Cucurbit Genetics Cooperative

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

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

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

Further, dues for the Cucurbit Genetics Cooperative (CGC) will be $2.50 per year and will be used to defray cost 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 and for Exchange, Membership Directory and Financial Statement. Other sections will be added in future reports as desired, i.e. gene lists, linkage groups, etc.

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

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

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

REPORT OF SECOND ANNUAL MEETING

The second annual meeting of the Cucurbit Genetics Cooperative was held in conjunction with the American Society for Horticultural Science on July 19, 1978 at Boston, MA. Although too late to announce the meeting in the official ASHS program, there were 12 in attendance including seedsmen, experiment station and USDA personnel. The meeting was chaired by Warren R. Henderson. He reported on publication of CGC Report No. 1 and on the Financial Status of CGC: $356.16 received minus expenses of $153.76 (primarily for publication of CGC Report No. 1) on a balance of $202.40.

A committee composed of Brent Loy, J. D. McCreight, R. W. Robinson, F. W. Zink and R. L. Lower, Chairman, was suggested to prepare a set of bylaws for the society fashioned after TGC.

With sufficient funds now on hand, membership on an annual basis rather than biennial was discussed and approved, and those that join within the calendar year will receive a copy of the current year's report. A reminder for current year's dues will be sent out annually.

It was suggested past copies of the report be made available to anyone who wishes a copy, but at a cost of $3.50. For this purpose, the master of the report should be saved for 10 years. Due to the added cost of mailing reports to foreign members, there was support by the group for an added assessment to the foreign membership.

There was general agreement that a table of contents containing a listing of each paper would be useful. There was agreement that a committee for germplasm (mutants) containing a member from each of the commodity groups be appointed by Editor R. L. Lower.

Appreciation was extended to the section chairman for cooperation in publishing the first CGC Report and especially to the editor, R. L. Lower, for coordinating the entire effort in getting this new publication off the ground.

Warren R. Henderson

The 1979 Annual Meeting of the CGC will be held at 5:00 p.m. on Thursday, August 2, 1979 in Room 114 of University Hall, The Ohio State University, Columbus, OH, U.S.A. The meeting will be chaired by R. L. Lower.

COMMENTS FROM THE COORDINATING COMMITTEE

The call for papers for the 1980 report will go out in November, 1979, and they should be submitted to the coordinating committee by January 31, 1980. Hopefully, the third report will be published by May, 1980.

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 and Marsha Mavis who were 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.

ANNOUNCEMENT OF CUCURBIT RELATED MEETINGS

Cucurbitaceae Conference

An International Conference on the Biology and Chemistry of the Cucurbitaceae is tentatively scheduled for August 4-6, 1980, at Cornell University, Ithaca and Geneva, New York. Invited speakers will discuss the current knowledge of systematics, biochemistry, ecology, anatomy, palynology, genetics, and breeding of cucurbits. More information about the conference, when it becomes available, may be obtained from R. W. Robinson, Seeds and Vegetable Sciences Department, New York State Agricultural Experiment Station, Geneva, NY 14456 or from C. Jeffrey, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AB, ENGLAND.

Eucarpia Conference

The Eucarpia Cucumber and Melon Breeding Conference is scheduled for August 19-22, 1980, at the Institute for Horticultural Plant Breeding, Wageningen, Netherlands. More information will be forthcoming from Ton P. M. den Nijs, Institute for Horticultural Plant Breeding, Mansholtlaan 15, Wageningen, NETHERLANDS.

ERRATUM

CGC #1, page 1, line 30 should read "on NAA (0.1 mg/l)" rather than 9.1.

RESEARCH NOTES

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I. Cucumber

1. The Effects of Illumination, Explant Position, and Explant Polarity on Adventitious Bud Formation *In Vitro* of Seedling Explants of *Cucumis sativus* L. cv. 'Hokus'

Custers, J. B. M. and L. C. Buijs, Institute for Horticultural Plant Breeding, Wageningen, The Netherlands.

In certain interspecific crosses in *Cucumis*, the embryos abort at the early embryonic stages. Artificial culture of very young embryos proved to be unsuccessful in many plants. Surprisingly, research on somatic embryo culture sometimes seems more successful. Therefore, it may be valuable to induce callus formation from the aborting embryos and to attempt subsequent regeneration of adventitious buds or embryoids. We have investigated adventitious bud formation on seedling explants of cucumber. On the medium used by Jelaska (1), our explants gave rise to adventitious roots only. High cytokinin concentrations were necessary to induce bud differentiation. The degree of the bud formation, however, was limited. Therefore, attention was paid to illumination, to the place in the seedling where the explant was excised, and to the position of the explant on the culture medium. This report deals with preliminary results of experiments on these factors.

The experiments were performed under different culture conditions:

L^1 : per day 16 hr Philips TL 33 light (approx. intensity 4,000 lux) and 8 hr darkness at 25.0 ± 0.5°C;

D^1 : continuous darkness at 25.0 ± 0.5°C;

L^{11}: per day 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;

D^{11}: continuous darkness at the same temperature regime as under L^{11}.

Seeds of *Cucumis sativus* cv. 'Hokus' were surface sterilized and sown aseptically on MS medium (2) without growth substances. They were either kept in L^1 or D^1. After eight days when seedlings were obtained, two explants wer excised from a cotyledon and four from the hypocotyl. Explant lengths were proportional to the lengths of the original organs. The position in the seedling of each explant was marked. The explants were implanted vertically in the medium, the cotyledon explants either with the proximal or the distal wound down, and the hypocotyl explants always upside down. The MS medium was used with addition of casein hydrolysate 1 g/l, sucrose 4% (w/v), Oxoid agar 0.7% (w/v), kinetin 10 mg/l, and the potassium salt of IAA 0.1 mg/l. The cultures were kept in L^{11} or D^{11}. Examination of the results was done 2.5 and 6 weeks after explant incubation. Both percentage of explants which showed organ formation and the mean number of buds produced were calculated on the basis of the number of uncontaminated explants. The significance at $P = 0.05$ of differences between the means was assessed by Student's t test.

Table 1. Organogenesis on Cucumis sativus L. cv. 'Hokus' seedling explants as influenced by light condition, position of the explant in the seedling, and its position on the medium. The number of explants per treatment was at least 15. Mean values designated by the same letter are not significantly different from each other at P = 0.05.

Light conditions	Explant position in the seedling	Explant wound placed in the medium	Bud formation (%) after		Root formation (%) after 6 wks	Mean number of buds after 6 wks	
			2.5 wks	6 wks			
Seedlings in L^{1} and explants in L^{11}	Cotyledon						
	distal half	proximal	0	0	0	0	a
	proximal half	"	6	13	0	0.6	a
	distal half	distal	0	0	13	0	a
	proximal half	"	0	0	6	0	a
	Hypocotyl						
	apical quarter	apical	88	88	0	10.6	e
	upper median quarter	"	88	94	0	6.4	d
	lower median quarter	"	69	69	0	3.6	bd
	basal quarter	"	63	69	0	3.6	bc
Seedlings in D^{1} and explants in D^{11}	Cotyledon						
	distal half	proximal	0	25	0	1.3	ab
	proximal half	"	12	77	0	6.5	d
	distal half	distal	0	0	0	0	a
	proximal half	"	0	50	0	5.4	bcd
	Hypocotyl						
	apical quarter	apical	0	41	50	2.8	b
	upper median quarter	"	0	0	25	0	a
	lower median quarter	"	0	6	41	0.3	a
	basal quarter	"	0	0	58	0	a

The experimental design and the results of a first experiment are shown in Table 1. The L^1L^{11} treatments as well as the D^1D^{11} treatments show gradients of organogenesis. Bud formation increased from the basal to the apical parts of the hypocotyl and from the distal to the proximal part of the cotyledon. The L^1L^{11} treatment as compared with the D^1D^{11} treatment increased bud formation of the hypocotyl parts and decreased that of the cotyledon parts. Bud formation of the cotyledon explants was promoted by insertion of their proximal ends in the medium. Since bud formation on these explants, however, preferably occurred in the medium, this phenomenon may also be caused by the budding-gradient.

Although root formation was rather poor (only one of two very small roots on a rooted explant), the studied factors seemed to influence it opposite to bud formation.

In a second experiment, the effects of L^1L^{11}, D^1D^{11}, L^1D^{11}, and D^1L^{11} treatments were studied. The number of explants per treatment was 8 or 12. The effects of L^1L^{11} and D^1D^{11} were almost identical with those of the first experiment. In the L^1D^{11} treatments, only two hypocotyl explants regenerated buds and in the D^1L^{11} treatments, only one cotyledon explant did so.

The results of the two experiments indicate that 16 hr/day illumination and continuous darkness give rise to different budding stimuli and that the stimulus built up during the seedling phase is still too weak to give realization of bud formation. It may also be possible that the light-stimulus and the dark-stimulus antagonize each other.

Literature Cited

1. Jelaska, S. 1974. Embryogenesis and organogenesis in pumpkin explants. Physiol. Plant. 31:257-261.

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

2. Breeding Glabrous Cucumber Varieties to Improve the Biological Control of the Glasshouse Whitefly

de Ponti, O. M. B., Institute for Horticultural Plant Breeding, Wageningen, The Netherlands.

On glasshouse tomatoes in the Netherlands, the biological control of the glasshouse whitefly (Trialeurodes vaporariorum Westwood) with the parasitic wasp (Encarsia formosa Gahan) is successfully applied on an ever increasing scale. On glasshouse cucumbers, however, despite repeated and large introductions of the parasitic wasp, sufficient control is rarely achieved. This failure of control was ascribed to the many large hairs on the cucumber leaf and the honeydew on the hairs. These factors reduce the mobility and consequently, the parasitization activity of the wasp. If this hypothesis is true, the parasitization frequency would be improved on hairless (glabrous) leaves.

From the N.I. Vavilov All-Union Institute of Plant Industry in Leningrad, seeds of glabrous mutants were received. First, the mobility of the wasp was studied. It appeared that on the glabrous leaves, the wasp was no longer hampered by hairs or honeydew and covered per unit of time a distance 3.5 times larger than on normal hairy leaves (1). At the moment, the expected positive influence of this enhanced mobility on the parasitization frequency is investigated.

Anticipating the results of these investigations, the breeding of glabrous cucumber varieties has already been started.

Recently, eight advanced breeding lines have been released to private breeding firms in the Netherlands. Besides glabrous, these lines are bitterfree, gynoecious, parthenocarpic, and producing slicers of a good quality. Because of the simple inheritance (one recessive gene) and selectability of the character concerned glabrous varieties may be awaited rather soon.

So far, no unfavorable characteristics have been discovered with respect to the glabrous character. On the contrary, it is expected that growers will welcome these varieties, which cause less fruit damage and skin irritation.

Literature Cited

1. Hulspas-Jordaan, P. M. and J. C. van Lenteren. 1978. The relationship between host-plant leaf structure and parasitization efficiency of the parasitic wasp Encarsia formosa Gahan (Hymenoptera: Aphelinidae). Meded. Fac. Landbouww. Rijksuniversiteit Gent: in press.

3. Development and Release of Breeding Lines of Cucumber with Resistance to the Twospotted Spider Mite, Tetranychus urticae Koch

de Ponti, O. M. B., Institute for Horticultural Plant Breeding, Wageningen, The Netherlands.

Based on a thorough study of the host-parasite relationship using cucumber varieties with different levels of resistance to the twospotted spider mite, two resistance tests were developed: a laboratory test (1) measuring acceptance and reproduction and a practical test (2) measuring damage as criteria of resistance.

After a first screening of 800 varieties from the IVT Cucumis sativus L. collection, the 50 least damaged varieties were extensively retested in laboratory and practical tests (2). Nine varieties (from 800) were significantly different from the susceptible control for acceptance, reproduction, and damage index (2).

