Cucurbit Genetics Cooperative

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Department of Horticultural Science
North Carolina State University
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2nd Printing
University of Wisconsin
Spring 1985

3rd Printing
University of Maryland
Summer 1990

Resolution and notes of organization meeting, October 28, 1976, Denver Hilton, Denver, Colorado, U.S.A.

The following resolution was adopted by research workers interested in organizing a Cucurbit Genetics Cooperative:

> The Cucurbit Genetics Cooperative is organized to develop and advance the genetics of economically important cucurbits.
>
> Membership to this Cooperative is voluntary and open to workers who have an interest in Cucurbit Genetics (an invitation to participate is extended to all Horticulturists, Entomologists, Plant Pathologists, Geneticists, and others with an interest in Cucurbits).
>
> Reports of the Cooperative will be issued on an annual basis. The reports will include articles submitted by members and for the use of the members of the Cucurbit Genetics Cooperative. None of the information in the annual report may be used in publications without the consent of the respective authors for a period of five years. After five years the information may be used in publications without the consent of the authors.

Further, dues for the Cucurbit Genetics Cooperative (CGC) will be $5.00 for two years and will be used to defray cost of preparation and mailing of the annual report. The initial annual report will include four sections: Research Notes, Stocks and Germplasm desired and for Exchange, Membership Directory and Financial Statement. Other sections will be added in future reports as desired, i.e. gene lists, linkage groups, etc.

In accordance with the above resolution we requested that an invitation to join the CGC be published in the following:

Agronomy News
Euphytica
HortScience
Journal of Economic Entomology
Journal of Heredity
Phytopath News

We are most pleased to acknowledge the assistance of the editors of these publications.

REPORT OF FIRST ANNUAL MEETING

The first annual meeting of the Cucurbit Genetics Cooperative was held October 13, 1977, at Salt Lake City in conjunction with the American Society for Horticultural Science. Although erroneously listed in the A.S.H.S. program as a meeting of the Cucumber Genetics Cooperative, thereby possibly deterring researchers interested in cucurbits other than cucumber from coming, the meeting was attended by sixteen seedsmen, Experiment Station researchers, and U.S.D.A. personnel.

R. W. Robinson explained the background and purpose of the CGC, and led discussion on the proposed format for the CGC Report. There was general agreement with the plan to include in the Report sections on Research Reports and on Stocks Desired and Available. Those attending the meeting were not enthusiastic about including in each Report a bibliography of all publications of the previous year pertaining to cucurbit genetics. There was much more support for a proposal to periodically publish an index to CGC research notes, and it was urged that the cross index be compiled more frequently than every tenth year as is done by the Tomato Genetics Cooperative.

Volunteers were solicited for serving on committees to develop a set of by-laws for the CGC, establish policy for gene nomenclature, and coordinate linkage testing. Those attending the meeting who were not members of the CGC were invited to join, and all were urged to bring the CGC to the attention of others interested in cucurbits.

Appreciation was expressed for the efforts of R. L. Lower and Warren Henderson in founding the Cucurbit Genetics Cooperative and in publishing its Report.

R. W. Robinson

The 1978 Annual Meeting of the CGC will be held at 4:30 p.m. on Wednesday, July 19, 1978, in room Dalton A at the Sheraton-Boston Hotel, Boston, MA, U.S.A. The meeting will be chaired by W. R. Henderson.

COMMENTS FROM THE COORDINATING COMMITTEE

The initial issue of the CGC was delayed due to a limited response in the number of research notes submitted by the appointed deadline (December 31, 1977). A second request for research papers (by March 15, 1978) was sent out by the coordinating committee, and it resulted in a greater response. The papers were forwarded to the Chairman by the coordinating committee and then compiled for publication in June 1978.

The call for papers for the 1979 report will go out in November 1978, and they should be submitted to the coordinating committee by January 31, 1979. Hopefully, the second annual report will be published by April 1979.

We are eager to hear from the membership regarding the future direction of the CGC. Volunteers to draft a set of by-laws and guidelines are requested.

It is a pleasure to acknowledge the assistance of Linda Reece, Susan Stallings and Jeannine Beaudoin, who were responsible for the typing, proofing and duplicating of the report. We express our sincere appreciation.

Coordinating Committee

W. P. Bemis (Cucurbita spp.)
W. R. Henderson (watermelon)
J. D. Norton (muskmelon)
M. L. Robbins (cucumber)
R. W. Robinson (other genera and species)
R. L. Lower, Chairman

The chairman thanks all of the coordinating committee for their assistance. Special tribute goes to W. R. Henderson and R. W. Robinson who also acted as "Co-chairmen" during our initial year.

ADDENDUM TO CGC REPORT 1, p. v-vii

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I. Cucumber

Preliminary Report on *In Vitro* Propagation of Cucumber

Alsop, W. R., W. W. Cure, G. F. Evans, and R. L. Mott, North Carolina State University, Raleigh, NC 27650.

Preliminary investigations on the feasibility of *in vitro* propagation of cucumber (*Cucumis sativus* L.) have been conducted in this laboratory. Shoot regeneration from callus has not been reported for this species although some success has been reported with related species (1, 2). Maciejewska-Potaczykowa *et al.* (3) have observed callus growth as well as *in vitro* axillary and floral bud growth in cucumber. However, their studies emphasized possible mechanisms of sex determination rather than propagation. Coutts and Wood have also tried unsuccessfully to get shoots from callus (4). We have conducted experiments to determine an appropriate medium for callus growth and organogenesis, and to investigate the possibilities of *in vitro* propagation using organ explants.

Explants obtained from 6-7 week old greenhouse-grown cucumber plants were surface sterilized in 10% Clorox solution with a drop of liquid detergent added followed by water rinses. Media including Murashige and Skoog (5), Greshoff and Doy (6), and White's (7) have been employed with various combinations of coconut milk, casein hydrolysate, and growth regulators. The best callus growth was observed on Murashige and Skoog medium supplemented with 10% coconut milk (v/v) and naphthalene acetic acid (NAA) (0.1 mg/l) on 1% agar solidified media at 21°C under approximately 2,000 lux fluorescent light. Callus has been initiated from stems, roots, tendrils, petioles, leaves, and flowers, as well as seedling hypocotyls and cotyledons. On this medium, callus frequently gives rise to adventitious roots, which then grow rapidly.

To date, our attempts to induce shoot formation from callus have been unsuccessful. Single and combined additions of NAA and benzylaminopurine (BAP) in concentrations of 0 to 5 and 0 to 10 mg/l respectively have been tried. The addition of coconut milk was beneficial regardless of other media components. BAP became toxic at concentrations of 10 mg/l or higher, and most vigorous callus growth was observed in the absence of BAP. Callus grown on NAA (0.1 mg/l) and BAP (0-1 mg/l) exhibited a tendency to organize into round knobs with green centers. However, no further organization has been achieved.

A propagation scheme which may be of use to breeders utilizes the induction of axillary bud development from the nodes of excised stem segments. The crevices at the leaf axil make surface sterilization of excised nodes particularly difficult, especially from field-grown plants. Uncontaminated node explants cultured on White's salts with 30.0 g/l sucrose and 300 mg/l casein hydrolysate typically formed callus from the pith of the basal portion of the stem, and adventitious roots were observed in just 3 or 4 days. Vegetative axillary buds grew out after approximately 2 weeks. The plants grew to be 6 to 8 nodes in length and flowered under continuous fluorescent light.

We are continuing experiments aimed toward shoot regeneration from callus.

However, from a practical point of view and from these preliminary experiments it seems that a workable *in vitro* propagation system for clonal propagation of *Cucumis sativus* L. could make use of the many axillary buds which already exist at the nodes of the cucumber plant. Where desired, further increase could be obtained by successively subculturing nodes excised from the already sterile shoots formed *in vitro*.

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3. Maciejewska-Potapczykowa, W., A. Rennert and E. Milewska. 1972. Callus induction and growth of tissue cultures derived from cucumber plant organs of four different sex types. *Acta. Societatis. Botanicorum Poloniae* 41:329-339.

4. Coutts, R. H. A. and K. R. Wood. 1977. Improved isolation and culture methods for cucumber mesophyll protoplasts. *Plt. Sci. Lett.* 9:45-57.

5. Murashige, T. and F. Skoog. 1962. A revised medium for rapid growth and bioassays with tobacco tissue cultures. *Physiol. Plant.* 15:473-497.

6. Sommer, H. F., C. L. Brown and P. P. Kormanik. 1975. Differentiation of plantlets in longleaf pine (*Pinus palustris* Mill.) tissue cultures *in vitro*. *Bot. Gaz.* 136:196-200.

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Fusarium Wilt Resistance of Cucumbers

Armstrong, G. M. and J. K. Armstrong, Georgia Experiment Station, Experiment, GA 30212.

Fusarium wilt of cucumbers has not been of importance in the United States, but is of considerable importance in other parts of the world. Three different isolates of Fusarium oxysporum f. sp. cucumerinum viz., #ATCC 16416 from Fla., #706 from Israel, and C732601 from Japan have been used in our inoculations. Cultivars 'Ashley', 'Bet Alpha', and 'Shimoshazujihai' were susceptible to all isolates.

Cultivar reactions after inoculation with Fusarium isolates of F. oxysporum f. sp. cucumerinum.

Cultivar	Fusarium isolates 16416 (Fla.)	706	C732601
MSU 441034 (Chipper)	S[a]	S	
Addis	S	S	
Calypso	R	R	
Carolina Hybrid (F.M. 13811)	R	R	
Miga	S	S	
Neoro-L-120 F. Hybrid	R	R	
Picadilly Hybrid (F.M. 13748)	R	R	
Sampson	S	S	
MSU 9429CM	R	R	R
MSU 4108H	S	S	S
Aofushinari (A) (Komada)	R[b]	R	R
Saitama Ochiai #4 (Komada)	R[b]	-	R
China (Kyoto) Harris	S	S	S
Hyuga #2 Improved	R	R	R
Palomar DMR (F.M. 500)	S	S	
National Pickling (F.M. 510)	R	R	
Green Spot Improved F_1 Hybrid	R	R	R
Kurume Ochiai #1	R	-	R
Early White Spine (F.M. 502)	S	S	
Long Green (F.M. 503)	S	S	
Spottex	R	R	
P.I. 390241	S	S	S
P.I. 390263	S	S	S

[a] S=susceptible; R=resistant
[b] R from one source but S from another

Breeding for Fruit Rot Resistance in Cucumber

Bowers, J. L. and M. J. Goode, University of Arkansas, Fayetteville, AR 72701.

We now have two characters that we think may be helpful in breeding for fruit rot (Rhizoctonia) resistance. A small leaf type was found in our material 3 years ago, and we are in the process of crossing it with normal leaf lines to determine its mode of inheritance.

Another characteristic that seems to have merit from the standpoint of fruit rot resistance was found in a line that carries the uniform fruit color gene. If our data on fruit rot resistance in 1977 are completely valid, then our AR 77-55 line possessing the uniform green color will be very helpful in our program.

Two of our inbred gynoecious lines seemed to possess a usable level of resistance to fruit rot and we are increasing these lines in the greenhouse to use in a test for checking on the level of resistance.

In 1977, we had a rather heavy infestation of Corynespora cassicola (target spot) and we found that 'Model' possesses a fairly good level of resistance to this foliage disease.

Cucumis hardwickii: A Source of Germplasm for the Cucumber Breeder

Horst, E. K. and R. L. Lower, North Carolina State University, Raleigh, NC 27650.

Cucumis hardwickii, an annual monoecious cucurbit species resembling *C. sativus*, hybridizes readily with *C. sativus*, producing a fertile F_1 with no observed reduction of fertility in the F_2. *C. hardwickii* sets larger numbers of fruit per plant than *C. sativus* and does so in a manner not typical of *C. sativus*. Fruits with developing seed do not inhibit growth and seed development of later fruit as occurs in *C. sativus*.

Plants of the *C. hardwickii* line we are using are indeterminate, seem to lack apical dominance and have more and longer laterals than lines of *C. sativus*. *C. hardwickii* plants are typically slow-growing in early stages of growth and remain vegetative for extended periods of time. After the slow growth period, *C. hardwickii* enters a rapid phase of growth surpassing total vine length of *C. sativus* cultivars. Preliminary observations of field plantings of *C. hardwickii* in North Carolina revealed that number of days to flowering was sensitive to length of day or photoperiod and possibly temperature. Plants grew well vegetatively but did not flower until early September regardless of whether planted in May or July.

