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A Serious Note From Your Editor

In 2015, your editor offered a few thoughts at the conference in Gorham, Maine relative to editorial problems in the hope - indeed, the expectation - that individuals who go exploring wild orchids and photographing them would also share their thoughts at length with others via the journal's pages. I touched on my/our personal library and offered its information as a reference source for individuals interested in doing serious orchid writing. Go back and re-read my words in Vol. 13(1): 1, 2016. Our library was extensive then and now it's *far* more extensive! However, for the most part, my offer fell on deaf ears. Access to the orchid literature wasn't the problem. It's been far easier to explore and then use the NOC chat line to display photos and get prompt personal gratification without the bother of writing for your organization's journal! A journal publishes information to be archived and retained for future generations. Chat line stuff is here today but becomes inaccessible with a "new" electronic communications system as quickly as "tomorrow". Remember the "floppy" disks $5^{1/8} \times 5^{1/8}$ inches? You have the disk, but where's your machine to read it? Also, if you think CDs are "permanent", how about trying to read an early version of Microsoft Word with a System 10+ computer, and don't try to tell this editor you're "immune" to an "only-once" computer virus that wipes out your Word documents and X's out your digital images!! NOC members need to either get serious about conserving orchid information or get serious about replacing this editor with one who's not serious about orchids! (Read that again!)

I've had original manuscripts from foreign individuals that might have been published, but there were objections to publishing material other than from North America, and of terrestrial orchids related to North American even ones members of the same genus! I've run across objections to writing on Mexican orchids in the NOC *Journal* because NOC's "North America" didn't include Mexico. What to do? Absent articles from NOC members, I queried the board and the reply was that I had *carte blanche* to publish as I saw fit and if there were objections, the objectors could supply more material. However, having a totally free hand doesn't mean I wish to be one, but what would you do when - month after month - manuscripts are not forthcoming? Receiving a few pictures *does not* constitute an article and *any* editor would quickly tire of *building* articles around such material. This has been *your* journal, and perhaps you, as members are quite content for NOC to be a chat line group with a once-a-year get-together-party. If so, so be it.

At David McAdoo's charge years ago, I formed and named this publication, but soon resigned as editor due to restrictions I felt were intolerable. I returned to do what I could, and in the process I established the organization's archive files.

Since Gorham, we've seen $15,000+ of dental problems plus inside-the-eye surgery and other major heath issues. Wilma's in her 70's and I'm 86, and our problems are ours. Period! I take pain pills and keep going!! I *will* work physically and mentally until I *can work no more*! Let me know, and let the board know, in plain language, what you want or don't, and what you *personally* are willing to do and contribute to your NOC *Journal*. Are you *serious* about orchids? Show me!

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Native Orchid Conservation at Longwood Gardens

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Curator and Plant Breeder at Longwood Gardens
(Table and all photos are credited to the author)

Native orchids represent some of the most charismatic, intriguing, and perplexing members of the U.S. native flora. Pennsylvania alone has more than 55 species of orchids, nearly half of which are of conservation concern and have considerable ornamental value, yet successful propagation and cultivation techniques have yet to be established for many species. To combat these issues the Research Team at Longwood Gardens has developed a conservation program dedicated to propagation and cultivation of native orchids.

We are seeking to answer fundamental research questions about seed germination and seedling growth, build a collection of known-provenance native orchids to supplement and increase the conservation value of our world-renowned orchid collection, and engage in restoration efforts by providing seedlings back to the natural lands where the original seed was collected. We have obtained permits to collect seeds of nine species; six species are state-listed (Table 1), and three others are locally rare; if initial efforts prove successful, the plan is to expand to other species, and different populations within species. To help achieve these goals, we are collaborating with multiple institutions with expertise regarding various aspects of native orchid biology, horticulture, and management, including: The North American Orchid Conservation Center (NAOCC), The Pennsylvania Department of Conservation and Natural Resources Bureau of Forestry, The Brandywine Conservancy, and Mt. Cuba Center. In 2015, we successfully collected, germinated, and established three species *in vitro*; *Cypripedium parviflorum* Salisb. var. *pubescens* (Willd.) Knight, *Platanthera ×bicolor* (Raf.) Luer, and *Spiranthes casei* Catling & Cruise. One species, *Platanthera peramoena*, has so far resisted germination. The following is a report on the status of these projects initiated in 2016, and the future of the program.