The reduction in reproduction after moving the mites from a susceptible variety, on which they are normally reared, to other (resistant) varieties might only be of a temporary nature. In that case, the resistance of the selected varieties would not be genuine. To investigate this, both resistance tests were repeated after the mites had been reared on the selected varieties for 10-20 generations. The degree of acceptance and reproduction and the damage index decreased rather than increased, providing evidence for the genuineness of the resistance (3).

To increase the level of resistance found in the partially resistant varieties, these varieties have been intercrossed and the successive generations subjected to selection in laboratory and practical tests. A number of F_5-lines have been selected with a markedly lower mite reproduction than the parental varieties (Table 1). The 15 most resistant lines were released in 1978 to private breeding firms in the Netherlands. They will attempt to combine this resistance with other important horticultural characters to develop high standard twospotted spider mite resistant varieties.

It is not surprising that all resistant varieties are bitter because the world collection of cucumber contains 99% bitter varieties. Although we found that resistant and bitter varieties generally do not contain more cucurbitacin-c than susceptible and bitter ones, we noticed an unintended increase in the amount of cucurbitacin-c in the selected F_5-lines compared with the parental varieties. On the other hand, many bitterfree and resistant plants were found in F_2 and backcross generations after crossing resistant and bitter with susceptible and bitterfree lines.

Table 1. Degree of acceptance and reproduction of the twospotted spider mite on a susceptible control, on 2 partially resistant cucumber varieties, and on 2 lines derived from crosses between these varieties.

Variety or line	Acceptance (%)	Reproduction (eggs/♀, 3 days)
'Hybrid LGP'	36	14.1
'Robin 50'	45	15.1
F_5 ('HLGP' x 'Robin 50')	45	8.4
F_5 ('HLGP' x 'Robin 50')	34	9.4
Susceptible control	72	21.0

Literature Cited

1. de Ponti, O. M. B. 1977. Resistance in Cucumis sativus L. to Tetranychus urticae Koch. 2. Designing a reliable laboratory test for resistance based on aspects of the host-parasite relationship. Euphytica 26: 641-654.

2. de Ponti, O. M. B. 1978a. Ibid. 3. Search for sources of resistance. Euphytica 27:167-176.

3. de Ponti, O. M. B. 1978b. Ibid. 4. The genuineness of the resistance. Euphytica 27:435-439.

4. Linkage of Bacterial Wilt Resistance and Sex Expression Genes in Cucumber

Iezzoni, A. F. and C. E. Peterson, Dept. of Horticulture, University of Wisconsin, Madison, WI 53706.

Cucumber lines resistant to bacterial wilt caused by Erwinia tracheiphila were established for each of the four sex types (gynoecious, monoecious, hermaphrodite, and andromonoecious) to investigate a possible linkage between the gene for bacterial wilt resistance and the genes controlling sex expression. From the backcross data, a strong linkage was detected between the gene B for bacterial wilt resistance and the gene M for pistillate vs. perfect flowers (Table 1). Similar results were obtained from F_2 data from populations in which the M and B alleles were in coupling phase (Table 2). A linkage intensity of .011 ± .0032 was calculated by the product method. Bacterial wilt segregation was consistent with a single monogenic gene as has previously been reported. However, the poor fit of the M/m locus to a 3:1 ratio in the F_2 data is unexpected and is being investigated.

Table 1

Backcross coupling phase	MmBb	Mmbb	mmBb	mmbb	Total	% Recomb
$\frac{MB}{mb} \times \frac{mb}{mb}$	102	0	0	111	213	0
		1M:1m	Probability	50-60%		
		1B:1b	Probability	50-60%		

Table 2

F_2 coupling phase	M-B-	M-bb	mmB-	mmbb	Total	% Recomb
$\frac{MB}{mb} \otimes$	311	1	10	132	454	1.1 ± 0.32
		3M:1m	Probability	≈ 0%		
		3B:1b	Probability	1-5%		

5. The Influence of Temperature on Powdery Mildew Resistance in Cucumber

Munger, H. M., Departments of Plant Breeding and Vegetable Crops, Cornell University, Ithaca, NY 14853.

In studying the inheritance of powdery mildew resistance in cucumber, we have repeatedly noticed that plants in the greenhouse with any given level of resistance show much more mildew during the winter months than during May and June. Likewise, plants in the field, independent of their age, show much more mildew during August and September than they do in June and July. We have not located information about the effects of photoperiod, temperature, and light intensity on extent of mildew development that would explain the differences observed. A recent unintentional experiment seems to implicate temperature as the main factor.

In the process of adding gynoecious sex expression to 'Marketmore 76', 15 progenies were planted in the greenhouse on October 10, 1978. As a result of repeated backcrossing, these progenies were essentially isogenic with each other and with 'Marketmore 76', except for the gynoecious gene F. As standards of sex expression, progenies of constitution FF, Ff, and ff in 'Marketmore 70' background were included in the planting. Mildew developed heavily on these progenies in spite of some attempts to control it by fungicides, but 'Marketmore 76' backcross progenies which were never treated with fungicide showed no trace of mildew. In mid-December, six of the progenies were moved into another greenhouse section 40 feet away. This section was maintained at night/day temperatures of 15-21°C, while the rest of the planting remained at 21-27°C.

Four weeks later, the plants in the cooler house showed distinct mildew on both young and old leaves, but it did not appear to be sporulating heavily. There were no susceptible plants in this cooler section to provide continuing inoculum. Meanwhile, similar progenies in the original location at the higher temperature and continuously exposed to inoculum from nearby susceptible plants remained completely free of mildew symptoms. Neither group of plants received direct supplemental light, but it happened that each group was placed almost exactly the same distance from an intervening greenhouse section in which many lights were on for 24 hours a day, giving ample light to be photoperiodically effective. Since light intensity and photoperiod were the same for both groups of plants, the lower temperature appears to have been responsible for greater mildew development on one group.

We cannot say from this experience whether a temperature regime of 15-21°C is optimum for mildew development, but it seems certain that it is much more favorable than a 21-27°C regime. Our experiences over a period of years suggest that the effect of temperature is more pronounced on cucumbers with intermediate levels of powdery mildew resistance than on susceptible ones. 'Tablegreen', which we consider to have a low intermediate level of resistance, frequently shows almost no mildew when grown in the greenhouse in late spring or in the field in early summer, while susceptible varieties have striking

mildew symptoms. On the other hand, in winter months in the greenhouse, 'Tablegreen' may develop so much mildew that one would call it susceptible, except by comparison with truly susceptible varieties which have even more mildew. 'Poinsett', which we consider to have a high intermediate level of resistance, shows similar marked differences in amount of powdery mildew under different growing conditions.

This temperature effect may explain some of the contradictory reports about the level of resistance in plant introductions which have been used as sources of resistance in various breeding and genetic studies. Likewise, it may account for some of the different genetic interpretations of powdery mildew resistance as well. In studies of either sort, it seems important to report temperatures at which the studies were made and, if possible, to make comparisons under different temperature regimes.

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6. Dominant Genes for Resistance to Powdery Mildew in Cucumber

Munger, H. M., Abad Morales, and Sadig Omara, Departments of Plant Breeding and Vegetable Crops, Cornell University, Ithaca, NY 14853.

All reports we have seen on the inheritance of powdery mildew resistance in cucumbers have shown that any resistant parent crossed with a susceptible parent gave a susceptible F_1. In the course of breeding 'Marketmore 76' with 'Spartan Salad' as the source of resistance, we observed that certain resistant plants in the F_2 of the third backcross to 'Marketmore 70' gave F_1 progenies with an intermediate level of resistance when they were backcrossed again to 'Marketmore 70'. Morales, in his Ph.D. thesis research, crossed 'Marketmore 70' with several plants of 'Spartan Salad' and found in the composite F_1 that about half of the plants had an intermediate level of resistance that was distinctly different from the susceptibility of 'Marketmore'. Omara concentrated on this aspect of mildew resistance and tested the F_1 progenies of 79 'Spartan Salad' plants which were both selfed and crossed individually with 'Marketmore 70'. Seventy-one of the progenies were uniformly susceptible, but the remaining eight had plants with distinct resistance at an intermediate level. One of the eight, plant no. 77-717, gave an F_1 with 'Marketmore 70' with uniform resistance of about the same level as 'Poinsett'. Another, 77-730, gave an F_1 with approximately half the plants showing resistance comparable to the 'Poinsett' check. The other six seemed to be segregating for a level of resistance similar to that of 'Tablegreen 65'. The inheritance of resistance from plant 77-717 is now being studied.

Another source of dominant resistance was found in PI 197088, introduced from India. This parent when crossed with 'Marketmore 70' gave an F_1 with high resistance in the field and low to intermediate resistance in the greenhouse in the winter. In this hybrid, resistance tended to become lower as the plants were maturing, whereas the F_1 of 'Marketmore 70' x 'Spartan Salad' 77-717 maintained a high intermediate level of resistance throughout the plant's life and had a higher level of resistance in the greenhouse. In a genetic study of resistance, Omara found that PI 197088 carries a dominant gene for resistance, which is partially epistatic to the major gene for susceptibility found in 'Marketmore 70', 'Wisconsin SMR 18', and 'Cornell SR 551'.

A high level of resistance was found in F_1's in the field when either PI 197088 or 'Spartan Salad' 77-717 was crossed with 'Tablegreen 65', 'Pixie', and 'Poinsett'.

7. Interspecific Grafting to Promote Flowering in Cucumis hardwickii

Nienhuis, J. and R. L. Lower, University of Wisconsin, Madison, WI 53706;
Pharr, D. M., North Carolina State University, Raleigh, NC 27650.

Cucumis hardwickii Royle is thought to be either a feral or progenitor species of the cultivated cucumber, C. sativus L. It is currently being evaluated in our breeding program as a potential source of variability for several horticulturally important characteristics (2). However, our strain of C. hardwickii is a short day plant which flowers only when the photoperiod is less than 12 hours at 30°C day/20°C night temperatures (2). The short day nature of C. hardwickii has restricted its use in genetic studies as well as in population development by random mating in the field.

In many plant species, grafting has been used as a tool to promote flowering in varieties which would not flower in specific environments. Lang (3) recently reviewed the work of numerous authors who investigated the transfer of flowering promoters from induced to non-induced scions by grafting between varieties as well as species. In Cucurbitaceae, there are also examples of flowering promotion and changes in sex expression as a result of grafting (1, 4).

The objectives of this investigation were: 1) to study the effects of grafts using gynoecious and monoecious C. sativus cultivars on the flowering response of C. hardwickii recipient scions and 2) to observe the effect of defoliation of the recipient scions.

This study was undertaken at the Southeastern Plant Environmental Laboratory in Raleigh, NC from June to September 1978. Growth chambers were programed to provide similar environmental conditions for all factors other than photoperiod. Both a 9 hour inductive and a 15 hour non-inductive photoperiod at 30°C day/20°C night temperatures were used. The grafting method was an approach graft technique similar to that described by Friedlander et al. (3). Treatments consisted of a non-grafted C. hardwickii check plus C. hardwickii recipient scions grafted onto three donor scions: C. hardwickii and two C. sativus cultivars 'Addis' (monoecious) and 'GY14' (gynoecious). Within each graft combination, four of the replications had their recipient arms defoliated and the other four remained vegetative. In all cases, the rootstock corresponded to the donor scion.

In the inductive photoperiod (9 hours), the graft combinations resulted in no significant change from the normal flowering characteristics of the check and self-grafted C. hardwickii recipient scions.

In the non-inductive photoperiod (15 hours), both the gynoecious and the monoecious C. sativus donor scions resulted in increased total flowers/day and increased pistillate flowers/day on C. hardwickii recipient scions (Table 1). Within each graft combination, there was no significant difference between vegetative and defoliated scions; however, the number of pistillate flowers generally increased on the defoliated scions (Table 1). The check and self-grafted C. hardwickii recipient scions did not initiate flowering until approximately 65 days after ..

planting, whereas flowering was initiated after approximately 45 days when either C. sativus cultivar was used as a donor scion.

