

Plant Propagation Protocol for *Goodyera repens*

ESRM 412 – Native Plant Production

URL: <https://courses.washington.edu/esrm412/protocols/2021/GORE2.pdf>



TAXONOMY	
Plant Family	
Scientific Name	Orchidaceae
Common Name	Orchid
Species Scientific Name	
Scientific Name	<i>Goodyera repens</i> (L.) R. Br. in Ait. & Ait. f. ¹
Varieties	N/A
Sub-species	N/A
Cultivar	N/A
Common Synonym(s)	<i>Goodyera ophioides</i> (Fernald) Rydb.

	<p><i>Goodyera repens</i> (L.) R. Br. var. <i>ophioides</i> Fernald <i>Goodyera repens</i> (L.) R. Br. ssp. <i>ophioides</i> (Fernald) Á. Löve & Simon <i>Peramium ophioides</i> (Fernald) Rydb. ²</p>
Common Name(s)	Dwarf Rattlesnake Plantain, Lesser Rattlesnake Plantain, Northern Rattlesnake Plantain ¹ , Creeping Lady's Tresses ⁵
Species Code (as per USDA Plants database)	GORE2

GENERAL INFORMATION

Geographical range	<p align="center">North America Distribution</p> <p align="center">Source: USDA PLANT Database ²</p> <p>Lesser rattlesnake plantain is transcontinental in Canada and occurs in continuous and discontinuous populations in the United States. Its northern range occurs in Alaska, Yukon, and Newfoundland. In the eastern United States, its southern range reaches North Carolina and Tennessee; in the West, it occurs in disjunct populations in Arizona, New Mexico, and Colorado. ³</p>
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Ecological distribution	<p>Part shade, shade; coniferous swamps, bogs, forests; mixed forests ⁴</p> <p>In pine woods, rarely under birch or on moist fixed dunes in northern Britain ⁵</p>
Climate and elevation range	<p>Hardiness: 5-9 ⁵</p> <p>Elevation: Lesser rattlesnake plantain occurs at elevations ranging from sea level to about 9,500 feet (0-2,900 m). This varies with geographic location. For example, lesser rattlesnake plantain occurs at high elevations in disjunct populations in Colorado (8,065-8,258 feet (2,460-2,515 m)) and New Mexico (7,450 feet (2,270 m)) and occurs at low elevation in eastern Canada (450 feet (135 m)). ²</p>
Local habitat and abundance	<p>In North America, Lesser rattlesnake plantain is associated with undisturbed, late-successional and old-growth forests. In much of its range, lesser rattlesnake plantain occurs in shady, moist, coniferous or mixed forests, on mossy or humus-covered ground, and can sometimes occur in bogs or swamps. However, it also occurs in xeric conditions in the southern Appalachian Mountains including high, rocky, exposed cliffs and slopes of the Carolina hemlock (<i>Tsuga caroliniana</i>) community; xeric heath balds and forest heathlands; and relatively xeric eastern hemlock (<i>Tsuga canadensis</i>) forest. ²</p> <p>In New York State, <i>Goodyera repens</i> is found in coniferous, mixed hardwood-coniferous, and hardwood forests predominately in thin acidic soils. ⁶</p>
Plant strategy type / successional stage	<p>Mid- to late-successional species generally occurring in stands more than 70 years old. ²</p>
Plant characteristics	<p><u>General</u>: <i>Goodyera repens</i> is a PERENNIAL growing to 0.3 m (1ft). ⁵</p>

Forb/herb ⁶

Leaves: Blade uniformly green or with green lateral veins bordered by white or greenish white tissue, narrowly to broadly ovate, 1.1–3.2 × 0.5–1.8 cm, apex acute or obtuse. ⁷

Mostly basal ²



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Flowers: Inflorescences secund, infrequently loosely spiraled, 7–36-flowered; peduncle 3–18 cm. Flowers: lateral sepals 3–5.2 mm; petals distinct; hood 3–5.5 mm; lip narrowly saccate, lanceolate, 1.8–4.8 × 1.4–3.2 mm, apex acute, recurved or reflexed, inner surface with 2 or 4 glandular ridges; anther inflexed, not immersed in shallowly concave clinandrium, apex apiculate; pollinia blunt; rostellar beak 2-pronged, 0.2–0.6 mm, shorter than body of stigma; viscidium orbiculate. $2n = 30$. ⁷



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White or pale green flowers occur close together on one-sided racemes, perfect, bilateral flowers ²

