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Cucurbit Germplasm at the North Central Regional Plant Introduction Station, Ames, Iowa

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Abstract
There are few crops native to the United States, causing us to rely on introduced species for most of our food. The United States government recognized the importance of such introduced plants before the turn of this century, and began recording and consecutively numbering plant introductions (PI) in 1898.

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There are few crops native to the United States, causing us to rely on introduced species for most of our food. The United States government recognized the importance of such introduced plants before the turn of this century, and began recording and consecutively numbering plant introductions (PI) in 1898.

By 1947, more than 150,000 items (accessions) had been introduced and numbered, but, unfortunately, there was no system to preserve them. Starting in 1948, with the North Central Region, four regional PI Stations were established to ensure that plant materials brought into our country would not be lost. In the mid-1950s, the National Seed Storage Lab was established in Fort Collins, Colo., to provide long-term backup storage for the PI Stations.

Each PI Station has responsibility for the preservation of diverse populations of many plant species, including the various species of the Cucurbitaceae. At present, the North Central Regional Plant Introduction Station (NCRPIS), Ames, Iowa, is responsible for all *Cucumis* L. species and *Cucurbita pepo* L., *C. texana* A. Gray, and *C. fraterna* Bailey accessions. Other important collections of Cucurbitaceae held at PI Stations include *Citrullus* Schrad., *Cucurbita argyrosperma* Huber (= *C. mixta* Pang.), *C. moschata* (Duch.) Duch. ex Poir., *Lagenaria* Ser., *Luffa* Mill., and *Momordica* L. accessions at the Southern Regional Plant Introduction Station, Griffin, Ga., *Cucurbita maxima* Duch. accessions at the Northeastern Regional Plant ntroduction Station, Geneva, N.Y., and *Cucurbita foetidissima* H.B.K. accessions at the Western Regional Plant Introduction Station, Pullman, Wash.

Cucurbit Germplasm at Ames

The melon *(Cucumis melo* L. and *C. metuliferus* E. Mey. ex Naud.) collection is the largest of the vine crops maintained at NCRPIS. It also is the most recently acquired collection, having been transferred to Ames in 1987 from the Southern Regional PI Station. There are > 1200 accessions of *C. melo* from 52 countries currently available. Table 1 shows the numbers of accessions currently available for distribution, arranged by species and by country of origin within species.

The cucumber *(Cucumis sativus* L.) collection numbers > 1000 accessions with > 800 lines from 45 countries available for distribution (Table 1). This collection has been at Ames for many years, with the first accessions received in 1948.

We recently assumed responsibility for maintaining all other species in the genus *Cucumis.* Excluding *C. melo* and *C. sativus,* we can now make available 109 accessions of 19 other *Cucumis* spp. from 22 countries (Table 1).

Important collections of pumpkins and squash at the NCRPIS include *C. pepo* and its wild relatives *C. fraterna* and *texana.* More than 500 accessions of *Cucurbita* from 34 nations are available for distribution (Table 1).

Table 1. Accessions of Cucurbitaceae held at Ames that were available for distribution as of 1 Dec. 1990.

Taxon	Country of origin	No. accessions
Cucumis anguria L.	Iran	28
	Zimbabwe	10
	Five other countries	9
		47
Cucumis melo L.	India	276
	Afghanistan	186
	Turkey	167
	Spain	152
	Iran	92
	Yugoslavia	53
	Soviet Union	45
	Canada	26
	United States	26
	Zimbabwe	26
	Japan	25
	China	22
	Forty other countries	147
		1243
Cucumis metuliferus E. Mey. ex Naud.	Zimbabwe	18
	South Africa	2
	Germany	1
		21
Cucumis sativus L.	Turkey	169
	China	110
	Yugoslavia	66
	Iran	58
	Soviet Union	55
	Japan	53
	India	51
	Spain	46
	Czechoslovakia	29
	Egypt	22
	Netherlands	20
	Thirty-four other countries	168
		807
Cucumis—17 wild species	Thirteen countries	41
Cucurbita pepo L.	Turkey	211
	Yugoslavia	104
	Mexico	64
	Iran	33
	Spain	15
	United States	14
	Twenty-eight other countries	116
		557
Cucurbita texana A. Gray	United States	1

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(continued from inside front cover)

Maintenance

Seeds of *Cucumis* are started in the greenhouse in early May and transplanted to the field in mid- to late May. Eight hills (three plants each) are transplanted 60 cm apart in the center of a 1.5 × 6-m area, over which a 1.5-m-tall cage frame has been assembled. The plants are mulched with straw to preserve moisture and reduce weed competition. The cage frame is then covered with a lumite screen.. The cage provides protection from bacterial wilt infection by excluding the cucumber beetle vectors.

When both male and female flowers are found on an accession, a small queenright colony of honeybees is placed in the cage for pollinations (Ellis et al., 1981). Multiple harvests are made as fruits mature from August through October. The fruits are sliced, and seeds are extracted by hand and washed in a screened tray. Seeds are then floated in water to remove light, immature seeds and debris. After seeds have been dried in dryer carts, they are put through a Clipper (Blount/Ferrell-Ross, Bluffton, Ind.) air-screen cleaner to remove any remaining low-quality seed and impurities. After germination tests, seeds are stored in 1-liter jars at 3C and 40% RH.

