

# Special Report

## Disorders in Muskmelon Shipments to the New York Market, 1972-1984

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Consumption of muskmelon (*Cucumis melo* L.), a summer favorite, exceeds that of table grapes, pears, and any stone fruit (7). During 1980-1984, about 96,000 t of muskmelons were delivered annually to the New York market (7,8). Cantaloupe (*C. melo* var. *reticulatus* Naud.) accounted for about 66,000 t, placing it in the top 10 volume leaders of fresh fruits and vegetables on the market (7); honeydew (*C. melo* var. *inodorus* Naud.) accounted for about 25,000 t, and crenshaw, casaba, Persian, and Spanish melons, for most of the remaining 5,000 t. California supplied about 65% of the muskmelons; Mexico, 11%; Texas, 7%; Arizona, 5%; and Puerto Rico and Central and South America, the remainder.

This report is another in a series on the arrival condition of major fresh produce crops on the New York market (1,3,4) and was prepared from a computerized data bank containing pertinent information abstracted from more than 125,000 fresh fruit and vegetable inspection certificates provided by the U.S. Department of Agriculture Fresh Products Branch of the Agricultural Marketing Service. During 1972-1984, USDA personnel inspected 12,275 muskmelon shipments consisting of more than 10.6 million cartons or wooden crates (Table 1), the containers for cantaloupe weighing 16.3-18.1 kg and those for the other melons, about 14 kg. These shipments represented

about 15% of all muskmelon deliveries to the New York market during the 13-year period (7,8). More than 90% of the inspections were of cantaloupe (72%) and honeydew (21%). Typically, at least six packs (cartons or crates) of a shipment were inspected; more were examined when considered necessary or requested by the shipper or receiver.

USDA inspectors, trained to diagnose disorders by symptomatology, identified 16, using common designations for 12 and descriptive terms for four (Table 2). The most frequent were Fusarium rot (*Fusarium* spp.), Cladosporium rot (*Cladosporium cucumerinum*), bacterial soft rot (*Erwinia* spp.), unidentified decays, and Rhizopus soft rot (*Rhizopus* spp.). Fusarium rot was reported most often in cantaloupes and Cladosporium rot, in honeydew and other melons. Alternaria rot is easily confused with Cladosporium rot and probably accounted for a substantial proportion of the unusually large number of Cladosporium rot reports.

The descriptive terms unidentified decays, surface molds, sunken or pitted lesions, and brown discoloration suggest parasitic or abiotic diseases. Symptoms only partially developed, low disease incidences that met grade tolerances, and unfamiliar diseases could explain the large number of unidentified decays reported. *Geotrichum candidum*, the fungus associated with sour rot of melons (2) and other produce, probably caused some decays, and fungi that cause rots, mainly *Fusarium* and *Alternaria* spp., also may have been involved in surface molds. Excessive moisture or high humidities during

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**Table 1.** Load volumes of muskmelons inspected by USDA on the New York market, 1972-1984

Year	Cantaloupe		Honeydew		Other <sup>a</sup>	
	Shipments (no.)	Packs (no.)	Shipments (no.)	Packs (no.)	Shipments (no.)	Packs (no.)
1972	1,710	1,052,355	533	638,765	177	122,191
1973	904	633,379	293	345,711	40	20,100
1974	625	501,383	207	281,107	28	21,869
1975	530	513,737	137	176,418	148	150,471
1976	681	525,395	185	239,628	1	970
1977	565	466,522	185	260,187	24	28,895
1978	377	321,215	64	80,490	78	92,274
1979	385	362,166	84	101,006	58	43,029
1980	397	364,148	96	102,785	20	9,487
1981	211	146,607	80	72,983	7	3,033
1982	399	294,760	144	122,009	51	22,213
1983	1,016	947,238	262	261,546	118	46,160
1984	1,055	930,887	370	364,502	30	10,923
<b>Total</b>	<b>8,855</b>	<b>7,059,792</b>	<b>2,640</b>	<b>3,047,137</b>	<b>780</b>	<b>571,615</b>

