Butler University Botanical Studies

Volume 14 Article 2

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# Butler University Botanical Studies

**(1929-1964)**

*Edited by*

**J. E. Potzger**

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The Botany Department attracted many notable faculty members and students. Distinguished faculty, in addition to Cain and Friesner , included John E. Potzger, a forest ecologist and palynologist, Willard Nelson Clute, co-founder of the American Fern Society, Marion T. Hall, former director of the Morton Arboretum, C. Mervin Palmer, Rex Webster, and John Pelton. Some of the former undergraduate and master's students who made active contributions to the fields of botany and ecology include Dwight. W. Billings, Fay Kenoyer Daily, William A. Daily, Rexford Daudenmire, Francis Hueber, Frank McCormick, Scott McCoy, Robert Petty, Potzger, Helene Starcs, and Theodore Sperry. Cain, Daubenmire, Potzger, and Billings served as Presidents of the Ecological Society of America.

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# A PRELIMINARY STUDY OF THE CROSSING RELATIONSHIPS OF *CAPSICUM BACCATUM*[1]

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## INTRODUCTION

The common bird pepper or *chilipequin* is a variable species ranging from the southern United States throughout Central America into Colombia. It has generally been assumed that this pepper was first described by Linnaeus in his *Mantissa* of 1767 under the binomial *Capsicum baccatum*, although Hunziker (1958) in his synopsis of the genus apparently does not accept this interpretation. While some authors have treated this taxon as a distinct species, others have considered it a variety of *C. frutescens* (Irish 1898) or as a variety of *C. annuum* (Smith and Heiser 1957). Hence, it seemed desirable that a study be undertaken to contribute to an understanding of the diverse forms of *C. baccatum*, both to each other and to other species within the genus.

## MATERIALS AND METHODS

Thirty-nine different collections of *C. baccatum* were grown for this study, and the six races enumerated in Table I represent different morphological types used in the crossing program. One strain each of nine other species (Table I) were used in crosses with *C. baccatum*. Flowers were emasculated and all operations were carried out in an insect-free greenhouse. Pollen counts were determined by staining the grains with lactophenol blue. Pollen counts of the species listed in Table I range from 60 to 90% fertile. Chromosome counts showed all of these plants to be diploid ($N = 12$).[3]

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[1] Condensed from a thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts at Indiana University, June, 1960.

[2] The author is indebted to Dr. Charles B. Heiser, Jr. who directed this research.

[3] Specimens of all parent plants and hybrids are deposited in the herbarium of Indiana University.

TABLE I

Sources of *Capsicum* species employed in crossing studies

| *Species* | *Number* | *Collector* | *Location* |
|---|---|---|---|
| *C. annuum* L. | Cu27 | C. B. Heiser 3346 | Turrialba, Costa Rica |
| *C. baccatum* L. | Cb1 | C. B. Heiser 3286 | Avery Isle, La. |
| *C. baccatum* L. | Cb5 | P. Alvin | Tabasco, Mexico |
| *C. baccatum* L. | Cb8 | C. B. Heiser 3839 | Guatemala City, Guat. |
| *C. baccatum* L. | Cb18 | C. B. Heiser 3520 | Turrialba, Costa Rica |
| *C. baccatum* L. (X?) | Cb22 | C. B. Heiser 3462 | Moravia, Costa Rica |
| *C. baccatum* L. | C36 | I. Kelly | Vera Cruz, Mexico |
| *C. cardenasii* Heiser & Smith | U1 | P. Smitb Ac1793 | La Paz, Bolivia |
| *C. chacoense* Hunziker | | P. Smith Ac1848 | La Pampa, Argentina |
| *C. chinense* Jacq. | CA5 | P. Gonzales | Lima, Peru |
| *C. frutescens* L. | T1 | Burpee "Tabasco" | Burpee Seed Co. |
| *C. galapagense* Heiser & Smith | | P. Smith Ac1501 | Galapagos Islands, Ecuador |
| *C. microcarpum* Cav. | C69 | P. Smith Ac1005 | Oruro, Bolivia |
| *C. praetermissum* Heiser & Smith | C72 | P. Smith Ac1231 | Piracicaba, Brazil |
| *C. sp.* | CA1 | D. C. Webster | Jamaica, British West Indies |

*Infraspecific crosses of Capsicum baccatum.* Nine reciprocal hybrid combinations were readily secured between strains listed in Table I. The pollen counts of the forty hybrids tested ranged from 25 to 90% fertile with a mean of 57%.

*Interspecific crosses of C. baccatum with several other species. Capsicum baccatum* X *C. annuum* L. Reciprocal crosses were attempted with Cb1, CB8, and Cb5; all were successful. Pollen counts ranged from 21 to 81% fertile with a mean of 57% for the ten plants studied.

*Capsicum baccatum* X *C. chinense* Jacq. Crosses were successful with Cb1, Cb5, Cb8, and C36 as the female parents. The reciprocal crosses all failed to produce seeds. For the eight hybrids studied, pollen counts ranged from 15 to 91% fertile, with an average of 54%.

