Differential Flower Morphology Among Three Morningglories From the Southern U. S.

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Introduction

A total of 342 species in genus *Ipomoea* (Convolvulaceae) are currently recognized in the Americas (Austin and Huáman 1996). Over 500 species of *Ipomoea* are estimated throughout the world (Mabberley 1989; McDonald and Mabry 1992), but based on the compilation by Austin and Huáman (1997) there may be as many as 600 to 700 species of morningglories worldwide. Morningglories are very important weeds that are very competitive and reduce both crop yields and harvest efficiency (Crowley and Buchanan 1978). In a survey, McWhorter and Barrentine (1988) found that morningglories were the most troublesome weeds in the United States, regardless of the agricultural system.

Of the weedy morningglories in the southeastern United States, pitted morningglory (*Ipomoea lacunosa* L.) complex seems to be one of the most variable in terms of morphology and control with glyphosate (Norsworthy *et al.* 2001; Webster *et al.* 1999). Glyphosate rate was the most important factor that influenced pitted morningglory control (Koger *et al.* 2004), and inadequate control of pitted morningglory was more related to glyphosate tolerance than to glyphosate spray coverage (Koger and Reddy 2005). Lack of consistent pitted morningglory control with glyphosate coupled with widespread adoption of glyphosate-resistant crops and the increased use of glyphosate (Young 2006), are all factors that have contributed to the status morningglories now occupy as the most common and difficult-to-control weeds in row crops in the southern United States.

Genetic variation for glyphosate tolerance in tall morningglory has been reported from Georgia, U.S.A. (Baucom and Mauricio 2004). Tolerant tall morningglory lines produced 35% fewer seed in the absence of glyphosate when compared to the most susceptible line, an indication that natural selection in the absence of glyphosate tends to minimize levels of tolerance. The genetic make up of pitted and sharppod (*Ipomoea cordatotribola* Dennst.) morningglories in agronomic systems has not been researched. Based on research by Baucom and Mauricio (2004), it is likely that herbicide exposure in the pitted morningglory complex could select for biotypes with certain morphological traits.

Little was known about the diversity of macro-morphological characteristics in the pitted morningglory until Stephenson et al. (2006) reported a survey of pitted morningglory. A morphological comparison has not been made between pitted and sharppod morningglory and a purported hybrid (*Ipomoea* x *leucantha* Jacq.) between pitted and sharppod morningglory (hereafter referred to as hybrid morningglory) in agronomic crop situations. The compatibility and direction of potential gene flow were determined among pitted, sharppod, and hybrid morningglories by Abel and Austin (1981) and that hybrid.

The objectives of the research were to determine 1) macro-morphological flower parameters to distinguish pitted morningglory biotypes from sharppod and hybrid morningglories and 2) to develop baseline data to correlate with herbicide efficacy and herbicide tolerance/resistance issues.

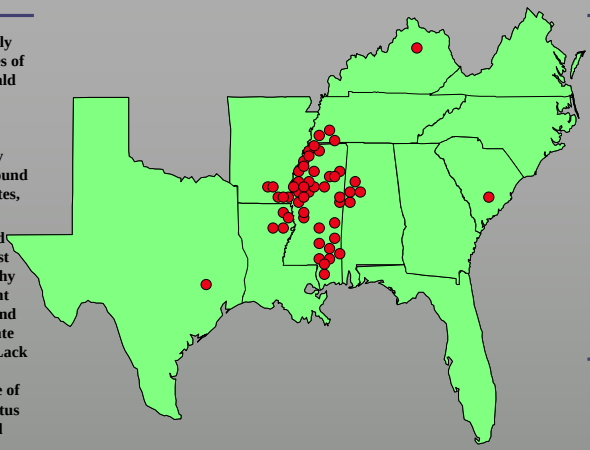
Materials and Methods

Seed were collected for a total of 70 morningglory accessions from agricultural and non-agricultural areas in eight states during the fall of 2004-2006. The morningglory accessions included the closely kin species pitted, sharppod, and hybrid morningglory, each in the Subgenus *Eriospermum*, Section *Eriospermum*, and Series *Batatas* (Austin and Huáman 1997).