<sup>a</sup>Principally crenshaw, casaba, Persian, and Spanish melons.

transit encourage fungal growth on cantaloupe, and hydrocooling or application of crushed ice to the top of a load contributes to a moist environment. Damage is greatly mitigated when melons are exposed to a drier environment, e.g., after top ice is gone or after unloading. Sunken or pitted lesions, often discolored, may be manifestations of chilling injury (10). The cause of brown discoloration is not known. USDA inspectors reported brown discoloration of honeydew to be generally firm and superficial and usually confined to the rind. Preliminary investigations indicate that chilling injury may be

responsible in some instances; gray surface areas and reddish tan discolorations have been associated with chilling of honeydew (6). Some brown discoloration may result from bacterial activity. A current study (9) identifies *Erwinia ananas* as the causal organism of bacterial brown stain, first reported recently on South American honeydew (5).

Of the inspected cantaloupe shipments, 98% came from California, Mexico, Arizona, and Texas; Table 3 lists the principal diseases reported in inspections of shipments from these areas. Fusarium rot, the most prevalent disease, was often distinguished by a purplish discoloration of the flesh at the stem end or by cracked or sunken lesions sometimes covered by white or pinkish mycelium. Cladosporium rot (sometimes called slip rot because the stem scar is usually infected) and bacterial soft rot also caused major damage. Black rot (*Mycosphaerella citrullina*), reported in a few shipments from each growing area, is seldom found on cantaloupe and may have been misapplied to rots actually caused by *Alternaria* spp.

Brown discoloration was reported most often on honeydew and was found in about one-third of such shipments (Table 4). Cladosporium rot, characterized chiefly by smooth, shiny black lesions, was the most frequently reported parasitic disease, followed, in descending order, by Fusarium rot, bacterial soft rot, unidentified decays, and Rhizopus soft rot. Reports of Alternaria rot, black rot, and gray mold rot (*Botrytis cinerea*) were comparatively few.

Diseases other than those commonly found in cantaloupe and honeydew shipments were reported in shipments of crenshaw, casaba, Persian, Spanish, and other miscellaneous melons (Table 5). Stem-end rot (*Diplodia natalensis*), anthracnose (*Colletotrichum lagenarium*), blossom-end rot, and Phytophthora rot (*Phytophthora* spp.) were reported in shipments from Florida, and one or more were also found in shipments from Mexico and Texas. In California shipments, disorders were similar to those reported for cantaloupes.

The frequencies of disorders in cantaloupe and honeydew shipments from California are shown in Table 6. Fusarium rot, Cladosporium rot, and bacterial and Rhizopus soft rots were

**Table 2.** Diseases and occurrences reported in USDA inspections of 12,275 muskmelon shipments on the New York market, 1972-1984

Disease	Cantaloupe (8,855 shipments)	Honeydew (2,640 shipments)	Other <sup>a</sup> (780 shipments)
Fusarium rot	3,367	260	118
Cladosporium rot	2,717	483	181
Bacterial soft rot	1,930	207	83
Unidentified decays	1,524	191	73
Rhizopus soft rot	207	81	42
Alternaria rot	16	12	11
Stem-end rot	1	1	44
Black rot	27	3	0
Blue mold rot	1	14	4
Blossom-end rot	0	0	20
Gray mold rot	8	7	3
Anthraco nose	0	2	26
Phytophthora rot	0	0	8
Surface molds	140	0	3
Brown discoloration	16	891	25
Sunken or pitted lesions	256	99	16

<sup>a</sup>Principally crenshaw, casaba, Persian, and Spanish melons.

