Cucurbit Genetics Cooperative

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Department of Horticulture
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Contents

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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 Curcurbits).
>
> Reports of the Cooperative will be issued on an annual basis. The reports will include articles submitted by members 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 Germ Plasm desired or for Exchange, Membership Directory, and Financial Statement. Other sections will be added in future reports as desired, i.e. gene lists, linkage groups, etc.

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

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

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

REPORT OF FIFTH ANNUAL MEETING

The fifth annual meeting of the Cucurbit Genetics Cooperative was held in conjunction with the American Society for Horticultural Science on August 13, 1981 in Atlanta, Georgia. There were 15 in attendance. The meeting was chaired by R. L. Lower. He reported on publication of CGC No. 4 and the financial status of CGC. The cost of publication and mailing for CGC Report No. 4 was $523.17, which left a balance of $410.20. A motion was made, seconded and unanimously approved to alter the dues structure as follows:

Dues Structure Biennial Membership, effective 1982 & 1983

Subscriber	Dues Biennial Membership	Back Issue Fee
U. S.	$ 6.00	$3.50
Libraries	10.00	6.00
Foreign	10.00	6.00

The dues increase was necessary because of the increased costs of printing and postage. There was no further new or old business and the meeting was adjourned.

R. L. Lower

The 1982 Annual Meeting of the CGC will be held in Ames, Iowa, U.S.A., during the American Society for Horticultural Science meetings August 8-13, 1982. Consult local program for exact time and place.

COMMENTS FROM THE COORDINATING COMMITTEE

The call for papers for the 1983 report will go out in November, 1982, and they should be submitted to the Coordinating Committee by January 31, 1983. Hopefully, the sixth report will be published by June, 1983.

We are eager to hear from the membership regarding the future direction of the CGC. It is a pleasure to acknowledge the assistance of Patricia Coan who was responsible for the typing, proofing, and duplicating of this report. We express our sincere appreciation.

Coordinating Committee

W. P. Bemis (Cucurbita spp.)
W. R. Henderson (watermelon)
J. D. McCreight (muskmelon)
R. W. Robinson (other genera)
T. C. Wehner (cucumber)
R. L. Lower, Chairman

The Coordinating Committee acknowledges the service of the Nominating Committee chaired by August Gabert.* The Committee nominated Dr. T.C. Wehner as the replacement for Dr. M. L. Robbins on the Coordinating Committee. The chairman thanks all of the Coordinating Committee for their assistance and especially Dr. Robbins who rotated off the committee effective January 1, 1982.

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* Nominating committee includes: August Gabert, David Groff and C. E. Peterson.

We are pleased to announce the "First International Conference on the Buffalo Gourd". Conference brochures and registration forms can be obtained by contacting the Sydney-based Conference Secretariat, or the Chairman of the Organizing Committee, at the University of Arizona.

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RESEARCH NOTES

I. Cucumber

I. CUCUMBER

1. Effect of the Duration of Short-day Treatment on the Flowering Response of a Cucumis sativus var. hardwickii (R.) Alef. Line

Della Vecchia, P.T., C.E. Peterson, and J.E. Staub, University of Wisconsin, Madison, WI 53706.

Since Horst and Lower (1) first reported on the potential of Cucumis sativus var. hardwickii (R.) Alef. as a possible source of germplasm for increasing yield in pickling cucumbers, there has been considerable interest by both public and private cucumber breeders in the exploitation of 'hardwickii' types. Potentially the most useful characteristic of 'hardwickii' types is their ability to sequentially set a large number of seeded fruits per plant. They also differ from C. sativus in several other morphological and flowering characteristics. 'Hardwickii' types are facultative short-day plants with respect to flowering. This short-day requirement for early flowering has restricted their use in genetic studies and population development, especially under field conditions at high latitudes. The objective of this study was to investigate the effect of the duration of short-day treatments on the flowering response of a 'hardwickii' line (PI 215589).

The experiment was conducted in the greenhouse at Madison, WI, from June to August, 1981. Photoperiod was controlled by a dark chamber built on a greenhouse bench. Plants of the 'hardwickii' line were grown under 10 hr photoperiod for 0, 5, 10, 15, and 20 days, the short-day condition being imposed after the cotyledons expanded. Treatments were replicated 4 times, with 2 plants per plot. After the short day treatment, plants were moved to an adjacent greenhouse bench and grown under 16 hr photoperiod. Fluorescent lights (Sylvania F96T12/CW/VHO), providing approximately 6,000 lux at the shoot apices, were used to extend the photoperiod to 16 hr. Greenhouse temperature was not controlled. Maximum and minimum temperature monitored daily for each photoperiod regime were very similar, ranging from 17° to 35°C. The effect of the duration of short day treatments on the flowering response was measured as the node number of the first flower on the main stem (node of the first flower) and number of days from germination to anthesis of the first flower on the main stem (days to first flower). The treatment x replicate mean squares were used as an estimate of the experimental error.

Mean values for node of the first flower and days to first flower are presented in Table 1. Five days under a 10 hr photoperiod were enough to lower the node of the first flower from approximately the 14th to the 5th node. Exposure to the short-day treatment for more than 10 days resulted in practically no additional response in terms of the node number at which the first flower appeared. In contrast, additional periods of time under short day treatments significantly decreased days to first flower. This phenomenon is commonly observed in a large number of photoperiodic plants (2).

Nienhuis and Lower (3) successfully used grafting techniques to induce early flowering under field conditions in the 'hardwickii' derived line 'LJ90430'. If the photoperiodic response observed in the present study is true of other late flowering 'hardwickii' and C. sativus accessions, then short day treatment can be as effective as grafting. Since 'hardwickii' plants can be induced to flower earlier by as little as five days under short photoperiod, seedlings could be exposed to the short-day treatment before being transplanted to the field.

Table 1. Mean values of node of the first flower (NNFF) and days to first flower (NDFF) for PI 215589 plants grown under short (10 hr) photoperiod for different number of days.

No. of days under short photoperiod	No. of plants observed	NNFF	NDFF
0	8	13.63	54.00
5	8	4.88	42.88
10	8	3.13	38.38
15	8	2.88	34.25
20	8	2.88	32.63
LSD (0.01)		1.09	2.56
CV %		8.76	3.08

Literature Cited

1. Horst, E.K. and R.L. Lower. 1978. Cucumis hardwickii: A source of germplasm for the cucumber breeder. Cucurbit Genetics Coop. Rpt. 1:5.

2. Lang, A. 1965. Physiology of flower formation. Vol. XV(1): p. 1380-1536. In W. Ruhland (ed.) Encyclopedia of Plant Physiology. Springer-Verlag, New York.

3. Nienhuis, J. and R.L. Lower. 1979. Interspecific grafting to promote flowering in Cucumis hardwickii. Cucurbit Genetics Coop. Rpt. 2:11-12.

2. Inheritance of Short-day Response to Flowering in Crosses Between a *Cucumis sativus* var. *hardwickii* (R.) Alef. Line and *Cucumis sativus* L. Lines

Della Vecchia, P.T., C.E. Peterson and J.E. Staub, University of Wisconsin, Madison, WI 53706.

Cucumis sativus var. *hardwickii* (R.) Alef. has been suggested as a possible source of germplasm for increasing yield in pickling cucumbers (1). Potentially the most useful characteristic of 'hardwickii' types is their ability to sequentially set a large number of seeded fruits per plant. The exact mechanism by which this is accomplished is still unknown. Horst and Lower (1) suggested that in the 'hardwickii' types, unlike the commercially grown *C. sativus* cultivars, fruits with developing seeds do not inhibit set and development of additional fruits. 'Hardwickii' types are facultative short-day plants with respect to flowering. Nienhuis and Lower (2) suggested that this photoperiodic response to flowering could be involved in the yield capacity of 'hardwickii' plants. By delaying flowering and fruit set, a large leaf area can be attained which could support high fruit yields.

The objective of this investigation was to study the inheritance of short-day response to flowering in crosses between a short-day 'hardwickii' line (PI 215589) and unrelated day-neutral *C. sativus* lines. This should provide some basic information for further investigations of the relationship of flowering and yield in the 'hardwickii' types.

In order to study the inheritance of short-day response to flowering the following crosses were made: Cross I - W1606 x PI 215589; Cross II - W1909 x PI 215589; Cross III - W1548 x PI 215589. W1606 and W1909 are typical U.S.A. pickling and slicing cucumbers, respectively. W1548 is a long-fruited line selected from a recent plant introduction from the People's Republic of China. F_1's were selfed and backcrossed to the respective parental lines in order to produce F_2 and BC_1 progenies for each cross. Parental lines, F_1, F_2 and BC_1 generations of Crosses I, II, and III were grown under long days (16 hr) in greenhouses at Arlington, WI during the summers of 1980 and 1981. Fluorescent lights (Sylvania 96T12/CW/VHO), providing approximately 7,500 lux at the shoot apices, were used to extend the photoperiod to 16 hr. The greenhouse temperature ranged from 20° to 35°C. Plants were arranged on benches in a randomized complete block design with 3 replications. Each replication consisted of the following number of plants per generation: F_1 and parental lines, 4 plants each; BC_1 generations, 12 plants each; F_2 generations, 28 plants. Data on the photoperiodic responses were node number of the first flower on the main stem (NNFF). Plants were further classified as early (NNFF $\leq$ 5) or late (NNFF $\geq$ 11) flowering.

The phenotype of F_1 and BC_1P_1 plants for all crosses was similar to the early flowering parent (P_1). Frequency distributions of NNFF for F_2 and BC_1P_2 generations for all crosses showed clear-cut segregation of early and late flowering plants in approximate 1:1 and 3:1 ratios, respectively. A combined Chi-square test for the segregation data is presented in Table 1. A good fit to the expected genetic ratios supports the hypothesis that the short day requirement for early flowering in this 'hardwickii' line (PI 215589) is determined by a single recessive gene. A preliminary allelism test indicates that this recessive gene is most likely allelic to the previously reported *df* recessive mutant for the delayed flowering phenotype in cucumber (3).

Table 1. Number of early and late flowering plants in the parental lines, F_1, F_2, and backcross generations of Crosses I, II, III grown under 16 hr photoperiod in greenhouses at Arlington, WI, in 1980 and 1981.[z]

Generation	No. of Plants		Expected Ratio	Chi-Square	P
	Early[y] Flowering	Late[w] Flowering			
P_1: W1548; W1606; W1909	36	...			
P_2: PI 215589	...	36			
F_1	36	...			
BC_1P_1	108	...	1:0	0.00	1.00
BC_1P_2	53	55	1:1	0.04	0.75-0.90
F_2	196	56	3:1	1.04	0.25-0.50

[z]Populations were combined for segregation analysis based on test of homogeneity.

[y]Early flowering: NNFF $\leq$ 5.

[w]Late flowering: NNFF $\geq$ 11.

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1. Horst, E.K. and R. L. Lower. 1978. Cucumis hardwickii: A source of germplasm for the cucumber breeder. Cucurbit Genetics Coop. Rpt. 1:5.

2. Nienhuis, J. and R. L. Lower. 1980. Influence of reciprocal donor scions on fruit setting characteristics of recipient scions of Cucumis sativus and C. hardwickii R. Cucurbit Genetics Coop. Rpt. 3:17-18.

3. Shifriss, O. and W.L. George, Jr. 1965. Delayed germination and flowering in cucumbers. Nature 206:424-425.

3. Comparative Yields of Compact and Vining Plant type Isolines in Cucumber at Four Densities

Edwards, M. D. and R. L. Lower, University of Wisconsin, Madison, WI 53706.

The compact plant type of cucumbers has been suggested as an alternative to the standard vining phenotype for use in high-density plantings (3). Although the plant architecture appears adapted for efficient utilization of space under intense inter-plant competition and compact genotypes have repeatedly achieved impressive yields in observation plots, their performance relative to standard genotypes has not been adequately tested.

The original compact (PI 308916) has been backcrossed to a number of pickling cucumber inbreds, yielding compact plants with greatly improved horticultural characteristics.

Two sets of predominately female hybrids were used to compare yields of compact and vining plant types. Each set was comprised of both vining and compact plant types. Isolines of gynoecious inbreds, 'Gy2' and 'Gy14', were used as female parents and isolines of 'Addis' were used as male parents. Since seed from fruit of compact plants is smaller than that of vining plants and sometimes of poor germinability, both sets of hybrids were made using vining-type seed parents. Female inbreds heterozygous at the compact locus (Cpcp) were pollinated by compact lines. These seed segregated one compact (cpcp): one vining (Cpcp). Plots were over-seeded and thinned to compact plants at the two-leaf stage. This precaution was necessary to assure uniform stand establishment and seedling vigor for comparisons between plant types. The vining hybrids (Cpcp) were produced routinely. The two sets of hybrids were planted at four densities: 37,000, 74,000, 148,000 and 296,000 plants per hectare. The three lowest densities were achieved by varying within-row spacing from 30 cm to 8 cm on 91 cm row centers. The 296,000 plants per ha density consisted of 8 cm within-row spacing on 45 cm row centers. All plots had 30 plants and the middle 25 were harvested. This plot size was recommended by Smith and Lower (4).

Total fruit numbers for the two plant types are graphed against the varying plant densities for first-harvest and multiple-harvest in Figures 1 and 2, respectively. The least-squares simple regression line was fitted through the data points corresponding to each plant type. Responses to increasing density are reasonably well explained by a straight-line model in all cases. Coefficients of determination, R^2, for the regression models were 97% and 80% for first harvest fruit numbers of compact and vining plant types, respectively. The corresponding values for multiple-harvest fruit numbers were 97% and 89%. These values reflect a considerably better fit to the straight line model for the compact plant type than for vining isolines.

The difference in multiple-harvest yields of the two plant types at the greatest density may, in part, reflect differences in ease of harvest. Vining plant types at high densities are much more difficult to hand-harvest without inflicting some damage to the plants.

Satisfactory stand establishment from compact seed is the greatest problem facing commercial utilization of compact genotypes (1). This problem was avoided in this study by using seed segregating from a heterozygous (Cpcp) maternal parent. Selection for improved seed quality in compact genotypes is underway. Initial heritability estimates for emergence percentage are large and suggest that improvement for this trait should progress rapidly (2).