Cultivars containing *C. hardwickii* germplasm might result in genotypes with higher yields per plant than present *C. sativus* cultivars. The development of a plant type suitable for mechanical harvesting as well as improved yield is an important consideration of our breeding program. In a genetic study, *C. hardwickii* was crossed with two *C. sativus* cultivars, 'GY14', a gynoecious, indeterminate line, and 'PG', a monoecious, determinate line. Plants of parental and F_1, F_2 and B.C. generations were spaced 0.6 m apart and were allowed to set a full complement of fruit. 'GY14' had 1-6 fruit/plant. Number of fruit for *C. hardwickii* was not determined due to inhibition of flowering by long-day conditions. (In other seasons *C. hardwickii* has averaged 80 fruit/plant.) The F_1 ('GY14' x *C. hardwickii*) averaged 20 fruit/plant. Backcrosses to 'GY14' and *C. hardwickii* ranged from 0-40 and 0-250 fruit, respectively, while the F_2 plants had 0-90 fruit. Backcrosses to 'PG' and *C. hardwickii* ranged from 0-27 and 0-97 respectively. The F_2 plants had 0-99 fruit. Because of lack of fruit number data for *C. hardwickii*, further genetic analysis was not attempted. However, data were taken for all populations for number of laterals. *C. hardwickii* had a mean of 11.4 laterals/plant. 'PG' had 2.4, while the F_1 had 12.9. The estimation of heterosis was 87%. The backcross to *C. hardwickii* had 10.6 laterals, while the backcross to 'PG' had 5.2, and the F_2 had 8.8. Environmental variance was 4.38, additive variance was 12.46, and dominance variance was -1.19. Heritability was 80%.

1/ G. W. Bohn, USDA, Brawley, CA 92227, supplied our original seed as LJ 90430.

An Interspecific Cross Between Cucumber (Cucumis sativus) and Muskmelon (Cucumis melo)

van der Knaap, B. J. and A. C. de Ruiter, Deruiterzonen B. V., Bleiswijk, The Netherlands.

In 1971 we started a program for making an interspecific cross between a cucumber and melon. If such a cross would succeed it would enable us to exchange certain genes between the cucumber and the melon, especially resistance to powdery mildew, Sphaerotheca fuliginea. Although there are many sources of powdery mildew resistance found within the cucumber species, C. sativus, this resistance is generally believed to be based on 3 recessive genes, while the resistance of the melon species is based on 1 dominant gene. It is obvious that it would be much more convenient to work with the monogenic dominant resistance from the melon.

The pickle variety, used as the female parent, was susceptible to powdery mildew, and the male parent was a powdery mildew resistant breeding line of muskmelon. During a 4 week period in the greenhouse, we made 1,000 pollinations in 26 different combinations, which can be divided into 3 groups: -we varied the ages of both female and male flowers from 2 days before till 2 days after anthesis; -we used tetraploid and diploid cucumber lines both as female or male parent; -we pollinated using pollen mixtures containing 50% pollen of the male and 50% pollen of the female parent.

It has been the last group which yielded the hybrid plants. The seeds we have collected from certain mixed pollinations [C. sativus x (C. sativus + C. melo)] were plump and resulted in approximately 2% hybrid plants after planting.

The F_1 hybrid plants raised from the seeds of the mixed pollinations were quite different from both the parent lines. The shape of the leaves was more or less similar to the muskmelon and the color of the leaves resembled that of the pickling cucumber. The fruits were intermediate and looked like a pear. As far as the vitality is concerned the F_1 plants showed a completely different habit. The growth was very poor and the plants did not get taller than 100 to 120 cm., where as the growing-point was very small with extremely short internodes, like a rosette. We decided to call these F_1 plants "MEGURK", derived from the Dutch words MEloen (melon) and auGURK (pickling cucumber).

The majority of the megurk plants were found to have 19 chromosomes. All of the megurk plants were fertile and produced viable seed when selfed. The F_2 progeny were phenotypically similar to the megurk F_1 plants, and the only segregation which has been observed was for the number of chromosomes, varying from 14 to 19. No segregation was found in either the F_3 or F_4.

All backcrosses made to the muskmelon failed to set fruit, whereas those made to the pickling cucumber using the megurk as the female parent, yielded fruits with plump seeds. The BC1 to the cucumber consisted entirely of cucumber phenotypes. After selfing the BC1 plants a segregation of 243 cucumber and 44 megurk phenotypes were found, all had 14 chromosomes.

We can not explain the lack of segregation for phenotype in the F_2, F_3 and F_4. Because of the high degree of fertility of the F_1 megurk plants it is reasonable to assume that the cucumber and melon chromosomes are closely related.

Although the male muskmelon parent of the original cross was monogenic dominant mildew resistant, the F_1 plants all were very susceptible. This means that the genes for susceptibility of the cucumber are more dominant in comparison with the melon gene for resistance. The F_2, F_3 and F_4 progenies showed some resistance to powdery mildew, but none were completely resistant.

In the various backcross progenies of megurk to cucumber, we hope to get a translocation of the melon chromosome segment carrying the gene for mildew resistance into a cucumber chromosome. In order to enlarge the chance of the occurrence of this desired recombination we set up a program covering 3 different methods:

A. Colchicine treatment of megurk seeds in order to get an amphidiploid genotype which might enable us to make backcrosses to melon (if necessary to tetraploid melon). There is a chance that the dominant Pm gene from muskmelon would be expressed if present twice in the amphidiploid. We have not succeeded in getting any recombination in this way.

B. Irradiation of the megurk seed. These irradiations took place at the I.T.A.L. at Wageningen in 1975. The doses varied from 0 to 10 krad Nf (fast neutrons). In the M_1 generation we have found one off-type plant, which resembled the cucumber parent as far as the growth and plant habit is concerned. After crossing this plant to megurk followed by selfing, we found in the F_2 generation: -cucumber type - megurk plants, -megurk plants, unchanged, -plants of a type in between the cucumber-type megurk and the standard megurk.

The cucumber type-megurk plants had much longer internodes than the stand ard megurks, were very susceptible to damping-off, and had long tendrils. For several months they formed only male flowers. Later, they formed hermaphroditic flowers, which were superior and whose carpels had not joined, so the nucelli were easy to see. After this transient period they formed female flowers. Unfortunately, the plants that survived were so old that the pollinated flowers aborted and the plants died.

Spraying the cucumber-type megurk plants in a younger stage with ethephon has not stimulated early production of female flowers. These plants probably have a higher internal level of gibberellic acid, though we did not check it. Chromosome counts of the cucumber-type megurk plants have failed. The so called in - between - type plants were not susceptible to damping-off, were monoecious and had rudimentary tendrils.

C. Continued irradiation of flowering megurk plants. In 1975 we placed 9 groups of flowering megurk plants on different distances from a 137Cs-y source. The distances varied from 1 to 9 m, which corresponded with dose rates varying from 910 - 956 to 16-17 rad per day. The Cs source was operating for 20 or 21 hours per day. The necessary pollinations have been done during the same period of irradiation. The M_2 and M_3 generations of the treated plants yielded some promising genotypes: We found one progeny with very long (± 15 cm) hypocotyls, one progeny with distinct larger leaves and one progeny that contained one plant with a different leaf shape, called sunflower leaf-type. Unfortunately the latter died before yielding any viable seeds.

Although we have tried to repeat the original cross several times under the same circumstances and with the same material, we never succeeded in establishing this cross. Obviously the success of the 1971 cross has been a lucky shot. Because we do not have too much seed of the different progenies mentioned earlier, we must note that there is no seed available.

Our research program for the future is: -Screening the various new types of Megurk plants for resistance to powdery mildew; -Inbreeding of all new types of Megurk plants; -Crossing the various new types with each other and also with the pickle and melon parent.

Effects of Silver Nitrate and Gibberellic Acid on Gynoecious Cucumber

Lower, R. L., D. M. Pharr and E. K. Horst, North Carolina State University, Raleigh, NC 27650.

Research by Beyer (1) and by De Ponti and Kho (2) discuss the effects of silver nitrate alone, and in combination with gibberellic acid, respectively, on sex-expression of cucumber. Preliminary observations in the field in North Carolina indicate that silver nitrate will induce staminate flowers on the gynoecious inbred, 'GY 14', however concentrations greater than 250 ppm resulted in severe phytotoxicity in a fall planting. A more detailed experiment was conducted in the greenhouse during the winter of 1977-78. Five treatments were used and data were collected on staminate flower no., plant height, fruit size and shape (Table 1).

Table 1. Effects of silver nitrate and gibberellic acid on sex-expression and growth of gynoecious cucumber, 'GY 14'.

Treatment[1/]		Plant Height (cm)	Nodes with Staminate Flowers	Fruit Length (cm)	Fruit Diameter (cm)	Fruit Weight (g)
1.	$AgNo_3$ 50ppm (3x)	53.4	3	17.5	7.6	613
2.	$AgNo_3$ 250ppm (1x)	61.2	9	16.3	7.4	464
3.	GA 4/7 50ppm (3x)	115.6	16	17.8	7.6	596
4.	Combination of 1 and 3	114.2	15	18.3	7.9	635
5.	Control	42.9	<1	15.0	6.6	385
	LSD .05	12.3	1.5	1.8	NS	147

1/ Single treatments were made at the first true leaf stage. Additional treatments were made 5 and 10 days later.

Plant height was measured 30 days after the initial treatment and was greatest for the two treatments involving GA. The silver nitrate treatments were not different but were different from the GA treatments. The control was shorter than all treatments except the low rate of silver nitrate.

The GA treatments gave a larger number of staminate nodes than the other treatments and the 250 ppm silver nitrate was more effective than the lower rate of silver nitrate. There was no difference between GA alone or in combination with silver nitrate. Generally, staminate flowers were found at consecutive nodes until pistillate flowers appeared. The presence of both staminate and pistillate flowers at the same node was more common at 50 ppm silver nitrate treatment than at any other treatment.

Fruit from the control plants were shorter than those treated with GA and the lower rate of silver nitrate. Fruit diameter was not affected by treatment. Fruit of the control were smaller than those in all treatments except the high rate of silver nitrate.

Seed yields were inconsistent and no trends or differences were measured. No measurements of pollen viability or amount were made.

There was no evidence of phytotoxicity from any of the treatments.

Literature Cited

1. Beyer, E. Jr., 1976. Silver : a potent antiethylene agent in cucumber and tomato. HortScience 11:195-196.

2. De Ponti, O. M. B., and Y. O. Kho, 1977. Induktie van mannelijke bloei in komkommer en augurk door zilvernitraat: een alternatief voor gibberellzauur? Zaadbelangen 31:53-57.

Association of Fruit Shape and Sex Expression in the Cucumber

Robinson, R. W., New York Agricultural Experiment Station, Geneva, NY 14456.

It has been proposed that a single recessive gene (m) conditions andromonoecious sex expression, and a different but very closely linked locus governs round vs elongated fruit shape in the cucumber. I have never found a single crossover type in F_2 populations of several thousand plants, raising the question if there really are two independent, but completely linked loci for sex expression and fruit shape, or if the two traits are pleiotropic effects of the same gene.

Crossovers were observed between m and the linked gene (l) for fruit locule number, and it was evident that gene interaction influences fruit shape; m + and + l plants always had fruit length intermediate to the elongated fruit of ++ plants and the round fruit of m l plants. Thus, l and other background genes modify fruit shape, but andromonoecious plants always had shorter fruit than their monoecious counterparts. Fruit shape of hermaphrodite plants was similar to that of andromonoecious plants, and gynoecious and monoecious plants were similar in fruit shape.

The monoecious cultivar 'Wisconsin SMR 18' occasionally produces perfect flowers. Typically one flower on a plant will be perfect, while all other flowers on that plant are pistillate or staminate. The incidence of perfect flowers is low, less than one for every thousand pistillate flowers. Significantly, fruit developing from a perfect flower invariably were round, whereas fruit developing from pistillate flowers on the same plant would be elongated. The perfect flowers had normal male and female fertility, and produced only monoecious progeny with elongated fruit when self pollinated. The simultaneous change in both sex expression and fruit shape, therefore, was due to a nongenetic accident in development.

Ethephon application to the andromonoecious cultivar 'Lemon' induced it to develop pistillate flowers. Whereas the perfect flower of untreated plants developed into round fruit, the pistillate flowers of treated plants developed into elongated fruit. Since nongenetic events such as growth regulator application and developmental change simultaneously effects sex expression and fruit shape, and round shape is always associated with perfect flowers, both sex expression and fruit shape are likely affected by the same endogenous hormone. The m gene probably affects the same hormone, and therefore has pleiotropic effects on sex expression and fruit shape.

Fasciation in the Cucumber

Robinson, R. W., New York State Agricultural Experiment Station, Geneva, NY 14456.

