



## DEVELOPMENT OF MEDFLY FEMALE ATTRACTANT SYSTEMS FOR TRAPPING IN SPAIN

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### Abstract

This report contains information from a four-year research programme co-ordinated by the International Atomic Energy Agency. The objective of the programme was to develop a trapping system for females of the Mediterranean fruit fly (medfly), *Ceratitis capitata* (Diptera: Tephritidae), for practical use in Sterile Insect Technique (SIT) programs and to design and evaluate a trap to obtain eggs from wild female medflies in order to estimate sterility induction in the field population. Spain (through INIA) participated in this programme because of interest in the control of medfly in this area of the Mediterranean. Citrus, peaches, plums, apricots and other subtropical fruits are some of the cultures which are severely attacked by this pest. To facilitate comparison of results, all the trials of 1994 - 97 were carried out in the same orchards. These orchards were located near the Malaga airport in the south of Spain on the Mediterranean coast. Female medfly attractants tested were three food based "female" attractants (FA-3), namely ammonium acetate (AA), 1,4 diaminobutane (putrescine) and trimethylamine, all formulated to last at least one month. These attractants were evaluated either in combinations of two (AA + putrescine, termed FA-2) or all three (termed FA-3). The attractants were tested in various traps including the plastic International Pheromone's McPhail traps (IPMT) and Tephri traps, a Spanish trap similar to the IPMT. Traps were used either as a dry trap (provided with DDVP) or a wet trap (provided with water and 0.01% surfactant). Jackson traps with Trimedlure (JT,TML), a routinely used male medfly trapping system, was also used. Based on the results of successive years, we can observe progress towards the project goals. In 1994, the development of the FA-2 attractants (P+AA) with their selectivity for female medflies was a significant effort towards reaching future goals. The synergism of trimethylamine with the FA-2 attractants, yielding the FA-3 attractants (P+AA+TMA), used with the new Tephri Trap produced very good results in 1996. There were no doubt about the results of the different traps and attractants in this year. At last, the experiment of 1997 demonstrated the efficiency of both traps (Tephri and IPMT) with or without water inside the trap. The choice of which trap to use will depend, perhaps, on the temperature or humidity of the local climate, but both always gave excellent results. We now have an excellent trap and attractant to capture medfly females to assure good control of the pest. Killing the first overwintering generation of medfly females by a mass trapping method will provide a powerful tool to avoid big populations in the summer and fall in countries with moderate climates.

### 1. INTRODUCTION

From 1986 to 1992, the JOINT FAO/IAEA Division, which has long been involved in medfly eradication and control activities in different regions, organized a co-ordinated research programme with the objective of standardizing the new and the most common medfly traps in several countries of Africa, Europe and Central America.

Spain (through INIA) participated in this programme because of interest in the control of medfly in this area of the Mediterranean. Citrus, peaches, plums, apricots and other subtropical fruits are some of the cultures which are severely attacked by this pest [1, 2, 3].

From these studies, the Trimedlure plug and NuLure were found to be the best attractants for males and females respectively and the International Pheromone's McPhail trap (IPMT) was the best of all traps tested [4].

In September 1993, the Joint FAO/IAEA Division offered a research contract to INIA to participate in the Co-ordinated Research Programme (CRP) "Development of Female Medfly Attractant Systems for Trapping and Sterility Assessment". The objective of this programme was to obtain data on the efficacy of new medfly female attractants (synthetic substances) and new traps supporting it. The development of a female trapping system for medflies would be a major step towards improving eradication and control technologies because it could be used to

monitor wild populations when used with the male-only strains currently employed in Sterile Insect Technique (SIT) programs. Also, a good female medfly attractant would give a great impulse to the mass trapping systems to control this noxious insect in the countries not involved in SIT programmes.

During the months of September - November of 1994 -1997, we carried out the experiments with the female attractants and traps that the Agency was proposing in yearly base protocols for all countries participating in this CRP.

Two Co-ordination Meetings were established by the Agency to evaluate the results obtained to date. The first was held in Antigua, Guatemala in May 1995. The action of a combination of putrescine and ammonium acetate (FA-2 attractants) against NuLure as control was discussed by the participants. The efficacy of a new dry trap, the Closed bottom dry trap or CBDT, was evaluated. For the next two years, the FA-2 attractants plus a third component, trimethylamine, (FA-3 attractants) were tested in a new trap, the Open bottom dry trap or OBDT, and in two other traps - Tephri Trap and Fructect Trap. The second Coordination Meeting was held in Funchal, Madeira Island, Portugal in January 1997. The FA-3 attractants formulated in slow release polyethylene bag dispensers, showed the most powerful attraction to medfly females known to date. The performance of the IPMT and Tephri Trap were evaluated as very efficient by the participants. The proposed protocol for the last year of the Programme was to compare the efficiency of these two traps baited with the three component (FA-3) lure.

We describe here the year by year detail of the trials carried out in Spain under the framework of the Programme cited above.

## **2. MATERIAL AND METHODS**

### **2.1. Placement**

To facilitate comparison of results, all the trials of 1994 - 97 were carried out in the same orchards. These orchards were located near the Malaga airport in the south of Spain on the Mediterranean coast.

