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THE EFFECTIVENESS OF THE TRAP TYPES AND LURES USED FOR MASS TRAPPING TO CONTROL CHERRY FRUIT FLY [*RHAGOLETIS CERASI* (L., 1758)] (DIPTERA: TEPHRITIDAE)

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ABSTRACT: Trapping experiments were carried out in Ankara and Çankırı Provinces, Turkey during 1998-2000. Several traps and trap combinations with different food attractants were used in mass trapping to control *Rhagoletis cerasi* L. The most effective trap combination was found to be the visual yellow sticky Rebell trap and slowly released ammonia capsule. It was concluded that for a successful mass trapping, hanging four of these trap combination per tree was sufficient. It was found that the effectiveness of mass trapping was 95.99-97.41% in cherry orchards.

KEYWORDS: *Rhagoletis cerasi*, cherry, lures, traps, mass trapping

Cherry [(*Prunus avium*) (Rosales: Rosaceae)] is one of the important fruit crops of Turkey. It has an important position in the Turkish economy so that it matures in early seasons and its production for domestic market and especially as an export product. According to 1999 statistics there are 12.550.000 cherry trees in Turkey (Anonymous, 2003).

Cherry fruit fly [*Rhagoletis cerasi* L. (Diptera: Tephritidae)] is a most serious pest of cherries in Europe and our country, because of its direct harm on the fruit. The larvae of the cherry fruit fly feed inside the fruit and causes severe economic losses. Pesticide is used to control adult cherry fruit fly in Turkey, and to protect cherry fruit spraying is carried out on adults. But since the farmer cannot establish adult emergence time or when to spray or because cherries mature after the rains pesticide spraying has to be done over and over again. Due to the existence of different varieties of cherry trees in orchards, pesticide remaining on the cherries cause a problem when spraying isn't properly timed. Thus this research was found necessary. Zümreoğlu and associates first tried out trapping activities against cherry fruit fly in 1987 in our country. Between 1988 and 1991 regions in Greece cherry fruit fly populations were found to follow Rebell yellow visual sticky traps (Katsoyannos et al., 1994). In 1993-94 in Italy various trap types and food types were researched against *R. cerasi*. (Casagrande et al., 1995) In Italy yellow visual sticky trap and ammonium carbonate combination traps were used to find out *R. cerasi* flying patterns. (Romani, 1999). Rebell traps were not used as monitors only but were successful in mass trapping studies. (Katsoyannos et al.,2000 a). In the fight against cherry fruit fly effective traps and trap combinations were researched for mass trapping, as an aid in the cherry fruit fly problem.

MATERIALS AND METHODS

Main material in the research is the cherry fruit fly (*Rhagoletis cerasi* L.). Aiding materials were a orchard with early, mid season and late cherry varieties, 15x20cm dimensioned Rebell yellow visual sticky trap (Swiss Federal Research Station for Arboriculture, Horticulture and Viticulture, Waedenswil, Switzerland) + ammonia salt lure capsules, fiberglass yellow visual sticky trap in 15x20cm dimensions + ammonia salt lure capsules, glass McPhail trap, 2% DiAmonnium sulphate luquid, Ammonia salt lure capsule, Tanglefoot adhesive (Tanglefoot Company, Grand Rapids, MI) and Formothion 336 g/l insecticide. Studies were done in orchard in the town of Çankırı. Varieties of cherries in the orchard that were used were Early Burlat early, 0900 agriculture, Vista and Blackcherry midseason, Yarımca, Napoleon, Van, Sapıkısa, Karabodur and Boing were used as late varieties. During the study here mass trapping was being done no spraying as done in the orchard. Traps were hung 1.5-2m high on thick branches that were mid center and outside the trees crown. In order to establish adult cherry flies 2 Rebell traps were hung around the orchard on 1st May. Monitor / Control traps were checked twice a day until the first mature fly was trapped and then they were checked once a week. Mass trapping techniques were done in accordance to Zümreoğlu and associates (1987) explanations, distance between traps being 15-20m, and 50m between blocks. After the trapping of the first adult the traps were checked once a week and numbers of male and female flies were noted down and the traps then were cleaned. New ones replaced yellow visual sticky traps that were very dirty. Ammonia salt lure capsules were changed once a month. Adults were sieved from the McPhail liquid traps, DiAmmonium phosphate liquid was changed after each weeks count. Traps were checked 3 more weeks after the last adult's appearance and then were collected. Finally the effective traps and trap combinations used in the control against *R.cerasi* were tried out in Eldivan district of Çankırı in 1998 in a orchard that was infected cherry fruit fly with 120 cherry trees. Traps and trap combinations used in this orchard are given as follows; Rebell yellow visual sticky trap, Rebell yellow visual sticky trap + ammonia salt lure capsule, Rebell cross trap, Fiberglass yellow visual sticky trap, Fiberglass yellow visual sticky trap+ammonia salt lure capsule, McPhail trap + 2% Di Ammonium phosphate (DAP).