The initial concept for the Program was inspired by the desire to propagate one of the last remaining populations of the large yellow lady's slipper (*C. parviflorum* var. *pubescens*) in Southern Chester County, Pennsylvania, near Longwood Gardens. Although it can be locally common in Pennsylvania, it is still considered a rare species in Pennsylvania (G5/S4), and occurs naturally over much of North America. Because of its large stature, conspicuous showy flowers, and broad distribution, it is familiar to many native plant enthusiasts, and serves as a flagship species for native orchid conservation and horticulture (Case, 1984; Stone, 1945). Despite this, this species remains rare in public gardens, and the origin of these collections is likely to be mostly unknown, thus undermining the conservation value of such collections (Krupnick et al., 2014). Therefore, a small population on a Brandywine Conservancy property not far from Longwood Gardens provided a unique opportunity to not only propagate a local genotype of this species that would be ideal for establishing an *ex situ* population, but also allows for frequent

visitation and observation to better understand the long term dynamics of this population. Only a small number of individuals occur here (>30 flowering stems, and > 15 genets) and the habitat is severely threatened by invasive plant species, including: winged burning bush (*Euonymus alatus*), garlic mustard (*Alliaria sativa*), and Asian bittersweet (*Celastrus orbiculatus*). Additionally, white-tail deer pressure in the area is exceptionally high, and represents another potential hurdle to the long-term persistence of this population. In October 2015 we were granted permission to harvest mature seed and began seed sowing experiments.

Table 1.

Taxa	PA Heritage rank[z]	Historical populations (No.)[y]	Number of public gardens where present[x]	Part of Longwood Conservation Program
Arethusa bulbosa	E	21	0	X
Cypripedium parviflorum var. makasin	E	20	9	
Isotria medeoloides	E	8	1	
Platanthera dilatata	E	8	6	
P. hyperborea	E	---	4	
Spiranthes casei	E	3*	1	X
S. ovalis var. *erostellata*	E	1	4	
S. romanzoffiana	E	6	9	
S. vernalis	E	13	7	X
Cypripedium reginae	PT	27	54	
Aplectrum hyemale	R	48	12	
Malaxis bayardii	R	23	0	
Coeloglossum viride	PE	20	9	
Corallorhiza wisteriana	PE	24	0	
Platanthera aquilonis	PE	---	4	
Platanthera blephariglottis	PE	27	6	
Platanthera hookeri	PE	26	1	
Platanthera huronensis	PE	18	3	
Platanthera macrophylla	PE	8	0	
Goodyera tesselata	PT	10	2	X
Platanthera ciliaris	PT	>70	8	X
Platanthera peramoena	PT	31	2	X
Spiranthes lucida	PT	44	1	
Cypripedium parviflorum var. pubescens	NL	>50	12	X
Platanthera xbicolor	NL	1	0	X

[z]E = Endangered; PT = Potentially threatened; R = Rare; PE = Potentially endangered; PT = Potentially threatened.

[y]Data derived from Rhoads and Block, 2007.

[x]Data from Botanic Garden Conservation international (BGCI) PlantSearch! website. It is not currently known whether these represent intentional cultivation or naturally occurring populations on land holdings.