Fasciated plants with wide, flattened stems and increased numbers of leaves, tendrils, and flowers per node, frequently occur in the cucumber cultivar 'Lemon' and other andromonoecious cucumber cultivars. Fasciation is associated with opposite leaf arrangement at lower nodes of the main stem. Leaves are borne in decussate arrangement for several nodes on normal appearing stems, then phyllotaxis abruptly changes, leaf arrangement thereafter being alternate and some plants develop a fasciated stem.

Fasciation is recessive; reciprocal crosses between fasciated and normal plants produced only normal plants in the F_1. The ratio of fasciated to normal plants varied significantly in different F_2 populations. Although available genetic evidence is not definitive, it appears reasonable that fasciation is conditioned by a single recessive gene with incomplete penetrance. Genic background likely influences penetrance and expression of the fasciation gene, accounting for the different proportion and degree of fasciation manifested in the F_2 of different crosses. Environmental factors also influence penetrance of the fasciation gene; the proportion of fasciated plants of 'Lemon' was increased by irradiation and growth regulator treatments, but these treatments did not induce fasciation in normal monoecious cultivars.

Linkage Relations of Genes for Tolerance to Powdery Mildew in Cucumber

Robinson, R. W., New York State Agricultural Experiment Station, Geneva, NY 14456.

The F_1 of powdery mildew tolerant 'Ashley' x susceptible 'Lemon' was susceptible to Sphaerotheca fuliginea. The F_2 segregated 193 susceptible : 248 tolerant, in good agreement ($p = .5 - .7$) with the 27:37 ratio expected if tolerance were governed by three complementary recessive factors.

The F_2 data gave no indication of linkage between genes for tolerance to powdery mildew and B, l, pr, yg, or genes for fasciation, leaf size, leaf arrangement (opposite vs. alternate), fruit position (on main stem and laterals vs. only on laterals), spine size and number, and fruit netting. Significant deviations from contingency expected was obtained between powdery mildew genes and m ($p = .02 - .05$) and fruit striping ($p = .01 - .02$). However, this deviation is attributed to chance, since there was a deficiency, not an excess, of parental phenotypes. The F_2 segregation from the repulsion phase cross was 152 + susceptible : 42 m susceptible : 166 + tolerant : 74 m tolerant and 150 nonstriped susceptible : 42 striped susceptible : 166 nonstriped tolerant . 81 striped tolerant.

Other F_2 populations involving 'Ashley' as the powdery mildew tolerant parent segregated for a chlorosis that appeared to be related to manganese deficiency. Complete linkage or pleiotropy occurred between the interveinal chlorosis and susceptibility to powdery mildew.

Gene Linkage in the 'Lemon' Cucumber

Robinson, R. W., New York State Agricultural Experiment Station, Geneva, NY 14456.

The 'Lemon' cucumber is an interesting novelty. Named after its round, yellow fruit, it was apparently introduced in the early 1890's. The slight resemblance of its fruit to a citrus gave rise to an ingenious prevarication in the year 1909. A huckster announced that he had plucked an orange blossom from his daughter's bridal bouquet and used it to pollinate a cucumber plant. The result of this bizarre union was, he claimed, a cucumber plant with fruit like an orange. He offered to sell seed of this marvelous creation for the not inconsiderable sum of a dollar per seed. It was, of course not an interfamilial cross, but rather high priced seed of the 'Lemon' cucumber.

The 'Lemon' cucumber is still grown today by home gardeners, not only for its novelty value but also for its lack of bitterness and its sweet taste. In my refractometer tests of fruit soluble solids, 'Lemon' was higher than all other cultivars.

The 'Lemon' cucumber was introduced to Russia from the U. S. There it was considered so distinctive that it was classified as a new species. Cucumis sphaerocarpus. However, the relatively few genes that distinguish 'Lemon' from other cucumbers, and the complete fertility of crosses between 'Lemon' and other cucumbers, leaves no doubt but that 'Lemon' is a cultivar of Cucumis sativus.

A surprisingly large number of the characters that distinguish 'Lemon' are linked on the same chromosome. Linkage was evident in the F_2 of 'Lemon' x 'Ashley' for genes governing sex expression (m), fruit locule number (l), leaf position (alternate vs. opposite at lower nodes of the main stem), fruit position (on main stem and laterals vs. only on laterals), fruit spine size and number (fine and many vs. coarse and few), fruit shape (round vs. elongated), fruit striping, and ovary shape (pr). Monogenic Mendelian ratios were obtained for m, l, pr, spine size and number, fruit shape, and fruit striping, but not for the other characters of this linkage complex. B, yg, and genes for powdery mildew tolerance segregated independently of this linkage group and of each other.

Complete linkage was noted for m, pr, fruit shape, and spine size and number. It is likely that some or all of these characters are due to the same pleiotropic gene. Crossover types were observed between m and the other linked characters, but pleiotropy cannot be excluded because of the possibility of incomplete penetrance or misclassification. Not all associations were due to pleiotropy, however, and the l locus appears to be distinct from but linked to the m locus.

Pleiotropy would, in part, explain the occurrence of multiple linked factors in 'Lemon'. It is unresolved, however, why so many genes not present in other cucumber cultivars, some linked and others independent, should accumulate in the 'Lemon' cucumber. I would appreciate receiving any information on the origin of the 'Lemon' cultivar.

Linkage of Male Sterility and Sex Expression Genes in Cucumber

Robinson, R. W., New York State Agricultural Experiment Station, Geneva, NY 14456.

A male sterile cucumber, obtained from N. Nakamura, was pollinated with the cultivar 'Lemon'. Linkage was detected between male sterility and the m gene for monoecious vs. andromonoecious sex expression and the l locule number gene (Table 1). The male sterile gene is most closely linked with the m gene. This segment of the chromosome is already well-endowed with genes, if not a very pleiotropic allele, and it may be very genetically active. In another cross, male sterility segregated independently of the gl gene.

Table 1. Linkage tests with the male sterile, m, and l genes.

	Male fertile		Male sterile		
Tester	+	mutant	+	mutant	unclassified
m	130	36	42	0	33
l	78	36	26	4	13

Mutagenic Experiments with the Cucumber

Robinson, R. W., New York Agricultural Experiment Station, Geneva, NY 14456.

Chemical and irradiation treatments were applied to cucumber seed to induce gene mutations. Mutagenic agents and doses that were successful include 5,000 to 30,000γx-rays, 9 to 18 hours of thermal neutrons, 0.5 to 2% ethyl methane sulfonate, 0.5 to 2.0% methyl ethane sulfonate, 0.05 to 0.20% ethylene imine, and .025 to .200% diepoxy butane. The highest dose listed for each agent resulted in the most mutations. The greatest frequency of mutations for all treatments resulted from 18 hours of thermal neutrons.

All mutations observed were recessive. It is necessary, therefore, to self-pollinate M_1 plants. Treated monoecious plants were self-pollinated by hand, but it was possible to use open-pollinated seed for hermaphroditic or andromonoecious plants. The higher degree of natural self-pollination in these plants permits the recovery of recessive mutants in the M_2 generation produced by open-pollination. Both pedigree and mass selection techniques were used.

Recurrent treatments were used to increase the frequency of mutants. Seed of the M_2 generation of thermal neutron treatments was treated again, and the next generation was given the same treatment as before. The next generation segregated for mutants induced by all three treatments, in a frequency much higher than that for any single treatment.

Numerous chlorophyll deficient mutants of many types occurred. Some were nonviable albinos, others were virescent or lutescent, and still others maintained different degrees of chlorophyll deficiency in all stages of development. Male sterile mutants were frequently observed. Other induced mutations affected internode length, leaf shape, trichome development, and flower structure.

Pleiotropic Effects of the Glabrous Gene of the Cucumber

Robinson, R. W., New York State Agricultural Experiment Station, Geneva, NY 14456.

The glabrous (gl) gene of the cucumber was induced by thermal neutron seed treatment. It is a useful seedling marker gene, since the mutant is readily identified in the young seedling stage as well as at all later stages and its fertility is good. It is linked with yc, and segregates independently of B, m, l, and yg.

There has been interest in using this mutant in practical plant breeding programs because of one of its pleiotropic effects; fruit of the mutant lack spines and warts, and have a very smooth, attractive appearance. Efforts to breed cultivars with this gene, however, have not been successful. The primary problem has been the sensitivity of gl plants to stress conditions. Glabrous plants grow very well under optimal conditions, but often are adversely affected by stress. Glabrous plants in the field grew vigorously until the hot, dry conditions of midsummer, when their growth was stunted and they developed a mottle that was not associated with any virus. Glabrous plants in a greenhouse grew luxuriantly at 21°C (day) and 16°C (night), but when transferred to a growth chamber at constant 35°C the gl plants, unlike the normal plants, developed a severe chlorosis on all new foliage, similar to iron deficiency symptoms.

The spines and warts of the fruit are trichomes modified through evolution, and both are affected by the gene controlling trichome formation on the foliage. Still another apparently pleiotropic effect of this gene is on root hair development; gl plants have poorer root hair development than normal, accounting for the sensitivity of plants with this gene to extreme conditions of temperature, soil moisture, and mineral elements.

Spontaneous Mutation in the Cucumber

Robinson, R. W., New York State Agricultural Experiment Station, Geneva, NY 14456.

A search was made for spontaneous mutants among 30,030 plants of 13 cucumber cultivars. Several chlorophyll deficient mutants were found, each conditioned by a different single recessive gene. Surprisingly, male sterile mutants occurred in a frequency much greater than that of all other visible mutants combined.

The overall frequency of male sterile plants was 0.9 per thousand plants. Seed lots of the same cultivar from different seed companies often were similar in male sterile frequency, but cultivars differed significantly. The frequency of male steriles per thousand plants was 2.1 for 'Wisconsin SMR 18' and 2.3 for 'SMR 58', but no male steriles were found among 2,828 plants of 'Pixie'.

The male sterile plants were easily recognized by abortion of their staminate flowers. Pistillate flowers of male sterile plants appeared normal, but the few staminate flowers that developed to anthesis had rudimentary anthers. Fruit set and development of the male sterile plants was normal, and thus male steriles would not be detected when seed production fields are rogued at harvest time. Despite the normal appearance of the pistillate flowers, the mutants had a high degree of female as well as male sterility. The average number of seed per fruit from open-pollinated 'SMR 18' male steriles was only 0.7, and many fruit were parthenocarpic. In controlled pollinations with the same source of pollen, male sterile plants produced an average of 0.3 seed per fruit while normal plants in the same F_2 had 157 seed per fruit.

Monogenic ratios were obtained in F_2 and backcross generations with each male sterile mutant tested. Nine different male sterile mutants of spontaneous origin were sib-mated with normal plants of the same cultivars, and then different F_1's were crossed inter se. In every case, the next generation segregated 3 normal : 1 male sterile. Thus, each of the nine male steriles is conditioned by the same single recessive gene.

Cultivar differences in frequency of this gene may be related to differing proportions of plants heterozygous for this gene in the initial seed released. The high frequency of this gene in commercial seed lots of different cucumber cultivars, despite the selection pressure against homozygotes because of their poor fertility, suggests this may be a very mutable gene.

Screening Cucumbers for Resistance to Pickleworm

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We have developed procedures for rearing and artificially infesting cucumber plants with neonate pickleworm larvae and for visually rating the plant feeding damage. We found that a minimum of ca 100 larvae per plant were required to give a susceptible rating of 4 on a 1-5 scale (1 = no visible damage; 5 = severe damage) using 6-week-old 'Addis' plants and 9 days feeding time when the average daily temperature was 29°C. Survival of the larvae on plants grown inside a screened enclosure ranged from 24 to 57 percent. The movement of laboratory reared larvae on mature host plants and their feeding response were similar to that of natural populations.

More than 300 plant introductions and cultivars were evaluated for resistance under natural populations and those showing least susceptibility were reevaluated with artificial infestations. Significant differences among lines were found for plant feeding damage and weight of surviving larvae. Differences were inconsistent on some entries; others, especially PI 390254, were lower than 'Addis' for damage rating and weight of surviving larvae. Further tests are underway to assess the resistance found in PI 390254 and to identify other sources of resistance.

II. Muskmelon

Dwarf Cantaloupe Breeding

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Numerous short-internode lines of Cucumis melo have been developed. The plants possess partial resistance to powdery mildew, Erysiphe cichoracearum and high level of resistance to alternaria blight, Alternaria cucumerina. The dwarf character was derived from an acquisition obtained from J. L. Bowers, Arkansas Agricultural Experiment Station, Fayetteville, Arkansas 72701. Crosses were made to commercially acceptable cultivars with desirable levels of quality. Crossings were interspersed with various numbers of generations of selfing to fix the dwarf habit. Levels of soluble solids fall generally in the range 10-14 percent, with a few segregates outside that range. Fruit size ranges .7-1.4 kg with good netting and round to oval shape. Flesh is orange-to-deep orange, medium-to-thick wall, with very small-to-small cavity.