Random trial blocks and ordered blocks were planned in 6 symbol and 3 repetitive. Results obtained from traps on mature flies were evaluated using ordered factorial variance analysis, different groups were evaluated using the "Duncan Test". To determine the best combination/tree number in the mass trapping of *R. cerasi* the most effective Rebell + ammonia salt lure capsule trap combination were used in Haymana district of Ankara in 1999. After the first adult was observed 3 traps/tree and 4 traps/tree was used in accordance to the "repetitive measurement" and Rebell trap+ammonia salt lure capsules combinations were placed in the orchard. Mass trapping studies were carried out in 3 orchard (mass trapping, pesticide spraying and control) which were infected with this pest, and each at least 100m from the other in Eldivan district of Çankırı in 1999-2000. Mass trapping, pesticides spraying were used in these control orchards. 4 Rebell traps + ammonia salt lure capsules combinations/tree were place after the observation of the first adult. Spraying in the orchard was applied in a week using insecticide according to plant protection technical instructions as first adult was spotted. Control orchard was kept in check using Rebell trap+ ammonia salt lure capsules combinations. Harvesting 500 random cherries from the counted trees form the 3 orchards did evaluations. The cherries were opened

and checked with binocular microscope and then put into 10% NaCl and the percentage of cherries with larvae were counted, and the data was used with Abbott to find percentile effect, variance analysis and Duncan test for different groups were used and the 3 characters were used in evaluations of larvae in the fruits.

RESULTS AND DISCUSSION

Table 1 contains effective trap and trap combinations for mass trappings of *R cerasi* used in the Eldivan district of Çankırı in 1988. As seen in the table Rebell type traps and trap combinations showed a good performance as of first adult captured to the last adult captured. Rebell trap + ammonia salt lure capsule trap combinations aced all the traps always had more flies comparatively (Table 1). Especially during the critical egg laying weeks of the fly (28 May, 4, 11 and 18 June) adults captured in Rebell trap+ ammonia salt lure capsule trap combinations and Rebell traps topped the trap lists, excluding Fiberglass yellow visual sticky trap+ ammonia salt lure capsule trap combination the other two were way back in the listings. As stressed by Katsoyannos (1996), he showed that Rebell type yellow visual sticky traps were more effective than yellow visual sticky traps when it came to mass trapping and control of *R. cerasi* populations. According to Katsoyannos (2000) more countries use the yellow visual sticky traps but none is as effective as the Rebell traps. Fiberglass yellow visual sticky traps + ammonium capsule trap combinations showed improved performance after 18 June cherry fly last egg laying period. But after this date it was noted that the fruits were sweet and the majority had darkened in color. It is inevitable that the use of these traps closed to and after harvesting cherry fruit will be infested with cherry fruit fly. As a fact Boller at al. (1998) showed that when the fruits were green or red they didn't require protection, *R cerasi* only laid eggs in cherries that were yellow or yellow with a pinkish tint. Glass McPhail trap + DAP trap combination didn't do well because visual aids played an important role in the trappings. Katsoyannos (2000 a) visual sensory information is an important factor in the laying of eggs of the *R. cerasi* on its host tree or fruit. Again the same researcher showed that Rebell traps and developed McPhail trap + ammonium acetate combinations were even more effective. It was noted that the difference in numbers of mature flies trapped using the Rebell traps and fiberglass yellow visual sticky traps was because of the wavelength of the yellow color on the traps. More flies were trapped using the Rebell cross traps because of their larger surface area. The addition of ammonium capsules showed increased effectiveness of the traps on either the Rebell traps or the Fiberglass yellow visual sticky traps. As a fact Nizamlıoğlu (1954), Katsoyannos et al. 2000 showed that ammonium compounds positively affected the cherry fruit fly. With all the data and statistics in mind Rebell + ammonium capsule trap combinations would be the best options for usage in mass trappings in the Central Anatolia region. Katsoyannos (2000) pointed out that Rebell trap +ammonium acetate combination against *R. cerasi* was the most effective. Katsoyannos (2000) pointed out that traps and trap combinations against *R cerasi* showed increased effects when ammonium acetate was used in the Rebell traps. Again Zümreoğlu et all. (1999) used traps and trap combinations against cherry fruit fly in İzmir and found that Rebell + ammonium phosphate combinations were most effective. Figure 1 shows the number of adult trapped during the all weeks. The differences between traps and number of flies trapped were found to be important, more adults were trapped with the Rebell + ammonia salt lure capsule trap combination and this has been shown on the

