Vaccinium oxycoccos

Small Cranberry

Ericaceae

Vaccinium oxycoccos by Peter M. Dziuk, 2005

Vaccinium oxycoccos Rare Plant Profile

New Jersey Department of Environmental Protection
State Parks, Forests & Historic Sites
State Forest Fire Service & Forestry
Office of Natural Lands Management
New Jersey Natural Heritage Program

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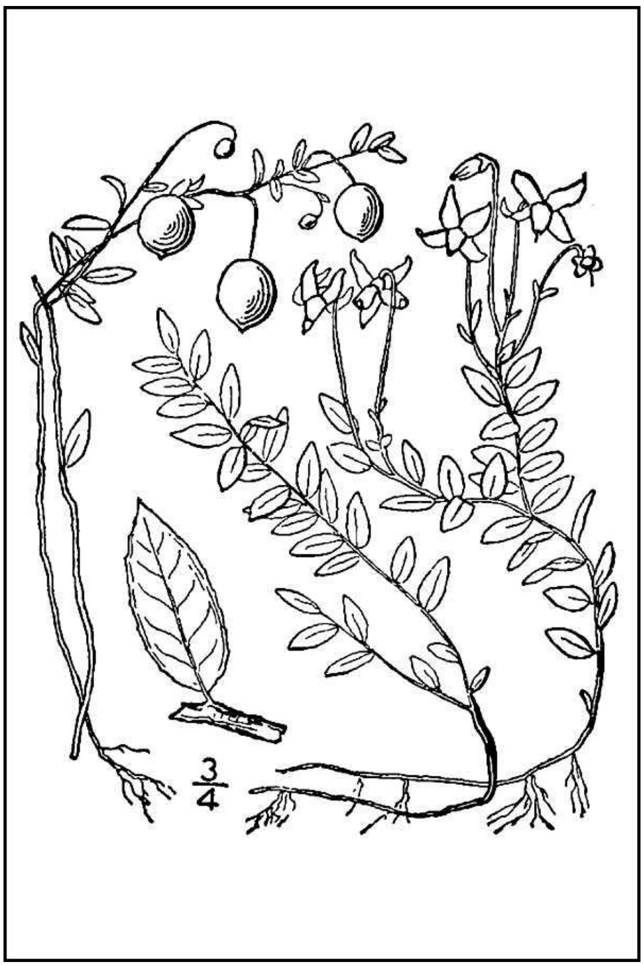
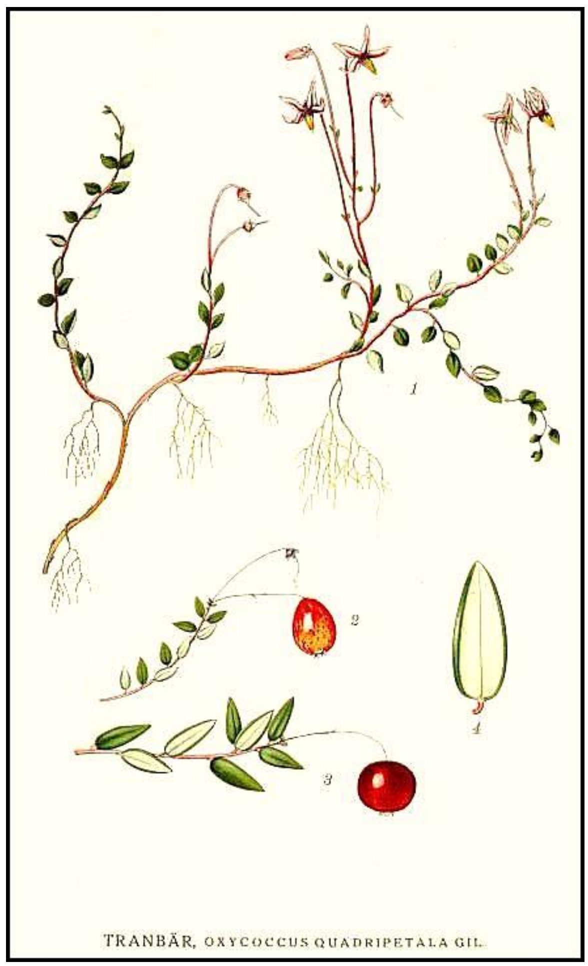
Life History

Vaccinium oxycoccos (Small Cranberry) is a rhizomatous evergreen subshrub in the Ericaceae. The hairlike roots branch abundantly and the slender reddish-brown stems creep along the ground and root at the nodes, occasionally producing upright branches. The alternate leaves are ovate in shape, dark green above, and whitish on the undersides: They are 3–10 mm long and 1–5 mm wide and usually distinctly rolled inward along the smooth margins. The reddish flower stalks are 2–3 cm long with two scale-like red bracts near or below the middle. The flowers are solitary at the end of branching fertile shoots, although the leaves of those shoots often do not develop so the flowers may appear to be growing in small clusters. Each flower has four small sepals and four pink to white petals that are strongly reflexed, exposing eight anthers with hairy filaments. The fruit of *V. oxycoccos* is a red berry 6–12 mm in diameter. (See Britton and Brown 1913, Fernald 1950, Vander Kloet 1988 and 2020, Gleason and Cronquist 1991, Jacquemart 1997a). The flowers form the season before they open (Jacquemart 1997a) and may emerge between April and August although June is typical; the fruits usually mature during September and October (Hough 1983, Rhoads and Block 2007, Borowicz 2014, Weakley et al. 2022).