In other studies, C. hardwickii has been successfully approach grafted onto both 'Addis' and 'GY14' under field conditions (unpublished data). It is, therefore, possible to induce C. hardwickii to flower under long day conditions in the field using either monoecious or gynoecious C. sativus donor scions. By grafting C. hardwickii onto gynoecious C. sativus donor lines, random F1 hybrids could be produced to initiate a breeding population.

Table 1. Effect of various graft combinations of gynoecious and monoecious C. sativus donor scions on the flowering response of C. hardwickii recipient scions.

Donor scion	C. hardwickii recipient scion	Total flowers/day	Pistillate flowers/day
C. hardwickii	check; non-grafted	1.94	.06
"	vegetative	1.48	0
"	defoliated	.19	0
'Addis' (C. sativus)	vegetative	4.10	.31
'Addis' (")	defoliated	5.44	.96
'GY14' (C. sativus)	vegetative	4.94	.33
'GY14' (")	defoliated	6.69	1.42
	LSD .05	1.92	1.25

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8. Low Temperature Adapted Slicing Cucumbers Release

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The Institute for Horticultural Plant Breeding (IVT) has since 1974 attempted to adapt slicing cucumbers for winter/spring glasshouse cultivation to lower temperatures. Fuel costs take a major share of total production expenses so that every reduction is very desirable. Selection was performed in poor light conditions in winter and early spring at temperatures of 20°C day, 15°C night. Root temperature, however, was maintained at 20°C throughout. This T-regime is about 5°C lower than usual and amounts to a savings of over 30% in fuel expenditures.

Few out of hundreds of varieties from all over the world tested grew well in the selection environment. The best growing varieties were crossed in a half diallel and progenies examined. The best plants were then selfed and intercrossed. Selection pressure was shifted from vegetative growth to growth and production (after pollination). After two more cycles of selection, a set of about 30 lines was developed that grow and produce well at the lower temperature and poor light conditions. At the lowered temperature, the best selections yielded during the first six weeks of harvest as much as leading varieties during the same harvest period at normal temperatures. Horticultural characteristics of the selections were acceptable, vinetype being rather luxurious and flowering in many exclusively female. Besides, they are, at the low temperature, parthenocarpic.

Comparison of several lines and control varieties at both low and normal temperatures revealed that differences in vegetative growth between lines are correlated well in both environments, but fruit production varied widely. Some lines yielded well at both temperatures; most performed rather poor at normal temperature.

Possibilities for selection of high yielding lines at an early stage of growth appear to be meager. Correlations between seedling growth and later vegetative vigor were reasonably high, but fruit yield was rather unpredictable. Still, elimination of weak seedlings is justified.

Most lines yield fruits of acceptable size and shape, but some react to higher temperatures with strong elongation of especially side shoot borne fruits. Possibilities for exploiting observed variation in this character between the lines are still being studied. Thirty lines and crosses with leading varieties have been released to the Dutch private cucumber breeding companies for the exclusive use during the next five years.

9. Silver Compounds Inducing Male Flowers in Gynoecious Cucumbers

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Silver nitrate is now used widely in the greenhouse in the Netherlands. Occasionally, however, the treatment with $AgNO_3$ results in severe burning and even loss of plants, especially when conditions are poor for growth. Delay of spraying until the second to third leaf stage and previous watering of the plants have been advised, but this has not always eliminated the problems.

While attempting to increase the longevity of cut carnations, Veen and Van de Geijn (1) demonstrated the manifold mobility of the silver ion in the anionic complex silver thiosulphate, $[Ag(S_2O_3)_2]^{3-}$, over that in $AgNO_3$. The anti-ethylene action of this compound prompted us to assay its potential in sex reversion of gynoecious cucumbers. Initial trials indicated that $Ag(S_2O_3)_2$ induced male flowers much the same as $AgNO_3$. A more detailed experiment was carried out late in the fall of 1978.

Two gynoecious pickling cucumber lines (A1 and A2), one slicing cucumber inbred (G6) and one commercial variety with known strong female background ('Farbio'), were planted in the greenhouse. There were nine treatments plus a water control: two concentrations of $AgNO_3$, five of $Ag(S_2O_3)_2$, one GA-3, and one GA-4/7 (Table 1). Plot size was four plants and there were two repetitions. Silver thiosulphate was prepared by adding excess $Na(S_2O_3)_2$ to $AgNO_3$ in the desired concentration, thereby shifting the equilibrium to $Ag(S_2O_3)_2$. This is an anionic complex. Growth conditions favored spontaneous production of male flowers, but all of the plants in the control group remained gynoecious.

All treatments resulted in male flowers on all lines except 'Farbio'. The 500 ppm $AgNO_3$ application yielded by far the most male flowers. The 300 ppm $Ag(S_2O_3)_2$ treatment produced about half the number of male flowers of 300 ppm $AgNO_3$. The 30 ppm GA-4/7 treatment gave few males and was definitely too low. The concentrations of $Ag(S_2O_3)_2$ were not sufficient to induce a substantial number of male flowers on 'Farbio'. Several nodes appeared to have been induced partially but they quickly reverted to produce female flowers. Both $AgNO_3$ applications hampered plant growth although neither extensive leaf crinkling nor necrosis was evident. Specifically, the plants in the 500 ppm $AgNO_3$ treatment were several leaves behind in their development. This was more clearly demonstrated in a subsequent trial in early winter under very poor light conditions. Ten plants each of four varieties were treated in the first leaf stage with 2,000 ppm and 500 ppm $AgNO_3$ and $Ag(S_2O_3)_2$ respectively. Another set of the four varieties was similarly treated at the third leaf stage, about 10 days later.

The high concentration of $AgNO_3$ proved disastrous at both treatment times. Plants became severely chlorotic and necrotic and none survived. The 500 ppm $AgNO_3$ treatment resulted in crinkled leaves and poor plants but still a good number survived, mainly from the second treatment. All plants produced male flowers as expected. Both application times and both concentrations of $Ag(S_2O_3)_2$ did not result in great damage to the plants. Some leaves were chlorotic at the edges with limited necrosis. All plants, however, grew out of this without a problem.

All plants of the first application time of $Ag(S_2O_3)_2$ bore male flowers from the first node on while those of the late treatment possessed a variable number of nodes with female flowers. The treatment with 500 ppm $AgNO_3$ resulted in approximatly 2-3 weeks retardation of growth in comparison with check plants, whereas neither concentrations of $Ag(S_2O_3)_2$ hampered plant growth.

Yield of male flowers thus appears to be lower after treatment with $Ag(S_2O_3)_2$, but the chance of losing plants is also definitely less than when using $AgNO_3$. In conditions of poor growth, the 'soft' treatment with $Ag(S_2O_3)_2$ could thus be preferred over the 'hard' treatment with $AgNO_3$.

Table 1. Number of male flowers per plant/Number of nodes with male flowers per plant[z] after treatment with various chemicals.

Treatment		VARIETIES			
Chemical	Conc. in ppm	A1	A2	G6	'Farbio'
$AgNO_3$	500	170/17	199/21	73/16	48/13
	300	114/19	128/20	65/15	21/8
$Ag(S_2O_3)_2$	100	28/6	50/5	9/1	0/0
	150	21/7	38/8	22/8	1/ 1
	300	54/11	45/8	24/6	1/ 1
	2x 100	36/6	48/5	15/3	1/ 1
	2x 150	36/7	89/11	35/9	1/ 1
GA-3	1500	25/7	98/13	40/11	5/3
GA-4/7	30	12/5	19/6	7/2	1/ 1
Water		1/ 1	0	0	0

[z]only the first 25 nodes considered.

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10. Investigations of the Effects of Plant Type and Morphology of the Cucumber on Infestation by the Pickleworm, Diaphania nitidalis Stoll

Pulliam, Terry Lane and R. L. Lower, Department of Horticultural Science, North Carolina State University, Raleigh, NC 27650; E. V. Wann, U. S. Vegetable Laboratory, USDA, SEA, Charleston, SC 29407.

Seven plant types of 'Addis', a pickling cucumber cultivar, five plant introductions, tetraploid lines, and other lines were evaluated for resistance to the pickleworm. Oviposition cage, screenhouse, greenhouse, and field experiments tested either the oviposition response of adults and/or the feeding response of larvae.

As expected, none of the plant types or plant introductions tested expressed immunity to infestation by the pickleworm, either to the adult in oviposition or the larvae in feeding.

Glabrous lines, whether on 'Addis' or another background and whether bitter or nonbitter, were consistently lower in number of eggs/cm^2 than other pubescent lines in oviposition experiments. When glabrous 'Addis' leaves and pubescent 'Addis' leaves were tested in the same cage, the glabrous leaves were significantly lower in number of eggs/cm^2 than the pubescent leaves. When glabrous 'Addis' leaves and pubescent 'Addis' leaves were tested in separate cages, significantly fewer eggs/cm^2 were oviposited on glabrous leaves. Therefore, it was concluded that the glabrous character was responsible for the nonpreference of the moth for oviposition on these leaves. When glabrous 'Addis' leaves were the only oviposition substrate in the cage, the moths laid fewer eggs on these leaves. Eggs were deposited on the crinkled serrate edges and next to the veins of the glabrous leaves. This supports the theory that a tactile stimulus is necessary for normal oviposition. Also, the tetraploids, which were visibly more pubescent than diploids, had generally higher numbers of eggs/cm^2 than the diploids.

In the greenhouse and screenhouse experiments, the glabrous lines tended to be very heavily damaged by feeding, to have surviving larvae with higher mean weights, and to have lower fresh plant weights. This suggests that larvae tended to feed more easily and quickly on plants without trichomes. Unfortunately, the feeding damage results for the tetraploids are inconsistent, and the relationship between levels of feeding is unclear.

PI 269480, West Pakistan, tended to have less damage, smaller larvae, and higher plant weights than other lines. PI 390254, Japan, which was selected in experiments in Charleston in 1977, gave results similar to PI 269480.

In the field experiment, results tended to show glabrous lines were not as heavily damaged as pubescent lines. The three glabrous lines, 'Addis' glabrous, 'Addis' glabrous nonbitter, and NCSU 75-834-5, were lower than other lines in damage ratings and in percent damage ratings. Glabrous lines also had higher numbers of nondamaged fruit per hill than other lines. The two tetraploid lines used in the field experiment were not as heavily damaged as about half the pubescent lines.

The results of the field experiment were most closely correlated to those of the oviposition experiments, where glabrous leaves were not preferred as an oviposition substrate. Therefore, the resistance of glabrous lines in the field can be attributed to a nonpreference of the adult pickleworm for glabrous plants for oviposition.

In relatively isolated plots, glabrous lines were nearly free from damage while other lines were heavily damaged.

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11. Isozyme Analysis of the Megurk

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A possible cross between the cucumber and muskmelon has been named the "megurk", after the Dutch words for melon and cucumber (1). The high self fertility of the F_1 megurk plants, their complete compatibility with cucumber but not with muskmelon, the lack of segregation in the F_2 and subsequent generations, the lack of segregants with the dominant gene for powdery mildew resistance gene that was possessed by the muskmelon parent, and the considerable differences between sativus and melo that indicate these species are not closely related--all these considerations raised questions as to the authenticity of this cross.

We used comparative electrophoretic analysis of isozymes to resolve this question. Cucumis sativus is considerably different from melo in every enzyme system studied (2). If the megurk really has both melo and sativus genes, this would be expected to be reflected in its isozymes.

Megurk plants and the parental cucumber and muskmelon lines were grown in the field at Geneva, NY in 1978. The megurk plants did show an outward resemblance to both the cucumber and the muskmelon parent. They were similar in disease resistance to the cucumber parent, resistant to cucumber mosaic virus and very susceptible to powdery mildew whereas the muskmelon parent was susceptible to CMV but resistant to powdery mildew. The megurk had shorter internodes than the cucumber parent, earlier maturity, rounded leaves somewhat like those of a muskmelon plant, and short, wide fruit intermediate in shape to cucumber and muskmelon fruit.