### **2.2. Traps and attractants**

The protocols for the first year were established by the Agency. After the discussion at the end of the first CRP meetings, new protocols were established and the next basic protocols gave the investigators the opportunity to test some local traps or attractants.

### **2.3. Trap placement**

Traps were hung 1 - 2 m above the ground in the lower half of the south eastern part of host tree canopy.

### **2.4. Plot selection and design**

Six or seven blocks (A-F) or (A-G) of four, five or six traps each (variable with the protocol) were placed in the different fruit trees in orchards previously selected for the trials. These types of fruit trees in the orchards were the follows: Mango, Chirimoya, Orange (Navelina, Navalate, Valencia late) and Mandarin.

## 2.5. Data collection

All traps were checked twice per week on a regular schedule and the number of male and female medflies captured was recorded. Traps within a block were rotated sequentially after each sample. The trials were run on 2 replicates of 4 weeks each (minimum) during fall of 1994, 95, 96 and 97.

## 2.6. Statistical analysis

All data were transformed by the change of variable  $X' = \text{SQRT}(X + 0.5)$ ,  $X = \text{flies/trap/day}$  or  $\text{female/trap/day}$  (F/T/D). An analysis of variance procedure was performed with the transformed data and followed by a Duncan's multiple range test to estimate the signification of the means. Generally, data from the Jackson trap was not included in the analysis.

## 2.7. Traps and attractants

Since the traps and attractants were variable each year, we are providing a complete description of the what was used during a given year.

### 2.7.1. 1994 Traps

There were five blocks (A-E) of four traps each (2 JT, TML, 2 CBDT, FA-2)

**1. Jackson Trap (JT, TML)** - a triangular trap with white sticky insert and baited with a trimedlure (TML) plug placed in a plastic basket hung inside the trap in the middle of the horizontal wire hanger

**2. Closed bottom, dry trap with green visual cue (CBDT, FA-2)** [5,6] - a closed, cylindrical trap with a green visual cue, baited with putrescine and ammonium acetate (FA-2) patches placed inside the trap on a lateral wall, two toxicant squares on top and bottom, and lateral holes for fly entrance and chemical release

### 2.7.2. 1995 Traps

There were six blocks of five traps each. The complete traps are described below.

**1. Jackson Trap (JT, TML)** - as above

**2. CBDT, FA-2** - as above.

**3. Open bottom plastic dry trap (OBDT, FA-2)** an opaque green trap baited with putrescine and ammonium acetate patches (FA-2) placed inside the trap on a lateral wall and a yellow sticky insert to catch the attracted insects

**4. Tephri Trap (Tephri, FA-2)** - a yellow and clear plastic McPhail type trap with four symmetric lateral holes, baited with FA-2 attractants and containing two toxicant squares to kill the attracted insects

**5. International Pheromone's McPhail Trap (IPMT, NU+B)** - the standard plastic McPhail type trap baited with an aqueous solution of 9% of NuLure and 3% borax

### 2.7.3. 1996 Traps

There were seven blocks (A-G) of seven traps each. The complete traps are described below.

**1. Jackson Trap (JT, TML)** - as above

**2. Open Bottom Dry Trap (OBDT, FA-2)** a cylindrical plastic trap with an open bottom, a yellow sticky insert to capture the flies and baited with FA-2 attractants on the inside wall

**3. Open Bottom Dry Trap (OBDT, FA-3)** a cylindrical trap with a open bottom, a yellow sticky insert to capture the flies, baited FA-3 patches on the inside lateral wall of the trap

**4. Tephri, FA-2** - a Tephri trap baited with FA-2 attractants placed on in inside lateral wall of the trap and a piece of toxicant glued at the top

**5. Tephri, FA-3** - a Tephri trap baited with FA-3 attractants placed on an inside lateral wall of the trap and a piece of toxicant glued at the top

**6. International Pheromone's McPhail Trap (IPMT, NU+B)** as previously described.

**7. Fructect Trap** - a trap consisting of a sticky yellow plastic square with a sphere in the middle and containing its own attractant inside the sphere

### 2.7.4. 1997 Traps

There were seven blocks (A-G) of six traps each. The traps and attractants of the basic and optional protocol are described below.

**1. Jackson Trap (JT, TML)** - as previously described

**2. International Pheromone's McPhail Trap (IPMT, NU+B)** - as previously described . **3. International Pheromone's McPhail Trap (IPMT, FA-3, wet)** - an IPMT trap used as a wet trap, baited with the FA-3 attractants, 300 ml water, and 1-2 drops of surfactant in the base to facilitate capture of flies

**4. International Pheromone McPhail Trap (IPMT, FA-3, dry)** - an IPMT used as a dry trap, baited with FA-3 attractants, and a piece of DDVP as killing agent

**5. Tephri Trap (Tephri, FA-3, dry)** - a Tephri trap used as a dry trap, baited with the FA-3 attractants, and a piece of DDVP in the basket of the trap

**6. Tephri Trap (Tephri, FA-3, wet)** - a Tephri trap used as a wet trap, baited with the FA-3 attractants, 200 ml water, 1-2 drops of surfactant in the base, and an optional piece of DDVP in the basket of the trap.

