin seed coat, embryo yellowish, filling cavity.

Laboratory analysis:

Purity – 1 g for routine analysis, 10 g for noxious weed count.

Germination – Data scarce, moist prechill reported to be helpful. Try 20 day prechill at 3-5C, germinate at 20-30C.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak 2 hrs. in water, under 10x scope cut off flat edge and squeeze out embryo with teasing needles, scratch inner seed coat, place in 1 percent tetrazolium solution.

Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper; 12 KV, 1 min. for Polaroid film; Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: None

Suggested references:

Crawford, H. S., C. L. Kucera and J. H. Ehrenreich. 1969. *Ozark Range and Wildlife Plants*. Agri Handbook No. 356, 236P. USDA, Forest Service, Washington, DC.

Smith, J. R. and B. S. Smith. 1980. *The Prairie Garden*. University of Wisconsin Press, Madison, WI. 219P.

CHENOPODIACEAE

SALSOLA KALI L. (RUSSIAN-THISTLE)

Distribution: AL, AR, AZ, CA, CO, CT, DE, FL, GA, HI, IA, ID, IL, IN, KS, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY:ALB, BC, MAN, NB, NFLD, NS, ONT, QUE, SAS

Description: Very bushy forb, annual, leaves 3-7 cm long, slender, stiffish, prickly-pointed, awl-shaped, alternate. Found on sandy shores, cultivated, fields, roadsides, wastes. A weed.

Flower and fruit: Perfect, inconspicuous flowers between 2 bractlets, sessile, axillary flowers, single. Fruit is a utricle, calyx with converging lobes forming a sort of beak over the fruit. Fruit is dark gray, looks like a miniature apple.

Seed: 800 per g, embryo amber-brown to yellow, coiled in seed coat, inner seed coat translucent and papery, no endosperm, 1.5-2 mm broad, radicle at top, cotyledons dark green.

Laboratory analysis:

Purity – 3 g for routine analysis

Germination – No data

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, break both seed coats and tease out coiled embryo, place in 1 percent tetrazolium.

Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper; 12 KV, 1 min. for Polaroid film; Filled, empty, and abnormal development visible.

Storage: No data

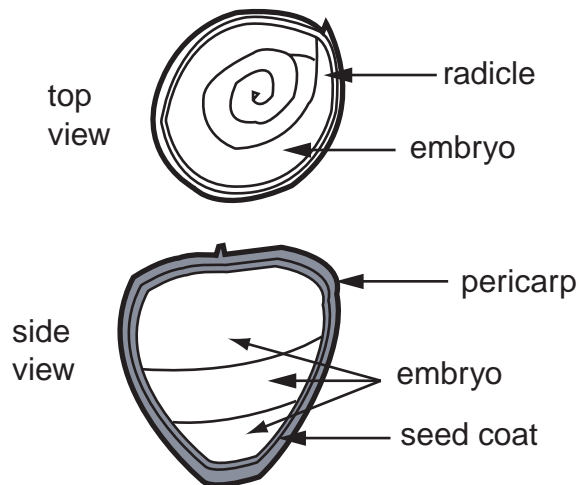
Endangered species classification: None, noxious weed in: HI & MO, restricted in AZ.

Suggested references:

Evans, R. A. and J. A. Young. 1972. *Germination and Establishment of Salsola Kali Tenuifolia in Relation to Seedbed Environment. II. Seed Distribution, Germination, and Seedling Growth of Salsola Kali Tenuifolia and Microenvironmental Monitoring of the Seedbed.* Agron. Jour. 64(2):219-224.

Wallace, A., W. A. Rhods and E. F. Frolich. 1968. *Germination Behavior of Salsola as Influenced by Temperature, Moisture, Depth of Planting and Gamma Radiation.* Agron. Jour. 60(1):76-78.

Young, J. A. and R. A. Evans. 1972. *Germination and Establishment of Salsola Kali Tenuifolia in Relation to Seedbed Environment. I. Temperature, Afterripening, and Moisture Relations of Salsola Kali Tenuifolia Seeds as Determined by Laboratory Studies.* Agron. Jour. 64(2):214-218.



LAMIACEAE

SALVIA AZUREA LAMARCK (SYNO: SALVIA PITCHERI) (PITCHER SAGE, SAGE PLANT, BLUE SAGE)

Distribution: CO, IA, KS, MO, NE, NM, OK, TN, TX, WI

Description: Perennial forb, upright slender square stems and alternate leaves from base to flowers. Found on the prairie, plains and well drained soils; range cattle browse.

Flower and fruit: Small 2-lipped flower, blue, inflorescence spike-like, whorls crowded above corolla, 1.5-2.5 cm long with prominently exerted tube, blooms May-September. Fruit is a capsule, gray-brown spotted white.

Seed: 270 per g, gray to tan, resembles the image of a brain with the shallow fissures, usually found with the fruit coat still attached, soft and crumbly, embryo grainy in appearance.

Laboratory analysis:

Purity – 10 g for routine analysis, 100 g for noxious weed count.

Germination – 20-30C; first count at 7 days; last count at 21 days; 15-25C will also produce acceptable germination; average germination is 30-50 percent.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, cut cotyledon end, place in 1 percent tetrazolium solution, slice lengthwise to evaluate.

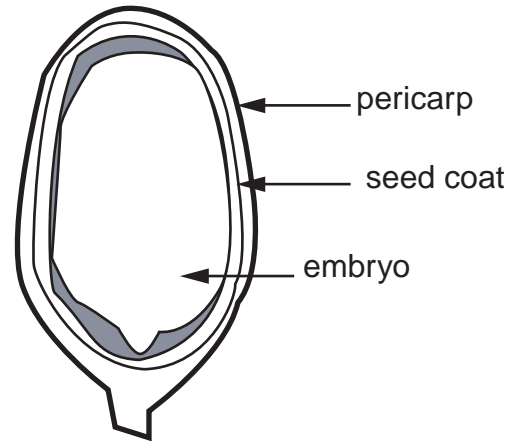
Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper; 12 KV, 1 min. for Polaroid film; Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: Threatened in NC.

Suggested references:

None



ADOXACEAE

SAMBUCUS CANADENSIS L. (AMERICAN ELDERBERRY, BLACKBERRY ELDER)

Distribution: AL, AR, CO, CT, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NY, OH, OK, PA, RI, SC, SD, TN, TX, UT, VA, VT, WI, WV, WY:MAN, NB, NS, ONT, QUE

Description: Small shrub, 1-3 m, pith white, compound leaf, leaflets usually 7, 15 cm long, opposite, margins sharply toothed, on stream banks and moist sites, provides food for songbirds, deer browse, nesting cover for small birds, fruit used in wine and jellies, dyes. New growth may be fatal to cattle and sheep; it tastes better and contains a glucoside.

Flower and fruit: Small cymes of white flowers up to 25 cm across, blooms June-July; fruit is a deep purple to black berry-like pome, 4-5 mm diameter, matures August-September.

Seed: 385 to 1,030 per g (mean 480), cream color to tan, rough texture surface, wedge-shaped inner seed coat orange-brown and thin, embryo surrounded by endosperm, seed rather flat, 2-3 mm long, 2 mm wide.

Laboratory analysis:

Purity – 5 g for routine analysis

Germination – Prechill 85-100 days at 3-5C, germinate at 20-30C; first count at 14 days, last count at 35 days, average germination is 60-70 percent; warm stratification for 60 days prior to cold stratification has been reported as helpful, temperature of 10-27C also reported as acceptable; requires very moist substrate; seed may be soaked in sulfuric acid for 20 min. to reduce the length of stratification.

Normal seedling – Vigorous but thin primary root, sturdy hypocotyl, without breaks or lesions, nearly twice the length of the primary root, 2 intact cotyledons.

Excised embryo – Cut 2 mm off radicle end and grasp seed with tweezers on the cotyledonary half. Apply steady pressure on tweezers and embryo will be pushed out of seed. Place embryo on moist media at 20-30C.

Tetrazolium – Remove embryo as with excised embryo and place in 1 percent tetrazolium solution.

Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper; 12 KV, 1 min. for Polaroid film; Filled, empty, and abnormal development visible.

Storage: Store dry at 5C, seed must be removed from the pulp before storage, viability reported good for 2 years.

Endangered species classification: Rare in MAN.

Suggested references:

- Hall, L. K. 1977. *Southern Fruit-Producing Woody Plants Used by Wildlife*. Gen. Tech. Report SO-16, 235P. USDA, Forest Service, New Orleans, LA.
- USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.
- Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

ADOXACEAE

SAMBUCUS CAREULEA RAFINESQUE (BLUE ELDERBERRY)

Distribution: CA, CO, ID, MT, NV, OR, TX, UT, WA, WY:ALB, BC

Description: Large shrub or small tree, 2-6 m high, found in open places up to 3,000 m.

