PROC. N.S. INST. SCI. (1981)
Volume 31, pp. 101-108.

BIOLOGY OF PRUNUS PENSYLVANICA L.F.

I.V. HALL and C.O. GOURLEY

Research Station
Agriculture Canada
Kentville, N.S. B4N 1J5

and

G.W. WOOD

Research Station
Agriculture Canada
Fredericton, N.B. E2B 4Z7

Prunus pensylvanica L.f. pin-cherry (Rosaceae) is a component of newly cleared or burnt forest land. Its rapid establishment results from wide dispersal by birds who eat the flesh of the fruit and regurgitate the bony seeds.

Following a period of dormancy and cold temperature, the seeds germinate readily. In some of the most favorable locations in Canada, the seedlings grow to a height of 10 m or more. The leaves of this species are poisonous to livestock under certain conditions. It is a beneficial nurse crop of coniferous seedlings and is sometimes cut for firewood.

Prunus pensylvanica L.f., la cerise d'été (Rosacées), se retrouve sur les sites de forêts récemment abattues ou incendiées. Il s'établit rapidement grâce à la grande dispersion de ses graines effectuée par les oiseaux qui consomment la chair de ses fruits et régurgitent les graines.

Après une période de dormance et de températures froides, les graines germent facilement. Dans quelques unes des régions du Canada qui leur sont les plus propices, les jeunes pousses croissent pour atteindre jusqu'à 10 m ou plus. Dans certaines conditions, les feuilles de cette espèce sont toxiques pour le bétail. La cerise d'été est aussi utile pour la protection des jeunes pousses de conifères et on s'en sert parfois comme bois de chauffage.

1. Name

Prunus pensylvanica L.f. — pin-cherry, bird-cherry, fire-cherry; cerises d'été. Rosaceae, rose family, Rosacées.

2. Description and Account of Variation

A deciduous tree up to 15 m in height, in older specimens the original leader has generally been killed and the trunk severely curved; bark reddish-brown with broad yellowish lenticels; shoots narrow with leaves spirally arranged on curved pedicels producing a broad, flat spray of foliage; leaves simple with 2 glands at the base of the blade, margin with irregular serration, veins strongly branched near margin, lanceolate-ovate, apex acuminate, base oblique; flowers (Fig 1a) in umbels or corymbs (Fernald 1950), sepals 5 green, petals 5 white, stamens numerous, pistil 1; fruit a drupe about 3 mm in diameter (Fig 1b), red, containing a simple seed enclosed in a stony endocarp (Lawrence 1951). Sax (1931) and Löve and Löve (1966) report a chromosome number of 2n = 16 while Bolkhovskikh et al. (1969) list a 2n = 32 count. This species is readily distinguished from *P. serotina* Ehrh. which has a row of hairs along the midvein of the lower leaf surface. The fruits of *P. pensylvanica* are glabrous and in corymbs while in *P. persica* (L.) Batsch the fruits are pubescent and usually solitary (Muenscher 1950).

3. Economic Importance

(a) *Detrimental* - Seedlings of *P. pensylvanica* become readily established in old fields and in fields of new plantings of small fruits (Fig 1c).

The leaves of several species of *Prunus,* including *P. pensylvanica,* are poisonous to livestock; in this species, however, the toxicity is lower than in most others (Kingsbury 1964). The cause of poisoning results from the breakdown of a glucoside, amygdalin, in the presence of specific enzymes to form hydrocyanic acid. Muenscher (1949) considered this species as one of the 10 most important in the United States producing hydrocyanic poisoning.