Fruits: Fruit is an ascending to spreading capsule, up to ¼ inch long. ⁴

Capsule that contains numerous tiny and lightweight seeds. ²



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PROPAGATION DETAILS

Protocol Information: The American Orchid Society, “Sowing Orchid Seed”

* This article discusses sowing seeds at home with tropical varieties. I have made minor adjustments to accommodate a nursery setting. All details come from this article unless otherwise stated. Surface sowing details have been adapted from **Plants For A Future**.⁵

Ecotype	Temperate terrestrial orchid
Propagation Goal	Plants
Propagation Method	Seed
Product Type	Container (plug) *If surface sowing-- Bareroot (field grown)
Stock Type	N/A
Time to Grow	Upwards of three years from seed to mature plant
Target Specifications	N/A
Propagule Collection Instructions	<p>Hand harvest seeds when mature-- the capsule turns yellow or splits. Remove the capsule from the plant and place on paper in a protected, warm, dry, place. A day later the capsule will be dry enough to shake out the seed. Fold the collected seed in unglazed paper to form a closed packet and store the seed with a packet of drying agent. Suitable drying agent packets, usually silica, can be used. Heat the packet for one minute in a microwave oven and let it cool before placing it in a bottle with the seed. The bottle containing the seed and the drying agent should be tightly capped and stored in a refrigerator with humidity control.⁹</p> <p>Flowering, and therefore maturity of capsules, varies for this species based on location.</p> <p>In North America, the flowering period ranges from early July to mid-September.²</p> <p>It is important to note that these seeds are tiny and are understood to possess a short-lived seed bank period.²</p>

	<p>*Surface sowing is another approach that requires seeds to be sown as soon as they are ripe. ⁵</p>
<p>Propagule Processing/Propagule Characteristics</p>	<p>A day after harvest the capsule will be dry enough to shake out the seed. Fold the collected seed in unglazed paper to form a closed packet and store the seed with a packet of drying agent. Suitable drying agent packets, usually silica, can be used. Heat the packet for one minute in a microwave oven and let it cool before placing it in a bottle with the seed. The bottle containing the seed and the drying agent should be tightly capped and stored in a refrigerator with humidity control. ⁹</p> <p>*If surface sowing use ripe seeds directly from the plant ⁵</p>
<p>Pre-Planting Propagule Treatments</p>	<p>The bottle containing the seed and the drying agent should be tightly capped and stored in a refrigerator with humidity control. ⁹</p> <p>A reminder that <i>Goodyera repens</i> seeds have a short-lived seed bank period. While time is not specified regarding this limitation it is recommended that seeds be treated and sowed without delay.</p> <p>Scarification and sterilization <i>in vitro</i> by using hypochlorites, is used to break dormancy by rupturing the water-repellent testa in orchid seeds. Calcium hypochlorite (Ca(OCl)₂) is usually preferred, since it often yields better germination results after sterilization than sodium hypochlorite (NaOCl). Hypochlorites are strongly alkaline in solution and oxidizing agents. Other oxidants, such as alcohols, do not promote germination. However, other strong bases, such as sodium hydroxide (NaOH), promote germination, suggesting that it is the alkalinity of the sterilant that improves germination. ¹¹</p> <p>*If surface sowing-- N/A</p>

<p>Growing Area Preparation / Annual Practices for Perennial Crops</p>	<p>Prepare and sterilize a nutrient gel that will act as a substitute to replicate the symbiotic relationship orchids share with mycorrhizae. ¹⁰</p> <p>Mediums to consider include: Hill's mother flask medium, and a medium that consists of Knudson's C with 100 to 200 ml of the water replaced by coconut milk. ⁹</p> <p>*If surface sowing it is recommended to use some of the soil that is growing around established plants in order to introduce the fungus, or to sow the seed around a plant of the same species and allow the seedlings to grow on until they are large enough to move. ⁵</p>
<p>Establishment Phase Details</p>	<p>Observe plants and look for protocorms to form.</p> <p>These miniature orchids will be sown again into new flasks which may contain a stronger medium, and again this is done in sterile conditions, eventually from the thousands of protocorms originally sown only around 25/30 will be sown into the final flask. The task of replating (reflasking) may be done again and again as the plantlets mature and grow, and eventually they will become large enough to be pricked out and sown in regular orchid compost to continue and grow into flowering plants. ¹⁰</p> <p>Flasks must be kept in temperature controlled chambers and light that mimics ideal conditions for <i>Goodyera repens</i>.</p> <p>*If surface sowing-- N/A</p>
<p>Length of Establishment Phase</p>	<p>N/A</p>
<p>Active Growth Phase</p>	<p>N/A</p>
<p>Length of Active Growth Phase</p>	<p>N/A</p>
<p>Hardening Phase</p>	<p>N/A</p>
<p>Length of Hardening Phase</p>	<p>N/A</p>