Flower and fruit: White flowers, fruit is a berry-like drupe, 5-6 mm diameter, black and glaucous, matures August-September.

Seed: 260-570 per g (mean 350), 2.5 mm long, 2.0 mm wide, more or less 3-sided or flat on one side and rounded on the other, rough textured seed coat, cream to tan, embryo embedded in endosperm.

Laboratory analysis:

Purity – 7 g for routine analysis

Germination – Prechill 98+ days at 3-5C, germinate at 20C, first count at 7 days, last count at 28 days, average germination is 50-80 percent; dormancy believed due to dormant or immature embryo; 48 hrs. GA3 soak (3.4g/1000cc water) followed by 60 days stratification at 20C and 90 days at 3-5C also recommended.

Normal seedling – No data

Excised embryo – Cut 1-2 mm off radicle end of the seed. Grasp with tweezers from the other end and not more than half way up the seed. Apply steady pressure to the tweezers and the embryo will be pushed out. Place the embryo on moist media and germinate at 20C.

Tetrazolium – Extract embryo as described for excised embryo, place in 1 percent tetrazolium solution.

Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper; 12 KV, 1 min. for Polaroid film; Filled, empty, and abnormal development visible.

Storage: Store dry at 5C, viability reported good for 5 years.

Endangered species classification: Endangered in TX

Suggested references:

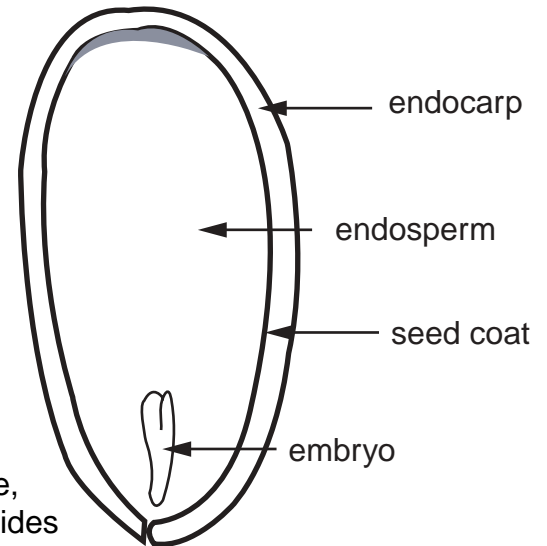
- Emery, D. 1964. *Seed Propagation of Native California Plants*. Leaflets of the Santa Barbara Botanic Gardens 1(10):81-96.
- USDA. 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

CAPRIFOLIACEAE

SAMBUCUS RACEMOSA L. **(SYNO: SAMBUCUS PUBENS) (RED ELDERBERRY,** **SCARLET ELDER)**

Distribution: CA, CO, IA, ID, IL, IN, MD, ME, MT, NM, NY, OR, PA, RI, SD, TN, UT, WA, WI, WV, WY:ALB, BC, MAN, NB, NFLD, NS, ONT, SAS

Description: Shrub, 60-400 cm, warty bark and brown pith, pinnately compound leaf, leaflets 5-7 serrate-pointed, rank smell when bruised; found in woods and openings, often rocky, 1,800-3,600 m; pith used for embedding in microtechnique, edible berry which is good for wine making, eaten by birds, provides animal habitat and stems are good for making whistles.



Flower and fruit: Yellow-white flowers blooms April-July, corolla open-urceolate with broadly spreading 5-cleft limb, numerous flowers in compound cymes. Fruit is a berry-like drupe, red, 5 mm dia., containing 3 small seed-like nutlets; matures June-August but may continue to November in the southwest.

Seed: 430-830 per g (mean 650), 3-4 mm long, 2 mm wide, seed coat yellowish cream, rough textured but less so than other *S. Caerulea*; small embryo in fleshy endosperm.

Laboratory analysis:

Purity – 4 g for routine analysis

Germination – 15-25C, first count at 7 days, last count at 28 days; some report the need for 60 days of warm stratification followed by 90 days of cold stratification, while others report no stratification needed; the seed does have a seed coat and embryo dormancy, constant 21C also reported as satisfactory for germination. Very wide variation in average germination (6-100 percent).

Normal seedling – No data

Excised embryo – Cut 1-2 mm off radicle end of the seed, grasp with tweezers from the other end and not more than half way up the seed, apply steady pressure to the tweezers and the embryo will be pushed out, place the embryo on moist media and germinate at 20C.

Tetrazolium – Extract embryo as described for excised embryo, place in 1 percent tetrazolium solution.

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper; 12 KV, 2 min. for Polaroid film; Filled, empty, and abnormal development visible.

Storage: Store dry at 5C.

Endangered species classification: Rare in MO & SAS.

Suggested references:

USDA. 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

CARYOPHYLLACEAE

SAPONARIA OFFICINALIS L. (BOUNCING BET)

Distribution: AL, CA, CO, CT, DE, FL, GA, IA, ID, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY:ALB, MAN, NB, NFLD, NS, ONT, QUE

Description: 90 cm, leaves oval to elliptic, 10 cm long, 3-veined, opposite; found along roadsides, roots used medicinally, juice can be used for forming a lather with water.

Flower and fruit: Large rose flowers in corymbed clusters, petal crowned with appendage at top of the claw, entire, blooms July-September; fruit is a 4-toothed capsule.

Seed: 310-730 per g (mean 570), flat, black, reniform, 1.7 mm diameter, warty in appearance, embryo curved around clear to translucent endosperm.

Laboratory analysis:

Purity – 5 g for routine analysis, 50 g for noxious weed count.

Germination – 30 day prechill, germinate at 20-30C, first count at 7 days, last count at 21 days, average germination is 90 percent, KNO₃ did not improve germination, 15-25C gave similar results, longer prechill not beneficial.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Puncture in center of flat side with a needle, soak 2 hrs. in water, place in 1 percent tetrazolium solution.

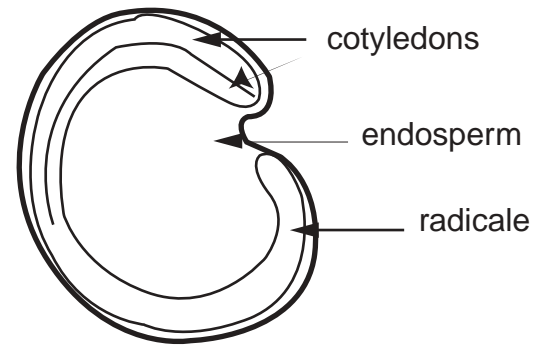
Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper; 12 KV, 2 min. for Polaroid film; Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: None

Suggested references:

None



SARCOBATACEAE

SARCOBATUS VERMICULATUS (HOOKER) TORRY (GREASEWOOD, BLACK GREASEWOOD)

Distribution: AZ, CA, CO, ID, MT, ND, NE, NM, NV, OR, SD, TX, UT, WA, WY:ALB, BC, SAS

Description: Round erect or spreading shrub, 30-300 cm tall, branches whitish, some branchlets leafless and spineless, leaves linear, sessile, fleshy, 4.5 cm long; wood is yellow and very hard. Found on alkaline or saline soils of dry plains and slopes of grasslands, 900 to 2,100 m; indicator of moist, saline or alkaline soils, forage for livestock in fall and winter (concentrated feeding on young stems may be poisonous), food for wildlife, wood used for fuel, proposed planting for salty mine wastes.

Flower and fruit: Monoecious flowers appear in July, fruiting calyx-wing 8-12 mm diameter, male spikes 3 cm long, fruit is a utricle, tan, with wings 6-13 mm wide, 1-celled, matures September-November.

Seed: 425-630 per g (mean 500), brown, 2 mm, oval, flat with wing around middle of seed, embryo coiled.

Laboratory analysis:

Purity – 5 g for routine analysis, 50 g for noxious weed count.

Germination – No pretreatment, germinate at 11C or 15C; first count at 7 days, last count at 14 days, average germination 60-70 percent; does not germinate well at any temperature above 15C, light not essential, prechill of 14-28 days at 3-5C beneficial for some lots, most need no pretreatment; 10-28C also useful; washing seed in running water beneficial to germination.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Puncture seed in middle with needle, soak 2 hrs. in water, place in 1 percent tetrazolium solution, slice lengthwise with flat axis to evaluate, only embryo stains.

Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper; 12 KV, 1 min. for Polaroid film; Filled, empty, and abnormal development visible.