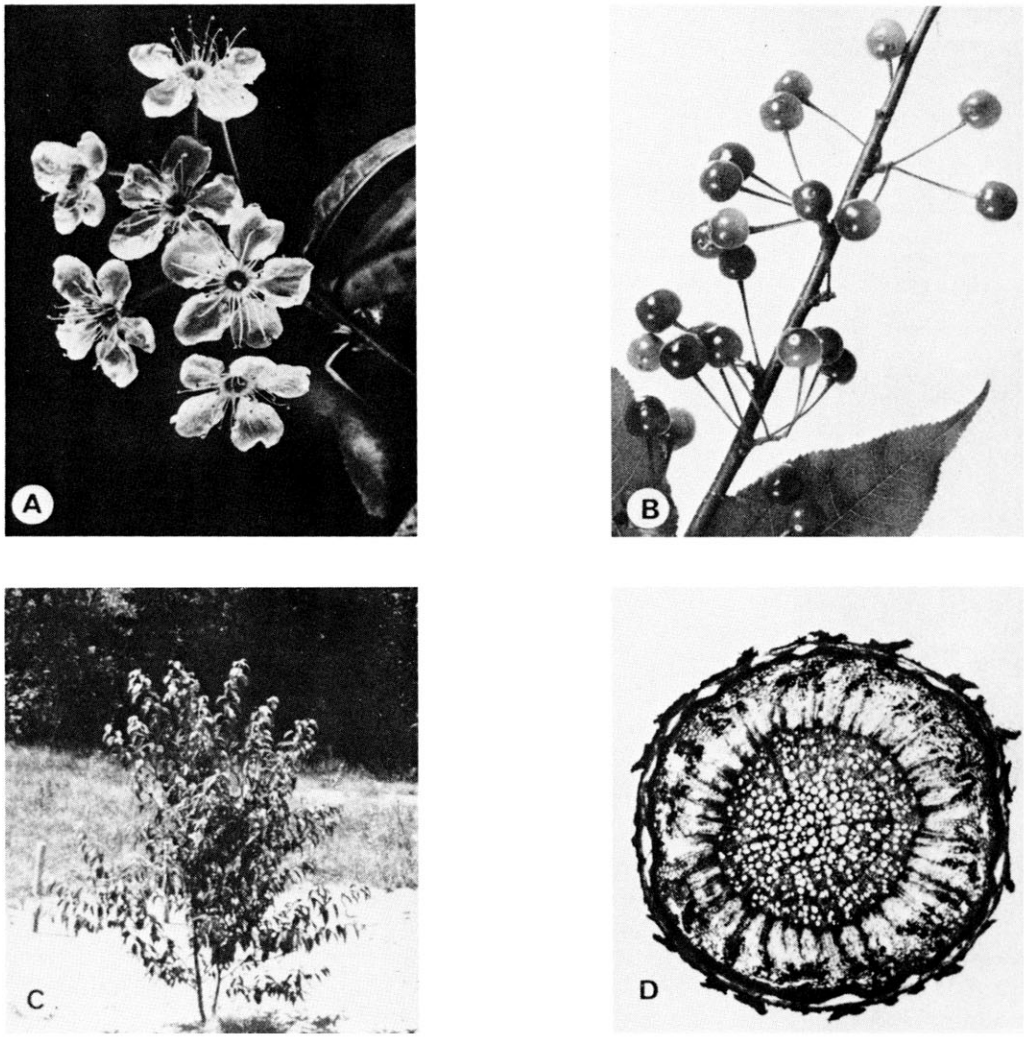

Fig 1. A. Flowers of *Prunus pensylvanica* showing 5 petals, several stamens and a single pistil per flower (1.5x). B. Clusters of fruit (1x). C. Young seedling tree (0.1x). D. Cross-section of root (60x).

(b) *Beneficial* - This species is a source of firewood and an important nursecrop to several species of conifers (Can. Dept. Mines Resour. 1949; Hosie 1969). The fruit is eaten by wildlife (Daubenmire 1947) and is a source of human food (U.S. Dept. Agr. For. Ser. 1948).

(c) *Legislation* - *Prunus pensylvanica* is not covered by any regulatory legislation.

4. Geographical Distribution

In Canada, this species extends from eastern Newfoundland to central British Columbia. It extends northward to about 63° latitude in the Mackenzie District. In the United States, it extends southward to Virginia and westward to Colorado (Fernald 1950). A map showing its distribution in eastern Canada based on records from 1923 to 1939 has been published by Groh and Senn (1940). Figure 2 shows the distribution in Canada as known today.

