screening tests of chemical deterrents

a progress report on tests to find a control for twig-feeding by *scolytus multistriatus* marsh

by arthur r. hastings & morton beroza

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Wanted — A Deterrent

DESPITE intensive research and zealous control efforts, the Dutch elm disease continues to kill valuable ornamental and wild elm trees over wide areas in the United States and Canada. Control of the disease at present is based on sanitation, the removal of dead and dying ornamental trees, and use of insecticides to kill the insects that carry the disease. The primary vector is the smaller European elm bark beetle, *Scolytus multistriatus* Marsh.

One possible way to prevent the disease would be to use a chemical deterrent that would discourage the insect from attacking the healthy tree. This is a progress report on screening tests to find a chemical deterrent that will deter the elm bark beetle from feeding on young twigs—in particular, the twig crotches which are attacked first. In these tests, 176 chemicals were tried.

Early research on chemical control of the elm bark beetle dealt with inorganic stomach-type and contact poisons. Felt and Bromley (1938) reported that lead arsenate prevented severe twig feeding but did not give sufficient control to prevent the disease. Whitten (1945), one of the first to report on the organic insecticides, found that DDT was much more effective than the older inorganic or botanical types. Becker (1949, 1950, 1954, and 1955), Doane (1958) and Al-Alwazi and Casida (1958) have reported on many of the newer insecticides as well as improved methods of application. Nielsen (1959) has reported very promising results from preliminary tests of a mistblower application of BHC (benzene hexachloride) and Aroclor 5460. So far, no materials or application techniques have proved more effective or economical than dormant applications of DDT with hydraulic or mistblower sprayers, so these are still recommended at present.

The first studies of repellents in connection with the elm bark beetle were aimed to prevent breeding of the insect in dead or dying trees and in logs (Whitten, 1942). Our study was a search for a way to prevent the disease by use of a chemical applied to living trees to prevent twig-crotch feeding by the beetle.

(Both the terms *repellent* (Dethier, 1947) and *deterrent* (Dethier et al., 1960) have been used and defined in such studies. We use deterrent to mean a substance that discourages the beetle from feeding or laying eggs in places where it ordinarily would do so.)

Our study was begun in 1958 in cooperation with the Pesticide Chemicals Research Branch, Entomology Research Division, Agricultural Research Service, U. S. Department of Agriculture, Beltsville, Md. The Synthesis Investigations Unit supplied the candidate chemicals for our tests. The first 176 chemicals were tested in the period July 1959 to September 1960.

Procedure and Method

Laboratory cultures of the smaller European elm bark beetle were maintained to supply beetles of known age for test purposes. The method of rearing has been described by Griswold (1942). Beetles were used for tests within 24 hours after their emergence from rearing chambers. No sex differentiation was made for these tests. Five beetles comprised a test lot.

Freshly cut elm twigs of 2- to 3-year-old growth were collected as required, cut in 4- to 5-inch lengths; and the cut ends were dipped in paraffin to prevent excessive drying during the test period. Ten twig crotches were used per replication.

The candidate chemicals were applied directly to these twigs in a spray chamber, which consisted of a plastic-lined fiber drum 20 inches in diameter and 36 inches deep. The spray nozzle was inserted through a 1-inch hole in the center of the cover.

The spray nozzle used was a modified Spraying Systems Co. pneumatic atomizing nozzle No. 2050 fluid body with a No. 67147 air nozzle. The modification consisted of a hole drilled into the mixing chamber (the normal liquid inlet opening was plugged). This direct access to the mixing chamber allowed total use of the small amounts of spray solution used in these tests.

The candidate chemicals were supplied in small quantities (usually 1-gram samples). A standard 10-percent solution was made with a suitable solvent. Three milliliters of solution were made up in a small vial, which was sealed with paraffin until used.

