

Cross-Compatibility of Cultivated *Amaranthus* Grain Lines with Wild *Amaranthus* Species

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Purpose

This is a preliminary attempt to evaluate grain amaranth lines for out-crossing with weedy species of *Amaranthus*.

Crop-weed hybrids are a source of off-type black seeds (Hauptli and Jain, 1984, Brenner, 1993) that are a cosmetic flaw in grain produced for human consumption (Sooby et al., 1999). Incompatible lines should be easier to maintain in their pure state than lines that cross readily with weeds.

Methods

Seeds of five accessions were planted in a greenhouse on May 2, 2005 and transplanted on May 27, 2005 to a field in Ames, Iowa, on Iowa State University's Curtiss Research Farm. The field was known to have weedy amaranths. The plot was sprayed with Assure II herbicide on June 8, 2005 to kill grass plants and favor broad-leaved weeds, including *Amaranthus*. In this plot *Amaranthus tuberculatus* was the most frequent weed, and *A. retroflexus* was present but infrequent. Two other weedy *Amaranthus* species (*A. albus* and *A. blitoides*) are known locally but were not seen in the vicinity of this research.

The seeds were harvested from four accessions in September, threshed by hand and cleaned with an air column separator. Shrunken immature seeds were intentionally left in the harvests on the untested assumption that including these seeds might increase the frequency of hybrid progeny.

Three-hundred seeds from each of the four harvested accessions were planted in a greenhouse where the crop-weed hybrids were determined visually and counted.



The 2005 field

Crop-weed hybrids		
accession	seedlings evaluated	% hybrids
PI 538321	40	20
PI 538327	246	0
PI 558499	153	9
PI 604461	209	2.8

Plant Materials

- PI 538321 *Amaranthus cruentus*. A breeding line developed by the Rodale Research Center from a cross between African and Mexican grain types. It is known as K436.
- PI 538327 *Amaranthus* hybrid, (from a cross between species). Developed at the Rodale Research Center from the species: *A. caudatus*, *A. hybridus*, and *A. hypochondriacus*. It is known as D136-1.
- PI 558499 *Amaranthus hypochondriacus*. A product of plant breeding at the Rodale Research Center released as a cultivar by the University of Nebraska. It is known as "PLAINSMAN", and K343.
- PI 604461 *Amaranthus hypochondriacus*. The ornamental variety 'Elephant Head' distributed by Seeds of Change. It has an unusual determinate inflorescence.
- PI 603899 *Amaranthus tricolor*. The ornamental variety 'Splendens Perfecta' distributed by Sakata Seeds, Inc. The plants died in August 2005 before seed harvest, so no data are presented.

Results

The amaranth lines tested had dramatically different percentages of weedy hybrids. PI 538327 is of special interest because it had no crop-weed hybrids.

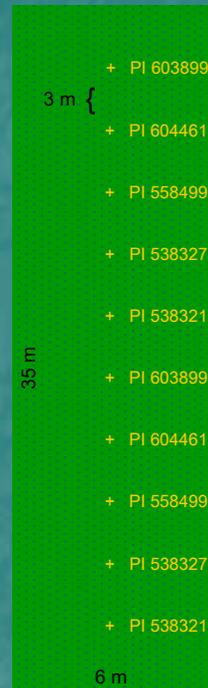
Discussion

Variable out-crossing rates were measured within the cultivated grain species by Jain et al. (1982). It is reasonable that these differences would exist because the grain amaranth crop is grown from 3 different species and diverse genomes are involved in their tetraploid make-up (Greizerstein and Poggio, 1995).

We propose that diverse amaranth types and breeding lines be evaluated for weed-pollen contamination in diverse environments with contrasting weed floras. Furthermore, laboratory studies should be used to improve the basic scientific understanding of *Amaranthus* crossing barriers.

Selected References

- Brenner, D. M. 1993. Planting black seeds. Legacy 6:11.
- Greizerstein E. J., and L. Poggio. 1995. Meiotic studies of spontaneous hybrids of *Amaranthus*: Genome analysis. Plant Breeding 114:448-450.
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- Jain, S. H., H. Hauptli, and K.R. Vaidya. 1982. Outcrossing rate in grain amaranths. The Journal of Heredity 73:71-72.
- Sooby, J., R. Myers, D. Baltensperger, D. Brenner, R. Wilson, and C. Block. 1999. Amaranth production manual for the central United States. Misc. Pub. EC 98-151-S. Univ. Nebraska Cooperative Extension, Sidney.



Plot Map 2005



The greenhouse-grown progeny of PI 558499 (left) with tall crop-weed hybrids and of PI 538327 (right) without hybrids.

The lines mentioned here and many others are available free of charge from the National Plant Germplasm System for research and development use. Information is on-line at <http://www.ars-grin.gov/npgs/> or contact David M. Brenner, dbrenner@iastate.edu.