Propagation and out planting of *Chrysopsis* species endemic to the Florida Panhandle©

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INTRODUCTION

Goldenasters (*Chrysopsis*), members of the Asteraceae, range from eastern to central North American native annuals to short lived perennial plants- with many endemics found throughout the southern United States. Two *Chrysopsis* native to the Florida panhandle include *Chrysopsis godfreyi* which is present in two forms (f. *godfreyi* and f. *viridis*) and *C. gossypina* ssp. *cruiseana* which occur in secondary beach dunes and scrub plant communities (FNAI, 2000). Both species are considered endangered in Florida and are restricted to the western Panhandle of Florida, with *C. godfreyi* occurring also in one coastal county in Alabama (FNAI, 2000, Keener et al. 2017).

These three *Chrysopsis* taxa may be differentiated based on foliar vegetative characteristics. Basal foliage of *C. godfreyi* f. *godfreyi* has leaves with a wooly pubescence and a silvery appearance while foliage of *C. godfreyi* f. *viridis* has green leaves with pubescence composed of glandular trichomes, resulting in a sticky leaf surface. For both forms of *C. godfreyi*, the bracts of the inflorescences express the same trichome characteristics as leaves from the basal rosette. C. *gossypina* spp. *cruiseana* has green leaves with moderate pubescence and a moderate silver appearance for fall and winter basal leaves with the quantity of trichomes diminishing as the inflorescences extend; bracts of the inflorescences are glabrous.

These endemic species are important in coastal restoration projects as a food source for subspecies of the endangered beach mouse (*Peromyscus polionotus*) and as a pollinator sustainer. Additionally, these species have potential as an ornamental for low-input landscapes for their adaptability to dry, infertile soils, interesting foliage, growth form, numerous yellow fall flowers and use in pollinator gardens.

While *Chrysopsis* species described here have restoration and ornamental potential, little published information is available on their propagation or planting in low input landscapes or restoration sites. Reproduction from seed was studied by Hooton (2011) to characterize seed production and germination requirements for these *Chrysopsis* from native populations in Escambia County, Florida. From mature flowers collected in a native setting, a range of 6,000 to 8,000 seeds was recorded per plant. Smith et al. (2014) produced landscape quality transplants from seed in a variety of production substrates. Here we describe sexual and asexual propagation information and planting results for these plants within a restoration context.

ASEXUAL PROPAGATION

We have successfully propagated all three *Chrysopsis*, described herein, utilizing terminal stem cuttings collected from seed-grown stock plants as well as terminal stem cuttings collected from wild populations. The following protocol was successfully implemented to produce research grade plants. Non-flowering terminal stem cuttings containing several visible nodes were removed and direct-stuck without supplemental auxins in a well-draining substrate (Fafard 4P or Fafard 3B). Propagation flats with 72-cells per flat were used with high rooting success. Cuttings rooted readily under intermittent mist resulting in rootballs that remained intact within 7 days of sticking (**Fig. 1**). Rooted liners may be transplanted within 2 weeks and in our experience filled a 4-in. pot in 8 to 10 weeks. It is important to only collect vegetative cuttings and avoid cutting collection once plants begin floral initiation. Floral initiation occurs in response to changes in photoperiod in the fall. Cuttings from plants that have initiated floral development will also root readily but will have little or no potential to develop new vegetative buds.

SEXUAL PROPAGATION

These three *Chrysopsis* taxa may also be grown from seed. To determine germination potential, seeds were collected in December 2009 from two coastal sites (Pensacola Beach and Perdido Key) within the western panhandle of Florida. Wild collected seed were separated from the seedheads and surface sterilized. Seed were soaked in a Physan 20™ solution (1.0 mL Physan 20 per 500 mL of deionized water) for five minutes, placed on the surface of a peat based media and lightly covered with vermiculite. Four replicates of 50 seeds (n=200) were used for each species. Seed trays were maintained inside a greenhouse in south Florida (Ft. Pierce) and trays were watered from below with seep irrigation. Germination (emergence) was recorded every other day for 8 weeks.

Cumulative germination did not differ between the three *Chrysopsis* 8 weeks after sowing and was between 30-50% (**Fig. 2**). However, cumulative germination differed between all three *Chrysopsis* 6 weeks after sowing, *C. godfreyi* f. *viridis* had the highest (27% ± 3%) followed by *C. gossypina* spp. *cruiseana* (22% ± 2%) with *C. godfreyi* f. *godfreyi* having the lowest (18% ± 0.8%) cumulative germination at 6 weeks.