Two applications of the test solution—0.5 milliliters each—were used on each set of twigs. The prepared twigs were placed in wire mesh baskets (½ x ½ inch mesh) suspended 6 inches above the bottom of the chamber. After the first application, a 20-minute waiting period was allowed for the spray droplets to settle. The baskets were then removed, the twigs were turned over and returned to the chamber, and the second application was made. After another 20-minute settling period, the twigs were removed and placed in cages for the tests. Applications were made at 10 pounds pressure per square inch.

The cages used for the tests were constructed of fine mesh plastic screening. They were cylindrical in shape, approximately 5 inches high and 3 inches in diameter. The tops and bottoms were closed with Styrofoam (polystyrene foam) disks held in place with elastic bands.

Preliminary tests indicated that the optimum length of exposure would be 48 hours. After this period, little additional feeding took place and mortality of the beetles increased rapidly. Observations of the feeding activity were made at 4, 24, and 48 hours.

Three replications were used for each test material. Untreated checks were set up for each daily series of tests, using the same number of replications as the treated materials.

Evaluation

The effectiveness of each candidate chemical was judged by comparing the number of feeding scars on treated twigs at each observation period with the untreated checks. A provisional classification of effectiveness was made for each observation period, using the following designation and criteria.

Class A: 90-100 percent reduction in the number of feeding scars.

Class B: 50-89 percent reduction in the number of feeding scars.

Class C: 0-49 percent reduction in the number of feeding scars or an increase in the number of scars.

The final rating used, a numerical designation, was based on a consideration of the combined provisional ratings for the successive observational periods. The criteria for final ratings were as follows:

Class 4: Strong deterrence during the entire test period—all Class A.

Class 3: Deterrence during the entire test period — all Classes A and B.

Class 2: Deterrence only during the first 24-hour period—combinations of Class A or B and Class C in the last observation period.

Class 1: Ineffective—less than 50 percent reduction in the number of feeding scars or an increase in the number—all Class C (or rarely, a Class B or A in just one of the first two observation periods).

Naming and Listing of Chemicals

The chemicals are named and indexed alphabetically in table 1 in accordance with the Chemical Abstracts system. ENT numbers, which were assigned by the Entomology Research Division, are included to help locate the compounds listed here in other publications issued, or to be issued, by the U. S. Department of Agriculture. (0-numbers of the Agriculture Handbook No. 69 (King, 1954) are now called ENT-numbers.) To facilitate the location of ENT-numbers in table 1, they are listed in table 2 in ascending order along with corresponding item numbers (order of listing in table 1).

Discussion and Results

In these tests, high mortality—particularly during the early hours of the test—affected the final class rating. None of the chemicals tested to date has shown a total or consistent deterrent action over the entire test period. In several cases—Ent. Nos. 5779, 20371, 20377, 22980, 32347, and 32437—the class rating (Class 3) may be more an expression of the toxicity of the chemical than a repellent or deterrent activity. In all these cases the mortality was greater than 50 percent.

With Ent. Nos. 262, 2484, 2638, 25151, and 25257, where mortality was less than 50 percent, the final rating may be a combined expression of toxicity and deterrence. Only Ent. No. 3916, rated as Class 3, caused no mortality; and this may be a true deterrent chemical.

Additional tests are being designed to try to separate the factor of toxicity from true repellence and deterrence.