FIG. 1 REGRESSION OF ONCE-OVER-HARVEST FRUIT NUMBERS ON DENSITY

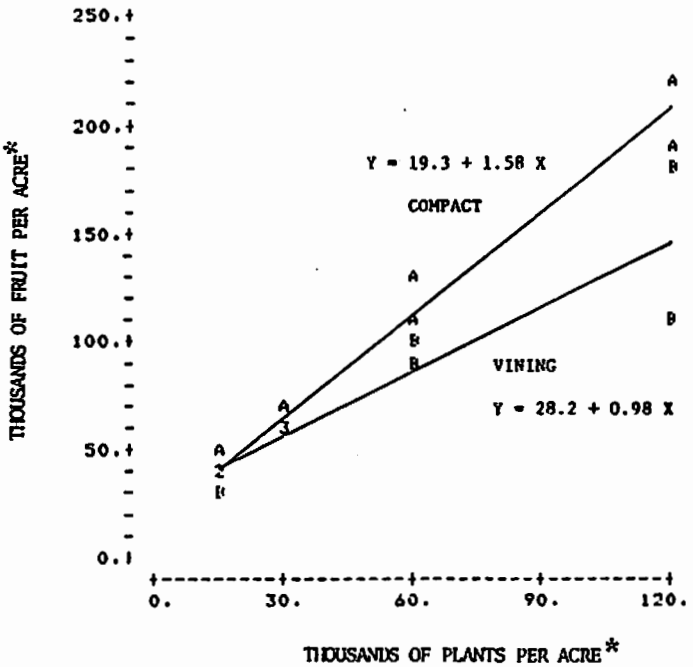
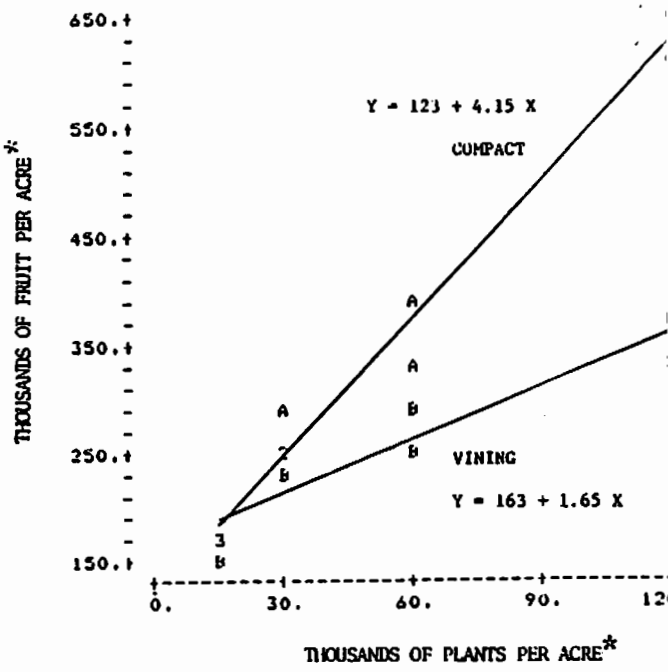


FIG. 2 REGRESSION OF MULTIPLE-HARVEST FRUIT NUMBERS ON DENSI



* 1,000 per acre = 2,470 per hectare.

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1. Edwards, M. D. and R. L. Lower. 1980. An analysis of factors related to germinability of seed from compact cucumber plants (Abst.). HortScience 15:108.

2. Edwards, M. D. and R. L. Lower. 1981. Selection against a seed abnormality in compact cucumber plants (Abst.). HortScience 16:35.

3. Kauffman, C. S. and R. L. Lower. 1976. Inheritance of an extreme dwarf plant type in the cucumber. J. Amer. Soc. Hort. Sci. 101:150-151.

4. Smith, O. S. and R. L. Lower. 1978. Field plot techniques for selecting increased once-over harvest yields in pickling cucumbers. J. Amer. Soc. Hort. Sci. 103:92-94.

4. The Genetic Regulation of Several Seed Traits in Compact (cpcp) Cucumbers - Maternal vs. Embryonic Control

Edwards, M. D. and R. L. Lower, University of Wisconsin, Madison, WI 53706.

Seed quality is a major limitation to utilization of the compact plant-type in cucumbers (1). Alterations in seed weight and shape are associated with poor emergence and are apparently pleiotropic effects of the gene conditioning compact plant type, cp (2). Although the compact allele exerts a major influence on seed quality, seed production environments and quantitative genetic effects condition substantial variability for seed traits within compact populations (3).

A heterogeneous population of compact cucumber genotypes was established in the summer of 1980. Plants were spaced about 15 cm apart in rows with 90 cm spacings between rows. Thirty-eight sets of reciprocal crosses were obtained by hand-pollinations in the field. Natural outcrossing was prevented by covering flowers with halves of size 000 gelatin capsules. Fruit were harvested and all extracted seeds were subjected to two days fermentation at 20°C ± 2°C before washing and open-air drying. Seedlots were stored in paper envelopes in a laboratory for about 12 months at ambient temperature and relative humidity.

At this time, four twenty-seed samples were taken from each seedlot and mean seed weights and percent "normal" seeds were determined. Samples were then treated with captan and planted 1.5 cm deep in peat-pots filled with washed sand in a controlled environment facility. Experimental design for emergence traits was a randomized complete block design with two reps at 20°C ± 1°C and two reps at 25°C ± 1°C. Pots were watered with distilled water and emergence percentage was recorded after 14 days.

Analysis of variance was conducted using a completely random effects model. Temperatures were a significant source of variation for emergence percentage but all interactions with temperature were non-significant. Mean emergence percentages for 20°C and 25°C were 43% and 51%, respectively.

Temperatures were pooled into block effects to produce a simplified analysis of variance which is presented in Table 1. Maternal parents nested within crosses were a significant source of variation for emergence percentage, seed weight and percent normal seeds. Crosses were a non-significant source of variation for all traits. Components of variance attributable to cross effects and maternal parents nested within crosses were also isolated from mean squares values. Zero values were obtained for variance due to cross effects for the traits of emergence percentage and percent normal seeds. A positive estimate was obtained for seed weight, but the estimate was one-tenth the magnitude of the corresponding variance due to maternal parents nested within crosses.

These results emphasize the importance of broad-sense maternal effects in the regulation of the seed traits evaluated in this study. Nuclear genetic effects did not contribute significantly to any of the traits studied. The maternal effects observed may be attributable to any of several influences, including: 1) cytoplasmic effects, 2) maternal genetic effects, or 3) environmental effects.

If due to cytoplasmic influences, these effects should be passed from mothers to progeny with undiminished magnitude. In the absense of cytoplasmic effects, heritabilities may be used to assess the relative contributions of maternal genetic effects and environmental effects. Further studies are planned to determine the nature of the maternal influence on emergence percentage and related seed traits.

Table 1. Analysis of variance for seed traits.

Source	df	Emergence Percentage	Seed Weight	Percent Normal Seeds
Block	3	3850 **	0.003 NS	144 **
Cross	37	3286 NS	0.30 NS	886 NS
Maternal Parent (Cross)	38	4506 **	0.25 **	1464 **
Error	225	566	0.005	150

** Significant at 1% level.

Literature Cited

1. Edwards, M. D. and R. L. Lower. 1980. An analysis of factors related to germinability of seed from compact cucumber plants (Abst.). HortScience 15:108.

2. Edwards, M. D. and R. L. Lower. 1981. Investigations into the characteristics of seed from compact cucumber plants. Cucurbit Genetics Cooperative 4:2-4.

3. Edwards, M. D. and R. L. Lower. 1981. Selection against a seed abnormality in compact cucumber plants (Abst.). HortScience 16:35.

5. Cucumber Shoot Tip Growth on 9 Nitrogen Sources in *in vitro* Culture

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Previous research (2) indicated that cotyledon explants formed adventitious shoots in culture whereas hypocotyl explants did not. A possible explanation for that is that hypocotyl explants must rely primarily on nitrogen supplied from the medium, but cotyledon explants have additional sources of nitrogen in their tissues. The form of nitrogen in the Murashige-Skoog (MS) medium is ammonium plus nitrate (1). The objective of this study was to determine whether the form of nitrogen available in the tissue culture medium affects shoot growth.

The experiment design was a factorial in a randomized complete block with 6 lines, 9 nitrogen sources, and 2 blocks. Each treatment unit consisted of 5 Petri plates of 5 shoot tips (1-2 mm long) each. The 6 lines were 'Chipper', 'Wisconsin SMR18', 'Sumter', M41, 'Pacer', and 'Poinmarket'. The 9 nitrogen sources were nitrate (NO_3^-), ammonium (NH_4^+), nitrate plus ammonium (standard Murashige-Skoog medium), aspartic acid (Asp), asparagine (Asn), glutamic acid (Glu), glutamine (Gln), alanine (Ala) and serine (Ser). The nitrogen sources were used in the standard Murashige-Skoog medium in place of nitrate plus ammonium in concentrations of 20mM for the amino acids, 20.2mM ammonium succinate, or 40.4mM potassium nitrate. Shoot tips were grown on the medium for 60 days at 25°C before shoots and callus were counted and weighed. Percent shoots was calculated as (weight of shoots) x 100/(weight of callus + weight of shoots).

The shoot tips placed in culture all formed callus with the exception of those on the medium containing serine. New shoots originated from axillary buds on the original shoot tips. Serine was a poor nitrogen source because there was only 1 shoot tip per Petri plate and no growth of either shoots or callus (Table 1). The best nitrogen source for the growth of shoots in culture

Table 1. Shoot and callus growth on 9 nitrogen sources in *in vitro* culture[z].

Nitrogen Source	No. Shoots per Petri Plate	Shoot Weight (g)	Callus Weight (g)	Percent of Total that is Shoots (By Wt.)
Asn	7.4	1.0	0.6	59
Gln	3.8	0.6	1.2	40
NO_3^-	4.8	0.7	1.2	38
NH_4^+	4.9	0.9	1.7	33
Asp	4.1	0.4	0.8	33
Glu	4.4	0.4	1.0	32
$NO_3^- + NH_4^+$	5.8	1.6	2.7	29
Ala	3.7	0.5	1.4	27
Ser	0.7	0.3	0.0	100
LSD (5%)	1.0	0.2	0.4	6
CV (%)	27	37	38	17

[z]Data are means per Petri plate over 6 lines, 2 blocks and 5 subsamples.

was asparagine. It had the greatest shoot number per petri plate, the greatest percent shoots, and the second greatest shoot weight. The nitrate plus ammonium nitrogen source produced the greatest shoot weight, but it promoted tremendous callus growth. Thus, the Murashige-Skoog nitrogen source (nitrate plus ammonium) was best for callus, not shoot growth.

Over all nitrogen sources, callus weight was not correlated with either shoot weight or shoot number, but it was negatively correlated with percent shoots ($r = -0.68^{**}$). Shoot number was correlated with shoot weight ($r = 0.21^{**}$). It was thought that the heavy callus growth on the Murashige-Skoog nitrogen source may have promoted the heavy shoot growth. This is because shoots rely upon callus to some extent to supply nutrients from the medium. Correlations by nitrogen source show that shoot growth is positively correlated with callus growth for most of the sources (Table 2). However, the Murashige-Skoog nitrogen source ($NO_3^- + NH_4^+$) showed a negative correlation between shoot and callus growth. Thus, it appears that shoots grew large in spite of the large amount of callus growth on that nitrogen source.

Table 2. Correlation (r) and coefficient of determination (r^2) of shoot weight with callus weight for shoot tip cultures grown on 9 nitrogen sources.

Nitrogen Source	r	r^2 (%)
Asn	.57**	32
Gln	.49**	24
NO_3^-	-.18	3
NH_4^+	.62**	39
Asp	.41*	17
Glu	.13	2
$NO_3^- + NH_4^+$	-.63**	39
Ala	.59**	35
Ser	-	-
$\bar{x}$	.25	6

*, ** Significant at the 5 and 1% levels, respectively.

In conclusion, the Murashige-Skoog nitrogen source is not the best one to use for tissue culture experiments in which shoot growth, but not callus growth, is desired. In that situation (such as when the shoot tip is the unit of selection), asparagine is probably the best nitrogen source to use in the medium.

Literature Cited

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

2. Wehner, T.C. and R.D. Locy. 1981. In vitro adventitious root and shoot formation of cultivars and lines of Cucumis sativus L. HortScience 16:759-760.

6. Linkage of Sex Type, Growth Habit and Fruit Length in Two Cucumber Inbred Backcross Populations

Owens, K. W. and C. E. Peterson, University of Wisconsin, Madison, WI 53706

Two inbred backcross populations (2) were developed by crossing W1540, a small-fruited, gynoecious, determinate USDA breeding line with W1925 (Population I) and W1928 (Population II), both of which were large-fruited, monoecious and indeterminate. Two backcrosses were made to W1540 and the BC_2 generation was selfed twice to produce BC_2SC_2 lines. Separate lines were maintained beginning at the BC_1 generation and all generations were grown in the greenhouse with no conscious selection practiced at any stage in the procedure. 108 lines in Population I and 79 lines in Population II were evaluated for fruit length, sex type and growth habit in the field at Hancock, WI in 1981. A randomized complete block design with three replications and four plants per plot was used.

In the BC_2SC_2 generation, four homozygous classes were expected: gynoecious, determinate (FF, dede); gynoecious, indeterminate (FF, DeDe); monoecious, determinate (ff, dede); and monoecious, indeterminate (ff, DeDe). Lines segregating for one of the traits were excluded from the analysis. Expectations for these classes were calculated on the assumption of no linkage and chi-square tests were performed to test for independence. In addition to looking at homozygous lines, individual plants were classified for sex type and growth habit so that the information from segregating lines could be used for analysis of independence. The frequency distributions of fruit length were plotted for both populations and examined for association with sex type and growth habit.

Tests of independence of sex type and growth habit (using homozygous line data) were highly significant in both populations (Table 1). The fact that there was an excess of parental types and a deficiency of recombinant types suggests an association or linkage between the F gene, for female sex type, and the de gene, for determinate habit. The tests of independence of sex type and growth habit, using individual plant data, were also highly significant for both populations (Table 2), which further supports the hypothesis of linkage. These results are in agreement with Odland and Groff's 1962 report (1) of linkage between growth habit and sex type in cucumber. The authors reported a 7.3% recombination value.

Unconscious selection against monoecious and determinate types probably occurred in both populations. This would explain the unequal numbers of recombinant types recovered (Table 2). No recombination values can be calculated using the inbred backcross approach. Since recombinant phenotypes were recovered, the linkage apparently is not tight.

From the analysis of the frequency distributions of fruit length in Populations I and II, there also appears to be an association of both sex type and growth habit with fruit length. Those lines homozygous for monoecious sex type (ff) and/or indeterminate growth habit (DeDe) had greater fruit length.

Literature Cited

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Table 1. Chi-square test of independence of sex type and growth habit in inbred backcross lines[z] (Population I and II).