### 3. RESULTS

#### 3.1. 1994 Experiments

TABLE I. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCKS A AND B (ORANGE NAVELATE) - 81 Days

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	1499	1499	0	9.2	0
JT	TML	1140	1140	0	7.0	0
CBDT	FA-2	456	25	431	2.8	2.6
CBDT	FA-2	524	34	490	3.2	3.0

TABLE II. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCKS C, D AND E (HIRIMOYA) - 81 Days

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	1265	1262	3	5.2	0
JT	TML	1274	1274	0	5.2	0
CBDT	FA-2	230	19	211	0.9	0.8
CBDT	FA-2	151	13	138	0.6	0.5

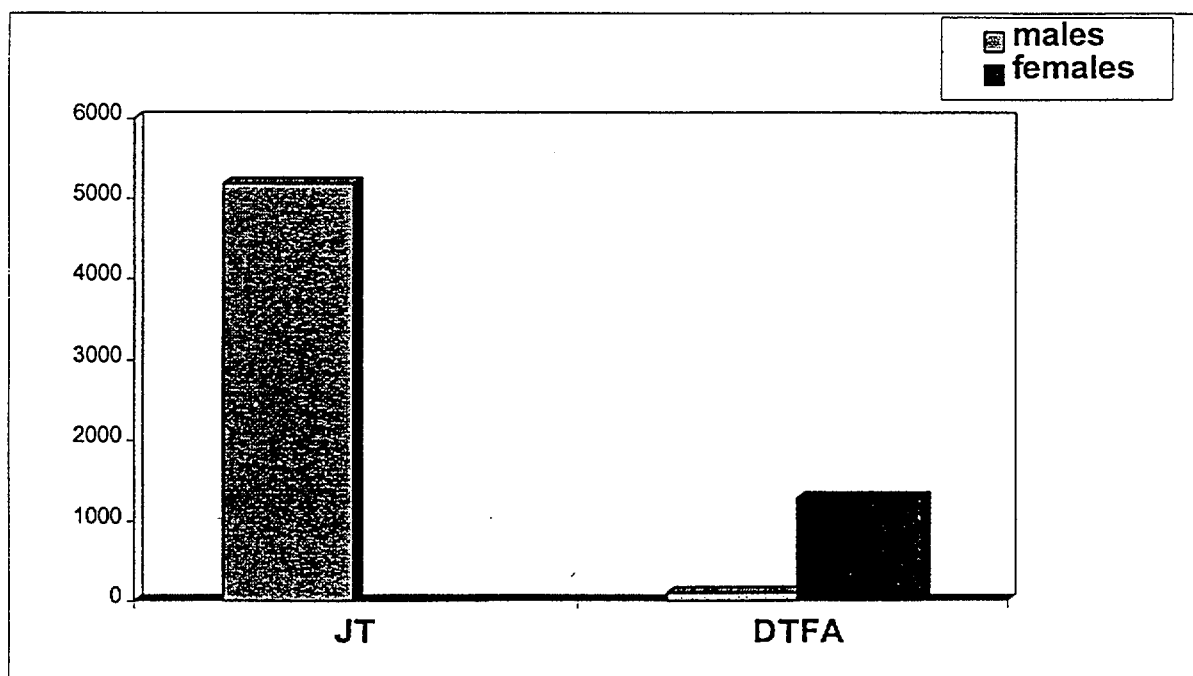


Fig. 1. Medfly captures obtained by each type of trap in the experiment of 1994; DTFA=CBDT

### 3.2. 1995 Experiments

TABLE III. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCK A (MANGO) - 56 DAYS

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	670	669	1	11.9	0
CBDT	FA-2	172	35	137	3	2.4
OBDT	FA-2	136	22	114	2.4	2
Tephri	FA-2	378	112	267	6.7	4.7
IPMT	NU+B	393	103	290	7	5.1

TABLE IV. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCK B (CHIRIMOYA) - 56 DAYS

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	767	761	6	13.6	0
CBDT	FA-2	29	3	26	0.5	0.4
OBDT	FA-2	101	10	91	1.8	1.6
Tephri	FA-2	80	7	73	1.4	1.3
IPMT	NU+B	484	94	390	8.6	6.9

TABLE V. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCK C (ORANGE) - 56 DAYS

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	1300	1282	18	22.8	0.3
CBDT	FA-2	226	18	208	4.3	3.7
OBDT	FA-2	462	17	445	8.2	7.9
Tephri	FA-2	821	80	741	14.6	13.2
IPMT	NU+B	1631	391	1240	29.1	22.1

TABLE VI. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCKS D, E AND F (MANDARIN) - 56 DAYS

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	1433	1426	7	25.5	0
CBDT	FA-2	78	22	56	13.9	1
OBDT	FA-2	97	21	76	1.7	1.3
Tephri	FA-2	474	136	339	8.4	6
IPMT	NU+B	845	196	649	15	11.5

TABLE VII. NUMBER OF FLIES CAPTURED BY EACH TYPE OF TRAP IN ALL EXPERIMENTS - MALAGA 1995

Trap	Attractant	Total Captures	Flies/T/D	Statistical Mean
JT	TML	4170	12.4	2.7 a
IPMT	NU+B	3354	9.9	2.3b
Tephri	FA-2	1755	5.2	1.7b
OBDT	FA-2	796	2.3	1.2d
CBDT	FA-2	505	1.5	1.1d