Table 1. — *Chemicals tested, and their evaluation for deterrence and toxicity*

Item No.	ENT No.	Chemical name	Deterrence class	Mortality, in percent
1	2,484	Acetanilide, *N*-butyl-	3	13.3
2	18,690	Acetic acid, bromo-, phenethyl ester	1	66.6
3	18,930	Acetic acid, bromo-, 2-chloroethyl ester	1	53.3
4	21,696	Acetic acid, (*p-tert*-butylphenoxy)-, allyl ester	1	53.3
5	21,695	Acetic acid, (*p-tert*-butylphenoxy)-, isobutyl ester	1	95.3
6	21,461	Acetic acid, (*p-tert*-butylphenoxy)-, propyl ester	1	26.7
7	25,085	Acetic acid, thiodi-	1	40.0
8	575	Acetophenone	1	.0
9	25,258	Acetophenone, 2-chloro-3′,4′-dihydroxy-	2	6.7
10	25,259	Acetophenone, 4′-methoxy-2-(*p*-methoxyphenyl)-	1	.0
11	25,002	Acrylamide, *N-tert*-butyl-	1	6.7
12	25,102	Ammonium compound, *p*-chlorobenzyl dimethyl 2-{2-[*p*-(1,1,3,3-tetramethylbutyl)phenoxy] ethoxy}ethyl—chloride	1	.0
13	184	Anisole, 2,4-dinitro-	1	60.0
14	1,170	*p*-Anisyl alcohol	1	33.3
15	19,089	Benzamide, *o*-ethoxy-*N*-isobutyl-	1	20.0
16	19,088	Benzamide, *o*-ethoxy-*N*-propyl-	1	46.7
17	20,297	Benzamide, *o*-ethoxy-*N*,*N*-diethyl-	1	40.0
18	19,083	Benzamide, *o*-ethoxy-*N*,*N*-dipropyl-	1	.0
19	50	Benzene, *p*-dichloro-	1	.0
20	25,182	Benzene, 1,2,4,5-tetramethyl-	1	46.7
21	523	Benzoic acid, benzyl ester	1	40.0
22	19,074	Benzoic acid, *o*-ethoxy-, 2-methoxyethyl ester	2	13.3
23	25,249	Benzoic acid, *p*-amino-, ester with glycerol	1	40.0
24	20,362	Benzoic acid, *p*-ethoxy-, allyl ester	1	26.7
25	8,981	Bicyclo[2.2.1]hept-5-ene-2-methanol	1	.0
26	32,347	Bicyclo[2.2.1]hept-5-ene-2,3-dicarboximide, *N*-butyl-x-methyl-, (*cis-endo*)	3	80.0
27	32,341	Bicyclo[2.2.1]hept-5-ene-2,3-dicarboximide, *N*-ethyl-x-methyl-, (*cis-endo*)	1	66.6
28	32,352	Bicyclo[2.2.1]hept-5-ene-2,3-dicarboximide, *N*-hexyl-x-methyl-, (*cis-endo*)	1	20.0

Continued

Table 1. — Continued.

Item No.	ENT No.	Chemical name	Deterrence class	Mortality, in percent
29	32,349	Bicyclo[2.2.1]hept-5-ene-2,3-dicarboximide, *N*-isobutyl-x-methyl-, (*cis-endo*)	1	60.0
30	32,342	Bicyclo[2.2.1]hept-5-ene-2,3-dicarboximide, *N*-isopropyl-x-methyl-, (*cis-endo*)	1	20.0
31	1,000	Bicyclo[2.2.1]hept-5-ene-2,3-dicarboximide, *N*-pentyl-	1	40.0
32	32,350	Bicyclo[2.2.1]hept-5-ene-2,3-dicarboximide, *N*-*sec*-butyl-x-methyl-, (*cis-endo*)	1	53.3
33	8,184-a	Bicyclo[2.2.1]hept-5-ene-2,3-dicarboximide, *N*-2-ethylhexyl-	1	60.0
34	32,354	Bicyclo[2.2.1]hept-5-ene-2,3-dicarboximide, *N*-(2-ethylhexyl)-x-methyl-, (*cis-endo*)	1	53.3
35	32,437	Bicyclo[2.2.1]hept-5-ene-2,3-dicarboximide, x, *N*-dimethyl-	3	73.3
36	32,442	Bicyclo[2.2.1]hept-5-ene-2,3-dicarboximide, x-methyl-*N*-propyl-, (*cis-endo*)	1	40.0
37	3,916	Bicyclo[2.2.1]hept-5-ene-2,3-dicarboxylic acid, *cis*-, dimethyl ester	3	.0
38	25,262	Butane, 2-bromo-	1	.0
39	25,144	2-Butanone, 3-hydroxy-3-phenyl-	1	20.0
40	25,355-X	Butyraldehyde, 3-methoxy- (50% in methanol)	1	26.7
41	25,336	Butyraldehyde, 3-methoxy-, dimethyl acetal	1	6.7
42	31,416	Butyramide, *N*-butyl-3-methyl-	1	53.3
43	1,775	Camphene	1	73.3
44	1,698	*d*-Camphor	1	60.0
45	25,031	Carbamic acid, per-, dimethyltrithio-, *tert*-butyl ester	1	53.3
46	20,453	Chrysanthemumic acid	1	33.3
47	20,888	Chrysanthemumic anhydride	2	33.3
48	25,338	Cinnamamide, *N*,*N*-diethyl-*p*-methoxy-	1	.0
49	2,026	Cinnamic acid, isopropyl ester	1	40.0
50	2,024	Cinnamic acid, propyl ester	1	33.3
51	203	Citronellal	1	100.0
52	20,013	*o*-Cresol, 4-*tert*-butyl-, acetate	1	40.0
53	19,909	Crotonic acid, 1-ethylpentyl ester	1	26.7
54	19,908	Crotonic acid, 2-methylpentyl ester	2	80.0
55	19,822	Crotonic acid, tetrahydro-2-furfuryl ester	1	60.0