OUT PLANTING

Beach planting of *Chrysopsis* for coastal restoration was evaluated with transplants produced from terminal stem cuttings of *C. gossypina* ssp. *cruiseana* as described above. Plants for the restoration evaluation were grown in 4-in. pots containing a 2:1 ratio of pine bark:Fafard® 3B substrate starting mid-October 2016. Plants with rootballs that held the substrate together when removed from pots were planted midslope on secondary beach dunes in the western panhandle of Florida on January 2017. Two spatially separated beach dune systems were used with 6 replicate blocks at each site. Each block contained a total of 20 plants with 10 plants receiving 1/2 teaspoon of Osmocote® (18-6-12) and the other 10 receiving no fertilizer at the time of planting. Survival, plant height and plant width (2 perpendicular widths) were recorded (inches) 8 months after beach planting and a plant index computed [(mean of two widths + height)/2].

Survival was near 100% and did not differ between planting sites or fertilizer treatments 8 months after planting (**Fig. 3**). Growth index for plants receiving fertilizer indicates the application of Osmocote at the time of planting increased overall plant size by 37% compared to plants receiving no fertilizer at the time of planting.

DISCUSSION

Utilization of western panhandle Florida endemic *Chrysopsis* in restoration and as a low-input ornamental is currently limited. What is needed are available stock plants and published data on their propagation and out planting. The asexual and sexual propagation methods for the *Chrysopsis* described here are easily accomplished without complicated procedures and protocols - and can be standardized across all three taxa. Seeds should be selected and sown without pre-treatment in winter, fall, or spring, and exposed to light for germination. Plants propagated asexually from small 1 in. apical stem cuttings can result in a marketable product within 8 to 10 weeks. While individual clones may be desirable for ornamental plantings, care must be taken to collect cuttings from the broadest possible population of individual plants when producing transplants for restoration projects utilizing asexual propagation techniques in order to ensure genetic diversity and resilience. Since these plants are mostly on protected lands, the status of the plants may require permits for collection. It is advisable to seek all appropriate permits prior to wild collection of seeds or cuttings.

Based on our present work, supplemental fertilization at out planting provides no benefit to transplant survival. However, supplemental fertilization did increase overall plant size, plant vigor and increased aesthetic appeal when nursery-grown plants were planted in a restoration context within a beach dune area. Continued monitoring and assessment is needed to determine if supplemental fertilization will affect flowering characteristics, seed production, or subsequent seed germination characteristics or if there will be differences in the ability of these plants to overwinter and become perennial.

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Figure 1. *Chrysopsis gossypina* ssp. *cruiseana* stem cutting one week after sticking in Fafard 3B using a 72 cell flat and overhead mist.