**Table 3.** Principal diseases reported in USDA inspections of 8,682<sup>a</sup> cantaloupe shipments on the New York market from main sources of supply, 1972-1984

Source	No. of shipments	Diseases and percentage of shipments affected									Sunken or pitted lesions
		Fusarium rot	Cladosporium rot	Bacterial soft rot	Unidentified decays	Rhizopus soft rot	Black rot	Alternaria rot	Surface molds		
California	6,401	35.9	27.5	20.5	19.4	2.1	0.2	0.1	1.1	3.2	
Mexico	1,154	35.4	36.9	27.1	14.5	2.7	0.7	0.2	2.9	1.3	
Arizona	587	53.3	31.0	26.4	9.5	1.5	0.2	0	1.0	1.2	
Texas	540	51.1	51.1	22.6	7.6	2.4	1.1	0.7	5.7	2.2	

<sup>a</sup>Representing 98% of total 8,855 cantaloupe shipments.

**Table 4.** Principal diseases reported in USDA inspections of 2,501<sup>a</sup> honeydew shipments on the New York market from main sources of supply, 1972-1984

Source	No. of shipments	Diseases and percentage of shipments affected									
		Brown discoloration	Cladosporium rot	Fusarium rot	Bacterial soft rot	Unidentified decays	Rhizopus soft rot	Alternaria rot	Black rot	Gray mold rot	Sunken or pitted lesions
California	1,880	30.5	14.1	8.0	6.4	6.9	2.2	0.4	0.1	0.2	3.0
Texas	263	30.8	25.1	15.2	9.5	8.7	3.4	1.1	0	0.4	3.8
Puerto Rico	140	52.8	45.7	6.4	17.1	5.0	6.4	0.7	0	0	11.4
Mexico	87	41.4	11.5	21.8	12.6	12.6	6.9	0	0	2.3	1.1
Arizona	80	55.0	22.5	5.0	6.2	5.0	1.2	0	1.2	0	12.5
Chile	51	43.1	31.4	17.6	11.8	3.9	2.0	0	0	2.0	3.9

<sup>a</sup>Representing 95% of total 2,640 honeydew shipments.

**Table 5.** Principal diseases reported in USDA inspections of miscellaneous muskmelon<sup>a</sup> shipments on the New York market from main sources of supply, 1972–1984

Source	No. of shipments	Diseases and percentage of shipments affected											
		Clado- sporium rot	Fusarium rot	Bacterial soft rot	Unidentified decays	Rhizopus soft rot	Alternaria rot	Stem-end rot	Anthrax- nose	Blossom-end rot	Gray mold rot	Phytophthora rot	Sunken or pitted lesions
California	570	26.8	15.4	10.2	10.0	4.9	1.1	0.8	0	0	0	0	2.3
Mexico	51	7.8	15.7	11.8	5.9	11.8	2.0	3.9	5.8	2.0	2.0	0	2.0
Florida	43	4.7	0	0	0	2.3	0	76.7	20.7	25.6	0	18.8	0
Arizona	42	42.9	21.4	19.0	7.1	7.1	4.8	0	0	0	4.8	0	4.8
Texas	30	3.3	14.3	20.0	16.7	0	0	6.7	14.3	0	0	0	0

<sup>a</sup> Principally crenshaw, casaba, Persian, and Spanish melons.

**Table 6.** Frequency of diseases reported in USDA inspections of 6,401 cantaloupe and 1,880 honeydew shipments from California on the New York market, 1972–1874