Class	Population I			Population II		
	Obs.	Expt.	χ^{2y}	Obs.	Expt.	χ^{2y}
FF, dede	92	82.78	0.9184	69	62.09	0.6627
FF, DeDe	2	6.24	2.2373	1	4.77	2.2450
ff, dede	0	6.24	5.2750	0	4.77	3.8261
ff, DeDe	2	0.49	2.0869	2	0.37	3.4962
	96	96	10.5176**	72	72	10.230**

[z]Data on BC_2S_2 lines homozygous for both loci.

[y]Using Yates correction for continuity.

** Significant at .01 level.

Table 2. Chi-square test of independence of sex type and growth habit in inbred backcross individuals (Population I and II).

Class	Population I			Population II		
	Obs.	Expt.[z]	χ^{z}	Obs.	Expt.[z]	χ^{z}
FF, dede	1038	986.55	2.683	776	729.96	2.904
FF, DeDe	83	134.44	19.685	33	79.04	26.818
ff, dede	4	55.44	47.733	9	55.04	38.512
ff, DeDe	59	7.56	350.250	52	5.96	355.651
	1184	1184	420.351**	870	870	423.88**

[z]Expectations calculated from marginal frequencies because of disturbed segregation observed for single genes.

** Significant at .01 level.

7. Correlation of Single-plant Yield with Multiple-harvest yield in Pickling Cucumber

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There are 2 basic methods for evaluating breeding material for yield: selection based on single plants, and selection based on rows (usually progeny of single plants). Single-plant selection permits the evaluation of more genotypes with a given amount of resources than progeny row selection does, and has been successful for yield improvement of maize (1). The objective of this experiment was to determine the correlation of multiple-harvest yield with single-plant yield for plants grown at 4 densities, and harvested at 2 stages. Several densities were tested because low densities aid in the separation of plants, while higher densities permit more plants to be screened in a given area.

Fifteen cultivars and lines were evaluated in a yield trial with 2 replications and 5 harvests made between June 15 and 29. Plots were 9m long and were planted on 1.5m centers at 64,400 plants/ha. The same 15 cultivars and lines were also planted in small plots at 10,600; 21,400; 64,400; and 128,900 plants/ha. Single plants were harvested at processing (10% oversize fruit) and at mature (seed harvest) stages. Multiple-harvest yield was then correlated with single-plant yield using Pearson product-moment and Spearman rank correlation procedures. The Pearson and Spearman correlations were similar, so only Pearson correlations are presented.

There was no correlation between multiple-harvest and single-plant yield (Table 1). The correlations were best for single plants harvested at processing stage and grown at 64,400 plants/ha (the same conditions under which the multiple-harvest trial was grown and harvested). However, only 2 of the 5 replications for that density and harvest stage had significant correlations, and the average correlation was not significant. Also, single-plant yield was less effective in separating the lines. While there were fairly large differences among lines for multiple-harvest yield, the differences for single-plant fruit number were smaller and the coefficients of variation (CV) were larger (Table 2).

Table 1. Correlation of multiple-harvest yield with single-plant yield at processing stage--10% oversize fruit, and (at the mature fruit stage--seed harvest), for single plants grown at 4 densities.

Replication	Density (plants/ha) 128,900	64,400	21,400	10,600
1	.48++ (.06)	.40+ (.08)	.30 (.55*)	-.11 (-.48++)
2	.04 (-.20)	.56* (-.14)	.01 (.30)	.11 (-.09)
3	.37 (.32)	.11 (-.47++)	.22 (.17)	.49** (-.19)
4	-.31 (-.10)	.10 (-.16)	-.11 (.27)	-.03 (.28)
5	-.20 (.04)	.13 (.03)	-.22 (-.07)	-.09 (.07)
$\bar{x}$	.16 (.02)	.26 (-.13)	.04 (.24)	.07 (-.08)

**, *, ++, + Significant correlation at the 1, 5, 10, and 15% levels, respectively.

Table 2. Mean yield of 15 lines of pickling cucumber tested at Clinton, NC in 1981.

Cultivar or Line	Seed Source	Multiple Harvest Yield ($/ha)	Fruit Number	
			Processing Stage (No./plant)	Mature Stage (No./plant)
Castlehy 2012	Castle	3283	2.4	3.1
Greenpak	Harris	3268	3.0	3.3
G 56 D	NCSU	3095	2.4	3.0
Tamor	Asgrow	3008	2.9	3.4
Regal	Harris	2920	2.4	3.2
Multipik	PetoSeed	2680	2.8	3.9
PSR 1479	PetoSeed	2616	2.4	3.6
Calico	PetoSeed	2522	2.3	3.0
Triplemech	PetoSeed	2430	2.6	3.0
G 76	NCSU	2282	3.0	3.7
Tempo	Harris	2159	2.7	3.7
Calypso	Harris	2100	2.7	3.1
Explorer	PetoSeed	2040	2.7	2.7
Score	Asgrow	2013	2.2	3.2
Sampson	PetoSeed	1793	1.9	3.2
LSD (5%)		1099	0.6	1.0
CV (%)		20	37	46

Considering the lack of correlation between multiple-harvest and single-plant yield, it appears that selection for yield should not be based on single plants. The selection unit should probably be at least a single progeny row.

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1. Mareck, J.H. and C.O. Gardner. 1979. Responses to mass selection in maize and stability of resulting populations. Crop Sci. 19:779-783.

8. Genetic Variation for Low-Temperature Germination Ability in Cucumber

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Low-temperature germination ability in cucumber varieties may be useful in establishing earlier and more uniform stands for spring plantings. Previous research showed that there were differences in germination speed at temperatures below 17°C (1). Also, % germination at 13°C had a narrow-sense heritability of 0.17 (2). The objective of this study was to identify lines with superior low-temperature germination ability, and to measure the heritability of that trait.

Cucumber lines were tested for germination speed at 15°C and 20°C in a randomized complete block design with 2 replications and 203 lines (19 cultivars, 8 breeding lines, and 176 plant introduction lines). The treatment unit was a 60mm diameter petri plate. Each plate had 20 seeds placed on 2 layers of filter paper to which 1.5ml of distilled water was added. The test was run for 30 days, and the number of seeds germinating each day was counted. Seeds were considered germinated when the radicle reached 6mm in length. Average days to germination and percent germination were calculated for each treatment unit. All lines had at least 70% germination at 20°C.

Heritability of low-temperature germination was measured using parent-progeny regression. Crosses were made at random among 68 lines from the screening study, and the F_1 tested as described above. Progeny means were regressed on maternal and paternal parent performance, and the narrow sense heritability estimated as twice the regression coefficient.

The fastest 15 lines to germinate at 15°C included 7 plant introduction lines from Turkey, and 5 cultivars (Table 1). The slowest 15 lines to germinate at 15°C (excluding the 16 that did not germinate at all) were all plant introduction lines and included one Cucumis sativus var. hardwickii accession (PI 215589).

Table 1. The fastest and slowest 15 lines to germinate at 15°C (excluding 16 lines that failed to germinate).

	Cultivar	Seed	Germination at 15°C		Germination at 20°C	
Rank	or Line	Source	Days	Percent	Days	Percent
1	PI 109484	Turkey	3.5	98	2.0	100
2	PI 222985	Iran	3.6	100	2.0	100
3	PI 174166	Turkey	3.8	90	2.0	100
4	Green Star	Harris Seed	3.9	100	2.0	90
5	PI 169392	Turkey	4.0	93	2.0	100
6	PI 222860	Korea	4.0	73	2.0	90
7	Dasher	PetoSeed	4.1	98	2.0	100
8	PI 174173	Turkey	4.1	80	2.0	100
9	Greenpak	Harris Seed	4.2	90	2.2	90
10	PI 293923	South Carolina	4.2	80	2.0	100
11	PI 164950	Turkey	4.2	50	2.2	100
12	Ashley	PetoSeed	4.3	100	2.0	100
13	PI 338236	Turkey	4.3	83	2.0	100
14	SMR 58	PetoSeed	4.4	95	2.1	100
15	PI 169397	Turkey	4.5	100	2.0	100

Table 1 continued

Rank	Cultiver or Line	Seed Source	Germination at 15°C Days	Germination at 15°C Percent	Germination at 20°C Days	Germination at 20°C Percent
173	PI 390252	Japan	9.0	50	2.0	100
174	PI 321009	Taiwan	9.0	43	2.0	100
175	PI 385967	Kenya	9.2	73	2.1	100
176	PI 215589	India	9.6	15	2.9	90
177	PI 401732	Puerto Rico	9.7	18	2.0	100
178	PI 390254	Japan	9.7	78	2.1	100
179	PI 390240	Japan	9.9	63	2.0	100
180	PI 306785	Canada	10.6	38	2.2	100
181	PI 376063	Israel	11.5	5	3.0	70
182	PI 206952	Turkey	11.5	3	2.0	100
183	PI 357838	Yugoslavia	11.5	23	6.1	70
184	PI 390253	Japan	13.1	58	2.0	100
185	PI 321010	Taiwan	13.5	3	4.0	90
186	PI 344435	Iran	13.6	48	2.2	100
187	PI 176953	Turkey	17.3	33	2.5	100
	LSD (5%)		3.6	45	-	-
	CV (%)		21	47	-	-

Parent-progeny correlation coefficients indicate that there is no maternal effect for low-temperature germination ability (Table 2). If anything, there is a slight paternal effect, since the correlation is slightly higher between progeny and paternal parent. Narrow-sense heritability would be approximated as twice the regression of offspring on parent if the genotypes were not inbred. However, since many of the parents were inbred, heritability is closer to b than to 2b (in the range of .15 to .20). Thus, the heritability estimated by Nienhuis and Lower (2) is fairly close to the one estimated here. The low heritability may be due in part to the small standard deviation in the parents as compared to their progeny (s = 1.7 and 10.9 days, respectively).

Table 2. Parent-progeny correlation and regression estimates for days to germination at 15°C.

Parent	r	b ± s	2b
Maternal	0.16	0.14 ± 0.11	0.28
Paternal	0.18	0.15 ± 0.10	0.30

It appears that sufficient genetic variability exists for low-temperature germination ability that progress could be made by selection. The low heritability for the trait indicates that selection should be based on families rather than on individuals.

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9. Weighted Selection Indices for Trials and Segregating Populations

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A selection index (SI) can be of great help in guiding the decisions of plant breeders by summarizing several variables into just one number. With the wide availability of computers for data analysis, it is now fairly simple to calculate an index for each entry in a trial (or progeny row in a population) and print them in rank order.

A number of selection indices have been developed and evaluated for efficiency (1), some requiring complex calculations, but it is easier (and perhaps just as useful for the breeder) to develop an index based on the importance the plant breeder feels each trait should have. The index should not be relied upon too heavily, but should be used as a guide along with the other traits in making decisions.

I have presented 3 indices that I use: one for progeny rows in a segregating population, and one each for pickling and for fresh-market cucumber variety trials. The index is constructed as follows: 1) list the traits to be included in the index; 2) write the approximate range expected for each trait; 3) scale the trait so it has a value from 1 to 10 with 10 being best and 1 being worst; 4) weight each trait according to its importance by multiplying it by a fraction of one (all weights should add up to one). The sum of all the weights multiplied by the scaled values is the index, which will be a number from 1 to 10.

The index for pickling cucumber variety trials (calculated from Table 1) is:
SI = .00064Y + .00128E + .14SH + .05C + .08SC + .05PO + .0167PR + .14(10-D)
+ .01(10-A)

Table 1. Selection index for choosing the best lines in a pickling cucumber trial.

Trait	Index Abbreviation	Approximate Range	Scaled 1-10	Weighted By Importance
Yield ($/ha)	Y	500-5000	.002 x Y	.32
Earliness[z] ($/ha)	E	125-1250	.008 x E	.16
Shape[y]	SH	1-9	1 x SH	.14
Color[y]	C	1-9	1 x C	.05
Seedcell[y]	SC	1-9	1 x SC	.08
Potential[x]	PO	1-9	1 x PO	.05
Pressure test[w]	PR	3-30	.333 x PR	.05
Disease[v]	D	9-0	10 - D	.14
Anthracnose	A	9-0	10 - A	.01
				1.00

[z]Value for the first harvest out of 5.
[y]Quality scores are subjective (9 = best, 5 = average, 1 = worst).
[x]Potential is a score given for the overall impression of the line.
[w]Pressure test in lbs. using Magness-Taylor tester with 5/16" diameter tip.
[v]Average score for all diseases rated (0 = no disease, 1 = trace, 9 = plant dead).

The index for fresh market cucumber variety trials (calculated from Table 2) is:

SI = .0028M + .013F + .0178E + .14SH + .05C + .08SC + .05PO + .14(10-D) + .01(10-A)

Table 2. Selection index for choosing the best lines in a fresh-market cucumber trial.

Trait	Index Abbreviation	Approximate Range	Scaled 1-10	Weighted By Importance
Marketable yield (q/ha)	M	70-700	.014xM	.20
Fancy yield (q/ha)	F	13-130	.0769xF	.17
Earliness[z] (q/ha)	E	9-90	.111xE	.16
Shape[y]	SH	1-9	1 x SH	.14
Color[y]	C	1-9	1 x C	.05
Seedcell[y]	SC	1-9	1 x SC	.08
Potential[x]	PO	1-9	1 x PO	.05
Disease[w]	D	9-0	10 - D	.14
Anthracnose	A	9-0	10 - A	.01
				1.00

[z]Weight for first harvest out of 5.
[y]Quality scores are subjective (9 = best, 5 = average, 1 = worst).
[x]Potential is a score given for the overall impression of the line.
[w]Average score for all diseases rated (0 = no disease, 1 = trace, 9 = plant dead).

The index for selecting progeny rows from a segregating population of pickling or fresh market cucumbers (calculated from Table 3) is:

SI = .04Y + .18SH + .06C + .10SC + .06PO + .20(10-D)

Table 3. Selection index for selecting the best progeny rows in a population improvement program.

Trait	Index Abbreviation	Approximate Range	Scaled 1-10	Weighted By Importance
Yield[z]	Y	10-100	.1 x Y	.40
Shape[y]	SH	1-9	1 x SH	.18
Color[y]	C	1-9	1 x C	.06
Seedcell[y]	SC	1-9	1 x SC	.10
Potential[x]	PO	1-9	1 x PO	.06
Disease[w]	D	9-0	10 - D	.20
				1.00

[z]Yield (no. fruit/3m row) can be measured by harvesting all plots at the earliest possible time to favor early maturing types.
[y]Quality scores are subjective (9 = best, 5 = average, 1 = worst).
[x]Potential is a score given for the overall impression of the row.
[w]Average score for all diseases rated (0 = no disease, 1 = trace, 9 = plant dead).