The megurk crossed readily with cucumber but not with muskmelon. All crosses were made with the megurk as the maternal parent, since it was gynoecious.

Extracts from young leaves of the megurk and its putative parents were compared for esterase and peroxidase isozymes. In every case, the isozymes of the megurk plants were identical to the cucumber and quite distinct from the muskmelon plants. Accordingly, it is concluded that the megurk is entirely C. sativus and is not derived from an interspecific cross.

Conclusive evidence concerning the origin of the megurk is not yet available, but it has all the earmarks of being a mutant conditioned by a single recessive gene. It is not more unlike the cucumber than different cucumber mutants that one of us (RWR) has induced with radiation and chemicals.

The ratios of megurk to normal plants that have been reported (1) are not in agreement with Mendelian monogenic ratios, yet they do not entirely conflict with a single recessive gene hypothesis. The original cross, in which a mixture of pollen from several cucumber and muskmelon plants was applied to the stigma of the cucumber, resulted in 2% megurk plants. If we may assume that the muskmelon pollen was not functional in this cross and only one of the several cucumber plants was heterozygous for a spontaneous mutation, the proportion of megurk plants in the next generation would depend on the proportion of self and sib pollination. If the heterozygous cucumber plant was pollinated with an equal mixture of its own pollen and that of 10 normal cucumber plants, approximately 2% of the progeny should be mutants. The failure to obtain any megurk plants when the experiment was repeated can be explained on the basis of none of the cucumber plants in the second experiment being heterozygous for the gene, which is probably very rare in occurrence.

The report (1) that the F_1 of the cross of the megurk and cucumber was entirely normal is consistent with the megurk being a recessive mutant. The proportion of 243 normal cucumbers to 44 megurks in the F_2 of the cross does not agree with a 3:1 ratio, and more evidence is needed to fully understand the genetic basis of the interesting megurk.

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II. Muskmelon

12. Pollen Germination in Interspecific Crosses Between Muskmelon and Some Wild *Cucumis* Species

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Cross pollinations were made among different lines of muskmelon (monoecious, andromonoecious, diploid, tetraploid) and five wild species of *Cucumis*: *C. metuliferus* (from FASSULIOTIS and Vavilov Institute), *C. ficifolius* (PI 196.844, PI 203.915), *C. prophetarum* (PI 193.967), *C. myriocarpus* (1096), and *C. zeyheri* (PI 273.192). For the description of these species, see Deakin and co-workers (1). Chromosome number of each wild species was counted.

Pollen germination and pollen tube growth were observed by means of the fluorescence technique described by Martin (3).

In the crosses between muskmelon (as female parent) and *C. metuliferus* or *C. prophetarum*, the stigmas were wounded prior to pollination to promote the pollen tube growth. The stigma was cut in the middle or was rubbed or scraped with a lanceolate needle.

Strong sterility barriers were generally present in these crosses. Frequently, there was neither pollen germination nor pollen penetration into the stigma. After germination, pollen tube growth stopped at different levels inside the style (Table 1). The most promising results were observed in the cross between diploid muskmelon as female parent, with the stigma rubbed, and *C. prophetarum* as male. Pollen tubes reached the muskmelon ovules and penetrated into the micropylar canal of some ovules. In this cross, the incongruity barrier seems to be localized in the first layers of cells of the muskmelon stigma. By rubbing off the stigma, the pollen tubes can overcome the barrier and reach the ovules.

The purposes of this cross were not only to introduce some disease resistances of *C. prophetarum* in the muskmelon but also to develop a bridge between muskmelon and other wild species.

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Table 1. The effects of various physical treatments on the germination and growth of pollen in interspecific crosses.

0 none ε very few x a few xx numerous xxx very numerous	Pollen germination	Pollen tubes penetration into the stigma	Pollen tubes can reach : the first fourth part of the style	half part of the style	the basal end of the style	the ovules	Pollen tubes into the micropyle	Pollen tubes reach the embryo-sac
I - C. melo as female parent								
C. melo x C. metuliferus (2x = 24)								
MEL (2x) x MET (Fassuliotis)	xx	xx	xx	x	x	ε	0	
MEL (2x) x MET (Vavilov)	xx	xx	xx	x	0			
MEL (2x) + rubbed stigma* x MET (Vavilov)	xx	x	x	x	0			
MEL (4x) x MET (Fassuliotis)	xx	xx	xx	0				
MEL (4x) x MET (Vavilov)	xx	x	x	0				
C. melo x C. prophetarum (PI 193967) (4x = 48)								
MEL (2x) x PRO	xx	xx	xx	ε	ε	0		
MEL (2x) rubbed stigma* x PRO	xx	xx	xx	xx	x	x	x	x
MEL (2x) cut stigma* x PRO	0							
MEL (4x) x PRO	x	x	x	0				
MEL (4x) rubbed stigma* x PRO	0-x	0						
MEL (4x) cut stigma* x PRO	x	x	x	0				
C. melo (2x) x C. ficifolius (PI 203915) (2x = 24)	xx	xx	xx	x				
C. melo (2x) x C. ficifolius (PI 196844) (4x = 48)	x	0		0				
C. melo (2x) x C. Zeyheri (PI 273.192) (2x = 24)	xx	0						
C. melo (2x) x C. myriocarpus (1096) (2x = 24)	xx	xx	xx	0				
II - C. melo as male parent								
C. metuliferus x C. melo								
MET (Fassuliotis) x MEL (2x)	xx	xx	xx	xx	xx	0		
MET (Vavilov) x MEL (2x)	xx	xx	xx	xx	0			
MET (Fassuliotis) x MEL (4x)	xx	xx	xx	xx	x	x	0	
MET (Vavilov) x MEL (4x)	xxx	xx	xx	xx	x	0		
C. prophetarum x C. melo								
PRO x MEL (2x)	xx	xx	xx	xx	xx	xx		
PRO x MEL (4x)	xxx	xxx	xx	xx	xx	xx		

* see text.

13. A Technique for Improving Fruit Set by Hand Pollination and Observations on Optimum Cultural Conditions for Fruit Set Under Greenhouse Conditions

Principe, J. A. and J. D. McCreight, USDA, SEA-AR, Imperial Valley Conservation Research Center, Brawley, CA 92227.

Melon pistillate flowers are often tied the afternoon before anthesis, after removal of anthers if they are present, to protect them from natural pollinators. They are revisited the next morning to affect pollination. This requires two visits and two sets of manipulation of each pistillate flower.

We regularly use pistillate flowers the day before anthesis for hand pollinations in the greenhouse. This results in a high percentage of successful pollinations and permits pollinations to be made throughout the afternoon. With a little experience, one can easily find flowers that will open the next morning. An unopened pistillate flower can be prepared for pollination by inserting the thumbnail into the corolla and tearing down to the base of the calyx. While holding the flower gently with the other hand, peel off the corolla and calyx by tearing around their bases at the top of the receptacle enclosing the ovary to expose the stigma. If the flower is andromoneocious, remove the anthers. There is no chance of self-pollination since they have not yet dehisced. If the stigma or ovary is damaged, try another flower; a damaged flower usually aborts. Apply pollen by gently, but somewhat firmly, rolling the anthers around the stigmas. The staminate flower, stripped of its petals and sepals, is held by its receptacle and pedicel for this maneuver.

With container-grown plants in a greenhouse, one should not attempt more pollinations than the particular plant can reasonably support. Pollinated flowers should be located on first nodes of secondary stems separated by two or more nodes on the main stem. Select the best flower or two and remove others nearby.

If pollinating insects are present, all subsequent pistillate flowers should be removed until each flower set from controlled pollination is well established. This may have to be done at 3-day intervals for at least two weeks.

14. Varietal Differences in Growth of Melon (Cucumis melo L.) at Low Temperature

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Melon is known as requiring high temperatures for a good growth, but we did not know if differences in varietal reaction occur at low temperature.

First, we studied the action of root temperature. For that, young plants of four melon cultivars were cultivated in nutrient solution, the temperature at the root level being constant and equal to 12°C, 15°C, 18°C, and 21°C. The experiment was conducted twice, in May 1976 and in February 1977.

When root temperature was maintained at 12°C, growth was very poor, especially in 1977 in a period of weak radiation. At this temperature, we observed some differences in varietal reaction. Yellowing of the foliage occurred on 'Persian-Small Type' followed by a partial wilting of the plants while 'Vedrantais' remained green and healthy. Growth of the 'Persian-Small Type' was weakened by low temperature more than growth of 'Vedrantais'.

From these tests, we concluded that varieties do not react similarly when grown in nutrient solution with a low temperature. Differences are more pronounced when global radiation is low.

Later, we tested varietal reactions of 31 lines in natural cold conditions, in a non-heated plastic greenhouse. After several days where mean temperature was below 15°C, we observed wilt, then necrosis, and some plants died. Rate of new leaf emergence was lessened. These various symptoms were correlated. Statistical analysis shows that significant varietal differences occurred. 'Persian-Small Type' was the least resistant variety for all the characters studied. The most resistant lines tested were 'Freeman's Cucumber', 'Shiroubi Okayama', 'Savor', 'Sucrin de Tours', and PI 136.173.

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III. Watermelon

15. Improvement of Watermelon with Polyploids

Eigsti, O. J., 17305, SR4, R. R. 1, Goshen, IN 46526.

Numerous polyploid species are important crops that show superiority over their diploid progenitors, and natural polyploid species exhibit a much wider range of adaptation than their related diploids (6). In both cases, the polyploids have attained a maximum fitness (2). The selective forces operating with crop species and the natural polyploids are not radically different; accordingly, the plant breeder should recognize the importance of these forces (2).

Comparisons were made between triploid hybrids and from the induced as well as the spontaneous tetraploids (5). In morphological characters and seed productivity, there were no significant differences between the two kinds of tetraploids or the performance of the different triploid hybrids. These observations are supported by a study of the dynamics of polyploid populations (12).

The use of colchicine opened a new opportunity for crop improvement (8). Such methods, in effect, speed up the process of evolution (2). A unique and notable application was made to watermelons with induced tetraploids and subsequent triploid hybridization (10).

First attempts to produce seedless watermelons originated at Michigan State University, combining colchicine and hormones (15). The colchicine treated plants were seedless and since this publication was made, it has been observed that the colchicine generation may be seedless. The concept to obtain seedless fruits with triploids began with the work of Prof. Kihara (10). His associates and others have used these methods, and all reports stress the fine quality of the triploid fruit (3, 4, 7, 11, 13, 14).

Difficulties with seed germination has retarded the expansion of triploid cultivation. In other cases, the lack of disease resistance was regarded as a serious obstacle. Disease resistance can be developed in the tetraploids and triploids (9). The seed germination problem can be solved and the tolerance to the serious diseases can be attained.

One tetraploid strain was propagated through twenty generations. Field populations provided natural selection and the surviving genotypes showed a gradual improvement with each generation. There was no attempt made to select the most disease resistant, the earliest, or the one plant superior to all others. Rather, the average and above average survived and these individuals gave the basic genetic material that was propagated. One should not select the most disease resistant without proper balance of other characters (1). After twenty generations, the tetraploid was improved and showed advantages over the early ones.

The first triploids showed excellent quality (7). At the same time, the first impression of triploids was not entirely favorable because ovules were equated with seeds and the vigor of triploids was lacking. The idea developed that it was impractical to produce seedless melons. The cost factor is given as another reason for impracticality, but this must be viewed in light of the success or failure to obtain a productive crop. Growers willing to modify procedures can and should consider triploid watermelon as a potentially valuable crop.

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16. Growing Seedless Hybrid (triploid) Watermelons by Direct Seeding

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To be successful in growing seedless hybrid (triploid) watermelons by direct seeding, it is necessary to alter cultural practices normally used in growing the common diploid watermelon.