Left: Britton and Brown 1913, courtesy USDA NRCS 2023a. Right: Carl A. M. Lindman, 1926.

Vaccinium oxycoccos is likely to be inconspicuous in the places where it occurs because its long horizontal stems are often concealed in *Sphagnum* mosses so that only the erect shoots of the current year's growth are visible. A tangle of branches may lie beneath the moss because the stems are capable of rapid elongation, sometimes resulting in as much as a meter of growth during a growing season (Vander Kloet et al. 2012). Based on the species' robust vegetative reproduction, Eriksson (2002) conjectured that some genets could become extensive and persist for hundreds of years. Individual leaves typically remain green for two years (Jacquemart 1997a).

Peter M. Dziuk, (left) 2004, (center) 2011, (right) 2001.

Vaccinium oxycoccos is closely related to *V. macrocarpon*, Large Cranberry, which is also native to New Jersey and is widely cultivated in the southern part of the state. *V. macrocarpon* has larger leaves (5–18 × 2–55 mm), larger fruits (9–14 mm), and greenish bracts on the floral pedicels (Vander Kloet 2020, Weakley et al. 2022). Despite its smaller berries, *V. oxycoccos* also has a long history of collection and/or cultivation for food and medicine in parts of Europe and North America (Brown et al. 2012, Česonienė et al. 2015, Jurikova et al. 2018, Pieroni and Sõukand 2018). A recent study of gene flow in the two species detected some possible evidence of hybridization (Zalapa et al. 2014).

Pollinator Dynamics

Vaccinium oxycoccos is pollinated by insects but the species is also highly self-compatible. The flowers of Small Cranberry are protandrous, meaning that the male reproductive organs mature first, and the anthers can begin to release pollen while the flowers are still in bud. Once blooming occurs an individual flower may remain open for 5–18 days (Jacquemart 1997a). Even the insect-pollinated flowers are likely to be fertilized with closely related pollen due to the high rate of clonal growth in the species (Somme et al. 2011). Fertility experiments using hand applications of pollen from different sources reported wildly dissimilar results in terms of productivity: One range was very high (80–100% fruit set, Reader 1977) and one was very low (2–12% fruit set, Fröborg 1996). The disparity might be attributable to the methods used to hand-pollinate the flowers. Nevertheless, the outcomes of both studies affirmed self-compatibility, demonstrating no significant difference in fruit production rates between plants that were fertilized with related or unrelated pollen. There is, however, some evidence that fruits which develop from self-pollinated flowers contain fewer seeds (Jacquemart 2003).

Reader (1977) observed that the majority of insects visiting *Vaccinium oxycoccos* flowers were bumblebees (*Bombus* workers) but also included other assorted bees (*Andrena*, *Dialictus*, *Lasioglossum*, and *Psithyrus* spp.), Syrphid flies (*Eristalis* spp.), and unidentified Tachinid and Anthomyid flies. The primary pollinators recorded by Jacquemart (1997b) were bumblebees (*Bombus* and *Pyrobombus* spp.) and honeybees (*Apis mellifera*). The rental of honeybees has been shown to significantly increase fruit production in cultivated crops of *V. macrocarpon* (Morse and Calderone 2000). However, *V. oxycoccos* typically receives fewer insect visitors than other ericaceous plants (Jacquemart 1997b, Van Rossum et al. 2013). The small low-lying flowers may be overlooked in favor of larger more showy blooms, but even in comparison with the similarly structured *V. macrocarpon* the flowers of *V. oxycoccos* produce smaller amounts of nectar and have less ultraviolet reflectance (Reader 1977, Van Rossum et al. 2013).

Insects appear to be needed for effective fertilization of Small Cranberry in any case. Despite the high level of self-compatibility demonstrated by Reader (1977) the author noted that *Vaccinium oxycoccos* did not produce any seeds when insects were completely excluded. Jacquemart (1997a) suggested that some self-pollination might occur if the flowers were shaken by wind, but there is no guarantee that fertilization will take place when pollinators are in short supply. In addition to an apparently low investment in attracting insect visitors, competition for pollinators with other ericaceous plants may reduce fertility rates in *V. oxycoccos* (Van Rossum et al. 2013). Vander Kloet (1988) observed that fruiting is often sparse in the species. Even so, *Vaccinium oxycoccos* may be able to function effectively at low pollination rates. A study of *V. macrocarpon* found that many flowers on the outermost shoots stopped developing soon after pollination, but if other buds on the branch were removed the outer flowers went on to produce fruit (Brown and McNeil 2006). The authors suggested that overproduction of buds could serve as a backup for lost flowers or permit greater productivity at times when resources were abundant, and that the low productivity rates reported for *V. oxycoccos* might indicate the use of a similar strategy in that species.

