Introduction of New Native Plants to Florida's Green Industry

Sandra Wilson, Environmental Horticulture, sbwilson@ufl.edu
Carlee Steppe, Environmental Horticulture, cryan@ufl.edu

ABSTRACT

Over the last two decades, we have assessed the invasive potential of nearly 20 ornamental species and their cultivars. This research has helped steer new breeding initiatives to develop improved and non-fruiting ornamental varieties of lantana, nandina, privet and Mexican petunia. The overall goal of this project was to identify and promote non-invasive cultivars as safe alternatives to popular ornamental invaders in Florida. Field trials were similarly established in Quincy, Citra and Balm, FL. Containerized plants of eight trailing lantana (Lantana montevidensis) varieties eight heavenly bamboo (Nandina domestica) varieties, and three privet (Ligustrum sinense and Ligustrum xvicaryi) varieties were planted in replicated plots and monitored for growth, landscape performance, flowering, and fruiting. Results from the trailing lantana study provide evidence that the U.S. varieties are morphologically and cytologically distinct from the Australian weedy form. The Australian weedy form is a tetraploid and highly fertile in terms of male (pollen) and female fertility, and the U.S. varieties examined in this study are triploids and highly male and female sterile. Results from the nandina and privet studies are ongoing but show clear promise for select cultivars to meet UF/IFAS infraspecific taxon protocol requirements for recommended use in Florida.

OBJECTIVES AND METHODS

1. To collect and evaluate sources of new cultivars (not yet assessed by our team) for growth, landscape performance, fruiting, and seed viability in north, central and south FL.
2. To determine how they are morphologically and/or cytologically distinct from their wildtype forms.
3. If approved by UF/IFAS's infraspecific taxon protocol, to promote and recommend their use in Florida.

Plant Material. Eight sources of trailing lantana were identified for use in this study. Four of the plant sources were nurseries based in Florida, one was a commercial breeding company, one was a naturalized area in Houston, Texas; and one was a naturalized area in Queensland, Australia. All varieties were trailing lavender with the exception of one trailing white variety from Hatchett Creek Farms, Gainesville. Under Permit P37-17-01621 (USDA APHIS), vegetative plant material from Australia was shipped overnight from the Queensland Herbarium to Gainesville, FL. Plants were vegetatively propagated and finished in 4" pots filled with Fafard 2P soilless medium.

For the nandina and privet study, eight varieties of nandina and three varieties of privet were obtained as finished 2-3 gal plants from various nurseries. Nandina varieties included 'Seika' Obsession™, 'Murasaki' Flirt™, 'Lemon Lime', 'Twilight', Greray sunray ®, 'Chime', and 'Emerald Sea'. These were compared to the wild type or resident taxon. Privet varieties included variegated privet (Ligustrum sinense 'Variegatum'), sunshine privet (L. sinense 'Sunshine'), and golden privet (L. ×vicaryi 'NCLXI' Golden Ticket™).

Study Sites. Fields were fumigated or herbicided at least one month prior to planting. For trailing lantana, six uniform 4" plants of each variety were installed under full sun conditions in north (Quincy; USDA cold hardiness Zone 8b) northcentral (Citra; USDA cold hardiness Zone 9a) and west central Florida (Balm; USDA cold hardiness Zone 9b) on 16, July 2018. Plants were placed 6.0 ft on center in beds in each of six plots covered with white on black polypropylene plastic. Plants were drip irrigated 3-5 days per week as needed; topdressed with 9 grams (0.5 Tbs) of 12-month 15N-3.9P-10K Osmocote Plus, and fertigated twice a month. Daily temperature and rainfall were recorded on site by the Florida Automated Weather Network (FAWN, https://fawn.ifas.ufl.edu).

Nandina and privet landscape trials were performed similarly to lantana trials but beds were covered with a black semipermeable landscape fabric. On 22 May 2019, 3-gallon plants of each variety were randomly placed in one of five plots with 4' and 6' spacing on center (for nandina and privet, respectively), and topdressed with 84 grams of slow release fertilizer.

Data Collection. Trailing lantana leaf and flower morphology were assessed from plants of each variety grown under the same conditions and of the same age. Measurements included leaf blade length, peduncle length, corolla tube length, inflorescence diameter, number of flowers per umbel, and number of serrations per lamina. For each of six plant replicates, two measurements were taken from opposite leaves 3 to 4 nodes from the apex and averaged. Data was analyzed using a one-way analysis of variance in JMP®, Version 13 (SAS Institute Inc., Cary, NC) with significant means separated by a Tukey's HSD at $P \leq 0.05$.