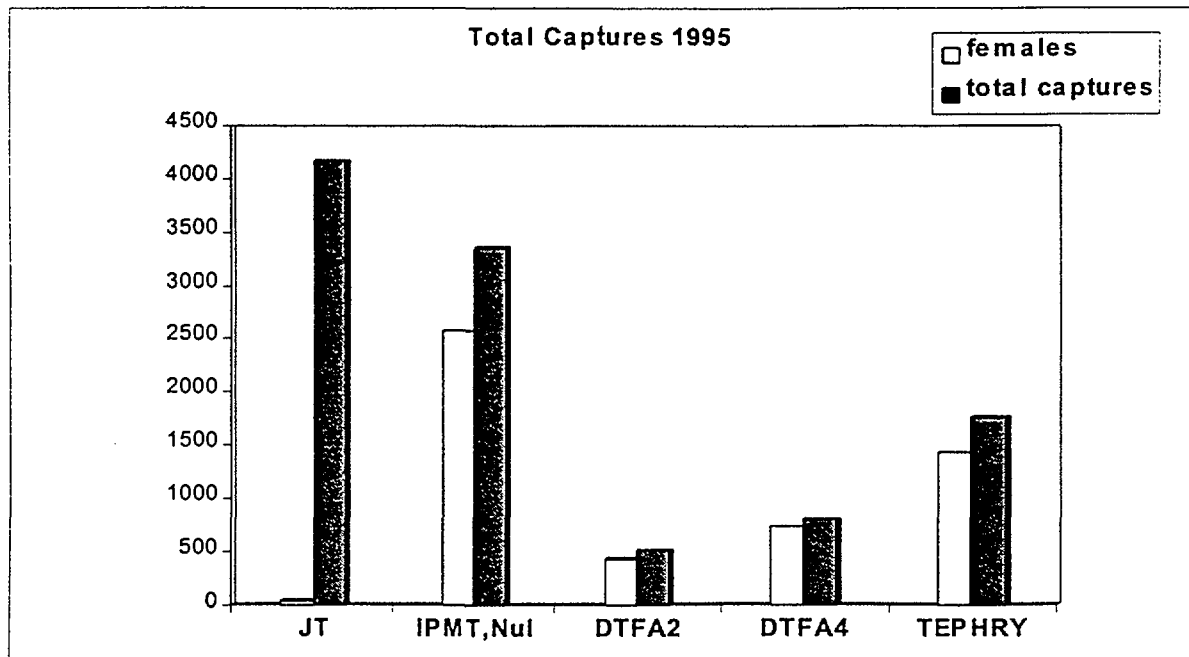


Fig. 2. Medfly captures (total and females) obtained by each type of trap in the experiment of 1995; IPMT,Nul=IPMT,NU+B, DTFA2=CBDT, DTFA4=OBDT

TABLE VIII. NUMBER OF FEMALES CAPTURED BY EACH TYPE OF TRAP IN ALL EXPERIMENTS - MALAGA 1995

Trap	Attractant	Total Females	Females/T/D	Statistical Mean
IPMT	NU+B	2570	7.6	1.7 a
Tephri	FA-2	1420	4.2	1.4 a
OBDT	FA-2	726	2.3	1.2b
CBDT	FA-2	427	1.5	1.1b
JT	TML	32	0	0c

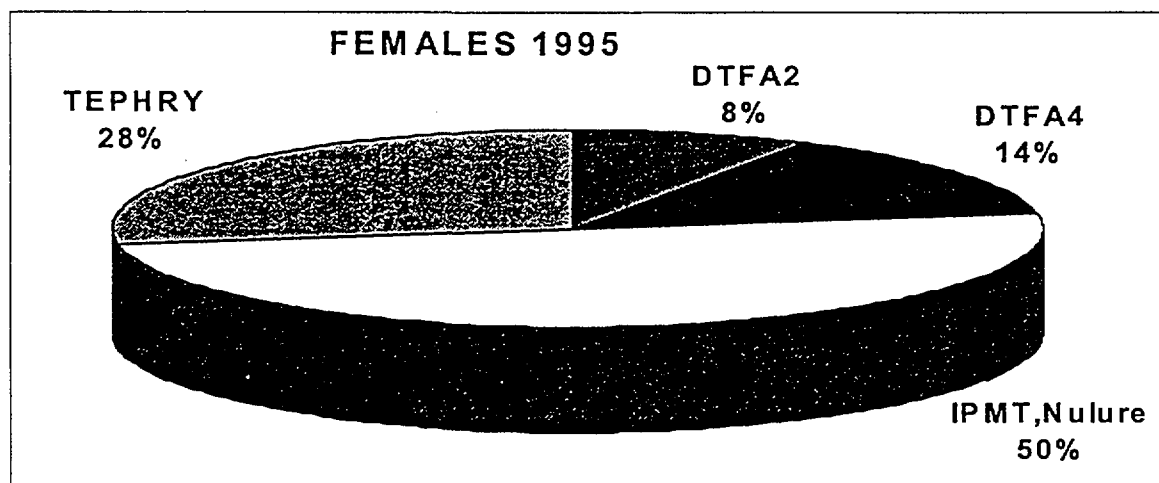


Fig. 3. Percentage of medfly females trapped by each type of trap in the experiment of 1995; DTFA2=CBDT, DTFA4=OBDT