The value for disease score has to be reversed by subtracting it from 10 so that no disease (0) will be given the largest value possible (10). Some traits may be included more than once in the index. For example, anthracnose score is included by itself, and as part of the average disease score in the indexes for the variety trials. The selection index should be printed out in the data summary table along with all of the other traits evaluated. That will permit the breeder to check for any lines or progeny rows that are defective for one or more traits. The selection index alone will not be sufficient for decision-making because superior performance in several traits can hide a single defective trait.

Literature Cited

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10. Correlation of Multiple-harvest Yield with Once-over Yield in Small Plots for Fresh-market Cucumbers

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Probably the most accurate method of measuring yield of fresh-market cucumber lines is through a multiple-harvest trial with large replicated plots. However, in a breeding program, it is usually necessary to evaluate more genotypes than can be practically handled with that method. For pickling cucumber, there is a significant correlation of once-over with multiple-harvest yield (2). Furthermore, since fruit weight and fruit value change during fruit set and development, once-over yield is best measured using fruit number (1). Selection for yield in fresh-market cucumbers could be made easier if fruit could be harvested once from small plots and counted. The value of that approach was tested by correlating yield from small plots harvested once with yield in a replicated multiple-harvest trial.

Ten hybrids were made up by crossing 20 diverse lines paired at random. The hybrids were tested in a multiple-harvest trial in a randomized complete block design with 4 blocks and 7 harvests. Harvests were made twice weekly from July 23 to August 13. Plots were 7.5m long with 1.5m alleys at each end, and were on 1.5m centers. Plots were seeded on raised beds with 0.5m tops at a population of 84,000 plants/ha.

The same hybrids were also planted in similarily arranged 3m plots in the same location. The plots were harvested once-over at the stage where 10% oversize fruit were present. Total number and marketable number of fruit were counted, and the data were correlated with the yield results from the multiple harvest trial. The once-over harvest experiment was replicated 4 times to measure the variability associated with the correlations with multiple-harvest yield.

The highest correlations were between total once-over harvest fruit number and total multiple-harvest fruit number or fruit weight (Table 1). Slight correlations existed for marketable fruit number for the once-over vs. multiple-harvest results. Correlations for marketable yield in the once-over harvested

plots were not significant in some of the blocks, especially block 2. Therefore, replication of the plots would probably be necessary to provide more reliable results for selection for marketable yield.

Table 1. Pearson product-moment correlations for once-over vs. multiple-harvest yield by fruit number (fruit weight) cumulative for harvests 1-7.

Block	Total Fruit Yield	Marketable Fruit Yield
1	.58+ (.68*)	.63+ (.63+)
2	.70* (.47)	.35 (.29)
3	.72* (.66*)	.48 (.48)
4	.73* (.57+)	.53 (.41)
$\bar{x}$	.68* (.60*)	.50+ (.45)

+,* Significant correlation at the 10 and 5% levels, respectively.

Once-over harvested plots were most highly correlated in yield with the multiple-harvest yield from all 7 harvests (Table 2). The once-over harvest was made at the same time as harvest 4 of the multiple-harvest trial, so it was surprising that the correlations increased throughout the 7 harvests without a peak around harvest 4.

Table 2. Pearson product-moment correlations for once-over vs. cumulative multiple-harvest yield for marketable fruit number (total fruit number).

	Harvest					
Block	1	1-2	1-3	1-4	1-5	1-6
1	.66*(.50)	.69*(.57+)	.67*(.70*)	.61+(.60+)	.61+(.63*)	.62+(.60+)
2	-.12(-.12)	-.08(-.06)	.17(.29)	.16(.44)	.22(.49)	.31(.61+)
3	.16(.18)	.24(.23)	.43(.58+)	.37(.56+)	.40(.63+)	.46(.69*)
4	.23(.29)	.23(.29)	.37(.52)	.36(.60+)	.40(.65*)	.48(.67*)
$\bar{x}$	.23(.21)	.27(.26)	.41*(.52**)	.38*(.55**)	.41*(.60**)	.47**(.64**)

+,*,** Significant at the 10,5 and 1% levels, respectively.

In conclusion, total fruit number from small plots harvested once is correlated with multiple-harvest yield. Furthermore, the correlation is high enough to make it a good method for evaluating large numbers of genotypes or progeny rows in a selection program. Marketable fruit number was not as well correlated with multiple-harvest trial results, so fruit quality should be monitored carefully while selecting for yield.

Literature Cited

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RESEARCH NOTES

II. Muskmelon

Table 1. Mean disease rating and percent survival of muskmelon cultivars screened for bacterial wilt resistance.

Entry	Mean disease rating[z]	% survival
Imperial 45	4.2	57
Burrell Gem	2.3	83
Super Market F_1	2.2	88
Banana	3.6	63
Honey Dew-Morgan	4.9	6
Casaba - Golden Beauty	5.0	0
Far North	4.8	15
Honey Dew - Green Flesh	5.0	2
Iroquois	2.8	66
M986	5.0	0
Yellow Canary	4.6	16
Ananas	4.6	13
W1589[y] (resistant cucumber)	---	100
SMR 18[y] (susceptible cucumber)	---	2
Perlita[y]	---	15

[z]Mean disease rating based on following scale:
0 = No bacterial transmission, excellent plant growth.
1 = Little bacterial transmission, excellent plant growth.
2 = Transmission of bacteria, good growth of the plant.
3 = Transmission of bacteria, some new growth of the plant.
4 = Transmission of bacteria, severe wilting but the plant survives.
5 = Plants are killed by BW.

[y]Control entries; inoculated only once.

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14. Further Observations on "Birdsnest" Muskmelons

Paris, H. S., Z. Karchi, H. Nerson, M. Edelstein, A. Govers and D. Freudenberg, Division of Vegetable Crops, Agricultural Research Organization, Newe Ya'ar Experiment Station, P. O. Haifa, Israel.

The birdsnest plant type or growth habit of muskmelon (Cucumis melo L.) has been described and compared with the familiar vine and short-internode types (1). Birdsnest muskmelons are distinguished by three main features: compact growth, placement of fruits close to the base of the plant, and uniform development and maturation of fruits. The expression of these features can be relegated to a number of component characteristics such as internode length, branching tendency, and concentration of fruit set. Birdsnest habit is a complex of a number of characters, and it is reasonable to assume that each is subject, in varying degrees, to genetic control and environmental influences. Continuous variation for growth habit has been exhibited by F_2 populations and progeny testing of selections.

One of the initial objectives has been to observe the available genetic material and compare accessions, in a replicated trial, for expressivity of birdsnest habit. The results of such a comparison carried out during the 1979 growing season have already been reported (1). In 1980, four accessions, designated 'Persia 201', 'Persia 202', 'Persia 221', and 'Russia 5062' were again compared. Of these accessions, 'Russia 5062' once again was clearly the least compact, its fruits were significantly farther from the base of the plant (although this difference was, admittedly, small: 'Persia 202'-15.4 cm, 'Persia 221'-15.8 cm, 'Persia 201'-15.9 cm, 'Russia 5062'-21.2 cm), and its yield appeared to be the least concentrated.

In a survey of plant introductions carried out in 1979, an accession represented by five plants, of which only one survived to maturity, appeared to have birdsnest habit. Seeds of this accession had been supplied to us by Mr. Y. Natav, former director of the Division of Vegetable Crops, Israel Ministry of Agriculture, Ha-Qirya, Tel Aviv, who described it as "a melon from southern Iran...from a very hot and very dry region". The accession was designated 'Persia Hot Dry', and self-pollinated progeny of the surviving plant were grown out in 1980 alongside the above described comparison trial. All of the progeny had birdsnest habit, with an expressivity which appeared to be as high as that of the other 'Persia' accessions and greater than that of 'Russia 5062'. As is the case with other 'Persia' accessions, 'Persia Hot Dry' is vigorous, early maturing, andromonoecious, with large, light green leaves, thick stems, large seeds; it germinates well at 15°C, and is highly susceptible to diseases, especially downy mildew. Fruit weight averages 1-1½ kg, the flesh is thin, averaging 3-4% soluble solids as measured by a refractometer, and the fruits decay quickly. Externally, the fruits resemble those of 'Persia 201' and 'Persia 202', having a coarse, heavy netting. Flesh color is green.

All of the 'Persia' birdsnest accessions reportedly originate from arid or semi-arid regions of Iran (Y. Natav, personal communication and ref. 2). In addition, all possess several seemingly unrelated characteristics which, taken altogether, could be argued to be indicative of a dry habitat origin: a) ability to germinate quickly at relatively low temperatures, b) extreme susceptibility

to diseases such as downy mildew, which are prevalent in relatively humid, mild climates, and c) a short life cycle conditioned by early and concentrated fruit maturity. It is hypothesized that the 'Persia' birdsnest accessions represent an ecotype or group of cultivars adapted to desert or semi-desert conditions.

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15. Vat and Fn, Two Linked Genes in Muskmelon

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Many viruses affecting melon are non-persistently aphid transmitted. Cucumber mosaic virus (CMV) is probably the most widespread, but Watermelon mosaic 1 and 2 (WMV-1 and WMV-2), and in France a third potyvirus tentatively named Muskmelon yellow stunt virus (MYSV) (3) may cause severe losses. This later virus seems to be very close to Zucchini yellow mosaic (ZYMV) recently described by Lisa, et al. (1981) in Italy.

A resistance to virus transmission by Aphis gossypii has been described as efficient against CMV transmission (1), and also against WMV-1, WMV-2 and MYSV transmission (2, 7). Therefore, this resistance is not virus specific. Plants possessing this resistance may be infected by these viruses when inoculations are made mechanically, or using other aphid vectors such as Myzus persicae, A. fabae, or A. craccivora. The resistance is specific to the melon aphid A. gossypii.

Muskmelon lines from India (PI 164320, PI 414723) and from Far East (PI 161375, PI 255478, Ginsen makuwa, Kanro makuwa, Shiroubi okayama) possess this form of resistance which has been shown to be goverened by a single dominant gene (5). We propose for it the symbol Vat and the name Virus aphid transmission resistance.

MYSV induces various symptoms in muskmelon and two pathotypes have been described (3). F pathotype provokes a wilting and necrotic reaction on some cultivars (e.g. Doublon). This reaction is controlled by a semi-dominant gene which has been called Flaccida necrosis (symbol Fn).

Vat segregates independently from Fom-1, Fom-2, ms-1, Wmv-1 and a but is linked with Fn (11.6 ± 1.9 units).

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16. Some Genotype-Environment Interactions in Cucumis melo L.

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In 1979, we reported that cultivars differ when grown in nutrient solution maintained at low temperature, especially when radiation is low. For instance, in an experiment where root temperature was maintained at 12°C, yellowing and partial wilting were observed on 'Persian' small type while 'Vedrantais' remained green and healthy. In other experiments with high root temperature, interaction between genotype, root temperature and radiation was also observed.

Three cultivars were grown in a heated glasshouse in nutrient solution during spring or summer to examine these interactions more closely. The greatest difference between these 2 experimental conditions was light intensity (Table 1): in experiment 2, daily global radiation was more than twice the amount in experiment 1.

Table 1. Climatic characteristics of the experiments to study genotype environment interactions in muskmelon.

Experiment	Time Period	Daily Air Glasshouse Temperature	Daily Outside Global Radiation MJ/m^2	Tested Root Temperature
1	10 Feb to 9 Mar 1979	21.5°C	10.8	18, 22, 16, 30°
2	19 Jun to 3 Jul 1980	23.5°C	22.4	22, 26, 30, 34°

Reactions of plants were quite different in the 2 experiments. During the spring (low light intensity, exp. 1), root temperature had a large effect on dry weight which differed with the cultivar (Fig. 1). When root temperature increased from 18 to 30°C, dry weight of both 'Freeman's Cucumber' and 'Vedrantais' increased. The increase was greater for 'Freeman's'. On the contrary, when root temperature was above 22°C, growth of 'Persian' was not so good: dry weight was less; foliage was dull; and at 30°C plants were in poor condition. During the summer period (high sunlight intensity, exp. 2) no significant differences were observed for cultivars or root temperatures (Fig. 1).

When radiation is low, significant variation occurs between cultivars at the lowest and highest root temperature. Screening for root temperature adaptation requires, therefore, control of light intensity.

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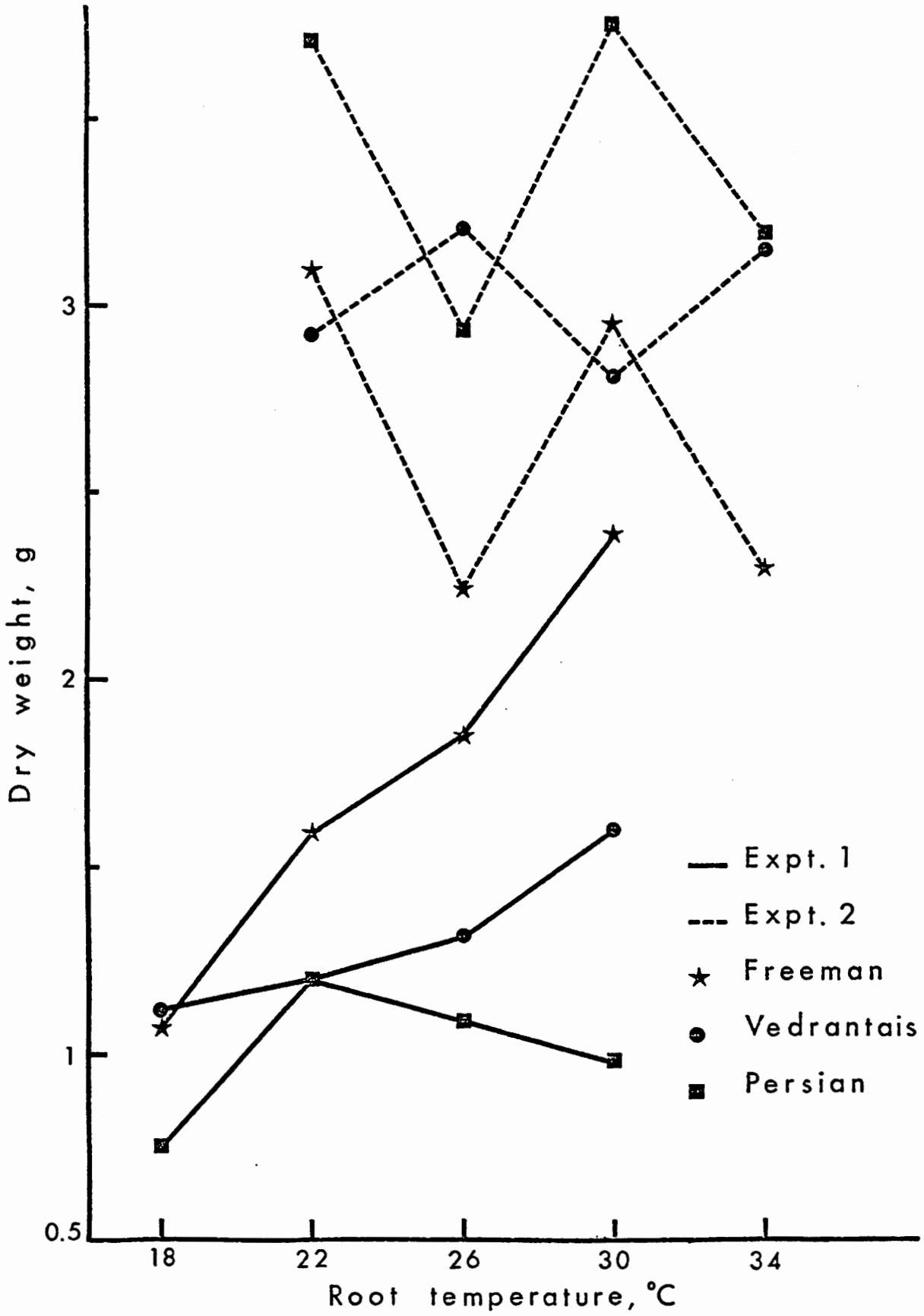

Figure 1. Dry weight at the end of experiments.

