# *Cucurbita argyrosperma* Sets Fruit in Fields where *C. moschata* is the Only Pollen Source

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*Cucurbita argyrosperma* Huber and *C. moschata* Duchense can often be found growing in close proximity, or even in the same fields in Mexico and Guatemala. While Whitaker and Knight (9) state that these species seldom overlap in Mexico, Merrick (4) found that, at lower elevations in Mexico, these two species are commonly paired. The same is true in Guatemala where both species grow from 0 to 1500 m above sea level (César Azurdia, University of San Carlos, Guatemala City, Guatemala, Personal communication). *C. argyrosperma* consists of two subspecies: *argyrosperma* and *sororia* (5). Subspecies *sororia* is either the progenitor or a weedy escape of subsp. *argyrosperma*. No wild or weedy populations are known for *C. moschata*. However, among species of *Cucurbita*, *C. argyrosperma* is clearly the most closely related to *C. moschata*. This is evident from crossing studies carried out by several workers (3, 4, 7, 8, L. Wessel-Beaver and T. Andres, unpublished). These studies indicate that fertile F1 plants can be rather easily obtained when using *C. argyrosperma* as the female parent in a manual interspecific cross. The reciprocal cross was never successful, indicating there are reproductive barriers between the species. I have found no reference in the literature directly confirming spontaneous hybridization under field conditions between *C. argyrosperma* and *C. moschata*. Spontaneous hybridization seems to occur between the domesticated and wild subspecies of *C. argyrosperma* (2, 6), although even in that case the evidence is indirect.. However, allozyme studies support the hypothesis that introgression occurs between *C. moschata* and *C. argyrosperma* (1). The objective of this study was to test whether open-pollinated fruit set with seed formation occurs in *C. argyrosperma* under field conditions where pollen is available only from *C. moschata*.

**Materials and Methods:** In Experiment #1, three plants of each of three populations of *C. argyrosperma* subsp. *sororia* (sor 80-1 and sor 177-1 from Mexico and sor 1 (P) from Panama) and three populations of subsp. *argyrosperma* (arg 46-3, arg 51-5, arg 182-2, all from Mexico) were planted within a field of various genotypes of *C. moschata* on 17 September 1999 at the Isabela Substation of the University of Puerto Rico (northwestern Puerto Rico, at an elevation of 138 m). Staminate flowers of the *C. argyrosperma* plants were removed every few days, before the flowers were able to open. Pistillate flowers were allowed to set fruit by open pollination. In experiment #2, five plants of each of one population of subsp. *argyrosperma* (arg 182-2 from Mexico) and one population of subsp. *sororia* (sor 177-1 from Mexico) were planted within a field of *C. moschata* on 31 January 2000 at the Lajas Substation of the University of Puerto Rico (southwestern Puerto Rico, at an elevation of 80 m). As in Experiment #1, staminate flowers were removed and pistillate flowers were allowed to set fruit by open pollination during a two week period with *C. moschata* being the only source of pollen. Plants were pruned leaving 1 vine for subspecies *argyrosperma* and 2 to 3 vines for subspecies *sororia*. This was done to reduce the number of staminate flowers having to be removed, which could be hundreds in the case of *sororia*. Seed was removed from harvested fruits and embryo development was noted.

**Results and Discussion:** All plants of all six populations of both subspecies of *C. argyrosperma* set at least one fruit during Experiment #1. However, due to heavy rains, I was unable to harvest fruits and evaluate seed development. In Experiment #2 each plant of both subspecies set several fruit during the two week period when staminate flowers were removed (Table 1). Fruit set ranged from 17 to 90%. Percentage fruit set was twice as high in subspecies *sororia* (73%) as in *argyrosperma* (36%). This same trend was observed by Merrick (3, 4) and in other work done in Puerto Rico by Thomas Andres and myself in manual cross, sib and self pollinations both within and between species. Domesticated *Cucurbita* often show a strong source/sink relationship where the presence of set fruit prevents or reduces set of later fruits. All plants in Experiment #2 produced fruits with at least some, and often many, partially to

fully developed seeds. Again, differences were observed in subsp. *sororia* vs. *argyrosperma*: seed was often normal or nearly normal in subsp. *sororia* while no fruits of subsp. *argyrosperma* produced seed with fully developed embryos (cotyledons generally half-filled the seed coat).

Still to be tested is the viability of these seed as well as the fertility of the $F_1$ plants. My previous experience suggests that most of these partially developed embryos will germinate and that the $F_1$ plants will be fertile. Continued studies will aid in determining what role introgressive hybridization has played or continues to play in the evolution of *C. argyr*osperma and *C. moschata*.

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**Literature Cited:**

1. Decker-Walters, D. S., T. W. Walters, U. Posluszny and P. G. Kevan. 1990. Geneology and gene flow among annual domesticated species of Cucurbita. Can. J. Bot. 68:782-789.
2. Nabhan, G. P. 1984. Evidence of gene flow between cultivated *Cucurbita mixta* and a field edge population of wild *Cucurbita* at Onavas, Sonora.
3. Merrick, L. C. 1990. Systematics and evolution of a domesticated squash, *Cucurbita argyrosperma*, and its wild and weeds relatives. In: D. M. Bates, R. W. Robinson and C. Jeffrey, eds., Biology and Utilization of the Cucurbitaceae. Cornell University Press, Ithaca.
4. Merrick, L. C. 1991. Systematics, evolution, and ethnobotany of a domesticated squash, *Cucurbita argyrosperma*. Ph.D. Dissertation. Cornell University. 323 pp.
5. Merrick, L. C. and Bates, D. M. 1989. Classification and nomenclature of *Cucurbita argyrosperma*. Baileya 23:94-102.
6. Merrick, L.C. and G.P. Nabhan. 1984. Natural hybridization of wild *Cucurbita sororia* Group and domesticated *C. mixta* in southern Sonoria, Mexico. Cucurbit Genetics Coop. Rpt. 7:73-75.
7. Whitaker, T. W. and W. P. Bemis. 1964. Evolution in the genus *Cucurbita*. Evolution 18:553-559.
8. Whitaker, T. W. and G. N. Davis. 1962. Cucurbits: botany, cultivation, and utilization. Interscience, New York.
9. Whitaker, T. W. and R. J. Knight, Jr. 1980. Collecting cultivated and wild cucurbits in Mexico. Economic Botany. 34:312-319.

Table 1. Open pollination fruit set in *Cucurbita argyrosperma* subspecies *argyrosperma* (ARG) and subspecies *sororia* (SOR) following removal of staminate flowers. Plants flowered in a field *where C. moschata* was the only pollen source.

| | Number of pistillate flowers opening during a 2-week period | Number of fruit set | Fruit set (%) |
|---|---|---|---|
| SOR-1 | 34 | 25 | 74 |
| SOR-2 | 15 | 11 | 73 |
| SOR-3 | 15 | 6 | 40 |
| SOR-4 | 18 | 16 | 90 |
| SOR-5 | 14 | 12 | 86 |
| ARG-1 | 17 | 5 | 29 |
| ARG-2 | 18 | 3 | 17 |
| ARG-3 | 13 | 6 | 46 |
| ARG-4 | 13 | 6 | 46 |
| ARG-5 | 12 | 5 | 42 |