Cypripedium propagation protocols have been streamlined in the last 25 years, yet propagation of particular genotypes or species may still require tweaking of established protocols, including *C. parviflorum* var. *pubescens* (Steele, 1996). We have had some success germinating the mature seed and a small number of seedlings are growing on. However, green capsule sowing of immature seeds has been highly successful in promoting germination of many *Cypripedium* species, and in

some cases, is the only method in which certain species can be successfully propagated from seed (Malmgren, 2016). This has been known for a long time, but phenology and timing of seed maturity can vary among climates, resulting in a need to modify protocols in different regions. It has been generally reported that sowing the seed 40 to 50 days after pollination is ideal and can result in high germination percentages.

Fig. 1. Green capsule (immature seed) propagation of *Cypripedium parviflorum* var. *pubescens*. A. The flowers. B. Immature (green) capsule at 49 days after pollination.

To test the potential for green capsule seed germination of *Cypripedium* in our region, we conducted green capsule sowing experiments using cultivated *Cypripedium* plants at Mt. Cuba Center (Hockessin, DE). Plants of *C. parviflorum* var. *pubescens* and *C. kentuckiense* were hand pollinated on May 13, 2015 and seed capsules were harvested at 34, 49, and 70 days after pollination and sown on three different media (Phytotech labs T839, M551, and O139) (Figure 1A-B).

These experiments confirmed that harvesting seed of *Cypripedium parviflorum* var. *pubescens* at 49 days after pollination resulted in high germination percentages on Phytotech Labs T839 medium supplemented with one 1 cm^3 cube of russet potato (Figure 1C). *Cypripedium kentuckiense* germinated equally at 49 days after pollination, but a similarly high germination percentage also occurred at 70 days after pollination. Seedlings were then used to determine optimal conditions for continued *in vitro* growth of seedlings. Seedling vigor and development was greatest after replating to individual test tubes with 13 milliliters of full-strength T839 without potato (Figure 1D). Including potato in the seedling replate medium resulted in high mortality for both species.

More than 500 deflasked seedlings were harvested and will be used to fine-tune our seedling growth and development in a nursery setting. Seedlings will ultimately be used in the gardens at Longwood and shared with regional botanical gardens.

Fig. 1. Green capsule (immature seed) propagation of *Cypripedium parviflorum* var. *pubescens*. C. Developing protocorms 8weeks after sowing. D. Replated seedlings.

On May 5, 2016, five flowers were hand pollinated and immature (green) capsules to be harvested on June 22, around 45 days after pollination; the ideal time for green capsule sowing is 40-50 days after pollination. Recently another population of *C. parviflorum* var. *pubescens* has been identified in Northern Chester County on a conservation easement, and is considerably larger than the southern Chester County population (ca. 1,000 plants). Working with the conservation group, we obtained permission and harvested immature capsules from this population on June 21st, 2016. Despite growing at a more northerly location than the population near Longwood, these plants flowered about five days earlier than the Brandywine conservancy population and provide a unique opportunity to compare the germination and development of two local, but geographically separated, populations. Seedlings from these efforts will be used to establish *ex situ* populations of this local genotype in various areas of Longwood Gardens, for repatriation of seedlings into the existing natural populations, and for sharing with interested regional public gardens.

In October 2015, we received an email stating interest from the Pennsylvania Department of Conservation of Natural Resources Bureau of Forestry in propagating the Pennsylvania endangered orchid *Spiranthes casei* var. *casei*, Case's ladies tresses (G4/S1; PE). This species reaches the southern limit of its geographic distribution in North Central Pennsylvania and many populations are in a state forest experiencing growth and development of fracking operations due to the rich natural gas deposits in the region. One population was accidentally destroyed by a gas company during road work mitigation in a state forest, and the forest botanist was interested in propagating plants for reintroduction to the destroyed and adjacent sites. In early November 2015, I was directed to sites where the species was seen flowering earlier that fall, and collected mature seed from ten individuals in three different subpopulations. Information regarding germination of *Spiranthes* seeds is