### 3.3. 1996 Experiments

TABLE IX . CAPTURES OF FLIES (MALES/FEMALES) N BLOCK A (MANGO) - 56 DAYS

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	3751	3739	12	66.9	0
OBDT	FA-2	223	77	146	4.1	2.6
OBDT	FA-3	701	157	544	12.5	9.7
Tephri	FA-2	1008	226	782	18	13.9
Tephri	FA-3	1623	324	1299	29	23.1
IPMT	NU+B	801	88	721	14.4	12.8
FRUTECT	Fructect	2195	108	464	10.2	8.2

TABLE X. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCK B (CHIRIMOYA) - 56 DAYS

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	2356	2354	2	42	0
OBDT	FA-2	102	19	93	2	1.6
OBDT	FA-3	398	51	347	7.1	6.2
Tephri	FA-2	359	35	324	6.4	5.7
Tephri	FA-3	325	25	300	5.8	5.3
IPMT	NU+B	159	11	148	2.8	2.6
FRUTECT	Fructect	152	73	179	4.5	3.2

TABLE XI. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCK C (ORANGE) - 56 DAYS

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	1489	1487	2	26.5	0
OBDT	FA-2	256	28	228	4.5	4
OBDT	FA-3	573	63	510	10.2	9.1
Tephri	FA-2	524	36	488	9.3	8.7
Tephri	FA-3	577	59	518	10.3	9.2
IPMT	NU+B	429	11	418	7.6	7.6
FRUTECT	Fructect	250	81	169	4.4	3

TABLE XII. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCKS D, E, AND F (MANDARIN/ORANGE) - 56 DAYS

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	4732	4723	9	28.1	0
OBDT	FA-2	943	377	566	5.6	3.3
OBDT	FA-3	1794	577	1217	10.6	7.2
Tephri	FA-2	2191	454	1737	13	10.3
Tephri	FA-3	4049	664	3385	24.1	20.1
IPMT	NU+B	926	139	787	5.5	4.6
FRUTECT	Fructect	697	277	420	4.1	2.5



TABLE XIII. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCK G (ORANGE) - 56 DAYS

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	1861	1861	0	33.2	0
OBDT	FA-2	204	27	177	3.6	3.1
OBDT	FA-3	278	55	223	4.9	4
Tephri	FA-2	461	32	429	8.2	7.6
Tephri	FA-3	748	56	692	13.3	12.3
IPMT	NU+B	305	18	287	5.4	5.1
FRUTECT	Fructect	281	79	203	5	3.6

TABLE XIV. NUMBER OF FLIES CAPTURED BY EACH TYPE OF TRAP IN ALL EXPERIMENT - MALAGA 1996

Trap	Attractant	Total Captures	Flies/T/D	Statistical Mean
JT	TML	14191	36.2	5.9 a
OBDT	FA-2	1748	4.4	1.7 d
OBDT	FA-3	3744	9.5	2.6 c
Tephri	FA-2	4543	11.5	2.8 c
Tephri	FA-3	7222	18.4	3.5 b
IPMT	NU+B	2628	6.7	2.3 cd
FRUTECT	Fructect	2282	5.8	2.1 d

