were classified as "male." If a plant aborted 1 or more floral buds prior to anthesis, it was classified as abortive. Chi-square analyses were used to test the segretation ratios and for linkage (4).

As expected from previous studies, sex type was conditioned by a single pair of genes (Table 1). Female tendency was completely dominant to male tendency. Discrete distributions of female (> 50% pistillate flowers) and male (< 20% pistillate flowers) types were obtained in the F_2 population when the pistillate to total flowers ratio was used as the classification criteria. Plants with 20-50% pistillate flowers were not observed in this population.

Flower bud abortion segregated as a single gene with abortion completely dominant to non-abortion (Table 1). The percentage of floral buds that aborted on plants classified as abortive ranged from 10 to 100%. Pistillate flowers tended to abort more readily than staminate flowers; however, many staminate flowers did abort. The adequate fit of the data to the expected 3:1 and 1:1 segretation ratios demonstrated that the character was controlled by a single gene; however, the variability in the percentage of floral buds that aborted suggested that modifier genes and/or environment may also affect the expression of this character. We have tentatively named this trait *f*lower *b*ud *a*bortion and assigned the gene symbol *Fba* to represent the abortive genotype.

Chi-square analyses of the F_2 and BC_2 populations showed that a linkage relationship existed between female tendency and *Fba* (Table 1). In the F_2 population, 15 crossover units were estimated between the 2 genes when the square root method was used and 14 crossover units when the product-ratio method was used. In the BC_2 population, the map distance between the genes was estimated at 22 units. When the F_2 and backcross methods were combined, we obtained an estimate of 18 units. All crossover values were based on coupling phase data since repulsion data were not available.

Flower bud abortion could have various genetic interpretations. The presence of crossover plants favors the linkage interpretation; however, the occurrence of these plants could have been due to incomplete penetrance. A pleiotropic interpretation could be made on the basis of similarities between "femaleness" and flower bud abortion including: 1) both sex expression and floral abortion are inherited identically, as single dominant factors, 2) both are on the same chromosome, 3) both characters are considered to be influenced by modifying and environmental factors, 4) both are associated with female sex expression, and 5) both affect floral development. Still another possible but unlikely interpretation is that *Fba* is not linked to *Acr*, but modifies and is expressed only in plants with the *Acr* allele. The objective interpretation of our data indicates that this abortive trait is inherited as a single gene closely linked to the *Acr* gene.

Table 1. Chi-square tests for segretation ratios and linkage between flower bud abortion and sex type.

Class[z]	No. of plants: MSU 713-5 P_1	$(P_1 \times F_1)$ BC_1	F_1	F_2	$(P_2 \times F_1)$ BC_2	MSU 0612 P_2
Female, abortive	39	90	11	87	24	0
Female, non-abortive	0	0	0	10	8	0
Male, abortive	0	0	0	6	7	0
Male, non-abortive	0	0	0	23	28	58
Total	39	90	11	126	67	58
Chi-square test						
Female vs. male				0.26(3:1)	0.13(1:1)	
Abortive vs. non-abortive				0.10(3:1)	0.37(1:1)	
Linkage				53.37**	20.43**	
Recombination fractions				0.15[y]	0.22	
				0.14[x]		

[z]Female = > 50% pistillate flowers; male = < 20% pistillate flowers.

[y]Based on square root method = 1.0-2 √ freq. of double recessive

[x]Based on product-ratio method = bc/ad.

**Significant at 1% level.

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Chilling Injury of 'Honey Dew' Muskmelons: Symptoms and Relation to Degree of Ripeness at Harvest[1]

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Abstract. **Chilling injury (CI) of 'Honey Dew' muskmelons (*Cucumis melo* L.) induced by 2½ weeks of storage at 0 or 2.5°C is characterized by a reddish-tan discoloration of the surface. Affected areas may be diffuse or discrete. CI was less severe at 2.5° than at 0°C and was absent at 5°C. The diffuse type of discoloration disappeared during 3 days at 20°C, particularly if the melons had reached full rather than only minimum horticultural maturity at harvest. Melons of minimum maturity accounted for 44% of the samples, but for 77% of those with CI.**

Symptoms of chilling injury (CI) of 'Honey Dew' melons were characterized by Wiant about 40 years ago (6). He, however, did not describe a decidedly pink sub-surface or surface discoloration which was observed in a recent shipment of 'Honey Dews' to Hong Kong (1) and which we now have identified as being a symptom of CI. This report will describe the symptom and note factors which influence its development.

'Honey Dew' was commercially harvested and packed into fiberboard boxes by various shippers in California's

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[2]Couture Farms, Bakersfield, CA and Pacific Farm Company, Firebaugh, CA furnished some of the melons used in these tests. James J. O'Grady, USDA, Fresno, assisted in various phases of this work.