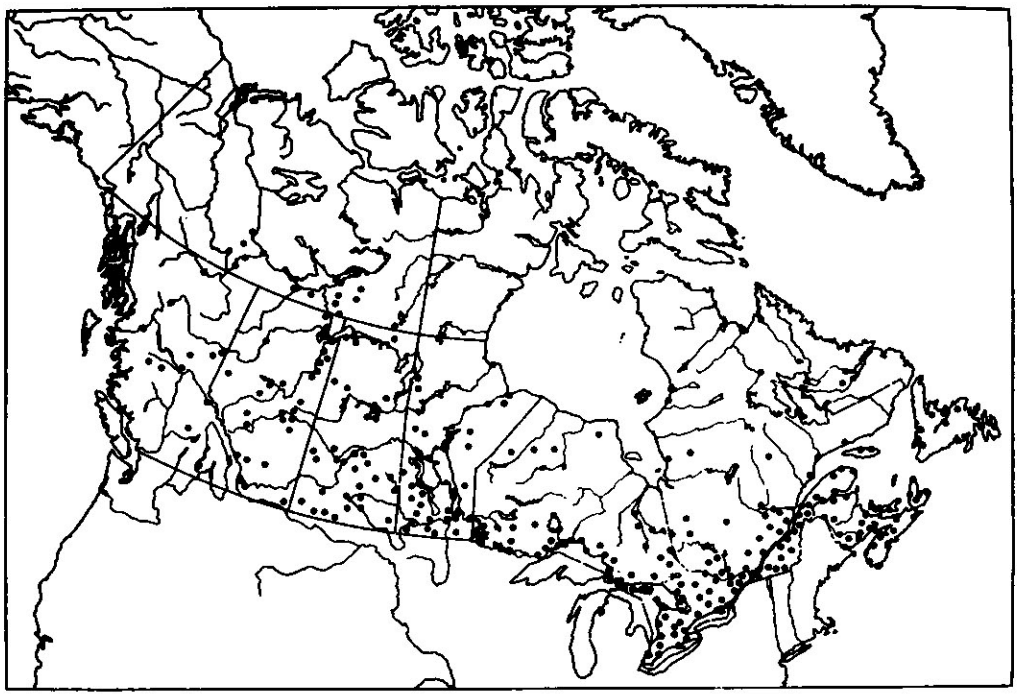

Fig 2. Canadian distribution of *Prunus penslyvanica* from specimens in the herbaria of Agriculture Canada, Ottawa, and the National Museum of Natural Sciences, Ottawa.

5. Habitat

(a) *Climatic requirements* - By comparing maps of climatic factors and the distribution of *P. pensylvanica* it is possible to gain some ideas on factors limiting growth. According to data on permafrost (Dept. Energy, Mines, Resour. 1973) the northern distribution of this species ends at the southern limit of widespread permafrost. In the northern limit on the Prairies, the average annual precipitation is 50.8 cm; the average daily maximum temperature for February is -20°C and the average daily minimum temperature is -30°C. The number of days with an average temperature over 5.6°C is 140, but the frost-free period in some areas is 60 days or less.

(b) *Substratum* - By far the most common soil type in its distribution is the humo-ferric podzol. Less commonly it is found in areas of dominantly organic fibrisol and cryic fibrisol and the luvisolic, gray luvisol (Clayton et al. 1977). The cation exchange capacity of these soils is low and the pH is strongly to quite acidic in reaction.

(c) *Communities in which the species occurs* - In northern Saskatchewan and Manitoba, *P. pensylvanica* grows in association with *Amelanchier alnifolia* Nutt., *Corylus cornuta* Marsh., and *Prunus virginiana* L. and this shrub cover indicates a forest of *Pinus banksiana* Lamb., *Picea glauca* (Moench) Voss, *Betula papyrifera* Marsh., and *Populus tremuloides* Michx. (Rowe 1956). In the Great Lakes region, Maycock and Curtis (1960) record its presence as 55% in the dry, 60% in the dry moist, 38% in the moist and 26% in the wet moist forest, but they give no value for importance. In Levis Co., P.Q., Doyon (1975) reports its occurrence as being considerable in stands of *Populus grandidentata* Michx. Farther up the St. Lawrence, in the county of Rivière-du-Loup, Blouin and Grandtner (1971) found it an understory species in the vegetation series of *Acer saccharum* Marsh. - *Betula lutea* Michx. f.

6. History

Prunus pensylvanica is a species native to Canada and its presence is recorded by Macoun (1883).

7. Growth and Development

(a) *Morphology* - Once the seedling (Fig 1c) has attained a height of 1 m or more, the strong root system begins to grow rapidly in a lateral direction (Hall & Mack 1959). New shoots grow directly from the root system (Fig 1d).