Many growers have failed in their attempts to grow triploids because they are geared to cultural practices that are normally used in growing diploid watermelons. This is understandable since it is necessary to interplant a diploid pollinator either in adjacent rows or within the row with the sterile triploids. Also, the grower feels more comfortable in using such cultural practices he knows will work on diploid watermelons.

There are several reasons why triploid watermelon culture is different from diploid watermelon growing: 1) triploid seeds will not germinate in cold, wet soils as well as diploid seeds; 2) triploid seedlings will not tolerate high soil moisture conditions between the seedling stage and runner development; 3) fruit set on triploid plants is later than most diploid cultivars; and 4) triploid plants are vigorous, long season, and productive.

We recommend the following cultural practices for growing direct seeded triploid watermelons. Land preparation: 1) prepare land similar to diploid production; 2) bed land in 38" or 40" rows; 3) in every other bed where seeds are to be planted, fertilize with 200 pounds of 16-20-5 and shape beds for top of bed planter; and 4) irrigate before planting if necessary. Planting: 1) plant two or three weeks after last freeze, usually about April 15 in our location; 2) hand plant two seeds per drop three feet apart in the row alternating one drop diploid with three drops triploid. Thus, the planting pattern is one diploid to three triploid drops within the row with the rows 78" or 80" apart or about 2,200 drops per acre.; 3) after plants have started running, fertilize with 200 pounds of ammonium sulfate per acre or about 40 pounds actual nitrogen; 4) bust out blank beds making 78" or 80" beds; 5) apply herbicide (Dacthal); and 5) irrigate as needed to maintain good plant growth.

Harvest usually starts in our location about July 20. Yields will exceed 30,000 pounds of triploid and 8,000 pounds of diploid watermelons per acre under normal growing conditions.

17. Preliminary Report on Association of *Diabrotica* Resistance and Morphological Characters in Watermelon

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Chambliss and Cuthbert (1) determined that resistance to *Diabrotica* in watermelon was controlled by a single recessive gene. No association between this gene and other genes has been reported. We are currently investigating the assortment of genes for *Diabrotica* resistance, dwarf habit, entire leaf, fruit shape, and seed size.

Lines inbred for four generations from crosses with 'Sugar Loaf', a *Diabrotica* resistant cultivar, were obtained from F. P. Cuthbert (U.S. Vegetable Lab, Charleston, SC). These were selfed and first evaluated for field resistance in 1977 (Table 1).

F_1, F_2, and backcross populations have been obtained among F_5 *Diabrotica* lines and cultivars with contrasting morphological characters. Field resistance ratings and scoring of morphological characters will be made in the field in 1979.

Table 1. Striped cucumber beetle populations and damage ratings of watermelon lines and cultivars.

Genotype[z]	No. beetles/plant[y]	Damage index
E56	0.00	0.01
E61	0.04	0.07
E51	0.07	0.10
E67	0.07	0.37
E69	0.08	0.13
E66	0.10	0.24
E60	0.10	0.04
E68	0.13	0.20
Sunshade	0.56	1.44
Coconutmelon	0.92	0.36
Charleston Gray	0.92	0.54
Kengarden	1.15	0.54
Supersweet	1.38	0.76
Crimson Sweet	1.60	0.72
Chris Cross	2.25	0.92
Allsweet	2.29	0.71
Jubilee	2.75	1.00

[z] *Diabrotica* resistant lines are designated E.

[y] Mean beetle number per sampling date.

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18. Race 2 Anthracnose Resistance in a Watermelon Line With a Pale Leaf Character

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Hadwiger and Hall (1) reported increased growth of Colletotrichum orbiculare on the dark green striped rind area of 'Garrisonian' watermelon fruits. No other report relating this disease to the pigmentation of the watermelon fruit or vine is known.

A pale leaf line, originally designated R143, was obtained from seed stocks at the U.S. Vegetable Laboratory at Charleston, SC. The pale leaf character is quite evident in the cotyledon stage. The cotyledons are almost yellow. However, pigmentation differences become less evident as the plant matures and is almost imperceptible in the older leaves. The character is not reported in the literature.

In the fall of 1976, the pale leaf line was inoculated with race 2 anthracnose (AR2) spores. Roughly one-half of the 2-week old seedlings survived inoculation with a solution of 20,000 spores/ml of AR2. Survival rate in other lines varied from 0-10%. A pale leaf survivor was crossed with the cultivar 'Allsweet'. The F_1 seed were planted in the field in the spring of 1977. Self-pollinated fruit were harvested from these plants and provided F_2 seed. Ten hills of these F_2 lines, as well as their parents, and other genetic material possessing the pale leaf variant were planted in the field in the spring of 1978 and were inoculated with AR2 (140,000 spores/ml). Plants showing superior resistance to AR2 were flagged two weeks after inoculation. Resistance ratings were based on percent defoliation (Table 1). Percent defoliation was estimated by dividing the length of a single vine into the segment of that vine with necrotic leaves. The amount of variability within a line is shown in Table 2. One F_2 population from the previously mentioned cross was judged to be the most resistant of more than 50 lines.

The pale leaf character was not evident in any of the parental material or F_2 progeny in the field in 1978, nor in the F_1 progeny in the field in 1977. The pale leaf character was clearly evident in the greenhouse plants used as the male parent in the winter of 1976-1977 and in all parental material and progeny planted in the greenhouse in the winter of 1978-1979.

Investigations are continuing on the inheritance of this character and its relationship, if any, to AR2 resistance.

Table 1. Percent defoliation of watermelon genotypes infected with race 2 anthracnose.

Genotype	% defoliation[a]	No. plants sampled
'Allsweet' (AS)	25	32
Yellow 1 (yel-1)	30	2
Yellow 2	20	2
Yellow 3	23	2
F_1 (yel-1 x AS)	23	12
F_2 (yel-1 x AS)	14	16
F_2 (yel-1 x AS)	21	18
F_2 (yel-1 x AS)	5	16

[a]Defoliation two weeks after inoculation with 140,000 spores/ml of race 2 anthracnose.

Table 2. Percent defoliation of individual hills of progeny from a cross between 'Allsweet' and a pale leaf line of watermelon (yel-1 x AS).

Generation	Hill no.									
	1	2	3	4	5	6	7	8	9	10
F_1	15	--	--	25	20	25	20	--	35	--
F_2	15	--	15	15	--	30	7.5	10	15	15
F_2	20	20	15	25	25	20	20	--	--	20
F_2	5	5	5	--	5	5	5	10	7.5	--

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RESEARCH NOTES

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IV. Cucurbita spp.

19. Attempts to Cross Cucurbita moschata (Duch.) Poir. 'Butternut' and C. pepo L. 'Delicata'

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Breeders have long been interested in interspecific crosses among major Cucurbita species. Whitaker (12) reviewed the research in this area of breeding. They concluded that C. moschata occupies a central position among the annual species and can be crossed with difficulty with C. pepo, C. maxima, and C. mixta. Embryo culture and/or amphidiploidy were suggested to overcome poorly developed embryos and F1 sterility usually encountered in these crosses. They also indicated that the likelihood of success varied with cultivar used.

Erwin and Haber (4) obtained 57 fertile seeds from 4 fruit resulting from 134 pollinations of 'Connecticut Field' (C. pepo) x 'Large Cheese' (C. moschata). Many fruits and fertile seeds were produced by the F1 and F2 plants. No fertile seeds resulted from the reciprocal or from reciprocal crosses between 'Table Queen' (C. pepo) and 'Large Cheese'. In these and other Cucurbita interspecific crosses, they obtained many parthenocarpic fruit. Castetter (2) also crossed 'Connecticut Field' x 'Large Cheese' with results very similar to those of Erwin and Haber (4). Wall (10) successfully crossed 'Yankee Hybrid' (C. pepo) x 'Butternut' (C. moschata) and backcrossed the F1 with each parent. Zygote viability was greater in the backcross to 'Butternut' and when the F1 was used as the seed parent.

Hayase (6) achieved C. pepo x C. moschata crosses and the reciprocal, by embryo culture, but only when pollinations were made at 4:00 a.m. using pollen stored at 10°C. Rhodes (9) used C. lundelliana as a bridge by making the trispecific hybrid C. pepo x (C. lundelliana x C. moschata 'Butternut') and reported that bush habit could thus be transferred from C. pepo to C. moschata. Others have reported crossing C. pepo and C. moschata with varying degrees of success (1, 3, 5, 8, 13).

This report describes attempts to cross cultivars of the 'Butternut' group of C. moschata with C. pepo 'Delicata'. Both natural field crossing and controlled pollinations were involved.

In 1976, plots of 'Ponca', 'Patriot', and 'Waltham Butternut' of C. moschata were grown in close association with 'Delicata' in an isolated area, but with C. pepo gourds growing about 15 m away. Seeds were saved from 15-20 fruits of each species and planted in field rows in 1977. From the combined seed of the 'Butternut' strains, 127 plants were grown. All were typical of the parents. Over 1,300 plants from the open pollinated 'Delicata' seeds were observed. Aside from a few obvious crosses with C. pepo gourds, all of these were typical of the parent and none were suspected to be 'Delicata' x 'Butternut' crosses.

In 1977, controlled reciprocal crosses were made between 'Delicata' and eight commercial 'Butternut' cultivars (Table 1). Unopened male and female flowers were tied late in the afternoon prior to anthesis. They were hand-pollinated at 08:00 to 09:00 the following day and securely bagged to prevent further

pollination by bees. (There was no attempt to employ embryo culture during fruit development, and there was no examination of fruit during this period to determine if embryos were developing normally.)

Fruits were examined beginning October 1. Of the 103 pollinations involving 'Butternut' cultivars as female, 81% set fruit of normal size and appearance (Table 1). All 83 of the fruit were parthenocarpic with empty seedcoats. There was no practical difference in results among the 'Butternut' strains. The same 'Butternut' strains, except 'Eastern Butternut' and 'Early Butternut', were used as parents for pollination of 'Delicata'. Two normal size and two very small fruits resulted from 78 pollinations, but all 4 were parthenocarpic with empty seedcoats.

These results support the observations of Whitaker and Davis (12) and Erwin and Haber (4) that natural crosses between C. pepo and C. moschata rarely or never occur. Failure of 181 hand pollinations to produce seeds suggests that 'Butternut' strains and 'Delicata' may be less promising as parents to achieve this interspecific cross than some cultivars previously used such as 'Large Cheese' and 'Connecticut Field'.

Whitaker and Bohn (11) suggested that C. pepo and C. moschata should be isolated in seed production. That advice was based on the possibility of reduced seed yield through parthenocarpic fruit set. However, it is sometimes stated that C. pepo and C. moschata should be isolated because crossing will occur. In view of the results reported here and those found generally in the literature, it seems that crossing would rarely or never result from growing these species together.

Table 1. Number of fruits produced from hand crosses between 'Butternut' (C. moschata) strains and 'Delicata' (C. pepo).

Cross	Number		
	Pollinated	Aborted	Normal[2] Fruits
Butternut (Park) x Delicata	17	2	15
Eastern Butternut x Delicata	4	0	4
Early Butternut x Delicata	5	1	4
Ponca x Delicata	24	6	18
Baby Butternut x Delicata	18	5	13
Patriot x Delicata	18	5	13
Waltham Butternut x Delicata	8	0	8
Butternut (Harris) x Delicata	9	1	8
TOTALS Butternut x Delicata	103	20	83
Delicata x Butternut[1]	78	74	2[3]

[1] 'Butternut' strains combined; 'Eastern Butternut' or 'Early Butternut' not used.
[2] All found to be parthenocarpic.
[3] Plus two abnormally small fruit.

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20. Interspecific Cross Between *Cucurbita pepo* and *C. martinezii*

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Powdery mildew, cucumber mosaic virus (CMV), and watermelon mosaic virus (WMV) are important and common diseases of *Cucurbita pepo* in France. High levels of resistance have not been described in this species.

