

The herbarium of Paul A. Fryxell (pf) and U.S. Department of Agriculture, College Station, Texas, integrated into The New York Botanical Garden Herbarium (NY)

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Zanoni, T. A. (The New York Botanical Garden, Bronx, New York 10458-5126, U.S.A.). The herbarium of Paul A. Fryxell (pf) and U.S. Department of Agriculture, College Station, Texas, integrated into The New York Botanical Garden Herbarium (NY). *Brittonia* 49: 197–203. 1997.—The herbarium specimens amassed by Paul A. Fryxell while working at the U.S. Department of Agriculture, College Station, Texas, were moved in October 1993 to The New York Botanical Garden and integrated into the Herbarium in 1994. The collection is particularly rich in specimens of the Malvaceae and other families of the Malvales, the areas of Fryxell's taxonomic specialty. Also included is the cotton reference herbarium of the former Cotton Branch of the Agricultural Research Service, U.S. Department of Agriculture, which consists of voucher specimens of germplasm introductions of cotton (*Gossypium*) from expeditions and from test plots in the United States and Mexico. A total of 19,918 specimens, including 167 type specimens, have been incorporated into The New York Botanical Garden Herbarium.

Key words: Malvaceae, Malvales, *Gossypium*, cotton, U.S. Department of Agriculture, New York Botanical Garden Herbarium, Fryxell herbarium, type specimens, history—herbaria.

The herbarium of Paul A. Fryxell and the former Cotton Branch, Agricultural Research Service (ARS), U.S. Department of Agriculture (USDA), College Station, Texas, was moved to The New York Botanical Garden in October 1993. This research collection (referred to as “pf” in Fryxell's publications) was one of the richest collections of specimens of the Malvaceae and Malvales (especially Sterculiaceae and Tiliaceae) held outside the major herbaria in North America.

The collection was developed over nearly 40 years, beginning in 1957 when Fryxell started working for the USDA in Tempe, Arizona, as a Research Botanist, specializing in the botany of cotton (*Gossypium*). The principal materials of what was then called “Herbarium Gossypianum Arizonicum,” acquired in the early years, were related to the study of cultivated cotton and

the native cotton of Arizona and adjacent Mexico, *G. thurberi* Tod. However, the development of a reference herbarium was not considered a major part of the work, so the accumulation of other specimens was slow. The specimens were transferred in 1965 to College Station, Texas, when Fryxell was assigned to a newly created post, i.e., cotton taxonomist, at the USDA's research station on the campus of Texas A & M University. The resolution of the taxonomy of cotton consumed his almost full-time effort in the first 20 years there (activities now undertaken at the Southern Crops Research Laboratory) and culminated in a summary paper (Fryxell, 1992c) that interpreted the taxonomy of *Gossypium* worldwide. Expeditions were made to Mexico in the late 1960s, initially in relation to this work. And later, beginning in 1975, this fieldwork was expanded as Fryxell's interest spread to oth-

er genera of the Malvaceae and the Malvales.

The laboratory at College Station had a reference collection of specimens taken from plants cultivated in winter gardens, first maintained at Iguala, state of Guerrero, Mexico, and later at Tecomán, Colima, Mexico, from earlier introductions of cotton germplasm. The series of specimens were vouchers for the different introductions (Anonymous, 1974; Percival, 1987) that had been collected by USDA collectors and also for material obtained from other sources. Each of these specimens usually included a leaf, floral bracts, calyx, petals, androecial and gynoecial column, a seed with coma (the cotton fibers still attached), and an illustration of the fruiting boll (made in the field on solar light-sensitive paper), all dry (heat) laminated under plastic to an herbarium sheet. This display allows the examination of the critical parts of the cotton plant. In some instances, a photograph showing the growth habit of the plant was made in the test fields and attached to the herbarium sheet. The label of each specimen ties the field-grown material to an original Cotton Branch Introduction Number, Plant Introduction Number, and Collectors' Number. The plastic lamination was to protect the specimens from heavy usage.