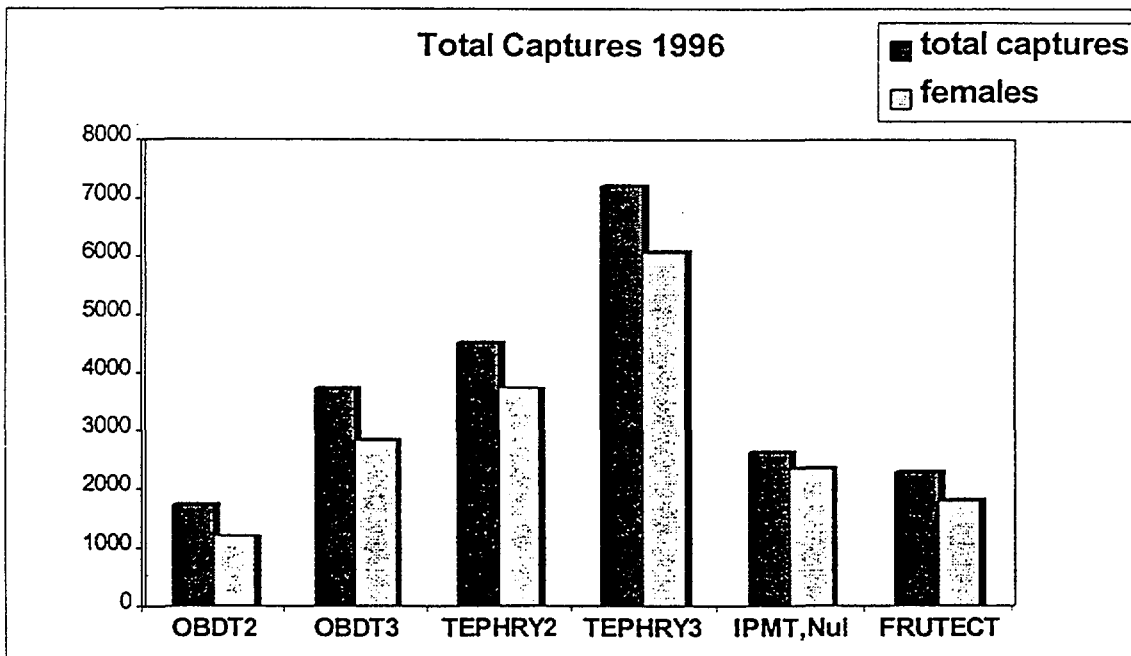


Fig. 4. Medfly captures (total and females) obtained by each type of trap in the experiment of 1996; OBDT2=OBDT, FA-2, OBDT3=OBDT, FA-3, Tephry2=Tephri, FA-2, Tephry3=Tephri, FA-3, IPMT,Nul=IPMT, NU+B

TABLE XV. NUMBER OF FEMALES CAPTURED BY EACH TYPE OF TRAP IN ALL EXPERIMENT - MALAGA 1996

Trap	Attractant	Total Females	Females/T/D	Statistical Mean
JT	TML	35	0	0.7 d
OBDT	FA-2	1210	3	1.5 c
OBDT	FA-3	2841	7.2	2.3 b
Tephri	FA-2	3760	9.5	2.6 b
Tephri	FA-3	6094	15.5	3.2 a
IPMT	NU+B	2361	6	2.2 bc

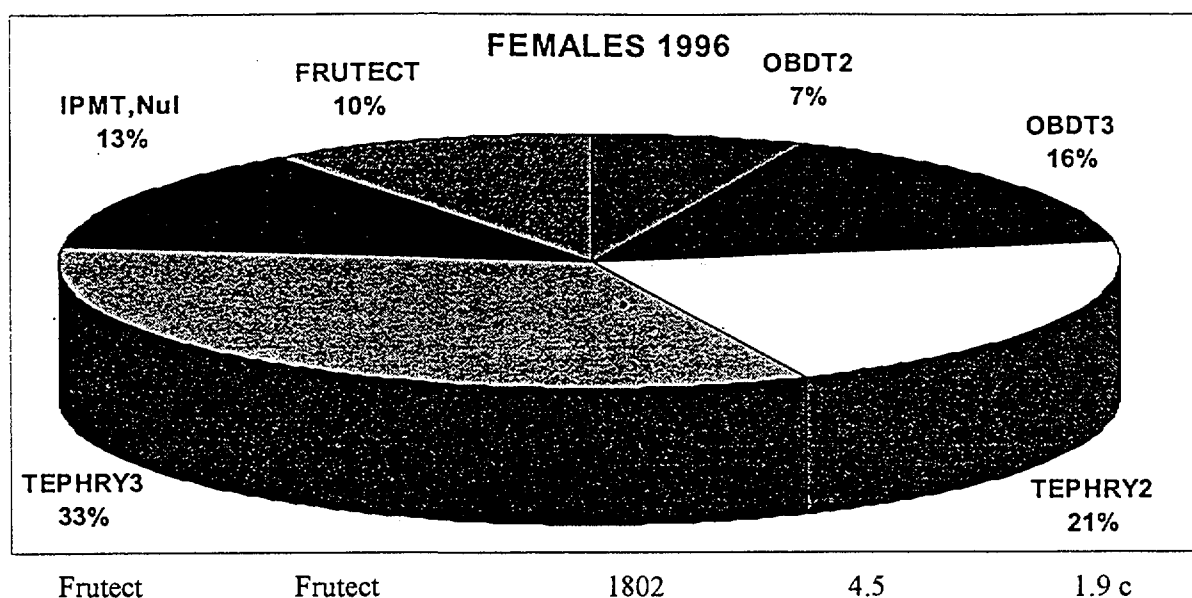


Fig 5. Percentage of Medfly females trapped by each type of trap in the experiment of 1996  
 OBBDT2=OBBDT, FA-2, OBBDT3=OBBDT, FA-3, Tephry2=Tephri, FA-2, Tephry3=Tephri, FA-3,  
 IPMT,Nul=IPMT,NU+B

### 3.4. 1997 Experiments

TABLE XVI. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCKS A AND B (MANGO) - 59 DAYS

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	4725	4723	2	40	0
IPMT	NU+B	1458	70	1388	12.3	11.7
IPMT, wet	FA-3	2639	192	2447	22.3	20.7
IPMT, dry	FA-3	2978	567	2411	25.2	20.4
Tephri, dry	FA-3	2968	637	2331	25.1	19.7
Tephri, wet	FA-3	3137	391	2746	26.5	23.2