(b) *Perennation* - Scoggan (1950) considered this species to be a microphanerophyte under Gaspé conditions where it grew from 2 to 8 m in height. Under Nova Scotian conditions and in many other areas it grows much taller.

(c) *Physiological data* - The following levels of nutrients (as % dry weight for macro- and ppm oven-dry for micronutrients) were found in a sample of leaves collected at Kentville, N.S. on 24 June, 1980: N, 3.24; P, 0.24; K, 1.27; Ca, 1.34; and Mg, 0.33; micronutrients were: Fe, 195; Mn, 91; Cu, 8; Zn, 22; and B, 35.

(d) *Phenology* - As *P. pensylvanica* occurs throughout Canada, flowering date varies considerably.

The earliest flowering date we found among specimens examined was 3 May 1933 and this occurred at Saskatoon, Sask. The latest flowering specimen was 1 collected on 2 July 1959 from Mackenzie District, N.W.T. A general date of flowering in eastern Canada was the period May 25 to 29.

The earliest record of mature fruit was noted on a specimen collected on 16 July 1941 in Pontiac Co., P.Q. A general period of fruit maturity occurred across southern Canada during the middle of August.

Flower buds of *Prunus* are laid down in August or September of the preceding year (Airy Shaw 1973).

(e) *Mycorrhiza* - None reported.

8. Reproduction

(a) *Floral biology* - Observations on insect pollinations have been made in the field in New Brunswick, particularly about the areas near Fredericton, Stanley, Blissfield, and Tower Hill. In 1980 a good fruit set occurred (3 to 4 fruit per in-

florescence), possibly because *P. pensylvanica* was in bloom ahead of most competing plants such as apple, blueberry, and chokecherry, and this species had almost the complete attention of the native species of bees in mid-May. Species of the genera, *Andrena, Dialictus, Halictus,* and *Evylaeus,* as listed by Thorpe (1979), were common and were the main pollinating agents.

The mean number of flowers per inflorescence in a sample of 28 inflorescences from a single tree at Kentville, N.S., was 3.8 ± 0.3 (SE) and the mean number of fruit in a sample of 16 inflorescences from a single tree was 3.6 ± 0.3 (SE) per inflorescence. In a greenhouse study, selfing produced no fruit whereas cross-pollination gave 20% set. Yeager (1937) reported that selfing produced less than 5% of normal.

(b) *Seed production and dispersal* - This species is very productive; for example, 45 cm of shoot growth produced a total of 65 fruits. Martin et al. (1951), describing the feeding habits of robins and starlings, report a steady flow of traffic from wild cherry trees to neighboring trees where the birds regurgitate the pits before returning to the cherries. In this respect Hall (1959) found a greater population of *P. pensylvanica* seedlings in lowbush blueberry fields recently developed from woodlands as opposed to those recently developed from abandoned hayfields.

(c) *Viability of seeds and germination* - The U.S. Department of Agriculture Forest Service (1948) report that the average number of cleaned seed per kg is 7128. They recommended storing the fruit in sand for 60 to 90 days at 5°C to overcome dormancy and they also recommended 10°C night and 26°C day temperature for 60 days for optimum seed germination. Many rosaceous genera, for example *Rubus* (Warr. et al., 1979), *Fragaria* (Bringhurst & Voth 1957) and *Pyrus* (Hall et al., 1978), require a cold period before good seed germination is obtained.

(d) *Vegetative reproduction* - See section 12.

9. Hybrids

Hosie (1969) states that *P. pensylvanica* hybridizes with *P. emarginata* Dougl. in central British Columbia.

10. Population Dynamics

Marie-Victorin (1964) states that *P. pensylvanica* is found in great abundance following fire. He suggests that the heat of the fire may destroy the seed coat which inhibits seed germination, or that the increased availability of nutrients, especially potassium, stimulates germination. In Nova Scotia, seedlings of *P. pensylvanica* arise following the removal of the forest canopy whether it be by burning, cutting, or whatever. Data showing the marked increase in frequency of occurrence of *P. pensylvanica* following cutting and burning of a woodlot are found in Hall (1955).

11. Response to Herbicides and Other Chemicals

Prunus pensylvanica is intermediate in susceptibility to sprays of 2,4-D, but dichlorprop, ammonium sulfamate, and 2.4,5-T will eradicate it (Ont. Min. Agr. Food 1977).