Improving Self-Pollinations in Muskmelon

Loy, B. and T. Natti, University of New Hampshire, Durham, NH 03824.

We have been investigating the problem of low fruit set in hand-pollinated muskmelon. Our approach has been based on the postulation that injury of flowers resulting from emasculation could induce wound ethylene. Excess ethylene production at the time of pollination could affect auxin metabolism and thereby reduce fruit set. We have increased fruit set between 25 to 65 per cent by applying 5 µg of an ethylene inhibitor (aminoethoxy-vinylglycine-AVG) in lanolin paste to perfect flowers at the time of clipping the petals shut. We are not ready to recommend AVG for use by breeders because we get better results with benzyladenine (BA). Studies are being conducted which involve combinations of BA and AVG.

We have found that considerable would ethylene is liberated from excised flowers which have been fully emasculated (corolla and anthers removed). Brush-pollinated (bee simulation) flowers produce low levels of ethylene and anther-only emasculation results in intermediate levels of ethylene production. Also, we have obtained about 85% fruit set in the greenhouse with brush-pollination of non-emasculated flowers; under the same conditions fruit set in emasculated flowers was less than 30%. In using the brush technique, the flowers are clipped shut the night before anthesis with Noesting #2 paper fasteners. The fasteners or clips are removed at the time of pollination and a fine-hair brush is gently swirled and dabbed around the anthers and stigma of the flower. The corolla is then clipped shut again with the fastener.

This summer we will conduct self-pollinations on a large scale with the brush method, and will also test the brush method in combination with BA.

Regulation of Sex Expression in Gynomonoecious Muskmelon for Hybrid Seed Production

Loy, B., University of New Hampshire, Durham, NH 03824.

Several approaches for obtaining hybrid seed in muskmelon without hand pollination have been suggested, but all the methods to date have serious limitations. It has been difficult to obtain stable, true-breeding lines of gynoecious muskmelon, and until recently, there were not easy methods for inducing large numbers of male flowers on female strains. The use of ethephon on monoecious lines suffers from the drawback that the induced pistillate stage is of short duration.

Gynomonoecious muskmelon plants are those which produce a flush of pistillate flowers, followed by development of both pistillate flowers and perfect flowers exhibiting various degrees of ovary development. We have found that treatment of gynomonoecious plants with successive foliar applications of 480 ppm ethephon at the 4-leaf stage and one week later, extends the pistillate stage to 16 to 20 days. This assures adequate pollen control for at least the major crown set of the plants.

We have also found that field application of 100 ppm of an ethylene inhibitor (aminoethoxyvinylglycine - AVG) promotes the formation of perfect flowers and some male flowers on the gynomonoecious strain. The results of a greenhouse study indicate that 3 successive weekly applications of 50 to 100 ppm AVG will give excellent results in enhancing perfect and/or male flower formation.

In backcross populations from gynomonoecious x andromonoecious crosses we have been recovering about 3% gynomonoecious plants which have an extended pistillate stage in the field. These plants may or may not be heterozygous for some genes governing the flowering pattern. If the gynomonoecious sex type is easily fixed, then it can be easily adapted for commercial hybrid seed production through the use of ethephon and AVG to further control flowering. The elongate fruit character associated with these plants remains a problem. We have selected a round-fruited monoecious strain, but have had difficulties recovering it in segregating populations.

Cantaloupe: Breeding for Resistance to *Mycosphaerella citrullina*, *Meloidogyne incognita acrita* and *Diaphania nitidalis*

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Multiple disease resistance, including resistance to *M. citrullina* has proven to be adequate for high yields of excellent quality fruit for advanced breeding lines and released varieties. The Hollar and Company, Inc., Rocky Ford, Colorado, has exclusive right to the 'Gulfcoast' and 'Chilton' cultivars.

Plant Variety Protection Certificates Number 73071, Muskmelon, 'Gulfcoast' and Number 73072, Muskmelon, 'Chilton', were granted by the Plant Variety Protection Office in 1977.

Some reports of infection of 'Gulfcoast', 'Chilton' and PI 140471 by *M. citrullina* can be verified. Although infection also occurred on PI 140471, the level of resistance is still very high. Infection of 'Chilton' and 'Gulfcoast' occurred late, therefore damage to production and fruit quality was negligible.

Further attempts to cross *Cucumis melo* (PI 140471) with *C. metuliferus* and *C. anguria* were unsuccessful. One backcross of the *C. metuliferus* x (*C. melo* (PI 140471) x *C. metuliferus*) F_1 was made. Seed from the backcross plants germinated very slowly and lacked vigor in the seedling stages. The backcross plants and progeny are currently being evaluated for plant characteristics and fertility in crosses.

Levels of resistance to the root knot nematode equal to that in *C. metuliferus* have not been secured in progeny from the original interspecific cross. Two methods are currently being utilized to possibly overcome this deficiency. Further attempts to backcross progeny to *C. metuliferus* and sib crossing of F_2 plants which exhibit tolerance levels will be continued.

Resistance to the pickleworm (*Diaphania nitidalis* Stoll) is present in a number of breeding lines. Source of resistance is PI 140471, as reported by W. L. Corley (1). Gautney (2) found that resistance was controlled by multiple recessive genes.

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Tolerance of Melon to Watermelon Mosaic Virus II

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Cucumber mosaic (CMV) is a very common and severe virus on melon in the Southeast of France. While observing different lines in the field to study their resistance, it appears that PI 161375 (received from the Southern Regional Plant Introduction Station, Georgia) was the most resistant one (2). After artificial inoculation with CMV, other lines as LJ 34340, LJ 90436 or Freeman's cucumber were as resistant as PI 161375. After the description of the watermelon mosaic virus (WMV II) in our area (1), we have thought that PI 161375 was more resistant than the other lines to this virus.

After artificial inoculation on the two cotyledons with different isolates of WMV II, a vein-banding with distortion of the leaves appears 12-15 days later on a susceptible cultivar. In PI 161375 distinct vein-banding appears on the first (and sometimes the second) leaf but the following ones are free of symptoms.

We inoculated the two cotyledons of a susceptible line, 'Charentais T' and PI 161375 with two isolates of WMV II. The first symptoms on 'Charentais T' appeared 12 days after inoculation. Fresh and dry matter weights were made weekly. Until the fourth week there were no differences between the inoculated and non-inoculated plants. Five weeks after inoculation, the fresh and dry matter of the inoculated 'Charentais T' was 50-60% of that of the non-inoculated check, whereas the growth of PI 161375 was not significantly affected (Table 1).

Table 1. Drymatter (in grams), 4 or 5 weeks after inoculation with WMV II (2 isolates) of two lines of Melon.

Cultivar	Time of Measurement	Isolates WMV II		Non-inoculated
		MAR	V 107	
'Charentais T'	4 weeks	0.85	1.23	1.06
	5 weeks	1.16**	1.30**	2.16
PI 161375	4 weeks	0.47	0.70	0.63
	5 weeks	0.87	1.22	1.12

** Difference (Prob. <0.01) between the inoculated and non-inoculated plants (Student's test).

After artificial inoculation, the symptoms on PI 161375 were less severe and its growth was less affected than 'Charentais T'. PI 161375 possesses tolerance to WMV II.

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III. Watermelon

Potential Uses of Micropropagation for Cucurbits

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Plant tissue culture offers a potential tool for rapid clonal propagation of most herbaceous plants. For plant breeders, these techniques would allow the rapid multiplication of a particularly desirable genotype; a potential for cost reduction of F_1 hybrids where seed costs are high due to hand labor; and specifically, in the propagation of triploid hybrid plants (e.g. seedless watermelon) and/or their diploid and tetraploid parents.

Attempts to promote adventitious shoots (i.e. shoot apices which arise de nova from differentiated cells) from callus of some species of the Cucurbitaceae has been unsuccessful (Cucumis sps (3)) or has occurred sporadically and at a low frequency for others (Cucurbita pepo (2)). Stimulation of existing axillary meristems can provide shoots which could be used to produce rooted plantlets, or subcultured with continued growth and formation of additional axillary meristems. This repeated stimulation and subculture would allow a geometrical rate of increase for asexual propagation.

Such a system of propagation could potentially be used to reduce the expense of triploid watermelons which cost approximately $150/lb of seed (plus the cost of growing and transplanting the seedling plants to the field) compared to $6.00/lb. for standard diploid cultivars (direct seeded).

Micropropagation of excised axillary buds and seedling shoot tips of triploid watermelons (Citrullus lanatus (Thumb.) Matsum. & Nakai) has been successful in our laboratory. Excised seedling shoots (1-3 mm) with attached cotyledon have been cultured on a modified Murashige and Skoog (M & S) high salts media (4). Optimal axillary bud break occurred with 4.4 μ M/l Kinetin (~ 1ppm) and .28 μ M/l Indole Acetic Acid (IAA) (~ .05 ppm) under long day (16/8 hrs, light/dark) and low light intensities (~ 1000 lux). An average of 4.6 axillary shoots of sufficient size to subculture were obtained from each seedling shoot tip in 35 days. These shoot-cuttings were excised and rooted in one-to-two weeks by subculturing to M & S media with no cytokinins and higher auxin (.28 - 1.43 μ M/l IAA). Rooted plantlets were transferred to soil and normal growth resumed. Alternately, these shoots could be subcultured to fresh media of the original high cytokinin/low auxin ratio, where additional precocious bud break occurred from each new leaf axil. With this continued rate of growth and subculture, 9,000 plantlets could be obtained in six months or 89 million (4.6^{12}) in one year from one original seed.

Excised buds from greenhouse grown vines have also been stimulated to provide shoots from axillary meristems. However, these grow and produce axillary shoots at only 1/3 the rate of the seedling shoots. One might expect that additional research will allow an increase in this lower multiplication rate to be more comparable with that of the seedling shoot.

The practicality of such a system has yet to be proven for watermelon. No cost estimates are presently available for watermelon. However, recent estimates for large scale production (~ 11,000 finished transplants/week) of broccoli plants produced by similar methods, based on a five-fold increase in five weeks, projected a total cost of 15.4¢ per plantlet of transplantable size (1). After initial costs for establishing a laboratory, the highest percentage of cost is due to labor requirements. These costs could conceivably be reduced by modifying this system by using larger culture vessels with media supplied thru capillary mats. Thus, large numbers of explants could be handled at one time, and nutrients and growth regulators could be easily exchanged.

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A Watermelon Bulk Population with Resistance to Cucumber Beetles

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A bulk population of cucumber beetle resistant watermelon has been developed from resistant single plant selections grown in minimum isolation and allowed to open-pollinate for three generations.

The original population was grown at the U.S. Vegetable Lab., Charleston, S.C. Single resistant plants were selected in greenhouse screening tests, using banded cucumber beetles, Diabrotica balteata, from F_2 and backcross generations of crosses between the resistant 'Sugar Loaf' and the following susceptible cultivars: 'Charleston Gray', 'Charleston Gray 133', 'Crimson Sweet', 'Graybelle', 'Sugar Baby','Black Diamond','Cobb Gem', 'Dessert King', 'Dessert Queen', 'Wilson Sweet', 'Orange Flesh Tendersweet', 'Market Midget', 'New Irish Gray', and 'Miss. 1717'. Genetic analyses indicated that resistance was controlled by a single recessive gene.

The procedure by which the bulk population was developed:

1st year - Single resistant seedlings (approximately 40 plants) selected in F_2 and planted in minimum isolation plot approximately 6 x 9 m, protected by similar size plots of cantaloupe and cucumber. O.P. seed were bulked (75/fruit).

2nd year - Bulk planted (approx. 100 plants) in isolation. O.P. seed were bulked (75/fruit).

3rd year - Bulk planted (approx. 200 plants) in isolation. O.P. seed bulked (150/fruit) to form existing bulk population.

During the summer and fall of 1977, the existing bulk population was evaluated for horticultural characteristics and cucumber beetle resistance. Fruit size was large, generally; many would be classed in the 20 kg range. Fruit types were highly variable in shape and color ranging from round to oblong, and from gray to dark green, both solid and striped, although many were oblong, gray types. Seed type varied from very small to large, and from dark brown to white. Flesh type was generally good in appearance. Most fruits had a deep red flesh, although a few were observed with white heart. Of the approximately 200 plants observed, one plant each produced yellow and orange flesh. Soluble solids determined on approximately ¼ of the population ranged from 9.4 - 12.8%. Only 2 plants of these produced fruits less than 10% solids. Average soluble solids for this sample of the population was 11%.

