SEMINAR ON MEDITERRANEAN FRUIT FLY

SEPTEMBER 30, 1981

**Ministry of Agriculture
and
IICA/Jamaica**

INTRODUCTION

As a consequence of the Mediterranean Fruit Fly infestation in Florida (USA) and given the heavy traffic between Jamaica and Miami, the Deputy Director of Research for Plant Protection of the Ministry of Agriculture, Mr. Walter van Whervin asked the IICA/Jamaica office to assist in setting up a program to determine whether the Mediterranean Fruit Fly (Ceratitis capitata) is in Jamaica.

IICA/Jamaica immediately called Dr. Federico Dao, Director of the Plant Health Program for IICA, and Chelston Braithwaite IICA Regional Expert on Plant Protection.

Dr. Dao, through arrangements with the U.S. Department of Agriculture and the Mexican Government obtained the assistance of two experts, Dr. Ed Ayers (US), and Dr. Jesus Reyes (Mexico). Drs. Ayers and Reyes' visit was coordinated by IICA/Jamaica and Dr. F. Young of the Ministry of Agriculture. The experts set traps, identified specimens, trained local personnel, dictated a seminar and prepared the present publication.

This non-programmed activity was a test to the regional cooperation action in an emergency call. The work displayed by the Ministry of Agriculture personnel, the experts of Mexico and the U.S., the unselfish bilateral cooperation of Mexico and the United States, and the coordination of the Plant Health Program of IICA was successful.

The concerned parties were relieved to learn that to this date all the results have indicated that there is no incidence of the Mediterranean Fruit Fly in Jamaica.

Percy Aitken-Soux
Director, IICA/Jamaica

CERATITIS CAPITATA

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BACKGROUND INFORMATION

Introduction

The Mediterranean Fruit Fly (*Ceratitis capitata* Weidemann) (Medfly) is considered to be the most serious insect pest of fruit and vegetables attacking over 200 different host fruits. Most thin skinned, ripe succulent fruits and vegetables are susceptible to attack by the Medfly. Some of the hosts commonly found in Jamaica include the tropical almond, star-apple, guava, *Annona* spp., Naseberry, Sapote paw paw, coffee, rose apple, citrus spp., mango, plums (Spondias sp.). Most other fleshly fruits and vegetables of Jamaica would also be subject to infestation depending upon availability of preferred hosts.

Economic loss

Some Mediterranean areas have experienced 100% infestation in stone fruits. Greece has reported 50% loss in citrus. A recent study has shown that 81% of U.S. citrus production is in a zone in which Medfly could become established if allowed to spread naturally throughout the sourthern tier of states. The study indicated that value losses in citrus would range from US$2.9 million to US$20 million dollars in California, and from US$70 million to US$524 million throughout the United States depending upon assumed damage rates. Control costs and production losses in California would be many times this amount for all host crops. California harvests 2.4 million acres of host crops valued at US$4.1 billion annually. In addition to direct losses due to control costs and crop loss, the United States could lose as much as one-half billion dollars in export markets due to foreign embargos.

An example of the Medfly affecting the economy of an area is the State of Hawaii which has been infested since 1910. The Hawaiian Islands which are in many ways similar to the island of Jamaica have not been able to develop their full agricultural potential due to the presence of Medfly. Production of fruit and vegetables for island consumption has been limited to host crops. Export of fresh fruit and vegetables has been limited to pineapple which is not considered to be a host under commercial production procedures and paw paw which must be picked green and treated for any possible infestation prior to shipment. Hawaii depends greatly upon imported fruits and vegetables due to the fruit fly problem.

The Government of Mexico and the United States have worked together on a cooperative detection programme for many years, and since 1977 on an eradication programme in the southern tip of Mexico. The reason for this joint effort costing over US$10 million a year is to prevent the Medfly from moving north into the crop lands of Mexico, and then into the United States.

It has been estimated that should Medfly become established throughout Mexico, the annual direct loss of production would reach 800 million dollars with indirect losses due to export restriction of host crops reaching US$1.2 billion dollars.

History

The Medfly was detected in the Hawaiian Islands in 1910 where it became established. In 1929, the Medfly was detected in the Orlando, Florida area where it was eradicated through the destruction of host fruits and trees and treatment with lead arsenate mixed with a molasses bait. In 1956, the Medfly was again detected in Florida. Eradication was carried out this time using Malathion - 25%, wettable power mixed with a hydrolized protein bait applied by air over about half the State of Florida. Soil treatments of infested trees with Dieldrin were also used. In 1962-63, small infestations in the Miami area of Florida were eradicated using the Malathion protein bait mixture applied by airplane. In 1966, an infestation was detected in Brownsville, Texas, and Matamoros, Mexico. A 20-square mile area was treated with 2.4 oz of technical Malathion mixed with 9.6 oz of hydrolized protein bait per acre applied by air. In 1975 and 1980, small infestations of Medfly were detected in Los Angeles, California. These infestations were eradicated using the sterile fly technique in conjunction with limited soil treatment beneath infested trees. In June 1980, an infestation was also detected in San Jose, California near San Francisco. The sterile fly technique, soil treatment and limited ground application of Malathion were used in an eradication attempt. When it became apparent that sufficient sterile flies were not available to eradicate the Medfly, the State of California refused to use the aerial application of Malathion and protein bait. Instead they used over 1,000 people to strip host fruit from 50 square miles and applied six applications of Malathion and protein bait by ground application. In the spring of 1981 with adult and larval finds, it became apparent that the effort had failed. The State of California, under threat of an embargo of the entire State, agreed to greatly increase trapping throughout the State, and to the aerial application of 2.4 oz of technical Malathion mixed with 9.6 oz of hydrolized protein bait applied at the rate of 12 oz per acre. Presently, over 1,400 square miles of infested area in California is being aerially treated.

In August of 1981, five medflies were detected in an urban area of Tampa, Florida. The State of Florida decided to eradicate using 2.4 oz of technical Malathion mixed with 9.6 oz hydrolized protein bait, applied at the rate of 12 oz per acre. To date eight applications have been made over an approximate 25 square mile urban area by airplane. The quarantined area covers approximately 50 square miles. There are no host crops presently being harvested in the mostly urban area. The infestation will be declared eradicated in late November 1981, if no additional flies are detected. Greatly increased trapping will continue for a number of months after the Medfly is declared eradicated.

The Medfly was first detected in Central America in Costa Rica in 1955. Mexico established a trapping programme that goes throughout susceptible areas of Mexico with emphasis on the border with Guatemala. Since 1955, the Medfly gradually spread northward reaching Nicaragua in 1960, El Salvador in 1975 and Guatemala in 1976. With the detection of the Medfly in El Salvador the trapping in Mexico was greatly intensified. Because of this increased trapping, the Medfly was detected within half mile of the Guatemala border in the State of Chiapas in South Mexico in early 1977.