17. Effect of Ethylene on Fruit Set in Emasculated and Non-emasculated Flowers of Muskmelon

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Studies by Mann (1) indicated that injury to the flower during emasculation inhibited fruit set. Experiments by Natti and Loy (2) showed that excised emasculated flowers produce 2 to 3 times as much ethylene as non-emasculated flowers during the first 6 hours following emasculation at anthesis. Aminoethoxyvinylglycine (AVG), an inhibitor of ethylene synthesis, suppressed wound ethylene production and also increased fruit set in emasculated, hand-pollinated flowers. Although the results of the above study suggested that wound ethylene might play a role in lowering fruit set in hand-pollinated muskmelon, they did not rule out AVG promotion of fruit set by lowering normal endogenous concentrations of ethylene in the ovary and style.

Experiments were conducted in the field during the summer of 1979 to further test the effect of ethylene on fruit set. The following lanolin paste treatments were applied to the base of corollas of cv. Minnesota Midget at anthesis using pollination and treatment techniques described previously (2): open-pollinated control (lanolin paste only), non-emasculated + 5 µg AVG in lanolin paste, non-emasculated + 0.1 µg ACC in lanolin paste, emasculated control (lanolin paste only), emasculated + 5 µg AVG and emasculated + 0.1 µg ACC. ACC (1-aminocyclopropane-1-carboxylic acid) is an ethylene precursor, and 0.1 µg per flower raised ethylene production in excised non-emasculated flowers above that of emasculated flowers. AVG at 5 µg lowered ethylene production in emasculated flowers below that of non-emasculated flowers.

Emasculation lowered fruit set in all cases (Table 1). Neither AVG nor ACC significantly affected fruit set in either emasculated or non-emasculated flowers. We are left with the conclusions that either endogenous ethylene has little effect on fruit set under some conditions, or that site of application of AVG and ACC must be at the base rather than top of the ovary for effectiveness.

Table 1. Effect of ACC and AVG on fruit set of emasculated and non-emasculated brush-pollinated flowers of cv. Minnesota Midget.

Treatment	No. of pollinations	% Fruit Set
Open-pollinated	80	78
Non-emasculated + 5 µg AVG	70	76
Non-emasculated + 0.1 µg ACC	73	71
Emasculated	107	56
Emasculated + 5 µg AVG	69	45
Emasculated + 0.1 µg ACC	65	44

Using field-grown plants and gas chromatographic methods described previously (2), we compared ethylene levels in excised emasculated or non-emasculated flowers from 10 cultivars of muskmelon (Table 2). There was considerable variability in ethylene production from flowers of different cultivars, and cultivars that produced high amounts of ethylene from non-emasculated flowers usually produced correspondingly high amounts from emasculated flowers. Mean ethylene production was always higher in emasculated than in non-emasculated flowers. There was often marked variability in ethylene production among replications, particularly with emasculated flowers, even though care was taken to emasculate uniformly. Perhaps certain flowers, because of position on the plant, produce larger quantities of ethylene which in turn lowers the probability of fruit set. Interestingly, flowers from the monecious line, 48-3-9-8-8, produced the least amount of ethylene, and this line generally sets fruit well. We had planned but were unable to obtain sufficient fruit set data to compare against ethylene levels for the cultivars listed in Table 2.

Table 2. Ethylene production by excised emasculated and non-emasculated flowers of several muskmelon cultivars. Data represent mean for 5 replications.

Cultivar	ηl ethylene/flower/6 hrs	
	Non-emasculated	Emasculated
Minnesota Midget	1.69 ± 0.28	2.25 ± 0.45
Delicious 51	1.20 ± 0.22	4.43 ± 1.46
45-Early Crown Set	3.30 ± 1.32	7.44 ± 4.35
53-1-4-12 (breeding line)	1.72 ± 0.16	4.96 ± 1.60
Granite State	1.91 ± 0.33	3.63 ± 1.10
Golden Champlain	1.27 ± 0.53	1.77 ± 0.37
Hearts of Gold	1.55 ± 0.31	3.73 ± 1.47
Honey Rock	2.65 ± 1.09	5.31 ± 2.43
Osage	1.02 ± 0.13	1.18 ± 0.25
48-3-9-9-8 (monoecious line)[z]	0.80 ± 0.09	1.21 ± 0.09

[z]Corolla removed as substitute for emasculation.

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RESEARCH NOTES

III. Watermelon

III. Watermelon

18. Bacterial Rind Necrosis of Watermelon in North Carolina

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Bacterial rind necrosis (BRN) has been reported in Florida (2), Texas (4), and Hawaii (3). Fruits infected with BRN were also observed in research plots in North Carolina in the late 1960's and have occurred sporadically since that time. The symptoms of BRN in watermelon are a corky, brownish discoloration of the fruit rind. Although surface roughening may occur in the area external to the diseased area, accurate identification of uncut fruits as diseased is usually difficult. Consequently, the consumer may purchase an otherwise acceptable fruit and find upon slicing an unattractive, diseased interior.

Based upon preliminary cultivar evaluations for BRN resistance, 'Charleston Gray' 'Grayhoma' and 'Blue Ribbon' were initially selected for further study. Tests reported herein were conducted in the field under natural infestation conditions. The three cultivars were rated for BRN resistance in test 1 based upon the percent fruits infested. The cultivars fell into three classes, 'Charleston Gray' resistant, 'Grayhoma' intermediate, and 'Blue Ribbon' susceptible (Table 1). Since fruits classed as diseased could have the entire rind infested or contain only a small lesion, a disease index was used in tests 2 and 3 to evaluate for the severity of BRN infestation. A rating of 5 indicated that the fruits were free of BRN, a rating of 4 - rind area equivalent to 1 locule infested with BRN, rating of 3 - area equal to 2 locules infested, and rating of 2 - all 3 locules infested. A rating of 1 would indicate that the fruit rind was completely infested with some entry into the flesh and some breakdown of the rind tissue itself. 'Sweet Princess' and 'Crimson Sweet' were added in tests 2 and 3. 'Charleston Gray', 'Sweet Princess', 'Grayhoma', and 'Crimson Sweet' were classed as resistant whereas 'Blue Ribbon' was susceptible - significance difference in test 3 but not test 2 (Table 2). Thus, in further tests for BRN the cultivars 'Charleston Gray', 'Sweet Princess', 'Grayhoma', and 'Crimson Sweet' could serve as resistant checks and 'Blue Ribbon' would be satisfactory as a susceptible cultivar.

Elmstrom and Hopkins showed that 'Sweet Princess', 'Charleston Gray' and 'Crimson Sweet' had a similar level of resistance whereas 'Blue Ribbon' was less resistant than 'Sweet Princess' and 'Crimson Sweet' but not different from 'Charleston Gray' based on percent fruits diseased (1).

To determine the effect of BRN infestation on soluble solids, the fruits of each variety were classed diseased if one or more locules contained BRN symptoms and disease free if no symptoms occurred. A statistical analysis was not conducted in test 1 because of insufficient number of fruits in certain plots, for example, disease free fruits in the cultivar Blue Ribbon and a diseased fruit in 'Sweet Princess' were in short supply. There appeared to be no reduction in soluble solids content between the diseased free and diseased fruits of either 'Charleston Gray' or 'Grayhoma' in test 1. A slight reduction occurred in the diseased fruits of 'Blue Ribbon', probably because the infestation was likely much greater than with the other two cultivars.

Although BRN has not become a severe annual problem in North Carolina, it is important because it does show up sporadically and particularly because fruits cannot be identified readily as being infested before cutting.

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Table 1. Percent bacterial rind necrosis and soluble solids content of fruits of 'Charleston Gray', 'Grayhoma' and 'Blue Ribbon', Clinton, N.C.

Cultivar	% (arcsin) Fruits Diseased	% Soluble Solids	
		Fruits Not Diseased	Fruits Diseased
Charleston Gray	15.8	11.4	11.4
Grayhoma	41.2	10.1	10.3
Blue Ribbon	88.7	12.6	11.7
LSD (5%)	16.5		
(1%)	35.2		

Table 2. Bacterial rind necrosis (BRN) in several watermelon cultivars (disease index)[z], Clinton, N.C.

Cultivar	Disease Index[y]	
	Test 2	Test 3
Charleston Gray	5.0[a]	5.0[a]
Sweet Princess	5.0[a]	5.0[a]
Grayhoma	4.9[a]	-
Crimson Sweet	-	4.8[a]
Blue Ribbon	4.4[a]	4.1[b]

[y] Treatment means followed by the same letter are not significantly different from each other.

[z] 5.0 = free of BRN; 1.0 = complete infestation of rind.

RESEARCH NOTES

IV. Cucurbita spp.

IV. Cucurbita spp.

19. On White Cotyledons in Cucurbita pepo L.

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In the fall of 1981, during a routine work of transplanting squash seedlings, one of us (H.A.) discovered that the lower side of the cotyledons of some plants is white instead of green. This observation prompted us to obtain data on the incidence of white cotyledons in inbred varieties and progenies that were available at that time.

We report these data here (Tables 1 and 2) without comments because we are still ambivalent about their meaning. If white-cotyledon is a heritable trait, as we presently believe, it would be interesting to determine its genetic basis as well as its adaptive value. It may also be a useful seedling marker.

The white color is usually confined to the central region of the lower side of the cotyledon. Preliminary examination suggests that the white color results from structural changes in the spongy parenchyma which affects the reflected light. But this possibility must be explored more critically.

Table 1. Incidence of plants with white cotyledons in inbred lines.

Inbred of	Green	White	Total	% white
'Caserta'	3	90	93	96.8
'Early Prolific Straightneck'	81	23	104	22.1
'NJ260'	61	2	63	3.2
'Fordhook Zucchini'	56	1	57	1.8
'Jersey Golden Acorn'	80	0	80	0

Table 2. Incidence of plants with white cotyledons in some breeding progenies.

Parents[z]	Offspring			
Self-pollinated	Green cotyledons	White cotyledons	Total	% white
1550-1	18	101	119	84.9
2	103	67	170	39.4
3	73	65	138	47.1
5	165	2	167	1.2
6	170	0	170	0

[z]These parents were the offspring of B_2 generation obtained from the following operation: (1) Caserta x NJ260. (2) An F_2 plant was backcrossed to Caserta, B_1. (3) An individual plant of B_1 was backcrossed again to Caserta, B_2.

20. Dry Matter Accumulation and Productivity in Bush and Vine Strains of Winter Squash

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The bush phenotype facilitates conventional row culture and manageability of winter squash, however, there is little information regarding comparative photosynthetic efficiency and productivity between bush and vine forms of C. maxima.

In 1980 and 1981, field experiments were carried out to compare yields and the partitioning of dry matter in a bush and a vine strain of winter squash. 'Blue Hubbard' was selected as the vine strain because of its vigor and high yielding capability. The bush strain (30-11-8-1 or phenotypically similar sister line 30-11-31-9) was a large-fruited, vigorous inbred which normally sets one fruit per plant with close spacing.

'Blue Hubbard' and 30-11-8-1 were about equally productive at the 5,600 plants/ha density (Table 1) a spacing shown to be near optimum for 'Blue Hubbard'. Highest yields for the bush strain occurred at the highest planting density, however, fruits were small and often misshapen, and exhibited lower percent dry matter at this density. A plant density of about 10,000 plants per hectare is considered optimum for the bush strain, but this could vary depending upon location, plant vigor, and time of flowering. Percent dry matter was low in both bush and vine strains in 1981 due to powdery mildew infestation in the spacing trial.

Table 1. Yield of a bush strain (30-11-8-1) at different plant densities as compared to yield of 'Blue Hubbard' planted at near optimum plant density.

Plant Density pls./ha	1980 kg/ha Fr.Wt.	1980 kg/pl Fr.Wt.	1981 kg/ha Fr.Wt.	1981 kg/ha Dry Wt.	1981 kg/pl Fr.Wt.
Bush					
22,000 (0.3 x 1.5 m)	77,000	3.7	74,800	5,310	3.5
11,000 (0.6 x 1.5 m)	70,300	6.6	61,500	4,551	5.5
7,400 (0.9 x 1.5 m)	64,600	9.0	55,300	4,313	7.7
5,600 (1.2 x 1.5 m)	61,300	10.6	52,200	4,594	9.2
Vine					
5,600 (1.2 x 1.5 m)	57,300	10.4	50,700	4,867	8.7

Above-ground dry matter accumulation was initially similar in 'Blue Hubbard' and 30-11-8-1 plants grown under non-competitive (low density) spacings (Table 2). With the onset of multiple secondary and tertiary branching in vine plants, total dry matter rose rapidly. Peak dry matter occurred earlier in the bush strain, and dry matter actually declined between 10 to 12 weeks from transplanting, due to early fruit maturity and onset of leaf senescence. Net assimilation rate (NAR) and harvest index were higher in the bush strain. This together with the rapid leaf canopy development of the bush strain under high density planting probably contributed to its high productivity.