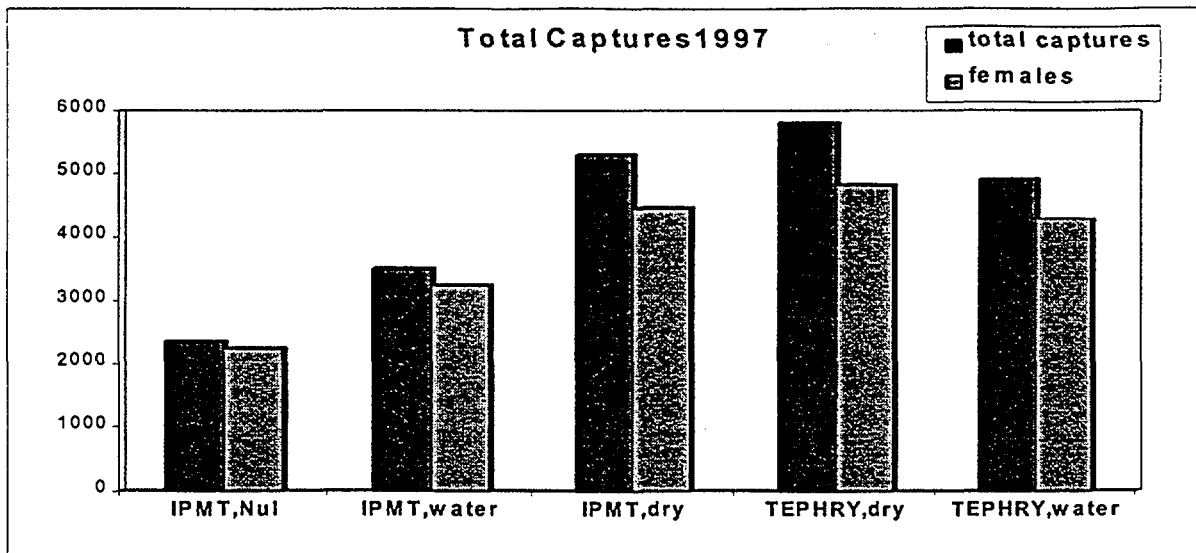


Fig 6. Medfly captures (total and females) obtained by each type of trap in the experiment of 1997; IPMT,Nul=IPMT,NU+B, all other traps contained the FA-3 lures

TABLE XVII. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCK C (ORANGENAVALATE) - 59 DAYS

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	615	592	23	10.4	0.4
IPMT	NU+B	527	12	515	8.9	8.7
IPMT, wet	FA-3	468	32	436	7.8	7.3
IPMT, dry	FA-3	802	124	678	13.5	11.5
Tephri, dry	FA-3	940	111	829	15.9	14
Tephri, wet	FA-3	1009	145	964	17.1	16.3

TABLE XVIII. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCKS D AND E (CHIRIMOYA) -59 DAYS

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	2724	2720	4	23	0
IPMT	NU+B	395	39	356	3.3	3
IPMT, wet	FA-3	277	32	245	2.3	2
IPMT, dry	FA-3	1259	104	1155	10.6	9.8
Tephri, dry	FA-3	1599	177	1422	13.5	12
Tephri, wet	FA-3	358	36	292	2.8	2.4

TABLE XIX. CAPTURES OF FLIES (MALES/FEMALES) IN BLOCK F (ORANGE VALENCIA LATE) -59 DAYS

Trap	Attractant	Captures	Males	Females	Flies/T/D	Females/T/D
JT	TML	876	870	6	14.8	0
IPMT	NU+B	68	4	64	0.5	0.5
IPMT, wet	FA-3	140	29	111	1.1	0.9
IPMT, dry	FA-3	258	48	210	2.2	1.7
Tephri, dry	FA-3	253	32	221	2.1	1.9
Tephri, wet	FA-3	118	22	118	1	0.8

TABLE XX. NUMBER OF FLIES CAPTURED BY EACH TYPE OF TRAP IN ALL EXPERIMENTS - MALAGA 1997

Trap	Attractant	Captures	Flies/T/D	Statistical mean
JT	TML	11144	30.9	
IPMT	Nu + B	2362	6.5	2.18 b
IPMT, wet	FA-3	3524	9.7	2.64 b
IPMT, dry	FA-3	5307	14.7	3.45 a
Tephri, dry	FA-3	5815	16.1	3.53 a
Tephri, wet	FA-3	4900	13.6	3.07 a

TABLE XXI. NUMBER OF FEMALES CAPTURED BY EACH TYPE OF TRAP IN ALL EXPERIMENTS - MALAGA 1997

Trap	Attractant	Females	Females/T/D	Statistical mean
JT	TML	6	0	
IPMT	NU+B	2258	6.2	2.12 c
IPMT, wet	FA-3	3239	9	2.50 bc
IPMT, dry	FA-3	4465	12.4	3.16 a
Tephri, dry	FA-3	4823	13.4	3.22 a
Tephri, wet	FA-3	4289	11.9	2.86 ab

TABLE XXII. MEAN NUMBER OF TOTAL FLIES AND FEMALES CAPTURED BY EACH TRAP TYPE MALAGA - 1997

Trap	Mean flies/trap/day	Mean Statistical *	Mean females/trap/day	Mean Statistical*
Tephri, FA-3, dry	16.1	3.53a	13.4	3.22a
IPMT, FA-3, dry	14.7	3.45a	12.4	3.16a
Tephri, FA-3, wet	13.6	3.07a	11.9	2.86ab
IPMT, FA-3, wet	9.7	2.64b	9.0	2.50bc
IPMT, NU+B	6.6	2.18b	6.2	2.12c

\* In a column, means with the same letter are not significantly different ( $\alpha=0.05$ ) ( $F=12.28$ ,  $P=0.0001$  for flies/T/D analysis and  $F=6.93$   $P=0.001$  for females/T/D analysis)