The Mexican Department of Agriculture and the United States Department of Agriculture have cooperated in a successful effort to stop the northward movement of Medfly, and have actually been able to eradicate Medfly from Mexico on a seasonal basis, using aerial and ground application of technical Malathion at a rate of 2.4 oz of Malathion and 9.6 oz of hydrolized protein bait, applied at a rate of 12 oz per acre, followed by the release of large numbers of sterile flies beginning in mid-1980. Mexico and the United States built and operate a Medfly rearing facility which is presently producing over 500 million sterile flies per week for release in the southern part of the State of Chiapas in southern Mexico and northern Guatemala. In 1979, 2,500 native medflies were detected in Mexico. In 1980, only 250 medflies were captured and to date in 1981 only 190 have been detected. Southern Mexico which is ecologically similar to Jamaica is subject to reinfestation from Guatemala on a yearly basis when populations build up during the dry season in Guatemala. Based on fruit sampling of 24 tons of 32 species of fruit in 1980-81, ten are known to be hosts of Medfly in southern Mexico. The five principal hosts are starapple, guava, coffee, sweet orange and tangerine. Trapping is carried out throughout the Republic of Mexico. Presently there are 6,000 traps in the State of Chiapas and approximately 24,000 in the rest of Mexico.

Threat of Medfly Infestation in Jamaica

The Medfly moves around the world and from country to country as a hitch-hiker. The greatest danger of movement of the Medfly lies with the movement of people. It is common for immigrants to carry with them to their new home, fruits, vegetables and meats. In general these fruits and vegetables come from the immigrant's garden and usually will not have the benefit of a pesticide spray programme. Very often tourists will also carry host fruits and vegetables from one location to another for their own use or as gifts. If the Medfly has laid its eggs in these fruits and vegetables each infested fruit is a potential infestation. When the traveller discovers maggots in their fruit, the immediate reaction is to throw the infested fruit away. The maggots leave the fruit, pupate and emerge as adults to begin another life cycle. The best protection against a Medfly infestation by this means is a sound quarantine programme. Baggage and hand luggage inspection as people enter a country is extremely important. Quarantine officials should work closely with customs officials, provide training and support for baggage inspection.

Probably the second greatest risk of Medfly introduction involves the removal of ship and airplane stores from foreign ships and airplanes transiting Jamaica. A sound quarantine programme should include the control of ship and airplane stores and the control of garbage being removed. Adequate control of ship or airplane stores and garbage can either prevent the landing of infested fruit safeguarding on board or destruction of infested garbage once landed. These activities should also be coordinated with customs and public health officials Quarantine laws should be enacted which permit agricultural officials to take whatever quarantine action is necessary

The risk of importation of infested fruit in commercial importations can be greatly reduced through entry requirements placed on host fruit and vegetables from infested countries Host fruit from infested areas should not be allowed entry unless adequately treated to kill any life form in the host fruit. Although the risk of entry of hitch hiking adult medflies in

ships and airplanes is minimal plant quarantine officials should be alert to this risk and cooperate with public health officials in this effort. Garbage containers on board ships should be kept covered In addition a strict control of airplane caterers is important Caterers will have access to foreign fruits and garbage and will often remove these materials from aircraft. Control of this foreign host material and garbage is necessary to assure the pest risk is destroyed.

The effectiveness of any quarantine programme can be increased through the use of radio, television, newspapers, magazines and printed information leaflets. An informed traveller will think twice before bringing in any item which may harm his country In addition Jamaican Embassies and Consulates can be used as a point to give tourists leaflets explaining Jamaican restrictions on host fruit and vegetables

The Need for an Adequate Medfly Detection Programme

Quarantine programmes reduce the risk of Medfly infestation. However no quarantine programme is 100% effective Therefore if a medfly infestation is to be eradicated before it becomes well established an adequate trapping programme must be implemented Of primary importance is a trapping programme which covers all ports of entry and the surrounding populated areas. It can be expected that an infestation will be detected in the populated area surrounding a port of entry more often than right at the port of entry Passengers who are able to get host material past customs will carry it to the surrounding area where they live Usually the surrounding urban area presents a better environment for a medfly to survive and start an infestation. Usually airports and sea ports are short of host material and often very windy, presenting a poor environment for an infestation to start Attachment #1 includes recommendations for minimal medium and the desired level of detection trapping Also included for each level are manpower vehicle and supply needs.

Jamaica has an ideal climate for the Medfly Host material is available on a year round basis and the Medfly would rapidly populate the entire island if allowed to do so To have any hope of eradicating the Medfly it must be detected early before it has had time to spread Therefore option three which calls for the placement of 1048 traps in ports of entry surrounding population centers and along main highways gives the greatest protection.

CERATITIS CAPITATA

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RECOMMENDATIONS

1 Minimum Level of Trapping

1 Objectives Trapping net in airports sea ports or large and small scale tourist and commercial

2. Description of trapping

2 1 Airports Kingston and Montego Bay

2.1.1. Number of traps 17

2.1.2. Location 2 traps near the airstrip 2 traps inside the airport 3 traps outside the airport (in the park or around) 10 traps along the roads with access to the airport placing on trap/half mile

2.2 Sea ports of large scale Kingston Montego Bay Savanna la mar and Port Antonio

2.2.1 Number of traps 34

2.2.2. Location 2 traps in the area of the wharves 2 traps in the areas surrounding the wharves 30 traps along the roads with access to the port placing one trap/half mile

2.3 Sea ports of small scale commercial and tourist Port Esquivel Port Kaiser Black River Negril Lucea Falmouth Discovery Bay St. Ann's Bay Ocho Rios Oracabessa Port Maria Annotto Bay Buff Bay Bowden and Port Morant.

2.3.1 Number of traps 14

2.3.2 Location 2 traps in the area of the wharves 2 traps in the areas surrounding the wharves 12 traps along the roads with the greatest access to the wharves placing one trap/half mile.

