Cucurbit Genetics Cooperative

Report No. 3

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Cucurbit Genetics Cooperative Report 3:ii-iv (introduction) 1980

Introduction

Resolution

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 the 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.

Dues

Further, dues for the Cucurbit Genetics Cooperative (CGC) will be $2.50 per year and will be used to defray costs of preparation and mailing of the annual report. Members from outside the U.S.A. are encouraged to pay dues in at least two-year increments because of bank charges incurred for clearing checks. Only postal money orders or checks drawn on U.S. banks are acceptable. The annual report will include four sections: Research Notes, Stocks and Germplasm desired or 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 Third Annual Meeting

by Warren R. Henderson

The third annual meeting of the Cucurbit Genetics Cooperative was held in conjunction with the American Society for Horticultural Science on August 2, 1979 at Columbus, OH. There were 19 in attendance including seedsmen, processing industry representatives, and experiment station and USDA personnel. The meeting was chaired by R. L. Lower. He reported on publication of CGC Report No. 2 and the financial status of CGC; the cost for publication and mailing of CGC Report No. 2 was $216.70 and left a balance of $178.09.

J. D. McCreight was appointed chairman of the By-Laws Committee. R. W. Robinson was appointed chairman of the Gene List Committee that was composed as follows: Todd Wehner, cucumber; J. D. McCreight, muskmelon; W. R. Henderson,

watermelon; C. A. John, *Cucurbita* spp.; and R. W. Robinson, other general and species.

Various methods of dues payment and the advisability of an annual basis or biennial basis were discussed. The consensus was to do whatever the Coordinating Committee deemed financially prudent.

The advisability of publishing abstracts of theses dealing with cucurbits was discussed and was to be considered for implementation in future reports.

Comments from the Coordinating Committee

by Richard L. Lower

The **1980 Annual Meeting** of the CGC will be held at Fort Collins, CO, U.S.A. during the American Society for Horticultural Science meetings from July 27 to August 2. Consult the local program for time and location.

The call for papers for the 1981 report will go out in November, 1980, and they should be submitted to the Coordinating Committee by January 31, 1981. Hopefully, the fourth report will be published by June, 1981.

We are eager to hear from the membership regarding the future direction of the CGC. It is a pleasure to acknowledge the assistance of Grace Ebert who was responsible for the typing, proofing, and duplicating of this 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 and J. D. McCreight for his efforts in developing the By-Laws.

Announcement of Cucurbit Related Meetings

by Richard L. Lower

Cucurbitaceae Conference

A conference on the Biology and Chemistry of the Cucurbitaceae will be held at Cornell University, Ithaca, NY, on August 4-6, 1980. You are cordially invited to attend.

The program will be organized in three sections dealing respectively with the broader canvas (taxonomic, morphological, and chemical surveys of the family), cucurbits in the ecosystem (ecological and evolutionary aspects), and cucurbits in cultivation (physiology, genetics, and breeding).

The conference will be hosted by the Bailey Hortorium, founded by the late renowned cucurbitologist, Liberty Hyde Bailey, at Cornell University, Ithaca, NY. It is located in the scenic Finger Lakes area of central New York about 50 miles (80 km) south of Syracuse. The airport at Ithaca is served by U.S. Air, which also connects with New York City, Chicago, Pittsburgh, Syracuse, and other U.S. cities. Greyhound Bus also provides transportation to Ithaca.

A bus will be provided to visit a state park, the New York State Agricultural Experiment Station at Geneva (50 miles northwest of Ithaca) where a special demonstration planting of species and mutants of the Cucurbitaceae will be made for the conference, and to a seed company producing F1 hybrid *Cucurbita* seed.

Housing will be provided in a dormitory of Cornell University at a cost of $8.00 per night for a single room and $11.25 double.

The registration fee of $40.00 ($35.00 if received before the conference) will include bus transportation, a barbeque and banquet, and all lunches.

Arrangements for the Cucurbitaceae Conference have been made by D. M. Bates, Director of the Bailey Hortorium, Cornell University; C. Jeffrey, Kew Gardens; and R. W. Robinson. For more information about the conference, write to R. W. Robinson, Seed & Vegetable Sciences Department, New York State Agricultural Experiment Station, Geneva, NY 14456, U.S.A.

EUCARPIA Conference

The EUCARPIA Cucumber and Melon Breeding Conference is scheduled for August 19-22, 1980, at the Institute for Horticultural Plant Breeding, Wageningen, The Netherlands. Contact Ton P. M. den Nijs, Institute for Horticultural Plant Breeding, Mansholtlaan 15, Wageningen, The Netherlands, for additional information.

Erratum

CGC Report No. 2, page 37, line 18 should read "44%" rather than "55%".

Cucurbit Genetics Cooperative Report 3:2-4 (article 1) 1980

In vitro adventitious bud formation on seedling and embryo explants of *Cucumis sativus* L.

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We have previously reported on the effects of illumination, explant position, and explant polarity on adventitious bud formation of seedling explants of *Cucumis sativus* cv. 'Hokus' (1). This paper reports on experiments on explant length, seedling age, light intensity during seedling growth, and concentration of growth regulators. Also, a preliminary test of the developed system and its suitability for the ultimate goal of regeneration of adventitious buds from very young embryos was conducted.

In most experiments a set of standard conditions was maintained and only one factor was varied in any experiment. Experimental material, aseptic germination, time of explant excision, nutrient medium, growth regulator concentrations (kinetin 10 mg/l and IAA 0.1 mg/l), explant position on the medium, and assessment of the results were as previously described (1). Seedlings were grown under 16 hr/day Philips TL 33 light (approx. intensity 2,000 lux). Three explants, each 1 cm long, were excised from hypocotyls 5 cm in length. The explants originated from the upper, middle, and lower region of the hypocotyl. They were kept under 16 hr Philips TL 34 light (approx. intensity 1,700 lux) at 24.5 ± 0.8°C and 8 hr darkness at 23.0 ± 0.7°C per day.

The different treatments and results are sown in Table 1. The explant length proved to be very critical, 2.5 mm being too small. In the experiments on seedling age and light intensity during seedling growth, the hypocotyls reached different lengths; thus, some hypocotyls were divided into two explants, each about 5 mm long.

In all experiments bud formation frequency increased from the basal to the apical parts of the hypocotyl. The decrease in bud formation in the four-day treatment, as well as the 13,000 lux seedling treatment, was likely caused by the small explant length. Large explants from seedlings grown at 0 or 1,400 lux, however, show decreasing bud formation, especially when excised from the lower regions. The kinetin concentration proved to be very critical, 10 mg/l was the optimum concentration. IAA at 0.01 mg/l was the most beneficial for the regeneration of the buds and also promoted growing point extension and development into complete plants, which rarely occurred at he other IAA concentrations.

To determine if the above system would be applicable to ontogenetically younger cucumber tissue, explants from immature embryos were excised from cotyledons obtained by selfing plants of *C. sativus* var. *hardwickii* (Gbn. 0777 and 1811). explants were taken at different times after pollination and incubated on standard medium darkness or 16 hr/day light. The explants from 2.5-4.0 mm long cotyledons (55 in total out of four fruits) regularly regenerated buds, especially in continuous darkness, whereas those from 0.8-1.2 mm long cotyledons (18 in total out of two fruits) did not and did not grow. These results agree well with those obtained with *in vitro* culture of the embryos from the crosses between *C. africanus* and *C. metuliferus* (2).

Table 1. The effects of explant length, seedling age, light intensity during seedling growth, and kinetin and IAA concentration on the percentage of hypocotyl explants of *Cucumis sativus* cv. 'Hokus' with adventitious bud formation.[z]

Explant position in the hypocotyl	**Treatment variable**			
	Explant length (mm)			
	2.5	5	10[y]	20
upper region	25	75	83	92
middle region	0	25	58	42

	Seedling age (days)/ hypocotyl length (mm)			
	4/10	8/50[y]	12/70	
upper region	58[x]	100	92	
middle region	--[w]	67	42	
	Light intensity during seedling growth (lux)/hypocotyl length (mm)			
	0/110	1,400/60	4,300/35[y]	13,000/20
upper region	53	93	87	40
middle region	0	7	33	20
lower region	0	0	20	33
	Kinetin concentration (mg/l)			
	0	5	10[y]	20
upper region	0	8	83	25
middle region	0	0	42	0
lower region	0	0	8	8
	IAA concentration (mg/l)			
	0	0.01	0.1[y]	1
upper region	50	92	83	50
middle region	42	75	58	0
lower region	8	8	0	0

[z] All data were taken after six weeks of culture. The number of explants per treatment was 12 or 15.

[y] Standard treatment.

[x] The upper half of the hypocotyl was incubated.

[w] The lower hypocotyl half + a radicle part incubated; radicle extension growth caused explant reversal into its normal position and bud formation did not occur.

Literature Cited

1. Custers, J.B.M. and L.C. Buijs. 1979. The effects of illumination, explant position, and explant polarity on adventitious bud formation *in vitro* of seedling explants of *Cucumis sativus* L. cv. 'Hokus'. Cucurbit Genetics Coop. Rpt. 2:2-4.
2. Custers, J.B.M. and G. van Ee. 1980. Reciprocal crosses between *Cucumis africanus* L.f. and C. *metuliferus* Naud. II. Embryo development *in vivo* and *in vitro*. Cucurbit Genetics Coop. Rpt. 3:50-51.

Cucurbit Genetics Cooperative Report 3:4 (article 2) 1980

Rosette, A Spontaneous Cucumber Mutant Arising from Cucumber-Muskmelon Mentor Pollination

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An interesting variant, given the acronym "megurk" from the combined Dutch words for cucumber and muskmelon, was obtained when cucumber plants were pollinated with a mixture of cucumber and muskmelon pollen (2). The plants had shorter internodes, more obtuse leaf lobing, and smaller length-diameter fruit ratio that the cucumber parent, and in some respects, were intermediate to normal cucumber and muskmelon plants. The possibility of interspecific origin, however, was refuted by electrophoretic evidence (1).

Crosses between the "megurk" and normal cucumber plants were fully fertile and normal in appearance. The F_2 segregated 483 normal to 162 mutant plants, in close agreement to 3:1 ratio (p= .95). Seven of 11 normal F_2 plants that were self pollinated produced segregating progeny and the four other F_3 lines were homozygous normal, agreeing with the 2:1 ratio. It is concluded that a single recessive gene is involved.

The non-Mendelian ratio in the original cross (2) is attributed to mixed pollination involving several homozygous normal cucumber plants and a single cucumber plant heterozygous for a spontaneous mutation. The Mendelian ratio expected for the selfed progeny of the heterozygote was distorted by the mixture of self- and cross-pollination, the selfed progeny would be expected to segregate but those from crosses would all by phenotypically normal.

The mutant is named rosette after its short internodes and closely spaced upper leaves, with the symbol *ro.*

Literature Cited

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2. van der Knap, B.J. and A.C. de Ruiter. 1978. An Interspecific Cross Between Cucumber (*Cucumis sativus*) and Muskmelon (*Cucumis melo*). Cucurbit Genetics Coop. Rpt. 1:6-8.

Cucurbit Genetics Cooperative Report 3:5-6 (article 3) 1980

Screening Cucumbers for Resistance to the Vegetable Leafminer

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Effective chemical control of the pickleworm and cucumber beetle has reduced natural populations of wasp species which formerly kept the vegetable leafminer, *Liriomyza sativae* Blanchard, under biological control (2,3,4). Host plant resistance to the leafminer was deemed more desirable than the use of additional chemicals to control leafminers on cucumber crops.

Greenhouse and controlled environment chamber (ca. 27°C, 55% RH) experiments were used to develop seedling screening techniques and to evaluate a collection of breeding lines, cultivars, and plant introductions for resistance (1). More mature plants (ca.3 leaves) were evaluated in the greenhouse only.

Both angle and height of the cotyledons were found to affect leafminer response to cucumber seedlings. Seedlings with revolute cotyledons received fewer mines than seedlings with cotyledons which were flat and parallel to the ground plane. In seedling tests conducted directly beneath a light source, taller seedlings had more mines than short seedlings. When seedling experiments were blocked against a light source, seedling height interacted with distance to the light source to affect leafminer choice. Consistent results among seedling experiments were obtained only when all cotyledons within each experiment were adjusted to a uniform distance above the ground plane. Because light reflection and distribution among seedlings may be affected by both height and angle of the cotyledons, the importance of both of these plant factors in resistance screening may be explained by the positive phototactic nature of the leafminer.

When cotyledon heights were adjusted within seedling experiments, similar results could be obtained in the controlled chamber and in the greenhouse. Greenhouse experiments with mature plants had similar results when plant samples within the experiments were of uniform development. Seedling response in the chamber or greenhouse did not predict the response of some lines in the more mature plant stage; cotyledon resistance apparently is not contingent on the same factor(s) as mature plant resistance.

Of the screened materials, PI 200815 and PI 279465 appeared to have the most potential as sources of resistant germplasm. These plant introductions were resistant in both seedling and in later stages. 'Gy 2,' a gynoecious breeding line, was resistant only in the seedling stage. 'Addis' and 'Spartan Salad', pickling cucumber cultivars, and PI 271327 were consistently susceptible at all plant stages.

Field experiments will be necessary to evaluate the resistance levels of PI 200815 and PI 279465 outside the greenhouse.

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Cucurbit Genetics Cooperative Report 3:6-8 (article 4) 1980

Effects of the White Spine Allele on Skin Toughness and Fruit Firmness in 'Wisconsin SMR 18' Cucumber

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The cream mature fruit color, associated with the white spine allele (b), is preferred by pickle processors over the orange mature fruit color associated with the black spine allele (B). However, many seedsmen and processors have felt that the white spine allele is also associated with less desirable tougher skin. For this reason, two near isogenic lines for sine color fro the Cornell program (69841-11,13 and 69950-7,8) were evaluated for skin toughness and fruit firmness. Comparisons were made between homozygous allelic segregant lines following five backcrosses to 'Wisconsin SMR 18'. The original white spine source was 'Hardin's dwarf cucumber PG 57'. A split plot experimental design was used at Freeville, NY in 1970 with lines as main plots and alleles as split plots. Plots contained 12 plants, two per hill spaced 61 x 183 cm. The experiment was replicated three times and was repeated in Ithaca, NY in 1971 to obtain further data on skin toughness.

Fruit were graded following the PCIC standards with grades and diameters as follows: No. 2, 2.7-3.8 cm; No. 3, 3.8-5.1 cm; No.4, 5.1-5.7 cm; No. 5, 5.7-6.4 cm; and No. 6, over 6.4 cm.

Firmness was measured with a 7.9 mm diameter center punch over the locule junction using an Italian fruit pressure tester similar to the Magness midol. A minimum of ten grade 3 fruit were tested from each plot at harvest time. No significant differences were found between alleles or lines (Table 1).

Skin toughness was measured with a .08 cm plunger in a Chatillion spring puncture tester. The measurement was made as the locule junction of ten intact fruit/grade/plot at harvest time. In the 197 experiment, lines and replicates were pooled to obtain enough fruit/grade. The only significantly different skin toughness in 1970 was with mature fruit. In 1971, the fruit were tested at harvest and after 48 hrs of holding in the field. It appears that the skin toughness approximately doubled in the 48 hrs following the harvest, but the white spine (bb) skin toughness was no greater than that of black spine (BB) except in oversize grade 6 fruit (Table 1).

Pericarp samples were taken adjacent to punctures from black spine and white spine fruit and fixed in FAA. Transverse pericarp sections 48 µ thick were made with a cryostat microtome and stained with Hematoxlin and Safranin. Ten measurements of cell wall thickness and cell shape were made with a micrometer at various distances from the pericarp surface of each sample.

Cell wall thickness was found t be significantly greater in the mature pericarp of white spine fruit (Table 2). The greatest difference occurred about 70 µ from the base of the epidermal cell layer. Cell wall thickness in the younger fruit was so small that it could not be measured at 500 X. The parenchyma cells in mature *bb* sections 166 µ from the epidermal layer were more rounded in transverse sections while *BB* had flatter cells (Table 2). The cell shape pattern was not evident in grade 1 fruit. Measurements of epidermal and hypodermal cells did not reveal any differences between allelic types.

A number of microchemical stains (Basic fuchsin, Sudan III, Toluidine Blue O) indicated a difference in mature fruit cuticles. No differential staining occurred with immature fruit. A considerable quantity of waxy material could be scraped from the mature white spine fruit surface without damaging the epidermis. Similar material could not be obtained from the mature black spine fruit. In addition, it was observed that after a month in storage at room temperature, the black spine mature fruit became very light weight and soft. The white spine fruit remained heavy and firm. Peeled mature white spine skin is very

elastic and curls up. In contrast, the black spine skin did not stretch or curl after peeling. Thus, it appears that skin differences associated with the spine color alleles occur only in mature fruit.

Table 1. Firmness and skin toughness as related to grade and alleles. Freeville, Ithaca, 1970-1971.[z]

	Grade					
Experiment	**2**	**3**	**4**	**5**	**6**	**Mature**
Firmness 1970						
BB	---	21,100	---	---	---	---
bb	---	20,500	---	---	---	---
Toughness 1970						
BB	71.6	98.0	---	147.8	---	201.9**
bb	71.9	97.4	---	144.0	---	247.2
Toughness 1971						
BB	35.0	55.9	---	---	---	---
bb	30.6	51.7	---	---	---	---
Toughness 1971 + 48 hrs						
BB	57.8	110.9	152.4	184.0	179.1*	---
bb	58.4	96.7	168.4	192.8	218.6	---

[z] Pressure in g/cm^2 required to puncture the pericarp.
*Significantly different (.05) between alleles.
**Significantly different (.01) between alleles.

Table 2. Association of cell wall thickness and cell shape ratio with spine color alleles. Ithaca, 1971.

Allele	Grade	Skin toughness [z]	Hypodermal wall thickness (μ)	Mesocarp cell shape ratio [y]
BB	1	22.7		0.98
	5	190.3		1.88
	mature	212.9	1.45*	2.17**
bb	1	24.9		1.06
	5	185.8		1.64
	mature	242.4	2.56	1.80

[z] Pressure (g/cm^2) required to puncture the pericarp.
[y] Transverse diameter/radial diameter.
* Significant difference (.05) between alleles.
** Significant difference (.01) between alleles.

Cucurbit Genetics Cooperative Report 3:9 (article 5) 1980

An Apetalous Male Sterile Mutant in Cucumber

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A sterile plant with misshapen fruit was found in a crop of 'Butchers Disease Resisting' grown at the Rothamsted Experimental Station, Harpeden, Herts, U.K. Plants obtained from cuttings were grown under glass at this institute for observation and test crossing.