*Capsicum baccatum* X *C. chacoense* Hunziker. Reciprocal hybrids were secured with Cb1, Cb5, Cb8, and C36. Pollen counts ranged from 0 to 41% fertile with a mean of 18% for thirteen plants. Another plant which appeared to be a hybrid produced 84% stainable pollen, but this plant was lost so that verification of its hybrid nature could not be made.

*Capsicum baccatum* X *C. frutescens* L. Reciprocal hybrids were secured with Cb1, Cb5, and Cb8; hybrids were also obtained with C36 as the male parent, but the reciprocals failed. Pollen counts of the ten hybrids ranged from 0 to 83% fertile with a mean of 35%.

*Capsicum baccatum* X *C. sp.* The species employed in this cross has not yet been satisfactorily identified. It closely approximates the description given by Dunal (1852) for *C. cerasiforme.* The fruit is within the size range of *C. baccatum* but in the form of a cherry. Reciprocal hybrids were secured with Cb1, and Cb5. Using Cb8 and C36 as the female parents, hybrids were produced, but the reciprocals of these combinations failed. Pollen counts of the hybrids ranged from 7 to 32% fertile with a mean of 19% for 12 hybrids.

*Capsicum baccatum* X *C. cardenasii, C. galapagense, C. microcarpum,* and *C. praetermissum.* No hybrids were secured with the exception of Cb8 crossed with *C. microcarpum,* where seedlings were produced which died shortly after germination. Seeds were formed in several crossed with *C. praetermissum,* but all were inviable.

## RESULTS

The chief value of these crosses is in demonstrating that it is possible to secure hybrids of *C. baccatum* with several *Capsicum* species and impossible to secure them with others. However, it must be pointed out that these results are based on only one representative for all the species other than *C. baccatum.* Considerable diversity is encountered in several species of *Capsicum;* such that it seems reasonable to refer to these as species complexes. It is with reservations that any conclusions may be drawn regarding the fertility of the hybrids based on the results of pollen counts. During the course of the study it was found that there was some variation in pollen counts depending on the season of the year during which pollen samples were collected. Soria (1958) has found that tropical species of *Solanum* show variation in fertility when grown under different day lengths. Detailed studies of seed set were not made, but it was observed that all of the hybrids produced some fruit with viable seeds. Most of the fruits produced by the hybrids of *C. baccatum* X *C. chacoense* were devoid of seed. It is clear, however, that there is a close genetic relationship among the members of the *C. baccatum* complex, and that there seems to be an equally close relationship between *C. baccatum* and *C. annuum.* The pollen fertilities of hybrids with *C. chinense* were nearly as high as those with *C. annuum,* but it may be significant that the reciprocals failed in this case.

Although it is not possible to establish *C. baccatum* as a species on the basis of these crosses alone, there does seem to be sufficient evidence for regarding it as a species based on morphological findings. The following description of the species is formulated from the study of thirty-nine different living collections grown under uniform field conditions supplemented with the study of collections from several herbaria.

*Capsicum baccatum* L. Plants .3 to 1.5 m tall, branches numerous, rather slender, fastigiate, flexuose, frequently purple striate, glabrous or sparingly pubescent, leaf blades 30-130 cm long, 20-80 cm wide, ovate-acuminte, abruptly narrowing into petioles; peduncles solitary; calyx cyathiform, truncate, subentire or with obscure teeth; corolla rotate to slightly campanulate, greenish-white, unspotted, less than 1.5 cm in diameter with lobes 5-7 mm long and sinuses 1-5 mm deep; fruit subround or ovate, rarely somewhat elongate, about 7-8 mm in diameter, unripe fruit blackish-spotted to almost entirely black, becoming red at maturity. No single character is in itself sufficient to distinguish this taxon from closely related species, but the combination of characters is usually effective. The black color of the immature fruit seems to be a consistent and useful character although neglected by previous investigators.

## DISCUSSION

Whether natural hybridization occurs was not determined by the present investigation; however, it is clear from the results secured here that such hybridization might well be expected with species having a sympatric distribution. Heiser has collected plants in Costa Rica that may represent hybrids with *C. annuum* and possibly with *C. frutescens* and *C. chinense*.

During the course of this investigation seeds of a plant similar to *C. baccatum* (Fig. 1) collected at Key Largo, Florida, were received from Dr. Monroe Birdsey. A single seed from this collection germinated and gave rise to a plant (KL1) that proved to be tetraploid (N = 24). Since this count is based on a single specimen, one cannot be certain whether the tetraploid number is characteristic of a whole population or whether it represents a single aberrant individual. However, it is the first report of a natural polyploid in this genus. All attempts to cross the tetraploid with various strains of *C. baccatum* as well as with other species were unsuccessful.

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FIG. 1. Drawing of a naturally occurring *Capsicum* tetraploid (KL1) from Florida.