Continued

Table 1. — Continued.

Item No.	ENT No.	Chemical name	Deterrence class	Mortality, in percent
56	25,333	Crotonic acid, vinyl ester	1	66.6
57	31,658	Cyclohexanecarboxamide, (4 or 5)-chloro-*N*,*N*-diethyl-2-methyl-	2	86.7
58	25,314	Cyclohexanecarboxylic acid, 4,5-epoxy-2-methyl-,4,5-epoxy-2-methylcyclohexylmethyl ester	1	53.3
59	25,140	Cyclohexanol, 1-vinyl-	2	13.3
60	2,133	Cyclohexanol, 2-phenyl-	1	6.7
61	25,180	Cyclohexanol, 4,4′-isopropylidenedi-	2	60.0
62	25,153	2-Cyclohexanol, 1,1′-ethynylenebis [3,5,5-trimethyl-	1	6.7
63	21,756	Cyclopentanecarboxylic acid, 2-oxo-, 2-chloroethyl ester	2	33.3
64	25,264	Cyclopentanol	1	.0
65	25,148	Cyclopentanol, 1,1′-ethynylenedi-	2	.0
66	25,651	Confidential	1	20.0
67	25,030-X	Confidential Phillips 293	1	40.0
68	17,596	4a(4H)-Dibenzofurancarboxaldehyde, 1,5*a*,6,9,9*a*,9*b*-hexahydro-	1	60.0
69	25,032	Dibutylamine, *N*-methylsulfinyl-	1	20.0
70	5,533	*m*-Dioxane, 4-(*p*-methoxyphenyl)-5-methyl-	1	20.0
71	25,310	1,3-Dioxolane, 2-ethyl-2-methyl-	2	46.7
72	25,361	Dipropylamine, 3,3′-diamino-	1	33.3
73	25,362	Dipropylamine, 3,3′-diamino-*N*-methyl-	1	13.3
74	25,309	Ethanol, 2-(2-methylpentyloxy)-	1	26.7
75	2,145	Ethanol, 2-phenoxy-, acetate	1	73.3
76	25,334	Ether, butadienyl methyl	1	33.3
77	14,249	Fencholic acid	1	6.7
78	18,814	Formamide, *N*-heptyl-	1	53.3
79	25,141	Furan, tetrahydro-2,2,5,5-tetramethyl-	1	6.7
80	25,060	Furan, 2,5-diethoxytetrahydro-	1	6.7
81	15,541	Glutarimide, 3-[2-(3,5-dimethyl-2-oxocyclohexyl)-2-hydroxyethyl]-(Acti-dione)	1	93.3
82	26,084-a	Glutarimide, 3-[2-(3,5-dimethyl-2-oxocyclohexyl)-2-hydroxyethyl]-, acetate	1	66.6
83	26,259	Glutarimide, 3-[2-(3,5-dimethyl-2-oxocyclohexyl)-2-hydroxyethyl]-, acetoacetate	1	33.3
84	26,261	Glutarimide, 3-[2-(3,5-dimethyl-2-oxocyclohexyl)-2-hydroxyethyl]-, 2-methylhydrazone	1	53.3

Continued

Table 1. — Continued.