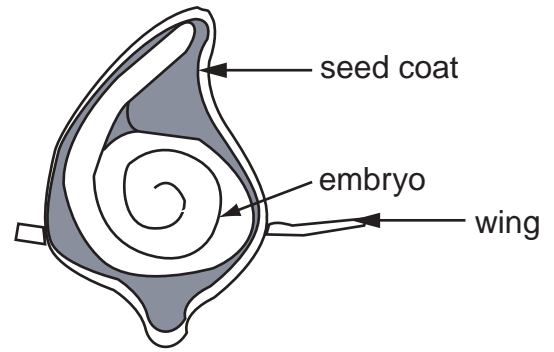
Storage: No data

Endangered species classification: None

Suggested references:

USDA. 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.



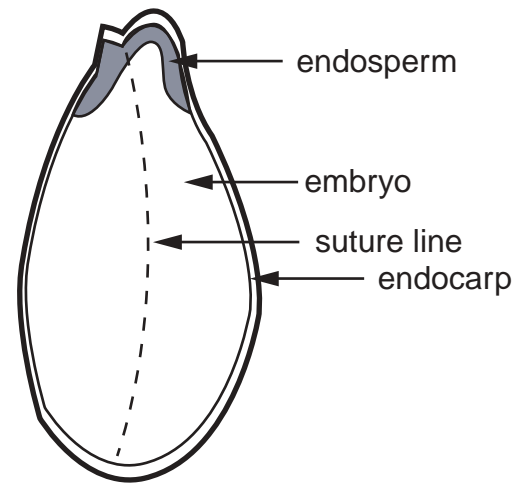
ELAEAGNACEAE

SHEPHERDIA CANADENSIS (LINNAEUS) NUTTALL (RUSSET BUFFALOBERRY, SOAPBERRY, NANNYBERRY)

Distribution: AK, AZ, CO, ID, IL, IN, ME, MI, MN, MT, ND, NM, NV, NY, OH, OR, PA, SD, UT, VT, WA, WI, WY:ALB, BC, MAN, NB, NFLD, NS, ONT, QUE, SAS

Description: Deciduous shrub, 1-2.5 m tall, thornless, leaves green and nearly glabrous above, silvery and scruffy with brown scales beneath, opposite, simple, entire, 2-4 cm long, found in sandy or rocky woods and along streams, 1,950-3,600 m.

Wildlife food and habitat, watershed planting.



Flower and fruit: Bell-shaped yellow flowers in small clusters appearing before the leaves, blooms April-May; fruit is a drupe, reddish, insipid, egg-shaped, 1-seeded, 6 mm diameter, matures June-August.

Seed: 108 per g, seed smooth, shiny, flattish, red-brown, suture angles across the seed lengthwise, embryo yellowish, filling cavity, small amount of endosperm mostly around the radicle.

Laboratory analysis:

Purity – 25 g for routine analysis, no weeds

Germination – 60 days prechill at 3-5C; germinate at 20-30C with light; first count at 7 days; last count at 28 days; average germination 60-70 percent. Soak in sulfuric acid for 15-30 min. will replace the need for prechill. Seed should be removed from the acid when pitting of the seed coat occurs. Sources differ in their rates of germination and in their pretreatment requirements. This species has a more restrictive seed coat than silver buffaloberry.

Normal seedling – Short, stout primary root, sturdy stout hypocotyl without breaks or lesions, 3-4 times the length of the primary root, 2 green intact cotyledons, evidence of an epicotyl.

Excised embryo – No data

Tetrazolium – Soak overnight in water, remove cotyledon end exposing embryo, place in 1 percent tetrazolium solution (less than 24 hrs.), slice lengthwise to evaluate.

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper; 12 KV, 2.5 min. for Polaroid film; Filled, empty, and abnormal development visible.

Storage: Dry at 3C, good for 5 years.

Endangered species classification: Endangered in IL & ME; restricted in distribution in PA; rare and endangered in IN.

Suggested references:

Heit, C. E. 1970. *Germination Characteristics and Optimum Testing Methods for Twelve Western Shrub Species*. Proc. Aosa 60:197-205.

McLean, A. 1967. *Germination of Forest Range Species from Southern British Columbia*. J. Range Mgt. 20(5):321-322.

Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

ELAEAGNACEAE

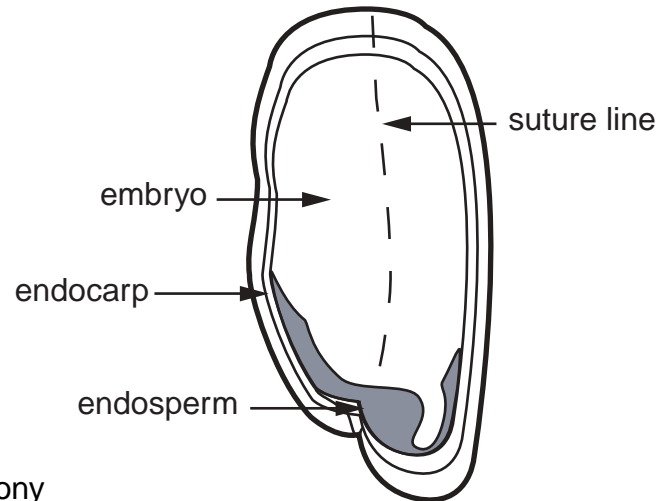
SHEPHERDIA ROTUNDIFOLIA PARRY (BUFFALOBERRY)

Distribution: AZ, UT

Description: Shrub

Flower and fruit: No data

Seed: 21 per g, nearly round or oblong, brown to reddish-brown, suture in middle lengthwise, very hard, bony outer seed coat, inner seed coat more like felt but harder, embryo yellowish and filling seed coat, radicle large and curved; seed coat surface is shiny but not smooth, 5-6 mm long, 4-5 mm wide.



Laboratory analysis:

Purity – 125 g for routine analysis.

Germination – Soak in concentrated sulfuric acid for 15-30 min. (until seed coat is pitted), rinse thoroughly in water, germinate at 20-30C, first count at 7 days, last count at 21 days. Can also use 30-60 days of prechill in place of the acid soak. If left too long in the acid soak, seed can be damaged.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, remove seed coat by cutting on suture with pressure, cut inner seed coat, place in 1 percent tetrazolium solution (appears to be slow staining), slice lengthwise for evaluation.

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper; 12 KV, 2.5 min. for Polaroid film; Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: None

Suggested references:

Heit, C. E. 1970. *Germination Characteristics and Optimum Testing Methods for Twelve Western Shrub Species*. Proc. Aosa 60:197-205.

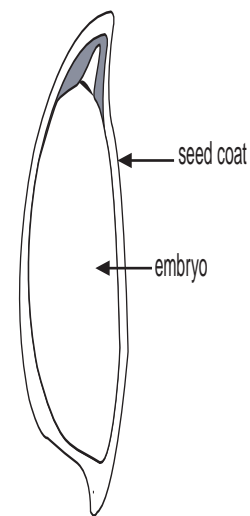
USDA. 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.

ROSACEAE

SORBUS AMERICANA MARSHALL (AMERICAN MOUNTAIN-ASH)

Distribution: CT, GA, IA, IL, MA, MD, ME, MI, MN, MS, NC, ND, NH, NJ, NY, PA, TN, VA, VT, WI, WV:NB, NFLD, NS, ONT, QUE

Description: Shrub, 4-9 m tall, pinnately compound leaf, 25 cm long, leaflets 11-17, narrow, 4-10 cm long, sharply serrate, gray-green beneath. May develop into a tree. Found in cold swamps or bogs and on rocky ledges at high elevations. Provides wildlife habitat and food, deer browse and ornamental and food for wild birds.



Flower and fruit: Large perfect white flowers in flattened dense clusters, 15 cm across, flowers each 6 mm across; blooms May-July. Fruit is a pome, orange-red, 2-5-celled, berrylike, 4-6 mm diameter, 1 or 2 small seed each; matures August-October.

Seed: 180-520 per g (mean 350), brown to reddish-brown seed, beaked, embryo filling cavity with radicle at beaked end of seed, radicle large.

Laboratory analysis:

Purity – 7 g for routine analysis, no weeds.

Germination – 60 days prechill at 3-5C, germinate at 20-30C; first count at 7 days; last count at 21 days; average germination is 20 percent.

Normal seedling – Hypocotyl 3+ cm tall with medium thick green cotyledons, hypocotyl thin, epicotyl may or may not be visible; root 1-2 cm long with no lateral or branch roots, quickly tapering.

Excised embryo – Soak in water 24 hrs. at room temperature, gently remove seed coat, place on moist blotter at 20-30C, examine in 6 days for green and firm embryos.

Tetrazolium – Soak overnight in water, cut 1 mm from cotyledon end (end opposite beak), place in 1 percent tetrazolium solution, slice lengthwise for evaluation.

Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper; 12 KV, 1 min. for Polaroid film; Filled, empty, and abnormal development visible.