3 Summary

3.1. Total number of places covered 21

3.2. Total number of traps installed 210

These are distributed in the following way

Place	Quantity	Traps/place	Total number of traps
Airport	2	17	34
Sea port of large scale	4	34	136
Sea port of small scale	15	14	210
TOTAL	21		380

3.3. Total number of traps per place

Kingston	51
Montego Bay	51
Savanna-la-mar	51
Port Antonio	34
Port Esquivel	14
Port Kaiser	14
Black River	14
Negril	14
Lucea	14
Falmouth	14
Discovery Bay	14
St. Ann's Bay	14
Ocho Rios	14
Oracabessa	14
Port Morant	14
Annotto Bay	14
Buff Bay	14
Bowden	14
Port Maria	14
Total	330

4. Monthly logistics (Inspection of traps each two weeks)

4.1. Men hour 160 (one people/40 hours per week)

4.2. Pounds of attractant = 3

4.3. Inserts = 100

4.4. Cotton wicks = 130

4.5 Trap body = 200

4.6. Wires = 30

11. Medium Level of Trapping

1. Objective Trapping net in the airports sea ports of large and small scale commercial and tourist in the areas surrounding the airports and in the roads with access to the ports

2. Description of trapping

2.1. Airports Kingston and Montego Bay

2.1.1 Number of traps 56

2.1.2 Location 2 traps on the airstrip 2 traps inside the airport 2 outside the airport 1 trap per acre in the 10 acres surrounding the airport 40 traps along the roads with access to the airport placing one trap/half mile

2.2 Sea ports of large scale Kingston Montego Bay Savanna la mar and Port Antonio.

2.2.1 Number of traps 44 (Kingston and Montego Bay 54)

2.2.2 Location 2 traps in the area of the wharf 2 traps in the areas surrounding the wharf 40 traps along the roads with access to the wharf placing one trap/half mile.

NOTE Especially for Kingston and Montego Bay in the 10 acres surrounding the wharf place one trap/acre

2.3 Sea ports of small scale commercial and tourist Port Esquivel Port Kaiser Black River Negril Lucea Falmouth Discovery Bay St Ann's Bay Ocho Rios Oracabessa Port Maria Annotto Bay Buff Bay Bowden and Port Marant

2.3.1 Number of traps 32

2.3.2 Location 1 trap in the area of the wharf 1 trap in the area surrounding the wharf 30 traps in the roads with access to the port placing one trap/half mile

3 Summary

3.1. Total number of places covered 21

3.2 Total number of traps installed 788

These are distributed in the following way

Place	Quantity	Traps/place	Total number of traps
Airport	2	56	112
Sea port of large scale	4	2(44) 2(54)*	196
Sea port of small scale	15	32	480
Total	21		788

* See section 2 2.1

3 3 Total number of traps per place

Kingston	110
Montego Bay	110
Savanna la mar	44
Port Antonio	44
Port Esquivel	32
Port Kaiser	32
Black River	32
Negril	32
Lucea	32
Falmouth	32
Discovery Bay	32
St. Ann's Bay	32
Oracabessa	32
Ocho Rios	32
Port Maria	32
Annotto Bay	32
Buff Bay	32
Bowden	32
Port Morant	32
Total	788

4. Monthly logistics (Inspection of the traps every two weeks)

4.1. Man hours = 320 (two people/40 hours per week)

4.2. Pounds of attractant = 7

4.3. Inserts = 190

4.4. Cotton wicks = 300

4.5. Trap body = 425

4.6 Wires = 65

III High Level of Trapping

1. Objective Trapping net in airports sea ports of large and small scale commercial and tourist in the areas surrounding airports and sea ports of large and small scale in the roads with access to the airports and sea ports of large scale in the roads with access to the ports in the roads with secondary access to the ports and along the principal road which run around the country

2 Description of trapping

2.1. Airports Kingston and Montego Bay

2.1.1. Number of traps 56

2.1.2. Location 2 traps on the airstrip 2 traps inside the airport 2 outside the airport 1 trap per acre in the 10 acres surrounding the airport 40 traps along the roads with access to the airport placing one trap/half mile

2.2. Sea ports of large scale Kingston Montego Bay Savanna la-mar and Port Antonio

2.2.1 Number of traps 54

2.2.2. 2 traps in the area of the wharf 2 traps in the area surrounding the wharf one trap/acre in the 10 acres surrounding the wharf 40 traps along the roads with access to the port placing one trap/half mile

2.3 Sea ports of small scale commercial and tourist Port Esquivel Port Kaiser Black River Negril Lucea Falmouth Discovery Bay St Ann's Bay Ocho Rios Oracabessa Port Maria Annotto Bay Buff Bay Bowden and Port Morant

2.3.1 Number of traps 32

2.3.2. Location 1 trap in the area of the wharf 1 trap in the areas surrounding the wharf 30 traps in the roads with access to the port placing one trap/half mile.

2.4. Secondary roads with access to the ports

2 4.1 Number of traps 5

2.4 2. Location 5 traps along each road placing one trap/half mile

NOTE A secondary access road should be considered as one which does not run around the country e e Ocho Rios Spanish Town Annotto Bay Kingston etc

2.5. Towns located on the main roads which circle the island

2.5.1 Number of traps 1 per town

2.5.2 Location Place one trap approximately every five miles placing it in a community/village although it may be small. Beside trapping the road which circles the Island trapping should also be done along the road which takes the following routes Freetown Port Esquivel Race Course Junction-Pedro Cross--Fullerwood Black River

3. Summary

3.1. Total number of places covered 165

3 2 Total number of traps installed 1048

These are distributed in the following way

Place	Quantity	Traps/place	Total number of traps
Airport	2	56	112
Sea port of large scale	4	54	216
Sea port of small scale	15	32	480
Secondary roads	24*	5	120
Towns on the main roads	120**	1	120
Total	165		1048

* Kingston has 3 secondary roads Savanna la mar has 2 Montego Bay has 3 all the other 16 ports have only one secondary road

** Approximately

3 3 Total number of traps per place

Kingston	110
Montego Bay	110
Savanna-la mar	54
Port Antonio	54

Port Esquivel	32
Port Kaiser	32
Black River	32
Negril	32
Lucea	32
Falmouth	32
Discovery Bay	32
St. Ann's Bay	32
Ocho Rios	32
Oracabessa	32
Port Morant	32
Annotto Bay	32
Buff Bay	32
Bowden	32
Port Maria	32
Sub-total	808

Secondary Roads		Towns on main roads	
1	5 traps	1	1 trap
2	5	2	1
3	5	3	1
4	5	4	1
5	5	5	1
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.		.	.
.	.		.
24	5	120	120
Sub-total	120	Sub-total	120

Total· 1048

4. Monthly logistics (inspection of traps each 2 weeks)

4.1. Man hours = 480 (3 people/40 hours per week)

4.2. Pounds of attractant = 9

4.3. Inserts = 250

4.4. Cotton wicks = 400

4.5. Trap body - 565

4.6. Wires = 85

MEDITERRANEAN FRUIT FLY

DETECTION TRAPPING

MEDITERRANEAN FRUIT FLY DETECTION PROGRAM

1. INTRODUCTION

In any insect detection program, trapping is the activity by which you can detect the existence of a pest in the adult stage in a certain area. In the specific case of the Mediterranean Fruit Fly (Medfly), populations are detected by means of specially designed traps, baited with a lure which attracts the male Medfly. The traps have to be placed using a logical strategy so that they can provide the required information.