Item No.	ENT No.	Chemical name	Deterrence class	Mortality, in percent
85	26,258	Glutarimide, 3-[2-(3,5-dimethyl-2-oxocyclohexyl)-2-hydroxyethyl]-, 2-oxime	1	66.6
86	26,260	Glutarimide, 3-[2-(3,5-dimethyl-2-oxocyclohexyl)-2-hydroxyethyl]-, 2-semicarbazido-	1	60.0
87	26,262	Glutarimide, 3-[2-(3,5-dimethyl-2-oxocyclohexyl)-2-hydroxyethyl]-, 2-thiosemicarbazido-	1	33.3
88	30,744	Heptanoic acid, tetrahydro-2-furfuryl ester	1	26.7
89	25,311	1-Heptanol, 2-propyl-	1	46.7
90	25,312	Hexanal, 3-ethoxy-, diethyl acetal	1	40.0
91	375	1,3-Hexandediol, 2-ethyl-	2	6.7
92	25,142	1-Hexen-3-o1, 3,5-dimethyl-	1	20.0
93	25,151	3-Hexyne-2,5-diol, 2,5-bis (*p*-chlorophenyl)-	3	20.0
94	25,134	1-Hexyn-3-o1	1	13.3
95	9	1,4-Pyran-2-carboxylic acid,5,6-dihydro-6,6-dimethyl-4-oxo-, butyl ester (Indalone)	1	20.0
96	25,356-X	Isodecylamine (mixed isomers)	1	26.7
97	25,034	Isophthalonitrile	2	6.7
98	5,563	2-Naphthol, 1,2,3,4-tetrahydro-	1	80.0
99	25,054-X	Octane, 2,3-epoxy-, 85% (Mixture with 15% 1,2-isomer)	1	20.0
100	25,037	Octanoic acid, 3-hydroxy-, butyl ester	1	20.0
101	25,146	2,7-Octanediol, 2,7-dimethyl-	1	13.7
102	620	Oil, Sassafras	1	80.0
103	25,021	7-Oxabicyclo[4.1.0]heptane-3-carboxylic acid, 4-methyl-, *sec*-butyl ester	1	13.3
104	25,137	2-Pentanone, 3-hydroxy-3-methyl-	1	20.0
105	25,136	1-Penten-3-o1, 3-methyl-	1	6.7
106	25,135	1-Pentyn-3-o1, 4-methyl-	1	6.7
107	25,275	Phenol, 2,2′-methylene bis(4-ethyl-6-*tert*-butyl)-	2	20.0
108	25,000	Phenol, 2-ethoxy-5-propenyl-	1	.0
109	25,190	Phenol, 4-*tert*-butyl-2-*alpha*-methylbenzyl-	1	6.7
110	25,181	Phenol, 4,4′-isopropylidenebis (2,6-dichloro-)	2	20.0
111	25,260	Phthalamic acid, *N*-allyl-, methyl ester	2	6.7
112	262	Phthalic acid, dimethyl ester	4	40.0
113	283	Phthalic acid, dibutyl ester	1	6.7
114	2,418	Phthalimide, *N*-butyl-	1	40.0

Continued

Table 1. — Continued.