Resistance to spotted cucumber beetles, Diabrotica undecimpunctata howardii, was tested on seedlings from bulked seed of this same population. Tests were conducted in greenhouse cages, using approximately 1 insect per seedling. Seedlings were rated qualitatively as either resistant or susceptible when the susceptible check, 'Charleston Gray' was exhibiting severe damage. The resistant bulk was as resistant or more so than the original source of resistance, 'Sugar Loaf' as shown below:

Population	No. of Seedlings Resist.	Suscept.	% Resist.
Bulk - 77	145	14	91.2
Sugar Loaf	46	5	90.2
Chas. Gray	0	44	0

Thus, a variable population of cucumber beetle resistant watermelons has been developed from which breeders can select desirable types directly, or use as a source of cucumber beetle resistance in breeding programs.

Watermelon: Breeding for Resistance to Mycosphaerella citrullina and Colletotrichum lagenarium

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Severe crop losses and reduced yields of melons have resulted from gummy stem blight (Mycosphaerella citrullina) in certain fields in Alabama. Although the damage seemed to be more widespread in the Gulf Coast area, there have been frequent reports of damage in central and northern Alabama.

Plant introductions, PI 189225 and PI 271778, were recently classified as resistant to M. citrullina. 1/

A planting of PI 189225 and PI 271778 and desirable cultivars was made in the greenhouse in the winter of 1969-1970 to permit crosses of the resistant and susceptible material. A backcrossing and screening program is being followed to incorporate resistance to M. citrullina into commercial types. High resistance in PI 189225 and moderate resistance in PI 271778 are due to two independent and different recessive gene pairs.

Advanced breeding lines with resistance to M. citrullina and high quality fruit were available for evaluation in the Southern Cooperative Watermelon Variety Trials in 1977. A replicated test of six of these lines in 1976 indicated that Auburn breeding lines 1, 3, and 5 are worthy of further evaluation for possible release.

An active breeding program to develop breeding lines resistant to Colletotrichum lagenarium (Race 2) is in progress. PI 189225 and PI 271778 are being used as sources of resistance.

Resistance to C. lagenarium is present in a number of advanced breeding lines from the M. citrullina breeding program.

1/ G. B. Sowell, Jr., Research Pathologist, U. S. Department of Agriculture, S. E. Regional Plant Introduction Station, Experiment, Georgia.

IV. Cucurbita spp.

The Versatility of the Feral Buffalo Gourd, Cucurbita foetidissima HBK

Bemis, W. P., University of Arizona, Tuscon, AZ 85721.

A wild perennial gourd, native to the arid regions of Western North America may be the key to additional food and feed crops adapted to low water use agriculture. This plant is Cucurbita foetidissima HBK, the Buffalo gourd. It has probably been growing in our western deserts long before the advent of man. It has developed a highly efficient method of asexual propagation by producing roots along its vines when they are in contact with moist sand or soil, principally during periods of summer rains. Large homogeneous colonies of plants are formed in this manner. While the asexual propagation is the primary method of reproduction, this plant is still a prolific producer of fruit and seed. A single plant may produce several hundred fruit, each about 7-8 cm in diameter, containing about 300 seeds weighing around 12 grams. The seed when dried contain from 25 to 40 percent oil, and 30 to 40 percent protein. The oil contains about 65 percent linoleic acid, a polyunsaturated fatty acid which is an essential dietary requirement of humans and animals. In addition to the oil and protein of the seed, the vine growth which dies back with the advent of frost can be used as fodder. The perennial root develops into a large fleshy storage root containing 15 to 18 percent starch. A single root several seasons old may weigh 20 to 30 kilograms.

A research program is under way to study the domestication and utilization of this plant which in its own fashion has developed crop attributes and is adapted to our hot dry environments.

Multiple Virus Resistance in *Cucurbita* species

Provvidenti, R., R. W. Robinson and H. M. Munger, New York Agricultural Experiment Station, Geneva, NY 14456.

Adequate levels of resistance to several viral diseases have not been found in cultivated *Cucurbita* species. Therefore, we tested wild species of the genus to determine if genes for virus resistance could be transferred to squash and pumpkin.

Cucurbita martinezii has previously (1) been reported to be resistant to cucumber mosaic virus (CMV), frequently a destructive disease of squash in the Northeast. CMV resistance appears to be the rule, rather than the exception, among wild species of *Cucurbita* (Table 1). All wild species tested, except *andreana*, *sororia*, and *texana*, developed only local necrotic reaction on inoculated leaves without any systemic symptoms of infection.

Resistance was also common for tobacco ringspot virus (TRSV). The three cultivated species and all wild species except *digitata*, *lundelliana*, and *sororia* were resistant, developing only localized nonsystemic symptoms. Resistance to bean yellow mosaic virus (BYMV) was also found in many wild species. Six wild species appeared immune and three were resistant, developing only local symptoms. Six of the 14 wild species were resistant to tomato ringspot virus (TmRSV). Resistance to the important watermelon mosaic viruses (WMV-1 and WMV-2) was less common, but *C. ecuadorensis* and *C. foetidissima* were highly resistant to each strain of the watermelon viruses.

The only important virus of *Cucurbita* for which a high level of resistance was not found was squash mosaic virus. All species became infected, and only *C. ecuadorensis*, *C. okeechobeensis*, and *C. martinezii* recovered from initial systemic symptoms.

Cucurbita ecuadorensis, because of its good resistance to several viruses and compatibility with *C. maxima*, is an excellent source of resistance for that species. *Cucurbita foetidissima* is equally good in virus resistance, but is more refractory for breeding purposes because of interspecific sterility. *Cucurbita martinezii* is not resistant to as many viruses, but can be used to transfer resistance to CMV and powdery mildew (1) to *C. moschata*, and that F_1 can be used as a bridge to transfer these resistance genes to *C. pepo*.

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Table 1. Reaction of Cucurbita species to six viruses.

PRSV-W

Species	Virus					
	CMV	TRSV	BYMV	TmRSV	WMV-1	WMV-2
C. andreana	S*	R	0	S	S	S
C. cordata	R	R	0	S	S	S
C. cylindrata	R	R	S	R	S	S
C. digitata	R	S	S	R	S	S
C. ecuadorensis	R	R	S	S	0	0
C. foetidissima	R	R	0	S	0	0
C. gracilior	R	R	0	R	S	S
C. lundelliana	R	S	S	S	S	S
C. martinezii	R	R	0	S	S	S
C. okeechobeensis	R	R	0	S	S	S
C. palmata	R	R	R	R	S	S
C. palmeri	R	R	R	R	S	S
C. sororia	S	S	R	R	S	S
C. texana	S	R	S	S	S	S
C. maxima	S	R	R	S	S	S
C. moschata	S	R	0	S	S	S
C. pepo	S	R	S	S	S	S

*0 = no infection

S = systemic symptoms

R = resistant, developing local reaction but not systemic symptoms

Comparative Electrophoretic Analysis of Isozymes in *Cucurbita* Species

Puchalski, J. T. and R. W. Robinson, New York Agricultural Experiment Station, Geneva, NY 14456.

A chemotaxonomic investigation of 19 different species of the genus *Cucurbita* including all five cultivated species, was made on the basis of isozymic composition. The multiple molecular forms of esterase, peroxidase, and leucine aminopeptidase in young green leaves were analyzed by starch gel horizontal electrophoresis technique.

Large interspecific differences for all three enzyme systems were observed. The largest differences were for fast migrating anodic isoesterases and for very active cathodic isoperoxidases. On the basis of the similarity of species specific isozyme patterns, all 19 species analyzed were divided into seven different groups. The first group consisted of four very similar species, *C. cylindrata*, *C. cordata*, *C. digitata*, and *C. palmata*. *Cucurbita martinezii* and *C. okeechobeensis* showed uniform patterns for all enzyme systems and were classified together with *C. lundelliana* into the second group. The species *C. foetidissima* contained some unique isoesterases and was delegated alone to the third group. Two other species, *C. texana* and *C. pepo*, showed only small differences in composition of anodic isoperoxidase and some quantitative differences for isoesterases; they comprised the fourth group. Five species showing the highest heterogenity of esterases were classified in the fifth group: *C. moschata*, *C. mixta*, *C. palmeri*, *C. sororia* and *C. gracilior*. *Cucurbita andreana* and *C. maxima* had the same pattern of esterases and leucine aminopeptidases, and differed only for one peroxidase fraction. Both of these species, together with the enzymatically similar *C. ecuadorensis*, were classified in the sixth group. *Cucurbita ficifolia* had some similarity to the species in the sixth group, but in addition contained some specific isoesterases and was classified separately in a seventh group.

'Seminole', a pumpkin cultivated by Indians in Florida for centuries, was previously classified as *C. moschata*. However, on the basis of the same zymogram pattern as *C. mixta*, it appears to belong to that species.

This biochemical classification of the genus *Cucurbita* based on isozymic composition is in close agreement to the numerical taxonomy classification of Bemis and co-workers (1) that was based on morphological characters.

Literature Cited

1. Bemis, W. P., A. M. Rhodes, T. W. Whitaker, S. G. Carmer. 1970. Numerical taxonomy applied to *Cucurbita* relationships. Amer. J. Bot. 57:404-412.

Genetic Variation of Esterases and Peroxidases in an Interspecific *Cucurbita* Cross

Puchalski, J. T., R. W. Robinson, and J. W. Shail, New York Agricultural Experiment Station, Geneva, NY 14456.

The aim of this preliminary study was to investigate the inheritance and linkage relations of multiple electrophoretic forms of esterases and peroxidases in an interspecific cross between *Cucurbita moschata* cv.'Butternut' and *C. martinezii*. The zymogram method, with starch gel as the separation medium, was used to analyze isozymes extracted from young leaves of the parents, F_1, F_2, and backcross of the F_1 to *C. moschata*.

C. moschata and *C. martinezii* differed in their pattern of both enzyme systems. The largest differences observed were for fast migrating anodic isoesterases. *Cucurbita moschata* contained two very active peroxidase bands, Px1 and Px3, that were not present in *C. martinezii*. *Cucurbita martinezii* showed three additional specific peroxidase bands, Px2, Px4a, and Px4b. The bands Px1, Px2, Px3, and Px4a were all found in the F_1, but their intensity was lower than in the respective parents. The F_2 population segregated for all these bands, but Px1 was always associated with Px3 and segregates with Px2 always had Px4a. The backcross (F_1 x *C. moschata*) generation also showed a similar association of Px1 with Px3 and of Px2 with Px4a. Nineteen backcross plants had a peroxidase zymogram pattern characteristic of *C. moschata*, and nine were similar to that of the F_1.

Eleven electrophoretic esterase bands were found in *C. moschata*, but only four occurred in *C. martinezii*. Four isoesterase bands showing the fastest migration on the gel and two bands with a more moderate rate of migration, found in *C. moschata* but not in *C. martinezii*, were under dominant genetic control. They occurred in the F_1 and segregated in the backcross (F_1 x *C. moschata*) as well as in the F_2. *Cucurbita martinezii* contained two specific esterase bands, one very active and the other lightly stained; they were both present in the F_1 and segregated independently in the F_2 and backcross generations.

Linkage was not detected between esterase and peroxidase genes and morphological traits.

Insect Associations with Cucurbita in Illinois

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For the past seven years we have evaluated the host preference of several insect species that were attracted to five cultivated and 14 mesophytic and xerophytic wild Cucurbita spp. The striped cucumber beetles, Acalymma vittata, were most attracted to the young growth of the Maxima and Ficifolia groups and the wild xerophytic Digitata group. The spotted cucumber beetle, Diabrotica undecimpunctata howardi, exhibited a high affinity for the Maxima, the wild Lundelliana and Digitata groups. The western corn rootworm, Diabrot vigifera, preferred the Digitata and the Lundelliana groups. The squash vine borer, Melittia cucurbitae, severely injured the Maxima and Pepo groups. The squash bug, Anasa tristis, show a high ovipositional preference for the Maxima and Mixta groups. All Cucurbita spp. were poor hosts for the melon aphid, Aphis gossypii, with the wild Sororia and Ficifolia groups most suitable for reproduction. The potato leafhopper, Empoasca fabae, preferred cultivated species but oviposited on all wild species except C. foetidissima. The potato aphid, Macrosiphum euphorbiae, preferred the Sororia and Pepo groups. Overall C. moschata showed the most resistance to the various insect species.

Systematic counting of cucumber and corn rootworm beetles in Cucurbita blossoms was conducted from June to October, 1977. The striped cucumber beetle was the dominant species in June, followed by western corn rootworm, and finally by southern corn rootworms. The population of northern corn rootworms, Diabrotica longicornis, was low throughout the season.

Gynoecious Sex Expression in *Cucurbita* Resulting from an Interspecific Cross

Robinson, R. W., M. A. Boettger, and J. W. Shail, New York Agricultural Experiment Station, Geneva, NY 14456.