The distribution of the traps in a specific zone forms the so-called "Trapping Net", used to detect the presence of the pest.

2. ORGANIZATION OF THE TRAPPING PROGRAM

In order to start a trapping program, it is necessary to plan all the activities based on a knowledge of the area where one wants to work. For this reason, the person in charge of the trapping activities has to inspect the area thoroughly, keeping in mind the following points:

- areas of possible introduction (sea ports, airports)
- topography of the land (rivers, canyons, and mountains)
- population centers
- vegetation
- tourist attractions and resorts
- areas where fruits and vegetables are produced
- marketing centers for the fruit products
- roads

The trapping department should possess recent topographic maps with a detailed explanation of the zone. With this information, you can begin to plan the trapping activities.

A trapping route consists of 50 traps (average), which are inspected at time intervals of 7-14 days. Inspection intervals are determined by the presence of host plants and by the amount of manpower and vehicles available to

to inspect traps. Trapping routes should be designed to cover strategic entry points such as sea ports and airports, major population centers and major highways leading from points of entry and population centers. Traps should be evenly distributed within an area and not all placed close together.

3. METHODS

3.1 Trapping Equipment

In the specific case of Medflies, the Jackson trap is the preferred detection trap. It consists of a hollow triangular shaped board with a cotton wick. Inserted in the base of the triangle is an insert with Stick 'em, which catches any flies that lands on it. This type of trap is used in massive detection programs because of its low cost and effectiveness. The attractant used in the Jackson trap is a synthetic lure called Trimedlure. Trimedlure attracts only male medflies except in extremely low infestations when an occasional female may be attracted.

The trapping equipment generally consists of a box where the necessary materials are placed (traps, Stick 'em, lure, cotton wicks, inserts, plastic droppers, and gasoline to clean the implements). Every trapping unit should also have a 4-meter telescope pole to place the traps high in trees. The inspector has to make sure that his equipment is in good condition and should be ready to change at least 25 traps daily.

3.2 Preparation of the Jackson Traps

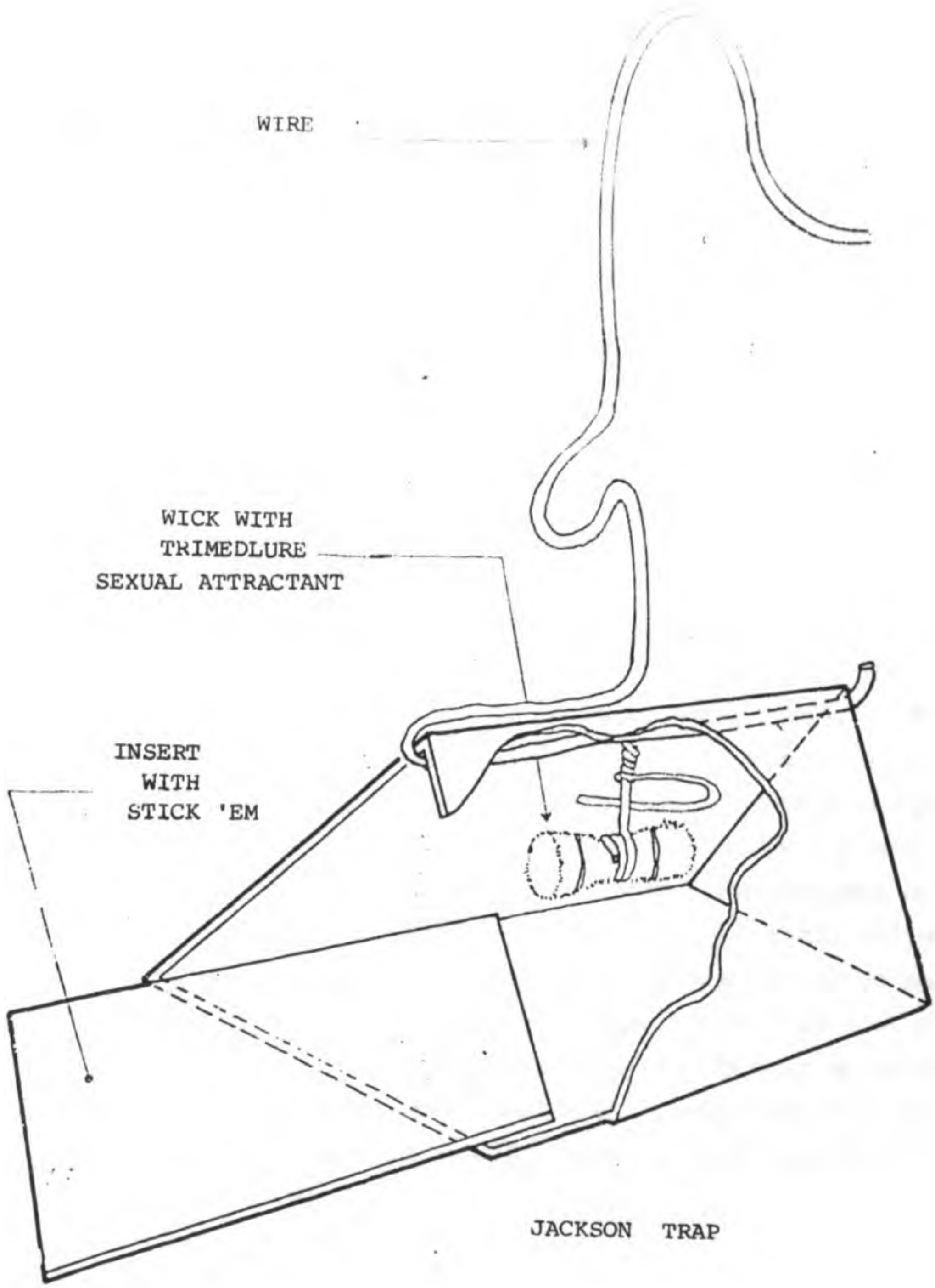
When the inspector gets to the starting point of a route, he stops to prepare a certain number of traps; locate the cotton wick on the wire, put the lure on the cotton wick, spread the Stick 'em on the insert and place it in the bottom of the trap. One should always keep in mind the following:

3.2.1 Attach the trap securely so that it will not come down in the wind or rain.

3.2.2 Make sure the cotton wick is tightly attached.

3.2.3 Locate the cotton wick exactly in the center of the trap.

3.2.4 Smear the Stick 'em uniformly leaving only two corners free so the insert can be handled and changed.



JACKSON TRAP

3.2.5 Avoid contamination with trimedlure, that is, none should fall out of the cotton wick. The cotton wick should never be touched with the fingers. (When rebaited, use an eye dropper). This is important to avoid the dispersion of the attractant outside of the trap. Usually a cotton wick is rebaited five times and then discarded.