To determine trailing lantana pollen stainability, anthers were collected from field-grown plants of each variety and stained in a 1.5-mL microcentrifuge tube containing 50 μL of acetocarmine (4%) overnight. Pollen from anther sacs was released on slides and observed under a bright field microscope at 10× and 200× magnification. For each variety, more than 600 pollen grains (if produced and available) were examined from four replicate samples.

The ploidy level of trailing lantana varieties was determined using an advanced CyFlow® Cube 6 flow cytometer that was equipped with laser light and could also report absolute nuclear DNA contents. This was calculated as sample nuclear DNA content (pg/2C) = internal reference nuclear DNA content (1.69) × (mean fluorescence value of sample / mean fluorescence value of internal reference).

Landscape performance was assessed by observing plant growth, flowering, and visual quality every month (trailing lantana) or three months (nandina and privet). Flowering was assessed on a scale from 1-5 where 1=no flowering, 2=a few flower buds present, 3=a few flowers open, 4-good flowering, 5=abundant flowers, possible peak. Visual quality was assessed on a scale from 1-5 where 1=dead or very poor quality, 2=fair quality, 3=good color and form, 4-very good color and form, 5=excellent color and form. Plant growth was determined by measured the height and two perpendicular widths of each plant in order to calculate the growth index.

Female fertility of trailing lantana was determined by sampling 20 random peduncles from each plant at each site every month. Drupes were separated as immature (green) and mature (purple), counted, manually cleaned and air dried. Seeds were surface sterilized with a 2.4% sodium hypochlorite solution for 10 min and then triple-rinsed with autoclaved distilled water. Pre-germination viability was examined on a subsample of 100 seeds using a 1% Tetrazolium staining test. To determine female fertility, four replicates of 100 cleaned seed were placed in 11x11x4 cm transparent polystyrene germination boxes containing one sheet of germination paper on top of one sheet of blotter paper moistened with 15 mL of autoclaved distilled water. Germination was counted when the radicle emerged from the seed once a week for 63 days.

RESULTS

Plant Morphology. The Australian plants were morphologically distinct compared to the U.S. varieties **(Figure 1)**. Plants had leaves with 54-78% shorter leaf blade lengths and 43-59% fewer leaf serrations. Flowers were smaller in inflorescence diameter, with fewer florets per inflorescence, and shorter corolla tube lengths. Australian plants were smaller in habit, produced abundant fruit, had distinct serrate-crenate leaf margins and less appressed hairs. Peduncle length was similar among all cultivars.

Landscape Performance. Throughout the 24-week trailing lantana study, mean flowering was between 4.08 and 4.48 (very good to abundant flowering) among U.S. varieties and 3.45 for the Australian form. Mean plant quality was between 4.37 and 4.66 among U.S. varieties and 3.88 for the Australia form. After 16 weeks the visual quality of Australian plants began to decline and after 20 weeks the flowering declined as well, likely due to colder temperatures. Regardless of location, Australian plants were smaller in height, width, and growth index compared to other varieties. Australian plants were similar in height among Balm and Citra locations but grew twice as wide in Balm compared to Citra. It was estimated that a single plant in Citra produced a total of 1,517 fruit in 24 weeks.

Female Fertility and Pollen Stainability. Throughout the 24-week study, the only trailing lantana variety that produced fruit from 20 random peduncles was the Australian form. Plants in Balm produced 1.7 times more fruit on 20 peduncles than plants in Citra. Seeds collected from Balm and Citra were 59% and 77% viable, respectively as determined by TZ staining. Seeds from Balm and Citra were 70% and 91% filled, respectively. X-ray analysis showed that 18% of seeds contained a second viable embryo. After 63 days, seed germination (4 reps of 100 seed) was 24% (Balm) and 72% (Citra). A prechilling treatment of 28 days did not improve germination. This suggests that cold stratification is not effective in alleviating physiological dormancy in trailing lantana.

Pollen stainability has been used as an indicator of lantana's male fertility (or sterility) and hybridization potential. The presence of pollen in the anther sacs was only observed for the Australian plants. Hence, the U.S. varieties had empty anther sacs. Average pollen stainability of Australian plants was 58.83%.

Nuclear DNA Content and Ploidy Analysis. The average nuclear DNA content of Australian trailing lantana plants was determined to be 3.98 pg/2C, using tomato as the internal reference. All U.S. varieties had the nuclear DNA content ranging from 2.80 to 2.85 pg/2C. This study represents the first report of the nuclear DNA content of trailing lantana. By comparing the nuclear DNA content of these varieties with that of a triploid lavender trailing lantana with 2n = 3x = 36, it was determined that the Australian trailing lantana is a tetraploid and all the U.S. varieties are triploids.