Seed Dispersal and Establishment

Maturation of *Vaccinium oxycoccos* fruits may be stimulated by frost (Eriksson 2002). As the cranberries ripen they are initially red-spotted but eventually turn deep red (Vander Kloet 2020). An average *V. oxycoccos* fruit contains 7–8 seeds (Jacquemart 1997a). Small Cranberry is mainly dispersed by birds and mammals that consume the fruits and defecate viable seeds. *V. oxycoccos* fruits have been found in the stomachs of passerine birds in the northeastern United States (White and Stiles 1992), and the berries are also eaten by an assortment of game birds and shorebirds as well as a wide variety of mammalian species (Willson 1993, Anderson 2011). *V. oxycoccos* seeds that were identified in scat samples from a diverse group of mammals and birds germinated readily when planted in a greenhouse (Vander Kloet et al. 2012). Some *V. oxycoccos* fruits may also be dispersed over short distances by water (Les 2017). Small Cranberry fruits that are not dispersed during the fall can generally persist through the winter months, freezing and sheltering beneath a layer of snow. In the spring there is another opportunity for dispersal, or fruits that remain in place may become buried by the growth of mosses and germinate on site (Eriksson 2002, Borowicz 2014).

Vaccinium species in general are poorly represented in seed banks at the sites where they occur (Eriksson and Fröborg 1996, Hill and Vander Kloet 2005) and *V. oxycoccos* is no exception (Jacquemart 1997a). That may be partially because the palatability of the berries hastens their dispersal. When Huopalainen et al. (2000, 2001) recovered some *V. oxycoccos* seeds from substrate in the vicinity of mature plants the vast majority were situated within the top 5 cm of the soils. The seeds of *V. oxycoccos* remain viable for a relatively short time—only about half will germinate after two years and none after three years (Vander Kloet and Hill 1994).

Germination of *Vaccinium oxycoccos* is substantially increased by a brief (30 day) period of cold stratification (Les 2017). Seeds may sprout any time during the growing season (Eriksson 2002). Development proceeds slowly: Cotyledons first appear nearly three weeks after germination, and several more weeks pass before the initial leaves are produced. At ten weeks a seedling consists of a slender vertical shoot with a few branching roots and leaves resembling those of mature plants. *V. oxycoccos* plants generally don't produce fruit until they are 6–7 years old (Jacquemart 1997a). Les (2017) indicated that clonal growth is probably more important than sexual reproduction for maintenance of established *Vaccinium oxycoccos* populations. Young vegetative plants transplanted into suitable sites showed a capacity for rapid expansion (Vander Kloet et al. 2012). The authors suggested that *V. oxycoccos* stems which became dislodged during the winter might serve as a means of establishing new colonies.

The presence of ericoid mycorrhizae in *Vaccinium oxycoccos* is well-documented (Harley and Harley 1987) although it is not clear what developmental stage the cranberry plants must reach in order to form fungal associations. *V. oxycoccos* was one of the species used by Pearson and Read (1973) to demonstrate that ericoid mycorrhizae transfer nutrients (eg. carbon and phosphorous) to their host plants. The fungi are not species-specific: Some fungi isolated from *V. oxycoccos* were successfully used to stimulate root formation and growth in shoot cuttings and seedlings of *V. macrocarpon* (Nieuwdorp 1969), and Van Geel et al. (2020) determined that fungal symbionts can be shared by multiple ericoid species in bog communities.

Habitat

Vaccinium oxycoccos can be found in similar habitats throughout its global range. Small Cranberry grows in open, wet, oligotrophic habitats such as bogs, fens, muskeg, tundra, and marshy lakeshores at elevations of 0–1500 meters above sea level (Moore and Taylor 1921, Hough 1983, Jacquemart 1997a, Eriksson 2002, Anderson 2011, Morimoto et al. 2017, Vander Kloet 2020, Van Geel et al. 2020). The sites are acidic and generally have pH values between 2.5 and 5.0 (Jacquemart 1997a, Vander Kloet 1988). The typical substrate is organic peat (Fairbrothers and Hough 1973, Jacquemart 1997a, Rhoads and Block 2007), and in some northern sites the peat forms palsas—mounds with frozen permafrost cores (Railton and Sparling 1973). *V. oxycoccos* can also occur over sand in interdunal swales and dune heathlands (Wilhelm 1980, Groom 2007, Tiner 2009, Damgaard et al. 2013).

Jacquemart (1997a) characterized the bog habitats of *V. oxycoccos* as having a high level of stagnant water that favors peat accumulation. Some of the bogs are fed by groundwater seepage (Les 2017) but *Vaccinium oxycoccos–Sphagnum* spp. communities in Japan derive their moisture from rainfall and fog (Morimoto et al. 2017). Mature *V. oxycoccos* plants are usually found in the wetter portions of bogs but seedlings sometimes develop in drier microsites along the edges (Eriksson and Fröborg 1996, Eriksson 2002). Les (2017) indicated that the species was shade-intolerant but Humbert et al. (2007) characterized *V. oxycoccos* as having a broad tolerance for a variety of light conditions.

In Indiana bogs characteristic associates of *Vaccinium oxycoccos* include *Chamaedaphne calyculata*, *Drosera rotundifolia*, *Sarracenia purpurea*, *Rhynchospora alba*, and *Sphagnum* spp. (Aldrich et al. 1986), and similar associates have been noted at New Jersey sites (NHNHP 2022). Some saturated shrubland habitats where *V. oxycoccos* is typically found, including the *Betula pumila*—(*Salix* spp.) Saturated Shrubland Alliance and the *Chamaedaphne calyculata*—(*Gaylussacia dumosa*) —*Decodon verticillatus*/*Woodwardia virginica* Dwarf Shrubland Association, were described by Breden et al. (2001). Anderson and Davis (1998) analyzed the vegetative composition of 30 peatland community types in Maine using data from 108 locations. *V. oxycoccos* was documented in more than half (16) of the peatland types, and some key habitat characteristics are summarized in Table 1.

