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Inspection Agency

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d'inspection des aliments

Identification of Selected Species in Solanaceae

Jennifer Neudorf and Angela Salzl

Seed Science and Technology Section, Saskatoon
Laboratory, Canadian Food Inspection Agency

July 15th, 2021



Canada

Learning objectives

1. Become familiar with the structures and seed features of the selected species.
2. Become aware of the updates to the nomenclature of certain *Solanum* species.
3. Know how to apply this knowledge to distinguish selected *Solanum* species.

Agenda

1. Solanaceae Family Overview
2. Nomenclature updates of *Solanum* species
3. Seed features of *Solanum* species in the subgenus *Solanum* (Group 1)
4. Live demonstration of the seeds in Group 1
5. Seed features of *Solanum* species in the subgenus *Leptostemonum* (Group 2)
6. Live demonstration of the seeds in Group 2

Solanaceae Family Overview - Fruits

Datura stramonium



Solanum carolinense



Solanum rostratum



Solanum nigrum



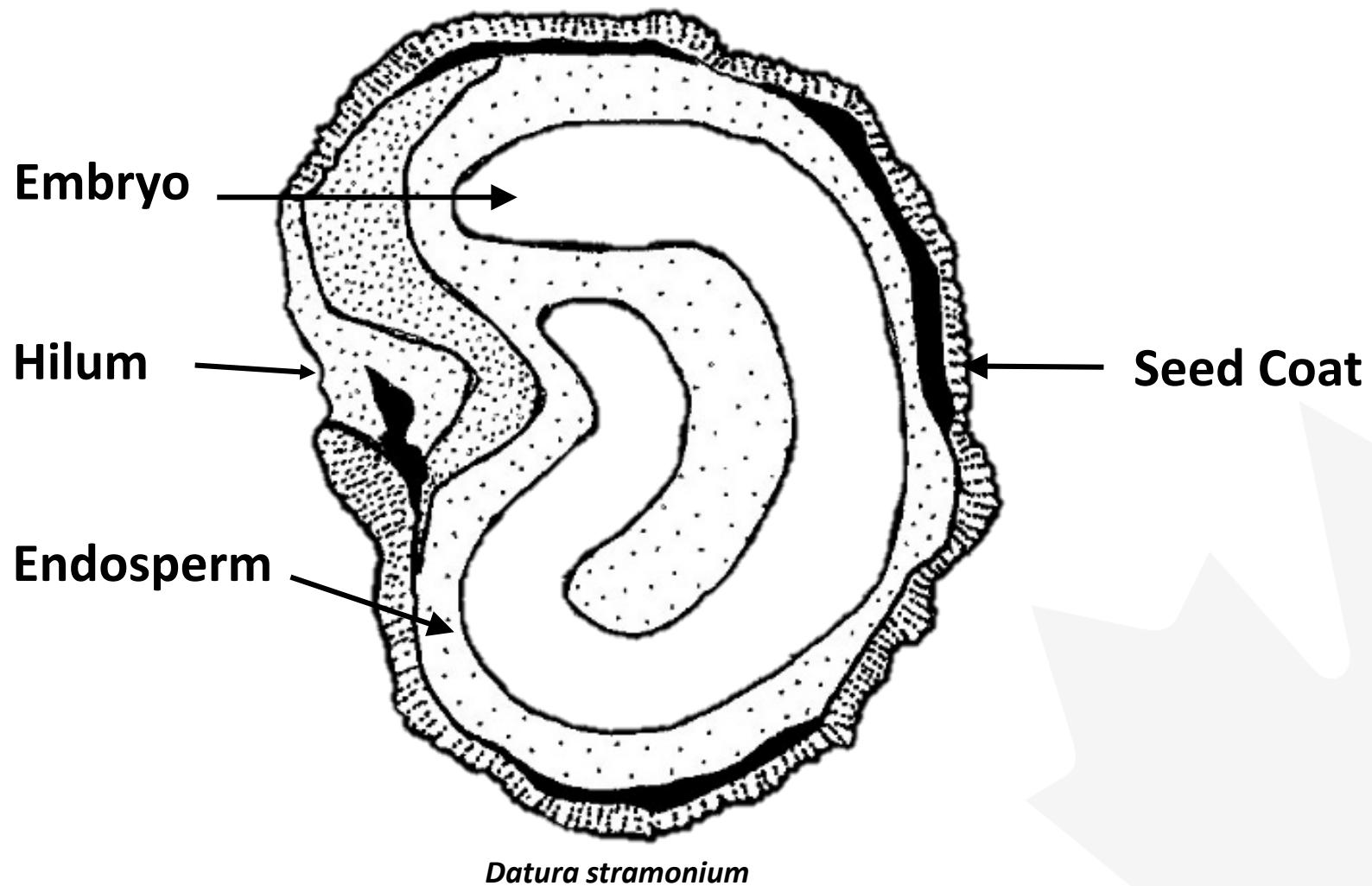
Solanum elaeagnifolium



Solanaceae Family Overview – Seeds



Solanum Seed Internal Structure



Stone cells (Sclerotic granules) in Solanaceae

1 mm



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Solanum triflorum

Found in:

- *Solanum emulans* (4-8)
- *Solanum americanum* (0-4)
- *Solanum nitidibaccatum* (1-3)
- *Solanum triflorum* (> 10)

Not generally found in:

- *Solanum nigrum* (may have 2)

Not found in:

- *Solanum elaeagnifolium*
- *Solanum carolinense*
- *Solanum viarum*
- *Solanum torvum*
- *Solanum rostratum*

Refs.: Knapp et al. 2019,
Chiarini and Barboza 2007



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Nomenclature Updates of *Solanum* Species

Angela Salzl

Seed Science and Technology Section, Saskatoon Laboratory

Canadian Food Inspection Agency (CFIA)

July 15, 2021



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Scientific Names: A Universal Language

- **Scientific names:** universal and understood no matter language spoken
 - Naming of plants is by the scientific community:
 - Since 1905, governed by the *International Code of Botanical Nomenclature*; updated regularly by taxonomists from around the world (AVH 2021)
 - Comprised of Genus/species name (more if subspecies or variety)
 - The authority is the name(s) or abbreviation(s) after the species name
 - informs us who applied that particular name to the species
 - e.g.)**Centaurea diffusa Lam.* (stands for Jean-Baptiste Lamarck)
 - **Nassella viridula (Trin.) Barkworth* (two authors involved in naming)
 - author of most recent naming outside of parentheses
- Mistakes still occur but more traceability than with common names
- **Common names:** more local in nature; no governing body
 - e.g.) fireweed used for 2 unrelated species (*Bassia scoparia* versus *Chamaenerion angustifolium* subsp. *angustifolium*)

Scientific Names: Synonyms Explained

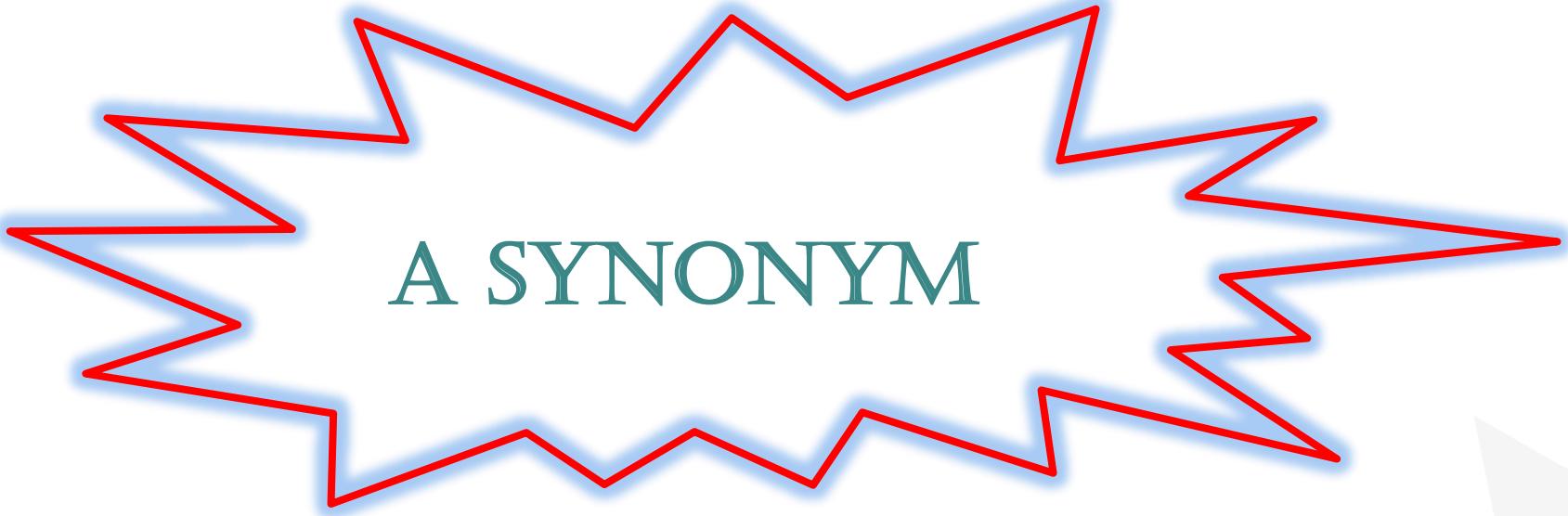
A scientific name in Canada likely same as one in use around the globe

- One exception is when a **synonym** is used instead of the **accepted** name
 - Many synonyms arose in the past when one botanist or taxonomist used a different name to refer to a species already with an assigned name
 - Results in more than one name for a species
 - Synonyms also arise the more we learn about species, especially complex ones
 - e.g. a subspecies or a variety of a species, may be ruled its own individual species, such as *Lepidium draba* var. *chalepense* is now *L. chalepense*
 - Synonyms are relatively easy to trace back to the accepted name using:
 - Reputable websites provided at end of presentation
 - ID books

Remember: Some sources outdated; best practice is to check multiple sources

Update #1: *Solanum ptychanthum* as a valid synonym

Solanum ptychanthum is a **synonym** of *Solanum americanum*



A SYNONYM

***S. ptychanthum* Dunal = *S. americanum* Mill.** (American black nightshade)

- **Canada:** introduced to British Columbia and Manitoba (Brouillet et al. 2010+)
- **US:** native to 14 States
- Native to Mexico and some South American countries
- Widely naturalized in tropical countries (USDA-ARS 2021)

Scientific Names: Misapplied names

- Occasionally, a plant species may be called a scientific name erroneously
- On GRIN you may see something like this:

Taxon: *Solanum emulans* Raf.