3.2.6 The cotton wick has to be perfectly saturated with trimedlure, so that no space is left without the attractant but the operator should avoid any dripping.

3.2.7 The information provided in the insert should include:

- number of the trap
- number of the route
- date when the insert was placed
- date of inspection

This procedure is followed in all those locations which are potential centers of infestation because of the presence of wild and cultivated host plants, and where there is movement of fruit in ships, planes, buses, border towns, etc. and other ecological and geographical areas. The traps are located in places which were selected with special care, and are easily reached, such as branches of host trees. They should be protected from the sun and dominant winds and should be out of the reach of children. The distance between traps should be a minimum of 300 meters considering a 150 meter influence range. Because the host plants present variable fruiting seasons, traps should be rotated and should always be in those trees with ripe fruits. If host plants are absent, traps can be placed in trees infested with insects such as aphids and scales, which produce honeydew or sweet substances. Once traps have been installed in each route, every inspector should prepare a trapping index containing the following information:

- route establishing date
- name of the inspector
- route code number
- number of trap
- tree location

- place location
- owner of the place
- town
- references

Establishing date: _______

Inspector: __________________________ Route No: ____________

No. of traps	Tree	Place	Owner	Town	References
1	Guava	St. Vincente Farm	Mr. Wilson	Salt River	20 meters south of main entrance
2	Star-apple	The Flowers Farm	Mr. Jackson	Old Harbour Bay	In front of the Government bldg.

Besides this information, a map must be available where each route and the exact location of the traps are marked. This makes the control of the traps easier. The advantage of such an index method is:

- it provides the exact location of the traps whenever a fly is identified.
- it can serve as a guide for supervisors' activities or for trap inspectors with little experience.

It is a very convenient way to indicate the total trapping area and to control the trapping net by means of quadrants.

3.3 Inspection of Traps

The trapping inspectors should possess a degree of training that enables them to recognize a suspect fly at sight, even if the specimen is in bad condition. If this is not possible, all inserts should be changed at each inspection and the inserts brought back to the laboratory for inspection by a qualified person. Routes should be constantly checked, replacing, rotating, or increasing the number of traps when necessary.

The inspection of traps has to be repeated every 7 to 15 days depending on the importance of the trapping zone, and available manpower and vehicles. When inspecting inserts, one should be very careful because frequently only parts of a fly are left (wings, abdomen, head or thorax). Samples should be taken to the identification laboratory, where special techniques can be used to determine if it is a medfly specimen or not.

MEDITERRANEAN FRUIT FLY

Ceratitis capitata (Weidemann)

Distribution, Hosts, Life History and Habits,

Description and Graphs

MEDITERRANEAN FRUIT FLY

Distribution

Mediterranean fruit fly infestations were found in the United States in Hawaii since 1910, in Florida April 1929 to July 1930, April 1956 to November 1957, June 1962 to February 1963, and June to August 1963; in Texas June to July 1966, in California September 1975; in June 1980 in California, and August 1981 in Florida. Other countries are Albania, Algeria, Angola, Argentina, Australia, Austria*, Azores, Balearic Islands, Belgium*, Bermuda, Bolivia, Brazil, Burundi, Cameroon, Canary Islands, Cape Verde Islands, Chile, Costa Rica, Crete, Cyprus, Dahomey, Egypt, El Salvador, Ethiopia, France, Germany*, Ghana, Greece, Guatemala, Guinea, Honduras, Hungary*, Israel, Italy, Ivory Coast, Jordan, Kenya, Lebanon, Liberia, Libya, Madagascar, Madeira Islands, Malawi, Mali, Malta, Mauritius*, Mexico*, Morocco, Mozambique, Netherlands*, Nicaragua, Niger, Nigeria, Panama, Paraguay, Peru, Portugal, Reunion, Rwanda, Saint Helena, Saudi Arabia, Senegal, Seychelles, South Africa, Southern Rhodesia, Spain, Sudan, Switzerland, Syria, Tanzania, Togo, Tunisia, Turkey, Uganda, Upper Volta, Uruguay, Venezuela, Yugoslavia, and Zaire. As asterisk indicates those countries with occasional infestations.

Hosts

Thin-skinned, ripe succulent fruits of over 200 species. Most common hosts are the following stone, pome, and citrus fruits: *Prunus* spp. (peach, nectarine, apricot, plum, cherry, almond), *Pyrus communis* (pear), *Malus sylvestris* (apple), and *Citrus* spp. (orange, mandarin orange, grapefruit, pummelo, citron, calomondin, sweet lime, lemon*). Some of the other hosts are *Achras zapota* (sapodilla), *Annona* spp. (cherimoya, soursop, bullocks-heart, custard apple, sugar apple), *Asparagus* spp., *Atropa belladonna* (belladonna), *Calocarpum sapota* (sapote), *Calophyllum inophyllum* (Indiapoon beauty leaf), *Capsicum* spp. (peppers), *Carica papaya* (papaya*), *Carissa* spp., *Casimiroa* spp. (whitesapote), *Chrysobalanus* spp. (cocoplum), *Chrysophyllum* spp. (star apple), *Coffea* spp. (coffee), *Cydonia oblonga* (quince), *Diospryros* spp. (persimmon), *Eriobotrya japonica* (loquat), *Eugenia* spp., *Euphoria longan* (longan), *Ficus* spp. (fig), *Fortunella japonica* (marumi kumquat), *Gossypium*

spp. (cotton), Litchi chinensis (lychee), Lycopersicon esculentum (tomato), Malpighia sp., Mammea americana (mamey), Mangifera indica (mango), Mespilus germanica (medlar), Mimusops spp., Morus sp. (mulberry), Murraya paniculata (jasmin orange), Musa spp. (banana)*, Olea europaea (olive), Opuntia spp. (prickly pear), Persea americana (avocado)*, Phoenix dactylifera (date), Pimenta dioica (allspice), Punica granatum (pomegranate)*, Psidium spp (guava), Santalum spp (sandalwood), Solanum spp. (eggplant, black nightshade), Sorbus sp. (sorbe apple), Spondias spp. (mombins), Strychnos spp. (poison nut), Terminalia spp., Theobromo cacao (cocoa), Vaccinium cereum, Vitis spp. (grape), Zizyphus mauritiania (Indian jujube). An asterisk indicates those fruits which must be overripe or cracked to be infested.