The 'Buttercup' and 'Golden Delicious' cultivars of *Cucurbita maxima* were crossed with the 'Butternut' and 'Waltham Butternut' cultivars of *C. moschata*. Each parent was monoecious, producing many more staminate than pistillate flowers. Each of the four interspecific hybrids, however, was highly female in sex expression. In one year the hybrids were predominantly female, developing many pistillate but also a few staminate flowers. In other years, the hybrids were gynoecious. No differences were noted in reciprocal crosses.

The buff skin color of mature fruit of 'Butternut' and 'Waltham Butternut' was recessive to the green skin of 'Buttercup' and to the orange skin of 'Golden Delicious'. The fruit shape of the hybrids was intermediate to the parents, and the blossom end protrusion of 'Buttercup' fruit was recessive. The fleshy peduncle of the *C. maxima* parents was also recessive. The deeper orange flesh color of the *C. maxima* parents was dominant to the lighter flesh color of the *C. moschata* parents. The *C. maxima* parents are more tolerant to powdery mildew than the *C. moschata* parents, and this was a dominant trait. The interspecific hybrids were resistant to the squash vine borer, similar to the *C. moschata* parents. The interspecific hybrids were very attractive, early in maturity, very high yielding, and exceptionally good in quality.

The desirable features of the interspecific hybrids stimulated interest in developing derived breeding lines, but the lack of staminate flowers restricted selfing the hybrids or using them as pollen parents. Attempts were therefore made to induce staminate flower development by application of gibberellic acid, GA 4/7, at the rate of 50, 100, or 200 ppm, was applied in the first true leaf stage. Other plots received a second application of the same concentration a week later, and three weekly applications of each of the three concentrations were applied to other plots. Each of the GA treatments was successful, stimulating the development of staminate flowers. Pistillate flower formation was reduced by each GA treatment, but not to the extent to interfere with fruit production; the number of pistillate flowers per plant for a 22-day period ranged from 29.0 for untreated hybrids to 15.1 for plants given 3 applications of 200 ppm, and there were no significant differences in fruit production among the treatments. Although the GA treatments increased staminate flower and reduced pistillate flower formation, all treated plants were still predominantly female in sex expression.

The interspecific hybrids were highly sterile. Normal appearing staminate flowers of the hybrids had reduced amounts of pollen, and the pollen of the

hybrids averaged only 7.7% stainable with acetocarmine in contrast to over 90% for the parents. There were no significant differences among the GA treatments and the check for pollen stainability. The hybrids produced a high proportion of abnormal staminate flowers. The petals and sepals of these flowers were normal in appearance, but the androecium was reduced in size or absent. Pollen produced by these flowers was scanty and even less fertile than that of normal appearing flowers, averaging only 1.8% stainable. The hybrids had a high degree of female as well as male sterility as indicated by the poor seed production in reciprocal backcrosses between the hybrids and the parents.

Good fruit set was obtained from self- and sib-pollinations of the interspecific hybrids, but viable F_2 seed was not produced. Several months storage of self-pollinated F_1 fruit before seed extraction, to permit further development of the seed, did not improve seed viability. Gibberellic acid treatments did not affect fertility of the F_1 plants. Viable seed was produced by the hybrids in open-pollination and by backcrosses to 'Buttercup', and the amounts were low and the seeds were very light and flat. These seeds had very poor endosperm development, and germinated better when cultured on White's media with 1 ppm IAA, than when planted on germination blotters.

Genetic Differences in Sex Expression and Response to Ethephon in Summer Squash, Cucurbita pepo L.

Shannon, S. and R. W. Robinson, New York Agricultural Experiment Station, Geneva, NY 14456.

Problems have been encountered in the commercial production of hybrid seed of summer squash when recommended rates of ethephon application were used to inhibit staminate flower production on the maternal inbred parent. The label recommendation of 88 g ethephon/ha in 370 to 940 l (100 to 250 ppm) applied once in the 2-leaf stage has often been insufficient to prevent staminate flower formation, and costly manual removal of staminate flowers has been necessary to prevent self- and sib-pollination of the maternal parent of a hybrid. Experiments were therefore conducted with different concentrations and times of application under actual commercial conditions in the field for seed production of summer squash. These tests were conducted in cooperation with the Robson Seed Co.

Three monoecious inbred lines of Cucurbita pepo differing in degree of femaleness were used as maternal parents. They included a strongly female 'Cocozelle' type, a strongly male 'Yellow Crookneck' inbred, and a 'Yellow Straightneck' line of standard monoecious type. Ethephon was applied the first year at rates of 125 to 375 ppm in 1 to 3 applications, but none of these treatments reduced staminate flower formation sufficiently to permit hybrid seed production without manual defloration of the maternal parent. The next year one to three applications of 200 to 600 ppm was applied at different stages of seedling development. The 600 ppm rate applied at the 2 and 4 leaf stages was the most effective treatment for reducing male flower formation. None of the treatments affected seed yield or quality.

Genetic differences in responsiveness to ethephon were noted. The 'Yellow Crookneck' inbred, the most strongly male line in the tests, was the inbred least responsive to ethephon.

Compact Mutations in Cucurbita pepo L. Induced by Ethyl-Methanesulfonate

Whitwood, W. N. and J. L. Weigle, Robson Seed Farms, Hall, NY 14463.

Seeds of Cucurbita pepo cv. Early Prolific Straight Neck, were treated with a .035M solution of ethyl-methanesulfonate (EMS) for 24 hours at room temperature. The M_1 plants were selfed in the field to form the M_2 generation. Twenty M_2 seeds were planted in flats and grown until the 2 true-leaf stage in the greenhouse. Two M_2 lines, entries 185 and 623, segregated for a mutant plant habit phenotypically resembling that of the extreme dwarf gourd previously reported by Scarchuk (1). Plants with the compact habit were slower to germinate, had small hypocotyls, and compact nodes compared to the normal. In the greenhouse, the pistillate flower development was greatly reduced and 2-3 weeks later the staminate flower formation was also slower with only 3-4 flowers per plant. Several attempts to self or sib the extreme dwarf plants in the greenhouse failed to produce any fruit. Normal plants from entry 185, entry 623 and extreme dwarf gourd were selfed and the progenies examined for the occurrance of extreme dwarf seedlings (Table 1). Segregation for the two mutant entries and for the extreme dwarf gourd indicated simple monogenic inheritance.

An allelism test was conducted between the two compact mutants isolated from 'Early Prolific Straight Neck' and an F_1 gourd heterozygote (normal gourd x extreme dwarf gourd). The data from these backcrosses (Table 1) indicates that the two compact mutants isolated from 'Early Prolific Straight Neck' were the same allele as the naturally occurring mutation in gourd.

Table 1. Plant habit segregation in an F_2 and backcross generation for two induced compact mutations and extreme dwarf mutation in gourds, (C. pepo).

			Observed	Ratio	χ^2	Probability
F_2	Entry 185	compact	26	1		
		normal	101	3	1.61	.10-.25
F_2	Entry 623	compact	28	1		
		normal	101	3	0.731	.25-.50
F_2	Gourd selfed Ex	compact	30	1		
		normal	96	3	0.099	.75-.90
BC	(Normal gourd x extreme dwarf gourd) x 185 compact	compact	290	1		
		normal	328	1	2.35	.10-.25
BC	(Normal gourd x extreme dwarf gourd) x 623 compact	compact	166	1		
		normal	179	1	0.491	.10-.25
BC	(Normal gourd x extreme dwarf gourd) x extreme dwarf gourd	compact	98	1		
		normal	96	1	0.02	.75-.90

Literature Cited

1. Scarchuk, John. 1974. Extreme dwarf gourd Cucurbita pepo. var. ovifera Alef. HortScience 9:135.

Natural and Induced Mutations in C. Pepo

Whitwood, W. N. and J. L. Weigle, Robson Seed Farms, Hall, NY 14463.

Mutations were induced in a cultivar of C. pepo, 'Early Prolific Straight Neck', by Ethyl-methanesulfonate (EMS). A 0.035 m concentration of EMS was used to treat 2,000 seeds for 24 hours. The seeds were rinsed in distilled water, treated with a fungicide and planted in the field. An untreated population was soaked in water and treated with a fungicide to serve as a check. Germination of the treated population was 60% vs. 93% in the check population. The number of off-type plants and fruit characters in the M_1 generation was not statistically different between the treated and untreated population. From the M_1 selfed plants, 946 M_2 entries were grown in the greenhouse and remnant seed was planted in the field. The seedling mutations observed in the greenhouse included 31 lines with chlorophyll deficiencies, 5 lines with abnormal foilage, and 2 lines with compact plants. In the field 1 line segregated for male sterility, 1 line segregated for fasciated plant habit and 5 lines with temperature induced chlorosis were found. Adverse field environmental conditions probably contributed to the low number of mature plant mutations observed. The M_2 entries which segregated for seedling mutation were selfed to produce the M_3 generation.

In the M_3 generation, 17 of the M_2 entries segregated for a similar phenotypic mutation. The M_3 populations for the remaining M_2 entries were not sufficiently large to ascertain if the M_2 mutation was genetically controlled. Two new seedling mutations were observed in the M_3 generation. These mutations were different from the ones observed in the M_2 generation.

The mutation frequency in the M_2 generation was 4.62% for the EMS population compared to a mutation frequency of 1.01% observed in the untreated population. The mutation frequency in the M_3 generation was 6.89%.

One hundred fifty-five bush and semi-bush plant introductions of C. pepo were observed for seedling mutations. Two accessions PI 288241 and PI 172866 segregated for a yellow lethal character. A third accession, PI 169435 segregated for a light green chlorotic plant character. The inheritance of these mutations were not studied due to the difficulty in obtaining selfed fruit under greenhouse conditions.

V. Other genera and species

Dormancy of *Cucumis* Species

Heit, Claude, R. W. Robinson, and W. Mishanec, New York Agricultural Experi Station, Geneva, NY 14456.

Dormancy is seldom a serious problem with seed of cucumber and muskmelon. Freshly harvested seed may be dormant, but this can usually be easily overcome by removal of the seed coats or by storage after harvest. Seed of certain other *Cucumis* species, however, have a dormancy that does not respond to aging or seed coat removal. Interspecific hybridization experiments were hampered by the seed dormancy of these species, prompting this investigation to find a suitable method to break dormancy.

Seed of different *Cucumis* species were placed on blotters in Petri dishes at constant 20°C in darkness to determine the extent of seed dormancy. Species that were not dormant, but germinated within a week, included *Cucumis africanus* var. *anguria*, *C. anguria* var. *longipes*, *C. dipsaceus*, *C. heptadactylus*, *C. hirsutus*, *C. melo*, *C. metuliferus*, *C. prophetarum*, *C. sativus*, *C. sativus* var. *sikkimensis*, *C. trigonus*, and *C. zeyheri*. Species that did not germinate in this experiment were *C. africanus*, *C. ficifolius*, *C. leptodermis*, and *C. myriocarpus*.

One year old seed of PI 264217, an accession of *C. myriocarpus*, was selected for further study. Pretreating the seed for 8, 16, or 24 hours with 5% H_2O_2, scarification by nicking the seed coat or by 30 minutes immersion in sulfuric acid, variations in moisture on the germination blotter, and applications of KNO_3 or 2, 50, or 500 ppm gibberellic acid did not improve germination. Little response was noted to light, but temperature treatment were very effective for breaking dormancy (Table 1). Seed was dormant at low temperature, but germinated at warm temperature. Seeds dormant after 4 weeks at 15°C had 93% germination within a week after the temperature was increased to 25°C. Good germination was achieved with diurnal variation in temperature, fluctuating at 12-hour intervals from 30°C to 10 or 20°C. Prechilling the seed at 3-5°C improved germination, but prolonged prechilling was insufficient to overcome the dormancy occurring at low temperature.

The *Cucumis* species with seed dormancy are of African origin and adapted to tropical conditions. Dormancy at low temperature may have been favored by natural selection to delay germination until conditions are suitable for good growth and development.

Table 1. Influence of temperature and light on germination of *Cucumis myriocarpus*.

No. days prechilled at 3-5°C	Germination conditions	% Germination by days			
		7	14	21	28
none	15°C light	0	0	0	0
none	15° dark	0	0	1	1
none	20° light	0	0	0	2
none	20° dark	0	3	3	9
none	25° dark	8	14	15	16
none	10-30° light	8	40	57	78
none	15-30° light	3	9	10	12
none	20-30° light	7	11	16	18
none	20-30° dark	11	20	30	33
20	25° dark	81	85	87	--
20	10-30° light	90	93	93	--
20	20-30° light	74	87	88	--
30	25° dark	83	88	90	--
30	10-30° light	40	72	91	--
30	20-30° light	86	90	--	--
45	20° light	4	10	11	12
45	20° dark	31	34	38	43
45	25° dark	89	90	90	--
45	10-30° light	70	83	87	--
45	20-30° light	78	81	--	--
150	15° light	0	1	4	4
150	20° light	0	10	12	12
150	10-30° light	70	78	80	81
150	20-30° light	76	82	82	82

White Fly Resistance in *Cucumis* Species

Kowalewski, E. and R. W. Robinson, New York State Agricultural Experiment Station, Geneva, NY 14456.