Nomenclature	Common Names	Distribution	Economic Uses
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Summary

Genus:	<i>Solanum</i>
Subgenus:	<i>Solanum</i>
Section:	<i>Solanum</i>
Family:	<i>Solanaceae</i>
Subfamily:	<i>Solanoideae</i>
Tribe:	<i>Solaneae</i>
Nomen number:	488372
Place of publication:	Autik. bot. 107, 1840
Verified:	03/04/2020 ARS Systematic Botanists.
Accessions:	1 (1 active, 0 available) in National Plant Germplasm System. (Map it)

Autonyms (not in current use), synonyms and invalid designations

Invalid Designation(s)

Solanum americanum auct.
Solanum ptychanthum auct.

- The auct. means “Used to represent an incorrect usage of a name for a different taxon than the one intended by the original author” (USDA-ARS 2021)
 - **Incorrect usage** of *Solanum ptychanthum* for *S. emulans*
 - **Incorrect usage** of *Solanum americanum* for *S. emulans*
- So ***Solanum emulans*** erroneously called *S. americanum* and *S. ptychanthum* in the past

Update #2: *Solanum ptychanthum* as a misapplied name

Solanum ptychanthum is **NOT** a synonym of *Solanum emulans*

A MISAPPLIED NAME

Solanum ptychanthum Dunal ≠ *Solanum emulans* Raf. (eastern black nightshade)

- **Canada:** Saskatchewan to Nova Scotia (Brouillet et al. 2010+)
- **US:** native to 39 states (USDA-ARS 2021)
- Naturalized elsewhere
- Not native to Mexico (USDA-ARS 2021)
- *Solanum emulans* is more common in Canada than *S. americanum* (CFIA 2021)

Update #3: *Solanum americanum* as a misapplied name

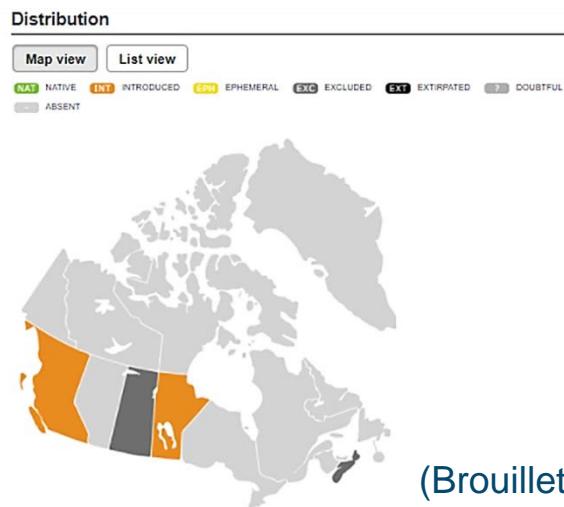
Solanum americanum is NOT a synonym of *S. emulans*

A MISAPPLIED NAME

***S. americanum* Mill. ≠ *S. emulans* Raf.**

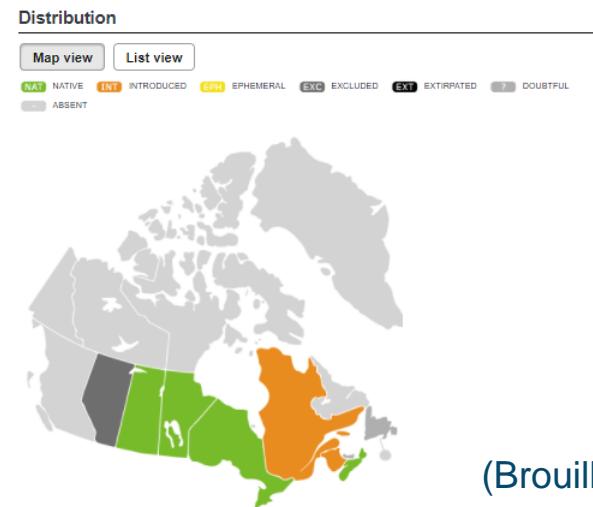
- GRIN lists as *S. americanum* auct. = *S. emulans*
- *S. emulans* erroneously called *S. americanum*

***Solanum americanum* in Canada:**



(Brouillet et al. 2010+)

***Solanum emulans* in Canada:**



(Brouillet et al. 2010+)

What are the impacts of Updates #1 and #2?

Impact of name updates *Solanum ptychanthum*

- REGAL list:
Based on legislation so must use synonym
of *S. ptychanthum* (*S. americanum*)
- AOSA/SCST exam list:
Common name provided (eastern black
nightshade) so likely *Solanum emulans*?

Update #4: One common name for two morphologically similar species

- Is your hairy nightshade *Solanum sarrachoides* Sendtn. OR *Solanum nitidibaccatum* Bitter?

Solanum sarrachoides common name is hairy nightshade (USDA-ARS 2021)

- Native to South America (USDA-ARS 2021)
- **Canada:** not present (Brouillet et al. 2010+)
- **US:** introduced to 12 states (USDA-ARS 2021)
- Sporadic distribution in North America (Knapp et al. 2019)

Solanum nitidibaccatum common name is hairy nightshade (USDA-ARS 2021)

- Native to parts of North America and South America
- **Canada:** introduced to much of the country
- **US:** in 26 states
- More common as agricultural weed in North America than *S. sarrachoides* (Knapp et al. 2019)

Update #4: One common name for two morphologically similar species

Is your hairy nightshade *Solanum sarrachoides* Sendtn. AND
Solanum nitidibaccatum Bitter?