Resistances exist in some wild and cultivated *Cucurbita* species. Particularly, *C. martinezii* is resistant to powdery mildew and CMV (1, 2). In our field conditions, *C. martinezii* is completely resistant to powdery mildew and CMV and exhibits only mild symptoms of WMV.

Reciprocal interspecific crosses between *C. pepo* and *C. martinezii* were attempted in field and greenhouse conditions. One F_1 hybrid seedling was obtained using *C. pepo* as female parent and seven seedlings with *C. martinezii* as female parent. The F_1 plants were quite different in vigor and in leaf and fruit shape (the *C. pepo* parent is a commercial F_1 hybrid). One plant did not produce male flowers. The fertility was sufficient to obtain F_2 and BC1 progenies.

The resistance to CMV is dominant (the F_1 plants are apparently free from virus like *C. martinezii*) but the resistance to powdery mildew is intermediate. We are now studying the heredity of the resistances in the F_2 and BC1 progenies.

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21. Sex Expression in *Cucurbita foetidissima* HBK

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Sex expression in *Cucurbita* species including *C. foetidissima*, the Buffalo gourd, have been considered as stable breeding monoecious species. Antherless and male sterile plants were described by Curtis (1). A population of *C. foetidissima* grown by Curtis in Lebanon from seed collected at one location in Texas segregated 431 monoecious to 129 antherless (gynoecious). Curtis suggested that "Antherless" was recessive and the seed collected in Texas came from a homogeneous colony of plants that were monoecious but heterozygous.

A germplasm nursery containing 63 accessions of *C. foetidissima* was established from seed in 1976 at Tucson, AZ. In 1977, the plants, which are perennial, were scored for sex expression. Twenty-nine accessions contained at least 1 gynoecious plant, 19 accessions having a population of 6 or more were all monoecious and 15 accessions having a population of 5 or less plants were also all monoecious. The total count from the 29 accessions segregating gynoecious plants were 114 gynoecious to 153 monoecious. In no case was an accession exclusively gynoecious plants.

Populations of plants from selected crosses and monoecious selfs have shown the gynoecious character is conditioned by a dominant gene and is heterozygous, i.e., ♀♀ - Aa, and the monoecious condition is homozygous recessive. This dominant gene appears to be widespread throughout the native range of *C. foetidissima*. A proposed term "gynomonodioecious" is suggested to describe a population containing gynoecious and monoecious segregates.

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22. Six Interspecific Trisomics (2n *C. moschata* + 1 *C. palmata* chromosome) and One Primary Trisomic of *Cucurbita moschata*

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A fertile interspecific trisomic of *Cucurbita moschata* was first reported by Bemis, who added a single chromosome from the wild, perennial, xerophytic species, *C. palmata*, to disomic *C. moschata* cv. 'Butternut' (1). Repeating the procedure of crossing the autoallotriploid, containing two *C. moschata* genomes and one *C. palmata* genome, with diploid *C. moschata* resulted in sixteen interspecific trisomic lines, seven of which were morphologically similar to the original interspecific trisomic. The remaining nine lines represented five additional phenotypically distinctive groups, suggesting that a total of six different *C. palmata* were recovered. One primary trisomic of *C. moschata* was obtained from a triploid 'Butternut' plant.

Since the trisomic progeny of the aneuploids were morphologically distinguishable from their disomic sibs, an accurate determination of transmission rates of the extra chromosome through the female and male was possible (Table 1). Transmission through the female ranged from 15% to 32% for the *C. palmata* chromosomes and was 55% for the extra chromosome in the primary trisomic. None of the extra chromosomes were transmitted through the male.

Considering the diploid nature of *Cucurbita* and the distant relationship between *C. moschata* and *C. palmata*, there was surprisingly little effect of the *C. palmata* chromosomes on the gross morphology of the *C. moschata* recipient. Fruit from one of the interspecific trisomics exhibited the hard rind of *C. palmata* showing that this dominant trait is carried on one chromosome. In only two of the interspecific trisomics was the vigor of the plants visibly less than that of disomic *C. moschata*. Reduction in tendril length and the occurrence of male buds at the branches of the early tendrils were common to most of the trisomics, including the primary trisomic, suggesting a chromosomal effect due to genic imbalance of trisomics.

Table 1. Transmission of the extra chromosome in *C. moschata* trisomics.

Phenotypic Group	No. Lines	Female Transmission (2n + 1) x MM		Male Transmission MM x (2n + 1)	
		Total Plants	% 2n + 1	Total Plants	% 2n + 1
Interspecific Trisomics					
P1 restricted neck fruit	8	677	26	505	0
P2 hard rind	2	100	26	95	0
P3 sticky leaves	3	259	32	143	0
P4 slightly restricted neck	2	88	31	97	0
P5 pale staminate flowers	1	47	21	42	0
P6 club shaped fruit	1	73	15	89	0
Primary Trisomic	1	57	44	70	0

Literature Cited

1. Bemis, W. P. 1973. Interspecific aneuploidy in *Cucurbita*. Genet. Res. 21:221-228.

23. Bitter *Cucurbita* spp. as Attractants for Diabroticite Beetles

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The attacks of the striped cucumber beetle, *Acalymma vittata*, and the spotted cucumber beetle or southern corn rootworm, *Diabrotica undecimpunctata howardi*, on cultivated Cucurbitaceae and of the corn rootworm, *D. u. howardi*, northern corn rootworm *D. longicornis*, and western corn rootworm *D. virgifera* on corn in the Midwest are conservatively estimated to cause damage and expenditures for control aggregating hundreds of millions of dollars annually. Approximately 40 million A. (16 million HA.) of corn are treated each year with soil insecticides and more than 10 million A. (4 million HA.) are sprayed to control the adult beetles.

There is need for a satisfactory monitoring and trapping system to determine population densities of adult Diabroticites in order to schedule insecticide treatments and develop integrated pest management programs. Such a system, if effective, could be used to control the beetle populations in small garden plots and in limited acreages of row crops. It is well known that several species of Diabroticite beetles are attracted by the tetracyclic triperpene cucurbitacins (1, 2, 3). These cucurbitacin "bitter substances" are specific kairomones for the Diabroticite beetles, acting as arrestants and feeding stimulants. The attacks of these beetles on the foliage and fruits of 18 species of *Cucurbita* were found to be directly related to the amounts of cucurbitacins B and E present. The cucurbitacin content may range up to 0.3% fresh weight in the fruit and roots of certain wild *Cucurbita* species.

The fruits of *C. andreana*, containing large amounts of cucurbitacin B, and *C. texana*, containing large amounts of cucurbitacin E glycoside, were found to be particularly suitable as trap crops or for attractant preparations for the Diabroticite beetles. In our preliminary experiments, approximately 100 g of squash fruit were homogenized in 500 ml of water to make a thick paste. This was poured into 10 inch (25 cm) paper pie plates so that each plate contained about 15 g of homogenate. In a typical experiment using *C. texana* fruit and three replicate traps placed around the perimeter of a planting of about 400 sq ft of *C. andreana*, the following average numbers of Diabroticite beetles were attracted:

Minutes of exposure	Average number of beetles
5	16
10	21
20	75
30	154
60	197
120	355

In these traps, the beetles, largely *D. undecimpunctata* with some *D. virgifera* and *A. vittata* compulsively ate the squash homogenate until it was totally consumed in about 5 hrs. The effectiveness of such traps was greatly improved

by adding from 0.01 to 0.1% (w/v) of the contact insecticides trichlorfon or methomyl. These poisoned traps killed the feeding beetles within 5 minutes and up to 1,000 beetles within 4 hours. We estimate the cost of the individual traps at less than $0.10. Cucurbita texana and C. andreana produce large numbers of fruits under Illinois conditions and sufficient quantities will be grown to explore the practicality of trapping Diabroticites to protect home gardens and to determine population densities in corn plantings.

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24. Electrophoretic Analysis of Protein in Single Pollen Grain of Cucurbita

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Analysis of individual pollen grains offers a means of determining genetic ratios with only a single heterozygous plant. The large size of Cucurbita pollen makes it possible to use microelectrophoresis to classify different pollen grains of the same F_1 plant for specific proteins and to determine their inheritance.

Acrylamide gels 29 to 30 mm long within 1 ml microcapillaries were covered with marker dye (1% xylene cyanol in 20% sucrose) and 2-3 mm of 0.4 M urea. A single pollen grain was pierced with a fine needle and inserted into the urea solution at the top of the capillary. The needle was withdrawn within a few moments, after hydration of the pollen grain, leaving the ruptured pollen grain in the urea solution.

Electrolysis of the capillary was completed within 20 minutes, when the front of the dye had advanced 10 mm into the gel, then the gel was removed and stained for 10-15 minutes with 1% Coomassie blue in 7% acetic acid containing 20% ethanol.

No evidence of protein variation was observed among pollen grains of Cucurbita pepo, cv. 'Caserta'. Pollen of the interspecific hybrid of C. martinezii x C. moschata, cv. 'Seminole', however, segregated for specific proteins. Segregation for presence or absence of two different bands agreed with a 1:1:1:1 ratio, indicating monogenic control of synthesis of each protein and no linkage of the two genes. Furthermore, the results are evidence that the genes coding for synthesis of these proteins are transcribed and translated post meiotically.

25. The Effect of Light and Fruit Development on Internode Elongation in *Cucurbita maxima* Squash

Zack, C. D. and J. B. Loy, University of New Hampshire, Durham, NH 03824.

Bush strains of *Cucurbita maxima* squash exhibit a compact form of growth under field conditions during the summer, but grow in a vining manner during the fall and winter in the greenhouse in Durham, NH. Bush-vine heterozygotes exhibit changes in growth pattern, even within a single growing season. This pattern is characterized by a bush type of early growth, followed by a vining habit at a later stage of development. Shifriss (2) attributed this growth response to a "developmental reversal of dominance" phenomenon.

A growth chamber study using incandescent and fluorescent lights revealed that the quality of light prior to a dark period rather than photoperiod has a significant effect ($P = 0.05$) on internode elongation of *C. maxima* squash (Table 1). Thus, the vining of bush strains in the greenhouse is probably due to the use of incandescent lighting during the evening. Further growth chamber studies using red and far-red light indicate phytochrome involvement in the end-of-day light response in squash, agreeing with similar studies reported for other species (1, 3).

We had observed that vegetative growth in bush strains appeared to be depressed more than vining strains by fruit set and development. Thus, a further field comparison was made of vegetative growth between plants which were allowed to set fruit or those in which female flowers were removed at anthesis.

Both the bush-vine hybrid and bush strain exhibited increased elongation of successive mature internodes; however, the increase was greater in the bush-vine hybrids. Approximately two weeks following pollination and fruit set, rapid fruit development almost completely suppressed leaf initiation in the bush strain, but did not affect vegetative growth of the bush-vine hybrid. Thus, in *C. maxima*, growth patterns are similar in bush and bush-vine hybrids in the absence of fruiting. The apparent "developmental reversal of dominance" phenomenon can be interpreted as a physiological response rather than a reversal of dominance of a gene.

Table 1. Length of a mature second internode of a bush strain (76-30-11-6) and a bush-vine hybrid (76-30-11-6 x cv. 'Pink Banana').

Treatment	Length (mm)[z]	
	Bush	Bush-vine
12 hrs fluorescent	10.8	19.1
16 hrs fluorescent	9.4	20.9
11 hrs fluorescent + 4 hrs incandescent	31.4	39.6
LSD ($P = 0.05$)	2.7	9.9

[z]Mean of 5 replications per treatment.

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V. Other Genera

26. Mentor Pollen as a Tool in Interspecific Hybridization in Cucumis

Oost, Emiel H. and A. P. M. den Nijs, Institute for Horticultural Plant Breeding, Wageningen, The Netherlands.

The African species Cucumis metuliferus carries resistance to root knot nematodes (Meloidogyne spp.), which would be an important asset for both melons and cucumbers. The species, however, could so far not be crossed with any other representative of the genus (1, 2, 3). In C. africanus, resistance has been found against cucumber green mottle mosaic virus (CGMMV). However, attempts to introduce this resistance into cucumber have failed so far.

