

Conservation Evaluation of the Prairie Lupine, *Lupinus lepidus* var. *lepidus*, in Canada*

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In Canada, Prairie Lupine, *Lupinus lepidus* var. *lepidus*, is restricted to southeastern Vancouver Island. Of the nine sites where it has been collected, five are extirpated and the status of two of the populations is uncertain. There are two extant populations; some of the other sites may contain the species in the seed bank. Some of the sites are protected to a certain extent from direct habitat destruction by their remote location, although introduced herbaceous species may pose a serious threat by preventing the establishment of the species at other sites. Fire suppression or the lack of other types of disturbance also likely plays a role in discouraging emergence of *Lupinus lepidus*.

Key Words: Prairie Lupine, *Lupinus lepidus*, endangered, distribution, population size, British Columbia.

The Prairie Lupine, *Lupinus lepidus* Dougl. ex Lindl. var. *lepidus*[†] is a member of a genus of over 100 species. Most of these occur in North America but the genus occurs on all continents except Australia (Hitchcock et al. 1961). It is one of 20 species of *Lupinus* occurring in British Columbia (Pojar 1999) and of about 27 species in Canada (Scoggan 1978). The genus is of some economic importance in the horticultural trade.

The *Lupinus lepidus* complex has been a source of difficulty to researchers over the years. Hitchcock et al. (1961) state that although the *L. lepidus* complex is distinct, the variation within this group has resulted in a large number of proposed subspecies and varieties of which some are considered to be distinct species by others. According to Phillips (1955), the nomenclature is even more confusing, and the number of synonyms is greater for *L. lepidus* than for any other *Lupinus* species. The work of Detling (1951), Phillips (1955) and Dunn and Gillett (1966) has improved the nomenclature and delineation of *Lupinus* species but many problems remain.

The type specimen of *L. lepidus* var. *lepidus* was collected by David Douglas from "... Fort Vancouver to the Great Falls of the Columbia". Subsequently, Hitchcock et al. (1961) recognized five varieties of *L. lepidus* two of which, var. *lepidus* and var. *lobbii* (A. Gray) C. L. Hitchc., are reported to occur in British Columbia. The latter variety is considered to be a separate species (*L. lyallii* A. Gray) in more recent floras of Canada and British Columbia (eg., Dunn and Gillett 1966; Taylor 1974; Scoggan 1978; Douglas 1990; Pojar

1999) and occurs on well-drained soils in subalpine and alpine areas (Douglas 1990; Douglas and Bliss 1977).

Lupinus lepidus var. *lepidus* as recognized by Hitchcock et al. (1961), Douglas (1990), Douglas et al. (1998a) and Pojar (1999), included *L. minimus* Dougl. in synonymy but they failed to account for the location of the type specimen (Rocky Mountains, Kettle Falls in the upper Columbia River drainage) or the range of *L. minimus* in the western Cordillera east of the Coast-Cascade Mountains. *Lupinus minimus* is considered by other authors to be a separate species (e.g., Cox 1973a, 1973b; Dunn and Gillett 1966; Scoggan 1978; Taylor 1974). Douglas et al. (2002a, 2002b) also now treat *L. minimus* as a distinct entity. The latter has been reported to occur in the Columbia River drainage of southern British Columbia (Dunn and Gillett 1966; Taylor 1974), but no specimens have been located. It is also reported to occur in the Crowsnest area of Alberta (Dunn and Gillett 1966) and, more recently, in and adjacent to Waterton Lakes National Park (Argus and White 1978; Kuijt 1982) and at six locations near the southern Alberta border (Packer 1983). Both Kuijt (1982) and Packer (1983) consider *L. minimus* to be synonymous with *L. lepidus*.

Lupinus lepidus is a multi-stemmed perennial herb 20–45 cm tall (Figure 1; Pojar 1999). The stems are slender with long, soft hairs. The plant has oblanceolate palmate compound leaves that are 5 to 9 foliate and copiously silky-hairy. The leaves are mostly basal with only 1 to 4 leaves on the stem. The petioles are 2–5 times as long as the blade. The racemose, pea-like

*The original field work for the *Lupinus lepidus* project was funded by the British Columbia Conservation Data Centre. The results appear in the British Columbia Conservation Data Centre database and a rare plant manual (Douglas et al. 2002a). This information formed the basis for a Committee on the Status of Endangered Wildlife in Canada status report (Ryan and Douglas 1996*) and the subsequent assessment of *endangered* (COSEWIC 2000*). This paper includes more recent information that did not appear in the original status report.