Table 1. *Vaccinium oxycoccos* in Maine Peatlands.

Community Type	mean pH	% H_2O in peat	% overstory	peat layer depth	Small Cranberry % cover
(Sphagnum rubellum/Chamaedaphne calyculata - Enophorum virginicum)	4.02	93.0	0	5.8	5.3
(Sphagnum rubellum/Chamaedaphne calyculata - Eriophorum vaginatum var. *spissum)*	4.04	94.5	0	4.9	3.6
(Trichophorum cespitosum - Gaylussacia dumosa var. *bigeloviana)*	4.51	94.4	0	2.0	3.3
(Chamaedaphne calyculata - Kalmia angustifolia - Rhododendron groenlandicum)	4.03	87.3	0.2	4.3	2.1
(Sphagnum cuspidatum-Cladopodiella fluitans/ Rhynchospora alba)	4.04	95.6	0	6.2	1.8
(Carex oligosperma- Chamaedaphne calyculata)	4.83	86.6	0	3.4	1.4
(Kalmia angustifolia-Chamaedaphne calyculata - Gaylussacia dumosa var. *bigeloviana/Sphagnum capillifolium)*	3.87	84.3	1.5	3.8	1.4
(Carex limosa-Rhynchospora alba-Scheuchzeria palustris ssp. *americana/Sphagnum papillosum-Sphagnum magellanicum)*	4.43	95.6	0	2.4	1.3
(Gaylussacia dumosa var. *bigeloviana/Empetrum nigrum)*	4.18	91.8	2.2	4.0	1.3
(Carex oligosperma-Chamaedaphne calyculata/Sphagnum recurvum- Sphagnum magellanicum)	4.88	94.2	1.3	2.5	1.1

(Picea mariana - Chamaedaphne calyculata - Kalmia angustifolia - Rhododendron groenlandicum/Picea mariana)	4.16	89.3	8.4	4.4	1.1
(Picea mariana - Larix laricina/Carex stricta - Rhododendron canadense - Rhododendron groenlandicum)	4.63	91.1	33	2.7	1.1
(Picea mariana/Picea mariana/Picea mariana - Rhododendron groenlandicum- Maianthemum trifolium)	4.27	94.0	27.1	2.3	0.4
(Trichophorum cespitosum- Carex lasiocarpa- Rhynchospora alba - Trichophorum alpinum - Muhlenbergia glomerata)	7.89	88.0	7.2	4.8	0.2
(Rhynchospora alba- Carex limosa/Cladopodiella fluitans- Drosera intermedia)	4.90	96.6	0	3.1	0.2
(Sphagnum cuspidatum)	3.94	94.6	0	5.7	0.2
Source: Anderson and Davis 1998					

Wetland Indicator Status

Vaccinium oxycoccos is an obligate wetland species, meaning that it almost always occurs in wetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2023b)

VAOX

Coefficient of Conservancy (Walz et al. 2020)

CoC = 9. Criteria for a value of 9 to 10: Native with a narrow range of ecological tolerances, high fidelity to particular habitat conditions, and sensitive to anthropogenic disturbance (Faber-Langendoen 2018).

Distribution and Range

The native range of *Vaccinium oxycoccos* extends throughout the northern hemisphere, including much of North America, Europe, and Asia (POWO 2023). The map in Figure 1 depicts the extent of the species in the North America.