variable and incomplete, and seed germination of *S. casei* has not been reported. Dr. Warren Stoutamire (personal communication) mentioned that *Spiranthes* species have fragile seed coats that are rapidly denatured by chemicals used for surface sterilization, and suggested using sterilization times of 10 minutes or fewer. This evidence is supported by additional reports, and Zettler indicated that a sterilization time of three minutes resulted in successful germination of a number of *Spiranthes* species from the eastern U.S. (Rasmussen, 1995). Seeds were surface sterilized for 10 and three minutes using a 9:1 v/v DH_2O:Chlorox solution. Embryos in the 10 minute treatment became translucent and failed to germinate, whereas those sterilized for three minutes were opaque and white and germinated well on three different media (Phytotech P723, M551, and Knudson C) after four to six weeks. The highest germination and most rapid seedling development occurred on Phytotech Labs P273 medium. The protocorms developed rapidly and six to eight weeks after germination began to produce shoots. At this stage, more than 400 individual seedlings were transferred to test tubes and a photoperiod experiment was established in which seedlings were given constant (24-hr) light, 18-hr light/6-hr dark, and total darkness. Initial results indicate that light is essential for continued development of seedlings. To date, seedlings in the lighted treatments have produced as many as four leaves, while those in the dark have produced etiolated shoots indicative of insufficient light levels. Seedlings will be harvested after 20 weeks and data (i.e. fresh weight, number of leaves, number of roots, mean root length, etc.) will be recorded to determine if there are differences in seedling quality and vigor between the treatments. Once this is complete, the next stage will be a series of experiments to determine the optimal medium for establishing the seedlings in containers in a production greenhouse environment. If successful, the resultant plants will be planted back into State Forest sites and used to establish *ex situ* populations at Longwood Gardens. In September 2016, I visited these populations again while they were flowering. Interestingly, these populations exhibit characters of *S. casei* and *S. ochroleuca*.

A third initiative of the program is asymbiotic seed propagation of selected *Platanthera* species. *Platanthera* is the largest genus of orchid native to North American and includes many well-known, showy species of conservation concern with significant ornamental potential for wildflower and bog gardens. In 2015, work was initiated with three species and a fourth will be added in 2016. At least one species, *Platanthera ciliaris*, has been propagated from seed in large numbers and is commercially available, and a relatively large amount of information regarding the propagation of this species has been published (Anderson, 1996; Rassmussen, 1995). However, this level of information is lacking for most species and several are considered difficult to propagate.

The purple fringeless orchid, *Platanthera peramoena*, has considerable ornamental potential and preliminary information suggests that it is easy to grow in a bog garden setting, but seed propagation efforts have not been successful (Rasmussen, 1995; Tullock, 2005) (Fig. 2A). We obtained permission to collect seeds from one of the last known population of *P. peramoena* in New Castle County, Delaware (G5/S1). This species is also rare in Pennsylvania (S2), but several populations are known to exist. Anecdotal information indicated that *P. per-*

amoena is difficult to germinate, and successful reports of symbiotic or asymbiotic germination do not exist in the scientific literature. Despite sowing more than 60 replications testing different media, different seed harvest times, and seed sterilization techniques, a single seed has yet to germinate in any of our treatments. In attempt to overcome this difficulty, this year we will collect green capsules at short (one week) intervals and attempt to circumvent issues that inhibit germination of mature seeds. If further tests of asymbiotic seed sowing continue to fail, then it is possible that this species requires symbiotic seed sowing in the presence of a fungal symbiont. In the meantime, we will continue to observe and work with existing cultures and run a series of experiments to determine if different temperature regimes will promote germination.