[†]Taxonomy and nomenclature follow Douglas et al. (1998b, 1999, 2001a, b) and Pojar (1999).

blue flowers are similar to those of other Fabaceae species. The petals are 8-13 mm long, and the banner is often lighter or darker and reflexed below the mid-point. The wings are glabrous, the keel ciliate, and the calyx silky-hairy. Both lips are 6-7 mm long, the upper ones of which are bifid for at least half their length. Peduncles are 9-10 cm long, pedicels are 2 mm long and petals are 8-13 mm long. The hairy pods are 1-2 cm long and contain three to five large seeds. In British Columbia, it is separated from three similar looking species by its distinct range in the coastal lowlands on southeastern Vancouver Island. It is distinguished from most other species of *Lupinus* by its small stature, the white appressed hairs covering the stems and leaves and the thick caudex at the base of the plant.

Distribution

Lupinus lepidus extends from southwestern British Columbia to north-western Oregon, west of the Cascade Mountains (Douglas et al. 1990; Pojar 1999). In Canada it is rare on southeastern Vancouver Island, British Columbia (Figure 2; Douglas et al. 2002a; Pojar 1999).

Habitat

Lupinus lepidus inhabits xeric sites ranging from grass-dominated meadows to steep rocky slopes where the vegetation is comprised of scattered clumps of Douglas-fir (*Pseudotsuga menziesii*), Arbutus (*Arbutus menziesii*), and Lodgepole Pine (*Pinus contorta* var. *contorta*). These sites are restricted to southeastern Vancouver Island, where rainfall is low compared to other coastal areas in British Columbia, and during the summer, they often experience an extended period of drought. Associated species include Scotch Broom (*Cytisus scoparius*), Hedgehog Dogtail (*Cynosurus echinatus*), Sweet Vernalgrass (*Anthoxanthum odoratum*), several species of Brome (*Bromus*), and Common Camas (*Camassia quamash*). The habitat at the Somenos site was unnatural, consisting of gravel deposited during railroad or highway construction.

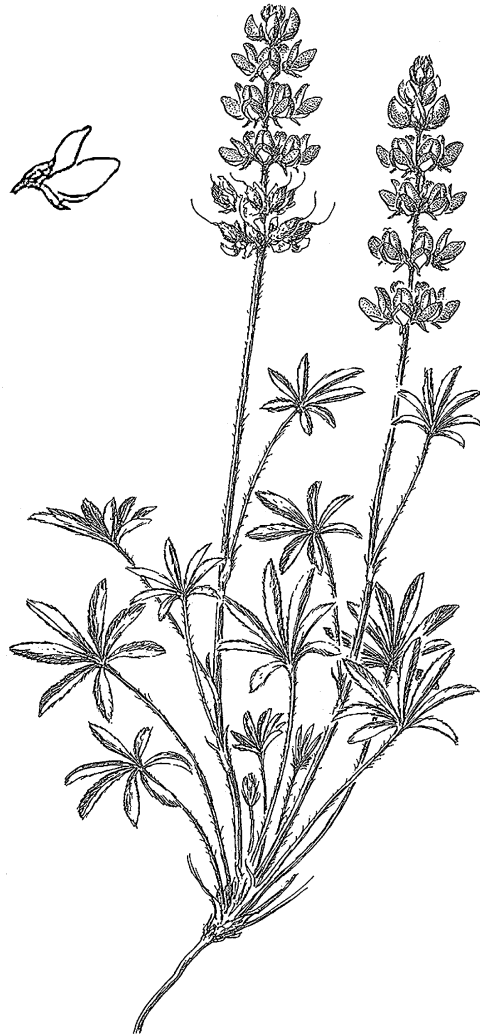


FIGURE 1. Illustration of *Lupinus lepidus*. (Line drawing from Pojar 1999)

TABLE 1. Populations of *Lupinus lepidus* in Canada.