The stems and leaves of the mutant were normal but the flowers and fruit were abnormal. The corolla of both staminate and pistillate flowers was reduced to a whorl of five green, reflexed appendages identical to sepals. The flowers, therefore, appeared to have ten sepals in two whorls of five.

The staminate flowers never matured and usually fell off while they were still small. The pistillate flowers developed to their usual size and, if left unpollinated, produced parthenocarpic fruit, as is usual in the parental cultivar.

The ovaries of the pistillate flowers were inferior but the usual narrow attachment between the base of the sepal and the ovary was absent. In this respect, the flowers resembled hermaphrodite flowers, but there were no anthers and the ovary was of a normal length. The base of the ovary was usually tri-locular but the number of locules increased to four, five, or sometimes six at stigmatic end and resulted in a club-shaped ovary with irregular ribbing.

Pollinations were made using pollen from normal plants of 'Butchers Disease Resisting.' Since all the "sepals" were reflexed from a very young stage, the immature stigma was exposed and it was difficult to judge when it was receptive to pollen; thus , pollination was repeated on several successive days when ovary size and stigma appearance suggested that the latter might be receptive.

F_1 seed was obtained from the cross *mutant* x *wild type*. All the F_1 plants were normal. In the F_2 family 14 plants were normal and five showed all the characters of the original mutant. It seems that the character is controlled by a single recessive allele. The name apetalous and the symbol *ap* are suggested.

Cucurbit Genetics Cooperative Report 3:10-11 (article 6) 1980

An Estimate of Heritability of Fruit Number from a Cross Between a Pickling Cucumber Inbred (*Cucumis sativus* L.) and an Inbred of *C. hardwickii* R.

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Low fruit number per plant is the major factor in reducing yield of once-over mechanically harvested pickling cucumbers (4). Smith *et al*. (6) used a North Carolina Design I to obtain estimates of variance components associated with several characteristics of pickling cucumber, the narrow sense heritability based on full-sib families for fruit number was 0.17. The reference population was random mating and derived from 18 inbred lines obtained from several U.S. breeding programs (5). The low heritabilities and variances associated with fruit number per plant in existing populations might be increased by incorporating multiple fruiting genotypes into the germplasm pool (6). One possible source of such multiple fruiting genotypes is *Cucumis hardwickii*, an annual monoecious Cucurbit species, which is thought to be either a feral or progenitor species of the cultivated cucumber (*Cucumis sativus* L.) (1, 3). Previous studies reported that *C. hardwickii* averaged 80 fruit per plant under North Carolina conditions (3).

The purpose of this study was to estimate the heritability of fruit number per plant in an exotic population which incorporated germplasm from a *C. hardwickii* line.

Individual plants of F_2 and both backcrosses from a cross between a gynoecious inbred line 'Gy 14', and a selection from *C. hardwickii* were evaluated for fruit number per plant in Clinton, NC, in 1978. Half-sib offspring of 53 single plant selections based on either high fruit number (> 100) and/or high fruit weight (> 6 kg) were evaluated in a replicated trial in Hancock, WI, in 1979.

Regression of offspring on parent was significant. The heritability of fruit number per plant on an individual basis was estimated as twice the regression coefficient, and was equal to 0.88 ± 0.156 (Table 1). The 95% confidence interval of heritability ranged from 0.57 - 1.20. One of the assumptions of parent offspring regression was that environmental correlations between parent and offspring was zero (2). This was met by evaluating parents and offspring in separate environments. Additional assumptions were made:

- Regular diploid inheritance
- Hardy-Weinberg equilibrium
- Linkage equilibrium
- No epistasis
- No maternal effects
- No assortative mating, including selfing

Parent-offspring covariance is free of genotype x environment interaction (2).

Incorporation of *C. hardwickii* germplasm has resulted in increasing the variance and heritability of fruit number, suggesting that selection within this exotic population should be effective in increasing yield. Genetic correlations due to linkage or pleiotropy between high fruit number and other less desirable horticultural traits are unknown at this time.

Table 1. Analysis of variance and estimates of regression coefficients for regression of offspring on parent for fruit number/plant.

Source	**df**	**MS**
Total (Corr)	52.0	-
Regression	1.0	14469.46*
Dev. from regression	51.0	440.29
R^2	0.39	-
b_0	60.94 ± 6.38	-
b_1	0.44 ± 0.078	-

*Significant at 1% level.

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Cucurbit Genetics Cooperative Report 3:12-13 (article 7) 1980

Complementation Between Two Perfect Flowered Mutants in Cucumber

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In 1928, Rosa reported simple inheritance for flower type in cucumber: *M*/- plants have pistillate flowers and *m*/*m* plants have perfect flowers. Over the past several years, we have developed perfect flowered lines from backcrossing programs using two sources of the perfect flowered gene. The sources were the American cv. 'Crystal Apple' and a Polish breeding line from Kubicki. Both of these lines showed the characteristic clusters of perigynous perfect flowers with small rounded ovaries. When lines derived from the same *m*/*m* source are crossed, the prefect flowered phenotype is observed. However, when two perfect flowered lines originating from different sources are crossed, the F_1s have one epigynous long ovaried pistillate flower per node. This appears to be a classical example of genetic complementation in which two mutants are crossed and the wild type phenotype is obtained. we have arbitrarily assigned the 'Crystal Apple' derivatives allele m_1 and those from the Polish breeding line, m_2[1]. In this study, the apparent complementation between two perfect flowered types was investigated. The simply inherited dominant gene for bacterial wilt resistance which is tightly linked to the M/m_1 locus (~1% CO) was used as a genetic marker.

Two different crosses which exhibited complementation in the F_1 were investigated in the F_2 and BC_1 populations. In the F_2 population, a 1 perfect:1 pistillate flowered plant ratio was obtained (Table 1). The perfect flowered types could further be separated into bacterial wilt resistant or susceptible plants which indicates whether they are homozygous for *m*1 or *m*2. Upon backcrossing to the susceptible parent, a 1 perfect:1 pistillate flowered plant ratio was obtained and as expected, all the perfect flowered types were susceptible and all the pistillate types were resistant (Table 2).

Both flower type and ovary shape show complementation. Unfortunately, this system does not lend itself to further analysis of the chromosome segment. Therefore, it is impossible to conclude whether the m_1 and m_2 mutants represent different genes (non-allelic complementation) or whether they are different mutational sites within the same gene (allelic complementation).

[1] This nomenclature is temporary and will be revised following further investigation.

Table 1. F_2 data from two populations exhibit complementation in the F_1.

	(*m*1*Bw*/*m*2/*bw*)		
Phenotype	**Genotype**	**Population A**	**Population B**
Perfect, resistant	m_1Bw/m_1Bw	91	83
Pistillate, resistant	m_1Bw/m_2bw	204	160
Perfect, susceptible	$m_2$bw/$m_2$bw	87	71
Total		382	314
X^2 (1:2:1)		1.85	1.03
Probability		25-50%	50-75%

Table 2. BC_1 data from two populations exhibiting complementation in the F_1.

	(*m1Bw/m2bw*) x (*m2bw/m2bw*)		
Phenotype	**Genotype**	**Population A**	**Population B**
Pistillate, resistant	m_1Bw/m_1bw	21	67
Perfect, susceptible	m_2bw/m_2bw	29	51
Total		50	118
X^2 (1:1)		1.28	2.78
Probability		20-25%	5-10%

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Cucurbit Genetics Cooperative Report 3:14 (article 8) 1980

The Identity of Genes for Glabrousness in *Cucumis sativus* L.

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The occurrence of glabrous cucumber has been reported from the USSR and the USA. In the USSR the cucumbers in question are the spontaneous mutants *Odnostebelnyi 33* and *Mayak 422*, which were found at the Vavilov Institute in Moldavia (3). The American material concerns a radiation-induced mutant, selected by Robinson, New York State Agricultural Experiment Station (2). The glabrousness of line NCSU 75-M834-6, provided by R.L. Lower, probably originates from Robinson's materials.

For an improved biological control of the glasshouse white fly *Trialeurodes vaporariorum* Westwood with the parasitic wasp *Encarsia formosa* Gahan, we introduced glabrousness into the Dutch slicing varieties. Meanwhile glabrous lines of good cultural value have been released (1).

We were also interested in the identity of the genes of the three accessions. To this end we have made a half diallel with the lines *Odnostebelnyi 33*, *Mayak 422*, and NCSU 75-M834-6. Fifteen plants were examined from each F_1, both in the seedling and the pot plant stage, for the presence of pubescence. Pubescence was entirely lacking on all F_1 plants.

From this, we conclude that the character glabrousness, both in the Russian and American material, depends on the same recessive gene *g1*.

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The Effect of Fruit Size on Various Fruit Quality Characteristics

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Fruit firmness is an important factor in assessing the quality of pickling cucumbers. The most frequent measurement of fruit firmness is pounds of pressure as determined by a Magness Taylor Fruit firmness is pounds of pressure as determined by a Magness Taylor Fruit Pressure Tester (MTFPT) equipped with a 7.9 mm tip plunger. A study was made to determine the relationship of fruit diameter, the fruit skin, and tip placement on MTFPT readings taken on fresh fruit. Assessments of placental hollowness and carpel separation were made on larger fruit.

Plants of the cv. 'Calico' were grown at the Hancock, WI Experimental Station using standard cultural practices. Five sections of 30ft of row were used as replications. The fruit were harvested in mid-september and graded by hand. Fruit grading was based on PCIC standards (Table 1). A 20 fruit sample of each size from each replication was selected bases on uniform shape. The skin was removed about 25.4 mm from both the stem and blossom end from one-half of the sample (ten fruit). Pressure tests were taken at both ends of fruit with and without skin. The plunger was placed at the juncture of two carpels, one-third of the distance from either the stem or blossom end, and penetration was at a 90° angle to the plane of the fruit which was on a solid platform. Only one measurement was obtained at each end. Fruit of the two largest sizes were cross-sectioned at both ends and the middle, and were checked for placental hollowness and carpel separation. The diameter of the fruit and the seed cavity were measured from the middle cross-section.

Pressure tests were significantly greater with the skin on the fruit and generally increased with increased diameter at both stem and blossom ends (Table 1). Pressure tests on fruit without skin were greater in size 2 than size 4 at the stem end. A similar pattern was observed at the blossom end where size 2 fruit had higher readings than both sizes 3 and 4. Measurements were greater at the stem end than at the blossom end and the relationship is fairly constant. Tests at the stem end are about 1.25 lbs higher than the blossom end. Thus, it seems that only one reading per fruit is necessary to test relative firmness as long as it is taken at the same end of all fruit.

the incidence of placental hollowness and carpel separation was almost exclusively confined to the largest sized fruit (Table 2). The relationship between diameter of the seed cavity and fruit diameter was expressed as interior ratio and was not significantly different in sizes 3 and 4, thus as the fruit increased in size, the relative size of the seed cavity remained constant. Further investigation will be necessary to test the relationship of these fresh fruit data and brinestock quality.

Table 1. Effect of fruit size, skin, and plunger placement on fruit firmness readings.

	Fruit [z]		Mean pressure test [y]	
Treatment	**Size**	**No.**	**Stem end**	**Blossom end**
With skin	1	50	23.16	22.42
	2	50	25.94	24.72
	3	50	26.44	24.60
	4	50	27.92	26.64
Without skin	1	50	19.48	18.56
	2	50	20.22	19.54
	3	50	19.58	17.82
	4	50	18.36	17.54

	LSD .05		1.31	1.43

[z] Size based on PCIC standards	Size	Diameter in cm
	1	up to 2.7
	2	2.7-3.8
	3	3.8-5.1
	4	over 5.1

[y] Pounds of pressure determined by using Magness Taylor Fruit Pressure Tester with 7.9 mm tip.

Table 2. Effect of fruit size on several fruit quality factors.

				Placental hollowness			
Fruit size[z]	**Fruit size (mm)[y]**	**Seed cavity diameter (mm)[y]**	**Interior ratio[x]**	**Blossom end (%)**	**Center (%)**	**Stem end (%)**	**Carpel separation (%)**
3	44.74	26.54	0.59	0	0	6	0
4	66.38	38.20	0.60	2	8	10	24

[z] Size based on PCIC standards. Size 3 = 3.8 cm to 5.1 cm diameter; size 4 = over 5.1 in diameter.
[y] Mean of 50 fruit.
[x] Based on seed cavity diameter/fruit diameter.

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Influence of Reciprocal Donor Scions on Fruit Setting Characteristics of Recipient Scions of *Cucumis sativus and C. hardwickii R.*

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Cucumis sativus cultivars average approximately 1 1/4 marketable fruit per plant in once-over mechanically harvested operations (5). Low fruit number per plant is presumably due to the inhibitory effect of the seed development of the first fertilized flower on the development of subsequently pollinated fruit (4,8). There is speculation as to whether the fruit setting mechanisms involve a translocated fruiting inhibitor produced by the developing fruit, or if the developing fruit set is precluded due to the limited availability of substrates. The later hypothesis is supported by the observation that in greenhouse seed production, multiples of seeded fruit can be produced on *C. sativus* plants if pollination is delayed until the plants are very large. The increased photosynthesis are would be expected to produce more dry matter and, hence, support a larger "sink" of seeded fruit.

Horst and Lower (3) reported that *C. hardwickii* plants set as many as 80 fruit per plant under North Carolina conditions. *Cucumis hardwickii* plants have the ability to sequentially set large numbers of fruits that weigh approximately 25-35 g each. Apparently in *C. hardwickii,* fruits with developing seed do not inhibit later fertilized fruit as is apparent in *C. sativus* cultivars.

Cucumis hardwickii plants are large (7.5 kg fresh cut) compared to *C. sativus* cultivars (6). Also, *C. hardwickii* is a short day plant with a critical photoperiod of <12 hrs (2). The photoperiodic response of may be a natural mechanism which delays fruit set until photosynthetic are is maximized, analogous to the delayed pollination of greenhouse seed production in *C. sativus* cultivars. However, the reasons for the widely different fruit setting behavior in the two species are unknown.

The objective of this experiment was to measure the relative efficiency of grafted *C. hardwickii* and *C. sativus* donor scions in supporting fruit on defoliated recipient scions.

The experiment was conducted at the University of Wisconsin Biotron from May to July, 1979. Two growth chambers were programmed to provided similar environmental conditions: 30°C day/ 20°C night temperatures, 70% RH, and approximately 500 µE m^2 of light intensity at plant height.

The graft combinations used were the following:

	Vegetative donor scion	**Defoliated recipient scion**	
1	*Cucumis hardwickii*	*Cucumis hardwickii*	(self-grafted)
2	*Cucumis sativus*	*Cucumis hardwickii*	
3	*Cucumis hardwickii*	*Cucumis sativus*	
4	*Cucumis sativus*	*Cucumis sativus*	(self-grafted)

The *C. sativus* cultivar used was the gynoecious inbred Gy 14. The grafts were made approximately three weeks after planting using a modified approach graft technique similar to the one described by Denna (1). All the above graft combinations were repeated using each species as rootstock. No fruit were allowed to develop on the donor arms. The recipient scions were defoliated (by removing leaves as they expanded) to make them primarily dependent upon the donor scions for photosynthate. Pollinations were attempted on all pistillate flowers available on the recipient scion. The experimental design was a split plot using rootstocks as main plots and graft combinations as sub-plots, with six replications. Main plots (rootstocks) were non-significant for all variables; therefore, the graft combinations were averaged over both

replications and rootstocks.

The dry and fresh weights of the *C. sativus* donor scions were either not significantly different or less than the *C. hardwicki*i donor scions. However, fruit number per plants was greater on both *C. sativus* and *C. hardwickii* recipient scions when *C. sativus* was used as donor scion than when *C. hardwicki*i was used as donor scion (Table 1). Also, fruit weight was greater on the *C. sativus* recipient scions as donor scion (Table 1). Neither dry weight (excluding fruit weight) nor seed weight of the recipient scions were significantly different regardless of donor scion.

The *C. sativus* recipient scions may more accurately measure donor scion potential, as the increased fruit number on *C. hardwickii* recipient scions may have been a result of the increased frequency of pistillate flowers. Previous studies (7) have demonstrated that gynoecious *C. sativus* donor scions promote flowering, particularly pistillate flowering, on *C. hardwickii* recipient scions.

Although the weight of the *C. sativus* donor scions was less than that of *C. hardwickii* donor scions, they were able to support a greater "sink" of developing fruit. If fruit number and fruit weight on the *C. sativus* donor scions reflects the amount of photosynthate produced and translocated by the donor scion, then *C. sativus* appears more efficient that *C. hardwickii*.

Table 1. Graft combination means over reps and rootstocks for several vegetative and fruiting characteristics.

		Donor scion		Recipient scion			
Vegetative donor scion	**Defoliated recipient scion**	**Dry wt (g)**	**Fresh wt (g)**	**Fruit No.**	**Fruit wt (g)**	**Dry wt (g)[z]**	**Seed wt (g)[y]**
C. hardwickii	*C. hardwickii*	49.7	394.4	1.1	21.3	13.8	13.8 A
C. sativus	*C. hardwickii*	36.1	266.1	4.5	111.9	9.7	9.7 AB
C. hardwickii	*C. sativus*	30.4	229.3	1.3	753.3	7.6	7.6 B
C. sativus	*C. sativus*	27.1	210.2	2.4	2017.9	9.0	9.0 AB
	LSD .05	5.6 [x]	57.3 [x]	1.0 [x]	1217.4 [x]	5.6 [x]	

[z] Dry weight of recipient vine excluding fruit weight.

[y] Mean separation by Duncan's multiple range test.

[x] LSD calculated by Waller-Duncan Bayesian K- ratio t-test.

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Cucurbit Genetics Cooperative Report 3:20-21 (article 11) 1980

Heterosis Estimates for Several Characteristics in a Cross Between a Gynoecious Inbred of *Cucumis Sativus* L. and *C. hardwickii* R.

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Characteristics such as multiple laterals and prolific fruiting make *Cucumis hardwickii* a potentially useful source of germplasm in a breeding program to improve yield of pickling cucumbers (1). The use of *C. hardwickii* also represents an opportunity to broaden the genetic base of common cucumber cultivars (3). Information about the nature of differences in fruit setting and other morphological characteristics between *Cucumis sativus* and *C. hardwickii* would be very beneficial to plant improvement programs. The object of this study was to estimate heterosis for yield components and several vegetative characteristics in a cross between a gynoecious pickling cucumber inbred line, Gy 14, and a *C. hardwickii* line, 'LJ 90430'.

The two parental lines, Gy 14 and 'LJ 90430', (designated as P_1 and P_2 respectively), and their F_1 were utilized in this study. The parents had been maintained by selfing for several generations and were assumed to be homozygous. The three generations were grown in a randomized complete block design with ten blocks at the Horticulture Crops Research Station in Clinton, NC, in 1978. A replication consisted of five plant single row plots for each generation; the plants were spaced on 1.5 m centers.