Fig. 2. A. *Platanthera peramoena*

Seeds of *Platanthera blephariglottis* (G4/S)*, and Platanthera ×bicolor* (Not listed) from the well-known and popularized Valmont Bog in Luzerne County, Pennsylvania were also collected. Pennsylvania native orchid enthusiast Bob Sprague is a conservation steward of this property and has written extensively about the platantheras at Valmont Bog. He was instrumental in identifying and tagging select flower color forms of hybrid platantheras for later seed harvest (Catling, 2013; Sprague, 2013). Mature seeds of both taxa were harvested on October 19, 2015 and sown during winter of 2015/2016. Seeds of both taxa have germinated at low percentages over an extended period of time. Since seeds were collected from plants tagged at flowering time and kept separate during the germination process, we have been able to track germination differences among different plants. Interestingly, there are obvious differences among seed lots regarding ability to germinate at this stage. Cultures will continued to be monitored as seedlings are replated and measurements will be taken to determine if differences in growth rate of seedlings are correlated to the differences in germination rate.

The population of *P. ×bicolor* in Pennsylvania represents one of the rarest orchid occurrences in the state yet receives no protection status because of its presumed hybrid origin. Not only does there appear to be F_1 hybrids in this population, but the range of flower colors and patterns suggest introgression from paren-

tal taxa and other hybrids, which is a rare phenomenon among terrestrial orchids. At least one study of terrestrial orchid hybrid zones of *Orchis* species indicated that they may be important in the evolution of new species, and should be of high conservation concern. This underscores the potential scientific importance of the hybrid *Platanthera* in Valmont Bog, and suggests that state botanical agencies should prioritize the conservation status of this unique population (Catling, 2013; Cozzolini et al., 2006). From a horticultural perspective, the considerable beauty of these plants lend themselves to display purposes at a time of year when many greenhouse orchids in the Longwood Gardens collection are not flowering (July-August) and have commercial potential if easy-growing clones can be selected and increased through vegetative propagation or tissue culture. To this end, there is also the question concerning inheritance of the color patterns in seed grown progeny. Since seeds were collected from previously identified and marked parent plants of known flower color and given the likely hybrid origin of the these plants, flower color inheritance is likely to be complicated and propagation could lead to the discovery of new flower colors and patterns for horticultural use.

Fig. 2B. *Arethusa bulbosa*.

Although started in 2015, the program continues to grow rapidly, and there are plans to expand the number of species we are working with on a yearly basis. In addition to seed collection activities mentioned above, we have also collected root samples from species that were sent to SERC where they will undergo fungal extraction, molecular identification, and inclusion in the fungal bank held there. These fungi are also available for distribution and use in orchid conservation studies. Since we are propagating orchids asymbiotically, these efforts will benefit orchid conservation studies at Longwood Gardens that involve greenhouse acclimation and production studies where we can address the feasibility of introducing symbiotic fungi to seedlings after they are removed from *in vitro* conditions. This could prove to be a critical step in the long term establishment of *ex situ* populations and the success of seedling repatriation efforts at existing natural orchid sites. In fall 2015, Longwood Gardens hosted the mid-Atlantic regional NAOCC meet-

ing and have positioned the program at Longwood to become the leading regional program dedicated to native orchid seed propagation and growth. Through a developing and expanding relationship with the PA DCNR Bureau of Forestry we were able to collect seed of other Pennsylvania endangered orchids including the state endangered *Arethusa bulbosa* (G4/S1, Fig. 2B) and *Goodyera tesselata* (G5/S1) in 2016. Our goal will be to add additional species to this list each year, and expand this project continually over the course of the next five years and to expand the reach of the program outside of the U.S. by developing relationships with domestic and international gardens interested in orchid conservation. Additionally, since one-third of orchid species are terrestrial, and a disproportional number of these are endangered and extinct compared to epiphytic species, we are also attempting seed propagation of non-native temperate and terrestrial orchid species from around the world. Not only will this help us refine our seed propagation techniques, it will also help us build a collection of native orchids that supports and enhances the conservatory and outdoor displays at Longwood Gardens.

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A New and Beautiful Orchid Hybrid

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Perhaps it was inevitable!