12. Response to Other Human Manipulations

To eradicate *P. pensylvanica,* cultivation must be extensive as new shoots can arise from pieces of root left in the soil. Root cuttings about 10 cm in length

rooted 33% when incubated in soil under favorable conditions in the greenhouse.

A condition commonly found in this and other *Prunus* species is gummosis in which the middle lamella of the cell wall of the xylem breaks down and is transformed into a mass of gum. This condition is brought about by various types of injury or disease conditions (Eames & MacDaniels 1947).

13. Responses to Parasites

Conners (1967) noted 10 species of fungi found on *P. pensylvanica*. *Apiosporina morbosa* (Schw.) v. Arx, the cause of black knot, and *Monilinia laxa* (Aderh. and Ruhl.) Honey, the cause of blossom and twig blight are probably the most destructive to the host, especially in years most favorable for growth of the fungi. These fungi as well as several others which are parasitic on *P. pensylvanica* may spread from this source to cultivated species of *Prunus*. The most important of these are *Coccomyces hiemalis* Higgins, cherry leaf spot; *Monilinia fructicola* (Winter) Honey, brown rot of fruit and blossom and twig blight; *Podosphaera cladestina* (Wallr. ex Fr.) Lév., powdery mildew; and *Valsa leucostoma* (Pers. ex. Fr.) Fr., a wood dieback and canker forming fungus. *P. pensylvanica* is not an important natural host of virus diseases.

With regard to insect pests, the most common and the one causing greatest injury is the uglynest caterpillar, *Archips cerasivoranus* (Fitch). In 1980 one of us (G.W.W.) also saw some injury by the eastern tent caterpillar, *Malacosoma americana* (F.). In other years, pin cherry has been infested by the fourlined leaf roller, *Argyrotaenia quadrifasciana* Fern; the pear slug, *Caliroa cerasi* (L.), and an unidentified species of leaf bettles (Annual Report of the Forest Insect and Disease Survey, Environment Canada 1975). Also reported was the willow sawfly, *Nematus limbatus* (Cress.) (Annual Report of the Forest Insect and Disease Survey, Environment Canada 1974).

Acknowledgements

We thank A. Brydon and A. Lightfoot for technical assistance. W.J. Cody of the Biosystematics Research Institute, Agriculture Canada, made available the photograph by D. de Laferrère of the flower used in Figure 1. The loan of specimens from the herbaria listed in Figure 2 is gratefully acknowledged. G.E. Byers, supervisor of the soils and crops laboratory at Nova Scotia Agriculture College, Truro, N.S. did the analysis of leaf tissue reported in section 7(c).

References

Airy Shaw, H.K. 1973. *A Dictionary of the Flowering Plants and Ferns.* Cambridge, Univ. Press, Cambridge.

Blouin, J.L. and **Grandtner, M.M.** 1971. *Etude écologique et cartographic de la végétation du comté de Rivière-du-Loup.* Gouv. Qué. Min. Terres Forêts. Ser. Rec., Québec. Mem. No. 6.

Bolkhovskikh, Z., Grif, V., Matvejeva, T., and **Zakharyeva, O.** 1969. *Chromosome Numbers of Flowering Plants.* Acad. Sci. USSR. Moscow.

Bringhurst, R.S. and **Voth, V.** 1957. Effect of stratification on strawberry seed germination. *Proc. Am. Soc. Hort. Sci.* 70: 144-149.

Canada Department of Mines and Resources. 1949. *Native Trees of Canada.* Bull. 61. Mines, For. Sci. Ser. Br., Dominion For. Serv.

Clayton, J.S., Ehrlich, W.A., Cann, D.B., Day, J.H. and **Marshall, I.B.** 1977. *Soils of Canada.* Vol. 1. *Soil Report* Research Branch, Can. Dep. Agr. Res. Br. pp. 114-142.

Conners, I.L. 1967. *An Annotated Index of Plant Diseases in Canada and Fungi Recorded on Plants in Alaska, Canada and Greenland.* Can. Dep. Agric. Res. Br. Publ. 1251. pp. 224-231.

Daubenmire, R.F. 1947. *Plants and Environment - A Textbook of Plant Autecology.* John Wiley & Sons, Inc., New York.