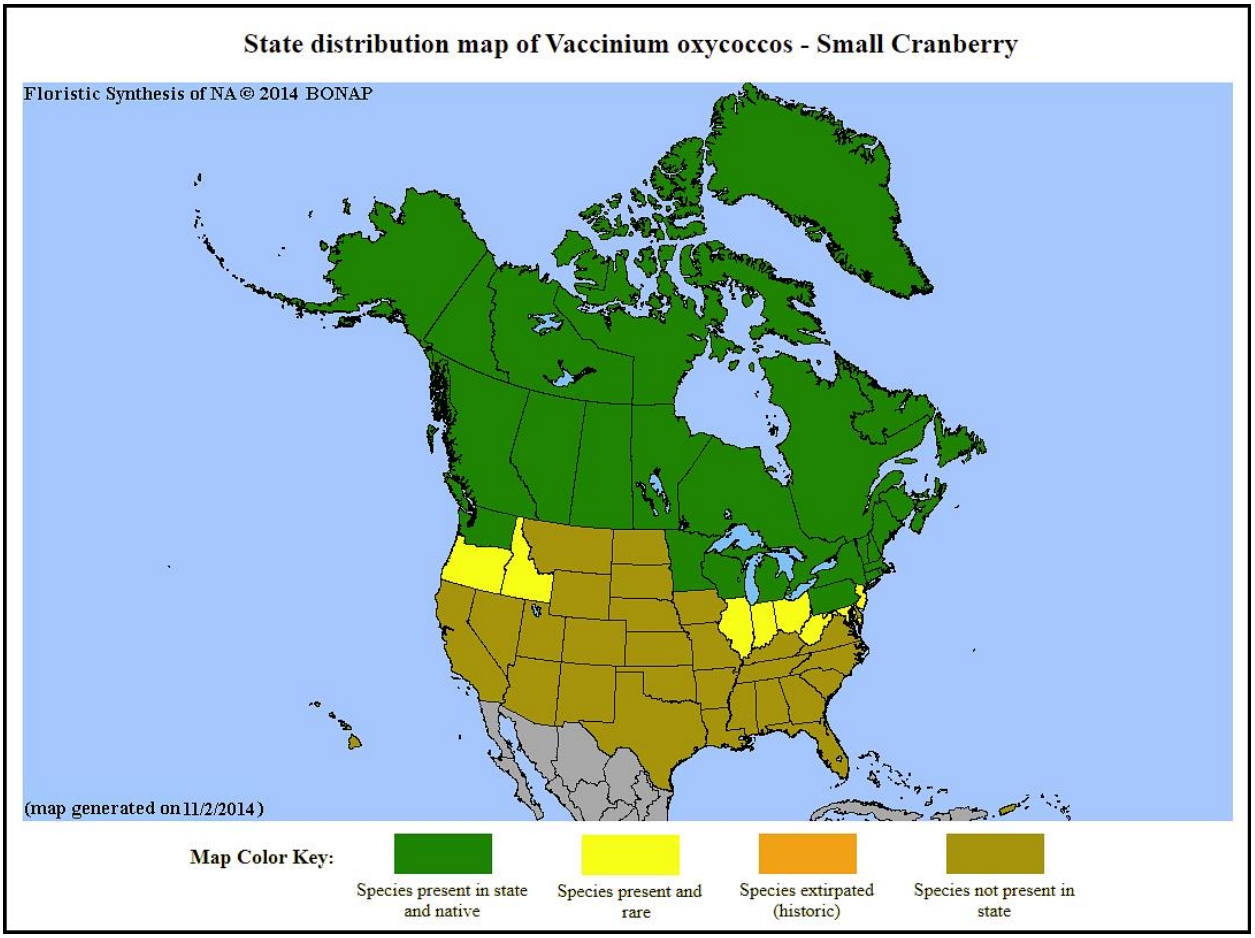


Figure 1. Distribution of V. oxycoccos in North America, adapted from BONAP (Kartesz 2015).

The USDA PLANTS Database (2023b) shows records of *Vaccinium oxycoccos* in eight New Jersey counties: Bergen, Hudson, Monmouth, Morris, Ocean, Passaic, Sussex, and Warren (Figure 2 below). Herbarium specimens labeled as *V. oxycoccos* have also originated in Atlantic and Burlington counties (Mid-Atlantic Herbaria 2023). The data include historic observations and do not reflect the current distribution of the species. Early reports of Small Cranberry in Monmouth and Ocean counties have been called into question. Willis (1874, 1877) initially characterized *V. oxycoccos* as common in the state, although in his updated flora he noted that the species was formerly frequent in the Pine Barrens but had been largely eliminated by the cultivation of *V. macrocarpon* because growers preferred the larger fruits of the latter species. Other early regional floras indicated that reports of *V. oxycoccos* in the Pine Barrens had not been confirmed (Britton 1889, Taylor 1915). Stone (1911) suggested that Willis may have mistaken natural occurrences of *V. macrocarpon* for *V. oxycoccos* because the fruits on the wild *V. macrocarpon* plants were smaller than those on the cultivated strains. Although Fairbrothers and Hough (1973) included the Pine Barrens reports in their notes on *V. oxycoccos*, Hough (1983) later indicated that Monmouth and Ocean County records of the species were unverified. All of the occurrences tracked in the Natural Heritage Database are (or formerly were) located in the northern part of the state (NJNHP 2022).