Table 2. Dry matter accumulation and distribution in bush and vine strains of winter squash grown at low density planting.

Sample Times (Weeks from Transplanting)	Total Plant Dry Wt.		NAR[y] g/dm^2 leaf		% Dry Wt. Fruit/Total	
	Bush	Vine	Bush	Vine	Bush	Vine
4	59	67	1.0	0.8	-	-
6	725	978	1.6	1.6	17.8	3.2
8	2555	2514	2.4	1.9	-	-
10	3125	8174	3.7	2.5	-	-
12	2575	9471	5.7	2.8	69.6[z]	57.0[z]

[y] Net assimilation rate (cumulative)

[z] Equivalent to harvest index (includes both green and mature fruit of 'Blue Hubbard').

21. Cucurbitacins of Cotyledons of Cucurbitaceae Cultivars as Related to Diabroticite Beetle Attack

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The worldwide culture of many species and varieties of Cucurbitaceae is complicated by the feeding of many species of rootworms, cucumber beetles, pumpkin beetles, of the order Coleoptera, family Chrysomelidae, tribe Luperini. A common feature of the preference of this group of beetles for cucurbits is the presence of the oxygenated tetracyclic triterpenoid cucurbitacins that act as kairomones promoting arrest and compulsive feeding. In the United States cucurbit seedlings are especially severely attacked and often defoliated by the spotted cucumber beetles Diabrotica undecimpunctata undecimpunctata Mannerheim and D. u. howardi Barber, by the banded cucumber beetle D. balteata LeConte, and by the striped cucumber beetles Acalymma vittata Fabricius, and A. trivittata (Mannerheim).

The cucurbitacins seem clearly to have arisen by coevolutionary selection as intensely bitter substances effective as feeding deterrents to herbivores. Their presence renders cucurbitaceous fruits completely unpalatable to man and our present cultivars selected over thousands of years for palatability, are essentially devoid of Cucs (1, 2). However, the extent of Diabroticite feeding on the cotyledons of many varieties of Cucurbita, Cucumis, and Citrullus suggests that substantial amounts of Cucs are present. Cuc synthesis in these genera is initiated by a single dominant gene B_1 (3) but non-bitter fruit may develop from bitter seedlings in the presence of a modifier suppressing Cuc synthesis in the fruit.

We have investigated the Cuc content of the cotyledons of 19 species and 47 cultivars of Cucurbita, Cucumis, and Citrullus by extracting the Cucs, separating them by thin-layer chromatography, and localizing them by the feeding spots produced after exposure to adult D. undecimpunctata and D. balteata. Some cultivars have also been characterized by high pressure liquid chromatography. Substantial amounts of Cucs were found in 30 of 47 cultivars (Table 1) and 10 of 11 wild species examined (Citrullus colocynthis, Cucumis hardwickii, Cucurbita andreanna, C. ficifolia, C. foetidissima, C. lundelliana, C. martinezii, C. okeechobeensis, C. palmeri, and C. texana). Cotyledonary Cuc content was found to be directly related to seedling beetle damage on the field but unrelated to fruit or leaf beetle damage.

Although other factors may be involved in Diabroticite feeding on Cucurbit cultivars, they are negligible in the presence of the powerful kairomones, the cucurbitacins. The screening of Cucurbits in the seedling stage is paramount in developing non-Cuc containing cultivars for incorporation into IPM programs to lessen Diabroticite attack upon the Cucurbitaceae.

Table 1. Cucurbitacin content of cotyledons of Cucurbitaceae cultivars as estimated by Diabroticite feeding on TLC plates developed from standard chloroform extracts. Species abbreviations and characteristic major Cucs: Cuc E and Cuc-glycosides - LAN = *Citrullus lanatus*; Cuc C - SAT = *Cucumis sativus*; Cuc B-ANG = *Cucumis anguria*, MELO = *Cucumis melo*, MAX = *Cucurbita maxima*, MIX = *C. mixta*, MOS = *C. moschata*, PEPO = *C. pepo*.

Cucurbitacin content*: Species - Cultivar		
Large	Moderate	None detected
LAN	LAN	MELO
Charleston Gray	New Hampshire	Early Dawn
Iopride	MELO	Gold Star
Sugar Baby	Golden Rind	SAT
Yellow Doll	Honey Mist	Saticoy
ANG	SAT	MIX
West Indian Gherkin	Marketmore	Gold Striped Cushaw
SAT	Pot Luck	MAX
Liberty Hybrid	Wis. SMR-18	Sweet Mama
Palomar	MAX	MOS
MAX	Boston Marrow	Dickinson Field
Mammoth Gold	Golden Hubbard	Early Butternut
MOS	Pink Banana Jumbo	PEPO
Tahiti	PEPO	Bush Table King
PEPO	Blackjack	Crookneck
Ambassador	Caserta	Early White Squash
Black	Greyzini	Goldbar
Diplomat	Seneca Butterbar	Goldneck
Gourmet Globe		Patty Green Tint
Greenbay		Scottsdale
Cocozelle		Seneca Prolific
Scallopini		St. Pat Scallop
Storr's Green		Straightneck
Striato Striped		

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* Cuc content verified by HPLC Iopride (large) = 39.3 µg Cuc E/g fwt cotyledons; Black (large) = 23.0 µg Cuc B/g fwt; Blackjack (moderate) = 10.8 µg Cuc B/g fwt; and Goldbar (none detected) <0.25 µg/g fwt.

22. Parthenocarpic Fruit Set in Glasshouse Grown Zucchini Squash

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Zucchini squash is grown in the Netherlands in glasshouses in spring and fall. The crop has limited importance so far (annual sales less than a million guilders), but it has potential for increased production. The major drawback, especially for the spring culture (planting in February/March) is the necessity of pollination for normal fruit development. Bees kept in the glasshouse for pollinating are inactive under the prevailing cloudy and cool conditions and hand pollination is very laborious. Chemical stimulation of parthenocarpic fruit set has not proved practical.

Genetic parthenocarpy would eliminate the need for pollination. Besides it may allow a change in sex-expression towards more completely female cultivars which may produce an even earlier crop. In addition the growth of parthenocarpic fruits could be less exuberant, resulting in less competition between plant parts and more flexibility in harvesting schedules. Rylski (3), when studying the effects of temperature and light on the tendency to parthenocarpic fruit set of two summer squashes, detected a strong difference between them. She also confirmed (4) earlier observations (1,2) on the positive effect of low night temperature. This low night temperature being recommended for glasshouse production in the Netherlands, we decided to take a practical approach by screening a collection of cultivars for parthenocarpic fruit development when grown at low night temperature. This report gives results of one such trial involving 19 cultivars in the spring of 1981.

The plants were grown at 75 cm distance in rows 150 cm apart in an insect-proof Venlo-type glasshouse. Seeds were sown February 13, planting was March 5. Temperature was set at 17°C D / 10°C N. Five plants of each cultivar were randomly arranged in 3, 4, or 5 repititions. Biweekly harvests of parthenocarpic fruits started April 13 and were terminated May 11. Individual male and female flowers were counted from March 31 until April 17, and all fruits of all 8 harvests were counted, weighed, and classified for quality. Only normal-shaped, regular-sized fruits were assigned to quality class 1. All partly developed fruits (with e.g. tapering ends) were placed in lower quality classes. Many of these fruits suffered from blossom-end rot, initiated by rotting of the non-dehisced flower. From the number of fruits per plant in the earliest harvests (until April 24) and the mean number of female flowers per plant until April 17, the percentage early parthenocarpic fruit set was calculated (see Table 1).

Clear differences in parthenocarpic fruit yield are evident from the table, in the earliest harvest as well as for the combined first four weeks of harvest. Only three cvs. yielded three fruits or more per plant. Only four cvs. attained more than 1000 grams of total fruit weight per plant. Most parthenocarpic cvs. are in the early and medium maturity groups. The percentage first quality fruits was not correlated with the degree of parthenocarpy. 'Black Jack,' DG-4, 'Baroz' and 605 produced a good share of first quality fruits. DG-4 and 'Black Jack' had the highest actual yield of such fruits.

The ranking of cultivars according to parthenocarpic fruit set in this trial corresponded quite well with that from a similar trial in 1980. In that experiment cv. Dark Green Zucchini (by Otis Twilley Seeds Co.) stood out because of high yields of first quality fruits. Several plants of this cv. were selfed, but only one line, DG-4 could be included in the present trial. Unfortunately the original cv. could not be planted because of lack of seed.

The outstanding yield of the line testifies to the hereditary basis of the character which can apparently be fixed. This holds promise for breeding of zucchini squash with increased parthenocarpic fruit set in glasshouses. We cannot involve ourselves in such a program at the Institute. Remnant seed of the line DG-4 and related materials are available to interested breeders.

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Table 1. Parthenocarpic fruit set per plant of zucchini squash cultivars.

Cultivar (group)	Fruit type*	Fruits set until 24-4-81		Fruit set until 11-5-81		
		Number	Percent	Number	Yield	Percent class 1
(early)						
605	d.	0.7	17	2.6	944	52
DG-4	d.	1.8	42	4.1	1420	66
Poseidon	d.	0.9	24	3.6	1391	33
Baroz	l.	0.4	4	2.2	588	54
Cocozelle	l.	0.7	27	3.0	1101	43
(medium)						
Black Jack	d.	0.1	9	2.6	1011	77
Diamant	d.	0.4	8	1.7	371	17
Storr's Green	d.	0.1	4	1.1	398	27
Burpee Hybrid	d.	0.1	3	0.5	182	75
Elite	d.	0.3	8	0.8	424	58
Fordhook	d.	0	0	1.3	629	69
Clarita	l.	0.2	3	1.1	326	71
Greyzini	l.	0.1	3	0.7	240	55
Bassar	l.	0.1	1	2.0	373	13
Marba	l.	0.1	3	0.6	257	88
(late)						
Ambassador	d.	0	0	1.2	365	19
Aristocrat	d.	0	0	0.3	45	60
Gourmet Globe	r.	0	0	0.2	59	33
White Bush	w.	0	0	0.1	7	0

*d. = dark green, l. = light green, r. = round, w. = white.

23. Sources of Resistance or Tolerance to Viruses in Accessions of Cucurbita maxima

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Sources of resistance to cucumber mosaic virus (CMV) and watermelon mosaic virus 2 (WMV-2), and tolerance to watermelon mosaic virus 1 (WMV-1) were recently found in three foreign accessions of Cucurbita maxima.

Resistance to CMV. A single plant selection of PI 234608 (cv. Queensland Blue from Johannesburg, South Africa) appears to possess an adequate level of resistance to isolates of this virus. Following foliar inoculation, plants reacted with chlorotic spots which turned necrotic, involving the entire leaf area. The virus, however, failed to move systemically and this condition persisted after 3 to 6 subsequent inoculations. Under field conditions, the progeny of 234608-1 remained unaffected by CMV, whereas most of the plants of other cultivars of C. maxima developed mosaic and foliar distortion. However, during late autumn and early winter, plants of 234608-1 inoculated with CMV at the cotyledonary stage tended to develop severe mosaic and stunting. This shift toward susceptibility could be attributed primarily to reduced light intensity and/or quality, since temperature was adequately controlled.

Resistance in 'Queensland Blue' to CMV had been reported by Greber (1) from Queensland, Australia, where this cultivar is the most commonly grown 'pumpkin'. Two lines of it were recently obtained from Greber, but they yielded mostly susceptible plants when inoculated with our isolates of CMV. Those few plants which appeared to be free of systemic infection segregated for susceptible and resistant individuals in the next generation. In Queensland, this cultivar is affected by WMV-1 and WMV-2 (1). Our field and greenhouse tests have confirmed its susceptibility to these two viruses and to others such as squash mosaic virus (SqMV) and tomato ringspot virus (TmRSV), which occurs in New York State.

Resistance in plants of 234608-1 to CMV requires further field evaluation, particularly under the pressure of severe CMV epidemics.

'Queensland Blue' is a very productive cultivar with round and ribbed fruits which have gray-blue skin and thick, dark orange flesh.

Tolerance to WMV-1. A single plant selection of the cultivar Zapallito Redondo, from Uruguay, has been determined to have a good level of tolerance to isolates of this virus from New York, Florida, Virginia, and Hawaii. Inoculated plants responded with scattered, small, chlorotic spots involving 2 to 5 leaves; subsequent growth was free of symptoms. Plants remained vigorous and productive. This selection of 'Zapallito Redondo' (ZR-1) is susceptible to CMV, WMV-2, SqMV, and TmRSV.

Plants of ZR-1 have bush habit; fruits are small (about 15 cm in diameter) with green skin and yellow flesh.

Resistance to WMV-2. A single plant of PI 419081 (cv. Pai Yu) (White Jade) from China was selected because it was free of symptoms when an epidemic of WMV-2 affected all other plants of domestic and foreign accessions of C. maxima at the Northeast Regional Plant Introduction Station, Geneva, NY, in 1978.

In field trials in subsequent years, the progeny of 419081-1 has remained free of symptoms of WMV-2. Similar results have been obtained in greenhouse tests using isolates of this virus from New York, Florida, California, and China. However, recovery tests have revealed a low level of symptomless infection confined to the inoculated leaves. In late autumn and early winter tests, plants of 419081-1 tended to develop scattered, systemic, chlorotic spots, some ring-like, on 1 to 4 leaves, with further growth free of symptoms.

Plants of 419081-1 have a vine habit and produce medium to large fruits with white skin and light orange flesh. No resistance to other viruses was found in this selection or in the parent, PI 419081.

During the summer of 1981, plants of 234608-1, ZR-1, and 419081-1 were crossed with each other and with those of cvs. Buttercup and Emerald, both accessions of C. maxima. The F_1 and relative parents will be evaluated under greenhouse and field conditions in 1982.

Although resistance to viruses had been found in feral Cucurbita spp. (2), our findings provide additional sources of resistance to CMV and WMV-2, and tolerance to WMV-1 in cultivated accessions of C. maxima.

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24. On the Silvery-Leaf Trait in *Cucurbita pepo* L.

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Recent observations and breeding data suggest that there exists a silvery-leaf (SL) trait whose expression is subject ot marked genetic and non-genetic variations, that the genetic variants include M/M for mottled leaves (2) and m/m for non-mottled leaves, and that modifier genes greatly affect the SL expression of gene M.

There are at least five true-breeding SL variants and their phenotypes, designated by symbols SL-1 and SL-5, are described in Table 1. The SL-1 phenotype is represented by 'Jersey Golden Acorn' (JGA) and some other cultivars. For example, 'Early Prolific Straightneck', m/m (2), which superficially appears to have "uniform green leaves" (2), actually exhibits the SL-1 phenotype upon closer examination.