Collection Site	Last Observation	Collector/Observer	Population data (plants/area in m ²)
Langford Plains (Victoria)	1908	Macoun	Extirpated
Observatory Hill (Victoria)	1915	Newcombe	Extirpated
Koksilah River Valley (Duncan)	1960	Hardy	Unknown
Cattle Point (Victoria)	1973	Brayshaw	Extirpated
Beacon Hill (Victoria)	1993	Brayshaw	Extirpated
Somenos Lake (Duncan)	1994	Douglas	Extirpated
Mount Wells (Victoria)	2006	Roemer	No plants
(2 plants/1 m ² in 2003)			
Mount Braden (Victoria)	2005	Roemer	2 plants
Mount McDonald (Victoria)	2005	Roemer	113 plants/75 m ²

Biology

Little is known regarding the biology of *Lupinus lepidus*. However, many species of *Lupinus* share common traits, some of which likely characterize *L. lepidus*. It is likely to be associated with nitrogen-fixing *Rhizobium*, which may allow it to invade sites where soils are low in nitrogen. It is suspected that *L. lepidus* is a short-lived colonizer of recently disturbed sites in xeric, open, exposed areas where it persists for several years. It eventually declines, possibly from competition with more aggressive species that either directly compete for resources or prevent the establishment of seedlings, or from lack of vigour in mature plants. The seeds may not have any dormancy requirements but like other legumes, *L. lepidus* seeds have a hard seed coat which may delay germination for several months or years. Nothing is known regarding pollination, seed set, and survival rates.

Population Attributes

Of the nine Canadian sites from which *Lupinus lepidus* has been collected (Table 1, Figure 2), five populations are extirpated. Another two sites (Koksilah River and Mount Wells) are assumed extant but their status is unknown. Little is known regarding population trends for this species. Monitoring this taxon is difficult because populations may only be comprised of a few plants and therefore, easily overlooked, or they may remain in a seed bank for an unknown period before reappearing. However, four years of data collected at Somenos Lake (extirpated) showed a decline before it was destroyed at the site: 250, 1, 0, and 1 in 1991, 1992, 1993 and 1994, respectively. Other sites with limited data include Mount Wells, which contained nine plants in 2001, only a few plants in 2002, two plants in 2003, and no plants in 2004, 2005 and 2006 (H. Roemer, personal communication). The steady decline at this site is attributed to the re-growth of shrubs following a fire. In addition, in 2005, two plants were observed on Mount Braden (up from single plant in 1996) and 113 plants were observed on Mount McDonald (where they had only previous been known from 1915). In 2006, a single plant was seen on Mount Braden and 54 plants on Mount McDonald, but a thorough search of all the locations from 2005 was not done and therefore, the population should not be considered in decline.

Provincial, National, and Global Ranks

The British Columbia Conservation Data Centre has ranked *Lupinus lepidus* as S1 and placed it on the British Columbia Ministry of Environment Red-list (Douglas et al. 2002a). This is the most critical category for imperiled rare native vascular plants in British Columbia. A rank of S1 is considered "critically imperiled because of extreme rarity (5 or fewer occurrences or very few remaining individuals) or because of some factors making it especially vulnerable to extirpation or

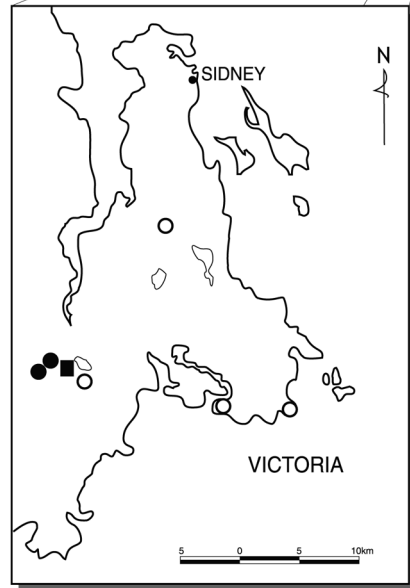
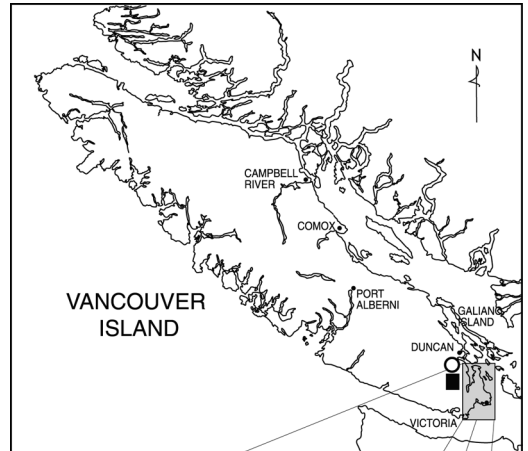