figure. In 1999 this trap was used using the 3 Rebell + ammonia salt lure capsule /tree and 4 Rebell + ammonia salt lure capsule/tree method in Haymana district in Ankara and the results are given in Table 2. From the table we can see that twice the number of *R cerasi* was caught using the 4 Rebell traps + ammonia salt lure capsule /tree method compared to the 3 Rebell traps + ammonia salt lure capsule /tree method and statistically this is an important difference. As a result in mass trapping technique of *R.cerasi* 4 Rebell + ammonia salt lure capsule trap combination as found to be the best option. According to Boller and Remund (1983) have suggested that depending on the *R.cerasi* population and tree size 2-7 units of visual traps would be sufficient and pesticide spraying wouldn't be necessary. Tezcan and Gülperçin (2000) used 15x20cm fiberglass yellow visual sticky trap in İzmir and Manisa districts ecologic orchard against *R. cerasi*, and when required they used 4 (2-7) trap units per tree for mass trappings. Orchards where mass trapping techniques were used showed larvae infested cherries at 0.26% sprayed orchard showed 0.20% and control orchard showed at 5.46%. After statistic evaluations it was noted that the difference was not important between mass trapping and spraying in orchard (Table 3). Çankırı and Eldivan districts *R cerasi* mass trapping results are given in table fifth orchards using mass trapping techniques had a 0.20% infestation and pesticide sprayed orchards had a 0.33% infestation where as control orchards had a 10.20% infestation rate (Table 3). Again infestation rates in mass trapping and pesticide sprayed orchards didn't have an important statistical value. When results from 1999 and 2000 were compared for the same garden 2 years consecutive mass trapping in the orchards showed a drop in infestation but the control orchards showed an increase in infestation percentages during that period. Boller (1980) used 3000 Rebell traps against *R cerasi* in a 850 cherry tree orchard in Switzerland for mass trapping studies, with this technique only 0.24% of the harvested fruits were infested. As a result the success of mass trapping in orchards depends on the timing of traps being hung and the number of traps, and the density of adult population being half or small.

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Table 1. Weekly data of adult *Rhagoletis cerasi* L. trapped using different traps and trap combinations Çankırı, Eldivan in 1998

Traps and Trap combinations	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
						Weeks					
Reball+ASL	0*A**c	11.Abc	72.3 Aa	84.0 Aa	106.3Aa	120.3Aa	98.0 Aa	71 Aa	12.3 Ab	3.0 Abc	0.3 Ac
Rebell	0 Ab	12 Aab	31.7 Ba	25.0 Bca	35.7 Ca	34.7 Ba	28.0 Ba	23.6 Ba	2.0 Abb	0.6 Ab	0 Ab
Rebell cross	0.3Aa	12.3 Ac	40.0Abb	34.0 Bb	58.7BCb	113.7Aa	36.0 Bb	37.0 Bb	6.3 Abc	0.6 Ac	0.3 Ac
Fiberglass+ASL	0 A c	0.3 Ac	26.0 Bb	25.3BCb	90.3ABa	75.7 Aa	108.0aA	76.3Aa	10.0ABBc	2.0 Ac	1.0 Ac
Fiberglass	0 A a	2.3 Aa	6.0 Ca	5.3 Cda	7.6 Da	3.6 Ca	4.3 Ca	0.6 Ca	0.3 Ba	0.3 Aa	0 Aa
Mcphail+DAP	0 A a	0 Aa	0.3 Ca	2.3 Da	1.0 Da	1.3 Ca	1.0 Ca	2.0 Ca	0 Ba	0 Aa	0 Aa

* Means within columns (capital) followed by the same latter are not significantly different (P<0.05; Duncan`s multiple range test).