Storage: Store clean seed at 3-5C, at 6-8 percent moisture content, sealed in containers, viability held 8 years without loss.

Endangered species classification: Rare and endangered in GA; endangered in IL; and rare in MAN.

Suggested references:

Flemion, F. 1938. A Rapid Method for Determining the Viability of Dormant Seeds. Contrib. Boyce Thompson Inst. 9:339-351.

Heit, C. E. 1955. *The Excised Embryo Method for Testing Germination Quality of Dormant Seed*. Proc. Aosa 45:108-117.

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.

ROSACEAE

SORBUS SCOPULINA GREENE (GREENE'S MOUNTAIN-ASH, WESTERN MOUNTAIN-ASH)

Distribution: AK, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY:
ALB, BC, SAS

Description: Small shrub, 1-4 m tall, leaves alternate, pinnate, leaflets 11-13, oblong, 2.5-6 cm long, serrate and glabrous. Found in canyons and wooded slopes, 1,200-2,700 m, wildlife habitat and food.

Flower and fruit: Perfect white flowers, 10 mm across, sepals pilose, in terminal corymbs. Fruit is an orange to scarlet pome, round, 8 mm diameter, 2-5 celled, with cartilaginous, fleshy walls.

Seed: 180 per g, red-brown, beaked, 3-4 mm long, 1.5-2.5 mm wide, embryo filling cavity, radicle very large.

Laboratory analysis:

Purity – 15 g for routine analysis, no weeds.

Germination – 90 to 120 days prechill at 3-5C; first count at 7 days; last count at 28 days; 72 hrs. GA3 soak may be helpful (3.4g/1000cc water) prior to prechill.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, cut 1 mm from cotyledon end (end opposite beak), place in 1 percent tetrazolium solution, slice lengthwise for evaluation.

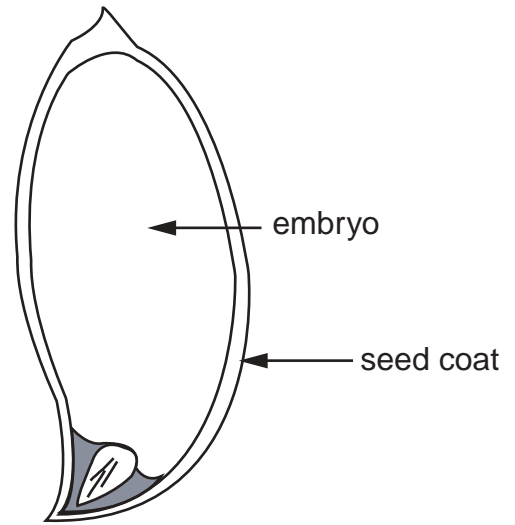
Radiographic – 12 KV, 45 sec. for Kodak AA film and Industrex paper; 12 KV, 2 min. for Polaroid film; Filled, empty, and abnormal development visible.

Storage: Dry in sealed containers at 3-5C.

Endangered species classification: Protected in MN.

Suggested references:

- Emery, D. 1964. *Seed Propagation of Native California Plants*. Leaflets of the Santa Barbara Botanic Gardens 1(10):81-96.
- USDA. 1979. *Native Shrub Production Project: Coeur D'Alene Nursery*. Surface Environment & Mining Program, 40P. USDA, Forest Service, Billings, MT.
- Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.



MALVACEAE

SPHAERALCEA COCCINEA (NUTTALL) RYDBERG (RED GLOBEMALLOW, RED FALSEMALLOW)

Distribution: AZ, CO, IA, KS, MN, MT, ND, NE, NM, OK,
SD, TX, UT, WY:ALB, BC, MAN, SAS

Description: Low perennial forb, 5-30 cm tall, hoary, leaves 2-4 cm broad, 5-parted. Found on sandy plains.

Flower and fruit: Showy coppery-scarlet flowers in short spikes or racemes, petals 1-1.5 cm long, blooms in May, fruit is a schizocarp with 10 or more carpels in a single whorl, upper part smooth-walled, dehiscent, basal part indehiscent; laterally reticulated, 3 mm high, 1 seed each called mericarps, matures in August.

Seed: 1,500 per g, mericarps gray to brown, kidney-shaped, inner seed coat hard, thin and translucent to tan, waxy embryo curved around endosperm, radicle pointing downward in fruit, seed 1.5 mm diameter.

Laboratory analysis:

Purity – 2 g for routine analysis, 20 g for noxious weed count.

Germination – No data

Normal seedling – Vigorous primary root, at least twice as long as hypocotyl; hypocotyl sturdy, light green; 2 intact, dark green cotyledons.

Excised embryo – No data

Tetrazolium – Soak in water overnight, clip cotyledon end of the seed coat to expose seed tissue or puncture seed in the middle with a needle, place in 1 percent tetrazolium solution, slice lengthwise through flat axis to evaluate.

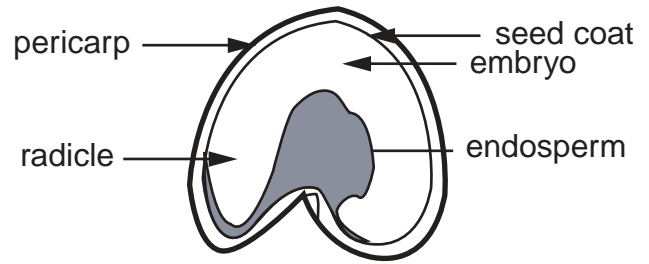
Radiographic – No data

Storage: No data

Endangered species classification: Rare in MAN.

Suggested references:

None



MALVACEAE

SPHAERALCEA GROSSULARIAEFOLIA (HOOKER & ARNOTT) RYBERG (GOOSEBERRYLEAF GLOBEMALLOW)

Distribution: AZ, CA, NM, NV, OR, UT

Description: Forb, 70-100 cm tall, leaves roundish, scarcely 3-lobed to deeply palmately parted or divided, finely toothed. Found in dry places in volcanic soil, up to 720 m.

Flower and fruit: Petals 8-20 mm long; fruit a schizocarp, densely pubescent, suborbicular to depressed-conical fruit, 10-20 mericarps in a single whorl; upper dehiscent, basal indehiscent, 1-3 seeded, straw colored fruit.

Seed: 420-450 per g, cordovan to black, reniform, usually with fruit coat attached which is lacy on the sides, embryo yellowish, curving around endosperm.

Laboratory analysis:

Purity – 5 g for routine analysis, 50 g for noxious weed count.

Germination – No data

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, remove the seed from the fruit, puncture the seed in the middle with a needle or cut cotyledon end to expose embryo tissue, place in 1 percent tetrazolium solution until stained, slice lengthwise on flat axis to evaluate.

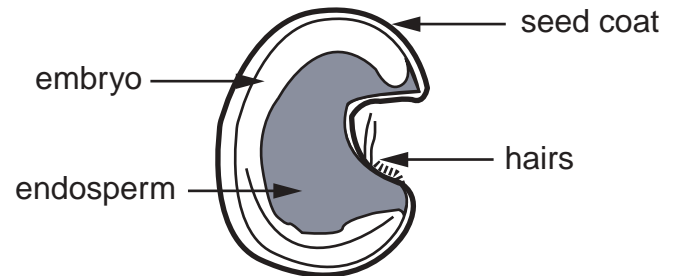
Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper; 12 KV, 1 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: None

Suggested references:

None

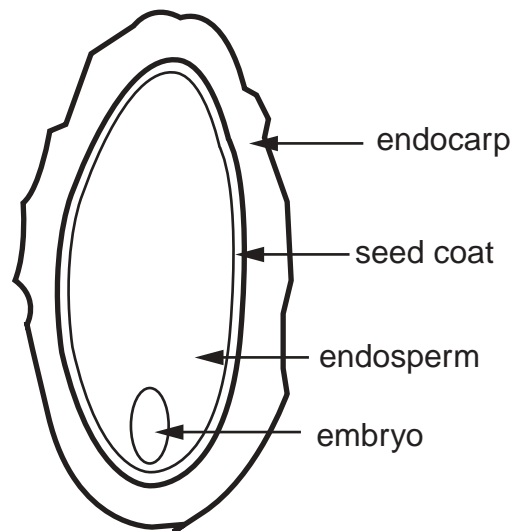


CAPRIFOLIACE

SYMPHORICARPOS ALBUS (L.) S.F. BLAKE (SNOWBERRY)

Distribution: CO, CT, DE, IA, ID, IL, MA, MD, ME, MI, MN, MO, MT, ND, NE, NH, NJ, NM, NY, OH, OR, PA, RI, SD, UT, VA, VT, WA, WI, WV, WY:ALB, BC, MAN, NB, NFLD, NS, ONT, QUE, SAS

Description: Small shrub, 20-80 cm high, leaves opposite, simple, elliptic, 5 cm long, sometimes lobed when young, wavy margin, thin, green. Found on dry, rocky, wooded slopes and banks, below 1,200 m. Used as an ornamental, occasionally used in reclamation, wildlife habitat and food.