The SL-5 phenotype is represented by NJ260 whose origin is known (4). A cross was made between JGA (SL-1) and NJ260 (SL-5). The F_1 was of the SL-3 phenotype (Table 1). The F_2 consisted of 686 mottled plants, which varied widely in their SL expression, and 213 non-mottled plants of the SL-1 phenotype, X^2 (3:1) = 0.82, P = 0.50-0.25. Of the 686 mottled segregates only three resembled the NJ260 parent (SL-5), a frequency of about 0.3% (3/899) based on the entire F_2. The backcross, F_1 (SL-3) x JGA (SL-1), consisted of 204 mottled plants, which did not include a single individual of the SL-5 phenotype, and 228 non-mottled plants of the SL-1 phenotype, X^2 (1:1) = 1.33, P = 0.75-0.50. A new true-breeding line of pheontype SL-4 (Table 1) was developed through selection in the F_2 and subsequent inbred generations. The great diversity among the mottled segregates in the F_2 leads me to believe that other true-breeding lines of new SL phenotypes could have been developed from this cross.

The available evidence is compatible with the hypothesis that modifier genes, acting separately or in concert, extend and/or intensify the SL expression of M. The SL-5 phenotype of NJ260 is probably conditioned by M/M and effective "extenders" and "intensifiers"; the true-breeding variant of SL-4 phenotype is probably conditioned by M/M and some "extenders" but few, if any, "intensifiers"; and the SL-3 phenotype of 'Caserta' is probably conditioned by M/M and effective "intensifiers". The genetic constitutions of SL-1 and SL-2 are somewhat less certain. The SL-1 phenotype of JGA, m/m, could be conditioned either by modifiers of M which have small silvery effects of their own or by a very low silvery expression of m. The SL-2 phenotype of 'Fordhook Zucchini' could be conditioned either by M/M and modifiers which delay and attenuate the expression of M or by weak M alleles.

Scarchuk and Lent (3) discovered that the palisade cells in the silvery areas of a mottled leaf are not in close contact either with the epidermis or with one another, thus creating air spaces. And they believed that these air spaces are responsible for the SL expression. Giving a genetic predisposition for a breakdown in intercellular cohesion, it is evident that cells located near leaf veins are more vulnerable to this phenomenon than other cells. There are other non-genetic factors which affect the SL expression, including fluctuations in rate of plant growth.

For several years, NJ260 appeared to be free of virus infection under field conditions in New Brunswick. It occurred to me that the silvery appearance of this line may function in a way analogous to that of aluminum mulch which repels aphids and, thus, lowers the incidence of virus diseases (4). If light which contains a relatively high proportion of short waves repels aphids (see reference 1 for literature review), then the reflected light from silvery leaves might contain a higher proportion of short waves than the reflected light from non-silvery leaves. A preliminary test by Dr. Ron Prokopy (personal communication) confirmed this expectation.

If the correlation between high SL expression and low incidence of aphid-transmitted virus dieases is valid, it should be worthwhile to further explore the nature of this correlation and its value not only in Cucurbita but also in other cultivated genera such as Pisum and Phaseolus.

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Table 1. Description, symbols and examples of true-breeding variants of the silvery leaf trait (SL) in Cucurbita pepo .

Description of Silvery-Leaf Variants[z]	Symbols of Phenotypes	Examples of True-breeding Representatives
A. Plants bearing non-mottled leaves, m/m[y]		
1. Leaves exhibit narrow, often inconspicuous, silvery lines along both flanks of veins. This is a weak phenotype and its onset occurs early in plant development.	SL-1	'Jersey Golden Acorn' (JGA)
B. Plants bearing mottled leaves M/M[y]		
2. Leaves exhibit relatively large, but sparsely-distributed, silvery patches in axils of veins. This is a weak phenotype and its onset occurs late in plant development.	SL-2	'Fordhook Zucchini'
3. Leaves exhibit relatively large and abundantly-distributed silvery patches in axils of veins. This is a strong pheontype and its onset occurs early in plant development.	SL-3	'Caserta'
4. Lightly-mottled leaves are observed occasionally, but the light silvery expression ofetn extends over the entire leaf surface. This is a weak phenotype and its onset occurs early in development.	SL-4	A recently-developed inbred from a cross between JGA (SL-1) and NJ260 (SL-5)
5. Mottled leaves are observed occasionally, but usually the leaves are uniformly silvery. This is a strong phenotype and its onset occurs very early in plant development.		

[z] The phenotypes of these variants are greatly affected by non-genetic fluctuations. The "strong" phenotypes are more intense in expression and more persistant during plant development than the "weak" ones.

[y] Tentative or incomplete genotype.

25. Comparison of Seed Coat Development and Composition in Normal and Hull-less Strains of Pumpkin (Cucurbita pepo L.)

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Pumpkin seeds normally develop a well-defined, five-zoned seed coat or testa (1) by ten to fifteen days post-anthesis (2). In 1934, Tschermak-Seysenegg reported a 'naked-seeded'or hull-less mutant in pumpkin which did not develop a distinctly organized testa. All seed coat tissue layers are present in the hull-less phenotype, however, all layers collapse during tissue desiccation of mature seeds. Early investigators attributed tissue collapse to a failure of mutant cell walls to lignify during seed coat development 3, 4). Celluloses and non-cellulosic polysaccharides comprise a substantial proportion of the seed coat of Cucurbita pepo (5). Therefore, it appeared relevant to compare more critically by biochemical and histochemical analyses, the seed coat composition of hull-less mutant and normal seeds of C. pepo.

Analyses of seed coat composition of two normal strains, cvs. 'Small Sugar' and 'Jack O'Lantern', and two hull-less mutant strains, cvs. 'Tricky Jack' and '293A', of pumpkin revealed a marked reduction of lignin, structural polysaccharides and protein, and increased amounts of ethanol-soluble substances and lipids in hull-less cultivars compared to normal cultivars (Table 1). Testae from hull-less seeds weighed roughly 57 percent less than those from seeds of the normal strains.

Table 1. Seed coat composition (mg/testa) of mature desiccated seeds of normal and hull-less strains of C. pepo.

	Normal Strain		Mutant Strain	
Component	'Small Sugar'	'Jack O' Lantern'	'Tricky Jack'	'293A'
80% ethanol soluble	1.1	0.9	2.0	1.7
Lipids/pigments	0.3	0.7	0.8	0.9
Lignin	5.6	5.0	1.0	0.8
Protein	4.0	3.8	1.8	1.8
Structural polysaccharides[a]	8.8	9.4	3.4	2.9
TOTAL	19.8	19.8	9.0	8.1

[a] This fraction includes cellulose, hemicelluloses and pectic polymers.

Histochemical studies indicated a deficiency in secondary cell wall development in hull-less mutant testae as early as ten days post-anthesis. Starch granules, presumed to function as precursor molecules for cell wall synthesis, were abundant in both mutant and normal testae early in development.

We suggest that the marked reduction in lignin in hull-less mutant testae may be a secondary phenomenon resulting from a deficiency in the polysaccharide matrix which is a prerequisite for lignin formation.

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RESEARCH NOTES

V. Other Genera

V. Other Genera

26. *In vitro* Culture of Embryos of *Cucumis zeyheri* Sond. (2n=24)

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It has been shown previously that embryos from the cross *Cucumis zeyheri** (Gene Bank no. 0181) x *C. metuliferus* (Gbn 1734) stopped growth during cotyledon development and seeds with such embryos did not germinate. Embryo culture did not result in the development of viable plants from these embryos (2, 3), possibly because the medium was unsuitable. Trying various modifications of the medium might be a next approach in the culture of these hybrid embryos. However, we decided first to culture embryos of the maternal parent, because this might reveal special culture requirements for the species and likely also for the hybrid. Moreover, more general questions about the culture of non-hybrid embryos in the genus *Cucumis* still require answers (1).

Embryos of various developmental stages from selfed *C. zeyheri* (2n=24) (Gbn 0181) were incubated in 6 cm Petri dishes, each containing 3.5 ml of MS-medium supplemented with casein hydrolysate (1 g/l), Difco Bacto agar (7.5 g/l), IAA (0.01 mg/l), and various concentrations of sucrose (5, 20, 35, and 50 g/l) and kinetin (0, 0.1, 1, and 10 mg/l), selected on the basis of previous experiments (1). The cultures were kept under 16 h light (Philips TL 34, approx. 750 lux) at a temperature of 24.5 ± 1.5°C.

Table 1 gives data on embryo development after 2½ weeks of culture. At that time, the variation in development was maximal. Two main types of development were present, viz. continuation of normal embryonic development (no chlorophyl development, organ proportions similar to those of *in situ* embryos) and precocious germination (cotyledon expansion, chlorophyl development, root development and, ultimately, development of a growing point). The tendency of the embryos to continue embryonic development gradually increased to a maximum in the late-intermediate-stage and then decreased quickly during the mature-stage. In addition, this tendency increased with higher sucrose concentration, whereas a high kinetin concentration counteracted it. Opposite to this, when precocious germination occurred, the highest kinetin concentration of 10 mg/l inhibited the development of a growing point.

A longer period of culture gradually changed the reaction pattern. Most embryos which started to develop embryonically switched from embryogenesis to germination. The weaker the embryonic tendency, the earlier was this transition. All the mature-stage embryos ultimately germinated and developed growing points. The same held true for the mid- and late-intermediate-stage embryos, except on 50 g/l sucrose, where no growing points appeared.

Most early-intermediate-stage embryos on 20 and 35 g/l sucrose also developed complete plants ultimately, but 10 mg/l kinetin diminished their frequency. Sucrose at 50 g/l kept these embryos in the embryonic phase continuously. On 5 g/l sucrose these embryos grew weakly and showed starvation, probably because of shortage of carbon.

* Formerly *C. zeyheri* (2n=24) was incorrectly named *C. africanus* L.f.(4).

The frequency of immature-stage embryos which developed a growing point did not increase after 2½ weeks of culture. Reasons for this were the increasing tendency for embryonic development on 50 g/l sucrose and the low survival and weak growth on 5 and 20 g/l sucrose. At 35 g/l, the embryos seemed to need a low to moderate content of cytokinin for the completion of the last steps in embryo morphogenesis.

The results of the present experiments show that it is possible to get 100 percent plant formation with C. zeyheri (2n=24) embryos from the beginning of the intermediate-stage onwards. As far as nutrient components of the medium are concerned, we expect that the present procedure will be suitable for the culture of the hybrid embryos of C. zeyheri (2n=24) x C. metuliferus, which should reach at least the intermediate-stage, as judged from their ultimate size in situ of 1 - 1.5 mm (2).

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Table 1. *In vitro* development of embryos of *Cucumis zeyheri* (2n=24) after excision at various stages and culture for 2½ weeks with different sucrose and kinetin concentrations.

Sucrose (g/l)	Kinetin (mg/l)	Developmental Stage and Size (mm) of the Embryos at Excision								
		Immature		Intermediate					Mature	
		early (globular)	late (heart)	early		mid	late		early	late
		0.07-0.1	0.3-0.4	0.8-1.2	1.2-1.8	2-2.5	3.2-3.5	4.6-5.0	5.5-6.0	5.5-6.0
5	0.0	d	d	d-g	g+	g+	e	e-g	g+	g+++
	0.1	d	d	d-g+	g+	g+++	e	e-g+	g+	g+++
	1.0	d	d	g	g++	g++	e-g	g++	g++	g+++
	10.0	d	d	g	g	g	e-g	g	g	g+++
20	0.0	d	d	g+	g++	g++	e	e	e	g++
	0.1	d	d-g+	g+	g++	g+++	e	e	e	g+++
	1.0	d	g+	g+++	g++	g+++	e	e-g	e-g+	g+++
	10.0	d	g	g	g	g+	e-g	e-g++	g+++	g++
35	0.0	g	g	e-g+	e-g	e	e	e	e	e-g+
	0.1	g++	g+	g++	e-g	e	e	e	e	g++
	1.0	g+	g++	g+++	g+	e-g++	e	e	e	g++
	10.0	g	g	g	g	g+	e	e	e-g+	g+
50	0.0	e	e	e	e	e	e	e	e	e-g
	0.1	e-g+	e-g	e	e	e	e	e	e	e-g
	1.0	e-g+	e-g+	e	e	e	e	e	e	e-g+
	10.0	g	g	e	e	e	e	e	e	e-g

d = death or low rate of survival; e = continuation of normal embryonic development; g = precocious germination; +, ++, and +++ = 0-33, 33-67, and 67-100 percent of growing point development, respectively. The number of embryos per treatment was 6, 12 or 18.

27. Inheritance of Resistance to Cucumber Green Mottle Mosaic Virus (Cgm) in Cucumis anguria L.

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Cucumber green mottle mosaic virus (Cgm), first described by Ainsworth (1), causes significant losses in the glasshouse culture of cucumbers in Western Europe and Japan (3, 5). Strict phytosanitary measures are necessary to minimize the damage. Symptomless carriers have been found among cucumber varieties of Asiatic origin, but the reduction in yield after inoculation was similar to that in susceptible varieties (5). No resistance has been observed within C. sativus L., but several wild Cucumis species of African origin proved to be resistant (6). One of these, C. anguria L. has also some resistance to root knot nematodes and bean spider mites (6).

Attempts to cross C. anguria, the West Indian Gherkin, with either cucumber or melon have thus far failed (2, 4, 6). Nevertheless, there appears to be a possibility that some kind of hybridization, be it conventional or novel, can be achieved beteeen C. sativus and C. anguria. Therefore, it seemed appropriate to reveal the genetics of the resistance to Cgm in the latter species.

Since no susceptible segregants were identified in any of the 14 accessions of C. anguria in our collection, outcrosses to the related susceptible species C. myriocarpus Naud. were made to produce segregating progenies for genetic analysis. The crosses and analysis of resulting progenies are in Table 1. The initial cross was only successful when anguria was the female present, whereas in the reciprocal, pollen tubes are arrested in the upper part of the style (4). The resulting hybrids were vigorous and reasonably self-fertile. Crosses with subspecies longipes of C. anguria as maternal parent were more difficult, and the F_1 plants sparingly self-fertile, so for this analysis only C. anguria ssp. anguria was used. All seedlings were tested by rubbing the cotyledons with a suspension of the virus with carborundum, which has proved a fully effective technique for infection. Since symptoms of the virus infection are sometimes hard to distinguish in C. myriocarpus, sap of all symptomless individuals was applied to tested plants of a cucumber line with clear symptoms for ultimate classification.