Beginning in 1975, Paul Fryxell started plant exploration in the company of Stephen D. Koch of the Programa de Botánica, Colegio de Postgraduados at Chapingo, Mexico. They traveled extensively in Mexico. Although both botanists collected specimens of all families, Fryxell's primary interests were in the Malvales and Koch's in the Poaceae. From these expeditions, the Fryxell herbarium also obtained specimens of non-Malvacean families as well as material for exchange and identification.

In 1983, two expeditions to collect cotton germplasm were made to tropical Australia. Fryxell and James McD. Stewart were funded by the USDA's Agricultural Research Service and its germplasm unit and by the Commonwealth Scientific and Industrial Research Organization (CSIRO) via the Australian National Herbarium. Lyn Craven of the Australian National Herbarium (CANB) was their Australian counter-

part. The Department of Agriculture of Western Australia also provided guides and transportation. Fryxell and Craven collected in northwestern Australia in search of native, wild germplasm (seeds) of *Gossypium australe* F. Muell., *G. cunninghamii* Tod., *G. pilosum* Fryx., *G. populifolium* F. Muell., and *G. pulchellum* (C. A. Gardner) Fryx. Seeds were also collected of *G. hirsutum* L. Specimens from other families of plants were also collected. The second expedition, in 1985, was supported by USDA-ARS, CSIRO, the International Board of Plant Genetic Resources (IBPGR) of the United Nations Food and Agricultural Organization (FAO), and several other organizations in Australia. This expedition took Fryxell, Stewart, and Craven to central, northern, and northwestern Australia. They collected germplasm and, particularly, specimens to study the "Kimberley cottons," which were poorly known at the time. Indeed, the number of species of Kimberley cottons was effectively doubled as a result of this work (Fryxell et al., 1992c). Again, herbarium specimens of other genera of vascular plants were also collected.

As Fryxell neared the time of his retirement and the USDA-ARS did not plan to continue funding a position in cotton taxonomy, he became concerned about the future of the herbarium. In late 1990, Laurence J. Dorr (then a Research Associate at The New York Botanical Garden), a friend of Fryxell, inquired about the disposition of the herbarium and the possibility of transferring it to The New York Botanical Garden. In 1993, Fryxell and Patricia K. Holmgren, Director of The New York Botanical Garden Herbarium, worked with Dr. Russell J. Kohel, Director of the Southern Crops Research Laboratory at College Station, to develop an agreement between the USDA-ARS and The New York Botanical Garden to transfer the collection to New York. It was agreed that all collections already duplicated at NY would be sent to the University of Texas at Austin (TEX), where Fryxell planned to work in retirement. Fryxell extracted specimens for TEX prior to shipment of the specimens to NY, and NY sent to TEX an additional 830 duplicates

located during the integration of the collection.

Content of the Herbarium

The collection had its primary focus on New World plants. Of the 20,748 specimens received at the herbarium at The New York Botanical Garden (NY), 14,187 specimens (71%) belonged to the Malvaceae, with the other families of the Malvales (especially the Sterculiaceae and the Tiliaceae) second in importance. The other larger groups (Apiaceae, Asteraceae, Euphorbiaceae, Lamiaceae, Leguminosae, Poaceae, Rubiaceae, Scrophulariaceae, Solanaceae, and the Pteridophytes) were represented by more than 100 specimens each. One hundred sixty-seven type specimens, including 150 from the Malvaceae (Appendix I), were filed in the type collection at NY; several specimens of taxa that have not yet been published were also added to the type collection.

Fryxell worked on the Malvaceae for all of Mexico (1988), of the Mexican states of Chiapas (1990), Veracruz (1992b), and Nayarit (in prep.), of the Valle de México [mainly the state of México and the Distrito Federal (1985)], of the Bajío region (1993a), and of the Nueva Galicia region [Jalisco, Colima, and adjacent states (in prep.)]. The herbarium specimens are an important and rich collection of Mexican Malvaceae. The extension of his interest in the family led to treatments of the taxa of Meso-America or southernmost Mexico to Panama (in prep.), the Lesser Antilles (1989), and South America (Fryxell, 1992a) and to a monograph of the genus *Pavonia* for Flora Neotropica (in prep.).