Names of commercial products are used for identification and do not constitute an endorsement by the U. S. Department of Agriculture.

Central Valley during the 1975 and 1976 seasons. Storage at 0, 2.5 or 5°C commenced the day of harvest or the following day. In the latter case, the melons were held overnight at 10°. Since CI was nearly as prominent at 2.5° as at 0°, and since none occurred in the first 2 tests at 5°, only 2.5° was used in later tests. Prior to storage, each melon was weighed and rated for ripeness (2, 4), and any defects or peculiarities in appearance were recorded. The melons were commercial sizes "5" or "6" (no. melons/box) and ranged from about 1900 to 3100 g and from about 1400 to 2900 g, respectively. Initial degree of maturity ranged from Class 1 (minimum horticultural maturity) to Class 3 (ripe), with the majority in Class 1 or 1-2 (fully mature).

The melons were not gassed with ethylene, even though the practice is recommended for unripe melons (2), because it might complicate symptom development and because most 'Honey Dew' shipped overseas from California is not gassed with ethylene.

Four of the tests at 2.5°C included 12 boxes of melons, and 1 test included 9; the preliminary tests consisted of 2 boxes at each temp. Half of the melons were stored in unprotected fiberboard boxes and half in boxes that were covered with perforated polyethylene bags (about 12 holes 6 mm in diam per bag) to determine whether reduction in moisture loss might effect symptomology. Since data did not differ between boxes with and without bags they are not further distinguished.

All 'Honey Dew' melons were examined after they had been stored 16 to 19 days at the low temp, and again after 3 days at 20°C, so that any changes in appearance of individual melons could be evaluated.

Description of symptoms. CI was manifested most commonly by a reddish-tan discoloration of sub-surface or surface cells. Sub-surface discoloration generally preceded surface discoloration. In this mild stage of CI, the discoloration tended to be diffuse, whether confined to small areas or expanded over a substantial part of the surface. Upon transfer to 20°C the discoloration frequently intensified to a reddish-brown, and discrete, slightly sunken lesions developed. The lesions had irregular boundaries and covered areas that ranged from a few mm^2 to a quarter of the melon surface. The discoloration never was olive nor was there ever any leakage of melon juice to the surface, as observed by Wiant (6). The symptoms were slightly less prominent at 2.5° than at 0°C and were absent at 5° (Fig. 1), an observation similar to that of Wiant. The substantial incidence of decay often associated with severe chilling injury did not occur in any of the tests. I attribute the difference in symptoms between the earlier and current tests primarily to the difference in storage periods, 2½ vs. 4 weeks.

Remission of symptoms. Symptoms of CI often become visible only upon removal of the product to a moderate temp, and if symptoms develop at low temp, they generally intensify at non-chilling temp (3, 5). However, the diffuse reddish-tan discoloration induced by holding 'Honey Dew' at a chilling temp had disappeared completely in some of the melons after they had been held 3 days at 20°C. This remission occurred repeatedly in fruit in which the diffuse patches or the entire surface were the characteristic reddish-tan. However, sharply outlined or sunken lesions always persisted and usually became more intense when the melons were held at 20°C.

Influence of maturity. Remission of the visible symptoms of CI was more common in melons that were in maturity Class 1-2 at harvest than on those in Class 1. In the latter, remission usually occurred only when the symptoms were faint. Melons of Class 2 rarely showed any symptoms of CI, and riper melons never did. This relationship suggested that degree of maturity at harvest substantially influences the susceptibility of 'Honey Dew' to CI, which is also true of other chilling-sensitive fruits (3, 5). Consequently, I compared the proportion of 'Honey Dew' of maturity Class 1 in the samples with the proportion of melons that showed CI. In the 5 tests at 2.5°C, 44% of the melons were maturity Class 1 at harvest, but they accounted for 77% of the melons with CI. The difference between these 2 percentages is the excess attributed to maturity Class 1 (difference of 33% sig. *P,* 2% level). This high susceptibility of maturity Class 1 'Honey Dew' to CI argues against shipping this class of melon long distances when chilling temp may occur. Under such conditions, the danger of CI would be added to the generally inferior dessert quality characteristic of such melons, even in an environment faborable for ripening (4).

Unfortunately, no objective method has been developed for a sure, quick and non-destructive measurement of maturity of 'Honey Dew' melons. Thus, under commercial conditions, maturity Class 1 melons will be shipped either intentionally or inadvertently, so great care must be taken to avoid exposing them to temp below 5°C if even the relatively mild symptoms of CI described here are to be prevented during transit of 2 weeks or more.

Fig. 1. 'Honey Dew' melons stored 17 days at 2.5° (left) or 5° (right) and then held 3 days at 20°. Melons from 2.5° have reddish-tan patches typical of CI; melons from 5° are free of CI. All melons turned to show their worst side.

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