2016

Conservation of *Amelanchier* in Pennsylvania

Timothy A. Block
University of Pennsylvania

Conservation of *Amelanchier* in Pennsylvania

Disciplines

Botany

Conservation of *Amelanchier* in Pennsylvania

Timothy A. Block, Ph.D.
December 6, 2016

The genus *Amelanchier* (Rosaceae) presents several challenges for conservation of potentially rare species. Historically, various authors have introduced substantial differences of opinion as to the number of species to include in a taxonomic treatment, as well as varying circumscriptions of species included. Campbell, et al (2014) note that relatively few morphological characters in Amelanchier are taxonomically informative. Add to this the following quote by Campbell, et al (2014) and one begins to see a major part of the problem, as many collection records of *Amelanchier* specimens are vegetative only.

"Identification from herbarium specimens is often inconclusive. Identification is best undertaken in the field, with visits during flowering and fruiting seasons, and observations of habitat, habit, presence of congeners, and flowering time relative to sympatric congeners."

Many species of *Amelanchier* are known to exist at multiple ploidy levels. These include the current and proposed PE species *A. bartramiana, A. canadensis* var. *canadensis, A. canadensis* var. *obovalis, A. humilis,* and *A. sanguinea.* All of these are known from diploid (2x=34) and tetraploid (2x=68) populations, but *A. bartramiana, A. canadensis* var. *canadensis,* and *A. sanguinea* are also known from limited numbers of triploid (2x=51) individuals. These triploid individuals may play a very interesting role in speciation in *Amelanchier* through the "triploid bridge hypothesis" (Burgess, et al, 2014).

Diploids of an *Amelanchier* species can be somewhat morphologically diverse, but all qualify as good species under one or more species concepts when considered separately from their conspecific polyploids (Burgess, et al, 2015). Burgess, et al also note that the distributions of diploid species populations are generally allopatric, and even where sympatric, don't tend to produce large numbers of hybrids.

Burgess, et al further note that eastern Pennsylvania is a location of some diploid species sympatry and an exceptionally high number of triploid occurrences. Most notable are sympatry of *Amelanchier arborea* with *A. bartramiana* and *A. humilis,* and many hybrids among these species have been reported.

Eastern Pennsylvania is also known to be a hotspot for *Amelanchier* polyploids. Tetraploids are known to reproduce mainly by agamospermy, but sexual reproduction among tetraploids is also known on occasion (Burgess, et al, 2015). Once established, this combination apomixis and low frequency of sex can lead to rapid morphological diversification, intergradation, and the formation of "hybrid swarms."

Campbell, et al (2014) note that morphologically distinct phenotypes of polyploid *Amelanchier* could be considered as taxonomically distinct entities if widespread enough, or that, if less widespread or less distinct, could be considered as "microspecies."

Reconciliation of the taxonomic treatment of the species of *Amelanchier* as presented in Rhoads and Block (2010) with the most recent widely accepted treatment of the genus (Campbell, et al, 2014) for Pennsylvania is relatively simple and is presented in table 1. The Campbell, et al treatment will be adopted in future editions of *The Plants of Pennsylvania* until more research leads to a clearer picture of the genus. In any case, we still lack a clear picture of the distributions of rare species of *Amelanchier* in Pennsylvania.

Table 1. Taxonomic correlation (* denotes taxonomic adjustment)

Rhoads and Block, 2010	Flora of North America, vol. 9, 2014	State status	PBS status	G-rank	S-rank
Amelanchier arborea (F. Michx.) Fernald	*Amelanchier arborea* (F. Michx.) Fernald	N	N	G5	S5
A. bartramiana (Tausch) M. Roem.	*A. bartramiana* (Tausch) M. Roem.	PE	PE	G5	S1
**A. canadensis* (L.) Medik.	*A. canadensis* (L.) Medik. var. *canadensis*	N	PE	G5	S1
A. humilis Wiegand	*A. humilis* Wiegand	TU	PE	G5	S1
A. laevis Wiegand	*A. laevis* Wiegand	N	N	G5	S5
**A. obovalis* (Michx.) Ashe	*A. canadensis* (L.) Medik. var. *obovalis* (Michx.) BSP	TU	PE	G4G5	S1
A. sanguinea (Pursh) DC.	*A. sanguinea* (Pursh) DC.	TU	PE	G5	S2
**A. stolonifera* Wiegand	*A. spicata* (Lam.) K. Koch	N	N	G5	SNR

Conservation of groups like *Amelanchier*, of which individuals often resist resolution to the species level due to a high rate of evolutionary flux, is not a straightforward matter. The mindset of protecting species alone is misplaced here. Rather, we must adopt the philosophy and practice of protecting evolutionary process and potential. While I realize that this doesn't mesh with existing law and regulations, it is, for the reasons given above, the only biologically supportable path forward. Toward this end, below are a few recommendations that will help protect the future of this very complex genus.

Conservation recommendations:

1. Protect all populations of rare species.
2. Protect all putative "hybrid" individuals suspected to be of rare species parentage, as these plants could represent sources of novel speciation events (see the "triploid bridge hypothesis" of Burgess, et al, 2014).
3. Protect suspected diploid populations of all rare species, at least until ploidy level can be determined.
4. Protect distinct phenotype populations, both those covering small areas (potential microspecies) or larger areas (potential taxonomically recognizable) of all rare species.
5. Promote funding for continued systematic research, including morphometric, cytometric, and genetic studies of *Amelanchier* in Pennsylvania, a known "hotspot" for diversity.

Modifications of these recommendations, and perhaps others, should be applied when considering other biologically similar genera. Such genera include (but not limited to)

Crataegus and *Rubus* in Rosaceae, and *Hieracium, Antennaria, Symphyotrichum,* and others in Asteraceae.

Literature cited:

Burgess, M.B., K.R. Cushman, E.T. Doucette, N. Talent, C.T. Frye, and C.S., Campbell, 2014. Effects of apomixis and polyploidy on diversification and geographic distribution in *Amelanchier* (Rosaceae). *American Journal of Botany* 101(8): 1375-1384.

Burgess, M.B., K.R. Cushman, E.T. Doucette, C.T. Frye, and C.S. Campbell, 2015. Understanding diploid diversity: a first step in unraveling polyploid, apomictic complexity in *Amelanchier*. *American Journal of Botany* 102(12): 2041-2057.

Campbell, C.S., M.B. Burgess, K.R. Cushman, E.T. Doucette, A.C. Dibble, and C.T. Frye, 2014. *Amelanchier* in *Flora of North America North of Mexico,* volume 9, pg. 646-661. Oxford University Press, New York.

Rhoads, A.F. and T.A. Block, 2010. *The Plants of Pennsylvania: An Illustrated Manual*, 2nd edition. University of Pennsylvania Press, Philadelphia.