Flower and fruit: Perfect pinkish flowers, blooms May-July, corolla campanulate, 6 mm long, flowers in clusters or spikes. Fruit is a berry-like drupe, white, 2-seeded, 6-12 mm diameter, matures August-October.

Seed: 160-210 per g, nutlets, white, rough, appearing as foam or fiberglass under magnification, 3-4 mm long, 2 mm wide, flattened on one side, bony endocarp, embryo very small, behind hole which is visible at one end of the seed on the flat side, embryo is embedded in endosperm.

Laboratory analysis:

Purity – 15 g for routine analysis.

Germination – Acid soak plus 60 days prechill at 3-5C; germinate at 20-30C; first count at 7 days, last count at 28 days; average germination is 50-60 percent. Soak in sulfuric acid for 60-75 min., remove when seed coat is pitted, wash and prechill. If an acid soak is not used, a warm followed by cold stratification is required. Stratify 30 days at 26C followed by 180 days at 10C.

Normal seedling – Vigorous primary root, long, thin, hypocotyl without breaks or lesions, 3-4 times primary root, 2 intact, green cotyledons and evidence of epicotyl.

Excised embryo – No data

Tetrazolium – Soak overnight in water, puncture seed in the center with a needle or cut cotyledon end to expose seed tissue, place in a 1 percent tetrazolium solution until stained, slice lengthwise on flat axis to evaluate.

Radiographic – 12 KV, 60 sec. for Kodak AA film and Industrex paper; 12 KV, 2.5 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: Store dry in sealed containers at 3-5C, viability good after 2 years (some viability retained 2 years at room temperature).

Endangered species classification: None

Suggested references:

Babb, M. F. 1959. *Propagation of Woody Plants by Seed*. Bulletin No. 26, 12P. Alaska Agri. Exp. Sta., University of Alaska, Palmer, AK.

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.

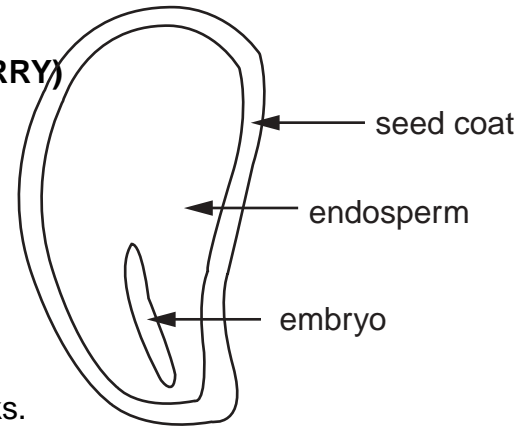
Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

ERICACEAE

VACCINIUM ANGUSTIFOLIUM AITON (LOWBUSH BLUEBERRY)

Distribution: CO, CT, DE, IA, IL, IN, MA, MD, ME, MI, MN, NH, NJ, NY, OH, PA, SC, TN, VA, VT, WI, WY:MAN, NB, NFLD, NS, ONT, QUE

Description: Dwarf shrub, 5-35 cm, intricately branched, leaves narrow, 0.7-2 cm long, 3-8 mm wide, bright green and glabrous on both sides. Found in dry open barrens, peat and rocks. Wildlife habitat and food, edible fruit.



Flower and fruit: Perfect, white or possible tinged in pink, flowers in glomerulate racemes from tips of branchlets or old leaf-axils, corolla 5-6 mm long, blooms May-June. Fruit is a berry, blue, covered with a heavy bloom, 5-8 mm diameter, many-seeded, August-September.

Seed: Red-brown, reticulate surface, 4,300 per g, 1.5 mm long, 1 mm wide, beaked, semi-curved, reflects light readily, white embryo in grainy endosperm.

Laboratory analysis:

Purity – No data

Germination – 60 days prechill at 3-5C; germinate at 20-30C; first count 7 days; last count at 35 days; average germination is 50-60 percent.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, clip cotyledon end, place in 1 percent tetrazolium solution until stained, slice lengthwise to evaluate.

Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper; 12 KV, 1 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: Store dry, sealed in containers at 3-5C, viability reported good for 12 years.

Endangered species classification: Rare in IA.

Suggested references:

Aalders, L. E., I. V. Hall and A. C. Brydon. 1980. *Seed Production and Germination in 4 Lowbush Blueberry Vaccinium Angustifolium Clones*. Hortscience 15(5):587-588.

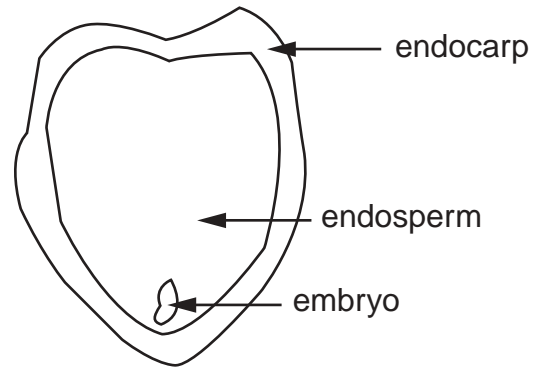
Smagula, J. M., M. Michaud and P. R. Hepler. 1980. *Light and Gibberellic-Acid Enhancement of Lowbush Blueberry Vaccinium Angustifolium Seed Germination*. Jour. Amer. Soc. Horticultural Science 105(6):816-818.

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.

ADOXACEAE

VIBURNUM EDULE (MICHAUX) RAFINESQUE (LOWBUSH-CRANBERRY, SQUASHBERRY, MOOSEBERRY)

Distribution: AK, CO, ID, ME, MI, MN, MT, NH, NY, OR, SD, UT, VT, WA, WI, WY:ALB, BC, MAN, NB, NFLD, NS, ONT, QUE, SAS



Description: Deciduous shrub, 30-120 cm, leaves opposite, simple, broadly oval with 3 broadly pointed short lobes above the middle, irregularly toothed, 2.5-7 cm long, petioles 1.5-2 cm long with a pair of small glands near the summit. Found in cool, moist woods and ravines, thickets, forest openings and along streams. Fruits used for sauce and jelly, wildlife habitat and food, fruits edible but sour, birds also eat fruits.

Flower and fruit: Flowers white or tinged with pink, in showy terminal panicles less than 4 cm broad, blooms May-October. Fruit is a drupe, red or orange, 1-seeded, persistent, round to slightly egg-shaped, 9 mm diameter, overripe fruit produces a musty odor. Matures August-October.

Seed: Color of light brick, heart-shaped with ribbed outline, inner seed coat brown and waxy, small embryo surrounded by a large amount of endosperm. Embryos usually immature when seed are harvested.

Laboratory analysis:

Purity – 40 g for routine analysis, 400 g for noxious weed count.

Germination – 30 days prechill at 3-5C; germinate at 20C or 20-30C; first count at 7 days; last count at 21 days; average germination is 90 percent. Requires after-ripening for the embryo to grow to the length of the seed. Epicotyl will only grow with additional prechilling of seedling.

Normal seedling – No data

Excised embryo – Cut off both sides of the seed leaving a 2-3 mm center strip, turn onto cut surface, cut cotyledon end and force seed coat apart, remove tiny embryo, place on moist media and germinate at 20-30C or constant 20C until embryo enlarges and develops color.

Tetrazolium – Turn seed on narrow edge with tweezers and slice off one flat face to expose endosperm, scratch or puncture endosperm to expose tiny embryo at basal end or remove the embryo with a teasing needle. Place embryo or cut seed in 1 percent tetrazolium solution until stained. Evaluate embryo rather than endosperm.

Radiographic – 12 KV, 80 sec. for Kodak AA film and Industrex paper; 12 KV, 3 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: Endangered in ME; endangered and protected in VT; threatened in MI; rare and endangered in SD; extirpated in WI.

Suggested references:

Densmore, R. 1974. *Germination Requirements of Vaccinium Vitis-Idaea, Rosa Acicularis and Viburnum Edule*. Unpublished MS Thesis, 56P. College of Biological Sciences and Renewable Resources, University of Alaska, Fairbanks, AK.

Viereck, L. A. and E. L. Little. 1972. *Alaska Trees and Shrubs*. Agri. Handbook No. 410, 265P. USDA, Forest Service, Washington, DC.