Analysis of variance was used to test mean differences among generations. Generation by block interaction was used as an estimate of experimental error. Heterosis above the midparent was defined as the superiority of the F_1 over the respective high parent for the trait under consideration. A t-test was used to determine the significance of differences between generations. Because of the short day nature of the *C. hardwickii* line, flowering was reduced and data on fruiting parameters were estimated from an unweighted least squares analysis of generation means (40). The estimate of the fruiting parameters obtained were gathered on individual plants at maturity as follows: number, weight and length/diameter ratios of mature fruit, lateral number and main stem vine length. Lateral number was counted as the number of lateral branches (primary, secondary, etc.) between the cotyledonary node and the first 1m of main stem.

Heterosis above both mid and high parent was observed for fruit weight per plant and main stem vine length (Table 1). Heterosis below the midpoint was observed for lateral number (Table 1). The length/diameter ration and number of fruit showed no deviation of the F_1 from the midparent. When estimates of heterosis fall above the high parent, it is tempting to conclude that this is overdominant type gene action; however, Moll and Stuber (2) point out that other non-additive types of gene action and linkage disequilibrium might result in effects which mimic those of overdominance.

From a plant breeder's point of view, heterosis estimates indicate whether homozygotes or heterozygotes represent the more ideal genotype. With no heterozygote advantage, breeding efforts should be directed towards homozygous inbred populations; alternatively, if there is a heterozygote advantage, then breeding methods such as reciprocal recurrent selection, which capitalize on heterosis, should be explored.

Table 1. Generation means and heterosis estimates for five characteristics in a *C. sativus* x *C. hardwickii* cross.[z]

Generations	Fruit no. per plant	Fruit weight per plant(kg)	Lateral no.	Main stem vine length	Length/diameter ratio of fruit
P_1 Gy 14*C. sativus*	4.03	2.21	4.10	121.31	2.24
P_2 'LJ 90430', *C.*	93.91 [x]	2.20 [x]	39.81	137.15	1.47 [x]

hardwickii					
F_1	53.12	6.70	16.50	290.32	1.99
Heterosis above midparent[z]	4.15 NS	4.49 **	-5.46*	161.09**	0.14 NS
Heterosis above high parent[y]	-	4.49**	-	153.17**	-

[z] F1 - $(P_1+P_2)/2$.

[y] F1 - high parent.

[x] Least square estimate from generation means, which included F_2, BC_1, and BC_2.

**Significant at .01 level ; *significant at .05 level.

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Effectiveness of AVG for Inducing Staminate Flowers on Gynoecious Cucumbers

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The amino-ethoxy of rhizobitoxine, amino-ethoxy-vinyl-glycine (AVG), inhibited ethylene production in muskmelon seedlings and improved fruit set following hand-pollination of emasculated muskmelon flowers (1).

Staminate flowering in gynoecious cucumbers can be induced by gibberellins, silver nitrate ($AgNO_3$) and silver thiosulphate ($Ag(S_3O_3)_3^{3-}$), which interfere with ethylene-production. Because of the promising results of AVG-treatment obtained by Tolla (personal communication), I compared its effectiveness for induction of staminate flowers with that of standard treatments of other silver compounds.

In a glasshouse trial six potted plants each of gynoecious hybrid slicing cultivars Farbio and Sandra and of gynoecious inbred pickling line were treated at the first true leaf stage with three concentrations of AVG along with $AgNO_3$ and $Ag(S_3O_3)_3^{3-}$. Seeding was on June 15 and treatment two weeks later. All solutions were prepared with distilled water and sprayed with an atomizer. Plants were transplanted two weeks after treatment and trained vertically without pruning. Temperature was set at 20°C night/23°C day, but it sometimes rose to 30°C on bright days. About two months after owing, each node of every plant was scored for sex expression (Table 1). Only mean numbers of staminate flowering nodes of the main stem are given because this correlates rather well with the total amount of staminate flowers produced (2, 3).

The silver treatments gave a similar number of staminate flowering nodes. The 1,000 ppm AVG treatment gave a slightly lower level of staminate induction than the silver compounds, whereas the other two treatments resulted in relatively fewer staminate flowers. The phytotoxicity of AVG is, however, very severe at the effective concentration. The first three to four leaves became extremely chlorotic and necrotic, and growth was checked for about three weeks. Although the plants eventually recovered, they remained unthrifty. The 100 ppm AVG application did only slight damage while the silver treatments gave no noticeable side effects. The $AgNO_3$-treated plants of Farbio were not scored for reasons other than phytotoxic effects. The extent of staminate flowering on side shoots followed the same pattern as that on the main stem, with most staminate flowers occurring on the pickle line.

I conclude that under our conditions AVG should not be preferred over treatments with the standard silver compounds. The fact that staminate flowers did occur lends support to the notion that blocking ethylene production/action is important in staminate induction. I also should like to mention that, in contrast with an earlier report (2), both silver compounds were about equally effective in this and other experiments (3).

Table 1. Mean number of staminate nodes following treatment of three gynoecious cucumber genotypes with various chemical compounds.[z]

		Genotype		
Compound	**Treatment rate**	**F1-Sandra**	**F1-Farbio**	**Gynoecious pickle inbred**
AVG	10 ppm	5.0	3.0	4.7
	100 ppm	5.8	5.3	6.0
	1000 ppm	14.0	15.0	14.0
$AgNO_3$	500 ppm, 3 mM Ag^+	17.0	---	19.0
$Ag(S_3O_3)_3^{3-}$	3 mM Ag^+	17.0	17.0	19.0

[z] No other statistical analyses performed.

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"Divided Leaf", a Recessive Seedling Marker in Cucumber

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A leaf mutant was obtained by Mackiewicz following ethylenimine treatment of several Polish pickling cucumber cultivars. The character seemed t be inherited recessively, but it was not always fully expressed. During a recent stay of Mackiewicz at the IVT in Wageningen we initiated a crossing program to establish the inheritance of the character and to evaluate its potential as a seedling marker for genetic studies.

Description of the mutant. The true leaves are partly or fully divided or dissected, often resulting in compound leaves with 2 to 5 leaflets, depending on the speed of growth. Under optimal growing conditions several leaves of mutant plants may appear normal, but almost all plants can be recognized by the first true leaf. Corollas of both male and female flowers have deep incisions showing 5 to 7 distinct slips. This deviating shape does not depend on the growing conditions, so the few doubtful plants in segregating progenies can always be classified at anthesis. All plants with divided leaves possessed incised corollas, whereas all plants with incised corollas had at least some off-type leaves. We have seen no evidence of recombination of separate genes for the flower and leaf characteristic, so we assume pleiotropy.

Inheritance. Of two seed samples sown at IVT, one (318) produced uniformly mutant plants while the other (319) segregated for the character. Mutant plants were selfed and crossed amongst each other and with normal segregants as well as with 'Levo', a Dutch pickling cultivar. All data confirm the single recessive gene hypothesis (Table 1). We propose the designation "divided leaf", symbol *dl* (later renamed *dvl* to avoid conflict with a previously published gene), for this character. It has potential as a seedling marker and we have already used it as such in genetic studies.

Table 1. Results of crosses involving "divided leaf".

	Observed					
Cross	**Divided leaf**	**Normal**	**Expected ratio**	**Proposed genotypes**	**χ^2**	**p**
318 (self) mutant	85	0	1:0	dl dl	-	-
319-2,3 (self) mutant	25	0	1:0	dl dl	-	-
318x319-1	3	0	1:0	dl dl x dl dl	-	-
318xLevo	0	155	0:1	dl dl x Dl Dl	-	-
319-4 (self) normal	17	47	1:3	Dl dl	0.083	0.773
319-5 (self) normal	79	243	1:3	Dl dl	0.037	0.847
319-4x319-2	95	93	1:1	Dl dl x dl dl	0.021	0.884
319-5x319-2	114	108	1:1	Dl dl x dl dl	0.162	0.687
F_2 (318xLevo)	17	57	1:3	dl dl x Dl Dl	0.162	0.687

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Pollen Receptivity of Different Areas of the Stigma in Cucumber

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Pollen was placed with a dissecting needle on different areas of 'Wisconsin SMR 18' stigmas to determine the area of greatest receptivity. Five different areas of the stigma were pollinated including (1) the apical tip of each of the three stigmatic lobes, (2) the upper center of the stigma, at the juncture of the three lobes, (3) the upper portion of the outer side of each stigmatic lobe, (4) the lower half of the side of each lobe, and (5) all external areas of a single stigmatic lobe.

Each area of the stigma was receptive to pollination. Each treatment resulted in fruit set and the formation of viable seed (Table 1). However, many of the fruit had poor seed development at the peduncle end of the fruit, probably due to the small amount of pollen applied. Better seed formation occurred when larger amounts of pollen were applied; 106 seeds per fruit resulted when a copious quantity of pollen was applied by hand to all parts of the stigma and open pollination resulted in 177 seeds per fruit, in contrast to 17 to 62 seed per fruit when smaller amounts of pollen were applied for the different treatments.

In-experienced pollinators sometimes apply a small amount of pollen to only the easily accessible apical tips of the stigmatic lobes, but this treatment resulted in the lowest fruit set. To obtain maximum seed production, it is advisable to apply a generous amount of pollen to the entire surface of the stigma.

Pollen tubes may develop laterally as well as basipetally. When pollen was placed on only one of the stigmatic lobes, the preponderance of seeds that developed were in the fruit locule directly below the stigmatic lobe that was pollinated. However, seeds also developed in the other fruit locules, indicating lateral growth of the pollen tubes.

Table 1. Effect of pollen placement on fruit set and seed formation.

Stigmatic area pollinated	No. of pollinations	% fruit set	Seeds per fruit	Seeds per pollination
Tips	11	36	62	23
Center	11	82	17	14
Upper half of side	9	56	27	15
Lower half of side	11	46	44	18
Single lobe	11	82	44	36

Cucurbit Genetics Cooperative Report 3:27-29 (article 15) 1980

In Vitro Callus and Shoot Induction from Hypocotyl and Peduncle of Muskmelon (*Cucumis melo*)

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In vitro propagation has been successful in some species of the Cucurbitaceae: axillary bud culture in watermelon (2) and shoot and root formation from callus in pumpkin (5). In *Cucumis* spp. callus and root formation have been obtained in cucumber (1) and chlorophyll formation on callus in muskmelon(3).

We report here that we have induced shoot formation from callus of muskmelon. Explants from hypocotyl and peduncle of two diploid Charentais lines have been cultivated on different culture media. Explants were sterilized with 10% calcium hypochlorite (plus Tween 20) and then washed three times in sterilized distilled water. Thin explant slices (1.5mm) were put on the culture medium in small plastic petri dishes.

Two different basal media have been used: one designated G (macro and microelements from Galun *et a1*. (4)) and the other one MS (macro and microelements from Murashige and Skoog (6)). Both were supplemented with the following vitamins and organic components: thiamin-HCl (0.55 mg/l), pyridoxin-HCl (0.55 mg/l), nicotinic acid (0.5 mg/l), glycine (1.5 mg/l), tryptophan (2.5 mg/l), and meso-Inositol (100.0 mg/l). Various concentrations of sucrose (10-90 g/l), difco-bacto agar (6-10 g/l), casein hydrolysate (0-0.4 g/l), and different combinations of growth regulators: indole acetic acid (IAA), naphthalene acetic acid (NAA), kinetin, benzylaminopurine (BAP), zeatin, and gibberellic acid (GA3) were tired. The cultures were incubated in a growth chamber at 26°C day temperature and 22°C night temperature with artificial light 12 hrs daily.

Callus has been initiated from hypocotyl explants from the basal end, and on both sections from peduncle explants on the different media tried. Similar results were obtained with both lines (Table 1).

Callus formation was obtained on G and MS media supplemented with 40 g/l sucrose, 7 g/l agar, 0.3 g/l casein hydrolysate (only for G), 2 mg/l kinetin, and 0.2 mg/l NAA, pH 5.6. On both media more than 250 mg callus weight were obtained within four weeks.

We tried to induce shoot regenerations from callus on several media: G and MS basal media supplemented with different sucrose, agar, NAA, and Kinetin concentrations (Table 1). Shoot regeneration was accomplished on MS medium supplemented with 30 g/l sucrose and 10 g/l agar (called MST). The optimal growth regulator concentrations were 0.2 g/l NAA and 0.2 or 0.02 mg/l kinetin. Regeneration was unsuccessful on G basal media at the different sucrose, agar, NAA, or kinetin concentrations tried.

The first shoots appeared two weeks after callus transfer. Later, several shoots with small leaves appeared from the same callus.

We have not yet succeeded in initiating rooting. However, on some media used for regenerations, we have notice adventitious root formation directly on callus but without shoot formation (media with high auxin and low cytokinin concentrations). These media and other are now under test for regeneration of complete plantlets.

Table 1. Callus growth and shoot regeneration of hypocotyl and peduncle explants of *Cucumis melo* on different media.

G Medium + 40 g/l sucrose + 7 g/l agar + 0.3 g/l casein hydrolysate[z]				
			Transfer medium G or	

NAA (mg/l)	Kinetin (mg/l)	Callus growth[y]	MST with NAA 0.2 mg/l, kinetin 0.2 mg/l[z]	Shoot regeneration[x]
0.00	0.00	0	-	-
			-	-
0.02	0.02	+	G	0
			MST	++
0.02	0.20	+	G	0
			MST	++
0.02	2.00	+++	G	0
			MST	++
0.20	0.02	++	G	0
			MST	++
0.20	0.20	++	G	0
			MST	++
0.20	2.00	+++	G	0
			MST	++

[z] MST and G - see composition in text

[y] Callus weight within four weeks
+ < 100 mg/explant
++ 100-200 mg/explant
+++ > 200 mg/explant

[x] Shoot regeneration
0 none
+ low
++ high

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Resistance to Cucumber Mosaic Virus Transmission by *Aphis Gossypii* in Melon

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Aphid borne cucumber mosaic virus (CMV) causes one of the major disease affecting muskmelon crops in southeastern France. Risser *et al*. (1) have started a breeding program to introduce an oligogenic recessive resistance to CMV "common" strains found in *Cucumis melo* line PI 161375 ('Songwhan Charmi' = SC) into Charentais type muskmelon. However, this resistance does not prevent some CMV isolates (grouped in the "Song" pathotype) to infect SC after mechanical inoculation. "Song" pathotype represents 35% of over 1000 CMV isolates collected in naturally infected weeds and vegetables (3). It was important to look for any other form of resistance to CMV in *C. melo*. We report here the discovery, also in SC, of a resistance to CMV "Song" strains transmission by *Aphis gossypii,* one of the major vectors of this virus in our field conditions. The melon aphid, although transmitting very efficiently CMV "Song" strains to a susceptible muskmelon cultivar was found to be unable to transmit this virus to SC, even in conditions where 100% of the susceptible plants are infected (2).

This resistance is governed by a single dominant gene independent of the oligogenic recessive resistance to CMV "common" strains and this gene control a form of resistance of melon to *A. gossypii* by non-preference. This resistance was also found in five other melon lines: three from Japan ('Ginsen Makuwa', 'Kanro Makuwa' and 'Shiroubi Okayama') and two from India (PI 164320 and PI 414723).

Resistance to CMV transmission is specific to *A. gossypii*; indeed, *Myzus persicae,* another efficient CMV vector in our field conditions, is able to transmit CMV "Song" strains to SC, although it is with a lower efficiency than to a susceptible variety.

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Male Sterile-1: Stability of Expression

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Muskmelon *male sterile-1* reported by Bohn and Whitaker (1) has not been utilized in F_1 hybrid melon production. Plant breeders report *ms-1/ms-1* plants difficult to identify. Some breeders have stated that the male sterile phenotype is not stable and have concluded that *ms-1* is, therefore, of no value for melon hybrid production. I report evidence indicating that expression of *ms-1/ms-1* is stable, but that expression of male fertile siblings is unstable.

Progeny 21322, and F_1 from a cross of two plants heterozygous for *ms-1,* was planted in the greenhouse in a 1:1 soil: sand mixture in a greenhouse flat; 48 seeds per flat. Staminate flowers were scored at anthesis for male sterility. Two to four flowers were scored per plant by two methods. First, presence of pollen was determined by rubbing the anther across the tip of a finger. Second, a crude squash mount of an anther was stained with acetocarmine or methyl blue and observed under low power magnification (100 X) for presence of pollen. A flower was scored as fertile if any pollen-like material was rubbed from the anthers. A flower with even the slightest amount of pollen-like material was scored as male fertile. All flowers from which none or only a slight amount of pollen-like material was rubbed from the anthers were examined microscopically for presence of pollen. A plant was score as male sterile only if all flowers were scored as male sterile by both methods.

Progeny 21322 segregated 74 *Ms-1*/_:27 *ms-1/ms-1*; a close fit to the expected 3 fertile: 1 sterile ratio, $x^2 = 0.1616$. A few male sterile plants produced at least one flower with distorted pollen grains similar to those reported by Bohn and Whitaker (1) in *ms-1/ms-1* plants. Male fertile segregates produced three types of flowers with respect to amount of pollen that was rubbed from the anthers: abundant; sparse; and none. Three fertile plants produced flowers that were observed to have no pollen when microscopically examined. Thirteen percent of the flowers on male fertile plants were scored as male sterile; 34% of the male fertile plants had at least one sterile flower.

These results indicate that phenotypic expression of *ms-1/ms*-1 is stable. The source of confusion in selecting *ms-1/ms-1* plants in a segregating population is variation in expression of male fertile plants. Once a male fertile flower is found on a plant, that plant should be scored male fertile and rouged from the seed field. Before leaving a plant identified as male sterile in the seed field, several (3 to 4) flowers should be scored male sterile. It is essential to confirm identification of male sterile plants by observing stained anther smears under low power magnification. I have observed as many as ten flowers on a plant to be male sterile when check by rubbing the anthers. When examined under the microscope, they were, however, fertile.

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Monoecious Sex Expression in Muskmelon, *Cucumis melo* L.

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Interest in monoecious sex expression in muskmelon is of recent origin and has increase because of the obvious difficulties associated with emasculation in the common andromonoecious cultivars of muskmelon. Seed of F_1 hybrids has been limited in muskmelon in some countries. Even genetic male sterility has not simplified the techniques of hybrid seed production. Monoecious parents for F_1 hybrids provide a partial answer to the difficulties met with in production of F_1 hybrids. Foster (1) was the first to highlight their use in exploitation of heterosis.

In the course of investigations on heterosis at Indian Agricultural Research Institute, New Delhi (India), a monoecious segregate was isolated (4). This genetic stock had oblong fruit shape and was designated M1. The line was tested as a female parent in studies on combining ability and showed good general combining ability (GCA) effects for early yield, total yield, and fruit weight. Concurrently, further studies were initiated to improve the fruit shape to round in this genetic stock. This led to the development of M2. This line had round fruit shape. It was tested in combining ability studies and it was observed that it had good GCA effects for earliness.