Life History and Habits:

Eggs, laid in an egg cavity in fruit, hatch in 2-3 days at 79 degrees F. Larvae tunnel throughout the fruit to feed for 6-10 days at 76-79 degrees F. At this time, these third instars leave the fruit to pupate in soil or on whatever is available. Adults emerge from the pupae in 6-13 days at 76-79 degrees F. They can fly a short distance, but winds will carry them 1.5 miles, or more, away. They newly emerged adults are not sexually mature. The females can begin egg laying after 4-5 days at 79-80 degrees F. This preoviposition period, ranging from 2 to 163 days, is shortened by warm temperatures or several hours exposure to sun. Males mature faster than females.

A mated female searches for a soft, injured, or punctured spot on a fruit where she will lay 1-9 eggs in an egg cavity 1 mm deep. She may lay a maximum of 22 eggs per day up to 3 times per day. A female has the potential to lay 800 or more eggs. Because females favor ovipositing in previously prepared egg cavities, a cavity may contain many more than 9 eggs or larvae. Such a cavity reaches deeper into fruit pulp with each successive hatch.

Temperature is one limiting factor. Females will not oviposit when temperatures drop below 60.8 degrees F., although several hours exposure to sun overcomes this limitation. Development in egg, larval, and pupal stages stop at 50 degrees F. Pupae carry the species through unfavorable conditions, such as lack of food, water, and temperature extremes.

When host fruit is available for many successive months, temperatures range 60.8 - 89.6 degrees F., and relative humidity is between 75-85 percent, successive generations will be large and continuous. Lack of fruit for 3-4 months reduces the population to a minimum. Heavy infestations do not suddenly appear; they have been developing somewhere on a reservoir of host fruits.

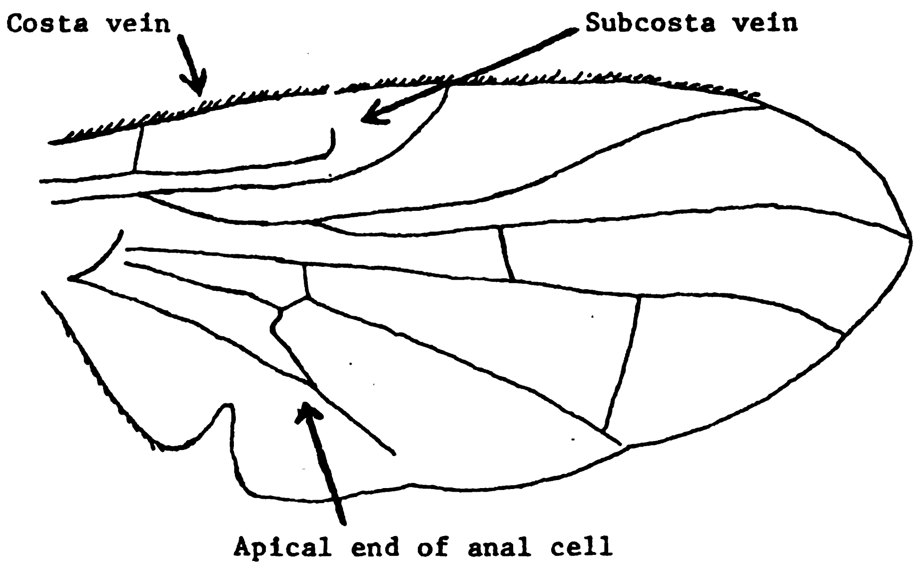
Adults usually die in 2 months at 77 degrees F. A few adults will survive up to a year or more under favorable conditions of food (fruit, honeydew, or plant sap), water and cool temperatures. Without food a newly emerged adult dies in 4 days.

Description

EGG. Very slender, curved, 1 mm long, smooth and shining white. Micropylar region distinctly tubercular. LARVA. Elongated and pointed at head end. Length from 1 mm newly hatched to 6.8 - 8.2 mm fully grown. White or color of ingested food. Head with accessory teeth near oral hooks. Anterior spiracle bears 7 - 10 lobes in a simple arc. Caudal spiracles in characteristic almost parallel pattern, not on raised surface, and with out black rings or seimcircles. Distinct low ridge connecting 2 tubercles on posterior swellings (observed on dry larval surface). Fully grown larvae "jump" repeatedly 10 inches or more when removed from fruit. PUPA. Cylindrical, 4 - 4.3 mm long, dark reddish-brown, resembling swollen grain of wheat. ADULT. Length 3.5 - 5 mm. Ye Yellowish with brown tinge, especially on abdomen, legs and some markings on wings. Lower corners of face with white setae. Eyes reddish purple. Ocellar bristles present. Male has pair of bristles with enlarged spatulate tips next to inner margins of eyes. Thorax creamy white to yellow with characteristic pattern of black blotches. Light areas with very fine white bristles. Humeral bristles present. Dorsocentral bristles anterior of halfway point between supra-alar and acrostichal bristles. Scutellum inflated and shiny black. Abdomen oval with fine black bristles scattered on dorsal surface and 2 narrow transverse light bands on basal half. Extended ovipositor 1.2 mm long. Wings broad and hyaline with black, brown, and brownish yellow markings. Wide brownish yellow band across middle of wing. Apex of anal cell elongated and parallel-sided. Dark streaks and spots in middle of cells in and anterior to anal cell. Wings droop on live flies.

TEPHRITIDAE--FRUIT FLIES

Tephritids are small to medium-size flies with "Pictured" wings (Bands and/or spots on clear wings). Two characters can be used to separate fruit flies from other flies. The first is that the subcosta turns up at a sharp angle and then fade before meeting the costal vein. The second is that the apical end on the anal cell is elongated.