At a roadside wildflower wetland habitat just north of the tiny Cumberland Plateau town of Cagle in Sequatchie County, Tennessee, healthy populations of Monkey-Face Orchid (*Platanthera integrilabia*) and Yellow-Fringed Orchid (*Platanthera ciliaris*) are interspersed and bloom at the same time. So it was not too surprising on August 1, 2016, to find an apparent hybrid between the two, in good bloom. It had unopened buds at the top of the inflorescence that were clearly orange, like those of its Yellow-Fringed parent, but it also had open flowers at the bottom of the inflorescence that were almost completely white, like its Monkey-Face parent. The open flowers also had some fringe on the lip; not as much as is typical with Yellow-Fringed Orchid but certainly more than is ever found with Monkey-Face blooms.


Platanthera ×rhinehartii

Searches thus far have not turned up any previously named hybrid between these two parents. Since this appears to be a new cross, I am proposing that it be named *Platanthera X rhinehartii*, since it was found not far from the former home of the late Dr. Margret Rhinehart, an avid wildflower enthusiast, amateur botanist, and long-time member of and trip leader for the Tennessee Native Plant Society.

As an unfortunate post-script, the site has since been severely damaged, most likely by wild hogs, which in recent years have become problematic in almost all counties of Tennessee. Only time will tell if the orchids and other wildflowers return another season.

In an additional note, the author states, “Professor Wofford of the U. Tennessee/Knoxville herbarium accepted the voucher specimen and agreed that it was clearly a cross resulting from that parentage.”

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Updating the Orchid Flora of Arizona and New Mexico

Ronald A. Coleman
(All images are credited to the author)

It has been about 14 years since the publication of *The Wild Orchids of Arizona and New Mexico* (Coleman 2002). The Native Orchid Conference held in Benson, AZ in August 2016 presented an opportunity to review the current status of our orchid flora. This article summarizes the updates to the orchid flora of Arizona and New Mexico presented at the Native Orchid Conference. The changes can be considered in two groups: nomenclature, and new discoveries. The following paragraphs address those changes, first in Arizona, then in New Mexico.

Changes to the Orchid Flora of Arizona

Nomenclature changes

Dichromanthus michuacanus is the last of our orchids to bloom. In Coleman (2002) I called this member of the Spiranthinae *Stenorrhynchos michuacanum*. Essentially in parallel Salazar and Arenas (2002) transferred the taxon to the genus *Dichromanthus*. Therefore the correct name for our late blooming orchid is *Dichromanthus michuacanus* (Lex.) Salazar & Soto Arenas (Fig. 1).

Three other nomenclature changes for Arizona are all in the genus *Hexalectris* based on the work of Kennedy and Watson (2010). Coleman (2002) recognized *Hexalectris revoluta* as growing in Arizona. Previously it was known in the United States only from Texas. Catling (2004) subsequently recognized differences between the Arizona and Texas plants, naming our *H. revoluta* var. *colemanii*. Kennedy and Watson (2010) used DNA analysis to show our plant were distinct from *H. revoluta* and named it *Hexalectris colemanii* (Fig. 2). *Hexalectris revoluta* is no longer considered part of our orchid flora.

Fig. 2

In the same paper Kennedy and Watson showed that the two taxa I had identified as *H. spicata* var. *spicata* and *H. spicata* var. *arizonica* were the same and not conspecific with the *H. spicata* that grows in the Eastern United States. Our plants reverted to the specific epithet used by Watson (Watson 1882) for the original description as *Corallorhiza arizonica* and hence are now called *Hexalectris arizonica*.

New Orchids for Arizona

Hexalectris parviflora has been documented for the first time in the United States. Previously the known northern extent of this species' distribution was in

the Sierra Madre Occidental in Mexico. On 1 May 2015 Janet Fox, leading a team fielded by WestLand Resources Inc. conducting surveys of *Hexalectris* observed an orchid unknown to her in the Dragoon Mountains in southeastern Arizona.