ADOXACEAE

VIBURNUM LENTAGO L. (BLACKHAW, WILD-RAISIN)

Distribution: CO, CT, GA, IA, IL, IN, MA, MD, ME, MI, MN, MO, MT, ND, NE, NH, NJ, NY, OH, PA, RI, SD, TN, VA, VT, WI, WV, WY:MAN, NB, ONT, QUE, SAS

Description: Shrub or small tree to 10 m tall, leaves elliptical, toothed on undulate-margined petioles, veins anastomosing petiole of leaves subtending cymes, 1.5-3.5 cm long, wood has a rank odor, found in borders of woods, stream-banks, etc. Wildlife habitat and food.

Flower and fruit: Uniform white flowers in compound cymes, cymes sessile, 5-12 cm broad; blooms April-June. Fruit is a drupe, blue-black, 1-seeded, 10-15 mm long, immature when red, sweet pulp, matures August-October.

Seed: 9-30 per g (average 12), black to brown, coarse seed coat, rough, round and thin, 8 mm wide, 8-10 mm long, seed coat is hard but brittle, embryo very small, embedded in hard, grainy endosperm. Embryo is immature when the seed is harvested.

Laboratory analysis:

Purity – 20 g for routine analysis.

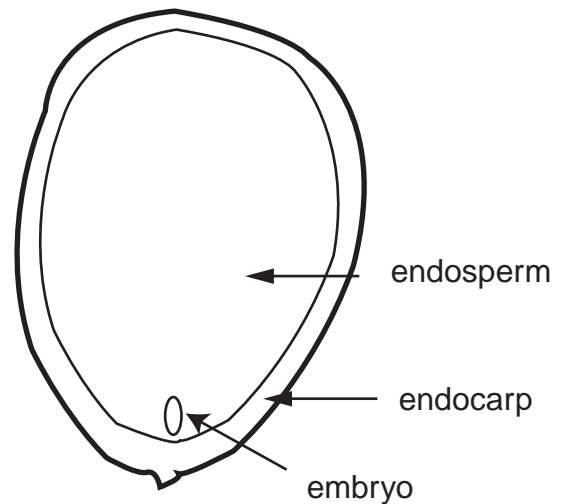
Germination – Stratify 150 days at 20 or 30C followed by 60 days at 3-5C; germinate at 20-30C; first count at 7 days; last count at 45 days; average germination is 40-60 percent. Warm stratification for 3 months followed by cold stratification for 3 months also reported as satisfactory; seed are fall sown in the nursery. Epicotyl will only grow with additional prechilling of seedling.

Normal seedling – Hypocotyl 2 cm, stout, two moderately large cotyledons, green epicotyl may not be visible, root twice length of hypocotyl with extensive lateral roots, broken tap roots will still develop into normal seedlings via lateral roots.

Excised embryo – Lay seed flat, cut off both sides of seed leaving a 2-3 mm center strip, turn onto cut surface and cut cotyledon end, force apart seed coat and endosperm and remove tiny embryo, place on moist media and germinate at 20-30C or constant 20C until embryo enlarges and develops color.

Tetrazolium – Turn seed on narrow edge and slice off one flat face to expose endosperm, scratch or puncture endosperm to expose tiny embryo, or remove embryo with a teasing needle, place in a 1 percent tetrazolium solution until stained.

Radiographic – 12 KV, 80 sec. for Kodak AA film and Industrex paper; 12 KV, 3 min. for Polaroid film. Filled, empty, and abnormal development visible.



Suggested references:

USDA. 1974. *Seeds of Woody Plants in the United States*. Agri. Handbook No. 450, 883P. USDA, Forest Service, Washington, DC.

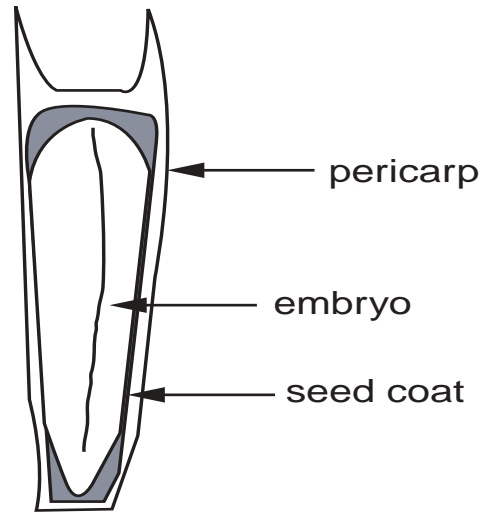
Vories, K. C. 1981. *Growing Colorado Plants from Seed: A State of the Art. Vol. I: Shrubs*. Gen. Tech. Report Int-103, 80P. USDA, Forest Service, Ogden, UT.

ASTERACESE

WYETHIA AMPLEXICAULIS (NUTTALL) NUTTALL (MULES EAR)

Distribution: ID, MT, OR, UT, WA, WY:BC

Description: Tall forb, 30-80 cm tall, leaves green, glossy-varnished, basal leaves oblong, 20-45 cm long, short-petioled, stem leaves smaller, sessile, alternate; found on north-facing slopes at high elevations (2,700m) and woodlands above the sage brush zone. Livestock graze the young growth, flower heads and seed; erosion control of disturbed areas.



Flower and fruit: Yellow flowers in heads 8-10 cm across, several, blooms June. Fruit is an achene, gray-brown appears whitish due to short hairs, 4-sided with short awns, 13-21 seed per head; achene 7-10 mm long, 1.5-2 mm wide.

Seed: Achene is "seed" of analyst, 58-65 per g, inner seed coat papery and grayish-brown.

Laboratory analysis:

Purity – 50 g for routine analysis.

Germination – 30 day prechill, germinate at 5-30C; first count at 7 days; last count at 28 days; average germination is 80-90 percent. 10-30C, 10-25C and 5-25C reported equally effective, 50 percent germination can be obtained without prechill when germinated at 5-25C or 5-20C.

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Slice seed lengthwise at edge, pry apart with fingernails and embryo will fall out, soak 2 hrs. in water, tease off inner seed coat, place in a 1 percent tetrazolium solution until stained.

Radiographic – 12 KV, 80 sec. for Kodak AA film and Industrex paper; 12 KV, 3 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: None

Suggested references:

Young, J. A. and R. A. Evans. 1979. *Arrowleaf Balsamroot and Mules Ear Seed Germination*. Jour. Range Mgt. 32(1):71-74.

LILIACEAE

ZIGADENUS ELEGANS PURSH (WHITE CAMASS, ALKALI GRASS)

Distribution: AK, AZ, CO, GA, IA, ID, IL, IN, MI, MN, MO, MS, MT, NC, ND, NE, NM, NY, OH, OR, SD, TX, UT, VA, VT, WA, WI, WY:ALB, BC, MAN, NB, ONT, QUE, SAS

Description: Forb, 1 m tall, bulbous, leaves mostly basal, 30 cm long, keeled, glaucous, sharp-pointed. Found in prairies, meadows, rocky slopes to open grassland.

Flower and fruit: Perfect green flowers, 1.5 cm long, in racemes, rarely panicles, each perianth segment with solitary, 2-lobed gland, blooms June; fruit is a capsule, twice as long as perianth, 3-lobed, septicidal, 4-6 mm diameter, mature in July.

Seed: 3-angled, straw color, 5-6 mm long, 2 mm wide, flattish.

Laboratory analysis:

Purity – Estimate 5 g for a routine analysis.

Germination – No data

Normal seedling – No data

Excised embryo – No data

Tetrazolium – Soak overnight in water, cut cotyledon end to expose embryo, place in 1 percent tetrazolium solution until stained, slice lengthwise on flat axis to evaluate.

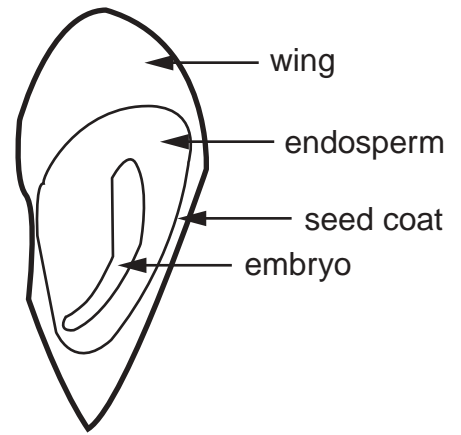
Radiographic – 12 KV, 30 sec. for Kodak AA film and Industrex paper; 12 KV, 1 min. for Polaroid film. Filled, empty, and abnormal development visible.

Storage: No data

Endangered species classification: Rare in IA & MO; special concern species in MN; Var. Glaucus endangered in IL & NC; rare and endangered in IN.

Suggested references:

None



GLOSSARY

Achene – A small dry fruit containing a single seed which nearly fills the cavity, the seed coat does not adhere to the pericarp.

Actinomorphic – Regular, radically, symmetrical flowers.