Harvesting, Storage and Shipping	N/A
Length of Storage	N/A
Guidelines for Outplanting / Performance on Typical Sites	<p>N/A</p> <p>*If surface sowing it can be assumed that propagation occurred at outplanting site</p>
Other Comments	<p>I can not say for certain that methods to propagate tropical varieties can be adapted to <i>Goodyera repens</i>.</p> <p>*If surface sowing: Cultivation details-- Requires a somewhat shady site and a well-drained compost of peat, leaf mold and sand. Does well in the woodland garden. Orchids are, in general, shallow-rooting plants of well-drained low-fertility soils. Their symbiotic relationship with a fungus in the soil allows them to obtain sufficient nutrients and be able to compete successfully with other plants. They are very sensitive to the addition of fertilizers or fungicides since these can harm the symbiotic fungus and thus kill the orchid. ⁵</p> <p>Like other terrestrial orchids, lesser rattlesnake plantain requires a mycorrhizal symbiont for seed germination and early seedling development. The symbiont is usually <i>Rhizoctonia goodyerae-repentis</i>. Lab experiments have demonstrated that lesser rattlesnake plantain can be germinated asymbiotically in the presence of an external carbohydrate source, whereas inoculated lesser rattlesnake plantain does not require a carbohydrate. Other lab experiments with seeds collected from Pinnacle Mountain, South Carolina, found that germination rates were greater when seeds were exposed to light (37% germination) compared to those incubated in continuous darkness (25% germination), and light had no effect on seed mortality. ³</p> <p>Rhizomes that arise from seed require 5 years to produce a rosette of evergreen leaves, which produces a flowering stalk and seed capsules after approximately 3 more years. ³</p>

PROPAGATION DETAILS

Protocol Information: Adapted from “Propagation, cultivation and breeding of terrestrial temperate orchids, with focus on *Cypripedium spp.*” by Linda-Marie Rännbäck.

*While *Goodyera repens* is not the focus of this study, it closely relates to *Cypripedium spp.*, as a temperate terrestrial orchid, and I felt it was appropriate to attempt to adapt vegetative propagation procedures of *Cypripedium spp.* to this protocol as there is no direct information regarding this practice with *Goodyera repens*. All details adapted from this study unless otherwise stated.

Ecotype	Temperate terrestrial orchid
Propagation Goal	Plants
Propagation Method	Vegetative
Product Type	Container (plug)
Stock Type	N/A
Time to Grow	N/A
Target Specifications	N/A
Propagule Collection Instructions	Rhizome clumps should be divided before the start of the annual root growth, which is immediately after flowering. ¹¹
Propagule Processing/Propagule Characteristics	Each division should have at least 3-4 scars representing not less than 3 years growth, and have 3 cm rhizome before the bud, but the more rootstock mass and buds the better. ¹¹
Pre-Planting Propagule Treatments	Bud proliferation could be promoted by making shallow cuts on the rhizomes during the growing season before the intended division. The cuts could be powdered with charcoal to dry it out. The divisions should be instantly

	transferred to new compost to minimize the root disturbance. ¹¹
Growing Area Preparation / Annual Practices for Perennial Crops	<p>For garden cultivation, the choice could be to either plant in pots or in a specially prepared bed. Robust species and hybrids can grow in ordinary garden soil which is well drained. The new artificial hybrids are so easily cultivated that they can be treated as ordinary perennials.</p> <p>The preferred light conditions for most hybrids and species are half shade, and exposure to sun should only occur early or late during the day. Planting is preferably done under shading trees or together with non-invasive companion plants. Average temperature during the day should ideally not reach above 20°C, since dry and hot conditions are injurious. The plants should further be protected against windy conditions to prevent the fragile stems to bend or break.</p> <p>Soil requirements range, but should always include soil that is moist during growing and flowering in early summer, but dry in late summer when new shoots are formed. There should be a high content of organic matter that has a slow mineral release. Drainage material should be included to keep the roots aerated. Species from boggy habitats could be grown in <i>Sphagnum</i>, or mixes containing it.</p> <p>Most temperate terrestrials thrive when the soil pH is in the range of 6,5 to 7,0. ¹¹</p>
Establishment Phase Details	Rhizomes should be planted in a shallow hole with the tips of the buds upright, and then covered by 2-4 cm of compost. The tips of the buds should be just below the surface, and not deeper than 2 cm. ¹¹
Length of Establishment Phase	N/A
Active Growth Phase	N/A
Length of Active Growth Phase	N/A