Seeds of *Cucurbita* are started in the greenhouse in early May and transplanted to the field in mid- to late May. Rows are 24 m long, with eight hills (three plants each) 3 m apart, and 6 m of spacing between rows. The fields are scouted weekly and sprayed as needed to control insect pests. Sib pollinations are made within each accession by using three male flowers for each female flower. We attempt to produce at least two fruits per plant. Open-pollinated fruits are removed from the vines and discarded. Fruits are harvested as they reach mature color or after a killing frost. The fruits are stored in a cold, dry room for as long as possible for the production of the best-quality seed. Fruits are split open with a hatchet to extract seed. Pulp is washed off the seeds in screened boxes and the seeds are dried in dryer carts at 30 to 34C for 24 h. Dried seeds are put through a Clipper air-screen cleaner to remove light, immature seeds. After germination tests, the seeds are inventoried and stored in 2-liter jars at 3C and 40% RH.

Photographs and descriptions are taken of representative fruits to help characterize each cucurbit accession before seeds are extracted. These photos also aid in the proper taxonomic identification of the collections.

Evaluation of resistance to diseases and insects

Evaluating germplasm for disease and insect resistance is a major activity of our research program. A large percentage of cucurbit seed requests comes from individuals seeking sources of pest or pathogen resistance (Table 2).

Our goal is to obtain data on the reaction of each accession to a broad range of important diseases and insects. Because testing thousands of accessions for every pathogen or pest is impractical, emphasis is placed on diseases and insects for which sources of resistance are currently inadequate or unavailable. The Cucurbit Crop Advisory Committee ranks priorities for disease and insect evaluation. Evaluations are conducted at many locations around the country.

Wehner (1988) surveyed plant breeders for the traits that they wanted evaluated most in the U.S. cucumber germplasm collection. Seven of the top 10 traits involved disease resistance, particularly resistance to gummy stem blight *[Didymella bryoniae* (Auersw.) Rehm], root-knot nematodes *(Meloidogyne* spp.), alternaria leaf blight *[Alternaria cucumerina* (Ell. & Everh.) Elliott], and rhizoctonia fruit rot *(Rhizoctonia solani* Kuhn). Most of the traits of interest have recently been or are currently being evaluated. The NCRPIS coordinates entry of all evaluation data into the USDA Germplasm Resources Information Network (GRIN) database so that the information is publicly available. Perry et al. (1988) recently published a description of GRIN. The following examples serve to illustrate some of the evaluations that have been conducted.

Staub et al. (1989) reported on evaluation of 753 accessions in the *Cucumis sativus* germplasm collection for reaction to six major diseases: rhizoctonia fruit rot, downy mildew, powdery mildew, angular leaf spot *[Pseudomonas lachrymans* (Smith & Bryan) Carsner], anthracnose *[Colletotrichum lagenarium* (Pass.) Ell. & Halst.], and target leaf spot *[Corynespora cassiicola* (Berk. & Curt.) Wei]. A significant number of resistant accessions originated in China, Japan, and India. The presence of many sources of disease resistance from Asian accessions is consistent with the widely held conviction that cucumbers were first domesticated in India (Whitaker and Bemis, 1976).

In the *Cucumis melo* collection, sources of resistance have been found for gummy stem blight (Sowell et al., 1966; Sowell, 1981), powdery mildew *[Sphaerotheca fuliginea* (Schlect.) Poll.] (Sowell and Corley, 1974), and downy mildew *[Pseudoperonospora cubensis* (Berk. & Curt.) Rostow] (Thomas, 1982).

Hall and Painter (1968) identified several sources of resistance to squash bug *(Anasa tristis* DeGeer) and/or cucumber beetles *(Diabrotica undecimpunctata howardi* Barber and *Acalymma vittata* Fab.) in *Cucurbita pepo, C. moschata, C. maxima,* and *C. okeechobeensis* (Small) Bailey.

Use of the collections

As with other germplasm at the NCRPIS, cucurbit germplasm is available for research at no cost to the user. This is true whether the scientist is in the United States or not. For the past 3 years, more than one fourth of our distribution of packets of *Cucumis* and *Cucurbita* was to scientists outside of the United States.

Screening for resistance to diseases and other pests is a very important use of these collections (Table 2). For *Cucumis,* biochemical analysis is of increasing importance. A recent report by Knerr et al. (1989) surveyed isozyme diversity in our cucumber collection.

Lists describing various aspects of our collections can be obtained upon request. We can help you quickly locate germplasm appropriate to meet your research needs. In most instances, 50 seeds are provided for each requested accession.

Please address all inquiries to the North Central Plant Introduction Station, Iowa State Univ., Ames, IA 50011 USA.

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Table 2. Summary of uses for *Cucumis* and *Cucurbita* germplasm requested from Ames for 1987-89.

Category	Orders by year (no.) 1987	1988	1989	Three-year total
	Cucumis			
Unknown	11	23	9	43
Disease screening	3	15	17	35
Nematode/insect screening	2	7	3	12
Trials	1	3	3	7
General breeding programs	3		3	6
Biochemical analysis	1	1	4	6
Other	1	6	6	13
				122
	Cucurbita			
Unknown	4	4	3	11
General breeding programs	2	1	2	5
Disease screening	2	1	1	4
Trials	1	1	1	3
Other	1	2	2	5
				28

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