Accumbent – Cotyledons lying together with only an edge against the radicle.

Adnate – Union or fusion of unlike parts; Ex., stamens or petals.

Alternate – Located singly at different heights such as leaves.

Ament – A catkin, common to willow, oak and birch.

Amphitropous – A half-inverted ovule, funiculus fused with the side of the ovule, common to mallow.

Anatropous – An inverted ovule, fused at the connection with the funiculus, forming a raphe on the seed coat, common to most taxa.

Anther – Pollen-bearing part of stamen.

Anthesis – Flowering, more precisely the time of pollination.

Apetalous – Without petals.

Aril – An appendage or outer covering of a seed, common to ovules of euonymous.

Articulate – Jointed.

Axil – Angle formed by plant stem and leaf.

Axile – Type of placement of ovule, attached to central strand in multicarpel ovary, considered free-central when central strand not clear.

Berry – A fleshy fruit without a stone, usually contains several seed embedded in pulp.

Bicarpellate – Ovary composed of 2 carpels.

Bilabiate – Two-lipped flowers of labiatae.

Bract – Much reduced leaf.

Calyx – The whorl of sepals, outer circle of floral envelope.

Campanulate – Bell-shaped.

Campylotropous – Incurved ovule, funiculus appears to attach at the side of ovule, common to chickweed.

Capsule – A dry fruit which opens by splitting along the back of individual carpels or along the line where two meet.

Carpel – Ovule-bearing unit of ovary.

Carpelled – Possessing or composed of carpels.

Catkin – An inverted spikelike inflorescence of willow, birch and oak.

Circinate – Coiled from the top downward.

Complete – Composed of all four whorls (calyx, corolla, pistil and stamens).

Conduplicate – Cotyledons folded around the radicle.

Cone – A dry strobili bearing seed in some gymnosperms.

Connate – Union or fusion of like parts, such as petals forming a tube.

Copious – Abundant.

Corolla – The whorl of petals, inner circle of floral envelope.

Corona – A crown or circular appendage or a circle of appendages, such as a circle of stamens.

Cotyledons – The seed leaf, primary leaves of the embryo.

Cruciform – Petals forming a cross.

Deciduous – Losing leaves in winter.

Dehiscent – Splitting open at maturity as in fruits.

Dioecious – Male and female flowers on different plants.

Drupe – Usually a one-seeded fruit with a fleshy outer layer covering a stone.

Embryo – Rudimentary plant within a seed.

Endocarp – Inner layer of the fruit wall or pericarp.

Endosperm – Storage tissue of the seed.

Epigynous – Borne on or arising from the ovary, inferior ovary.

Evergreen – Plants with persistent leaves, remains green in dormant seasons.

Exocarp – Outer layer of pericarp, the skins on fleshy fruits.

Filament – Most commonly the stalk of the stamen.

Floret – An individual flower.

Flower – The reproductive part of angiosperms.

Foliaceous – Like foliage, leaf-like.

Follicle – A dry pod-like fruit which opens along the side only.

Forb – Any herb that is not a grass or grasslike.

Free-central – Type of placentation, see axile.

Fruit – The ripened ovary.

Funicle – (or Funiculus) The stalk which connects the ovule to the placenta in the ovary.

Funnelform – A flower with a gradually expanding floral tube.

Glabrous – Not hairy, smooth.

Glaucous – Covered with a whitish bloom that rubs off.

Gynoecium – The female part of a flower, all pistils collectively.

Head – A short dense inflorescence of sessile flowers, a compressed spike.

Herb – A flowering plant whose stem above ground does not become woody or persistent.

Herbaceous – Not woody, dying back to the ground each year.

Hilum – A scar from the ovular connection.

Hypanthium – A cup-like structure surrounding ovary formed by the fusion of the bases of the sepals, petals, and stamens.

Hypogynous – All floral parts are below the ovary, superior ovary.

Imbricated – Overlapped, in a shingle-like fashion.

Imperfect – A flower lacking either male or female sex organs.

Incomplete – A flower lacking one of perianth whorls.

Incumbent – Cotyledons folded against the radicle and one side of the cotyledon rests on the radicle.

Indehiscent – Remaining closed.

Inferior – Referring to an ovary which is below the attachment of the floral parts.

Inflorescence – The arrangement of flowers on a floral axis.

Integument – The outer envelope of an ovule, which becomes the seed coat.

Involucre – Bract at the base of an inflorescence.

Irregular – An asymmetrical flower.

Legume – A dry fruit splitting at maturity along two sutures.

Lenticular – Lens-shaped, curved on both surfaces but flattened.

Locule – A chamber or cell of an anther, ovary or fruit.

Loculicidal – A dry fruit which splits open on the back directly into a locule (also see poricidal and septicidal)

Marginal – Type of placentation of the ovary, attached to the wall of a simple ovary.

Mericarp – A fruit, one-half of a schizocarp, contains one seed.

Mesocarp – Middle layer of the fruit or paricarp wall.

Micropyle – The opening in the integuments through which the pollen tube enters.

Monoecious – Male and female flowers on same plant.

Mucilaginous – Sticky.

Multicarpellate – Ovary possessing two or more carpels.

Nut – One-seeded, hard bony-wall, indehiscent fruit.

Nutlet – A nut which is composed of one-half of a carpel.

Orthotropous – Straight ovule, stands up with micropyle at opposite end from funiculus, common to buckwheat.

Ovary – Ovule bearing part of the pistil.

Pappus – Sepals reduced to modified hairs or scales and persistent in fruit of asteraceae.

Pariental – Type of placement of ovules, attached at union of carpels.

Pellucid – Transparent or nearly so.

Pendulous – Body suspended from a fixed point, as a peddulum.

Perfect – A flower containing both pistil and stamens.

Perianth – A collective term for calyx and corolla.

Pericarp – The wall of the ripened ovary (fruit).

Perigynous – Flowers with hypanthiums, flowers where carpels appear to be inserted at the same level as other floral parts.

Petal – A unit of the corolla.

Petaloid – Petal-like, resembling a petal.

Pistil – The female structure in a flower, a unit of the gynoecium composed of stigma, style and ovary.

Placenta – Tissue to which ovules are attached in the ovary.

Placentation – The arrangement of the placentae within the ovary.

Plano-convex – Flat on one side and convex on other.

Pollina – See pollinium.

Pollinium – A coherent mass of pollen grains as in Orchidaceae and Asclepiadaceae.

Pome – A fleshy, many-seeded fruit with enlarged fleshy receptacle surrounding the pericarp.

Poricidal – Dry fruit opening by pores or small holes and which may be covered by valves.

Radicle – Rudimentary root or embryo.

Raphe – A ridge on ovule formed by most anatropous ovules.

Receptacle – The enlarged end of the flower axis on which the flower parts are borne.

Reniform – Kidney-shaped.

Salverform – A long corolla tube with short petals at right angles, separate or joined.

Samara – An indehiscent winged fruit.

Scape – Leafless flower stalk arising from the ground.

Schizocarp – Dry, dehiscent, two-carpelled fruit, splitting into two one-seeded mericarps.

Seed – The ripened ovule.

Sepal – A unit of the calyx.

Septate – Partitioned or divided.

Septicidal – A dry fruit which splits into the interior partitions and not directly into a locule.

Septum – A partition or cross-wall.

Sessile – Without a stalk.

Shrub – A woody perennial plant smaller than a tree, usually having permanent stems branching at or near the ground.

Silicle – Fruit, a broad, short silique.

Silique – Fruit, specialized type of capsule characteristic of mustard family, opens by sutures at either margin.

Spathe – A bract surrounding the flower-cluster.

Stamen – Male organ of the flower, composed of an anther and filament and producing pollen.

Stigma – The apical part of the pistil.

Stipule – Basal outgrowth of a petiole.

Strobilus – Male or female fruiting body of the gymnosperms.

Style – The central portion of the pistil, between the stigma and ovary.

Superior – Referring to ovary when floral parts are connected to the receptacle below the ovary and form a floral tube.

Suture – A line of union, or seam, between two members.

Sympetalous – Having petals joined.

Syncarpous – A gynoecium of two or more united carpels.

Tepal – Sepal and petals alike and undifferentiated.

Testa – Outer coat of a seed.

Tree – A perennial plant having a permanent woody, self-supporting main stem or trunk.

Unicarpellate – Ovary possessing one carpel.

Umbel – An inflorescence in which the pedicels of the flower arises from the approximate same point.

Utricle – Dry, indehiscent fruit with pericarp papery and free from seed.

Valve – A separable part of a pod, the units or pieces into which a capsule splits.

Valvate – Opening by valves, meeting at the edges without overlapping.

Verticillate – Arranged in whorls or appearing so.

Whorl – Three or more leaves or flowers at a node.