Item No.	ENT No.	Chemical name	Deterrence class	Mortality, in percent
115	2,417	Phthalimide, *N*-pentyl-	1	40.0
116	2,419	Phthalimide, *N-sec*-butyl-	1	40.0
117	25,263	*alpha*-Pipecoline	2	20.0
118	25,360	Piperazine, 1-methyl-	1	6.7
119	25,357	1-Piperazineëthanol	2	6.7
120	25,358	1,3-Propanediamine	2	33.3
121	3,775	1,3-Propanediol, 2-butyl-2-ethyl-	1	53.3
122	25,029	2-Propanol, 1-(octylthio)-	1	13.3
123	25,036	Propionaldehyde, 2,2,3-trichloro-	1	66.6
124	2,839	Propionamide, *N*-butyl-	1	26.7
125	22,973	Propionamide, *N*-butyl-2-methyl-	1	40.0
126	22,979	Propionamide, *N*-ethyl-2-methyl-	1	60.0
127	19,796	Propionamide, *N*-heptyl-	1	13.3
128	21,869	Propionamide, *N*-hexyl-2-methyl-	1	46.7
129	2,841	Propionamide, *N-sec*-butyl-	1	46.7
130	22,980	Propionamide, *N-sec*-butyl-2-methyl-	3	80.0
131	2,842	Propionamide, *N*,*N*-dibutyl-	1	46.7
132	2,833	Propionamide, *N*,*N*-diethyl-	2	73.3
133	22,983	Propionamide, *N*-2-dimethyl-	1	20.0
134	20,377	Propionamide, 2-ethoxy-*N*,*N*-dipentyl-	3	53.3
135	22,982	Propionamide, 2-methyl-*N*-octyl-	1	13.3
136	20,378	Propionamide, 3-ethoxy-*N*-ethyl-*N*-1-naphthyl-	2	33.3
137	5,779	Propionanilide, *N*-ethyl-	3	66.7
138	5,815	Propionanilide, *N*-methyl-	1	53.3
139	5,802	Propionanilide, *N*-pentyl-	1	33.3
140	12,030	Propionanilide, *N*-propyl-	2	73.3
141	2,638	Propionanilide, *N*-ethyl-2-methyl-	3	26.7
142	19,450	Propionic acid, 3-ethoxy-, phenethyl ester	1	20.0
143	19,456	Propionic acid, 3-ethoxy-, 1,3-butanediol diester	2	73.3
144	25,276	Propionic acid, 3,3′-thiodi-	2	.0
145	20,371	Pyruvaldehyde, diisopropyl acetal	3	93.3
146	25,352-X	2*H*-Pyran-3,3,5,5-(4*H*,6*H*)-tetramethanol, 4-hydroxy-	1	20.0
147	20,131	Sorbamide, *N*,*N*-diethyl-	1	33.3
148	14,851	Sorbic acid	1	46.7
149	21,792	Sorbic acid, allyl ester	1	13.3
150	5,089	Sorbic acid, butyl ester	1	60.0
151	11,732	Sorbic acid, ethyl ester	2	46.7
152	21,797	Sorbic acid, hexyl ester	1	40.0
153	21,774	Sorbic acid, isobutyl ester	1	40.0
154	21,773	Sorbic acid, isopropyl ester	2	60.0
155	21,776	Sorbic acid, isopentyl ester	1	40.0
156	30,202	Sorbic acid, methyl ester	1	46.7

Continued

Table 1. — Continued.

Item No.	ENT No.	Chemical name	Deterrence class	Mortality, in percent
157	21,775	Sorbic acid, pentyl ester	1	40.0
158	5,088	Sorbic acid, propyl ester	1	60.0
159	21,777	Sorbic acid, 2-chloroethyl ester	1	73.3
160	21,798	Sorbic acid, 2-ethylbutyl ester	1	26.7
161	6,168	Succinamic acid, *N,N*-diethyl-, propyl ester	1	20.0
162	31,674	Succinimide, *N*-hexyl-	1	20.0
163	25,354-X	Sucrose, diacetate hexaisobutyrate	2	6.7
164	25,028	Sulfoxide, octyl propyl	1	.0
165	25,025	Sulfoxide, *tert*-dodecyl 2-[2-(2-hydroxyethoxy) ethoxy]ethyl	1	66.6
166	25,026	Sulfoxide, 2-hydroxyethyl octyl	1	26.7
167	25,027	Sulfoxide, 3-chloropropyl octyl	1	53.3
168	25,257	*s*-Triazine, 2,4,6-(1*H*)-trione, 3,5-dichloro-	3	20.0
169	25,359-X	Triisooctylamine (mixed isomers)	1	6.7
170	30,126	*m*-Toluamide, *N,N*-dibutyl-	1	13.3
171	3,572	Tartaric acid, diisopropyl ester	1	86.7
172	21,987	*o*-Toluic acid, 2-(2-butoxyethoxy)ethyl ester	1	20.0
173	22,542-bh	*m*-Toluamide, *N,N*-diethyl- (95% meta)	2	100.0
174	25,152	7-Tetradecyne-6,9-diol, 6,9-diethyl-	1	13.3
175	25,024	Valeric acid, 5-hydroxy-, *delta*-lactone	1	6.7
176	25,033	*m*-Xylene, *alpha,alpha'*-diamine	1	20.0
Solvents tested for repellency				
		Acetone	1	.0
		Methanol	2	33.3
		Methyl ethyl ketone	1	.0