Field Key to Four Economic Fruit Flies Genera

1. **Wings mostly** clear with brown band along costal margin and short **diagonal band near** base. With or without a short apical band (Fig. 1). **Third antennal segment** three or more times longer then wide (Fig. 2). -- Dacus

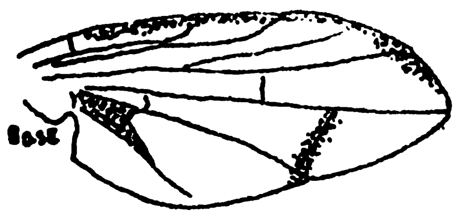


Fig. 1

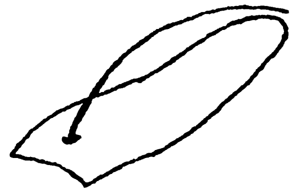


Fig. 2

1'. Wings more elaborately marked then above. Third segment of antennae short (Fig. 3 and Fig. 4). -- 2

2. Apical end of third antennal segment pointed (Fig. 4).--- Rhagoletis

2'. Apical end of third antennal segment rounded (Fig. 3).------------ 3

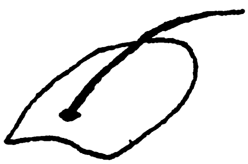


Fig. 3

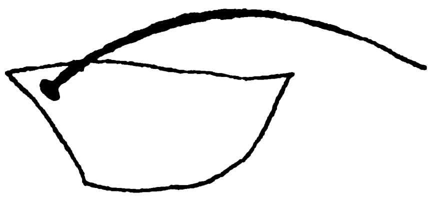


Fig. 4

3. Basal half of wings without dark spots (Fig. 5). Thorax with or without dark markings. -- Anastrepha

3'. Basal half of wings with dark spots (Fig. 6). Thorax with black or dark brown markings. -- Ceratitis

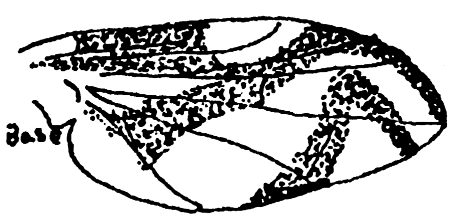


Fig. 5

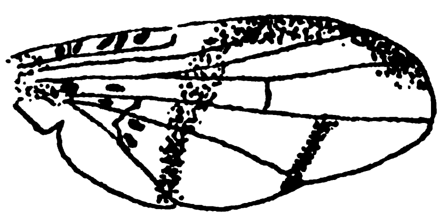


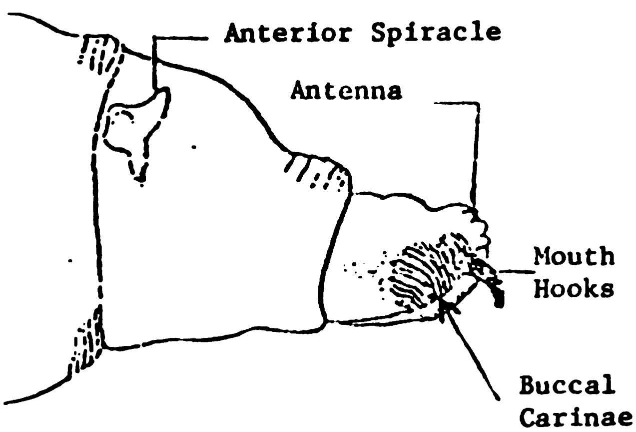
Fig. 6

Notes on some Commonly Intercepted Fruit Fly Larvae

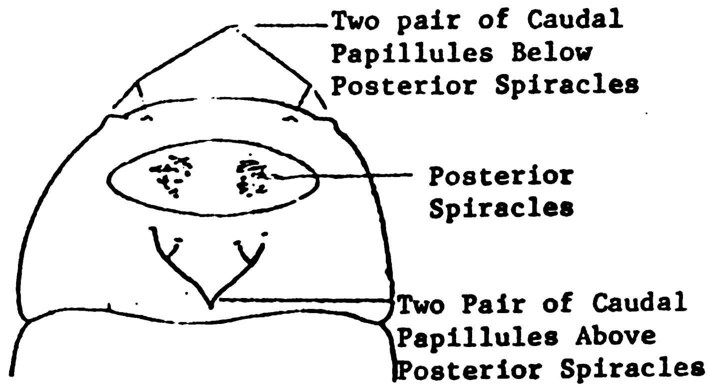
A. <u>Anastrepha</u> <u>spp</u>. - have four small caudal papillules above and four small ones below posterior spiracles. See Fig 2

1. <u>Anastrepha ludens</u> (Loew)

More than twelve buccal carinae; (Fig 1) caudal papillules above and below posterior spiracles arranged in two rows (lateral pair well ventrad of mesal pair) See Fig 2



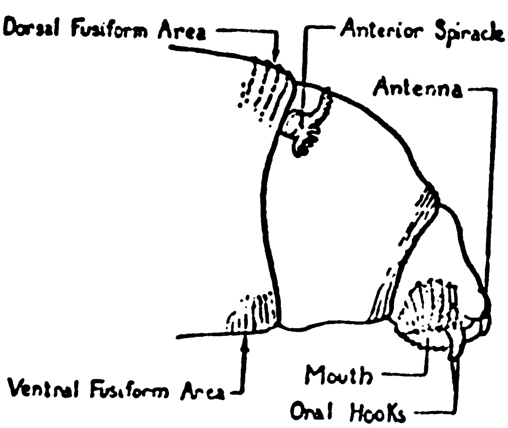
1. Lateral View of Head of Mature Larva

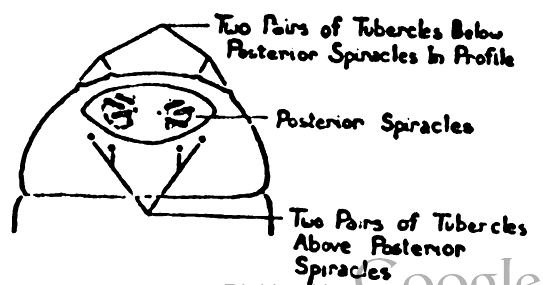


2. Dorsal View of Posterior End of Mature Larva

2. <u>Anastrepha</u> <u>sp</u>. other than <u>ludens</u>

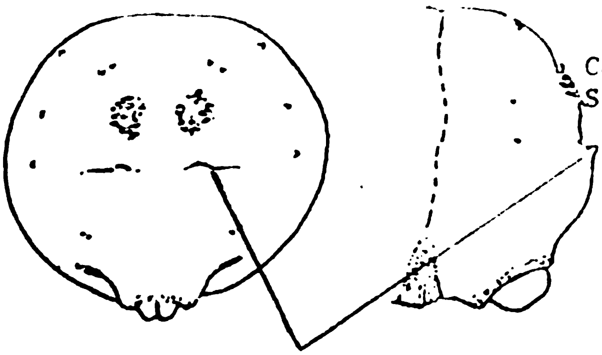
Twelve or fewer buccal carinae, usually eight or nine; caudal papillules in a transverse or slightly arched row.