Cucumis species were evaluated for resistance to natural infestation with white flies in the greenhouse. Scanning electron and stereoscope microscope studies were made to determine if white fly resistance is related to morphology or density of leaf trichomes. White fly resistance was compared to cucurbitacin content, as determined by ultraviolet fluorescence of chloroform leaf extracts treated with antimony trichloride.

The three species with the greatest density of trichomes, *C. dinteri*, *C. angolensis* and *C. asper*, were the species most resistant to white flies (Table 1). Overall, trichome density was inversely correlated with frequency of adults ($r = -.89$), pupae ($r = -.39$), larvae ($r = -.61$), and eggs ($r = -.53$) of the white fly, but this relationship was not evident among species having trichomes spaced further apart than the size of the white flies. White fly resistance did not appear to be related to any morphological feature of the trichomes, and none of the species had glandular trichomes. No correlation was noted between cucurbitacin content and white fly infestation.

Table 1. Number of Trichomes and Different Stages of the White Fly on Leaves of *Cucumis* species.

Species	Trichomes[1]	Eggs[1]	Larvae[1]	Pupae[1]	Adults[2]
C. prophetarum	34	108	199	12	9.0
C. trigonus	24	175	236	148	9.0
C. sativus	33	151	177	168	8.8
C. heptadactylus	14	257	197	18	8.5
C. ficifolius	18	64	119	10	8.5
C. leptodermis	34	173	144	98	8.5
C. longipes	38	160	166	133	8.2
C. metuliferus	26	82	119	63	8.0
C. hookeri	40	102	144	72	8.0
C. dipsaceus	62	123	99	28	7.5
C. anguria	45	234	226	74	7.5
C. zeyheri	43	106	121	40	7.1
C. pustulalus	30	46	70	19	7.0
C. myriocarpus	32	52	36	35	6.5
C. africanus	52	107	103	38	5.8
C. melo	56	88	77	17	5.0
C. asper	110	44	44	2	2.0
C. angolensis	117	44	86	13	2.0
C. dinteri	200	12	4	0	1.5

1/ Mean number per unit area of lower leaf surface.
2/ Subjectively rated from 1 (resistant) to 9 (susceptible).

1/ Present address: Research Center for Varieties of Agricultural Crops, Slupia Welkia, Poland.

Interspecific Crosses of *Cucumis* Species

Norton, J. D., Auburn University Agricultural Experiment Station, Auburn, AL 36830.

Interspecific crosses among *Cucumis melo*, *C. metuliferus* and *C. anguria* have been attempted over a ten year period. In greenhouse experiments one cross of *C. melo* x *C. metuliferus* was accomplished. Further attempts to make this cross resulted in an occasional fruit set with normal fruit and seed development; however, the embryos aborted before seed maturity. Embryos were removed before abortion and grown to maturity.

In growth chamber tests, crosses among *C. melo*, *C. metuliferus*, and *C. anguria* were made. Different environmental conditions were required to effect crosses of *C. anguria* and *C. metuliferus* with *C. melo* than for the reciprocal cross.

Comparative Electrophoresis of Isozymes of *Cucumis* species

Puchalski, J. T., R. W. Robinson, and J. W. Shail, New York Agricultural Experiment Station, Geneva, NY 14456.

Electrophoretic patterns of esterase, peroxidase, and leucine aminopeptidase of 24 different *Cucumis* species were compared. Large differences between several species were found for all these enzyme systems, but some other species showed a large degree of isozymic pattern similarity. For example, the zymograms of *C. myriocarpus* and *C. leptodermis* were identical, and similar to those of *C. africanus*, *C. zeyheri*, *C. meeusii*, and *C. anguria*.

Cucumis longipes, which has been classified as a subspecies of *C. anguria*, differed from *C. anguria* in specific esterase bands. The isozyme evidence does not support the theory that *C. longipes* is the direct progenitor of *C. anguria*.

According to isozyme analysis, *C. angolensis*, *C. dinteri*, *C. sagittatus*, and *C. asper* appear to be taxonomically closely related. Isozyme patterns distinctly different from all other species were found for *C. dipsaceus* and for *C. heptadactylus*.

Cucumis trigonus was enzymatically very similar to muskmelon, and appears to be a subspecies of *C. melo*. Two other species, *C. hirsutus* and *C. humifructus*, are distinctive in enzyme patterns, yet possess some common bands of esterase and peroxidase with *C. melo*.

Cucumis sativus and *C. hardwickii*, the only species with 14 chromosomes, were very distinctly different in isozymes from all species with 24 or 48 chromosomes. The zymogram of *C. hardwickii* was very similar to that of some cucumber varieties. According to these results, it should be classified as a subspecies of *C. sativus* rather than as a distinct species.

Interspecific Hybridization of *Cucumis*

Robinson, R. W. and E. Kowalewski, New York Agricultural Experiment Station, Geneva, NY 14456.

Diallel reciprocal cross pollinations were made among cucumber, muskmelon, and 19 wild species of *Cucumis*. The only species that crossed with the cucumber was *C. hardwickii*, and *C. trigonus* and *C. callosus* were the only species to cross with the muskmelon. In each of these crosses there was no sterility barrier; the cross was easily made and the F_1 was fully fertile. In morphology as well as in compatibility, *C. hardwickii* appeared to be a subspecies of *C. sativus*, and *C. trigonus* and *C. callosus* appeared not to be valid species but rather subspecies of *C. melo*.

Fruit set was obtained on cucumber, but not on muskmelon, when pollinated with other *Cucumis* species. No seed was produced however, and embryo culture attempts were unsuccessful. Viable seed was produced by *C. metuliferus*, but the progeny of interspecific matings were identical to the maternal parent, probably due to apomixis.

Gene interchange is possible among *Cucumis anguria*, *C. longipes*, *C. hookeri*, *C. leptodermis* and *C. zeyheri*, since crosses were made among all these species and the hybrids were fertile. Crosses were also made between *C. africanus* and *C. membranifolius*, *C. prophetarum* and *C. pustulatus*, and between *C. dipsaceus* and *C. prophetarum*.

Gene Nomenclature Rules for the Cucurbitaceae

Robinson, R. W., New York State Agricultural Experiment Station, Geneva, NY 14456.

The Pickling Cucumber Improvement Committee voted unanimously on October 18, 1977, to adopt the proposed (1) nomenclature rules for genes of the Cucurbitaceae. Discussion at the annual PCIC meeting brought out the following considerations:

Rule 1 states that the names of genes should describe a characteristic feature of the mutant in a minimum number of words. It was emphasized that the name chosen for a mutant should be as descriptive as possible, for descriptive names are a mnemonic aid and encourage use of the mutant by researchers with an interest in its phenotype. Names such as that of the chlorophyll deficient (cd) gene of the cucumber are not as descriptive as, for example, pale lethal (pl); both cd and pl are lethal, but the name of only one of the mutants describes this feature of its phenotype. Other chlorophyll deficient mutants of the cucumber, such as variegated virescent (vvi), have good descriptive names since they characterize the chlorophyll pattern and its change during development.

Rule 2 states that gene symbols should be a minimum number of italicized Roman letters. There is no need to use more than 3 symbols for a gene of any cucurbit at this time. Although short names and a minimum number of letters in the symbol are generally preferable for simplicity, the name should not be so short that it is not sufficiently descriptive. As examples of names and symbols that are overly abbreviated, we have the dark (D) gene and the light (l) gene of Cucurbita pepo; longer gene names and symbols would be desirable, to inform that D affects stem color and l fruit color.

The third rule states that the name and symbol for a gene should pertain to the mutant allele, and the normal or wild type allele should be given the symbol "+". To conserve gene symbols, this rule was not made retroactive. Genes which were previously named after the normal rather than the mutant phenotype were not changed, but gene names and symbols proposed in the future must relate to the mutant to be acceptable.

Some cucurbit genes were named in the past only on the basis of F_1 data or speculation. These gene symbols were not accepted, of course, and rule 4 requires that statistically valid segregation data be provided for each proposed gene.

Mimic series are permitted, but not required, by rule 5. Examples of such series, where different mutants with similar phenotypes have the same symbol followed by distinguishing numbers, are the ms-1 and ms-2; pm-1, pm-2, and pm-3; and yc-1 and yc-2 genes of the cucumber.

Rule 6 states that multiple alleles should have the same symbol, followed by a different letter or number superscript. A multiple allelic locus has been proposed for fruit skin color in the watermelon, with g conditioning light green skin, g^s striped green skin, and g^+ dark green skin.

Alleles of the same locus with identical phenotypes preferably should be given the same symbol. However, if there is reason to symbolize apparent reoccurrences of a previous mutation, rule 7 states that they should have the same symbol as the original mutant with distinguishing numbers or letters in parentheses or superscripts.

Rule 8 states that modifying genes may either have distinctive names and symbols or they may have a symbol for an appropriate name, such as intensifier, suppressor, or inhibitor, followed by a hyphen and the symbol of the allele affected. Examples of the latter are the In-de and In-F genes of the cucumber.

The only reason why gene symbols were revised (1) is because that symbol had previously been used for another gene. Rule 9 states that priority in publication is the primary consideration for establishing the preferred symbols. A very large number of cucurbit genes were given symbols that had previously been proposed for other genes, and in many cases several different symbols were used for the same gene. All such cases were revised on the basis of priority.

Literature Cited

1. Robinson, R. W., H. M. Munger, T. W. Whitaker, and G. W. Bohn. 1976. Genes of the Cucurbitaceae. HortScience 11:554-568.

STOCKS AND GERM PLASM DESIRED OR FOR EXCHANGE

Stocks Desired

J. M. Crall

Watermelon lines with gummy stem blight resistance for crossing with the most advanced lines in our progeny selection program.

T. P. M. den Nijs

In research for resistance to several cucumber diseases (notably Cucumber Green Mottle Mosaic Virus, black root rot caused by Phomopsis sclerotoides, and rootknot nematodes) the Institute for Horticultural Plant Breeding has started a program of interspecific hybridization in Cucumis. Despite vigorous acquisition efforts the available Asiatic wild and feral material remains scanty. These accessions deserve much evaluation because less severe hybridization problems are to be expected. Therefore, we request any wild or feral cucumber material of Asiatic origin, including the Turkey-Lebanon area. Screening data, identification, somatic chromosome number and crossing behavior will be supplied.

M. Pitrat

Material resistant to CMV and WMV.

R. W. Robinson

Cucurbita californica

C. fraterna	C. hystrix	C. seretoides
C. galleattii	C. kalahariensis	C. setosus
C. mammeata	C. laevigatus	C. sonderis
C. mooreii	C. lyratus	C. subsericeus
C. pedatifolia	C. microspermus	C. umbrosus
C. radicans	C. muriculatus	C. welwitschii
C. scabridifolia	C. purpureus	C. wildemanianus
C. globosum	C. quintanilhae	Cucumis cogniauxianus
C. gossweileri	C. rigidus	Cucumis mascatensis
C. halabarda	C. sacleuxii	
C. homblei	C. sereti	

Any species of the following genera:

Abobra	Cucurbitella	Herpetospermum	Rhynchocarpa
Acanthosicyos	Dactyliandra	Hodgsonia	Rosanthus
Actinostemma	Dendrosicyos	Hymenosicyos	Ruthalicia
Adenopus	Dicadiospermum	Marah	Schizocarpon
Ahzolia	Dicaelospermum	Melancium	Sechiopsis
Anguria	Dieudonnaea	Melothrianthus	Selysia
Antinostemma	Dimorphoch lamp	Microsechium	Sicydium
Bambekea	Doyerea	Myrmecosicyos	Tecunumania
Biswarea	Edgaria	Oreosyce	Toxanthera
Blastania	Edmondia	Penelopeia	Trochomeriopsis
Calycophysum	Eureiandra	Peponia	Tumamoca
Cephalandra	Fevillea	Peponopsis	Warea
Cerasiocarpum	Frantzia	Physedra	Wilbrandia
Ceratosanthes	Gomphygyne	Pittera	Zanonia
Cionosicyos	Guraniopsis	Posadaea	Zygosicyos
Cogniauxia	Gyrrardanthus	Praecutrullus	
Ctenolepis	Halosicyos	Raphanocarpus	
Cucumella	Helmonthia	Raphidiocystis	

Stocks for Exchange

W. P. Bemis

Cucurbita foetidissima, Buffalo gourd, Arizona Hybrid #1, (158 x 142). This hybrid seed has been produced utilizing the gynoecious character segregating in experimental lines of C. foetidissima. It represents a relatively homogeneous seed source when compared to composites of wild collections.