Department of Energy, Mines and Resources. 1973. *The National Atlas of Canada.* 4th ed. Survey and Mapping Branch, Ottawa.

Doyon, D. 1975. *Etude éco-dynamique de la végétation du comté de Lévis.* Mem. No. 1. Agr. Qué., Ser. Défense Cultures.

Eames, A.J. and **MacDaniels, L.H.** 1947. *An Introduction to Plant Anatomy.* McGraw-Hill Book Company, Inc., New York.

Fernald, M.L. 1950. *Gray's Manual of Botany.* 8th ed. American Book Co., New York.

Groh, H. and **Senn, H .A.** 1940. *Prunus* in eastern Canada. *Can. J. Res.* (Sec. C.) 18: 318-346.

Hall, I.V. 1955. Floristic changes following the cutting and burning of a woodlot for blueberry production. *Can. J. Agr. Sci.* 35: 143-152.

Hall, I.V. 1959. Plant populations in blueberry stands developed from abandoned hayfields and woodlots. *Ecology* 40: 742-743.

Hall, I.V. and **Mack, G.J.A.** 1959. Weeds. In: *Blueberry Substation Tower Hill, New Brunswick Progress Report 1954-1959. Can. Dep. Agric., Ottawa,* pp. 16-19.

Hall, I.V., Wood, G.W. and **Jackson, L.P.** 1978. The biology of Canadian weeds. 30. *Pyrus melanocarpa* (Michx.) Willd. *Can. J. Plant Sci.* 58: 499-504.

Hosie, R.C. 1969. *Native Trees of Canada.* Can. For. Ser. Dept. Fish. For., Queen's Printer for Canada, Ottawa.

Kingsbury, J.M. 1964. *Poisonous Plants of the United States and Canada.* Prentice-Hall Inc., Englewood Cliffs, N.J.

Lawrence, G.H.M. 1951. *Taxonomy of Vascular Plants.* The Macmillan Company, New York.

Löve, A. and **Löve, D.** 1966. Cytotaxonomy of the alpine vascular plants of Mount Washington. *Univ. Colo. Stud. Ser. Biol.* 24: 1-74.

Macoun, J. 1883. *Catalogue of Canadian Plants.* Part 1 - *Polypetalae.* Dawson Brothers, Montreal.

Marie-Victorin, Frère. 1964. *Flore laurentienne.* Deuxième ed. Les Presses de L'Université de Montréal 3.

Martin, A.C., Zim, H.S. and **Nelson, A.L.** 1951. *American Wildlife and Plants.* McGraw-Hill Book Company, Inc., New York.

Maycock, P.F. and **Curtis, J.T.** 1960. The phytosociology of boreal conifer-hardwood forests of the Great Lakes Region. *Ecol. Monogr.* 30: 1-35.

Muenscher, W.C. 1949. *Poisonous Plants of the United States.* The Macmillan Company, New York.

Muenscher, W.C. 1950. *Keys to Woody Plants.* Comstock Publishing Co. Inc., Ithaca, N.Y.

Ontario Ministry of Agriculture and Food. 1977. *Guide to Chemical Weed Control.* Ont. Min. Agr. Food Publ. 75.

Rowe, J.S. 1956. Uses of undergrowth plant species in forestry. *Ecology* 37: 461-473.

Sax, K. 1931. The origin and relationships of the Pomoideae. *J. Arnold Arbor.* 12: 3-22.

Scoggan, H.J. 1950. *The flora of Bic. and the Gaspé Peninsula, Quebec.* Can. Dept. Res. Develop., Nat. Mus. Can. Bull. 115.

Thorpe, E.J. 1979. *The Effect of Forest Spraying on Solitary Bee (Hymenoptera: Apoidea Populations in New Brunswick).* MSc Thesis, Univ. New Brunswick, Fredericton.

U.S. Department of Agriculture Forest Service. 1948. *Woody-plant Seed Manual.* Misc. Publ. 654, U.S. Govt. Printing Office, Washington.

Warr, H.J., Savory, D.R., and **Bal, A.K.** 1979. Germination studies of bakeapple (cloudberry) seeds. *Can. J. Plant Sci.* 59: 69-74.

Yeager, A.F. 1937. Pollination studies with North Dakota fruits. *Proc. Am. Soc. Hortic. Sci.* 35: 12-13.