Wing – In seed: a thin, dry membranaceous extension.

Zygomorphic – Bilaterally, symmetrical.

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AMELANCHIER ALNIFOLIA
AMELANCHIER UTAHENSIS
AMORPHA CANESCENS
AMORPHA FRUTICOSA
ARCTOSTAPHYLOS PATULA
ARCTOSTAPHYLOS UVA-URSI
ARTEMISIA CANA
ARTEMISIA NOVA
ARTEMISIA SPINESCENS
ARTEMISIA TRIDENTATA
ASCLEPIAS TUBEROSA
SYMPHOTRICHUM NOVAE-ANGLIAE (L) NESOM
ASTRAGLAUS CICER
ATRIPLEX BONNEVILLENSIS
ATRIPLEX CANESCENS
ATRIPLEX CONFERTIFOLIA
ATRIPLEX CUNEATA
ATRIPLEX GARDNERI
ATRIPLEX LENTIFORMIS
ATRIPLEX SEMIBACCATA
ATRIPLEX TRIDENTATA

BALSAMORHIZA SAGITTATA
MOHONIA FREMONTII (TORREY) FEDDE

CALLICARPA AMERICANA
CARAGANA ARBORESCENS
CARAGANA PYGMAEA
CEANOTHUS CUNEATUS
CEPHALANTHUS OCCIDENTALIS
KRASCHENINNIKOVIA LANATA (PURSH) A.D.J.
MEEUSE & SMIT
CERCOCARPUS LEDIFOLIUS
CERCOCARPUS MONTANUS
LEUCANTHEMUM VULGARE LAM.
CHRYSOTHANMUS NAUSEOSUS
CHRYSOTHANMUS VISCIDIFLORUS
CORNUS STOLONIFERA
COWANIA MEXICANA

DALEA PURPUREA

ELAEAGNUS COMMUTATA
EPHEDRA NEVADENSIS
EPHEDRA VIRIDIS
ERIOGONUM CORYOMBOSUM
FALLUGIA PARADOXA
FORESTIERA NEOMEXICANA
FRAXINUS ANOMALA

GRAYIA SPINOSA
GRINDELIA SQUARROSA

HALOGETON GLOMERATUS
HEDYSARUM BOREALE
HELIANTHUS MAXIMILIANI
HELIOPSIS HELIANTHOIDES
HESPERIS MATRONALIS

ILEX VOMITORIA
IPOMOPSIS AGGREGATA
IVA ANNUA

JUNIPERUS OSTEOSPERMA

LIATRIS PYCNOSTACHYA
LINDERA BENZOIN
LINUM LEWISII
LONICERA TATARICA

MALVA MOSCHATA

OENOTHERA CAESPITOSA
ONOBRYCHIS VICIIFOLIA

PENSTEMON PALMERI
PENSTEMON STRICTUS
PERAPHYLLUM RAMOSSISSIMUM
PHYTOLACCA AMERICANA
POTENTILLA FRUTICOSA
POTENTILLA GLANDULOSA
POTENTILLA GRACILIS
PRUNUS ANDERSONI
PRUNUS PENNSYLVANICA
PRUNUS VIRGINIANA
PURSHIA GLANDULOSA
PURSHIA TRIDENTATA

RATIBIDA COLUMNIFERA
RATIBIDA PINNATA
RHUS GLABRA
RHUS TRILOBATA
RIBES AUREUM
RIBES CEREUM
RIBES MONTIGENUM
ROBINIA NEOMEXICANA
ROSA ACICULARIS
ROSA WOODSII
RUDBECKIA HIRTA

SALSOLA KALI

SALVIA AZUERA
SAMBUCUS CANADENSIS
SAMBUCUS CAERULEA
SAMBUCUS RACEMOSA
SAPONARIA OFFICINALIS
SARCOBATUS VERMICULATUS
SHEPHERDIA CANADENSIS
SHEPHERDIA ROTUNDIFOLIA
SORBUS AMERICANA
SORBUS SCOPULINA
SPHAERALCEA COCCINEA
SPHAERALCEA GROSSULARIAEFOLIA
SYMPHORICARPOS ALBUS

VACCINIUM ANGUSTIFOLIUM
VIBURNUM EDULE
VIBURNUM LENTAGO

WYETHIA AMPLEXICAULIS

ZIGADENUS ELEGANS

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SUPPLEMENTAL NOTES ON SEED SOURCE

The species range used in this book was provided by the individual state and provincial herbariums. Additional information was obtained by plotting these species ranges and by reviewing the works of botanists who have studied a given species in depth.

SPECIES	OTHER POSSIBLE OCCURRENCES
AGOSERIS GLAUCA	IA, WI
ALNUS VIRIDIS	VA, WI, WV
AMBROSIA ARTEMISIIFOLIA	KY
ARCTOSTAPHYLOS PATULA	ID, WY
ARCTOSTAPHYLOS UVA-URSI	NV, WV
ARTEMISIA CANA	AZ, WA
ARTEMISIA TRIDENTATA	
ASCLEPIAS TUBEROSA	LA
SYMPHOTRICHUM NOVAE-ANGLIAE (L) NESOM	GA, SC, ALB, SAS
ASTRAGLAUS CICER	ALB, OR, NV, UT, WA
ATRIPLEX CANESCENS	SAS, WA
ATRIPLEX CUNEATA	AZ
ATRIPLEX SEMIBACCATA	NV
CALLICARPA AMERICANA	
CARAGANA ARBORESCENS	
	UT, WI
CARAGANA PYGMAEA	MN, ND, WY
KRASCHENINNIKOVIA LANATA (PURSH) A.D.J. MEEUSE & SMIT	ALB, AZ, OK, MAN, SAS
CERCOCARPUS MONTANUS	ID, NV
LEUCANTHEMUM VULGARE LAM.	LA, NV, TX
CHRYSOTHANMUS NAUSEOSUS	SD
CHRYSOTHANMUS VISCIDIFLORUS	ALB, NE, ND, SAS, SD
ELAEAGNUS COMMUTATA	NM
FALLUGIA PARADOXA	KS, NE
FRAXINUS ANOMALA	TX
GRINDELIA SQUARROSA	VT
HALOGETON GLOMERATUS	AZ
HEDYSARUM BOREALE	NB, NH, ME, ONT, VT
HELIANTHUS MAXIMILIANI	KY, NH, VT
HELIOPSIS HELIANTHOIDES	ALB, NB, NH, WA
HESPERIS MATRONALIS	ID, WA
IPOMOPSIS AGGREGATA	
IVA ANNUA	MN, SD
LIATRIS PYCNOSTACHYA	MS
LINDERA BENZOIN	QUE, WI
LINUM LEWISII	MO, WA, WI
LONICERA TATARICA	

OENOTHERA CAESPITOSA	AZ
ONOBRYCHIS VICIFOLIA	
PENSTEMON PALMERI	AZ
PENSTEMON STRICTUS	AZ
PERAPHYLLUM RAMOSSISSMUM	AZ, WY
PHYTOLACCA AMERICANA	AZ, MN, SD
POTENTILLA FRUTICOSA	AZ
PRUNUS PENNSYLVANICA	NE
PRUNUS VIRGINIANA	AZ
PURSHIA GLANDULOSA	AZ
PURSHIA TRIDENTATA	AZ, CA
RATIBIDA COLUMNIFERA	AZ, TN
RATIBIDA PINNATA	NY
RHUS GLABRA	ALB, AZ, NV
RHUS TRILOBATA	AR, AZ, IA, IS, IL, NE, TX I
RIBES AUREUM	AZ, NE, MAN
RIBES CEREUM	AZ, KS
RIBES MONTIGENUM	AZ
ROBINIA NEOMEXICANA	AZ, UT
ROSA ACICULARIS	PA
ROSA WOODSII	AZ
RUDBECKIA HIRTA	AZ, ME, NV, OR
SALSOLA KALI	KY, LA
SALVIA AZUERA	AR, IL, IN, KY, MN
SAMBUCUS RACEMOSA	KY, MA, MI, MN, NC, ND, NE, NH, OH, QUE, VA, VT
SAPONARIA OFFICINALIS	AR, AZ, LA, SAS
SHEPHERDIA CANADENSIS	NH
SORBUS AMERICANA	IN, KY, MAN, OH
SORBUS SCOPULINA	AZ, ND, SD
SPHAERALCEA GROSSULARIAEFOLIA	ID, WA
SYMPHORICARPOS ALBUS	CA, IN
VACCINIUM ANGUSTIFOLIUM	KY, NC, RI
VIBURNUM EDULE	ND, PA
VIBURNUM LENTAGO	KY, NC, SC
WYETHIA AMPLEXICAULIS	NV
ZIGADENUS ELEGANS	PA, WV