In order to improve the stocks further, more crosses were made with good quality andromonoecious cultivars. Another stock, M3, with slightly oblong shape and superior fruit quality was developed (2). It showed good GCA effects for fruit number, fruit weight, total yield per plant, TSS content and flesh proportion. In another sister line, M4, the fruit shape was round. Two backcrosses to an andromonoecious recurrent parent followed by two generations of selection for monoecious sex form and better fruit quality brought forth true breeding lines of M3 and M4. The ease with which these desirable recombinants were identified points out that sex and fruit shape in muskmelon are not as tightly linked as was thought before (5), and it is more of a chance association. We propose that in the evolutionary process and domestication of varieties in muskmelon, andromonoecious sex forms were established because of possibly human preference to round shape. Invariably monoecious varieties with oblong fruit shape probably were eliminated with the result that most of the cultivars, except those in Central Asia, are andromonoecious. This proposition is under investigation by studies on the existence of linkage, if any, and its estimation.

Studies were made on pollination and fruit set with M1 genetic stock comparing it with three andromonoecious varieties. In 1972 and 1973, it was observed that mean fruit set by controlled hand pollination using M1 genetic stock as female parent was 34.84%, while in the three andromonoecious varieties fruit set ranged from 10.05 to 23.05%. Fifteen andromonoecious varieties (as the male parent) were crossed onto M2 and M3 and average fruit set from hand pollination was 28.54% with M2 as a female parent and 41.62 % with M3 as a female parent. These results bring out the usefulness of monoecious forms in muskmelon in hand pollination.

In order to test the desirability of these stocks for hybrid seed production under open-pollinated conditions, the M1 line was treated with ethrel (2 times at 200 to 250 ppm). The first five flowering nodes bore pistillate flowers and then sex expression reverted to staminate flowers (3).

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Cucurbit Genetics Cooperative Report 3:34 (article 19) 1980

Embryo Culture of *Cucumis* Species

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Due to embryo abortion in greenhouse crosses, embryo culture was utilized to produce plants from the *Cucumis metuliferus* x *C. melo* cross. Although fruit appeared to develop normally in the *C. anguria* x *C. melo* cross, the embryos aborted before the fruit matured.

Plants of *C. melo* (PI 140471) and *C. metuliferus* (PI 292190) were grown in a growth chamber at 26°C day and 14°C night temperature with a 12 hr day. The growing media consisted of a peat, perlite, soil mixture, 1:1:1, in 30.5 cm clay pots. The plants were trellised on a 2.1 m x 2.5 cm x 2.5 cm wood stake in the center of each pot.

Fruit from controlled crosses were harvested at 5-day intervals beginning 15 days after pollination. Seed were surface sterilized and embryos were carefully removed in a contamination-free work area. The embryos were cultured on a pre-mixed, high salt Murashige and Skoog semi-solid medium plus thiamine, pyridoxin, nicotinic acid, myo-inositol, naphthalene acetic acid, kinetin and sucrose. The embryos remained dormant from two days to two weeks. After the radicle emerged as a root, the plumule would develop green color.

After six to eight weeks, growth of the embryos was adequate for transfer to a sterilized soil mixture in 10.2 cm peat pots. Later the plants were transferred to 30.5 cm clay pots and field plots.

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Induction of Perfect Flowers on Gynoecious Muskmelon by Silver Nitrate and Aminoethoxyvinylglycine

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Recently, several hormones have been found to induce staminate flowers on gynoecious cucumber: silver nitrate ($AgNO_3$) (1, 2, 3, 6), silver thiosulfate ($Ag_2S_2O_3$) (4), and aminoethoxyvinylglycine (AVG) (5). Silver nitrate and AVG were evaluated along with gibberellic acid$_4$/gibberellic acid$_7$ ($GA_{4/7}$) for their ability to induce perfect flowers on gynoecious muskmelon.

Gynoecious MSU-1G muskmelon plants grown in the greenhouse in the summer of 1979 were treated with $AgNO_3$ at 100, 200, and 400 ppm; AVG at 50, 100, and 200 ppm; and $GA_{4/7}$ at 100 ppm. All chemical solutions were made up in deionized, distilled H_2O and were applied twice to runoff at either the three-leaf of five-leaf stage with one week between applications.

$AgNO_3$, the most effective treatment, resulted in approximately 12 out of 20 nodes bearing perfect flowers, often in clusters (Table 1). The AVG treatments were also effective but induced only about half as many perfect flowers as $AgNO_3$. Plants treated with $GA_{4/7}$ at 100 ppm produced an average of only 1.3 nodes in the first 20 bearing perfect flowers while control plants had an average of 0.8.

Some phytotoxicity was observed with $AgNO_3$ at 200 and 400 ppm and in plants receiving AVG at 100 and 200 ppm, severe stunting and chlorosis persisted for about two weeks. Multiple applications of these chemicals at the lower concentrations may allow good induction without phytotoxicity.

Table 1. Effect of hormone treatment on mean number of nodes bearing a perfect flower on gynoecious muskmelon.[z]

Hormones	Concentration (ppm)	Number of perfect-flowered nodes [y]
$GA_{4/7}$	100	1.3 c
$AgNO_3$	100	11.9 a
	200	11.4 a
	400	12.0 a
AVG	50	5.5 b
	100	6.9 b
	200	5.9 b
Control	-	0.8 c

[z] Based on first 20 nodes of main stem.

[y] Mean separation within columns by Duncan's Multiple Range Test, 1% level.

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An Additional Seed Length Class in Watermelon

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Poole, Grimball and Porter (1) reported digenic control of seed length in watermelon. A ratio of 9 medium (10 mm mean length): 3 long (13 mm mean length) : 4 short (6 mm mean length) was reported. The range of seed lengths for the short parents was 4.5-7.5 mm, the range for the medium parents was 7.5-11.5 mm, and the range for the long parents was 11.5 to 16.5. A small-seeded melon was obtained from the USDA Vegetable Lab in Charleston labeled W 941 with an apparent origin in Hungary or Romania.

The mean length of seed for the 'Coconut Melon' was 3.8 mm; the seed length of selected watermelon varieties is given in Table 1. Of the varieties measured, a difference of 0.7 mm existed between 'Sunshade' and 'Chris Cross' seed and a difference of 1.8 mm between 'Sugar Bush' and 'Market Midget' seed. The gap between 'Sugar Baby' and 'Coconut Melon' was 3.2 mm. 'Coconut Melon' was 2.2 mm shorter than the mean for the short-seeded variety used by Poole et al. (1). The seed length class of 'Coconut Melon' has remained constant for three generations.

Table 1. Seed length of watermelon cultivars.[z]

Cultivar	Length (mm)	Cultivar	Length (mm)
Florida Giant	14.2	Charleston Gray	11.5
Blackstone	14.1	Congo	11.2
Smokylee	13.6	Sugar Bush	11.1
Texas Golden	13.3	Market Midget	9.3
Garrisonian	13.0	Dixie Queen	8.8
Stone Mountain	12.9	Crimson Sweet	8.7
Grahoma	12.6	Improved Peacock	8.3
Tom Watson	12.6	Winter Queen	8.2
Jubilee	12.5	Supersweet	8.0
Wondermelon	12.5	Kengarden	7.9
Ice Cream	12.5	Royal Charleston	7.5
Tendersweet	12.5	Allsweet	7.5
Sunshade	12.3	Sugar Baby	7.0
Chris Cross	11.6	Coconut Melon	3.8

[z] Ten seeds were measured with vernier calipers to the nearest half mm.

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Inheritance of a Pale Seedling Character in *Citrullus lanatus*

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The pale seedling character in watermelon was as described previously (1). On first examination, the character appeared to be associated with resistance to race 2 anthracnose (AR2). In 1979 the inheritance of this character and its relationship to AR2 resistance was investigated. One week old seedlings of the P_1 (pale characters), P_2 (Allsweet), F_1, F_2, and BC_1 to P_1 were transplanted to the field in peat pellets on April 1. Totals for seedling color for F_2 progeny were pooled from greenhouse and field data. On April 30, plants in the field were inoculated with 1250 spores/ml of an AR2 suspension. On July 26, plants were evaluated for resistance.

The F_2 segregation of pale seedlings and green seedlings fit a 13:3 ratio (Table 1). In the backcross of pale seedlings x F_1 (pale seedlings x Allsweet), the data are consistent with a 1:1 ratio. It is important that seedlings be scored after the cotyledons are fully expanded and before the second true leaf stage, since the pale condition often disappears after that period. If the pale seedlings character is assumed to be due to a recessive gene at one locus interacting with a dominant gene at a second locus, then a 13:3 ratio for the F_2 and a 1:1 ratio for the BC_1 populations are compatible.

The defoliation ratings and fruit lesion counts did not support an association between AR2 resistance and the pale seedling character (Table 2), nor that resistance existed in the line with the pale seedling character. However, it should be noted that disease ratings were made two weeks after inoculation in the first comparison (1) and well past fruit maturity in this comparison.

Table 1. Segregation for the pale seedling character in the F_2 and backcross populations from a pale seedling by green seedling cross.

	Observed				
Population	**Green**	**Pale**	**Expected ratio**	**Chi-square**	**Probability**
F_2	318	72	3:1	8.892	0.003
			13:3	0.021	>0.95
Pale x F_1	90	104	1:1	0.506	0.50

Table 2. Frequency distribution for anthracnose 2 defoliation ratings and fruit lesion counts within pale seedling and normal seedling classes.

		Percentage defoliation									
Population	**Seedling color**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Pale seedling	Pale green	0	0	0	0	0	0	0	0	0	2
Allsweet	Green	0	0	0	0	3	0	1	0	0	4
F_1	Green	0	0	0	0	0	0	0	0	1	9
F_2	Pale green	0	0	1	2	1	2	1	0	5	19
		Number of lesions/fruit									

Population	Seedling color	0	1-5	6-10	11-20	>20
Allsweet	Green	1	1	3	0	2
F_1	Green	1	2	3	0	2
F_2	Green	10	3	0	4	6
	Pale green	13	3	2	2	2

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Realization of the Interspecific Hybridization (F_1 and BC_1) Between *Cucurbita pepo* and *C. ecuadorensis*

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Cucurbita ecuadorensis is resistant to the most important and common diseases of *C. pepo* in France: powdery mildew, cucumber mosaic virus, watermelon mosaic virus (1, 2). The interspecific cross between the two species was attempted only in using *C. pepo* as pistillate parent (*C. ecuadorensis* produced no pistillate flowers in the conditions of our trials).

Observations of pollen germination of *C. ecuadorensis* on *C. pepo* stigma were made by means of fluorescence. The results were very different from one flower to the other: no pollen germination, pollen germination and short pollen tubes, and, in a few flowers, a small fraction of the pollen tubes could reach the ovule and the embryo sac.

Only parthenocarpic fruits with empty seed coats were obtained. However, some very small and white embryos (0 to 10 per fruit) were observed inside the seed coats one month after pollination. Without endosperm the embryos could not grow further. These embryos were put on a culture medium *in vitro* and gave rise to plants:15 viable plants were recovered from ten fruits. These plants had characteristics of the two parental species and were really F_1 hybrids. By selfing the F_1 plants, no fruit set was obtained.

The backcrosses with *C. pepo* gave fruits but the development of the embryos inside the seed coats was completely abnormal.

These embryos (10 to 40 per fruit) were transferred on a culture medium *in vitro* 40 or 60 days after pollination. A small fraction (10 of 100) gave rise to normal plants. The BC_1 plants are fertile and some normal seeds were gathered after selfing.

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Gibberellic Acid Treatment to Improve Germination of Cucurbit Seed

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Seed dormancy is not infrequent with wild species of the Cucurbitaceae. Temperature modification (1) can overcome the dormancy of some species, and the dormancy of freshly harvested cucumber seed can be alleviated by storage and by sowing on moist paper (2). Watts (2) reported that removal of the seed coats improved germination of freshly harvested cucumber seed, and we found it helpful for dormant seed lots of other cucurbit species after prolonged storage as well. However, these treatments have been insufficient for dormant seeds of many wild species of the Cucurbitaceae.

Dormant seed of *Cucumis* and *Cucurbita* species were treated with growth regulators in an attempt to improve their germination. Germination was not stimulated by kinetin (100 ppm), fusicoccin (2×10^{-5}M) or a combination of kinetin (10 ppm), ethephon (50 ppm), and gibberellic acid$_3$ [GA_3 (20 ppm)]. GA_3 alone, at 100 ppm and particularly at 1000 ppm, inhibited germination of *Cucumis myriocarpus* at 30°C (Table 1).

Table 1. Germination of *Cucumis myriocarpus* seeds at 30°C after treatment with growth regulators.

Treatment	% germination after 20 days
0	19
100 ppm GA_3	19
1000 ppm GA_3	0
50 ppm $GA_{4/7}$	25
500 ppm $GA_{4/7}$	75

Treatment with $GA_{4/7}$ has proven effective for seed of many genera of the Cucurbitaceae. This GA treatment should be used in conjunction with the optimum temperature for each species. *Cucurbita okeechobeensis*, for example, would not germinate at 20°C, even when treated with $GA_{4/7}$, but did germinate at 30°C.

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Cucurbit Genetics Cooperative Report 3:44 (article 25) 1980

Bitter Cucurbita Hybrids as Baits for Diabroticite Beetle Control

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We reported previously (1) that the leaves and fruits of bitter *Cucurbita* spp., e.g. *C. andreana* containing up to 0.3% cucurbitacins B and D and *C. texana* containing up to 0.1% cucurbitacin E-glycoside, were very attractive to adult cucumber beetles *Diabrotica undecimpunctata* and *Acalymma vittata* and to the western corn rootworm *D. virgifera*. The cucurbitacins acted as kairomones, arresting the beetles and stimulating them to compulsive feeding at quantities as low as 1 ng. There is evidence that the nonvolatile cucurbitacins co-distill from bruised leaves or damaged fruits and can be detected by the beetles over a distance of several meters. The effectiveness of cut fruits or homogenates was greatly improved by treating them with the rapidly acting contact insecticides trichlorfon or methomyl at concentrations of 0.01-0.1% of fruit weight. Such preparations killed feeding beetles within 2-5 min and prevented them from rapidly consuming the baits. Ten cut fruit of *C. andreana* each sprinkled with about 0.1 g or methomyl killed an average of 437 *D. undecimpunctata* and *D. virgifera* beetles over three days, compared with an average of 381 beetles for *C. texana* fruits. Such baits continued to kill the beetles for at least two weeks, individually treated fruits killing thousands of insects.

However, these wild bitter *Cucurbita* spp. are not dependable sources of cucurbitacins under Midwest growing conditions. Fruiting is generally dependent upon photoperiod, yields are low and often erratic. Therefore, a number of interspecific hybrids were grown and evaluated for beetle attraction in the field and the cucurbitacin contents determined. Hybrids of *C. andreana* x *C. maxima* and of *C. texana* x *C. pepo* were the most promising from the standpoint of high cucurbitacin content, high yield, and ease of culture. They were grown in acre-sized plots in 1979. The *C. andreana* x *C. maxima* hybrid fruits contained about 0.13% cucurbitacin B and D and yielded about 30,000 lbs/A. The *C. texana* x *C. pepo* hybrid fruits contained about 0.06% Cu E and its glycoside and yielded about 15,000 lbs/A.

The leaves, fruits, and blossoms of these hybrid bitter squash were evaluated for feeding preferences by the Diabroticite beetles and for cucurbitacin contents. In general, the hybrids plants were fully as attractive as baits as the parent bitter squash, although the cucurbitacin contents were slightly lower. Therefore, we now have a dependable source of highly attractive bitter fruits. The hybrids will be further selected for high cucurbitacin yield during the 1980 season and will be extensively evaluated as trap crops and as poisoned baits for Diabroticite pest management using cut fruits and granular and pelleted baits.

This research was supported in part by a grant from the USDA, SEA, Competitive Research Grants Office, 5901-0410-8-0067-0. Any opinions, findings, and conclusions are those of the authors and do not necessarily reflect the views of USDA.

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Cucurbit Genetics Cooperative Report 3:44 (article 25) 1980

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Synonymy of *Cucurbita martinezii* and *C. okeechobeensis*

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The okeechobee gourd was first given the name *Pepo okeechobeensis* by Small in 1930 (7). Bailey (2) retained the species name for this denizen of the Lake Okeechobee area in Florida but correctly revised its genus designation to *Cucurbita.*

Cucurbita martinezii was named by Bailey in 1943 (1). He distinguished *C. martinezii* from *C. okeechobeensis* primarily on the basic of pubescence and exocarp characteristics. Although he reported that the petiole and lower leaf surface of *C. okeechobeensis* is pubescent and that of *C. martinezii* is nonpubescent, we found no significant difference in pubescence of different accessions of the two putative species. Also, pubescence is evident on the lower as well as the upper leaf surfaces and the petioles of herbarium specimens of *C. martinezii* in the Bailey Hortorium, Cornell University, that were collected by M. Martinez in Aloyac, Mexico in 1941 and sent to Bailey. Accessions of *okeechobeensis* from Florida as well as those of martinezii from Mexico had similar light and dark green longitudinal striping on the fruit, although Bailey reported *okeechobeensis* to have striped and *martinezii* nonstriped fruit. He described the fruit rind of *martinezii* as being thick, very hard, and difficult to the knife whereas that of *okeechobeensis* was thin and not usually resisting. However, we found the exocarp of each accession of *okeechobeensis* to be equally thick and hard as those of *martinezii.* The morphological similarity of *C. martinezii* and *C. okeechobeensis* is supported by the numerical taxonomy study of Bemis *et al.* (3).

Cucurbita martinezii and *C. okeechobeensis* are also alike in disease resistance. Munger (4) reported that *C. martinezii* is resistant to cucumber mosaic virus, and he confirmed T. W. Whitaker's finding that it is resistant to powdery mildew. *Cucurbita okeechobeensis* has an equally high level of resistance to cucumber mosaic virus (5), and it is also resistant to powdery mildew. Both are also alike in being resistant to the severe strain of bean yellow mosaic virus, tobacco ringspot virus, and tomato ringspot virus. Both *C. martinezii* and *C. okeechobeensis* recovered from squash mosaic virus inoculation, unlike most of the other species tested, and both were susceptible to watermelon mosaic virus-1 and watermelon mosaic virus-2. They did not differ in reaction to any disease.

There is no sterility barrier isolating *C. martinezii* from *C. okeechobeensis*. Reciprocal crosses were easily made and the F_1 hybrids were fully fertile.