The mentor pollen technique has proved helpful in overcoming crossing barriers between allied species in the genus Populus (4). The merits of this technique in crosses between C. metuliferus, C. sativus, and C. africanus were evaluated in this study.

Fresh anthers with pollen of the three Cucumis species were irradiated with 100, 200, and 500 krad (cobalt source, 100 krad/4.5 minutes) during the summer of 1978. The lowest dose appeared to be sufficiently lethal, since no embryo development was found in selfings with 100 krad irradiated pollen. Pollen germination and pollen tube growth, however, appeared to be almost normal, although a rapid loss of viability was found (down to 10% within 12 hours). Irradiated pollen (anthers) of the mentor was mixed with unirradiated pollen (anthers) of one of the two other species in a volume ratio of about 2:1. Pollinations were made in five of the six possible combinations of reciprocal interspecific crosses. In vitro germination of all pollen was checked before pollination. After 48 hours, in vivo germination and pollen tube growth were examined under a U.V. microscope. Penetration of pollen tubes into ovules was evident in all pollinations with mentor pollen, either alone (as a control) or in mixtures with one of the other species. No difference was observed between these categories.

C. metuliferus and C. africanus, both non-parthenocarpic, yielded fruits only after pollination with own mentor pollen, independent of the presence of pollen of other species. Fruits were opened, starting from the 14th day after pollination, and the developing seeds were examined for embryo growth. Embryo sacs, some with globular structures (possible embroys), were found in C. metuliferus pollinated with C. metuliferus mentor pollen mixed with C. sativus pollen. Fourteen embryo sacs out of four C. metuliferus fruits from pollinations with mentor and sativus pollen were explanted on an artificial embryo medium, but all failed to grow. Pollinations of C. africanus with different mentor pollen combinations resulted only in some seeds with very small embryo sacs which exhibited no internal differentiation. In fruit of C. sativus, no embryo sacs were found. In all species, degeneration of nucellus and potential embryo sacs had already started in fruits opened 25 days after pollination.

Normal cross-pollinations on C. metuliferus and C. africanus never yielded fruits. The induced fruit set due to mentor pollen may have facilitated the development of

those few seeds which resulted from cross-fertilization. If our embryos were of hybrid origin, embryo development has been rather slow. Degeneration occurred after 25 days but probably started sooner. Therefore, embryo culture seems essential, but appropriate media are still to be developed.

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27. Disease Resistances in Some Wild Cucumis Species

Pitrat, M. and R. D. de Vaulx, Station d'Amélioration des Plantes Maraîcherès, I.N.R.A., Domaine Saint Maurice, 84140 Montfavet-Avignon (France).

Cucumis species in collection at the Vegetable Plant Breeding Station of Montfavet-Avignon (France) were evaluated for resistance to natural infestation or artificial inoculation to some important diseases in France: cucumber mosaic virus (CMV), watermelon mosaic virus (WMV)-2), powdery mildew, corky-root (Pyrenochaeta sp.) and root-knot nematode.

All the species tested were susceptible to CMV and WMV-2 but with different intensity levels (Table 1). In artificial inoculation, C. zeyheri was the least susceptible, i.e., mild symptoms and recovery. In natural infestation, C. zeyheri, C. prophetarum, and C. ficifolius (PI 196.844) were the least susceptible.

All the species except C. anguria and C. myriocarpus were powdery mildew resistant. C. prophetarum and C. zeyheri were resistant to corky-root. C. metuliferus from Fassuliotis was also resistant to nematode (Meloidogyne incognita) in our conditions.

Table 1. Results of six disease screening tests on various Cucumis species.

	Artificial inoculation		Natural infestation		Transplantation in a greenhouse infected with	Root-knot nematode
	CMV	WMV-2	CMV+WMV-2	powdery mildew	Corky-root	
C. anguria (= PI 196.477)	MS	VS	S	S	S	-
C. dipsaceus (from Ethiopia)	-	-	S	R	S	-
C. heptadactylus (PI 282.446)	S	MS	-	-	-	-
C. metuliferus (from Fassuliotis)	MS	VS	S	R	S	R
(from N.I.Vavilov Institute)	MS	VS	S	R	-	-
C. myriocarpus (1096)	-	-	MS	S	S	-
C. prophetarum (PI 193.967)	S	S	MS	R	R	MS
C. zeyheri PI 273.192	MS	MSr	R-MS	R	R	-
PI 299.570	MS	MSr	R-MS	R	R	-
PI 299.572	MS	MSr	R-MS	R	R	-
C. ficifolius PI 196.844	MSr	VS	MS	R	S	-
PI 203.915	VS	VS	S	R	S	-
PI 293.646	VS	VS	S	R	-	-

R = resistant MSr = mild symptoms and recovery MS = mild symptoms S = susceptible
VS = very susceptible - = no tested

28. Use of *In vitro* Culture for Inducing Germination of *Cucumis* Seed

Visser, D. L. and J. Franken, Institute for Horticultural Plant Breeding, Wageningen, The Netherlands.

Several 10-year old seed samples of accessions of wild *Cucumis* species in the breeding collection of the Institute for Horticultural Plant Breeding did not germinate under standard conditions, which included heat treatments as used for commercial cucumber seed. Soaking the seeds in GA-3 and scarification of the seed coat helped germination in some samples, but seed of several important accessions remained dormant.

Therefore, we tried a modified embryo culture technique, similar to that reported by George and Crowder (1). Seeds were sterilized for 20 minutes in 2% sodium hypochlorite solution and washed in sterilized water. The seedcoats were removed and apparently healthy embryos were placed in sterile conditions on a modified medium of Murashige and Skoog (2) with sucrose (2%), caseine hydrolysate (5×10^{-4}), indole acetic acid (1×10^{-7}), thiamine (4×10^{-7}), and Difco bacto agar (0.8%). After one week, 13% of the explants were growing well. The other embryos grew slowly or did not grow at all. Remarkably, the slow growing embryos did not develop a tap root. Only some lateral roots developed to a certain extent. About 50% of the embryos grew into normal plants; the others degenerated after some time. Using this technique, we have been able to raise plants of several accessions of the species *Cucumis africanus*, *C. myriocarpus*, *C. figarei*, and *C. metuliferus* that would otherwise have been lost.

Within *C. sativus* we encountered germination problems with the seed of tetraploid x diploid crosses. The fruits on tetraploid plants developed normally after such crosses, but the seeds were at best only partly filled. Eight weeks after pollination, the embryos were up to 6-7 mm in size (normal length is about 11 mm), and hardly any germinated. This phenomenon has been observed by many researchers when attempting to produce triploids, and it certainly has hampered the progress of triploid and aneuploid research in cucumbers. Therefore, the *in vitro* culture technique was used here also. The complete mature fruit was disinfected with 96% alcohol, seeds were extracted, and embryos were dissected out under sterile conditions. Each fruit typically contained 4-10 embryos of 4-7 mm long and a great number of embryos of about 1-2 mm, which often were brown. The larger embryos developed excellently, and 60% grew into plants which could be transferred into soil after only one week. The small embryos (1-3 mm) failed to grow. More than 90% of the dissected embryos grew, and out of several crosses, more than 100 plants were obtained. The ploidy level of the plants was checked by examination of pollen and general morphology, and all appeared to be triploid. In the same way, plants have been obtained of triploid x diploid crosses and 20 healthy plants are now being checked for aneuploidy.

The *in vitro* culture technique is a useful contribution to increase the yield of triploid plants to a suitable level for research programs, and it appears helpful for saving specific species accessions with inferior seed quality.

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VI. Special Report - Cucurbit Gene List Committee

29. New Genes for the Cucurbitaceae

Robinson, R. W. (Chairman, Cucurbit Gene List Committee), New York State Agricultural Experiment Station, Geneva, NY 14456.

The genetics of the Cucurbitaceae has been reviewed by a committee sanctioned by the American Society for Horticultural Science, and lists of the preferred symbol for each gene were published (13) in 1976. Since then, a number of reports of additional genes have been published, and some previously published papers omitted in the review have come to our attention. Following is a list of these genes:

Species	Preferred symbol	Synonym	Character	Reference
Citrullus lanatus	Af*		Aulacophora foveicollis resistance. Resistance to the red pumpkin beetle. Dominant to susceptibility.	21
" "	db		Didymella bryoniae resistance. Gummy Stem Blight resistance. Recessive to susceptibility.	10
" "	Fwr		Fruit fly resistance in watermelon. Dominant to susceptibility to Dacus cucurbitae.	5
Cucumis melo	Al-1*	Al_1	Abscission layer-1. One of two dominant genes for abscission layer formation.	18
" "	Al-2*	Al_2	"	18
" "	Bi		Bitter. Bitter seedling; dominant to nonbitter.	6
" "	dc-1*		Dacus cucurbitae resistance. One of two complementary recessive genes for resistance to the melon fruitfly.	15
" "	dc-2*		"	15
" "	jf*		juicy flesh. Juicy flesh recessive to less juicy; segregates discretely in monogenic ratio in segregating generations.	2

Species	Preferred symbol	Synonym	Character	Reference
Cucumis melo	*ri*		*ridge*. Ridged fruit surface recessive to ridgeless.	18
" "	*yv*		*yellow virescence*. Pale cotyledons; yellow green young leaves and tendrils; bright yellow petals and yellow stigma; etiolated; older leaves becoming green.	22
Cucumis metuliferus	*Wmv*		*Watermelon mosaic virus* resistance. Resistance to watermelon virus-1; dominant to susceptibility.	11
Cucumis sativus	*cla*		*Colletotrichum lagenarium* resistance. Resistance to race 1 of anthracnose; recessive to susceptibility.	1
" "	*Cca*		*Corynespora cassicola* resistance. Resistance to target leaf spot; dominant to susceptibility.	1
" "	*Cm*		*Corynespora melonis* resistance. Resistance to *C. melonis*; dominant to susceptibility.	20
" "	*dl*		*delayed* growth. Reduced growth rate; shortening of hypocotyl and first internodes.	7
" "	*Fba*		*Flower bud abortion*. Preanthesis abortion of floral buds, ranging from 10 to 100%.	8
" "	*Foc*		*Fusarium oxysporum* f. sp. *cucumerinum*. Resistance to fusarium wilt; dominant to susceptibility.	9
Cucurbita moschata	*cr*		*cream* corolla. Cream to nearly white petals for *cr/cr*, yellow for *cr/+*, and orange corolla for +/+; derived from *C. okeechobeensis*.	14

Species	Preferred symbol	Synonym	Character	Reference
Lagenaria siceraria	Af*		Aulacophora foveicollis resistance. Resistance dominant to susceptibility to the red pumpkin beetle.	21
" "	b*		bottle. Bottle-shaped fruit recessive to disk.	19
" "	db*		dumbbell. Interacts with b to produce F_2 of 9 club: 3 round: 4 dumbbell-shaped fruit.	19
" "	G		Green. Dark green fruit color; dominant to light green.	19
" "	lb*		light brown seed. Light brown seed coat color recessive to brown.	19
" "	r*		round. Round fruit; recessive to disk fruit shape.	19
Luffa sp.	a		andromonoecious. Staminate and perfect flowers on the same plant; interacts with g.	3
"	g		gynoecious. Pistillate flowers only; interacts with a to produce monoecious or trimonoecious (++), andromonoecious (a+), gynoecious (+g), or hermaphroditic (a g) plants.	3
Melothria medraspatana	s*		small seeds. Small (3.0 mm) seed recessive to large (3.6 mm).	16
" "	w*		white seeds. White seed coats if w/w, ashy if w/+, and black if +/+.	16
Momordica charantica	lbs*		light brown seed. Light brown seed coat color; recessive to dark brown.	17
" "	ls*		large seed. Large seed size; recessive to small seed size.	17

Species	Preferred symbol	Synonym	Character	Reference
Momordica charantica	w*		white epicarp. White immature fruit skin; recessive to green.	17

*Proposed new symbol.