** Means within rows (small) followed by the same latter are not significantly different (P<0.05; Duncan`s multiple range test).

Table 2. Trapping parameters Rebell traps + ammonia salt lure capsule trap combinations tested and number of mature *Rhagoletis cerasi* L. trapped   Ankara, Haymana in 1999

Parameters of Rebell+ASL combinations	Adults trapped with trap combinations	
	Mean± St.Error	Min-Max
4 Rebell+ASL/tree	86.7±14.0 a	4-306
3 Rebell+ASL/tree	43.4±13.2 b	5-232

Means within columns followed by the same latter are not significantly different

(P<0.05; Duncan's multiple range test).

Table 3. Effects found in mass trapping techniques used against *Rhagoletis cerasi* L. in Çankırı town Eldivan district in 1999 and 2000

Years	1999		2000	
Characters	Infected fruits (%) Mean± St.Error	Effect (%)	Infected fruits (%) Mean± St.Error	Effect (%)
Mass trapping orchard	0.26±0.11 a	95.99	0.20±0.10 a	97.38
Spraying orchard	0.20±0.60 a	96.11	0.33±0.12 a	94.81
Control orchard	5.46±0.60 b		10.20±0.13 b	

Means within columns followed by the same latter are not significantly different

(P<0.05; Duncan's multiple range test).
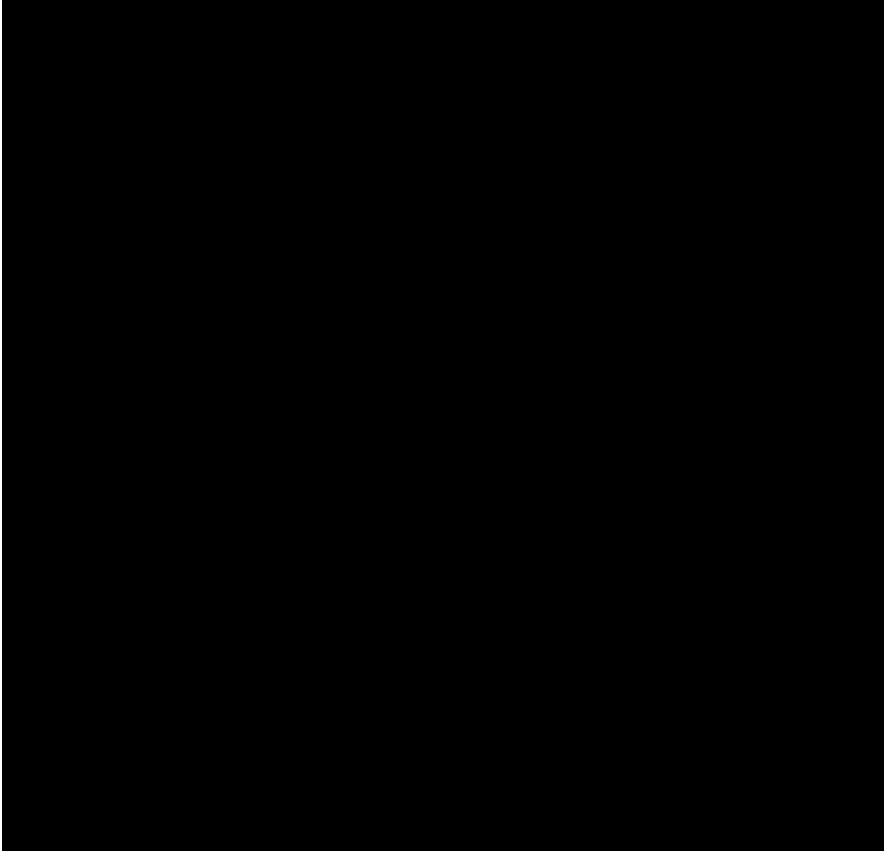
Figure 1. Number of adult *Rhagoletis cerasi* L. trapped using different traps and trap combinations in Çankırı Eldivan in 1998