Cucurbita martinezii differs from all but one of the know species of *Cucurbita* by having a cream colored corolla. The only other species to have cream instead of yellow petals in *C. okeechobeensis*. A single recessive gene and a modifier governs this flower fruit in *C. martinezii* (6). Our results indicate that *C. okeechobeensis* also has single recessive basic gene for cream corolla color, and it is allelic to the gene of *C. martinezii.*

Convincing evidence for synonymy of *C. martinezii* and *C. okeechobeensis* was obtained by starch gel electrophoresis of isozymes. Four accessions of *C. okeechobeensis* were compared to six accessions of *C. martinezii* and also with 17 different species of *Cucurbita*. Each accession of *okeechobeensis* and *martinezii* was identical in esterase, peroxidase, and leucine amino peptidase isozymes and all were distinct in isozymes from each of the other *Cucurbita* species.

The only apparent difference between the two entities is their origin, *C. martinezii* being from Mexico and *C. okeechobeensis* from Florida. In the absence of any other significant difference, it is concluded they are the same species, which was introduced to Florida from Mexico in prehistoric times. An unsolved question is how this species traveled such a great distance. One possible explanation is that it was acquired by an Indian tribe in Florida by trade with Indians from the west. The extremely bitter flesh of this species precludes it from being used for food, but the seeds are edible and nutritious and the fruit could also have been used for its detergent quality. The hard rind and good keeping ability would make it possible for the fruit to be transported from Mexico to Florida, even with the very long time such a trip must have taken. Another

possible explanation for the migration of the species from Mexico to Florida is by oceanic drift in the Gulf Stream of fruit containing viable seed.

The species name *okeechobeensis* has priority, hence, is preferred to its synonym, *martinezii.*

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Systematics of the Melon-Squash

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Sensational claims have been made for the 'Melon-squash', also known as the 'Tahitian' squash, which was introduced by the Thompson and Morgan Seed Co. in 1977. It has been described in Horticulture Magazine (January, 1977) and in seed catalogs as being *Cucurbita maxima,* yet it has cushaw-shaped fruit with a hard peduncle, quite atypical for that species but more characteristic of *C. moschata* or *C. mixta.*

Its purported origin is exotic. It is claimed to be an introduction from the isle of Tahiti. Cucurbita is native to the Americas, not the polynesian islands, although *C. maxima* was introduced to Tahiti in 1767 (1).

Remarkable gustatory qualities have been attributed to the 'Melon-squash'. It is claimed to have the texture of a carrot and the flavor and fragrance of a cantaloupe. A seed catalog described it as being the sweetest squash of the century. It is asserted to be delicious when eaten raw like a melon or cooked like a potato.

We grew the 'Melon-squash' to determine its botanical identity and to evaluate its horticultural qualities. It proved to be very prolific, bearing over 100 lbs of squash per plant. The fruit were large, averaging 18 lbs each, extremely variable in size and shape, and similar in appearance to the 'Golden Cushaw' cultivar of *C. moschata*. The fruit were of good quality for winter squash and stored well. Its flavor when eaten raw was only faintly reminiscent of a muskmelon, and, although lacking the fragrance of a muskmelon and inferior in flavor, was not disliked by a tasted panel. However, the quality of being palatable uncooked is not unique to the 'Melon-squash'; the taste panel found raw Butternut squash to be equally good and the soluble solids content of Butternut fruit was the same as that of the 'Melon-squash'.

Reciprocal crosses between the 'Melon-squash' and several cultivars of *C. maxima* were all unsuccessful. No fruit set was obtained from ten crosses between 'Melon-squash' and *C. mixta* cv. 'Striped Cushaw'. But the 'Melon-squash' crosses readily with *C. moschata* and produced fully fertile hybrids with Butternut.

Electrophoretic analyses of esterases, peroxidases, and peptidases revealed that the isozymes of the 'Melon-squash' are unlike *C. maxima* but are typical of *C. moschata*. The isozyme patterns for the 'Melon-squash' differed from that for the *Cucurbita* species *andreana, cordata, cylindrata, digitata, ecuadorensis, ficifolia, foetidissima, gracilior, lundelliana, martinezii, mixta, okeechobeensis, palmata, palmeri, pepo, sororia, and texana.*

It is concluded that the 'Melon-squash' is nothing more than a highly variable, large fruited type of *C. moschata,* and it is doubtful that it is of polynesian origin.

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Comparison of Squash and Honey Bees as Pollinators of Summer Squash

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Observations and experiments were conducted to ascertain if the specialized squash bee *Peponopis pruinosa* is superior to the honey bee *Apis mellifera* as a pollinator of summer squash, *Cucurbita pepo*, var. Italian Black Zucchini. The study site was the Greenville Farm operated by Utah State University at North Logan, UT. Natural populations of *P. pruinosa* have been recorded there since 1953 and since honey bees are common, it was not necessary to import hives for experimental purposes. Three parameters contributing to pollination efficiency are: 1) the number of visits necessary to achieve pollination, 2) the preference of the bees for staminate or pistillate flowers, and 3) the average time spent foraging on a flower.

Bagging and controlled visit experiments showed individual visits to pistillate flowers by each species to be equivalent. Honey bees display a significant preference for pistillate flowers; squash bees prefer staminate flowers. Squash bees work the flowers more rapidly than do honey bees. When all parameters are considered, there appears to be little difference between the species as pollinators of squash. However, because of their earlier diurnal flight periods, squash bees were responsible for most pollinations before honey bees appeared in numbers on the plantings.

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Fruit Development in Summer Squash in Relation to the Number of Stigmatic Lobes Receiving Pollen

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Although insects are necessary for the pollination of monoecious summer squash, *Cucurbita pepo*, it is not known if insect visitors must deposit pollen on all three stigmatic lobes of the pistillate flower for normal fruit development to occur. During a study comparing the pollination efficiency of squash bees, *Peponapis pruinosa*, and honey bees, *Apis mellifera,* on a small planting of Italian Black Zucchini in North Logan, UT, the opportunity was taken to clarify this point. Prebagged pistillate flowers were hand pollinated by rubbing the anther of a flower from another plant across one or two of the stigmatic lobes. Flowers were immediately rebagged after treatment.

Of 12 flowers receiving pollen on only one stigmatic lobe, ten produced "normal" appearing fruit (mean time to =18 cm = 7 days). Four of five flowers pollinated on two stigmatic lobes produced similar fruit (mean = 6.3 days). Although the fruits appeared typical externally, it is possible that a comparison of seed production would have revealed differences.

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Reciprocal Crosses Between *Cucumis africanus* L. F. and *C. metuliferus* Naud. II. Embryo Development *In Vivo* and *In Vitro*

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Using mentor pollen and amino-ethoxy-vinyl-glycine (AVG), we were able to obtain a number of fruits with embryos in crosses between *Cucumis africanus* and *C. metuliferus* (Nijs et al. 1980). The temperature during fruit development was set at 23°C D/18°C N, but on hot days it rose above 30°C. The fruits were opened at various times after pollination and all full-sized and almost full-sized ovules were examined. The size and stage of embryo development were determined, after which all successfully isolated embryos were incubated *in vitro*. MS medium was used with the addition of casein hydrolysate (1 g/l), sucrose (20, 35 and 50 g/l), Difes Bacto agar (7.5 g/l), kinetin (0.1, 1 and 10 mg/l), and IAA (0.02 mg/l). The cultures were kept at 25±0.8°C in a 16 hr photo-period (Philips TL 33; approximate intensity 1,500 lux).

In vivo results. Table 1 gives data on embryos excised from the fruit at different times after pollination. Different pollination aids as well as different accessions of the species did not affect embryo size, so all data were pooled per cross. The rate of embryo extension growth was almost similar in the reciprocal crosses for about four weeks. Thereafter, growth slowed down in *C. africanus* x *C. metuliferus*, but continued more rapidly in the reciprocal cross. In the former combination there was large variation in the size of the embryos, which appeared to increase with time. In both crosses the transition from globular to heart shape stage occurred when the embryos were 0.10 to 0.12 mm in diameter. When they were 1.2 mm long, the distance from radicle tip to the apex measured about 0.8 mm, whereas in the reciprocal cross, both length and width of the cotyledons increases considerably.

In vitro results. Only a limited number of the possible combinations of the variables was tested. Almost all small embryos (0.09 to 0.13 mm) started growing and greening on medium containing 0.1 mg/l kinetin and 5% sucrose; within two weeks the cotyledons were about 0.6 mm long. Although 5% sucrose was beneficial initially, subculturing on 2% sucrose prolonged embryo life. Development of complete plants, however, did never occur. When incubated on 10 mg/l kinetin, these small embryos died immediately.

Early heart shape stage embryos (0.14 to 0.40 mm) reacted rather like the globular ones, except that the cotyledon length reached up to 1 to 2 mm. Late heart shape stage embryos (0.5 to 0.8 mm) showed the same development, but sometimes exhibited a reaction pattern as found in the advanced stage embryos.

Advanced stage embryos (0.9 to 1.2 mm) remained fully white when incubated on 0.1 mg/l kinetin and 5% sucrose and did not grow. Some growth and marginal greening of cotyledons occurred on lower sucrose concentrations. The combination 1 mg/l kinetin + 3.5% sucrose brought about light green, glassy cotyledons, and sometimes new formation of leaf-like structures, but a growing point did not appear. The combination 10 mg/l kinetin + 5% sucrose induced the formation of small, thick, dark green cotyledons and sometimes hypocotyl extension growth and main root development. Promising embryoids developed as well, but organized growing points did not.

The embryos, 3.0 to 4.2 mm long, of *C. metuliferus* x *C. africanus* remained completely white on medium containing 0.1 mg/l kinetin and 5% sucrose. However, 10 mg/l kinetin induced development of normal plantlets, a number of which could be transferred into soil. These plants appeared to be real hybrids.

The embryos, 1.3 to 2.1 mm long, of *C. africanus* x *C. metuliferus* dissected 100 days after pollination looked weakened and shriveled. They retained vitality on medium containing 10 mg/l kinetin and hypocotyl and roots developed. Some embryos formed weak true leaves two months after incubation, but they are not yet ready to be transferred into soil.

Table 1. Size of embryos in ten fruits of Cucumis africanus x C. metuliferus and in five fruits of the reciprocal cross at

different times after pollination.

	C. africanus x C. metuliferus			*C. metuliferus x C. africanus*		
Days after pollination	**n**	**Mean size (mm)**	**CV (%)**	**n**	**Mean size (mm)**	**CV (%)**
15-17	14	0.15	22	12	0.12	17
"	5	0.14	17	-	-	-
18-20	10	0.39	24	2	0.24	6
"	6	0.34	21	-	-	-
"	9	0.30	14	-	-	-
21-23	41	0.79	18	-	-	-
24-26	-	-	-	9	0.87	40
27-29	30	1.05	43	12	3.44	15
"	84	1.06	30	-	-	-
38	-	-	-	21	4.06	7
100	27	1.70	28	-	-	-
"	38	1.61	30	-	-	-

n: number of measured embryos per fruit.
Mean size: mean diameter of globular or mean total length of heart shape and more advanced stage embryos (mm).
CV: coefficient of variation (variance/mean).

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Cucurbit Genetics Cooperative Report 3:52-54 (article 31) 1980

In Vivo Pollen Tube Growth as a Measure of Interspecific Incongruity in *Cucumis* L.

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Pollen tube growth in the style was studied in a diallel involving ten African species of *Cucumis* as well as *C. sativus* L. Several workers have studied interspecific relationships within the genus by assessing fruit and seed set and fertility of hybrid offspring. The present work extends this knowledge to the location of the barriers to pollen tube growth in the stigma, style and ovary. Moreover, almost all species in this study were represented by several accessions so that some insight was gained in intra-specific variability with respect to crossability. All accessions were identified taxonomically and are listed with their author.

For each combination in each year at least three flowers (and mostly a larger number) were pollinated. Pollen tube behavior was examined by UV microscopy of flowers three days after pollination.

Plants were grown in the summer in a glasshouse (25°C D/18°C N). Almost all crosses were repeated in three consecutive seasons. As there were no great discrepancies among the results in the different years, we combined all data. All species were monoecious except the cultivated melons. Only monoecious feral melons (type *agrestis*) were employed as female parent to avoid ambiguities due to emasculation. In most species the different accessions (Genebank numbers, Gbn) behaved similarly, so the results were pooled per species. Notable exceptions are *C. sativus* with five accessions and *C. anguria* with three. Four accessions of *C. sativus* can be tentatively designated as primitive or *hardwickii*-types. The fifth is *C. sativus* var. *sikkimensis*. The results of our investigation are in Table 1. For explanation of the figures, see the legends of the table. Some of the conclusions are as follows:

1. Selfing pollinations and intraspecific crosses result in good penetration of pollen tubes into numerous ovules of all species.
2. Part of the African species appear congruous.
3. *Cucumis myriocarpus* and *C. ficifolius* appear unilaterally incongruous with most representatives of the African group. *Cucumis myriocarpus*, when used as a staminate parent, gives better results than in reciprocal crosses whereas with *C. ficifolius*, the reverse is true.
4. *Cucumis metuliferus* is strictly separated from most of its relatives.
5. All accessions of *C. sativus* are, to some extent, mutually congruous though not as fully as might be expected of a single species. There is even evidence for unilateral incongruity.
6. Combinations between *C. sativus* and any of the African species exhibited restricted pollen tube growth, except several crosses of *C. sativus* x *C. melo.* The reciprocals of these crosses do not allow tube growth.
7. Of all african species tested, *C. melo* appeared to be most promising for use as a bridge between several species with resistances and *C. sativus*.

More intensive investigations of the most useful combinations are in progress. More detailed results (a.o. on identification, variation between accessions, fruit and seed set, embryo culture, nature and fertility of obtained hybrids) will be published shortly.

Table 1. Pollen tube (p.t.) growth in the style in interspecific crosses in *Cucumis* L.

		Male Parent															
	Female Parent	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
1	*Cucumis africanus* L.f., Gbn. 0162.0181.0330	4	3(4)	3(4)	3(4)	3(4)	2	2(3)	3(4)	4	1(2)	1(2)	1	2	1(2)	1(2)	2

2	*C. anguria* L., Gbn 0307.0310	3(4)	4	4	4	2		2	4	4	2	3(4)	1	2	2	2	2
3	*C. anguria* L., Gbn. 1758	2	4	4			1	1	2	4	1	1	1	1	2		
4	*C. myriocarpus* Naud., Gbn. 0182.1776	2(3)	2	1	4	1	1	1	2	1	1	1	1	1	1	1	1
5	*C. zeyheri* Sond., Gbn. 1053	4	3(4)	2	3(4)	4	3	3	3(4)	4	1	2(3)	1	1	1(2)		1(2)
6	*C. figarei* Naud., Gbn 1707	3		1	3(4)		4	3	3	3	3	2	2	2(3)	2	2(3)	3
7	*C. ficifolius* A, Rich., Gbn. 1729	4	4	4	4	4	3(4)	4	4	4	3	2(3)	2	2	2	3	2
8	*C. dipsaceus* Spach., Gbn. 0163	4	3		4	4	3	3	4	4	3	2(3)	1	2	1	3	1
9	*C. prophetarum* L., Gbn. 1751	3	4	4	3	1	1	1	1	4	1	1	1	1	1	0(1)	0(1)
10	*C. metuliferus* Naud., Gbn. 0164.1734.1747	2	1	2	2	3	1(2)	1	2	2	4	2	2	2	2	2	2
11	*C. melo* L., Gbn. 0309.1777.1717	1	1	1	1	0(1)	1	1	0(1)	0(1)	1	4	0	1	0(1)	0(1)	1
12	*C. sativus* L., Gbn. 1739	1	1		1		0	1	0(1)	2	1	1	4	1	1	1	1
13	Gbn. 1811	3	1	1	1	1	0(1)	1		1	1	3	3	4	4		4
14	Gbn. 0777	3	3	2	2	3	1	1	1		1	4	3	3	4	4	4
15	Gbn. 1753	2(3)	0(1)		1(2)	3	1	1	1	3	1	3	3		4	4	3
16	Var. *sikkimensis* Hook.	2	1	1	2(3)	1(2)	0(1)	1	1	1	1	3	3	3	3	4	4

Legends: 0 = no p.t. in stigma; 1 = p.t. in stigma; p.t. in style; 3 = p.t. in ovary; 4 = p.t. in ovule; ( ) a few pollen tubes.

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Problems with the Identification of *Cucumis* L. taxa

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The *Cucumis*-working group at our Institute attempts to introduce resistances of several African species of *Cucumis* L. into the cultivated cucumber *C. sativus* L. We have, therefore, collected a large number of species from all over the world. The identification of *Cucumis* species, either collected directly in the wild or maintained under cultivation, often appears to be difficult and many received accessions need to be renamed by our taxonomists.

In 1976, 76 accessions were examined, 25 of which had to be reclassified. The high number of misclassifications is not surprising, since results of taxonomic studies of the genus are often incomplete or contradictory. Many authors made description based on single plants or small groups, or only on herbarium specimens. The latter is certainly not sufficient since the material, as we studied it in the herbaria of Kew (UK) and Leiden (Netherlands) is often incomplete. Roots or rootstocks are largely lacking although they are important for determining the life cycle, which can be an important character in some cases. Even fruits are often lacking although they are decisive in the identification. Spirit collections are very poor or nonexistent. Also, the leaves of especially the older specimens may be untidily mounted on the sheets s that one cannot even recognize their shapes. More than one taxonomist appears to have been frustrated by the lack of live material as is shown by frequent amendments of earlier descriptions, sometimes leading to embarrassing changes. One can find different descriptions of, for example, *Bryonia callosa* Rottl (1903) later placed in the genus *Cucumis* by cogniaux (1) as *Cucumis callosus* (Rottl) Cogn. (1916), which is considered synonymous with *C. trigonus* Roxb. by Clarke (1897). The description of *C. myriocarpus* Naud. by Meeuse (2) is completely different from the original one composed by Naudin (3).

The existing descriptions cover only a small part of the intraspecific variability. Therefore, many taxa were labeled species, which to us seem to be only subspecies, varieties, or just synonyms. *Cucumis hardwickii* Royle was named a variety by Alefeld [*C. sativus* var. *hardwickii* (Royle) Alef]. The original form has never been found after Royle described it, and plants resembling Royle's description are thought by Filov, amongst others, to be formae of *C. sativus* L. Naudin, after studying live plants in his garden besides herbarium material, has pooled many taxa, reducing many specific names to synonyms.

The identification of wild *Cucumis* species under conditions of cultivation poses its own problems. Plants grow in a glasshouse at Wageningen proved to be much larger and more luxuriant, which affects he sizes of all plant parts and possibly also leaf shapes. Ripening of fruits undoubtedly proceeds in a different way. We have, for example, never observed fruits of *C. africanus* L.f. and *C. myriocarpus* Naud. turn brown when maturing, although they are supposed to do so. We attempt to grow the plants under very poor conditions, but these will never be a replica of those prevailing in nature.