We subsequently identified the plant as *Hexalectris parviflora* which had never before been reported from the United States (Coleman and Fox 2009). Shortly after Fox's discovery, Teague Embrey, also working on a field team for WestLand Resources Inc., discovered an additional plant in the Peloncillo Mountains of extreme southeastern Arizona. These records increase the known number of *Hexalectris* species in Arizona to four, and in the Unites States to eight. These two discoveries are northern range extensions of approximately 260 miles and 220 miles respectively, from the closest *Hexalectris parviflora* records in the Sierra Madre Occidental of Mexico. A new color form of *Dichromanthus michuacanus* (Llave & Lex.) Salazar et Soto Arenas has been added to the Arizona orchid flora. Coleman (2009) described *Dichromanthus michuacanus* forma *armeniacus.* The flowers are a striking apricot yellow. They bloom during the same mid- to late-October as the more typical greenish flowers. Morphologically the yellow flowers are structurally identical to the traditional greenish flowers, differing only in color. The background color of the sepals, petals, and lip is a rich apricot yellow. The stripes are dark green, slightly darker than in the typical flowers. The throat on all yellow flowers was very dark green. In typical flowers the throat is either greenish or pale yellow, however some do have a dark green area deep in the throat, but it does not approach the intensity seen in the yellow form. So far this color form has been found on only one hillside is SE Arizona (Fig. 3).

Fig. 3

Changes to the Orchid Flora of New Mexico

Nomenclature Changes for New Mexico

Hexalectris arizonica is the correct name of plants in New Mexico previously referred to *H. spicata* var. *spicata* and *H. spicata* var. *arizonica.* This nomencla-

ture change is identical to that discussed for Arizona and is based on the work of Kennedy and Watson (2010).

New Orchids for New Mexico

While doing research for *The Wild Orchids of Arizona and New Mexico* I determined that all herbarium specimens in New Mexico purported to be *Platanthera dilatata* were in fact *P. huronensis*. Additionally all *Platanthera* that I observed in the field with whitish flowers were just lightly colored *P. huronensis*. I concluded that *P. dilatata* did not grow in New Mexico. One of the Herbaria I visited to study their specimens was at San Juan College in Farmington, NM. Apparently I overlooked or otherwise missed two specimens from San Juan College that are clearly *P. dilatata*. One was collected from Taos County in 1976 by S. Williams, and the other from Rio Arriba County in 1980 by R. Owens. Relocating the plants will be challenging because Williams simply said "wet meadow," and Owens said "mountain bog."

Fig. 4

Hexalectris colemanii was documented in Arizona in 2010, but it was not until 2013 that it was discovered in New Mexico. Cloud-Hughes (Cloud-Hughes 2014) reported finding a single plant just east of the Arizona border in the Peloncillo Mountains. In subsequent years a few additional plants were found, but the number of *H. colemanii* in New Mexico remains low.

Listera borealis was known in Colorado, but had never been found in New Mexico. That changed in 2007 when Ben Legler discovered some plants along a stream in Taos County. He discovered some additional plants, also in Taos County in 2009. This is the second member of the genus *Listera* in New Mexico. It is very easy to tell *L. borealis* from *L. cordata*. The lip of *L. borealis* has two oblong lobes at the apex for about 20% of its length, with a small tooth between the lobes. The lip on *L. cordata* has two linear lanceolate lobes for about half its length, without a tooth. Their ranges overlap, and they sometimes grow near each other (Fig. 4).

Platanthera obtusata was also added to our orchid flora by Ben Legler. He found it in both Taos and Colfax Counties in 2007. Ken Heil extended the range when he found plants in Mora County in 2008. This tiny single leaf *Platanthera* grows in moist, shaded forest. The single leaf is linear-oblanceolate. On our plants

the leaf is rarely more that 6 to 8 cm long, although they can get about twice that in parts of the range. The total height of our plants is between 10 and 15 cm tall with a few whitish-green flowers. *Platanthera obtusata* is much more common in the Northern Rockies, but should be looked for elsewhere at high elevations in the terminus of the Rockies in New Mexico (Fig. 5).