Seeds of each morningglory accession were planted in 70- by 30-cm plastic flats in a 1:1 mixture of potting media and soil. Seedlings were transplanted into 15-cm diam. plastic pots filled with a 1:1 mixture of potting media and soil. Plants were grown in a greenhouse set to 30/22 C (± 3 C) day/night temperature.

Data were collected from individual live and oven-dried plant. Data were recorded for sepal pubescence, tip shape, length, and predominant color; and corolla diameter, length, and color were recorded. Sepal length and corolla diameter were measured with a digital caliper. All plants were harvested, pressed and dried after corolla data were recorded and vouchers were prepared citing parental lineage after the procedure described in Carter et al. (2007) to make and preserve herbarium specimens.

There were ten plants for each accession. Means and standard errors for quantitative morphological parameters were calculated with SAS. Qualitative data, such as leaf shape and corolla color, were converted to percentages.



Results and Discussion

Of the morningglory species evaluated in this study, hybrid morningglory accessions possessed the most variable morphological traits. Pitted morningglory accessions were the second most variable followed by sharppod morningglory accessions. Flower diameter was variable in some pitted morningglory accessions and may be due to ancestry involving hybrid or sharppod morningglory. Austin (1978) suggested that pitted morningglory was a relatively recent branch of the same progenitor line which produced sharppod morningglory and this close relationship may increase the likelihood of compatibility. We speculate that agriculture and other man-made disturbances have increased the chances for continual hybridization of hybrid, pitted, and sharppod morningglory populations and the mobility of propagules. Wallace et al. (1981) commented that pitted morningglory may be highly integrated by hybridization, thus the accessions with corollas white with faint pink veins may indicate ancestry that includes hybrid or sharppod morningglories. Additional research is needed to determine the degree of hybridization in agricultural settings.

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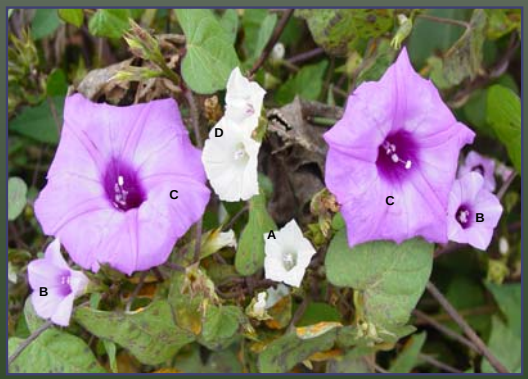
Flower traits averaged for pitted, sharppod, and hybrid morningglory accessions from eight states.

Species	Sepal				Corolla			
	Pubescent	Tip shape [1]	Length	Color [2]	Diameter	Length	Color [3]	Dark center
	%		cm	%	cm	cm	%	%
Pitted morningglory	91	3 NA; 92 A; 5 BA	10.5 ± 0.2	98 G; 2 P	16.2 ± 0.7	18.4 ± 0.3	88 W; 12 W(p)	0
Hybrid morningglory	64	4 NA; 83 A; 13 BA	10.1 ± 0.2	97 G; 3 P	17.1 ± 1.2	19.3 ± 0.4	24 L; 44 PL; 24 W; 8 W(p)	12
Sharppod morningglory	82	20 A; 80 BA	11.8 ± 0.8	100 G	37.0 ± 1.5	31.6 ± 1.3	100 L	75

[1] Tip shape: NA=Narrowly acute; A = Acute; BA = Broadly acute; O = Obtuse.
[2] Sepal Color: G = predominantly green; P = predominantly purplish tinged
[3] Corolla Color: L = Lavender; PL = Pinkish lavender; W = White; W(p) = White with faint pink veins.



Morningglory flowers showing differences in size and color (A, pitted morningglory; B, hybrid morningglory; C, sharppod morningglory; D, pitted or hybrid morningglory with white flower and pink tinged veins). Corolla color in B is pinkish lavender compared to white corolla with pinkish veins in D.

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