Thus the identification of *Cucumis* species is made difficult by inadequate descriptions and different growing conditions, with the result that the interpretation of names of *Cucumis* taxa varies from one worker to another. To solve this problem, we propose to adopt the following principles.

1. A consistent use of the available information from the literature can save much confusion. A Latin name without the name of the author is not sufficient. For example, one could mistake *C. prophetarum* Jacq., which is a synonym of *C. myriocarpus* Naud., for *C. prophetarum* L. When a description has been amended by a later author, this should be mentioned and pertinent literature should be cited.
2. Sometimes the variability of certain plant characters clearly trespasses the boundaries set by the available description of the taxon. In these cases we propose to make a description to which can be referred in future work, not with the intention to describe a new taxon, but to give a true image of the plants dealt with. If describing is not possible, one should add a question mark or an indication such as "received as. . .".
3. At least some plants to be classified should be grown under conditions resembling those in their habitat. Certainly a note about the growing conditions would be of value.

The collection of the North Central and Southern Regional Plant Introduction Stations at Ames (Iowa, USA) and Georgia

(USA), respectively, is widely used. We think that several accessions of the PI collection studied at our institute needed reclassification. Because we feel it is worthwhile that all workers concerned have the, in our opinion, correct names at their disposal, a list of the PI numbers with their taxonomic classifications is given in Table 1. The pertinent literature for the identification is included.

PI classification*	Origin as given at PI lists	PI no.	IVT genebank no.	IVT remarks	Literature no.
Cucumis africanus	S. Africa	203974	1785	*C. africanus* L.f.	8
"	S. Africa	274036	1986	no flowers	
"	S. Africa	299569	1787	*C. africanus* L.f.	8
"	S. Africa	299570	1457	*C. africanus* L.f. Seed sample received in 1974. See *C. zeyheri* Sond. 299570	8
"	S. Africa	299572	1053	*C. zeyheri* Sond.	5
"	U. S. A.	374151	1788	not *C. africanus* L.f.; seed like *C. myriocarpus* Naud.	
C. anguria L.	Brazil	196477	0307	*C. anguria* L.	2
"	Ethiopia	233646	0310	*C. anguria* L.	2
"	S. Africa	282442	1790	not *C. anguria* L.; no flowers	
"	Iran	386029	1791	*C. melo* L.	1
"	Iran	386031	1792	*C. melo* L.	1
"	Iran	386086	1793	*C. melo* L., much variation in fruits	1
C. dinteri	U. S. A.	374208	1794	no fruits	
"	U. S. A.	374209	1795	no fruits	
C. dipsaceus Ehrenb.	Ethiopia	193498	0255	*C. dipsaceus* Spach ex Ehrenb.	7
"	Ethiopia	236468	1170	*C. dipsaceus* Spach ex Ehrenb.	7
C. ficifolius A. Rich.	Ethiopia	196844	0870	*C. ficifolius* A. Rich	1
"	Ethiopia	203915	1984	*C. ficifolius* A. Rich; fruit like *C. myriocarpus* Naud.	
"	Ethiopia	273648	1796	*C. ficifolius* A. Rich.	1
"	Ethiopia	280031	1797	not *C. ficifolius* A. Rich	
C. heptadactylus Naud.	S. Africa	282446	1798	*C. heptadactylus* Naud.	1
C. leptodermis Scweik.	U. S. A.	374152	1799	no germination	
C. meeusii	U. S. A.	376068	1800	*C. meeusii* C. Jeffrey	6
C. melo var. *agrestis*	Texas	140471	1746	*C. melo* var. *agrestis* Naud.	1
"	India	183311	0309	*C. melo* var. *agrestis* Naud.	1
C. membranifolius	Ethiopia	273650	1801	possibly *C. ficifolius* A. Rich.	
C. metuliferus E. Meyer	S. Africa	202681	1730	*C. metuliferus* Naud	1, 7
"	Transvaal	292190	1802	*C. metuliferus* Naud.	
C. myriocarpus Naud.	S. Africa	282447	1007	*C. myriocarpus Naud*., the same as *C. zeyheri* Sond. 299568	
"	S. Africa	282449	1676	*C. myriocarpus* Naud.	8
				not *C. myriocarpus* Naud., the same as *C.*	

"	S. Africa	299568	1051	*zeyheri* Sond. 299568	
C. prophetarum L.	Ethiopia	193967	1729	*C. ficifolius* A. Rich.	1
C. pustulatus	Ethiopia	273649	1803	*C. ficifolius* A. Rich.	1
"	Nigeria	343699	1804	*C. figarei* Naud. es Del.	7
C. sativus L.	India	165506	0630	*C. sativus* L.	2
"	Turkey	167043	0632	*C. sativus* L.	2
"	Turkey	271337	1829/1830	*C. sativus* L.	2
C. hardwickii	India	215589	0777	segregating	
C. sativus var. *sikkimensis* Hook.	India	165499	0629	*C. sativus* var. *sikkimensis* Hook.	3, 4
"	India	165509	0631	*C. sativus* L.	2
"	Turkey	169304	0642	*C. sativus* var. *sikkimensis* Hook.	3, 4
C. trigonis Benth.	India	271337	1805	*C. sativus* L. type	
C. zeyheri Sond.	S. Africa	282450	1008	*C. myriocarpus* Naud.	8
"	S. Africa	299568	1806	not *C. zeyheri* Sond., the same as *C. myriocarpus* Naud. 299568	
"	Natal	299570	1807	*C. zeyheri* Sond. Seed sample received 1978. See *C. africanus* L.f. 299570	5
"	S. Africa	299571	1052	segregating	
C. species	India	183310	0308	no germination	
"	Burma	200817	0460	*C. melo* L.	1
"	India	214050	1808	possibly *C. melo* L., no flowers	
"	S. Africa	409732	1809	*C. zeyheri* Sond.	5
"	S. Africa	409733	1810	not *Cucumis L.* at all	

* We have not always been able to obtain the author's abbreviation used by the PI Station.

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Reciprocal Crosses Between *Cucumis africanus* L.f. and *C. metuliferus* Naud. I. Overcoming Barriers to Fertilization by Mentor Pollen AVG

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Cucumis africanus L.f. carries resistance to cucumber green mottle mosaic virus, and *C. metuliferus* Naud. to root knot nematodes. We wish to introduce these resistances into the cultivated cucumber, *C. sativus* L. Crosses among these three species never succeeded (2, 5), but we recently succeeded in obtaining hybrids of *C. metuliferus* and *C. africanus* and likely also of the reciprocal cross.

Oost and den Nijs (4) reported on mentor pollen as a tool in interspecific hybridization in *Cucumis*. This technique was used in an extensive crossing program also encompassing the above mentioned species. The rhizobitoxine analog, amino-ethoxy-vinyl-glycine (AVG), was also used in attempts to overcome the crossing barriers, following the report of Natti and Loy (3) on its favorable effect on seed production in emasculated muskmelon.

For the present experiment we used two accessions of *C. africanus* (Gene bank nos. 0162 and 0181) and two of *C. metuliferus* (Gbn. 0164 and 1734). Plants were grown in the glasshouse in the summer season (± 23°C D/18°C N). Pollinations were made from the appearance of the first pistillate flower up to four months later, so age and carrying capacity of the plants varied greatly during the season. Mentor pollen was prepared following Oost and den Nijs (4), irradiation dose being 100 krad. Amino-ethoxy-vinyl-glycine was applied mixed in lanolin paste-water (7:3) at a concentration of 0.5 mg/ml. The mixture was smeared around the base of the flower directly after pollination, at an approximate rate of 0.1 ml per flower. Fruits that developed were dissected to check for ovules and embryos, starting two weeks after pollination. We have seen no indication of different behavior of accessions, so all data were pooled per species.

Results are presented in Table 1. Some conclusions are as follows.

1. No fruit set in controlled pollinations.
2. Mentor pollen effectively induced fruit set, but only ca. 1/3 of the fruits contained an embryo. In those fruits, the number of embryos was generally low. Controlled self-pollinations with only irradiated pollen also yielded many fruits (4) but ovules in these fruits always contained an embryo sac without an embryo.
3. Amino-ethoxy-vinyl-glycine induced only relatively few fruits to develop, but they all contained ovules with embryos. The number of such ovules was generally high.
4. The combined mentor pollen/AVG treatment resulted in fruit set comparable to the mentor pollen treatment alone. Most fruits contained ovules with embryos, an effect comparable with that of AVG alone. The number of pollinations with the combination treatment is thus far limited.

Many immature embryos from both young and maturing fruits were incubated on an artificial medium. In total, 235 embryos were successfully explanted of the *C. africanus* x *C. metuliferus* cross, and 51 of its reciprocal (1). A batch of mature seeds of *C. africanus* x *C. metuliferus* failed to germinate.

Thus far, *in vitro* culture has yielded plants of only *C. metuliferus* x *C africanus*. Ten plants have been transplanted into soil. They grew moderately in the glasshouse in autumn and produced light green leaves of intermediate shape. All staminate flower buds aborted, whereas pistillate flowers were small with shape and spines intermediate between those of the parents. Also, esterase isozyme patterns on polyacrylamide-gel-electropherograms of crude leaf extracts confirmed the hybrid nature of the plants. Their resistance spectrum is still being investigated. No fruits set so far following pollinations with pollen of various species, but it should be noted that the plants are now growing under unfavorable winter conditions.

Table 1. Effect of pollination technique on the results of reciprocal crosses between *Cucumis africanus* and *C. metuliferus*.

Treatment	**Number of pollinated flowers**	**Number of developing fruits**	**Number of fruits containing embryos**	**Number of ovules with embryo/ Number of large ovules***
Cucumis africanus x *C. metuliferus*				
Control	39	0	-	-
Mentor pollen	19	17	5	1/24; 1/12; 5/40; 30/57; 42/49
AVG	31	4	4	6/15; 19/40; 15/27; 29/35
Mentor pollen + AVG	7	5	4	1/25; 9/16; 40/50; 85/100
C. metuliferus x *C. africanus*				
Control	52	0	-	-
Mentor pollen	6	6	2	1/20; 2/13
AVG	29	4	4	12/25; 10/20; 14/20; 22/30
Mentor pollen + AVG	5	4	2	2/19; 1/8

* Only (almost) full-sized ovules were examined.

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Karyo-Morphology of *Cucumis callosus* (Rottl.) Cogn.

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Detailed karyo-morphological studies of Cucumis callosus were made from root tip squashes following the procedure of Parthasarathy and Sampathkumar (1). Observations made on several metaphase plates revealed the presence of 24 chromosomes in the somatic cells. The length of 1.67 µ. The karyotype is symmetrical in view of the preponderance of median centromeres. The karyotype is presented in the following table.

Table 1. Length and arm ratio of the chromosomes of *Cucumis callosus*.

	Length of chromosomes (µ)					
No. of chromosomes for each type	**long arm**	**short arm**	**total**	**L/S ratio**	**Relative length**	**Position of centromere and secondary constriction**
4	1.00	1.00	2.00	1.00	19.95	median and satellite
6	1.00	1.00	2.00	1.00	29.93	median
2	1.00	0.75	1.75	1.33	8.73	sub-median
4	1.00	0.50	1.50	2.00	14.96	sub-median
2	0.75	0.75	1.50	1.00	7.48	median
2	1.25	0.25	1.50	5.00	7.48	sub-median
2	0.65	0.65	1.30	1.00	6.48	median
2	0.75	0.25	1.00	3.00	4.99	sub-median
24						

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Taxonomic Position of Dosakaya (*Cucumis* sp.) - The Acid Melon of India

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Dosakaya is a cultivated *Cucumis* grown in Andhra Pradesh, for its sour fruits which are used in many culinary preparations ranging from curries to pickles. According to Rao (4), Dosakaya types are *C. sativus*. There are no reports available on the systematic status of Dosakaya, but Kailasam (2) reported that Dosakaya was crossable with both *C. melo* and *C. sativus*. However, his studies lacked cytological evidence. With a view to ascertatin the systematic position of Dosakaya, the present studies were undertaken.

Seeds of ten Dosakaya types were used in the study. Counts of somatic chromosomes were made from root tip cells following the procedure of Roy (5) using propiono-orcein stain. To ascertain the compatibility with other Cucuis species, reciprocal crosses were made with *Cucumis metuliferus, C. anguria, C. longipes, C. zeyheri, C. myriocarpus, C. dipsaceus, and C. melo*. The success of the cross was determined by the per cent of fruit set in crosses, number of developed seeds in crossed fruits, per cent of pollen fertility and viability in F_1. Meiotic studies were carried out in the pollen mother cells of F_1 plants to study the behavior of chromosomes during diakinesis.

Examination of many metaphase plates of root tip cells revealed the chromosome number of 2n=24 in all Dosakaya types studied. The crosses revealed that each Dosakaya type studied was crossable with only *C. melo*. Fruit set was nil in crosses with other species. However, crosses with *C. melo* were successful only when *C. melo* was used as staminate parent. This failure may be due to the fact that the *C. melo* cultivar (Annamalai) used in the study was an andromonoecious type, and the mutilation due to emasculation might have caused the failure of fruit set (1).

The results clearly show that the fruit set, mean seed number, seed germination, and F_1 pollen fertility and viability of crosses between Dosakaya types and *C. melo* were well comparable to that of selfing, thus indicating the free crossability of Dosakaya types with *C. melo*. The presence of 24 somatic chromosomes and free compatability with *C. melo* as revealed by normal bivalent formation in all the F1s indicate that Dosakaya is *C. melo* (2n=24) and not *C. sativus* (2n = 14). Kailasam (2) reported that Dosakaya is crossable with both *C. sativus* and *C. melo,* but recently, Parthasarathy and Sampathkumar (3) reported that the material used as *C. sativus* (cv. Vellari) by Kailasam was actually *C. melo*. Hence, Kailasam had used Vellari, a cultivar of *C. melo*, erroneously as *C. sativus.*

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Taxonomy of *Cucumis callosus* (Rottl.) Cogn. - The Wild Melon of India

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Cucumis callosus, a feral species of India, has attracted the attention of muskmelon breeders, as this species is reported to possess genes for resistance to fruitfly and leaf-eating caterpillars (9). But this species remains to be a controversy for taxonomists. The synonym given for this species is *C. trigonus* (2). While cytologists have shown that *C. callosus* (syn: *C. trigonus*) has 14 somatic chromosomes (3, 10), the breeding experiments of Naudin (6), Vavilov (11), and of Sambandam and Chelliah (9) have given evidence of free compatibility between *C. callosus* and *C. melo*. Hence, to obviate the confusion regarding the chromosome number as well as the relationship with other *Cucumis* species, the present study was undertaken.

Seeds of stocks maintained in the Division of Horticulture, Annamalai University, were used in the study. Counts of somatic chromosomes were made from the root tip cells following the procedure of Roy (8) using proppiono-orcein stain. To ascertain the compatibility with other *Cucumis* species, crosses were made (including reciprocals) with seven *Cucumis* species, namely, *C. metuliferus, C. anguria, C. longipes (= C. anguria var. longipes), C. zeyheri, C. myriocarpus, C. dipsaceus, and C. melo*. The success of each cross was determined by the percent fruit set and the number of well developed seeds. The F_1 fertility was determined by pollen fertility and viability (germination). Meiotic studies were carried our in the PMCs of F_1 plants to study the behavior of chromosomes during diakinesis.

The metaphase plates revealed the somatic chromosome number of 24 for *C. callosus*. The crosses with seven *Cucumis* species indicated that *C. callosus* was crossable with only *C. melo*. The number of well developed seeds per fruit in the cross *C. callosus* x *C. melo* was, on an average, 266 seeds and the seeds showed about 93% germination. The pollen mother cells showed normal bivalent formation, indicating cross compatibility between *C. melo* and *C. callosus*.

The somatic chromosome number observed from the study (2n=24) is disagreement with that of Singh and Roy (10) who reported the 2n number to be 14. It is interesting to note the report of Brown *et al*. (1) who stated that *C. trigonus* from India was mislabeled and in reality was *C. hardwickii. Cucumis trigonus* is the synonym for *C. callosus* (2). But the confusion in the taxonomy of *Cucumis*, especially those found in India, is due to the fact that names have been given based on the morphological differences. To substantiate this, the following statements of Hooker (5) and Gamble (4) are presented. While Hooker and Gamble described *C. trigonus* and *C. pubescens* as synonyms, chakravarthy (2) placed *C. trigonus* under *C. callosus* and *C. pubescens* under *C. melo*. Watt (12) made a statement very long ago which still holds good for Indian *Cucumis*. He stated much confusion exists regarding the Indian so called wild and cultivated species and varieties of *Cucumis.*

Based on the chromosome number, its free compatibility with *C. melo*, and normal behavior of chromosomes during diakinesis, we conclude that *C. callosus* does not warrant a separate species status and is nothing but a progenitor of *C. melo*. This confirms the earlier breeding experiments of certain workers (6, 7, 9, 11).

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Cucurbit Genetics Cooperative Report 3:66-67 (article 37) 1980

The *Cucumis* Species Collection at the IVT

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A *Cucumis* species collection has been built up at our institute in the past three years to provide a basis for the species crossing program. At this time our collection consists of 118 examined accessions of 13 species. Except for *C. melo* L. and *C. sativus* L., nearly all the material originates, as far as we know, from the African continent. One of the exceptions is a feral accession of *C. dipsaceus* Spach. Which was collected at Curacao. About 30% of our collection was obtained from the USDA PI collections at Experiment (GA, USA) and Ames (IA, USA), and about as many came from a number of botanical gardens. The remaining part resulted from exchanges with institutes, universities, or research workers. Until now, the collection was gathered without collecting trips. Because of this, we generally lack specific data on the origin of the material or how it was maintained. As it is indispensable for our taxonomical research and species crossing program to dispose of diversity within a species, we like to have accessions of different origin. Among nine accessions of *C. africanus* L. f., only three PI numbers are of known origin (3). It is not known from how many sources the other six accessions originate.

The correct classification of *Cucumis* species is a recurring nightmare to anyone working with this material (see e.g. 3). It is, therefore, not remarkable that many samples are misclassified. For our collection, every seed sample is first grown in the glasshouse to check its botanical name and to evaluate the special characters of the accession. ONly thereafter is the accession introduced into the collection. Each sample is documented by a herbarium sheet with seedling, young and older leaves, shoot and flowers. Individual mature fruits are photographed. Mature fruits of each species are preserved in a spirit collection, whereas those of deviating accessions are stored separately. It is not always possible to identify an accession in one season, and in doubt of purity, we like to see offspring. The value of these observations is illustrated by the fact that 30% of all samples needs to be reclassified.