Disease and crop	Number of shipments affected according to incidence class (% melons)											
	0	1	2–5	6–10	11–15	16–20	21–25	26–33	34–50	51–75	>75	
<b>Fusarium rot</b>												
Cantaloupe	4,104	58	1,127	743	214	68	31	26	24	1	5	
Honeydew	1,729	3	89	41	5	7	1	3	1	0	1	
<b>Cladosporium rot</b>												
Cantaloupe	4,638	18	573	619	247	122	50	43	50	18	23	
Honeydew	1,614	0	97	108	29	13	10	4	2	1	2	
<b>Bacterial soft rot</b>												
Cantaloupe	5,091	48	643	421	102	38	14	17	16	3	8	
Honeydew	1,760	8	50	35	10	9	2	1	4	0	1	
<b>Unidentified decays</b>												
Cantaloupe	5,169	823	396	7	5	1	0	0	0	0	0	
Honeydew	1,751	107	20	2	0	0	0	0	0	0	0	
<b>Rhizopus soft rot</b>												
Cantaloupe	6,265	4	57	29	9	12	4	8	5	4	4	
Honeydew	1,839	0	11	17	5	3	1	2	1	1	0	
<b>Surface molds</b>												
Cantaloupe	6,332	4	25	24	8	4	0	1	2	0	1	
Honeydew	1,880	0	0	0	0	0	0	0	0	0	0	
<b>Brown discoloration</b>												
Cantaloupe	6,395	0	4	0	0	2	0	0	0	0	0	
Honeydew	1,307	12	138	157	118	61	32	30	17	5	3	
<b>Sunken or pitted lesions</b>												
Cantaloupe	6,199	18	120	53	9	1	1	0	0	0	0	
Honeydew	1,824	2	7	15	11	8	2	6	5	0	0	
<b>Miscellaneous rots<sup>a</sup></b>												
Cantaloupe	6,374	2	12	6	1	0	3	0	1	2	0	
Honeydew	1,863	0	4	9	3	1	0	0	0	0	0	

<sup>a</sup> On cantaloupe: black rot, 12; Alternaria rot, 7; gray mold rot, 7; stem-end rot, 1. On honeydew: blue mold rot, 7; Alternaria rot, 7; anthracnose, 2; black rot, 1.

most frequent in cantaloupe shipments and were not as prevalent or as commercially damaging in honeydew.

We acknowledge that the information in this report does not represent the arrival condition of all muskmelon shipments to the New York market. Most of the shipments that were inspected were affected by malfunctioning of protective service equipment or by transit delays or did not meet the quality standards of receivers. However, trained USDA personnel inspected more than 12,000 shipments and, despite some questionable identifications of diseases, did provide a fairly accurate appraisal of disease problems in the marketing of muskmelons. This report should provide a stimulus for investigating serious problems that are identified only by descriptive terms and for which causes have not been defined, e.g., sunken or pitted lesions and brown discoloration. We believe a more concerted production and marketing research effort would improve market quality and reduce physical losses.

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#### LITERATURE CITED

- Cappellini, R. A., Ceponis, M. J., Wells, J. M., and Lightner, G. W. 1984. Disorders in potato shipments to the New York market, 1972–1980. *Plant Dis.* 68:1018-1020.
- Ceponis, M. J. 1966. Occurrences of *Geotrichum candidum* in western melons on the New York market. *Plant Dis. Rep.* 50:222-224.
- Ceponis, M. J., Cappellini, R. A., and Lightner, G. W. 1985. Disorders in crisphead lettuce shipments to the New York market, 1972–1984. *Plant Dis.* 69:1016-1020.
- Ceponis, M. J., Cappellini, R. A., and Lightner, G. W. 1986. Disorders in tomato shipments to the New York market, 1972–1984. *Plant Dis.* 70:261-265.
- Ceponis, M. J., Wells, J. M., and Cappellini, R. A. 1985. Bacterial brown spot of 'Honey Dew' melons. *HortScience* 20:302-303.
- Lipton, W. J., and Mackey, B. E. 1984. Ethylene and low-temperature treatments of honeydew melons to facilitate long-distance shipping. *U.S. Dep. Agric. ARS-10*. 26 pp.
- United States Department of Agriculture. 1973–1982. Fresh fruit and vegetable unloads in eastern cities. *U.S. Dep. Agric. Agric. Mark. Serv. FVUS-1* (1972–1981).
- United States Department of Agriculture. 1983–1985. Fresh fruit and vegetable arrivals in eastern cities. *U.S. Dep. Agric. Agric. Mark. Serv. FVAS-1* (1982–1984).
- Wells, J. M., Sheng, W.-S., Ceponis, M. J., and Chen, T. A. 1986. Pathogenicity and characterization of strains of *Erwinia ananas* isolated from honeydew melons. *Phytopathology*. In press.
- Wiant, J. S. 1938. Market storage studies of honey dew melons and cantaloupes. *U.S. Dep. Agric. Tech. Bull.* 573. 47 pp.