FIGURE 2. The status and location of *Lupinus lepidus* in British Columbia. ● recently confirmed; ■ present status unknown; ○ extirpated

extinction" (Douglas et al. 2002a). *Lupinus lepidus* is on the Canadian *Species At Risk Act* legal list and the Committee on the Status of Endangered Wildlife in Canada has also assigned this species to the Endangered category (COSEWIC 2000*). Globally, it is ranked G5 or common and secure in its range (NatureServe 2006*).

Threats and Protection

The most direct threat to *Lupinus lepidus* is habitat destruction. Grass-dominated meadows, often associ-

ated with Garry Oak-Brome (*Quercus garryana-Bromus*) stands, commonly occurred on gentle slopes on the most climatically favourable coastal areas on south-eastern Vancouver Island and some of the Gulf Islands prior to European colonization. Since colonization both types of vegetation have been subjected to extensive agricultural and residential development. Their destruction has continued to the present, resulting in the elimination of almost all sites occurring outside parks or ecological reserves. The loss of these habitats, estimated at 95% (Lea 2002), severely reduces the availability of sites for the establishment of *L. lepidus* var. *lepidus* and imposes severe limitations on the long-term survival of this species in Canada.

Introduced species including *Cytisus scoparius*, *Cynosurus echinatus* and *Anthoxanthum odoratum* now dominate *L. lepidus* habitats, further threatening the survival of this species. The introduction of aggressive European species has resulted in substantial changes to the grass-dominated meadows associated with *Quercus garryana*, and rocky xeric sites in the Victoria area. *Cytisus scoparius*, in particular, has been one of the most devastating species. It has become a dominant shrub on xeric, exposed sites throughout much of south-eastern Vancouver Island and the Gulf Islands.

Furthermore, the suppression of natural and unnatural periodic fires appears to have resulted in changes to the vegetation of many sites where this species would be expected to occur. In the past, aboriginal peoples may have set fire to these sites to maintain them as an important habitat for wildlife (Roemer 1972). This would have destroyed much of the competing vegetation and created habitats where *L. lepidus* would have had the opportunity to become established. However, since that time, these sites have experienced little disturbance, resulting in invasion and expansion by trees, shrubs, and especially introductions, which effectively eliminate many herbaceous species.

In Canada, some populations of *L. lepidus* are protected to a certain extent by their location on public property. This was not the case, however, for the plant in Beacon Hill Park which was destroyed by maintenance activities along a roadbank in 1994, or for the population on the highway right-of-way at Duncan, which was also destroyed and covered in 1994 by heavy equipment used in a North Cowichan Municipality sewer line project. Extirpation is also a probable fate at Cattle Point and Observatory Hill. Even though Cattle Point is located in a municipal park, it is not protected from trampling by pedestrians and mountain bike enthusiasts. During the summer months, tour buses arrive at this park many times each day resulting in large numbers of people trampling the vegetation along the shoreline and adjacent rock outcrops. As a result of these activities, much of the vegetation has been degraded to the point where the number of potentially suitable habitats for the establishment of *L. lepidus* are far fewer today than in the past. The population

could also have been overcome if it occurred in areas now dominated by shrubs.

Observatory Hill is owned by the federal government and is home to the Dominion Astrophysical Observatory. Much of the vegetation has been replaced by exotic species but access is limited to a single road. Although further development on the hill is unlikely to occur, many of the suitable habitats in which *L. lepidus* would likely be found are infested with *Cytisus scoparius*.

Populations at Mount McDonald and Mount Braden are protected by their location within either the Greater Victoria Watershed District (which supplies drinking water to Victoria and adjacent communities and prohibits public access) or the CRD Sooke Hills Wilderness, respectively. Since these areas are dominated by steep rocky terrain and since there are few trails, vegetation has not been degraded to the same extent as it has in more accessible areas near Victoria.