Particular groups of specimens (not directly collected by USDA staff or Fryxell) were derived principally from the following sources: exchanges with other herbaria and individual botanists; gifts for identification, especially South American specimens, from The New York Botanical Garden (these specimens were not returned to NY in 1993), Missouri Botanical Garden (MO), and other herbaria; gifts for identification of Ecuadorean plants from the Universities of Göteborg (GB) and Aarhus (AAU) and

from Ecuador (QCA); gifts for identification of Mexican specimens from Universidad Nacional Autónoma de México (MEXU) and the University of Michigan (MICH); exchange of Mexican specimens from the Instituto Politécnico Nacional (ENCB) and the Instituto de Ecología (IEB); and exchange for material of the Malvaceae from the Instituto de Botánica del Nordeste, Corrientes, Argentina (CTES).

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Appendix I

Type specimens from the herbarium of Paul A. Fryxell at the Southern Crops Research Laboratory, U.S. Department of Agriculture, College Station, Texas, deposited in the Herbarium of The New York Botanical Garden.

Acanthaceae

- Elytraria mexicana* Fryx. & S. D. Koch, Aliso 11: 541. 1987. Mexico. Isotype: Koch & Fryxell 83103.
- Tetramerium oaxacanum* T. F. Daniel, Syst. Bot. Monogr. 12: 77. 1986. Mexico. Isotype: Fryxell & Lott 3390.

Asteraceae

- Eupatorium chlorostylum* B. L. Turner, Phytologia 59: 323. 1986. Mexico. Isotype: Koch et al. 79527.
- Microspermum debile* var. *arsenei* Rzedowski, Bol. Soc. Bot. México 31: 81. 1970. Mexico: Michoacán. Isotype: Rzedowski 25195.

Bombacaceae

- Ceiba pallida* Rose, Contr. U.S. Natl. Herb. 8: 320. 1905. Mexico. Syntype: Pringle 8212.

Caesalpiniaceae

- Bauhinia fryxellii* Wunderlin, Ann. Missouri Bot. Gard. 70: 112. 1983. Mexico. Isotype: Fryxell & Anderson 3427.

Cucurbitaceae

- Sicyos motozintlensis* Lott & Fryx., Brittonia 35: 34. 1983. Mexico. Isotype: Fryxell & Lott 3329.

Dilleniaceae

- Pachynema hooglandii* Craven & Dunlop, Austral. Syst. Bot. 5: 488. 1992. Australia. Isotype: Fryxell & Craven 4276.

Malvaceae

- Abutilon attenuatum* B. L. Rob. & Seaton, Proc.