Arkansas, Connecticut, Kansas,
Missouri, Montana and
Washington

- True *S. sarrachoides* and *S. nitidibaccatum* are both reported in your states (USDA-ARS 2021)

- These 2 species are morphologically similar; be skeptical of past records of *S. sarrachoides* (Knapp et al. 2019)
- Hairy nightshade incorrectly reported in Canada as *Solanum sarrachoides* (CFIA 2021)
- Some morphological differences provided in :**
Knapp S, Barboza GE, Bohs L, Särkinen T (2019) A revision of the Morelloid Clade of *Solanum* L. (Solanaceae) in North and Central America and the Caribbean. PhytoKeys 123: 1–144. <https://doi.org/10.3897/phytokeys.123.31738>

Caution: *Solanum nitidibaccatum* sometimes incorrectly referred to as *Solanum physalifolium*

Solanum nitidibaccatum has a synonym:

- ***Solanum nitidibaccatum* Bitter =**
S. physalifolium Rusby var. *nitidibaccatum* (Bitter) Edmonds
 - Sometimes ‘var. *nitidibaccatum*’ erroneously dropped from synonym
- ***Solanum physalifolium* ≠ *Solanum nitidibaccatum***
(Knapp et al. 2019)
 - ***Solanum physalifolium* Rusby** is endemic to Andean region and not closely related to ***S. nitidibaccatum*** (Knapp et al. 2019)
 - No mention of naturalization according to GRIN (USDA-ARS 2021)

Scientific Names: More Information

- For those of you wanting more information on the plant naming process the following websites provide good overviews:
 - The Plant List <http://www.theplantlist.org/1.1/about/>
 - <https://www.anbg.gov.au/chah/avh/help/names/index.html>
- Good source for current accepted names and synonyms:
 - Germplasm Resources Information Network (GRIN)
<https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysimple>
 - Prior to using GRIN - helpful to know what the abbreviations mean:
<https://npgsweb.ars-rin.gov/gringlobal/taxon/abouttaxonomy?chapter=symb>
- Other sources useful for synonym tracing:
 - Global Biodiversity Information Facility (GBIF)
<https://www.gbif.org/species/search>
 - Integrated Taxonomic Information System (ITIS) with the URL of:
<https://www.itis.gov/>
 - Flora of North America North of Mexico. 19+ vols. Flora of North America Editorial Committee, eds. New York and Oxford, <http://www.fna.org/FNA/>

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Australia's Virtual Herbarium (AVH)

<https://www.anbg.gov.au/chah/avh/help/names/index.html> [2021, July 03]

Brouillet, L., F. Coursol, M. Favreau and M. Anions 2010+. VASCAN, the database
vascular plants of Canada, <http://data.canadensys.net/vascan/> [2021, April 7].

CFIA (Risk Assessment) 2021. Distribution and nomenclature of Solanum species.

Knapp S, Barboza GE, Bohs L, Särkinen T (2019) A revision of the Morellloid
Clade of *Solanum* L. (Solanaceae) in North and Central America and the
Caribbean. PhytoKeys 123: 1–144. <https://doi.org/10.3897/phytokeys.123.31738>

USDA-ARS 2021. Germplasm Resources Information Network - (GRIN),
<https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysimple.aspx> [2021, April 7]



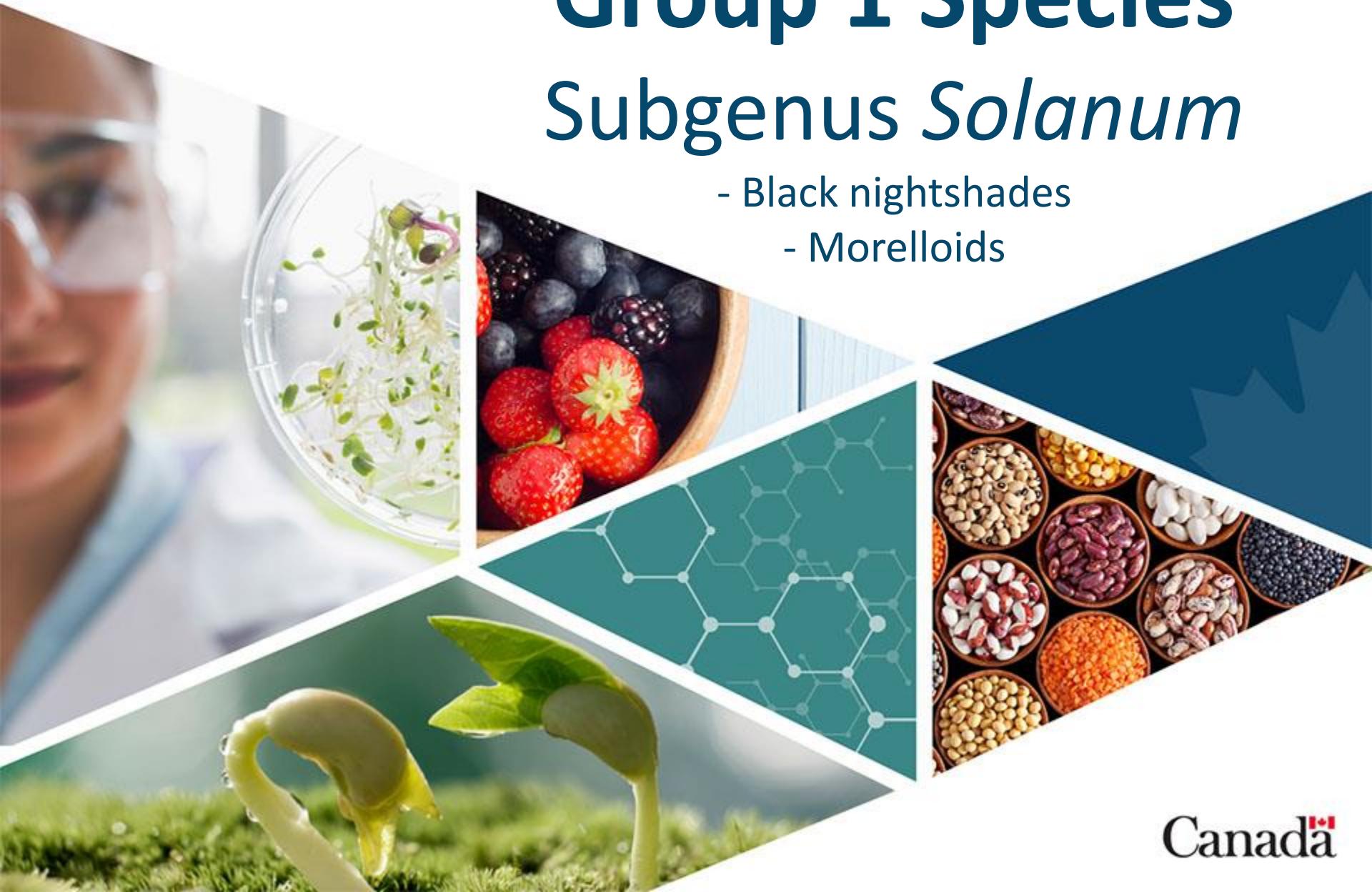
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Group 1 Species