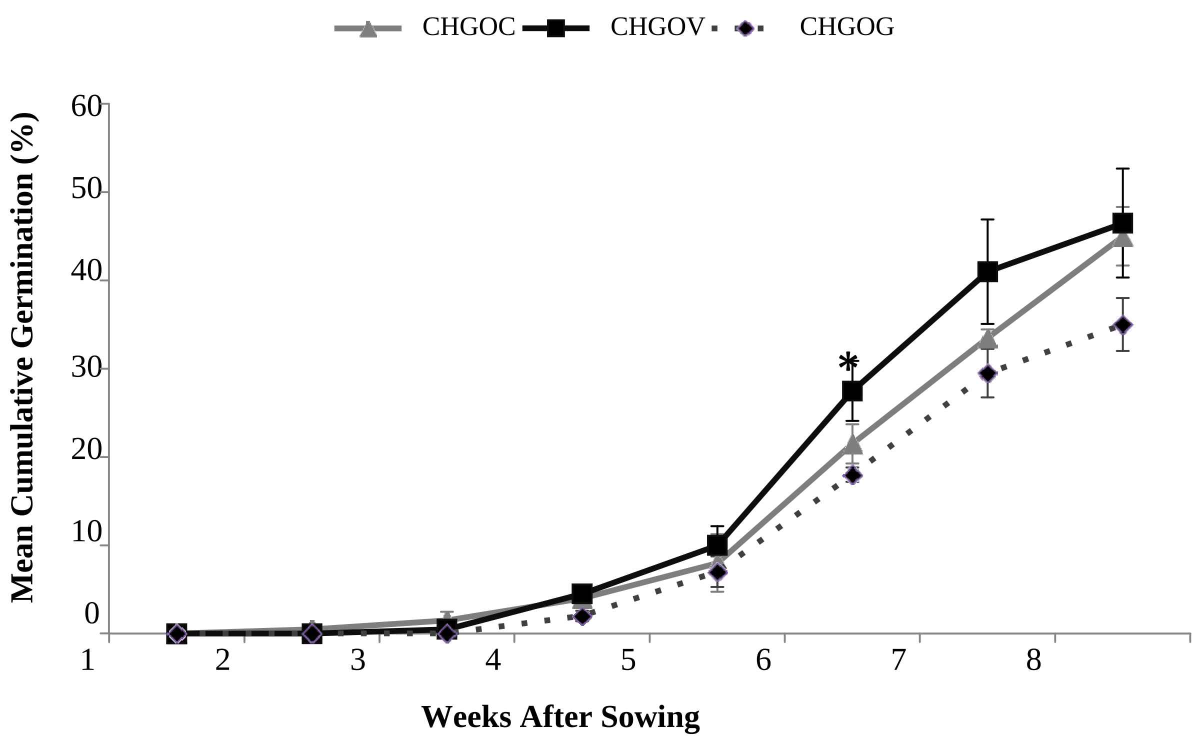

Figure 2. Mean cumulative germination (%) of *Chrysopsis godfreyi* f. *godfreyi* (CHGOG), *Chrysopsisgodfreyi* f. *viridis* (CHGOV), and *Chrysopsis gossypina* spp. *cruiseana* (CHGOC) over eight weeks in a greenhouse in Fort Pierce, Florida from Sept. to Nov. 2010. Error bars represent ± 1 standard error of the mean, *n*=200. *= week where cumulative germination between the three taxa was statistically different.

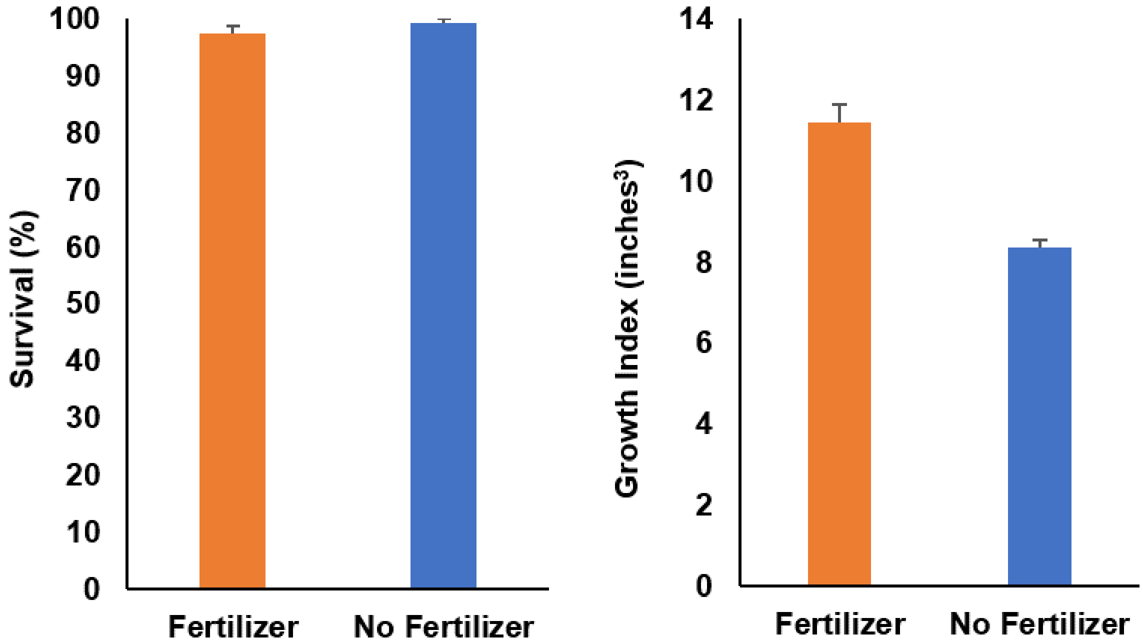

Figure 3. Survival (%) and Growth Index (in.^{3}) for *Chrysopsis gossypina* ssp. *cruiseana* eight months after beach planting of plants grown in 4 in. pots. Error bars represent ± 1 standard error of the mean.