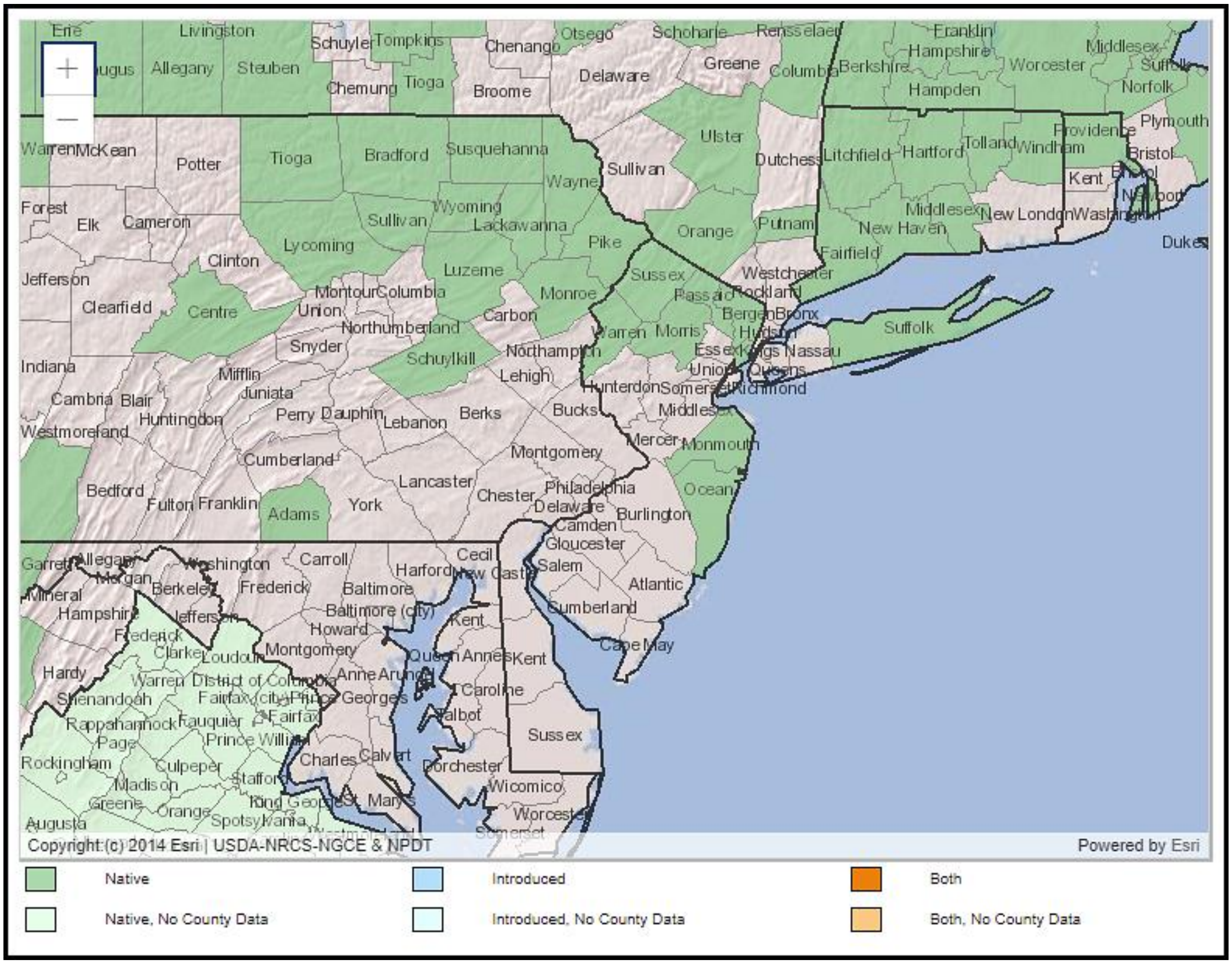


Figure 2. County records of V. oxycoccos in New Jersey and vicinity (USDA NRCS 2023b).

Conservation Status

Vaccinium oxycoccos is considered globally secure. The G5 rank means the species has a very low risk of extinction or collapse due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats (NatureServe 2023). The map below (Figure 3) illustrates the conservation status of the species in the United States and Canada. Small Cranberry is secure or unranked throughout Canada and in a number of the northeastern states. It is most likely to be identified as a species of concern along the southern edge of its range. *V. oxycoccos* is vulnerable (moderate risk of extinction) in two states, imperiled (high risk of extinction) in four states, and critically imperiled (very high risk of extinction) in two states.