Fig. 5

Microthelys rubrocalosa (B.L. Robins and Greenm.) Garay was discovered in 2004 growing within the Lincoln National Forest, in the Sacramento Mountains of Otero County, New Mexico by Marc Baker (Coleman and Baker 2006). This was the first record of this species from the United States and represented a northward range extension of approximately 270 miles (436 km). The original colony of just about 20 plants was badly damaged by fire. Fortunately Baker later found multiple locations in the Lincoln National Forest, so the total population of *M. rubrocalosa* in the United States is now several hundred plants, all growing in Otero County.

Leaves and flowers do not appear above ground until the after start of the monsoon induced rains in July, and don't bloom until August or later. The leaves are a dark, bluish green, narrowly lanceolate, and up to 10 cm long by 1.5 cm wide. The flower spikes are up to 32 cm tall with over 30 buds and flowers. Each tubular flower is about 5 mm long and two mm wide. Sepals and petals are greenish with white edges and formed a tight hood around the lip and column. Two bright reddish-orange calli cover the lower half of the lip, and are visible if you look at the bottom the flower (Fig 6).

Fig. 6

Table 1. The current orchid flora of Arizona and New Mexico.

	Arizona	New Mexico
1	1. *Calypso bulbosa* var. *americana*	1. *Calypso bulbosa* var. *americana*
2	2. *Coeloglossum viride*	2. *Coeloglossum viride*
3	3. *Corallorhiza maculata*	3. *Corallorhiza maculata*
4	4. *Corallorhiza striata*	4. *Corallorhiza striata*
5		5. *Corallorhiza trifida*
6	5. *Corallorhiza wisteriana*	6. *Corallorhiza wisteriana*
7	6. *Cypripedium parviflorum*	7. *Cypripedium parviflorum*
8	7. *Dicromanthus michuacanus* and *Dicromanthus michuacanus* forma *armeniacus*	
9	8. *Epipactis gigantea*	8. *Epipactis gigantea*
10		9. *Epipactis helleborine*
11	9. *Goodyera oblongifolia*	10. *Goodyera oblongifolia*
12	10. *Goodyera repens*	11. *Goodyera repens*
13	11. *Hexalectris colemanii*	12. *Hexalectris colemanii*
14	12. *Hexalectris parviflora*	
15	13. *Hexalectris warnockii*	
16		13. *Hexalectris nitida*
17	14. *Hexalectris arizonica*	14. *Hexalectris arizonica*
18		15. *Listera cordata*
19	15. *Listera convallaroides*	
20		16. *Listera borealis*
21	16. *Malaxis corymbosa*	
22	17. Malaxis porphyrea	17. *Malaxis porphyrea*
23	18. *Malaxis soulei*	18. *Malaxis soulei*
24	19. *Malaxis abieticola*	19. *Malaxis abieticola*
25		20. *Microtheleys rubrocalosa*
26		21. *Piperia unaalascensis*
27		22. *Platanthera aquilonis*

28		23. *Platanthera brevifolia*
29		24. *Platanthera dilatata* var. *dilatata*
30		25. *Platanthera huronensis*
31	20. *Platanthera limosa*	26. *Platanthera limosa*
32		27. *Platanthera obtusata*
33	21. *Platanthera purpurascens*	28. *Platanthera purpurascens*
34	22. *Platanthera sparsiflora*	29. *Platanthera sparsiflora*
35	23. *Platanthera zoethecina*	
30	24. *Schiedeella arizonica*	30. *Schiedeella arizonica*
38	25. *Spiranthes delitescens*	
39		31. *Spiranthes magnicamporum*
40	26. *Spiranthes romanzoffiana*	32. *Spiranthes romanzoffiana*

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