Only a species such as *C. metuliferus* Naud. is sufficiently distinct to prevent misclassification. In all the other species misclassifications occur. Renamed accessions have been included in Table 1 as: 'formerly...' The wild cucumber with small, sub-globose to ellipsoidal bitter fruits is tested as a variety of *C. sativus* L. based on the restricted description of Gabaew (2). The reason for this is that we agree with e.g. Robinson and Kowalewski (6), That on the basis of crossability, *C. hardwickii* Royle belongs within the species *C. sativus* L. and is sufficiently distinct as a subspecies. The *C. sativus* accessions in the tables are all non-cultivated, small fruit specimens which sometimes run wild in South Asia. Cultivars are not included in this list, as is true for melons. Since there is no good dividing line between wild, feral, and cultivated melons, the feral and wild forms have been listed as just *C. melo* L. The classification *C. melo* var. *agrestis* Naud. (4) was only used for specimens with small (up to 6 cm long) dark green fruits that do not change color at maturity. Because we do not have clarity as yet about the taxonomic status of the species *C. callous* (Rottl.) Cogn., *C. trignonus* Roxb., and *C. prophetarum* L., these three taxa have not yet been included in the table (3).

Seed is increased by selfs and crosses through hand pollination on three plants in an insect-proof glasshouse. Seed from the resulting is combined and stored in one sample.

Many accessions have now been tested for their resistance against cucumber green mottle virus (CGMV) black root rot (*Phomopsis sclerotioides*) and root knot nematodes (*Meloidogyne incognita acrita* and *M. javanica*). The results are summarized in Table2. All tested accessions of *C. africanus* L. f. and *C. anguria* L. are resistant to CGMV. The results of *C. figarei* Naud. are not yet clear and within *C. ficifolius* A. Rich., we found one out of two accessions resistant. All accessions of the other species are susceptible. For black root rot, no resistance was observed in any of the tested material. The level of resistance to nematodes varies within the species. The highest level of resistance has been found in *C. metuliferus* Naud., but a number of accession within this species have partial resistance. None proved absolutely resistant. Fassuliotis (1) and Pitrat and Dumas de Vaulx (5) found resistance in *C. metuliferus*. The level of resistance in most accessions of *C. africanus* L.f. is rather high, as it is in *C. ficifolius* A. Rich. and *C. heptadactylus* Naud.

Powdery mildew resistance was evaluated following natural infestation at the end of the growing season. There appears to

be a wealth of resistance to powdery mildew in the wild material. Our results largely concur with the observations of Pitrat and Dumas de Vaulx (5). Their results indicated *C. anguria* is susceptible whereas our five tested accessions of this species appear resistant.

For exchange, seed sample numbers have been included in Table 1 after the genebank number. As the wild species of the PI collections are readily available, these accessions have not been included in this list.

Table 1. Review of the *Cucumis* species collection at the IVT.

Botanical name	**Gene bank no.**	**Seed sample no.**	**Source**	**Country of origin**	**Remarks (concerning fruits or names)**
Cucumis africanus L. f.	0162	C77152	Naaldwijk[1] - The Netherlands	-	segregating, contam. with *C. dipsaceus*
"	0181	C78341	Copenhagen - Denmark	-	
"	0330	C78339	Coimbra - Portugal	-	formerly *C. anguria*
"	1773	C78343	Copenhagen - Denmark	-	formerly *C. anguria*
"	1780	C78342	Basel - Switzerland	-	
"	1969	C79229	Ege Univ. Izmir - Turkey	-	
C. anguria L.	0114	C79220	Burpee - USA	USA	cultivated
"	0198	C78338	Pisa - Italy	-	formerly *C. anguria longipes*
"	1735	C78375	Vavilov Leningrad[2] - USSR	Africa	formerly *C. myriocarpus*
"	1758	C78340	Kew - England	-	
"	1970	C79232	Annamalai Univ. - India	-	segregating slightly
"	1978	C79237	Liverpool - England	-	
C. anguria var. *longipes* A. Meeuse	1736	C78363	Vavilov Leningrad[2] - USSR	Africa	formerly *C. prophetarum*
"	1784	C79239	Kiev - USSR	-	segregating, some *C. anguria* types formerly *C. myriocarpus* fruit fully round, small
"	1827	C79238	R. Lower, NCSU - USA	-	
C. dipsaceus Spach.	0163	C79260	Naaldwijk[1] - The Netherlands	-	
"	1728	C78206	IVT - collection	Curacao	
"	1733	C79262	Vavilov Leningrad[2] - USSR	Africa	
"	1774		Copenhagen - Denmark	-	
"	1783	C79263	Kiev - USSR	-	formerly *C. anguria*
"	1983	C79264	Montfavet[3] - France	Ethiopia	
C. ficifolius A. Rich.	1828	C79267	R. Lower, NCSU - USA	-	
C. figarei Naud.	1706	C77168	Vavilov Leningrad[2] - USSR	Sudan	formerly *C. callosus*
C. melo L.	1754	C78372	Leiden - The Netherlands	Vilmorin	formerly *C*. species
"	1755		Leiden - The Netherlands	Vilmorin	formerly *C*. species
"	1766	C78216	Osm. Univ. Hyderabad - India	-	formerly *C. sativus* (Indian Cucumber)

"	1767	C78215	Osm. Univ. Hyderabad - India	-	formerly *C. sativus*
"	1817	C79280	Gatersleben[4] - DDR	-	formerly *C. melo* var. *agrestis*
"	1819	C79281	Gatersleben[4] - DDR	W. Africa	formerly *C. melo* var. *agrestis*
"	1820	C79282	Gatersleben[4] - DDR	S. Africa	formerly *C. melo* var. *agrestis*
C. melo var. *agrestis* Naud.	1165	C78349	IVT - collection	N. Nigeria	
"	1743	C78277	- Turkey	-	formerly *C. callosus*
"	1756	C78373	IVT - collection	Senegal	formerly *C.* species
"	1757	C78344	Canberra - Australia	Queensland	formerly *C. anguria*
"	1777		Copenhagen - Denmark	-	
"	1818	C79283	Gatersleben[4] - DDR	-	
"	1821	C79284	Gatersleben[4] - DDR	Afghanistan	
"	1987	C79285	Montfavet[3] - France	Togo	formerly *C. prophetarum*
C. metuliferus Naud	0164	C77165	Naaldwijk[1] - The Netherlands	-	
"	0256		Besancon - France	-	
"	1734	C78351	Vavilov Leningrad[2] - USSR	Africa	
"	1747	C77352	Gatersleben[4] - DDR	-	
"	1768	C78353	Dep. Pl. Biol. Birmingham - England	-	
"	1771		Dr. Provvidenti, Geneva - USA	-	
"	1775		Copenhagen - Denmark	-	
"	1822	C79289	Frankfurt - BRD	-	
C. metuliferus Naud.	1825	C79290	R. Lower, NCSU - USA	-	
"	1833	C70291	Salisbury - Zimbabwe	-	
"	1836	C78318	Copenhagen - Denmark	-	
"	1837	C79297	Mr. Howel - England	-	
"	1985	C79298	Montfavet[3] - France	-	
"	1994	C79299	Mr. Mackiewicz - Poland	local market Georgia	
C. myriocarpus Naud	0165		Naaldwijk[1] - The Netherlands	-	
"	0182	C78354	Copenhagen - Denmark	-	
"	0184		Kew - England	-	
"	0202	C78355	Poznan - Poland	-	
"	0203	C78356	Cluy - Romania	-	
"	0258	C78381	Besancon - France	-	formerly *C. prophetarum*
"	0335		Coimbra - Portugal	-	
"	1737		Lyon - France	-	formerly *C. prophetarum*

"	1742		Lodz - Poland	-	
"	1750		Gatersleben[4] - DDR	-	
"	1763		Gottingen - BRD	-	
"	1776	C78226	Copenhagen - Denmark	-	
"	1778		Kosice - CSSR	-	
"	1779	C78347	Kosice - CSSR	-	formerly *C. dipsaceus*
"	1838		Debrecen - Hungary	-	
"	1986		Montfavet[2] - France	-	
C. sativus L.	1592	A68040	IVT- collection	Egypt	
"	1713	C77169	Mr. Kohli - India	Himalaya	
"	1745	C79387	Dr. de Ruiter, The Netherlands	India	formerly *C. sativus* var. *hardwickii*
"	1759	C79321	Mr. Kohli - India	-	formerly *C. sativus* var. *hardwickii*
"	1772	C79305	IVT collection	Suriname	
"	1829	C79306	R. Lower, NCSU-USA	-	PI 271337, small fruit selection
"	1830	C79307	R. Lower, NCSU-USA	-	PI 271338, large fruit sel., segregating
"	1964	C79315	Pretoria - South Africa	-	
C. sativus var. *hardwickii* Alef.	1953	C79389	India	-	formerly *C.* species
"	1811	C79317	Vavilov Leningrad[2] - USSR	India	long fruits
"	1823	C79318	R. Lower, NCSU-USA	-	
"	1963	C78384	Pretoria - South Africa	-	variety "Hanzil"
C. sativus var. *sikkimensis* Hook.	0368	C78369	IARI - India	-	
"	1764	C78370	Liverpool - England	-	fruit size segregating slightly
"	1977	C79324	Liverpool - England	-	fruit size segregating slightly
C. sativus var. *squamosus* Gab.	1812	C78383	Vavilov Leningrad[2] - USSR	India	var. "Khira Cheshuichatyi"

Only a place-name as source means the Botanical Garden of that town.

[1] Glasshouse Crops Research and Experimental; Station.

[2] Vavilov All Union Institute of Plant Industry.

[3] Station d'Amelioration des Plantes Maraicheres.

[4] Zentralinstitut fur Genetik and Kulturpflanzenforschung.

Table 2. Results of disease resistance tests.

	Number of accessions										
		CGMV		**BRR**	**Nematodes**				**Powdery mildew**		
Species	CSC	R	S	S	0/1	1	2	3	0	1	2

Cucumis africanus L.f.	9	8		7		4	1		5		
C. anguria L. var. *anguria*	8	7		5			2	2	5		
C. anguria var. *longipes* A. Meeuse	3		1	2				1	1		
C. dipsaceus Spach.	8		6	6			4	2	6		
C. ficifolius A. Rich.	5	1	1	3		2	1		1		
C. figarei Naud.	2	(1)		2				1		1	
C. heptadactylus Naud.	1			1		1					
C. meeusii C. Jeffrey	1			1			(1)				1
C. melo L.	12		3	3					3	2	3
C. melo var. *agrestis* Naud.	10		3	6				(2)		1	7
C metuliferus Naud.	16		12	11	1	1	5		8	2	
C. myriocarpus Naud.	18		11	11			1	2	3	6	1
C. sativus L.	11		8	1						1	3
C. sativus var. *hardwickii* Alef.	5		4	1			1			1	4
C. sativus var. *sikkimensis* Hook.	5		4								3
C. sativus var. *squamosus* Gab.	1		1								1
C. zeyheri Sond.	3		1	3					1		

CSC: Cucumis species collection; CGMV: Cucumis green mottle mosaic virus, R: resistant, S: susceptible; BRR: black root rot, number of tested accessions; Nematodes: 0/1-highly resistant, 3-highly susceptible; Powdery Mildew: 0-no mildew, 2-heavy sporulation; ( ): limited information.

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Covenant and By-Laws of the Cucurbit Genetics Cooperative

Article I. Organization and Purposes

The Cucurbit Genetics Cooperative is an informal, unincorporated scientific society (hereinafter designated "CGC") organized without capital stock and intended not for business or profit but for the advancement of science and education in the field of genetics of cucurbits (Family: Cucurbitaceae). Its purposes include the following: to serve as a clearing house for scientists of the world interested in the genetics and breeding of cucurbits, to serve as a medium of exchange for information and materials of mutual interest, to assist in the publication of studies in the aforementioned field, and to accept and administer funds for the purposes indicated.

Article II. Membership and Dues

The membership of the CGC shall consist solely of active members; an active member is defined as any person who is actively interested in genetics and breeding of cucurbits and who pays biennial dues. Memberships are arranged by correspondence with the Chairman of the Coordination Committee.

The amount of biennial dues shall be proposed by the Coordinating Committee and fixed, subject to approval at the Annual Meeting of the CGC. The amount of biennial dues shall remain constant until such time that the Coordinating Committee estimates that a change is necessary in order to compensate for a fund balance deemed excessive or inadequate to meet costs of the CGC.

Members who fail to pay their current biennial dues within the first six months of the biennium are dropped from active membership. Such members ma be reinstated upon payment of the respective dues.

Article III. Committees

1. The Coordinating committee shall govern policies and activities of the CGC. It shall consist of six members elected in order to represent areas of interest and importance in the field. The Coordinating Committee shall select its Chairman, who shall serve as spokesman of the CGC, as well as its Secretary and Treasurer.

Approvals: W. Bemis; J.D. Norton; R.W. Robinson; W.R. Henderson; M.L. Robbins; R.L. Lower

2.The Gene List Committee, consisting of five members, shall be responsible for formulating rules regulating the naming and symbolizing of genes, chromosomal alterations, or other hereditary modifications of the cucurbits. It shall record all newly reported mutations and periodically report lists of them in the Report of the CGC. It shall keep a record of all information pertaining to cucurbit linkages and periodically issue revised linkage maps in the Report of the CGC. Each committee member shall be responsible for genes and linkages of one of the following groups: cucumber, *Cucurbita* sp., muskmelon, watermelon, and other genera and species.

3. Other committees may be selected by the Coordinating Committee as the need or fulfilling other functions arises.

Article IV. Election and Appointment of Committees

1. The Chairman will serve an indefinite term while other members of the Coordinating Committee shall be elected for ten-year terms, replacement of a single retiring member taking place every other year. Election of a new member shall take place as follows: A Nominating Committee of three members shall be appointed by the Coordinating Committee. The

aforesaid Nominating Committee shall nominate candidates for an anticipated opening on the Coordinating Committee, the number of nominees being at their discretion. The nominations shall be announced and election held by open ballot at the Annual Meeting of the CGC. The nominee receiving the highest number of votes shall be declared elected. The newly elected member shall take office immediately.

In the event of death or retirement of a member of the Coordinating Committee before the expiration of his/her term, he/she shall be replaced by an appointee of the Coordinating Committee.

Members of other committees shall be appointed by the Coordinating Committee.

Article V. Publications

1. One of the primary functions of the CGC shall be to issue an Annual Report each year. The Annual Report shall contain sections in which research results and information concerning the exchange of stocks can be published. It shall also contain the annual financial statement. Revised membership lists and other useful information shall be issued periodically. The Editor shall be appointed by the Coordinating Committee and shall retain office for as many years as the Coordinating Committee deems appropriate.

Approvals: W. Bemis; J.D. Norton; R.W. Robinson; W.R. Henderson; M.L. Robbins; R.L. Lower

2. Payment of biennial dues shall entitle each member to a copy of the Annual Report, newsletters, and any other duplicated information intended for distribution to the membership. The aforementioned publications shall not be sent to members who are in arrears in the payment of dues. Back numbers of the Annual Report, available indefinitely, shall be sold to active members at a rate determined by the Coordinating Committee.

Article VI. Meetings

An Annual Meeting shall be held at such a time and place as determined by the Coordinating Committee. Members shall be notified of time and place of meetings by notices in the Annual Report or by notices mailed not less than one month prior to the meeting. A financial report and information on enrollment of members shall be presented t he Annual Meeting. Other business of the Annual Meeting may include topics may include topics of agenda selected by the Coordinating Committee or any items that members may wish to present.

Article VII. Fiscal Year

The fiscal year of the CGC shall end on December 31.

Article VIII. Amendments

These By-Laws may be amended by simple majority of members voting by mail ballot, provided a copy of the proposed amendments has been mailed to all the active members of the CGC at least one month previous to the balloting deadline.

Article IX. General Prohibitions

Notwithstanding any provision of the By-Laws or any other document that might be susceptible to a contrary interpretation:

1. The CGC shall be organized and operated exclusively for scientific and educational purpose.
2. No part of the net earnings of the CGC shall or may under any circumstances inure to the benefit of any individual.
3. No part of the activities of the CGC shall consist of carrying on propaganda or otherwise attempting to influence legislation of any political unit.
4. The CGC shall not participate in, or intervene in (including the publishing or distribution of statements), any political campaign on behalf of a candidate for public office.

5. The CGC shall not be organized or operated for profit.
6. The CGC shall not:

- lend any part of its income or corpus without the receipt of adequate security and a reasonable rate of interest to;
- pay any compensation in excess of a reasonable allowance for salaries or other compensation for personal services rendered to;
- make any part of its services available on a preferential basis to;
- make any purchase of securities or any other property, for more than adequate consideration in money's worth; or
- engage in any other transactions which result in a substantial diversion of income or corpus to any officer, member of the Coordinating Committee, or substantial contributor to the CGC.

The prohibitions contained in this subsection (6) do not mean to imply that the CGC may make such loans, payments, sales, or purchases to anyone else, unless authority be given or implied by other provisions of the By-Laws.

Article X. Distribution on Dissolution

Upon dissolution of the CGC, the Coordinating Committee shall distribute the assets and accrued income to one or more scientific organizations as determined by the Committee, but which organization or organizations shall meet the limitations prescribed in sections 1-6 of Article IX.

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STOCKS AND GERMPLASM DESIRED OR FOR EXCHANGE

Stocks Desired

T. C. Wehner

Chlorophyll deficient stocks of *Cucumis sativus*, including lines with any of the following genes: *cd*, *g*, *gc*, *ls*, *pl*, *v*, *vvi*, *yc-1*, *yc-2*, and *yp*.

Stocks for Exchange

G. W. Bohn, A. N. Kishaba, and J. D. McCreight

Cantaloupe breeding line WMR 29 is a high quality watermelon mosaic virus (WMV) 1-resistant cantaloupe adapted to southwestern desert production areas for use in cantaloupe breeding programs. WMR 29 is also tolerant to high concentrations of minor elements, sulfur dust, WMV race-3 and is heterozygous for resistance to powdery mildew race-2.

WMR 29 was originated at the U.S Imperial Valley Conservation Research Center at Brawley in cooperation with the Boyden Entomology Laboratory at Riverside. The released seed is the 17th inbred generation (Sib_{17}=F) from the fifth backcross (BC_5) to breeding line PMR 29 (a sib of Campo) from the cross PMR 29 x WMV 1-resistant line 90105. Line 90105 was selected from PI 180280, a muskmelon used in soups and stews in southern Asia (1).

Different selection and breeding procedures were used at different locations in different series of generations to combine the several resistances and tolerances with high quality. Resistance to WMV race-1 derived from 90105 was selected in greenhouse tests at La Jolla and Riverside. Watermelon mosaic virus race-1 inoculated plants remain symptomless. Tolerance to WMV race-2 was selected during spring with natural infection in the Imperial Valley. Adaptation to desert culture, freedom from crown blight, high fruit quality, and plant longevity were selected in the field in the Imperial Valley during both spring and summer.