- Amer. Acad. Arts 28: 104. 1893. Mexico. Isotype: Pringle 4354.
- A. bakerianum* Rose, Contr. U.S. Natl. Herb. 5: 133. 1897. Mexico. Isotype: Pringle 6278.
- A. cordatum* Garcke & K. Schum. in Mart., Fl. Bras. 12(3): 369. 1891 (non Rafinesque, 1830). Ecuador. Lectotype: Jameson 605. [Designated by Fryxell, Fl. Ecuador 44: 12. 1992.]
- A. dentatum* Rose, Contr. U.S. Natl. Herb. 8: 315. 1905. Mexico. Isotype: Pringle 306.
- A. lemmonii* S. Wats., Proc. Amer. Acad. Arts. 20: 357. 1885. United States of America. Syntype: Pringle s.n. in May 1884.
- A. macvaughii* Fryx., Madroño 23: 332. 1976. Mexico. Isotype: McVaugh 25118.
- A. malacum* S. Wats., Proc. Amer. Acad. Arts 21: 446. 1886. Mexico. Syntypes: Pringle 164 & 363.
- A. peraffine* Shuttlew. ex A. Gray, Smithsonian Contr. Knowl. 3(5): 20. 1852. United States of America. Isotype: Rugel 95 b.
- A. pinkavae* Fryx., Phytologia 37: 285. 1977. Mexico. Isotype: Reeves & Pinkava P13044.
- A. procerum* Fryx., Syst. Bot. 10: 269. 1985. Mexico. Isotype: Richardson 939.
- A. reticulatum* Rose, Contr. U.S. Natl. Herb. 5: 171. 1899. Mexico. Lectotype: Pringle 6062. [Designated by Fryxell, Syst. Bot. Monogr. 25: 31. 1988.]
- A. simulans* Rose, Contr. U.S. Natl. Herb. 8: 315. 1905. Mexico. Isotype: Pringle 8427.
- A. turumiquirense* Steyerl., Fieldiana, Bot. 28: 363. 1952. Venezuela. Type fragment: Steyermark 62689.
- Abutilothamnus yaracuyensis* Fryx., Syst. Bot. 10: 273. 1985. Venezuela. Isotype: Fryxell & Smith 4330.
- Alcea glabrata* Alef., Oesterr. Bot. Z. 12: 253. 1862. Iran. Type: Kotschy s.n. in 1843.
- Allosidastrum dolichophyllum* Krapov., Fryx. &