J. M. Crall

Watermelon lines with large fruit size, combined resistance to wilt and anthracnose, intense red flesh color, and high soluble solids juice; also we could furnish small samples of seed of our mosaic-tolerant (?) lines.

T. P. M. den Nijs

We are offering a number of accessions of wild Cucumis material, most of which has been obtained from botanical gardens, with no stated origin. P.I. accessions are not included.

C. africanus
* 0162 H.V. Naaldwijk, Neth.
* 0181 H.V. HB Kopenhagen, Den.

C. anguria
* 0198 H.V. HB Pisa, It.
0330 HB Coimbra, Port.
1164 Suriname (W.I.G.)
1757 HB Canberra (Austr.)
1758 HB Kew, Eng.

C. callosus
1706 VIR, USSR
* 1739 H.V. IARI, India
1761 Hyderabad, India

C. dipsaceus
* 0163 H.V. Naaldwijk, Neth.
1728 Curacao
1733 VIR, USSR
1744 ZGK, DDR

C. figarei
* 1706 H.V. VIR, USSR

C. melo var. agrestis
1165 H.V. North Nigeria
* 1743 H.V. Turkey

C. metuliferus
* 0164 H.V. Naaldwijk, Neth.
1734 VIR, USSR
1747 ZGK, DDR
1768 Birmingham, Engl.
1771 Providenti, Geneva, NY, USA

C. myriocarpus
* 0165 H.V. Naaldwijk, Neth.
* 0182 HB Kopenhagen, Den.
* 0184 H.V. HB Kew, Engl.
0202 H.V. HB Poznan, Pol.
1735 VIR, USSR
1737 H.V. HB Lyon, Fr.
* 1742 H.V. HB Lodz, Pol.
1749 HB Salisbury, Zimbabwe
1750 ZGK, DDR
1763 HB Gottingen, BRD

C. prophetarum
1690 Weibull, Sweden
1736 VIR, USSR
1751 HB Mozambique
1752 Swarup, India

C. hardwickii
1738 VIR, USSR
1759 Kohli, India

NOTE: The accessions marked with an asterisk (*) are available now; others should be increased by October, 1978. The accessions marked with H.V. have been identified by IVT's Dept. of Taxonomy.

A. M. Rhodes

Cucurbita mixta cv. 'Mixta Gold', available for preliminary trial. A mutant of 'Green Striped Cushaw'; fruits mostly golden in color with underside green. Like other cvs. it is more susceptible to powdery mildew than C. moschata. Compare with 'Green Striped Cushaw'. Probable use: Ornamental. C. sororia, C. gracillior, C. palmeri, C. andreana and C. texana.

R. W. Robinson

Cucurbita andreana, C. ecuadorensis, C. foetidissima, C. lundelliana, C. okeechobeensis, C. texana.

J. C. Taylor

Watermelon, sources of resistance to fusarium wilt and lines with good internal quality.

CUCURBIT GENETICS COOPERATIVE - Members

1. Adams, H. Northrup, King and Company, Post Office Box 1406, Woodland, CA 956 Breeding commercial cultivars.

2. Angell, F. A. L. Castle, Inc., Post Office Box 279, Hollister, CA 95023. Cucumbers, squash, melons - breeding, genetics, variety development.

3. Armstrong, G M. Department of Plant Pathology, Experiment Station, Experime GA 30212. Wilt reactions (Quasrium oxysporum ff. spp.).

4. Azhar, Mohammad. 1850 Hanover Drive, #120, Davis, CA 95616. Muskmelon bree

5. Baker, L. R. 14205 Dunn Road, Haslett, MI 48840.

6. Balgooyen, B. Northrup, King and Company, Post Office Box 959, Minneapolis, MN 55440.

7. Bemis, W. P. Department of Plant Science, University of Arizona, Tuscon, AR 85721.

8. Central Library of Agricultural Science, Attention: Mr. P. Tuva, Post Offic Box 12, Rehovot, Israel.

9. Chambliss, O. L. Department of Horticulture, Auburn University, Auburn, AL 36830.

10. Chermat, M. C. Vilmorin, Documentation Center, La Menitre 49250 - Beaufort, En Vallee, France.

11. Clayberg, C. D. Department of Horticulture and Forestry, Manhattan, KS 665(

12. Coyne, D. P. Department of Horticulture, University of Nebraska, Lincoln, NI 68583.

13. Crall, J. C. Agricultural Research Station, University of Florida, Post Offi Box 388, Leesburg, FL 32748. Watermelons.

14. da Costa, C. P. Deportments de Genetics, ESALQ, Caixa Postal 83, 13. 4000 Piracicaba - S.P. Brazil.

15. de Ruiter, Ir. A. C. Deruiterzonen Seed Company, Hoekeind seweg 39 b, Post Office Box 4, Bleiswijk, The Netherlands. Cucumbers.

16. de Vaulx, R. D. Centre de Recherches Agronomiques div. sud-est station d'Amelioration des Plantes maraicheres, Domaine Saint Maurice - 84140 Montfavet, France. Cucumis melo - polyploidy, quality, interspecific cross and Cucurbita spp.- interspecific crosses.

17. Dennett, R. K. Route 1, Box 2145, Davis, CA 95616.

18. Eigsti, O. 17305, S R 4, R R 1, Goshen, ID 46526.

19. Elmstrom, G. W. Agricultural Research Station, University of Florida, Post Office Box 388, Leesburg, FL 32748.

20. Ferguson, D. B. Davids Sunsnax, Post Office Box 7907, Fresno, CA 93727.

21. Fowler, C. W. Asgrow Seed Company, Post Office Box P, Delray Beach, FL 33444.

22. Gabelman, W. G. Department of Horticulture, University of Wisconsin, Madison, WI 53706.

23. Galun, E. The Weizmann Institute of Science, Post Office Box 26, Rehovet, Israel. Breeding and sex-expression of cucumber and melon.

24. Geise, C. E. Del Monte, Post Office Box 36, San Leandro, CA 94577.

25. George, B. F. Heinz, U.S.A., Post Office Box 57, Tracy, CA 95376.

26. Hagan, W. L. Del Monte Corporation, Post Office Box 36, San Leandro, CA 94577.

27. Haley, A. B. Department of Plant Pathology, University of Wisconsin, 1630 Linden Drive, Madison, WI 53706. Disease resistance in cucumber, Cucumis sativus.

28. Henderson, W. R. Department of Horticultural Science, North Carolina State University, Box 5216, Raleigh, NC 27650.

29. Holland, N. S. Department of Horticulture, North Dakota State University, Fargo, ND 58102. Squash.

30. John, C. A. A. L. Castle, Inc., 24401 SW 197th Avenue, Homestead, FL 33031. Disease resistance and high quality in cucumbers, squash and melons.

31. Jones, D. A. 702 South 23rd Street, #4, Fargo, ND 58102. Cucumis maxima, inheritance of bush vs. vine and specific gravity.

32. Kamimura, S. Vegetable and Ornamental Crops Research Station, Ministry of Agriculture and Forestry, Shimokuriyagawa, Morioka, Japan 020-01. Breeding of cucumber varieties - variety testing and genetics.

33. Karti, Z. Bank Hapoalien, Israel.

34. Kiely, T. P. Charter Research Inc., Post Office Box YY, Twin Falls, ID 83301.

35. Kubicki, B. Department of Vegetable Crops, Warsaw Agricultural University, Warsaw, Poland.

36. Laborde, J. A. Unidad De Evaluacion y Planeacion, Apartado Postal No. 112, Celaya GTO Mexico. Mexican Cucurbita germ plasm and other cultivated cucurbits.

37. Laterrot, Mme. Station d'Amelioration des Plantes maraicheres, Domaine Saint-Maurice, 84140 Montfavet, France. Breeding of melon (Cucumis melo L.) and Cucurbita.

38. Lee, A. A. L. Castle, Inc. Post Office Box 279, Hollister, CA 95023.

39. Lower, R. L. Department of Horticultural Science, North Carolina State University, Box 5216, Raleigh, NC 27650. Cucumber breeding and genetics.

40. Loy, B. Department of Plant Sciences, University of New Hampshire, Durham, NH 03824. Developmental and physiological genetics, squash and muskmelon breeding.

41. McCreight, J. D. Imperial Valley Conservation Research Center, 4151 Highway 86, Brawley, CA 92227. Muskmelon genetica and breeding.

42. McFerson, J. R. Post Office Box 3792, Aggieland Station, College Station, TX 77844.

43. Mohr, H. C. Department of Horticulture, University of Kentucky, Lexington, K 40506.

44. Morelock, T. E. Department of Horticulture and Forestry, University of Arkan Plant Science Building, Fayetteville, AR 72701. Watermelons and Cucurbita spp.

45. Mott, R. L. Department of Botany, North Carolina State University, Box 5186, Raleigh, NC 27650.

46. New York Experiment Station Library, Jordan Hall, Geneva, NY 14456.

47. Ng, T. J. Department of Horticulture, University of Maryland, College Park, 20742. Muskmelon genetics and breeding.

48. Nijs, T. P. M. Den. Institute for Horticultural Plant Breeding, Wageningen, The Netherlands. Breeding of slicing and pickling cucumbers, production under low energy input; disease resistance, interspecific hybridization.

49. Norton, J. D. Department of Horticulture, Auburn University, Auburn, AL 36

50. PetoSeed Company, Inc., Route 4, Box 1255, Woodland, CA 95695.

51. Pitrat, M. Station d'Amelioration des Plantes Maraicheres, Montfavet, France Disease resistance in melon and Cucurbita.

52. Poostchi, I. Department of Agronomy, College of Agriculture, Pahlavi Univers Shiraz, Iran.

53. Rhodes, A. M. University of Illinois, Vegetable Crops Building, Urbana, IL 61801. Genus Cucurbita.

54. Rhodes, B. B. Edisto Experiment Station, Post Office Box 247, Blackville, SC 29827.

55. Risser, G. Station d'Amelioration des Plantes Maraicheres, I.N.R.A., Domain Saint Maurice, 84140, Montfavet-Avignon, France. Breeding of melon (Cucum melo L.).

56. Robbins, M. L. Clemson Experiment Station, Post Office Box 3158, Charleston SC 29407.

57. Robinson, R. W. New York State Agricultural Experiment Station, Post Office Box 462, Geneva, NY 14456.

58. Ruttencutter, G. Nestle Enterprises, Inc., 701 West Main Street, Leipsic, OH 45856. Breeding work with the species Cucurbita moschata.

59. Schroeder, R. FMC Corporation, Post Office Box 2508, El Macero, CA 95618. Sex expression of Cucumis sativus and melo.

60. Shattuck, Vernon. 21557 River Road, Perris, CA 92370.

61. Taylor, J. C. North Louisiana Extension Station, Post Office Box 10, Calhoun, LA 71225.

62. Thomas, C. E. USDA - Agricultural Research Service, Post Office Box 267, Weslaco, TX 78596. Development and testing of multipest resistant cantaloups, epidemiology of foliar diseases of cantaloup, and development of pest management systems.

63. Torrey, T. C. W. Atlee Burpee Company, Santa Paula, California 93060.

64. Valentine, T. M. Keystone Seed Company, Post Office Box 1438, Hollister, CA 95023. Cucumber, summer and winter squash breeding efforts.

65. Ventura, Y. Hazera Seeds Ltd., Post Office Box 1565, Haifa, Israel.

66. Werner, G. M. Pesticide Research Center, Michigan State University, East Lansing, MI 48824.

67. Whitaker, T. W. USDA - Agricultural Research Service, Post Office Box 150, La Jolla, CA 92038.

68. White, J. W. 1330 Virginia Street, Berkeley, CA 94702.

69. Whitwood, W. N. Robson Farms, Post Office Box 270, Hall, NY 14463. Cucurbita pepo - summer squash.

70. Wyatt, C. PetoSeed Company, Inc., Route 4, Box 1255, Woodland, CA 95695.

71. Yukura, Y. 46-7, 3-Chome, Miyasaka Setagaya-KU, Tokoyo, Japan. Genetics of sex expression in cucumber and melon.

72. Zuta, Z. Hazera Seeds Ltd., Post Office Box 1565, Haifa, Israel.

FINANCIAL STATEMENT June, 1978

(Prior to publication of Report No. 1)

Receipts	
Dues - 71 members @ $5.00	$ 355.00
Interest	15.16
TOTAL	$ 370.16
Expenditures	
Bank charge	$ 5.00
Balance	$ 365.16