Subgenus *Solanum*

- Black nightshades
- Morelloids



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Species in *Solanum* subgenus *Solanum*

- *Solanum nigrum* (*black nightshade)
- *Solanum emulans* (*eastern black nightshade)
- *Solanum americanum* (*American black nightshade)
- *Solanum nitidibaccatum* (*hairy nightshade)
- *Solanum triflorum* (*wild tomato)

*Darbyshire 2003

Group 1 General Seed features



Solanum nitidibaccatum

- Small seed size
- Ridged reticulation
- Thin seed, sharp edges
- Closed, linear hilum
- Hilum area with generally longer interspaces
- Shiny or dull straw yellow, orange or light brown colour
- Seed coat hairs
- Stone cells present in most

General Seed features – seed coat hairs



Solanum nitidibaccatum

- Seed coat hairs are a fringe-like extension of the surface ridges
- Normally lie flat under a thin outer coat seed layer
- This thin layer removed through washing or friction
- Hairs can obscure the surface features

(Edmonds 1983)

Solanum emulans Raf.



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- Seed length: 1.5 – 1.8 mm
- Reticulation interspaces small, visible across seed
- Cells elongated in hilum area
- Berry shiny purplish black, at maturity fall with pedicels + calyx attached
- Stone cells 6-9 (15), 0.3 mm diameter
- Common in southern Ontario, rare west

(Bassett and Munro 1985, Knapp et al. 2019)

Solanum emulans Raf.



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Solanum emulans Raf.



Bruce Ackley, The Ohio State
University, Bugwood.org

Solanum americanum Mill (= *Solanum ptychanthum*)

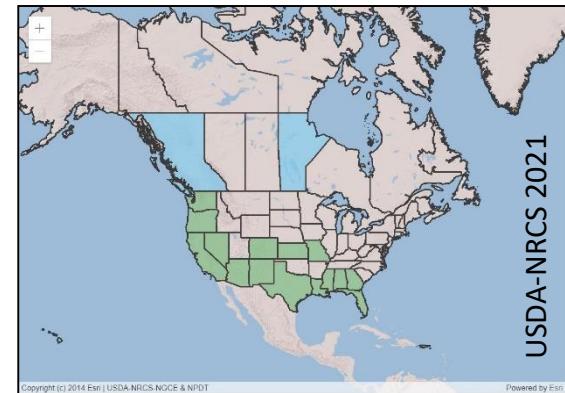


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(Bassett and Munro 1985, Edmonds and
Chweya 1997, Knapp et al. 2019)



- Seed length: 0.8 – 1.5 mm
- Reticulation interspaces small, visible across seed
- Cells elongated in hilum area
- Berries shiny black, pedicels do not drop with berries at maturity and stay on plant
- Stone cells absent, or up to 4, 2 are > 0.5 mm, 2 < 0.5 mm
- Common in south and Pacific United States

Solanum americanum Mill (= *Solanum ptychanthum*)



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Solanum americanum Mill (= *Solanum ptychanthum*)



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Joseph M. DiTomaso, University of California - Davis, Bugwood.org

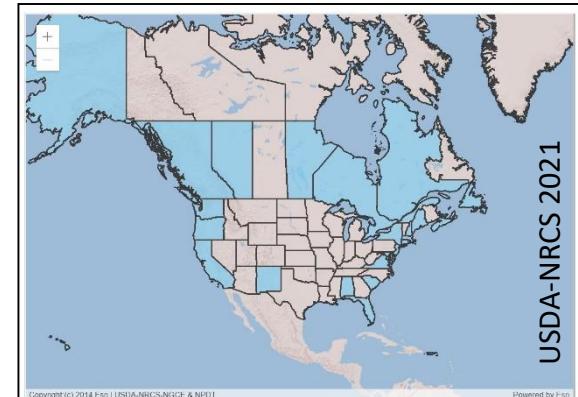
Solanum nigrum L.