The specific site at which *L. lepidus* was collected in the Koksilah River Valley is not known, thus it is not possible to provide any information on the extent to which this population is protected. However, if it is located on a steep, rocky, xeric sites similar to those found on Mount McDonald, Mount Braden, and Mount Wall, it is unlikely to be threatened in the near future by development or habitat destruction.

The site on Mount Wells is on private land but is not easily accessed at the present time. Nearby mountains, however, have been subject to housing developments in recent years thus the site of *L. lepidus* is not necessarily secure.

Lupinus lepidus is not formally protected in British Columbia, however, it could be in the future since this species is a potential candidate for listing under the provincial *Wildlife Amendment Act* (2004). As part of its commitment to the National Accord (*National Accord for the Protection of Species at Risk*), the province is required to take measures to protect this species. It is on Schedule 1 of the federal *Species At Risk Act* and a recovery strategy (which treats *Lupinus lepidus* in addition to several other species-at-risk) has been proposed (Parks Canada Agency 2005*). The recovery strategy is a planning document that identifies what needs to be done to arrest or reverse the decline of a species. Detailed planning is done at the action plan stage. However, an action plan is not currently available, nor are there any stewardship activities that are currently being implemented.

Evaluation

The Committee on the Status of Endangered Wildlife in Canada and the British Columbia Conservation Data Centre consider *Lupinus lepidus* to be endangered in Canada (Douglas et al. 2002a). It has only been collected nine sites in Canada, only three of which have recently been confirmed, all confined to southeastern Vancouver Island. It is believed to be extirpated at five

of these sites and has not been confirmed recently at two sites. The prognosis for this species is not good considering the threats posed by aggressive competitive species. The loss of suitable habitats at other sites to residential development severely limits the potential of this species to become established at new sites. Furthermore, fire, which may have been an important agent in the continued existence of this species in British Columbia, is now actively suppressed. With so little information known on the ecology of *L. lepidus*, and on its relationship to the environment and other species, successful management of the species is hampered.

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Documents Cited (marked * in text)

COSEWIC. 2000. Canadian Species at Risk. Committee on the Status of Endangered Wildlife in Canada. www.cosewic.gc.ca, Ottawa, Ontario. Available Online at: http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=187.

NatureServe Explorer. 2006. NatureServe Explorer: An online encyclopedia of life. Version 1.7. Arlington, Virginia, USA. Web site: <http://www.natureserve.org/explorer/> [Accessed 22 March 2006].

Parks Canada Agency. 2005. Recovery Strategy for Multi-species at Risk in Maritime Meadows Associated with Garry Oak Ecosystems in Canada (proposed). In *Species at Risk Act Recovery Strategy Series*. Edited by Parks Canada Agency. Ottawa, Ontario. 98 pages.

Ryan, M., and G. W. Douglas. 1996. Status Report on the Prairie Lupine, *Lupinus lepidus* var. *lepidus*, in Canada. Committee on the Status of Endangered Wildlife in Canada. 25 pages.

Literature Cited

Argus, G. W., and D. J. White. 1978. The rare vascular plants of Alberta. National Museums Canada, Syllogeus 17, Ottawa, Ontario.

Cox, B. J. 1973a. A chemosystematic comparison of the *Lupinus lepidus*-*L. caespitosus* complex. Bulletin of the Torrey Botanical Club 100: 12-17.

Cox, B. J. 1973b. Protein relationships among the perennial caespitose lupines. Bulletin of the Torrey Botanical Club 100: 153-158.

Detling, L. E. 1951. The caespitose lupines of western North America. American Midland Naturalist 45: 474-499.

Douglas, G. W. 1990. Fabaceae. Pages 21-45 in *The Vascular Plants of British Columbia*. Part 2 – Dicotyledons (Diapensiaceae through Portulacaceae). Edited by G. W. Douglas, G. B. Straley, and D. Meidinger. British Columbia Ministry of Forests, Victoria, British Columbia. 158 pages.

Douglas, G. W., and L. C. Bliss. 1977. Alpine and subalpine plant communities of the North Cascades Range, Washington and British Columbia. Ecological Monographs 47: 113-150.

Douglas, G. W., D. Meidinger, and J. L. Penny. 2002a. Rare Native Vascular Plants of British Columbia. Second edi-

tion. British Columbia Ministry of Sustainable Resource Management, Victoria, British Columbia. 359 pages.