The segregations listed in Table 1 are combined data of different families which behaved in similar fashion. Despite the fact that distorted gene segregations could be expected because of the interspecific nature of the cross, the data clearly fit a monogenic inheritance pattern. Therefore, I conclude that one dominant gene confers resistance to Cgm in C. anguria. Following the guidelines adopted by the CGC, I propose to designate this gene Cucumber green mottle mosaic virus resistance, symbol Cgm.

This is to my knowledge the first validly described gene in C. anguria. Earlier Meeuse (7) referred to the dominant gene for bitterness in subspecies longipes, in part on unpublished segregation data by Rehm. A similar genetical analysis, as presented above, was also attempted with Cgm resistant C. zeyheri Sond. (2x), but, until now, segregations have been inconclusive. It is also yet to be established whether the resistances in both species are identical or not.

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7. Meeuse, A. D. J. 1958. The possible origin of Cucumis anguria L. Blumea Suppl. IV:196-205.

Table 1. Distribution of plants and chi-square analysis of resistance in Cgm in crosses between C. anguria and C. myriocarpus

Type of Cross	Number of Families	Number of Plants Susceptibile	Number of Plants Resistant	Tested Ratio	p-value
(a x m)	4	0	42	0 : 1	
(a x m) ⊗	3	11	37	1 : 3	0.75
[(a x m)] ⊗ m	1	1	40	0 : 1	
[(a x m)] ⊗ a	1	0	9	0 : 1	
(a x m) ⊗⊗	1	2	11	1 : 3	0.42
(a x m) m	2	44	47	1 : 1	0.73
[(a x m)m] ⊗	2	2	9	1 : 3	0.53
[(a x m)m] m	2	24	24	1 : 1	1.00
(a x m) a	5	0	56	0 : 1	

28. Rectification of the Names of Certain Accessions of the IVT-Cucumis Collection

Varekamp, H. Q., D. L. Visser and A. P. M. den Nijs, Institute for Horticultural Plant Breeding (IVT), P. O. Box 16, Wageningen, The Netherlands.

During last summer we were fortunate enough to have the assistance of the Royal Botanic Gardens at Kew to check the taxonomic determinations of our Cucumis species collection. We found this necessary because doubts existed about the correct name for certain accessions used in breeding experiments. It concerns our conception of C. africanus L.f., which has led to confusion with certain forms of C. zeyheri Sond. owing to the variable fruit indumentum of the latter. Accession numbers that were determined by us as C. africanus invariably appeared to be the diploid form of C. zeyheri. All the other accessions of our collection, that had in the past been determined as C. zehyeri, were found to be tetraploid forms of this species. It has, therefore, been necessary to rename all the former C. africanus accessions as C. zeyheri Sond. 2X (2n = 24), while the tetraploid C. zeyheri accessions will be designated as C. zeyheri Sond. 4X (2n = 48). These two levels of ploidy were also distinguished by Dane, et. al. (1). The two forms show consistant morphological differences in the size and the indumentum of the fruits. The corrections for the accessions involved are given in Table 1. It follows that it will be necessary to change in previous reports of the IVT-Cucumis working group the name C. africanus L.f. into C. zeyheri Sond. These reports are listed in Table 2.

Meanwhile, further studies of our collection have turned up at least three accessions that correspond in the morphology of their fruits with the holotype of C. africanus L.f. cited by Jeffrey (3), which was examined in the Paris herbarium and also with specimens of this species in the Kew Harbarium that were annotated by Jeffrey. Unfortunately, we have been unable to procure seeds of PI 282 440, the C. africanus for which Deakin, et. al. (2), gave a description and a figure of the fruit.

We are indebted to the Royal Botanic Gardens at Kew for the loan of reference material of Cucumis specimens and to C. Jeffrey for generously putting his profound knowledge of the genus at our disposal.

Literature Cited

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2. Deakin, J. R., G. W. Bohn and T. W. Whitaker. 1971. Interspecific hybridization in Cucumis. Econ. Bot. 25:195-211.

3. Jeffrey, C. 1962. Notes on Cucurbitaceae, including a proposed new classification of the family. Kew Bull. 15:337-371.

Table 1. Accessions of C. zeyheri Sond. in the IVT Cucumis Species Collection

IVT Genebank nr.	Chrom. nr.	Origin
0162	24	Glasshouse Crops Research Institute, Littlehampton, U.K.
0181	24	H.B.[z], Montpellier or Nancy, France
0330	24	H.B., Coimbra, Portugal
1750	24	ZGK, Gatersleben, D.D.R.
1773	24	H.B., Izmir, Turkey
1780	24	H.B., Basel, Switzerland
1785	24	PI 203 974
1786	24	PI 274 036
1787	24	PI 299 569
1835	24	H.B., Salisbury, Zimbabwe
1969	24	H.B., Izmir, Turkey
2064	24	H.B., Salisbury, Zimbabwe
2065	24	Vavilov Institute, Leningrad, U.S.S.R.
2074	24	Vavilov Institute, Leningrad, U.S.S.R.
2148	24	H.B., Kosice, U.S.S.R.
1053	48	PI 299 572
1807	48	PI 299 570
1809	48	PI 409 732

[z] H.B. = Hortus Botanicas

Table 2. List of reports with accessions of C. africanus L.f. which must be considered C. zeyheri Sond. 2x

Custers, J. B. M. 1980. Proc. Eucarpia Meeting, Wageningen :50-55.

_____. 1981. Cucurbit Genetics Coop. Rpt. 4:48-49.

_____ and G. J. van Ee. 1981. Cucurbit Genetics Coop. Rpt. 3:50-51.

_____, A. P. M. den Nijs and A. W. Riepma. 1981. Cucurbit Genetics Coop. Rpt. 4:50-53.

Kho, Y. O., A. P. M. den Nijs and J. Franken. 1980. Cucurbit Genetics Coop. Rpt. 3:52-54.

_____. 1980. Euphytica 29:661-672.

Leeuwen, L. van and A. P. M. den Nijs. 1980. Cucurbit Genetics Coop. Rpt. 3:55-59.

Nijs, A. P. M. den, J. B. M. Custers and A. J. Kooistra. 1980. Cucurbit Genetics Coop. Rpt. 3:60-62.

_____ and E. Oost. 1980. Euphytica 29:267-271.

_____, D. L. Visser and J. B. M. Custers. 1981. Cucurbit Genetics Coop. Rpt. 4:58-60.

Oost, E. and A. P. M. den Nijs. 1979. Cucurbit Genetics Coop. Rpt. 2:43-44.

Visser, D. L., L. van Leeuwen and Y. O. Kho. 1980. Proc. Eucarpia Meeting, Wageningen :44-49.

_____ and A. P. M. den Nijs. 1980. Cucurbit Genetics Coop. Rpt. 3:68-74.

RESEARCH NOTES

VI. Special Report - Cucurbit Gene List Committee

Update of Cucurbit Gene List and Nomenclature Rules

In order to prevent confusion when genes of one species are transferred to another species, it is recommended that the same symbol not be used for different genes of compatible species. Interspecific crosses are being increasingly used, particularly in squash breeding programs. Therefore, the Cucurbit Gene List Committee proposes that the following rule be adopted to supplement previously published (HortScience 11:554-568, 1976) rules for nomenclature of cucurbit genes.

> The same symbol shall not be used for nonallelic genes of different *Cucurbita* species. Allelic genes of compatible species are designated with the same symbol for the locus.

Lists of known genes for the Cucurbitaceae have been published in HortScience 11:554-568, 1976, and Cucurbit Genetics Coop. Report 2:49-53, 1979. Since then, new genes have been reported in the literature, and some omissions of the previous lists have come to our attention. Following is a list of these genes:

Kind of Cucurbitaceae	Gene Symbol: Preferred	Gene Symbol: Synonym	Character	Reference
Citrullus lanatus	*Ar-2*[*]		*Anthracnose* race 2 resistance	20
	Fo[*]		Dominant gene for resistance to race 1 of *Fusarium oxysporum*	11
Cucumis anguria	*Cgm*		*Cucumber green mottle* resistance	13
Cucumis melo	*Fn*		*Flaccida necrosis*. Resistance to muskmelon yellow stunt virus	14, 16
	nsv		*necrotic spot virus* resistance	2
	Pa		*Pale* green foliage	9
	v-2		*virescent*-2	5
	Vat		*Virus aphid transmission* resistance	14
	Wmv		*Watermelon mosaic virus*-1 resistance	21

Kind of Cucurbitaceae	Gene Symbol Preferred	Gene Symbol Synonym	Character	Reference
Cucumis sativus	ap		apetalous male sterile	8
	bu		bush; shortened internodes	15
	dvl*	dl	divided leaf	12
	lh		long hypocotyl	17
	mp		multi-pistillate; several pistillate flowers per node, recessive to single pistillate flower per node	10
	ro		rosette; short internodes, muskmelon-like leaves	19
Cucurbita species	G*	(a,m)	Gynoecious sex expression in C. foetidissima	3, 7
	Gb*		Green band on inner side of base of petal; dominant to no band in C. pepo	4
	i		intensifier of the cr gene for cream flowers; derived from C. okeechobeensis	18
	I-T		Inhibitor of the T gene for trifluralin resistance in C. moschata	1
	lo	1	lobed leaves of C. maxima	6
	T		Trifluralin resistance in C. moschata; dominant to susceptibility to the herbicide; modified by I-T	1
	Ygp*		Yellow green placenta; dominant to yellow placental color in C. pepo	4

* Proposed new gene symbol

References

1. Adeoye, A. A. and D. P. Coyne. 1981. Inheritance of resistance to trifluralin toxicity in Cucurbita moschata Poir. HortScience 16:774-775.

2. Coudriet, D. L., A. N. Kishaba, and G. W. Bohn. 1981. Inheritance of resistance to muskmelon necrotic spot virus in a melon aphid-resistant breeding line of muskmelon. J. Amer. Soc. Hort. Sci. 106:709-791.

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13. den Nijs, A. P. M. 1982. Inheritance of resistance to cucumber green mottle virus (CGMV) in Cucumis anguria L. Cucurbit Genetics Coop. Rpt. 5:56-57.

14. Pitrat, M, H. Lecoq, and G. Risser. 1982. Vat and Fn, two linked genes in muskmelon. Cucurbit Genetics Coop. Rpt. 5:29-30.

15. Pyzhenkov, V. I. and G. A. Kosareva. 1981. A spontaneous mutant of the dwarf type. Bull. Appl. Bot., Genetics & Plant Breeding 69(2):15-21.

16. Risser, G., M. Pitrat, H. Lecoq, and J. Rode. 1981. Sensibilite varietale du melon (Cucumis melo L.) au virus du rabougrissement jaune du melon (MYSV) et a sa transmission par Aphis gossypii. Heredite de la reaction de fletrissement. Agronomie 1:835-838. (In French).

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18. Roe, N. E. and W. P. Bemis. 1977. Corolla color in Cucurbita. Jour. Hered. 68:193-194.

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20. Suvanprakorn, K. and J. D. Norton. 1980. Inheritance of resistance to anthracnose race 2 in watermelon. J. Amer. Soc. Hort. Sci. 105:862-865.

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

In order to prevent using the same symbol for two different genes, researchers are urged to consult this and the two previous gene lists before publishing a symbol for a new gene. Any questions concerning correct gene nomenclature may be directed to the gene list committee:

Cucurbit Gene List Committee

Cucumber:

T. C. Wehner, Department of Horticultural Science
North Carolina State University
Raleigh, NC 27650

Muskmelon:

J. D. McCreight, U. S. Department of Agriculture
P. O. Box 5098
Salinas, CA 93915

Watermelon:

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

Cucurbita spp.:

C. A. John, A. L. Castle, Inc.
24401 SW 197th Avenue
Homestead, FL 33031

Other Genera:

R. W. Robinson, Department of Seed & Vegetable Sciences
New York State Agricultural Experiment Station
Geneva, NY 14456

COVENANT AND

BY-LAWS OF THE

CUCURBIT GENETICS COOPERATIVE

ARTICLE I. Organization and Purposes

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

ARTICLE II. Membership and Dues

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

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

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

ARTICLE III. Committees

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

Approvals:

W. Bemis

J. D. Norton

R. W. Robinson

W. R. Henderson

M. L. Robbins

R. L. Lower

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

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

ARTICLE IV. Election and Appointment of Committees

1. The Chairman will serve an indefinite term while other members of the Coordinating Committee shall be elected for ten-year terms, replacement of a single retiring member taking place every other year. Election of a new member shall take place as follows: A Nominating Committee of three members shall be appointed by the Coordinating Committee. The aforesaid Nominating Committee shall nominate candidates for an anticipated opening on the Coordinating Committee, the number of nominees being at their discretion. The nominations shall be announced and election held by open ballot at the Annual Meeting of the CGC. The nominee receiving the highest number of votes shall be declared elected. The newly elected member shall take office immediately.

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

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

ARTICLE V. Publications

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

Approvals:

W. Bemis

J. D. Norton

R. W. Robinson

W. R. Henderson

M. L. Robbins

R. L. Lower

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

ARTICLE VI. Meetings

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

ARTICLE VII. Fiscal Year

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

ARTICLE VIII. Amendments

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

ARTICLE IX. General Prohibitions

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

1. The CGC shall be organized and operated exclusively for scientific and educational purposes.

2. No part of the net earnings of the CGC shall or may under any circumstances inure to the benefit of any individual.

3. No part of the activities of the CGC shall consist of carrying on propaganda or otherwise attempting to influence legislation of any political unit.

Approvals:

W. Bemis

J. H. Norton

R. W. Robinson

W. R. Henderson

M. L. Robbins

R. L. Lower

publishing or distribution of statements), any political campaign on behalf of a candidate for public office.

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

6. The CGC shall not:

   (a) lend any part of its income or corpus without the receipt of adequate security and a reasonable rate of interest to;

   (b) pay any compensation in excess of a reasonable allowance for salaries or other compensation for personal services rendered to;

   (c) make any part of its services available on a preferential basis to;

   (d) make any purchase of securities or any other property, for more than adequate consideration in money's worth from;

   (e) sell any securities or other property for less than adequate consideration in money or money's worth; or

   (f) engage in any other transactions which result in a substantial diversion of income or corpus to any officer, member of the Coordinating Committee, or substantial contributor to the CGC.

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

ARTICLE X. Distribution on Dissolution

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

W. Bemis
(Cucurbits sp.)

W. R. Henderson
(Watermelon)

J. D. Norton
(Muskmelon)

M. L. Robbins
(Cucumber)

R. W. Robinson
(Other genes and species)

R. L. Lower, Chairman

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