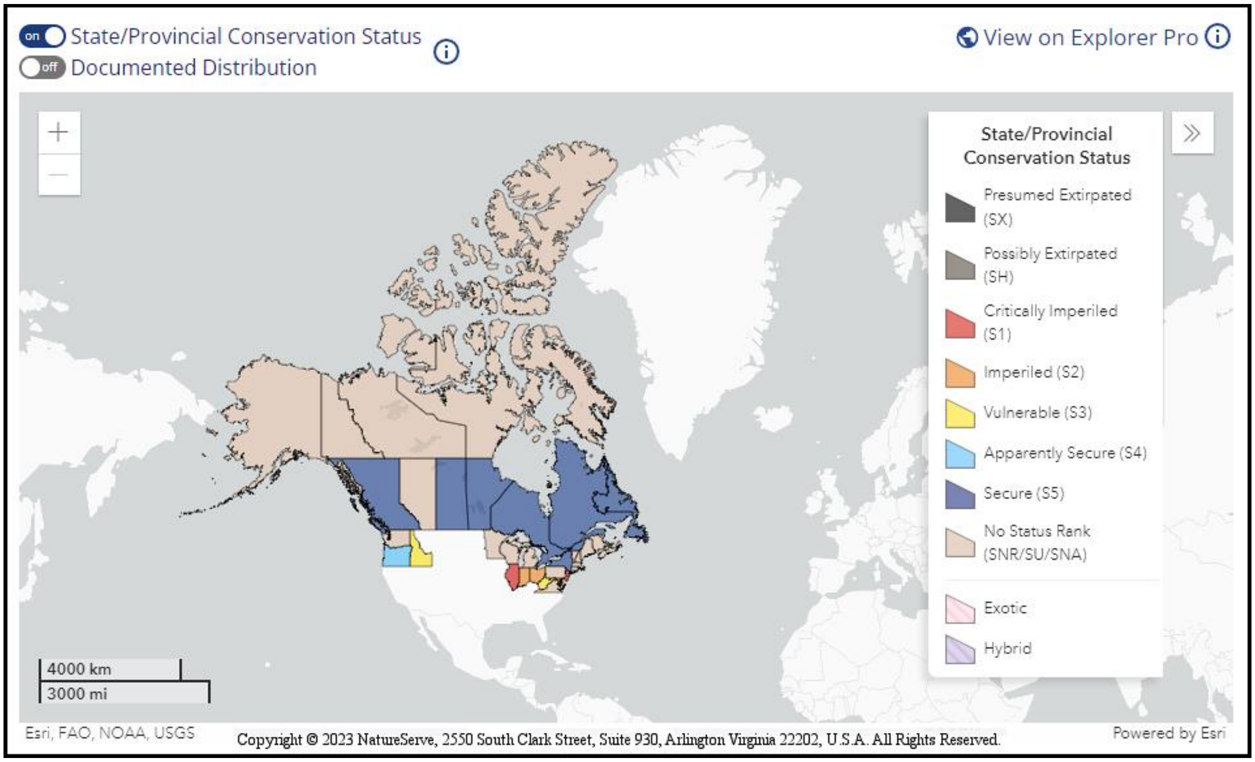


Figure 3. Conservation status of V. oxycoccos in the U. S. and Canada (NatureServe 2023).

New Jersey is one of the states where *Vaccinium oxycoccos* is critically imperiled (NJNHP 2022). The S1 rank signifies five or fewer occurrences in the state. A species with an S1 rank is typically either restricted to specialized habitats, geographically limited to a small area of the state, or significantly reduced in number from its previous status. *V. oxycoccos* has also been assigned a regional status code of HL, signifying that the species is eligible for protection under the jurisdiction of the Highlands Preservation Area (NJNHP 2010).

During the late 1800s, *Vaccinium oxycoccos* was documented at scattered locations in five of New Jersey's northern counties but even then it was considered rare in the state (Britton 1881, 1889). By the mid-1900s *V. oxycoccos* had disappeared from many of the original sites and was only known from two counties (Fables 1956), and it was included on an early list of New Jersey's rare and endangered vascular plants (Fairbrothers and Hough 1973). The species' rank on subsequent lists reflected some uncertainty regarding the status of occurrences in the state (eg. NJONLM 1992, NJNHP 2016) but *V. oxycoccos* is now listed as critically imperiled because only three populations are thought to be extant (NJNHP 2022).

Threats

Because *Vaccinium oxycoccos* is primarily associated with relatively open, acidic peatlands anything that results in a significant change to a community it inhabits may be a threat. Bog habitats can be particularly sensitive to changes in both water quantity and quality. The need for a water quality management plan was noted at the site of one New Jersey *V. oxycoccos* population (NJNHP 2022). Detrimental impacts to Small Cranberry were documented in

Finland at a number of sites where pollutants from smelter emissions had accumulated in nearby bogs. *V. oxycoccos* increased in abundance at greater distances from the pollution sources and the plants that grew closest to the sources were more likely to be sterile (Huopalainen et al. 2000, 2001). Fairbrothers and Hough (1973) noted that flooding or drainage of bogs where *V. oxycoccos* occurred in New Jersey could endanger local populations. The cranberry may tolerate some types inundation: For example, a long-term study following beaver flooding at a Connecticut site found that *V. oxycoccos* experienced little net change in abundance, decreasing in some parts of the wetlands but expanding in other parts, and portions of the community on floating sphagnum mats remained relatively stable because they rose as the water levels increased (Mitchell and Niering 1993). However draining of peatland habitats is known to be harmful to *V. oxycoccos* and the associated *Sphagnum* mosses (Veijalainen 1976, Jacquemart 1997a). In addition to directly harming species that are sensitive to desiccation, the drainage of peatlands can change soil characteristics such as pH and nutrient availability (Prévost et al. 1999), facilitating the establishment of generalist plants that replace those restricted to acidic environments. Even in bogs where the water levels remain intact some communities may be altered by the natural succession of woody species. Excessive growth of both shrubs and trees have been cited as threats to *V. oxycoccos* (Anderson 2011, Cherapanyn 2018). Once *Vaccinium oxycoccos* has been eradicated from a site the species does not readily reestablish without assistance. Its failure to colonize locations that had been utilized for peat mining or pastures were noted by Vander Kloet et al. (2012) and Morimoto et al. (2017).

Herbivory by mammalian species is not a threat to *Vaccinium oxycoccos*. Small Cranberry is generally not utilized for browse by large animals (Matthews 1992), which probably overlook the small plants concealed in the mosses. A study of the effects of sheep forage on Denmark heathlands found that *V. oxycoccos* was present in both grazed and ungrazed areas (Damgaard et al. 2013) and positive consequences of heavy local deer browse were reported by Pellerin et al. (2006) —probably because the herbivory helped to maintain open habitat to the benefit of *V. oxycoccos*. However, there is a frugivorous insect in eastern North America that specializes on *Vaccinium* species. The Cranberry Fruitworm, *Acrobasis vaccinii*, is an economically important pest of cranberry and blueberry crops throughout its range (Senft 1995). Each *A. vaccinii* larva must consume 5–8 cranberries in order to complete its development. Marchand and McNeil (2004) demonstrated that feeding activity by Cranberry Fruitworm larvae induced the fruits on *Vaccinium oxycoccos* plants to change their color from green to red. Since the larvae are more attracted to plants with green fruits, the effect probably reduces intraspecific competition from other *A. vaccinii* larvae, but it may also help to protect individual *V. oxycoccos* plants from overgrazing.