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(Bassett and Munro 1985, Edmonds and Chweya 1997, Knapp et al. 2019)



- Seed length: 1.8 – 2.0 mm
- Reticulation interspaces larger, faint at seed centre
- Cells elongated in hilum area, end often ‘beaked’
- Berries dull black, pedicels + calyx drop with them at maturity
- Stone cells absent, rarely 2
- Sporadic across Canada (abundant in South B.C.) and U.S. Pacific coast

Solanum nigrum L.



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Solanum nigrum L.



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Larry Trekell, Bugwood.org

Solanum nitidibaccatum Bitter



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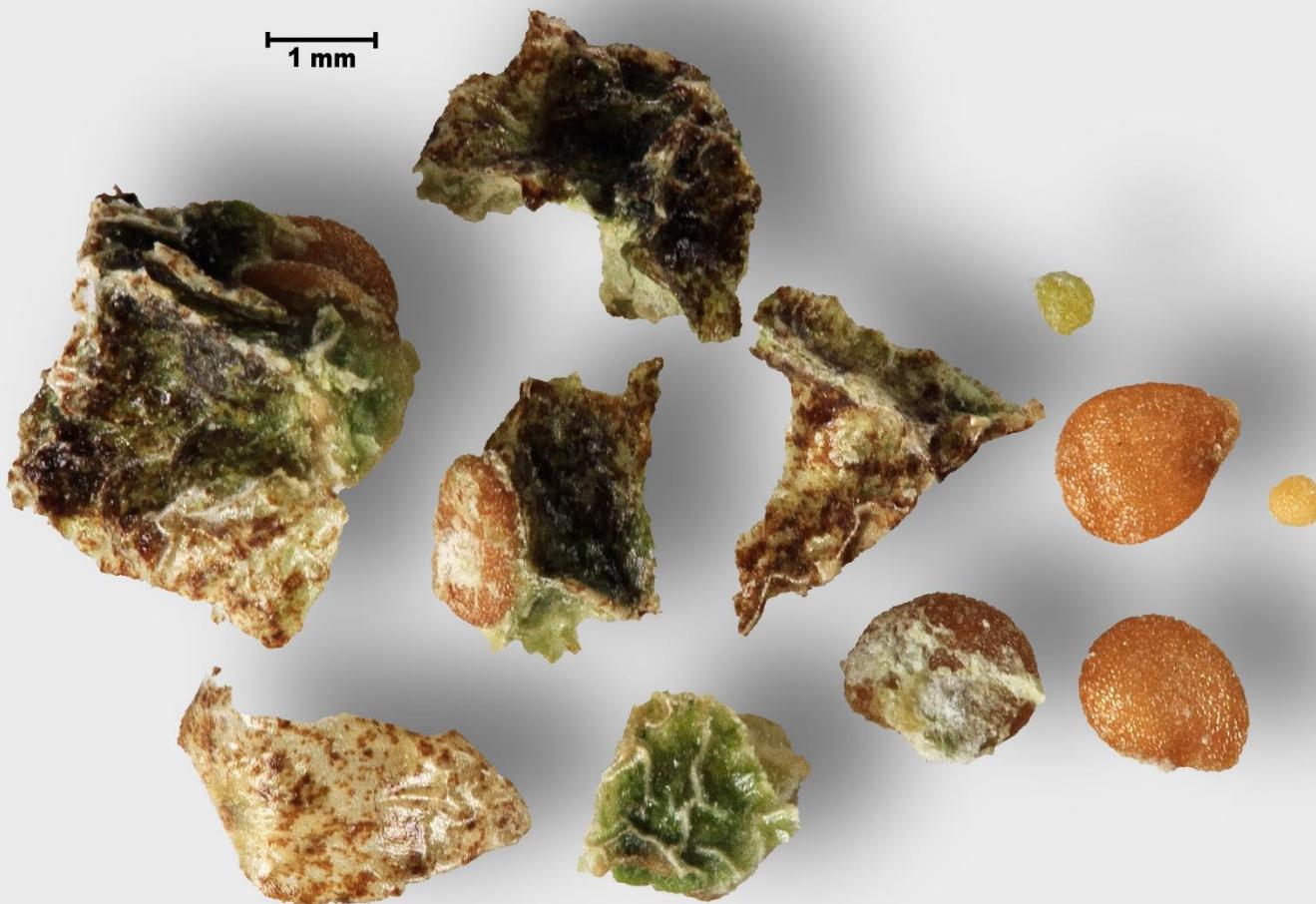
(Edmonds 1986, Bassett and Munro 1985,
Edmonds and Chweya 1997, Knapp et al. 2019)



Brouillet et al. 2010+

- Seed length: 2.0 – 2.4 mm
- Reticulation interspaces small, visible over seed
- Cells rarely elongated in hilum area, area darker, end rounded
- Berries shiny greenish brown, white patches, pedicels + calyx drop with fruit at maturity
- Stone cells generally 2, at end, 0.5 mm diameter
- Widespread across Canada and U.S., abundant in plains

Solanum nitidibaccatum Bitter



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Solanum nitidibaccatum Bitter