Nandina and Privet. The landscape evaluation of nandina and privet varieties is an ongoing, longer-term study, necessary for woody shrubs. To date, visual quality of nandina ranged from 4.0 to 5.0 (scale 1-5) with flower initiation occurring for 'Sunray', 'Flirt', 'Obsession', 'Twilight' and the wild type within the first 8 weeks after planting. Variegated privet showed signs of green reversion as early as 0-4 weeks after planting. Fruit initiation was observed for 'Flirt', 'Obsession', 'Twilight', and the wild type nandina. Fruit will be wrapped with mesh bags and allowed to mature on the plants for future seed germination studies. Mature, immature and abnormal fruit will continue to be categorized and counted at each of the three locations. Varieties with little or no fruit production and good landscape performance will be subjected to the UF/IFAS infraspecific taxon protocol for non-invasive status consideration.

CONCLUSIONS

In summary, results from this study provide evidence that two forms of trailing lantana exist. The Australian plants were morphologically, cytologically, and reproductively distinct compared to the U.S. varieties. Plants had leaves with shorter blade lengths, fewer leaf serrations, and less flowers per inflorescence. The Australian form appears to be tetraploid and highly fertile and the U.S. varieties appear to be highly male and female sterile. To our knowledge the Australian variety is not grown in the U.S. Measures should be taken to prevent its introduction.

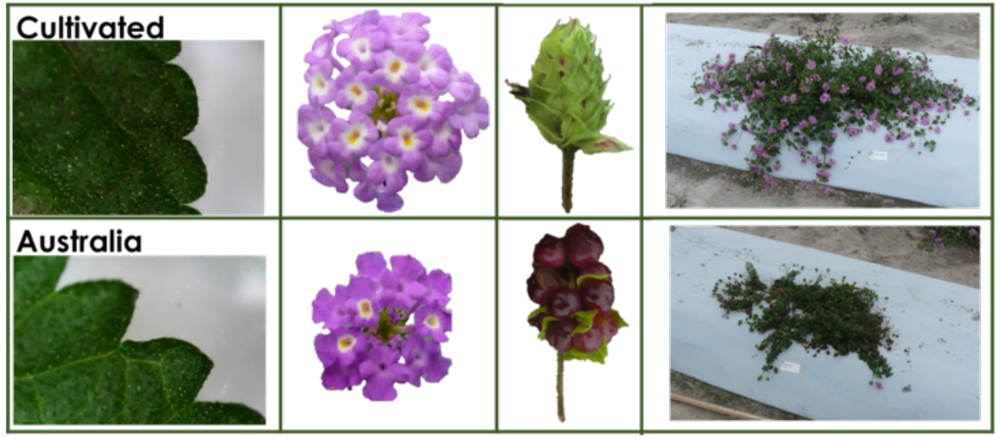

Figure 1. Representative comparison of U.S. cultivated (top) and Australian naturalized (bottom) trailing lantana. Note differences among leaf serrations, flower number, fruiting and form. Field picture taken 20 weeks after planting. Leaf photo credit B. Schutzman.

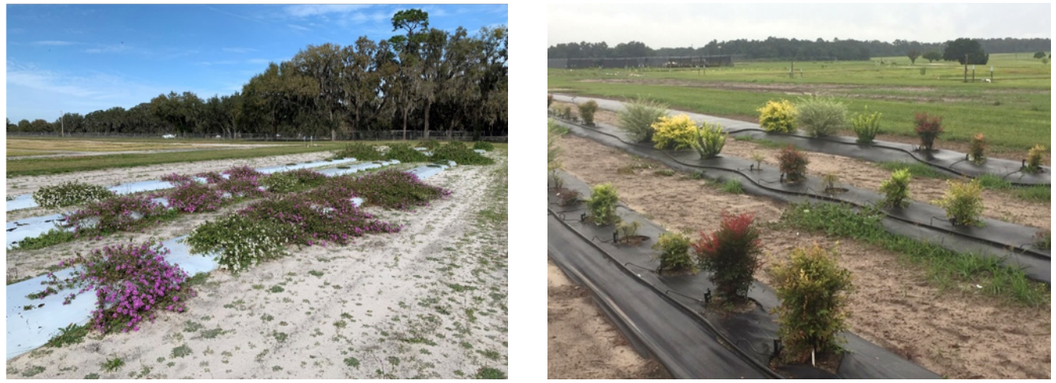

Figure 2. Representative pictures of trailing lantana (left) and nandina and privet (right) variety field trials conducted at north, north central and west central Florida. Photos taken at Citra, FL.