Low genetic diversity might be predicted in *Vaccinium oxycoccos* because of the high rate of vegetative propagation and the frequency of self-pollination. However, genetic studies of the species have not substantiated that expectation (Khoury et al. 2020). Zalapa et al. (2014) reported a considerable amount of variability within and among populations, and Rodriguez-Bonilla et al. (2020) suggested that the polyploid nature of *V. oxycoccos* might account for the high levels of genetic diversity present in the species (see Synonyms section).

A number of studies conducted in Europe have simulated the projected effects of climate change on peatland vegetation. Elevated carbon dioxide levels increased the rate of *Sphagnum* growth, causing *V. oxycoccos* plants to invest a greater proportion of energy in roots rather than aboveground shoots (Heijmans et al. 2001). Nitrogen deposition enhanced the growth of *V. oxycoccos* plants but also made them more susceptible to certain species of parasitic fungi that thrive in nitrogen-rich environments (Wiedermann et al. 2007). Buttler et al. (2015) found that *V. oxycoccos* responded negatively to warming, primarily because of a decrease in the water content of the *Sphagnum* mats where it grows. However an observational study in Sweden reported some expansion in the cover of *V. oxycoccos* during the period between 1994 and 2013. The researchers suggested that increased tree cover at the site was delaying the effects of climactic shifts on ground-level vegetation (Hedwall et al. 2017).

Modeling of climate change impacts on *Vaccinium oxycoccos* in North America predicted a strong trend for a northward shift in suitable habitat (Hirabayashi et al. 2022). *V. oxycoccos* is near the southern edge of its range in New Jersey and local populations are likely to experience significant changes as the climate continues to warm. Altered climactic conditions are causing temperatures to rise faster in New Jersey than in other parts of the northeast, and one of the consequences of changing regional precipitation patterns is more frequent and prolonged droughts (Hill et al. 2020). As a northern bog species with a low tolerance for desiccation, *V. oxycoccos* is likely to become even more imperiled in New Jersey. An assessment conducted in Illinois, which is similarly situated along the southern border of Small Cranberry's range, determined that the species is highly vulnerable to climate change in that state (Molano-Flores et al. 2019).

Management Summary and Recommendations

An updated status assessment is needed for *Vaccinium oxycoccos* in New Jersey. None of the three extant populations in the state have been monitored since the mid-1990s. There are also several historical occurrences that have not been sought out since they were first documented in the early part of the twentieth century and some could still be present.

Habitat protection appears to be the most critical issue for *Vaccinium oxycoccos* in places where the species is imperiled. Considerations may include land conservation and an evaluation of properties in the local watershed to determine whether specific actions are needed to preserve the natural hydrology and/or water quality at a particular site. Some management of succession may also be necessary in order to maintain open habitat. Fire could be a suitable management tool but more information is needed first. Burning is considered an effective way to deter the encroachment of woody species in open bogs and has been broadly recommended for use in *V. oxycoccos* habitats (Matthews 1992, Anderson 2011). However, studies have shown that fires generally stimulated the production of *V. oxycoccos* flowers and fruits but decreased the abundance of plants in the areas that were burned (Vogl 1964, Flinn and Wein 1977, 1988). Until there is additional data available regarding the most favorable burn frequency, intensity, and timing for *V. oxycoccos* the technique should be applied with caution.

Even in parts of North America where *Vaccinium oxycoccos* is not presently imperiled some consideration has been given to long-term planning for the species because of its cultural significance and commercial potential. For example, information has been compiled regarding seed harvesting and propagation techniques in Canada (Smreciu et al. 2013) and a collaborative effort between the U. S. Forest Service, the U. S. Agricultural Research Service, and the University of Wisconsin has focused on protecting wild populations, expanding investments in research, and raising public awareness regarding conservation issues (Khoury et al. 2020).

Synonyms

The accepted botanical name of the species is *Vaccinium oxycoccos* L. Selected orthographic variants, synonyms, and common names are listed below. Many additional varieties, forms, and subspecies have been described, particularly under the names *O. palustris*, *O. quadripetalus*, and *V. oxycoccos*, but none are currently accepted as distinct (ITIS 2021, POWO 2023, USDA NRCS 2023b). The basis for some of the formerly proposed divisions was the discovery that chromosome numbers can vary between different populations of *V. oxycoccos*, although Vander Kloet (1983) did not find morphological justification for splitting the species. However, despite having noted that diploid and tetraploid *V. oxycoccos* plants frequently co-occur, Smith et al. (2015) recently came out in favor of recognizing diploids and tetraploids as distinct taxa.

Botanical Synonyms

Oxycoccus hagerupii A. Löve & D. Löve
Oxycoccus intermedius (A. Gray) Rydb.
Oxycoccus microcarpos Turcz. ex Rupr.
Oxycoccus ovalifolius (Michx.) A. E. Porsild
Oxycoccus oxycoccos (L.) Adolphi
Oxycoccus oxycoccos (L.) MacMill.
Oxycoccus palustris Pers.
Oxycoccus quadripetalus Gilib.
Vaccinium microcarpos (Turcz. ex Rupr.) Schmalh.
Vaccinium microcarpum (Turcz. ex Rupr.) Schmalh.
Vaccinium microcarpus (Turcz. ex Rupr.) Schmalh.
Vaccinium oxycoccus L.
Vaccinium palustre Salisb.

Common Names

Small Cranberry
European Cranberry

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