Hardening Phase	N/A
Length of Hardening Phase	N/A
Harvesting, Storage and Shipping	N/A
Length of Storage	N/A
Guidelines for Outplanting / Performance on Typical Sites	N/A
Other Comments	The species is hermaphrodite (has both male and female organs) and is pollinated by Humble bees. The plant is not self-fertile. ⁵

INFORMATION SOURCES	
References	See Below
Protocol Author	Nicole Seiger
Date Protocol Created or Updated	5/25/21

References:

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² USDA. (n.d.). *Goodyera repens* (L.) R. Br. Plants 3. <https://plants.usda.gov/home/plantProfile?symbol=GORE2>. [Accessed 25 May 2021.]

³ Abrahamson, Ilana L. 2013. *Goodyera repens*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <https://www.fs.fed.us/database/feis/plants/forb/goorep/all.html> [Accessed 25 May 2021].

⁴ Minnesota Wildflowers. (n.d.). *Goodyera repens* (Lesser Rattlesnake Plantain). Minnesota Wildflowers. <https://www.minnesotawildflowers.info/flower/lesser-rattlesnake-plantain>. [Accessed 25 May 2021].

⁵ *Goodyera repens* - (L.)R.Br. Plants For A Future. (n.d.). <https://pfaf.org/user/Plant.aspx?LatinName=Goodyera+repens> . [Accessed 25 May 2021].

⁶ Weldy, Troy, David Werier, and Andrew Nelson. 2021 New York Flora Atlas. [S. M. Landry and K. N. Campbell (original application development), USF Water Institute. University of South Florida]. New York Flora Association, Albany, New York <http://newyork.plantatlas.usf.edu/Plant.aspx?id=2002> [Accessed 25 May 2021].

⁷ Flora of North America. (n.d.). 3. *Goodyera repens* (Linnaeus) R. Brown, Hortus Kew. 5: 198. 1813. *Goodyera repens* in Flora of North America. http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=200028685. [Accessed 25 May 2021].

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⁹ Bergman, F. J. (2006, July). *An Easy Approach to New Rewards*. Sowing Orchid Seeds. Orchids 526-531. <https://www.aos.org/AOS/media/Content-Images/PDFs/SowingOrchidSeed.pdf>. [Accessed 25 May 2021].

¹⁰ North of England Orchid Society . (n.d.). Propagating Orchids - The Various Methods... . Orchid Propagation - The North of England Orchid Society. <https://www.orchid.org.uk/orchidpropogation.htm>. [Accessed 25 May 2021].

¹¹ Rännbäck, L.-M. (2007). *Propagation, cultivation and breeding of terrestrial temperate orchids, with focus on Cypripedium spp.* Bachelor project in the Danish-Swedish Horticulture programme 2007:01 <https://core.ac.uk/download/pdf/211580601.pdf>. [Accessed 25 May 2021].

Other Sources Consulted (but that contained no pertinent information)

¹² Brzosko, E., Wroblewska, A., Jermakowicz, E., Hermaniu , A., (2013, April 27). High level of genetic variation within clonal orchid *Goodyera repens*. researchgate.net. Original publication: Plant System Evolution (2013) 299:1537–1548 DOI 10.1007/s00606-013-0817-7. https://www.researchgate.net/profile/Ada-Wroblewska/publication/257447646_High_level_of_genetic_variation_within_clonal_orchid_Goodyera_repens/links/00b7d52e66ea347a6f000000/High-level-of-genetic-variation-within-clonal-orchid-Goodyera-repens.pdf?origin=publication_detail. [Accessed 25 May 2021].

¹³ Kew, Royal Botanical Gardens . (n.d.). Orchid seeds: Nature's tiny treasures. Orchid seeds: Nature's tiny treasures. <https://www.kew.org/read-and-watch/orchid-seeds-natures-tiny-treasures>. [Accessed 25 May 2021].

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Note: This propagation protocol template was modified by J.D. Bakker from that available at: <http://www.nativeplantnetwork.org/network/SampleBlankForm.asp>