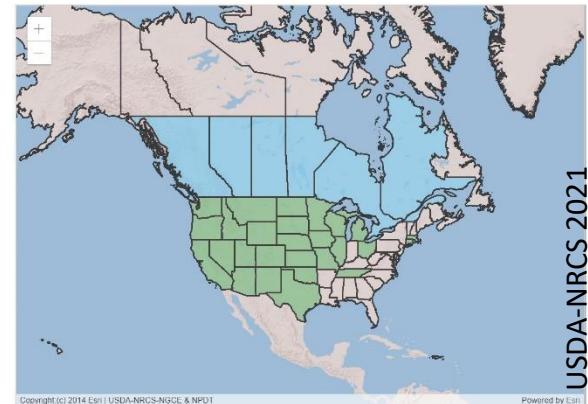


Phil Westra, Colorado State University, Bugwood.org

Solanum triflorum Nutt.

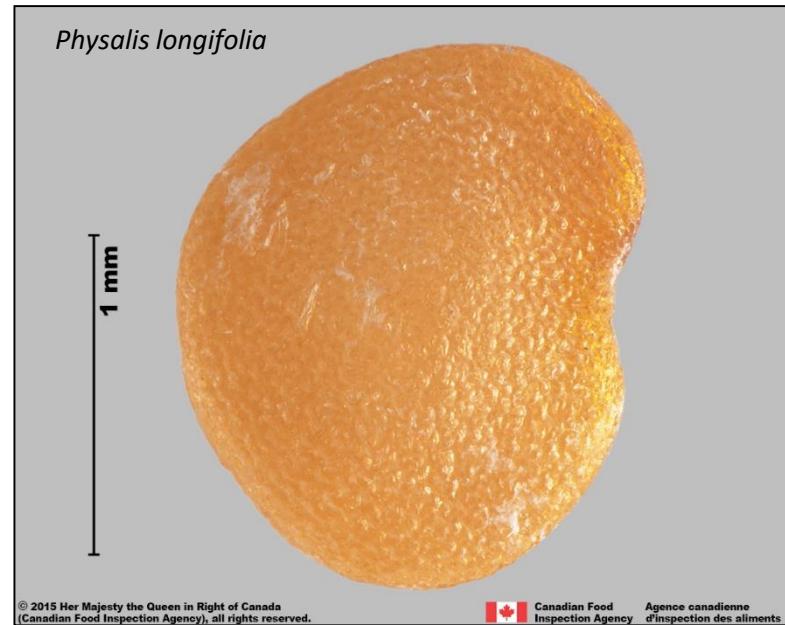
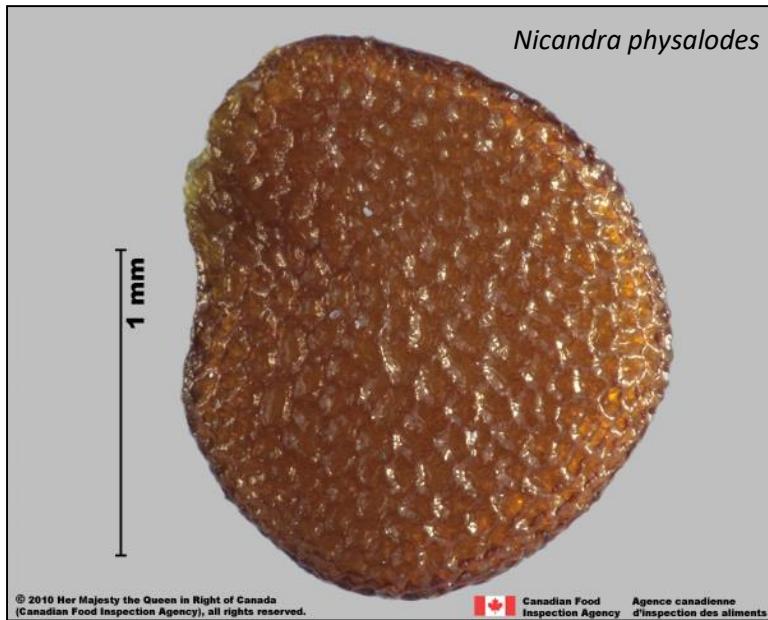


(Knapp et al. 2019)



- Seed length: 2.0-2.5 mm
- Reticulation interspaces very small, visible over seed
- Cells elongated in hilum area, long pointed
- Berries shiny green, pedicels + calyx drop at maturity
- Stone cells 15-30, 1.0-1.5 mm
- Widespread across S Canada and U.S., abundant in west

Similar seeds to *Solanum* Group 1 species



***Nicandra physalodes* (*apple-of-Peru)**

- Thicker seed
- Hilum flush with edge
- Translucent, glossy brown colour
- Reticulation ridges wider, cells deeper

*Darbyshire 2003

***Physalis* spp. (*ground-cherry)**

- Thicker seed
- Hilum flush or in a notch
- Yellow or orange colour
- Reticulation ridged or grooved



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Group 1 Species

Live Demonstration and Q & A



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Group 2 Species

Subgenus *Leptostemonum* - spiny Solanums



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Species in *Solanum* subgenus *Leptostemonum*

- *Solanum carolinense* (*horse-nettle)
- *Solanum elaeagnifolium* (**silverleaf nightshade)
- *Solanum torvum* (**turkeyberry)
- *Solanum viarum* (**tropical soda-apple)
- *Solanum rostratum* (*buffalobur)

*Darbyshire 2003

**USDA-ARS 2021

Group 2 General Seed features



Solanum elaeagnifolium

- Large seed size
- Grooved and ridged reticulation (can be faint)
- Thick seed, rounded edges
- Open, oval shaped hilum in some
- Hilum area flush with edge or in a notch, interspaces do not differ near the hilum
- Shiny yellow, orange or brown colour
- No stone cells

Solanum elaeagnifolium Cav.