- Bates, Bol. Soc. Bot. México 48: 25. 1988. Venezuela. Isotype: *Wingfield 12732*.
- Alyogyne cravenii* Fryx., Syst. Bot. 12: 277. 1987. Australia. Isotype: *Fryxell et al. 4870*.
- Anoda albiflora* Fryx., Aliso 11: 493. 1987. Mexico. Isotype: *Lape s.n.* in Jan 1978.
- A. hintoniorum* Fryx., Aliso 11: 500. 1987. Mexico. Isotype: *Hinton et al. 12778*.
- A. leonensis* Fryx., Aliso 11: 504. 1987. Mexico. Isotype: *Fryxell 1207*.
- A. maculata* Fryx., Aliso 11: 506. 1987. Mexico. Isotype: *Koch & Fryxell 82191*.
- A. palmata* Fryx., Aliso 11: 507. 1987. Mexico. Isotype: *Koch & Fryxell 83144*.
- A. polygyna* Fryx., Aliso 11: 512. 1987. Mexico. Isotype: *Breedlove 19033*.
- A. pristina* Fryx., Syst. Bot. 4: 253. 1980. Mexico. Type fragment: *Breedlove 7546*.
- A. thurberi* A. Gray, Proc. Amer. Acad. Arts 22: 299. 1887. Mexico. Lectotype: *Pringle 283*. [Designated by Hochenreutiner, Annuaire Conserv. Jard. Bot. Genève 4: 60. 1916.]
- Bakeridesia bezerrae* Monteiro, Anais Soc. Bot. Brasil, 23 Congr. Nac. Bot. 118. 1973. Brazil. Isotype: *Bezerra 288*.
- Bastardiastrum batesii* Fryx. & S. D. Koch, Aliso 11: 544. 1987. Mexico. Isotype: *Koch & Fryxell 82165*.
- Batesimalva pulchella* Fryx., Bol. Soc. Bot. México 35: 27. 1975. Mexico. Isotype: *Fryxell & Bates 827*.
- Callirrhoe sidalceoides* Standl., Field. Mus. Nat. Hist., Bot. Ser. 17: 198. 1937. Mexico. Isotype: *Marsh 100*.
- Cienfuegosia hearnii* Fryx., Brittonia 19: 33. 1967. Aden Protectorate, originally: specimen from cultivated plant at Tempe, Arizona, U.S.A. Isotype: *Herb. Gossypianum Arizonicum 14-005*.
- Decaschistia byrnesii* Fryx. var. *byrnesii*, Austral. J. Bot. 22: 187. 1974. Australia. Isotype: *Byrnes NB-1320*.
- D. byrnesii* var. *lavandulacea* Fryx., Austral. J. Bot. 22: 189. 1974. Australia. Isotype: *Byrnes 2284*.
- D. occidentalis* A. S. Mitch. ex Craven & Fryx., Austral. Syst. Bot. 2: 464. 1989. Australia. Isotype: *Fryxell & Craven 3903*.
- Dendrosida batesii* Fryx., Brittonia 22: 231. 1971. Mexico. Isotype: *Fryxell & Bates 896*.
- D. breedlovei* Fryx., Phytologia 37: 289. 1977. Mexico. Isotype: Chiapas. *Breedlove 24629*.
- D. wingfieldii* Fryx., Syst. Bot. 10: 277. 1985. Venezuela. Isotype: *Fryxell et al. 4301*.
- Dirhamphis balansae* Krapov., Darwiniana 16: 223. 1970. Bolivia. Isotype: *Gregory et al. 10031*.
- D. mexicana* Fryx., Syst. Bot. 9: 420. 1984. Mexico. Isotype: *Koch & Fryxell 83127*.
- Erioxylum aridum* Rose & Standl., Contr. U.S. Natl. Herb. 13: 307. 1911. Mexico. Type fragment: *Rose et al. 14199*.
- Fugosia punctata* Cunn. ex Benth., Fl. Austral. 1: 220. 1863. Australia. Isotype: *Cunningham 264*.
- Gaya violacea* Rose, Contr. U.S. Natl. Herb. 12: 286. 1909. Mexico. Isotype: *Pringle 10221*.
- Gossypium anomalum* G. Watt, Bull. Misc. Inform. 1927: 321. 1927. Egypt. Syntypes: *Simpson C854 & C853*.
- G. barbadense* var. *breve* Roberty, see *G. peruvianum* var. *aegypticum* G. Watt
- G. barbadense* var. *delticum* Roberty, *nomen illegit.* Candollea 10: 390. 1946. Egypt. Isotype: *Simpson C837*.
- G. barbadense* var. *nubarense* Roberty, Candollea 10: 392. 1946. Egypt. Possible type: *Simpson C87*.
- G. barbadense* var. *strictiflorum* Roberty, *nomen illegit.* Candollea 10: 390. 1946. Egypt. Possible type: *Simpson C125*.
- G. enthyle* Fryx., Craven & Stewart, Syst. Bot. 17: 98. 1992. Australia. Isotype: *Fryxell et al. 4676*.
- G. exiguum* Fryx., Craven & Stewart, Syst. Bot. 17: 98. 1992. Australia. Isotype: *Fryxell et al. 4727*.
- G. hirsutum* var. *harlandianum* Roberty, Candollea 13: 68. 1950. Egypt. Syntype: *Simpson C285*.
- G. hirsutum* var. *praticolum* Roberty, Candollea 13: 64. 1950. Egypt. Syntypes: *Simpson C138 & C826*.
- G. hirsutum* f. *rubrocoloratum* Roberty, Candollea 13: 70. 1950. Egypt. Possible type: *Simpson C114*.
- G. irenaeum* Lewton, Smithsonian Misc. Collect. 60(4): 1. 1912. Guatemala. Possible type: *Lewton s.n.* in May 1906. "From files of F. L. Lewton—presumably authentic specimen of *G. irenaeum*."
- G. londonderriensis* Fryx., Craven & Stewart, Syst. Bot. 17: 100. 1992. Australia. Isotype: *Fryxell et al. 4814*.
- G. marchantii* Fryx., Craven & Stewart, Syst. Bot. 17: 103. 1992. Australia. Isotype: *Fryxell et al. 4797*.
- G. nelsonii* Fryx., Austral. J. Bot. 22: 184. 1974. Australia. Isotype: *Nelson 2255*.
- G. nobile* Fryx., Craven & Stewart, Syst. Bot. 17: 103. 1992. Australia. Isotype: *Fryxell et al. 4824*.
- G. peruvianum* var. *aegypticum* G. Watt, Bull. Misc. Inform. 1927: 332. 1927. Egypt. Syntypes: *Simpson C103 & C104*. (Also, *Simpson C104* is syntype of *G. barbadense* var. *breve* Roberty, Candollea 10: 391. 1941, *nomen illegit.*)
- G. peruvianum* var. *arizonicum* Roberty, *nomen illegit.* Candollea 10: 390. 1946. Egypt. Possible type: *Simpson C133*.
- G. pilosum* Fryx., Austral. J. Bot. 22: 183. 1974. Australia. Isotype: *Byrnes 2316*.
- G. rotundifolium* Fryx., Craven & Stewart, Syst. Bot. 17: 11. 1992. Australia. Isotype: *Fryxell et al. 4556*.
- G. schwendimanii* Fryx. & S. D. Koch, Aliso 11: 546. 1987. Mexico. Isotype: *Koch & Fryxell 83239*.
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- Hampea bracteolata* Lundell, Wrightia 5: 357. 1977. Guatemala. Isotype: *Lundell & Contreras 19756*.
- H. breedlovei* Fryx., Phytologia 37: 291. 1977. Mexico. Isotype: *Breedlove 32601*.
- H. montbellenis* Fryx., Phytologia 37: 291. 1977. Mexico. Isotype: *Breedlove 32191*.