It is hoped that researchers will consult the above list and previous lists (13) of cucurbit genes before choosing a gene symbol, so that inadvertent duplication of gene symbols can be prevented.

The best person to select a symbol for a gene is the person first reporting on its inheritance, but this has often been neglected by cucurbit researchers. We urge that an appropriate gene symbol be included in all publications about new cucurbit genes. We would appreciate being informed of any publication about a cucurbit gene not included in these lists.

Cucurbit Gene List Committee

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STOCKS AND GERM PLASM DESIRED OR FOR EXCHANGE

Stocks Desired

J. M. Crall

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

J. D. McCreight

Chlorophyll deficient stocks and stocks having any one or more of the following genes of Cucumis melo: g, gynomonoecious; gp, green petals; h, halo cotyledons; and l, lobed leaves.

A. P. M. den Nijs

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

M. Pitrat

Material resistant to CMV and WMV.

R. W. Robinson

Cucurbita californica

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

Any species of the following genera:

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

Stocks for Exchange

W. P. Bemis

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

J. M. Crall

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

T. P. M. den Nijs

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

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

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

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

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

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

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

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

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

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

C. hardwickii
1738 VIR, USSR
1759 Kohli, India

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

A. M. Rhodes

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

R. W. Robinson

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

J. C. Taylor

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

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1. Adams, Howard. Northrup, King and Company, Post Office Box 1406, Woodland, CA 95695. Breeding commercial cultivars.

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

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

5. Baggett, J. R. Department of Horticulture, Oregon State University, Corvallis, OR 97331.

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

7. Balgooyen, Bruce, Northrup, King and Company, Post Office Box 959, Minneapolis, MN 55440.

8. Bemis, W. P. Department of Plant Science, University of Arizona, Tuscon, AZ 85721.

9. Bohn, G. W. Imperial Valley Conservation Research Center, 4151 Highway 86, Brawley, CA 92227.

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

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

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

13. Ciapy Library, Attention: J. Alberto Arellano, Librarian, ADPO, Postal 50-D, Merida, Yuc., Mexico.

14. Clayberg, C. D. Department of Horticulture and Forestry, Manhattan, KS 66506.

15. Coyne, D. P. Department of Horticulture, University of Nebraska, Lincoln, NE 68583.

16. Crall, J. C. Agriculture Research Center, Post Office Box 388, University of Florida, Leesburg, FL 32748. Watermelons.

17. Custers, J. B. M. Institute for Horticulture Plant Breeding. Post Office Box 16, Wageningen, Netherlands.

18. da Costa, Cyro Paulino. Deportments de Genetics-ESALQ, Caixa Postal 83, 13.400 Piracicaba, S.P. Brazil.

19. de Kroon, R. J. Enza-Zaden, Postbox 7, Enkhuizen, Holland.

20. de Ponti, O. M. B., Institute for Horticulture Plant Breeding, Post Office Box 16, Wageningen, Netherlands.

21. de Ruiter, Ir. A. C. Deruiterzonen Seed Company Post Office Box 4, Bleiswijk, Netherlands. Cucumbers.

22. de Vaulx, Roger Dumas. Centre de Recherches Agronomiques, Domaine Saint Maurice, 84140 Montfavet, France. Cucumis melo - polyploidy, quality, interspecific crosses and Cucurbita spp. - interspecific crosses.

23. Del Monte Corporation, Attention: Dorothy Arthur, Post Office Box 36, San Leandro, CA 94577.

24. Dennett, Robert K. Route 1, Box 2145, Davis, CA 95616.

25. Dumlao, Rosa. Joseph Harris Company, Moreton Farm, Rochester, NY 14624.

26. Eanhuizen, P. Rijk Zwaan, Zaudteelt En Zaadhandel B. V., Postbus 40, De Lier, Holland.

27. Eigsti, Ori. 17305, SR4, R. R. 1, Goshen, IN 46526.

28. Elmstrom, Gary W. Agricultural Research Center, Post Office Box 388, University of Florida, Leesburg, FL 32748.

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

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

31. Gabelman, Warren G. Department of Horticulture, University of Wisconsin, Madison, WI 53706. Breeding and genetics of vegetables.

32. Gabert, Augie. Ferry-Morse Seed Company, Inc., Box 66, Columbus, WI 53925.

33. Galun, Esra. Weizmann Institute of Science, Department of Plant Genetics, Post Office Box 26, Rehovot, Israel. Breeding and sex-expression of cucumber and melon.

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

35. Graham, John D. Department of Plant Science, University of Arizona, Tucson, AZ 85721.

36. Granquist, Britt. J. E. Ohlsens Enke A/S, Nymunkegaard, DK-2630 Taastrup, Denmark.

37. Groff, David. Asgrow Seed Company, R. D. #1, Bridgeton, NJ 08302.

38. Hagan, W. L. Del Monte Corporation, Agriculture Research Center, Post Office Box 36, San Leandro, CA 94577.

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

40. Hawk, James A. 204-I Prestbury Circle, Newark, DE 19713.

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

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

43. Hung, Lib. #13, Alley 5, Lane 30, Chow-shan Road, Taipei, Taiwan 106, Republic of China.

44. Iezzoni, Amy. 2012 University Avenue, Madison, WI 53705.

45. Janssens, Marc. Isar-Rubona, B.P. 167 Butare/Rwanda, Africa.

46. John, Charles A. A. L. Castle, Incorporated, 24401 SW 197th Avenue, Homestead, FL 33031. Disease resistance and high quality in cucumbers, squash and melons.

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

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

49. Karti, Zvi. Bank Hapoalien, Central Branch, Israel.

50. Kiely, Thomas P. Charter Research Inc., Post Office Box YY, Twin Falls, ID 83301.

51. Kongpolprom, Chuck. Graduate Student Office, North Carolina State University, Kilgore Hall, Raleigh, NC 27650.

52. Kosaka, Yashiro. Nihon Horticultural Production Institute, 207 Kamishiki, Matsudo-shi, Chiba-ken, Japan.

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

54. Kust, Tony. Asgrow Seed Company 7000 Portage Road, Division of Upjohn, Kalamazoo, MI 49001.

55. Laborde, Jose A. Unidad De Evaluacion y Planeacion, Apartado Postal No. 112, Celaya GTO Mexico. Mexican cucurbita germ plasm and other cultivated cucurbits.

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

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

58. Lower, Richard L. Department of Horticulture, University of Wisconsin, Moore Hall, Madison, WI 53706. Cucumber breeding and genetics.

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

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

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

62. Mohr, H. C. Department of Horticulture, University of Kentucky, Lexington, KY 40506.

63. Morelock, T. E. Department of Horticulture and Forestry, Plant Science Building 313, University of Arkansas, Fayetteville, AR 72701. Watermelons and Cucurbita spp.

64. Mott, R. L. Department of Botany, North Carolina State University Raleigh, NC 27650.

65. Mulkey, Bill. South Mississippi Branch Experiment Station, Route 1, Beaumont, MS 39423.

66. Munger, H. M. 410 Bradfield Hall, Cornell University, Ithaca, NY 14853.

67. New York State Experiment Station Library, Gordon Hall, Geneva, NY 14456.

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

69. Nijs, A. P. M. den. Institute for Horticulture Plant Breeding, Post Office Box 16, Wageningen, Netherlands.

70. Norton, J. D. Department of Horticulture, Auburn University, Auburn, AL 36830

71. O'Sullivan, John. Ministry of Agriculture and Food, Box 587, Simcoe, Ontario N3Y 4N5, Canada.

72. Partridge, H. 2205 16th Street, Vernon, TX 76384.

73. Peterson, Clinton E. USDA, Department of Horticulture, University of Wisconsin, Madison, WI 53706. Breeding methods, cultivar development, and genetic studies with carrots, onions, and cucumbers.

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

75. Pitrat, Michael. Station d'Amelioration des Plantes Maraicheres, INRA, Montfavet 84140, France. Disease resistance in melon and Cucurbita.

76. Poostchi, Iraj. Department of Agronomy, College of Agriculture, Pahlavi University, Shiraz, Iran.

77. Reed, Gary L. 3202 Kennedy Lane, Vincennes, IN 47591.

78. Rhodes, A. M. Vegetable Crops Building, University of Illinois, Urbana, IL 61801. Genus cucurbita.

79. Rhodes, Bill B. Edisto Experiment Station, Post Office Box 247, Blackville, SC 29817.

80. Richens, R. H. Commonwealth Bureau of Plant Breeding and Genetics, Department of Applied Biology, Pembroke St., Cambridge, CB2 /DX, England.

81. Risser, Georgette. Maitre de Recherches, Station d'Amelioration des Plantes Maraicheres, INRA, Domaine Saint Maurice, 84140 Montfavet-Avignon, France. Breeding of melon (Cucumis melo L.).

82. Robbins, M. LeRon. Clemson Experiment Station, Post Office Box 3158, Charleston, SC 29407.

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

84. Ruttencutter, Glen. Nestle Enterprises, Inc., Agriculture Research, 701 West Main Street, Leipsic, OH 45856. Breeding work with the species Cucurbita moschata.

85. Schroeder, R. H. FMC Corporation, Agricultural Chemical Division, Post Office Box 2508, El Macero, CA 95618. Sex expression of Cucumis sativus and melo.

86. Scott, John W. Department of Horticultural Science, 2001 Fyffe Court, Columbus, OH 43210.

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

88. Taylor, John C. North Louisiana Experiment Station, Post Office Box 10, Calhoun, LA 71225.

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

90. Tolla, Greg. USDA, Department of Horticulture, University of Wisconsin, Madison, WI 53706. Involved in the development and evaluation of pickling cucumber genotypes. Determination of the influence of various compounds on sex expression, seedling emergence, and tolerance to chilling injury of cucumber.

91. Torrey, T. C. W. Atlee Burpee Company, 335 S. Briggs Road, Santa Paula, CA 93060.

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

93. van den Berkmortel, Leo. Chief Plant Breeder, Bruinsma Seed Company, Post Office Box 24, 2670 AA Naaldwijk-Holland.

94. van der Arend, Wim. Nunhems Zaden b.v., Haelen, Holland.

95. van der Ploeg, D. Attention: Henri van Isselmuden, Elite Zaden N.V.-NL 3220, Barendrecht, Holland.

96. Ventura, Yaacov. Hazera Seeds, Ltd., Post Office Box 1565, Haifa, Israel.

97. Wehner, Todd. Department of Horticultural Science, North Carolina State University, Raleigh, NC 27650.

98. Werner, Georgina M. Pesticide Research Center, Michigan State University, East Lansing, MI 48824.

99. Whitaker, T. W. USDA/ARS, Post Office Box 150, La Jolla, CA 92038.

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

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

102. Williams, Tom V. Northrup King Company, Post Office Box 1389, Homestead, FL 33030.

103. Wyatt, Colen. PetoSeed Company, Inc., Route 4, Box 1255, Woodland, CA 95695.

104. Yukura, Yasuo. 46-7, 3-Chome, Miyasaka, Setagaya-Ku, Tokyo, Japan. Genetics of sex expression in cucumber and melon.

105. Zink, F. W., Jr. Vegetable Crops Department, University of California, Davis, CA 95616.

106. Zuta, Zeev. Hazera Seed Company, Oe Yehuda Post, Israel.

FINANCIAL STATEMENT June, 1979

(Prior to publication of Report No. 2)

Balance - June 1978		$365.16
Receipts - June 1978 to June 1979*		
Dues - 29 members @ $5.00 (2 year)	$145.00	
2 members @ $10.00 (4 year)	20.00	
Interest	18.11	
	$183.11	183.11
TOTAL		$548.27
Expenditures		
Cost of publication and mailing of CGC #1		169.48
		$378.79**

Balance of $378.79

*One complimentary membership to Plant Breeding Abstracts
**Also, three checks ($16.00) in bank processing