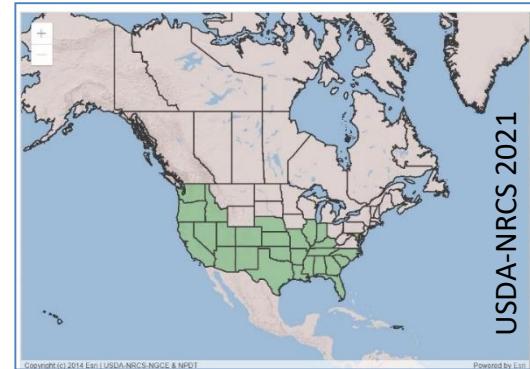


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(Bean 2004, Knapp et al. 2017)



- Seed length: 3.0-4.0 mm
- Shape round, egg-shaped
- Reticulation faint, wavy grooves along the edges
- Seed generally shiny brown
- Notched in hilum area
- Berries shiny yellow or orange, immature: green with dark green veins
- Widespread across drier areas in south and west U.S.

Solanum elaeagnifolium Cav.



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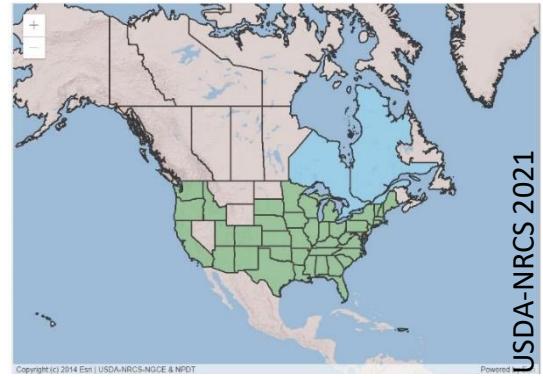
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Solanum elaeagnifolium Cav.



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Solanum carolinense L.



- Seed length: 1.7-3.5 mm
- Seed reticulation of wavy grooves, strongest at edges
- Oval or egg-shaped
- Seed shiny yellow, orange or brown
- Berries shiny yellow, Immature: green with dark green veins
- Widespread in east U.S. and SW Ontario

(Bassett and Munro 1986)

Solanum carolinense L.



James H. Miller & Ted Bodner,
Southern Weed Science
Society, Bugwood.org

Immature berry

Mature berry

Joseph M. DiTomaso,
University of California -
Davis, Bugwood.org



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Solanum torvum Sw.



(Bean 2004)



- Seed length: 1.7-3.5 mm
- Reticulation of thick, wavy ridges visible under the smooth surface
- Egg-shaped seeds
- Hilum is closed
- Seed shiny light yellow or brown
- Berries shiny light green, Immature: dull dark green
- Found in Alabama and Florida

Solanum torvum Sw.



Florida Division of Plant
Industry , Florida
Department of Agriculture
and Consumer Services,
Bugwood.org

Immature berry



Forest & Kim Starr, Plants of Hawaii, Image 080601-8964 from
<http://www.hear.org/starr/plants/images/image/?q=080601-8964>

Solanum viarum Dunal



(Mullahey et al. 1983)



- Seed length: 2.2-2.8 mm
- Seed reticulation of thick, wavy ridges, small interspaces
- Seed round with sharp edges
- Hilum area straight edge or slight notch
- Hilum is closed or with a hole
- Seed brownish-orange
- Berries shiny yellow, Immature: green with wide, dark green veins
- In SE U.S., abundant in Florida

Solanum viarum Dunal



Immature berry



Mature berry

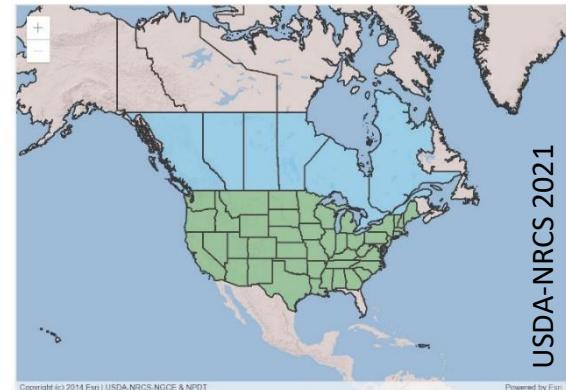
Charles T. Bryson, USDA
Agricultural Research Service,
Bugwood.org

UGA1115026

Solanum rostratum Dunal



(Bassett and Munro, 1986)



- Seed length: 1.7-2.1 mm
- Deep concave interspaces
- Oval shaped with wavy edges
- Seed shiny black or dark brown
- Hilum is open and round
- Berries dark brown, hidden in spiny calyx, split open at maturity
- Widespread, more common in drier areas of west-central U.S. and southern Canada

Solanum rostratum Dunal



UGA1391373

John D. Byrd, Mississippi State University, Bugwood.org



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Group 2 Species

Live Demonstration and Q & A



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Questions/comments send to:

SSTS@inspection.gc.ca

Canada