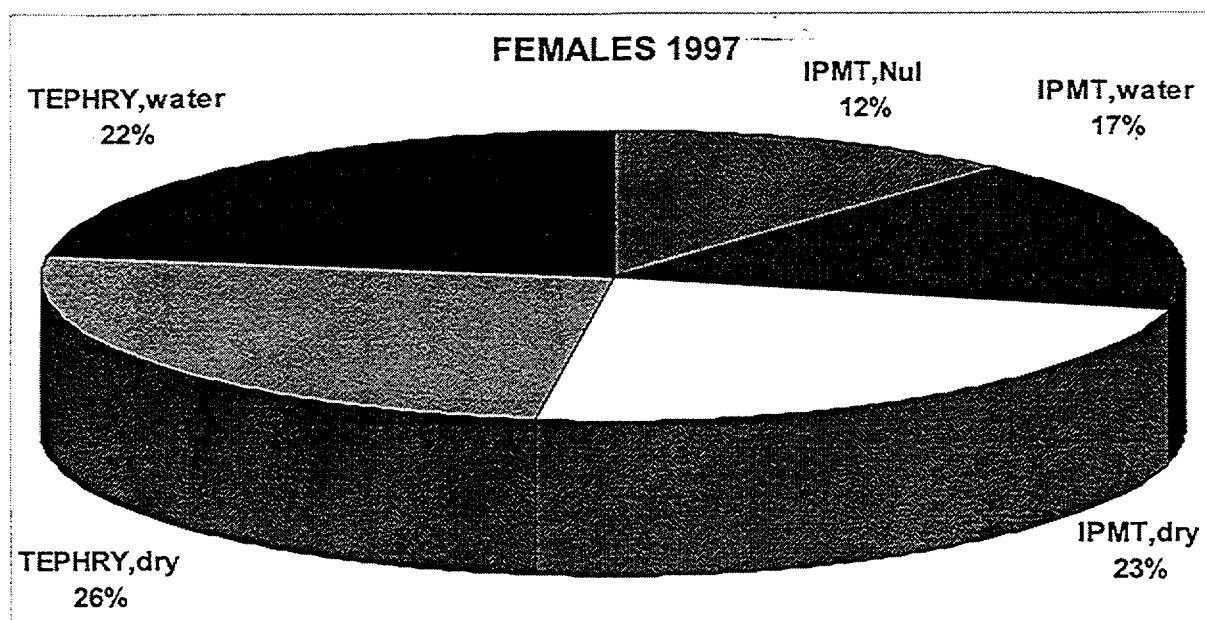
#### 4. DISCUSSION

By following the results of successive years, we can observe progress towards the project goals. In 1994, the development of the FA-2 attractants (P+AA) with their selectivity for medfly females was a big step towards reaching future goals.

The synergism of trimethylamine with the FA-2 attractants, yielding the FA-3 attractants (P+AA+TMA), used with the new Tephri Trap produced very good results in 1996. There were no doubt about the results of the different traps and attractants in this year. The use of trimethylamine was an authentic discovery.

At last, the experiment of 1997 demonstrated the efficiency of both traps (Tephri and IPMT) with or without water inside the trap. The choice of which trap to use will depend, perhaps, on the temperature or humidity of the local climate, but both always gave excellent results.

Now we have an excellent trap and attractant to capture medfly females to assure good control of the pest. Killing the first overwintering generation of medfly females by a mass



trapping method would be a good practice to avoid big populations in the summer and fall in countries with moderate climates.

Fig 7. Percentage of Medfly females trapped by each type of trap in the experiment of 1997

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### REFERENCES

- [1] ROS, J.P., et al., Estudio de la eficacia en campo de dos formulaciones de atrayentes para la mosca de la fruta *C. capitata* Wied., Bol. San. Veg. Plagas No 2, Ministerio de Agricultura. España (1979).
- [2] ROS, J.P., La mosca mediterranea dela Fruta *Ceratitidis capitata* Wied. Biología y métodos de control, Hojas divulgadora Ministerio de Agricultura, No 8/88 España (1988).
- [3] ROS, J.P., Estudio de diferentes combinaciones de productos atrayentes en las pulverizaciones cebo contra *C. capitata* Wied., Bol. San. Veg. Plagas No 16, Ministerio de Agricultura. España (1990).

- [4] IAEA, Standardization of medfly trapping for use in sterile insect technique programmes, Final report of a Co-ordinated Programme 1986-1992, IAEA-TECDOC-883, Vienna (1996).
- [5] EPSKY, N.D., et al., Visual cue and chemical cue interactions in a dry trap with food-based synthetic attractant for *C. capitata* and *Anastrepha ludens* (Diptera:Tephritidae), Environ. Entomol. **24** (1995) 1387-1395.
- [6] HEATH, R.R., et al., Development of a dry plastic insect trap with food-based synthetic attractant for the Mediterranean and Mexican fruit flies (Diptera:Tephritidae), J. Econ. Entomol. **88** (1995) 1307-1315.
- ROS, J.P., et al., Ensayos de campo con un nuevo atrayente de hembras de la mosca de la fruta Wied. (Diptera: Tephritidae), Bol. San. Veg. Plagas No 32, Ministerio de Agricultura España. (1996).