Douglas, G. W., D. Meidinger, and J. Pojar. 1999. Illustrated Flora of British Columbia. Volume 3. Dicotyledons (Diapensiaceae through Onagraceae). British Columbia Ministry of Environment, Lands and Parks and British Columbia Ministry of Forests, Victoria, British Columbia. 423 pages.

Douglas, G. W., D. Meidinger, and J. Pojar. 2001a. Illustrated flora of British Columbia. Volume 6. Monocotyledons (Acoraceae through Najadaceae). British Columbia Ministry of Sustainable Resource Management and British Columbia Ministry of Forests, Victoria, British Columbia. 361 pages.

Douglas, G. W., D. Meidinger, and J. Pojar. 2001b. Illustrated flora of British Columbia. Volume 7. Monocotyledons (Orchidaceae to Zosteraceae). British Columbia Ministry of Sustainable Resource Management and British Columbia Ministry of Forests, Victoria, British Columbia. 379 pages.

Douglas, G. W., D. Meidinger, and J. Pojar. 2002b. Illustrated Flora of British Columbia. Volume 8 – General Summary, Maps and Keys. British Columbia Ministry of Sustainable Resource Management, British Columbia Ministry of Forests, Victoria, British Columbia. 457 pages.

Douglas, G. W., G. B. Straley, and D. Meidinger. 1990. The Vascular Plants of British Columbia. Part 2 – Dicotyledons (Diapensiaceae through Portulacaceae). Special Report Series Number 2, British Columbia Ministry of Forests, Victoria, British Columbia. 155 pages.

Douglas, G. W., G. B. Straley, and D. Meidinger. 1998a. Rare Native Vascular Plants of British Columbia. British Columbia Ministry of Environment, Lands and Parks, Victoria, British Columbia. 423 pages.

Douglas, G. W., G. B. Straley, D. Meidinger, and J. Pojar. 1998b. Illustrated flora of British Columbia. Volume 1. Gymnosperms and Dicotyledons. (Aceraceae through Asteraceae). British Columbia Ministry of Environment, Lands and Parks and British Columbia Ministry of Forests, Victoria, British Columbia. 436 pages.

Dunn, D. B., and J. M. Gillett. 1966. The lupines of Canada and Alaska. Monograph Number 2. Canada Department of Agriculture, Ottawa, Ontario.

Hitchcock, C. L., A. Cronquist, M. Ownbey, and J. W. Thompson. 1961. Vascular plants of the Pacific Northwest. Part 3: Saxifragaceae to Ericaceae. University of Washington Press, Seattle, Washington. 614 pages.

Kuijt, J. 1982. A flora of Waterton Lakes National Park. The University of Alberta Press, Edmonton, Alberta. 684 pages.

Lea, Ted. 2002. Historical Garry oak ecosystems of Greater Victoria and Saanich Peninsula. 1:20,000 Map. Terrestrial Information Branch, British Columbia Ministry of Sustainable Resource Management. Victoria, British Columbia. Available online at: <http://www.goert.ca/maps/go-020202.pdf>.

Packer, J. G. 1983. Flora of Alberta. Second edition. University of Toronto Press, Toronto, Ontario. 687 pages.

Phillips, L. L. 1955. A revision of the perennial species of *Lupinus* of North America exclusive of southwestern United States and Mexico. Research Studies of the State College of Washington 23: 161-201.

Pojar, J. 1999. Fabaceae. Pages 64-180 in *Illustrated Flora of British Columbia*. Volume 3 – Dicotyledons (Diapensiaceae through Onagraceae). Edited by G. W. Douglas, D. Meidinger, and J. Pojar. British Columbia Ministry of

- Environment, Lands and Parks, British Columbia Ministry of Forests, Victoria, British Columbia. 423 pages.
- Roemer, H. L.** 1972. Forest vegetation and environments of the Saanich Peninsula, Vancouver Island. Ph.D. thesis, University of Victoria, Victoria, British Columbia. 405 pages.
- Scoggan, H. J.** 1978. The flora of Canada. Part 3. National Museum of Natural Sciences Publications in Botany. Number 7. National Museum of Natural Sciences, Ottawa, Ontario 568 pages.
- Taylor, T. M. C.** 1974. The Pea Family (Leguminosae) of British Columbia. Handbook Number 12. British Columbia Provincial Museum, Victoria, British Columbia. 251 pages.

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