Table 2. — *Index to chemicals tested*

ENT No.	Item No.	ENT No.	Item No.	ENT No.	Item No.
9	95	375	91	1,698	44
50	19	523	21	1,775	43
184	13	575	8	2,024	50
203	51	620	102	2,026	49
262	112	1,000	31	2,133	60
283	113	1,170	14	2,145	75

Continued

Table 2. — Continued.

ENT No.	Item No.	ENT No.	Item No.	ENT No.	Item No.
2,417	115	20,377	134	25,136	105
2,418	114	20,378	136	25,137	104
2,419	116	20,453	46	25,140	59
2,484	1	20,888	47	25,141	79
2,638	141	21,461	6	25,142	92
2,833	132	21,695	5	25,144	39
2,839	124	21,696	4	25,146	101
2,841	129	21,756	63	25,148	65
2,842	131	21,773	154	25,151	93
3,572	171	21,774	153	25,152	174
3,775	121	21,775	157	25,153	62
3,916	37	21,776	155	25,180	61
5,088	158	21,777	159	25,181	110
5,089•	150	21,792	149	25,182	20
5,533	70	21,797	152	25,190	109
5,563	98	21,798	160	25,249	23
5,779	137	21,869	128	25,257	168
5,802	139	21,987	172	25,258	9
5,815	138	22,542-bh	173	25,259	10
6,168	161	22,973	125	25,260	111
8,184-a	33	22,979	126	25,262	38
8,981	25	22,980	130	25,263	117
11,732	151	22,982	135	25,264	64
12,030	140	22,983	133	25,275	107
14,249	77	25,000	108	25,276	144
14,851	148	25,002	11	25,309	74
15,541	81	25,021	103	25,310	71
17,596	68	25,024	175	25,311	89
18,690	2	25,025	165	25,312	90
18,814	78	25,026	166	25,314	58
18,930	3	25,027	167	25,333	56
19,074	22	25,028	164	25,334	76
19,083	18	25,029	122	25,336	41
19,088	16	25,030-X	67	25,338	48
19,089	15	25,031	45	25,352-X	146
19,450	142	25,032	69	25,354-X	163
19,456	143	25,033	176	25,355-X	40
19,796	127	25,034	97	25,356-X	96
19,822	55	25,036	123	25,357	119
19,908	54	25,037	100	25,358	120
19,909	53	25,054-X	99	25,359-X	169
20,013	52	25,060	80	25,360	118
20,131	147	25,085	7	25,361	22
20,297	17	25,102	12	25,362	73
20,362	24	25,134	94	25,651	66
20,371	145	25,135	106	26,084-a	82

Continued

Table 2. — Continued.

ENT No.	Item No.	ENT No.	Item No.	ENT No.	Item No.
26,258	85	30,744	88	32,349	29
26,259	83	31,416	42	32,350	32
26,260	86	31,658	57	32,352	28
26,261	84	31,674	162	32,354	34
26,262	87	32,341	27	32,437	35
30,126	170	32,342	30	32,442	36
30,202	156	32,347	26		

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