- H. nutricia* Fryx., Brittonia 21: 372. 1969. Mexico. Isotype: Fryxell 526.
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- H. citrinus* Fryx., Techn. Bull. U.S.D.A. 1624: 14. 1980. Mexico. Isotype: Fryxell & Bates 2118.
- H. elegans* Standl., Contr. U.S. Natl. Herb. 23: 782. 1923. Mexico. Isotype: Pringle 7505.
- H. escobariae* Fryx., Techn. Bull. U.S.D.A. 1624: 42. 1980. Ecuador. Isotype: de Escobar 1298.
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- H. kochii* Fryx., Techn. Bull. U.S.D.A. 1624: 38. 1980. Mexico. Isotype: Koch & Fryxell 78405.
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- H. tenorii* Fryx., Acta Bot. Mex. 8: 35. 1989. Mexico. Isotype: Tenorio 3620.
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- H. palmeri* S. Wats., Proc. Amer. Acad. Arts 24: 40. 1889. Mexico. Isotype: Palmer 558.
- H. rotundifolia* S. Wats., Proc. Amer. Acad. Arts 24: 40. 1889. Mexico. Isotype: Palmer 351.
- Kokia rockii* Lewton, Smithsonian Misc. Collect. 60(5): 3. 1912. U.S.A.: Hawaii. Type: Rock s.n. [no date].
- Kosteletzkyia blanchardii* Fryx., Phytologia 37: 292. 1977. Mexico. Isotype: Bates et al. 1650.
- K. ramosa* Fryx., Phytologia 37: 294. 1977. Mexico. Isotype: McVaugh 17230.
- K. reclinata* Fryx., Phytologia 37: 294. 1977. Mexico. Isotype: McVaugh 17259.
- K. violacea* Rose, Contr. U.S. Natl. Herb. 8: 319. 1905. Mexico. Isotype: Pringle 8663.
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- M. bicuspidatum* subsp. *tumidum* S. R. Hill var. *glabrum* S. R. Hill, Brittonia 32: 474. 1980. Mexico. Isotype: Bates et al. 1642.
- M. grandiflorum* Krapov., Bol. Soc. Argent. Bot. 15: 467. 1974. Bolivia. Isotype: Krapovickas et al. 19300.
- M. greenmanianum* Rose, Contr. U.S. Natl. Herb. 5: 180. 1899. Mexico. Isotype: Pringle 6582.
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