Tolerance to high minor element concentration was tested in the greenhouse ar Riverside by growing plants in a modified Hewitt's solution with the minor elements five times more concentrated than normal. Its source is unknown. Tolerance to sulfur dust for powdery mildew control first observed in a Blythe planting was confirmed in controlled field trails at the University of California Imperial Valley Field Station. Its source is unknown. Resistance to powdery mildew race-2 derived from PMR 29 is controlled by the single gene *Pmr-2*. WMR 29 is segregating for resistance to powdery mildew race-2 since selection for homozygous resistant plants was not done.

WMR 29 produces well-netted, nearly spherical fruits with well-defined tracks, thick salmon-colored flesh, dry seed cavity and high soluble solids content. Fruits are extremely hard at fully slip and, thus, should withstand mechanical harvest and cross-country shipment.

WMR 29 retains considerable heterozygosity due to mass selection of open pollinated fruits for ten generations. It should be kept under selection pressure for fruit quality.

Muskmelon breeders desiring seed of WMR 29 should submit written requests to Dr. James D. McCreight, U.S. Agricultural Research Station, P.O. Box 5098, Salinas, CA 93915 or to Dr. Albert N. Kishaba, U.S. Boyden Entomology Laboratory, University of California, Riverside, CA 92521.

Literature Cited

1. Webb, R. E. 1979. Inheritance of resistance to watermelon mosaic virus in *Cucumis melo* L. HortScience 14: 265-266.

Cucurbit Genetics Cooperative Report 3:82-88 (membership directory) 1980

Membership List - Cucurbit Genetics Cooperative

1. Adams, H. Northrup, King and Company, Post Office Box 1406, Woodland, CA 95695. Breeding commercial cultivars.
2. Adeniji, A. A. University of Nebraska, Department of Horticulture, Lincoln, NE 68583.
3. Angell, F. A. L. Castle, Inc., Post Office Box 279, Hollister, CA 95023. Cucumbers, squash, melons - breeding, genetics, variety development.
4. Asgrow Seed Co., P. O. Box P, Delray, Beach, FL 33444.
5. Azhar, Mohammad. Associate Plant Breeder, 1850 Hanover Drive #120, Davis, CA 95616. Muskmelon breeding. (lost list)
6. Baggett, J. R. Department of Horticulture, Oregon State University, Corvallis, OR 97331.
7. Baker, L. R. Director, Vegetable Research, Asgrow Seed Company, 7171 Portage Avenue, Kalamazoo, MI 49001.
8. Balgooyen, B. Northrup, King and Company, Post Office Box 959, Minneapolis, MN 55440.
9. Bemis, W. P. Department of Plant Science, University of Arizona, Tucson, AZ 85721.
10. Bohn, G. W. Imperial Valley Conservation Research Center, 4151 Highway 86, Brawley, CA 92227.
11. Bowman, R. Vlasic Foods, Inc., West Bloomfield, MI 48033.
12. Burkett, A. PetoSeed Company, Inc., Rt. 4, Box 1255, Woodland, CA 95695.
13. Castellani, M. (Madame). Brentano's S.A., 37, Avenue de l'Opera, 75002 Paris, France.
14. Central Library of Agricultural Science, ATTN: A. Ratzabi, Periodicals Dept., Post Office Box 12, Rehovot, 76 100, Israel.
15. Chambliss, O. L. Department of Horticulture, Auburn University, Auburn, AL 36830.
16. Chermat, M. C. Vilmorin, Documentation Center, La Menitre 49250 Beaufort en Vallee, France.
17. Chung, P. Petoseed Company, Inc., Route 4, Box 1255, Woodland, CA 95695.
18. Ciapy Library, ATTN: J. Alberto Arellano, Librarian, ADPO, Postal 50-D, Merida, Yuc., Mexico.
19. Clayberg, C. D. Department of Horticulture and Forestry, Kansas State University, Manhattan, KS 66506.
20. Coyne, D. P. Department of Horticulture, University of Nebraska, Lincoln, NE 68583.
21. Crall, J. C. Agricultural Research Center, University of Florida, Post Office Box 388, Leesburg, FL 32748. Watermelons.
22. Custers, J. B. M. Institute for Horticultural Plant Breeding, Post Office Box 16, Wageningen, The Netherlands.
23. da Costa, C. P. Departamento de Genetica - ESALQ, Universidade de Sao Paulo, Caixa Postal 83, 13.400-Piracicaba-SP Brazil.
24. de kroon, R. J. Enza-Zaden, Postbox 7, Enkhuizen, Holland.
25. Del Monte Corporation, ATTN: Ms. Dorothy Arthur, Librarian, Post Office Box 36, San Leandro, CA 94557.
26. Dennett, R. K. Route 1, Box 2145, Davis, CA 95616.
27. de Ponti, O. M. B. Institute for Horticultural Plant Breeding, P.O. Box 16, Wageningen, The Netherlands.
28. de Ruiter, Ir. A. C. Deruiterzonen Seed Company, Postbus 4, Bleiswijk, The Netherlands. Cucumbers.
29. Dessert, M. Department of Horticulture, Michigan State University, East Lansing, MI 48824.
30. de Vaulx, R. D. Centre de Recherches Agronomiques, Station d'Amelioration des Plantes Maraicheres, Domaine St. Maurice-84140, Montfavet, France. *Cucumis* melo-polyploidy, quality, interspecific crosses; *Cucurbita* sp.-interspecific crosses.
31. Dumlao, R.. Joseph Harris Company, Moreton Farm, Rochester, NY 14624.
32. Eason, G. 2401B Wesvill Court, Raleigh, NC 27607.
33. Eenhuizen, P. Rijk Zwann, Zaudteelt En Zaadhandel B.V., Postbus 40, De Lier, Holland.
34. Eigsti, O. 17305, SR4, RR1, Goshen, ID 46526.
35. Elmstrom, G. W. Agricultural Research Center, University of Florida, P. O. Box 388, Leesburg, FL 32748.
36. Ferguson, D. B. Agricultural Research Manager, Davids Sunsnax, P. O. Box 7907, Fresno, CA 93727.
37. Gabelman, W. H. Department of Horticulture, Rm. 18, University of Wisconsin, Madison, WI 53706.
38. Gabert, A. Ferry-Morse Seed Company, Inc., Box 66, Columbus, WI 53925.
39. Galun, E. Weizmann Institute of Science, Department of Plant Genetics, Post Office Box 26, Rehovot, Israel. Breeding and sex-expression of cucumber and melon.
40. George, B. F. Heinz, U.S.A., Post Office Box 57, Tracy, CA 95376.
41. Graham, J. D. Webster Brook-Apt. 4, R.D. 2, Delhi, NY 13753.
42. Graines Caillard, ATTN: Pour le Directeur General et P. O., la Secretaire, BP 30, Chem de Pouille, 49130 Les Ponts

de Ce, France.
43. Granqvist, B. J. E. Ohlsens Enke A/S, Nymunkegaard, DK-2630 Taastrup, Denmark.
44. Grimbly, P. E. Glasshouse Crops Research Institute, Plant Breeding Department, Worthing Rd, Rustington, Littlehampton, W. Sussex BN16 3PU, U.K.
45. Groff, D. Asgrow Seed Company, R.D. #1, Bridgeton, NJ 08302.
46. Hagan, W. L. Del Monte Corporation, Agricultural Research Center, Post Office Box 36, San Leandro, CA 94577.
47. Haley, A. B. 112 Whitecliff Drive, Vallejo, CA 94590. Disease resistance in cucumber, *Cucumis sativus*.
48. Hawk, J. A. University of Delaware, Agricultural Experiment Station, Newark DE 19711.
49. Henderson, W. R. Department of Horticultural Science, North Carolina State University, Raleigh, NC 27650.
50. Holland, N. S. Department of Horticultural and Forestry, North Dakota State University, Fargo, ND 58102. Squash.
51. Hollar, L. A. Hollar and Company, Inc., Post Office Box 106, Rocky Ford, CO 81067.
52. Hung, L. #13, Alley 5, Lane 30, Chow-shan Road, Taipei, Taiwan 106, Republic of China.
53. Iezzoni, A. Department of Horticulture, University of Wisconsin, Madison, WI 53706.
54. Janssens, M. Isar-Rubona, B.P. 167, Butare/Rwanda, Africa.
55. Jebari, H. Laboratory of Vegetable Crops, Republique Tunisienne, Ministee De L'Agriculture, INRAT, Avenue de l'Independance - Ariana, TUNIS - Tunisie.
56. John, C. A. A. L. Castle, Inc., 24401 SW 197th Avenue, Homestead, FL 33031. Disease resistance and high quality in cucumbers, squash, and melons.
57. Johnson, C. E. North Louisiana Experiment Station, Louisiana State University, P. O. Box 10, Calhoun, LA 71225.
58. Jones, D. A. 616 North 14th Street, Moorhead, MN 56560. *Cucumis maxima,* inheritance of bush vs. vine and specific gravity.
59. Kamimura, S. Morioka Branch, Vegetable and Ornamental Crops Research Station, Ministry of Agriculture and Forestry, Shimokuriyagawa, Morioka, Japan 020-01. Breeding of cucumber varieties - variety testing and genetics.
60. Karti, Z. Bank Hapoalien, Central Branch, Israel. (lost list)
61. Kiely, T.P. Charter Research Inc., Post Office Box YY, Twin Falls, ID 83301.
62. Kongpolprom, W. Agricultural Center of Northeast, T. Thapra, Khonkaen, Thailand.
63. Kosaka, Y. Nihon Horticultural Production Institute, 207 Kamishiki, Matsudoshi, Chiba-ken, Japan.
64. Kubicki, B. Department of Vegetable Crops, Warsaw Agricultural University, Warsaw, Poland.
65. Kust, T. Asgrow Seed Co., Division of Upjohn, 7000 Portage Rd., Kalamazoo, MI 49001.
66. Laborde, J. A. Unidad De Evaluacion y Planeacion, Apartado Postal No. 112, Celaya GTO Mexico. Mexican *Cucurbita* germ plasm and other cultivated cucurbits.
67. Laterrot, Mme. Bibliothecaire, Station d'Amelioration des Plantes Maraicheres, Domaine Saint - Maurice, 84140 Montfavet, France. Breeding of melon (*Cucumis melo* L.) and *Cucurbita*.
68. Lee, A. Neuman Seed Company, Post Office Box 1530, El Centro, CA 92243.
69. Lower, R. L. Department of Horticulture; 208C, University of Wisconsin, Madison, WI 53706. Cucumber breeding and genetics.
70. Loy, B. Department of Plant Sciences, University of New Hampshire, Durham, NH 03824. Developmental and physiological genetics, squash and muskmelon breeding.
71. Lundin, M. Weibullsholm, Box 520, S-261 24 Landskrona, Sweden.
72. McCreight, J. D. USDA/SEA/AR, P. O. Box 5098, Salinas, CA 93915.
73. McFerson, J. R. Department of Horticulture, University of Wisconsin, Madison, WI 53706.
74. Mohr, H. C. Department of Horticulture, University of Kentucky, Lexington, KY 40506.
75. Morelock, T. E. Department of Horticulture and Forestry, University of Arkansas, Plant Science Building 313, Fayetteville, AR 72701. Watermelons.
76. Mott, R. L. Department of Botany, North Carolina State University, Raleigh, NC 27650.
77. Mulkey, B. South Mississippi Branch Experiment Sation, Route 1, Beaumont, MS 39423.
78. Munger, H. M. Cornell University, 410 Bradfield Hall, Ithaca, NY 14853.
79. New York State Experiment Station Library, Jordan Hall, Geneva, NY 14456.
80. Ng, T. J. Department of Horticulture, University of Maryland, College Park, MD 20742. Muskmelon genetics and breeding.
81. Nijs, A. P. M. den. Institute for Horticultural Plant Breeding, Post Office Box 16, Wageningen, The Netherlands. Breeding of slicing and pickling cucumbers: production under low energy input; disease resistance, interspecific hybridization.
82. Norton, J. D. Department of Horticulture, Auburn, University, Auburn, AL 36830.
83. O'Sullivan, J. Ministry of Agriculture and Food, Box 587, Simcoe, Ontario N3Y 4N5, Canada.
84. Owens, K. Dept. of Horticulture, Rm. 211, University of Wisconsin, Madison, WI 53706.
85. Paris, H. Agricultural Research Organization, Department of Vegetable Crops, Newe Ya'ar Experimental Station, P. O.

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86. Parker, M. M. USDA Technical Information Systems Selection and Order Section, Room 112, National Agricultural Library Building, Beltsville, MD 20705.
87. Parthasarathy, V. A. Scientist S-1 (Horticulture), ICAR Research Complex for NEH Region, Shillong-793 003 (Nongrim Hills), India.
88. Persson, A. Agricultural University of Norway, Department of Vegetable Crops, Post Office Box 22, 1432 Aas-NLH, Norway.
89. Peterson, C. E. USDA, Department of Horticulture, University of Wisconsin, Madison, WI 53706.
90. PetoSeed Company, Inc., Route 4, Box 1255, Woodland, CA 95695.
91. Pitrat, M. Station d'Amelioration des Plantes Maraicheres, INRA, 84140 Montfavet, France. Disease resistance in melon and *Cucurbita.*
92. Poostchi, I. Department of Agronomy, College of Agriculture, Pahlavi University, Shiraz, Iran.
93. Reed, G. L. 3202 Kennedy Lane, Vincennes, IN 47591. (lost list)
94. Rhodes, A. M. Vegetable Crops Building, University of Illinois, Urbana, IL 61801. Genus *Cucurbita*.
95. Rhodes, W. B. Edisto Experiment Station, Post Office Box 247, Blackville, SC 29817.
96. Richens, R. H. Director, Commonwealth Bureau of Plant Breeding and Genetics, Department of Applied Biology, Pembroke Street, Cambridge, CB2 3DX, England.
97. Risser, G. (Mademoiselle). Maitre de Recherches, Station d'Amelioration des Plantes Maraicheres, INRA, Domaine St. Maurice 84140, Montfavet-Avignon, France. Breeding of melon (*Cucumis melo* L.).
98. Robbins, M. L. Clemson Experiment Station. P. O. Box 3158, Charleston, SC 29407.
99. Robinson, R. W. New York State Agricultural Experiment Station, P. O. Box 462, Geneva, NY 14456.
100. Rodriguez, J. P. 25 De Mayo 75, 2930-San Pedro, Buenos Aires, Argentina.
101. Ruttencutter, G. Nestle Enterprises, Inc., Agricultural Research Center, 701 W. Main Street, Leipsic, OH 45856. Breeding work with the species *Cucurbita moschata.*
102. Schroeder, R. H. FMC Corporation, Agricultural Chemical Division, P. O. Box 2508, El Macero, CA 95618. Sex expression of *Cucumis sativus* and *melo*.
103. Scott, J. W. Department of Horticultural Science, 2001 Fyffe Court, Ohio State University, Columbus, OH 43210.
104. Seshadri, V. S. Division of Vegetable Crops and Floriculture, Indian Agricultural Research Institute, New Delhi-110012, India.
105. Shattuck, V. 825 N. Tucson Avenue, Tucson, AZ 85716.
106. Shifriss, O. 21 Walter Avenue, Highland Park, NJ 08904.
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108. Taylor, A. D. Director of Research, Robson Seed Farms, One Seneca Circle, Hall, NY 14463.
109. Tepedino, V. J. USDA/SEA/AR, UMC 53, Utah State University, Logan, UT 84322.
110. Thomas, C. E. USDA/SEA/AR, P. O. Box 267, Weslaco, TX 78596. Development and testing of multipest resistant cantaloupes, epidemiology of foliar disease of cantaloupe, and development of pest management systems.
111. Tolla, G. Campbell Institute of Agricultural Research, Napoleon, OH 43545.
112. Torrey, T. C. W. Atlee Burpee Company, 335 S. Briggs Road, Santa Paula, CA 93060.
113. Valentine, T. M. Keystone Seed Company, P. O. box 1438, Hollister, CA 95023. Cucumber, summer and winter squash breeding efforts.
114. van Blokland, G. D. Royal Sluis, Postbox 22, 1600 AA Enkhuizen, Holland.
115. van der Arend, W. Nunhems Zaden b.n., Voort 6, Haelen, Holland.
116. van der Ploeg, D. ATTN: Henri van Isselmuden, Elite Zaden N.V. - NL 3220, Barendrecht, Holland.
117. Ventura, Y. Hazera Seeds Ltd. P. O. Box 1565, Haifa, Israel.
118. Verhoff, R. Plant Breeder, Bruinsma Seed Company, P. O. Box 24, 2670 AA Naaldwijk, Holland.
119. Watterson, J. PetoSeed Company, Inc., Rt. 4, Box 1225, Woodland, CA 95695.
120. Wehner, T. Department of Horticultural Science, North Carolina State University, Raleigh, NC 27650.
121. Werner, G. M. c/o Dr. Dennis Werner, Department of Horticultural Science, North Carolina State University, Raleigh, NC 27650.
122. Whitaker, T. W. USDA/ARS, P. O. Box 150, La Jolla, CA 92038.
123. White, J. W. 1330 Virginia Street, Berkeley, CA 94702.
124. Williams, T. V. Project Leader, Northrup, King & Co., P. O. Box 1389, Homestead, FL 33030.
125. Wyatt, C. PetoSeed Company, Inc., Rt. 4, Box 1255, Woodland, CA 95695.
126. Yu, A. PetoSeed Company, Inc., Rt. 4, Box 1255, Woodland, CA 95695.
127. Yukura, Y. 46-7, 3-Chome, Miyasaka, Setagaya-Ku, Tokyo, Japan. Genetics of sex-expression in cucumber and melon.
128. Zink, F.W. , Jr. Department of Vegetable Crops, University of California, Davis, CA 95616.

129. Zuta, Z. Hazera Seed Company, Oe Yehuda Post, Israel

*If you know where these people can be reached, please inform us of an address; mail recently sent to them has been returned to us.

One last addition:

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Cucurbit Genetics Cooperative Report (volume 3, Financial Statement) 1980

FINANCIAL STATEMENT June, 1980

(Prior to publication of Report No. 3)

Balance - June, 1979		$378.79
Receipts - June 1979 to June 1980*		
Dues	$537.00	
Back issues	112.50	
Interest	28.00	
TOTAL	$677.50	677.50
		$1,056.29
Expenditures		
Cost of publication and mailing of CGC #2		216.50
		$839.79**
Balance of $839.79		

*One complimentary membership to Plant Breeding Abstracts.
** Also, one check ($7.00) in bank processing.