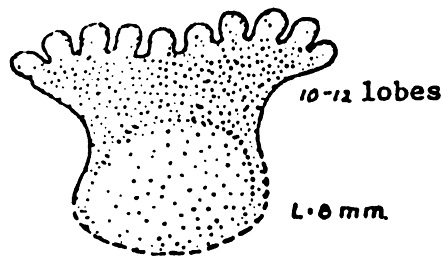




B. *Ceratitis capitata* (Wiedemann)

Two small caudal papillules above (entire or bifid) and two large papillose tubercles below posterior spiracles. (Fig 3) With 10-12 Spiracular lobes. (Fig 4)





Anterior Spiracle

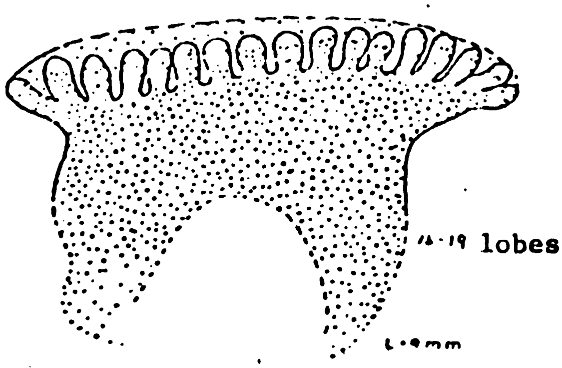
Ceratitis capitata (Wiedemann)

(Mediterranean Fruit Fly)

Fig 3

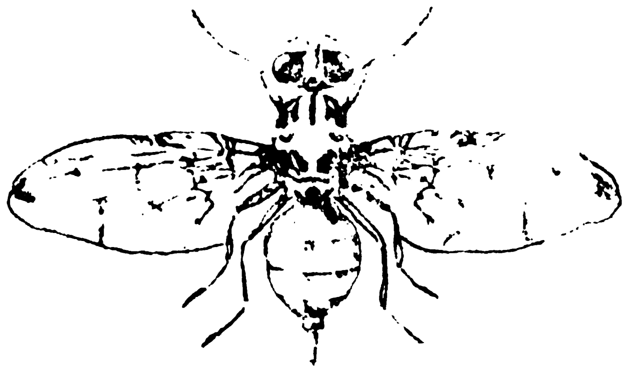
Fig 4

C. *Dacus spp.* - similar to *Ceratitis spp.*, with 16-19 Spiracular lobes (Fig 5)



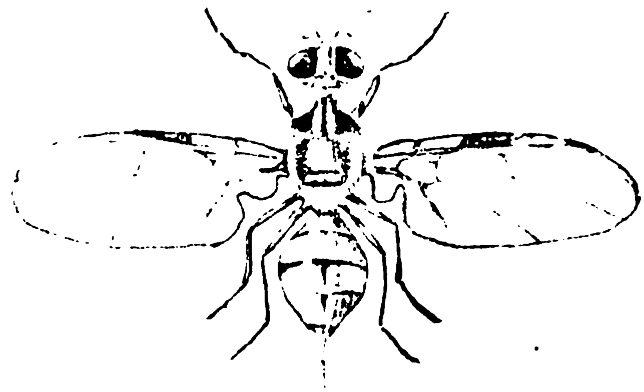
Anterior spiracle

Fig 5



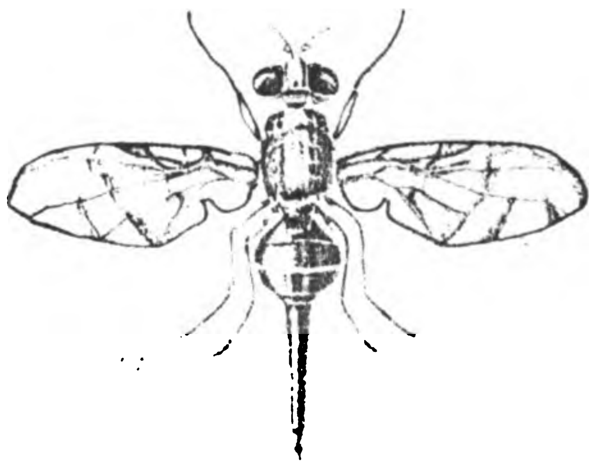
MEDITERRANEAN FRUIT FLY
Ceratitis capitata (Wiedemann)

Economic Importance: The Mediterranean fruit fly is a major pest of citrus. It also feeds on over 200 species of other fruits and vegetables. Distribution: This fly is widespread in Africa, Europe, Australia, Asia Minor, and Hawaii. In the Americas, it occurs from southern Mexico to Argentina.



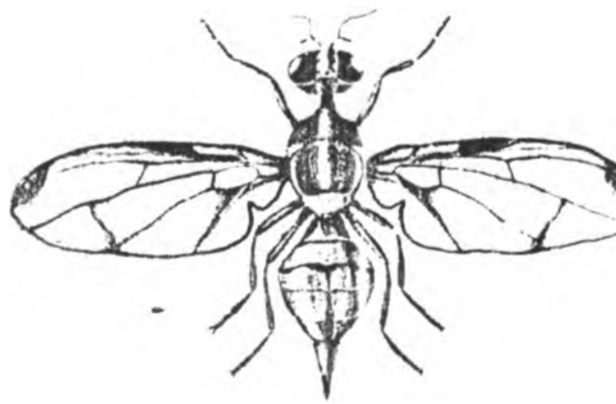
ORIENTAL FRUIT FLY
Dacus dorsalis Hendel

Economic Importance: This fly is a serious pest of fruits in many of the areas where it occurs. It is a pest of over 100 plants including citrus, mango, banana, tomato, and peach. Distribution: The Oriental fruit fly is found in Southeast Asia and Hawaii.



MEXICAN FRUIT FLY
Anastrepha ludens (Loew)

Economic Importance: The Mexican fruit fly is a major pest of citrus. Its other hosts include mangoes, peaches, avocados, and apples. Distribution: This fly is found from northern South America to the Rio Grande Valley in Texas.

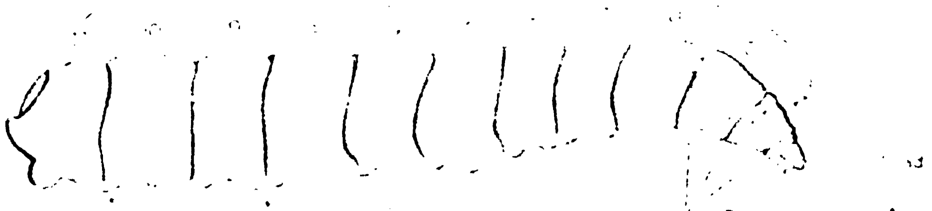


MELON FLY
Dacus cucurbitae Coquillett

Economic Importance: The melon fly attacks many fruits and vegetables. This fly is an important pest of cultivated cucurbits like melons and cucumbers. Distribution: This fly occurs in Southeast Asia, parts of East Africa, and Hawaii.

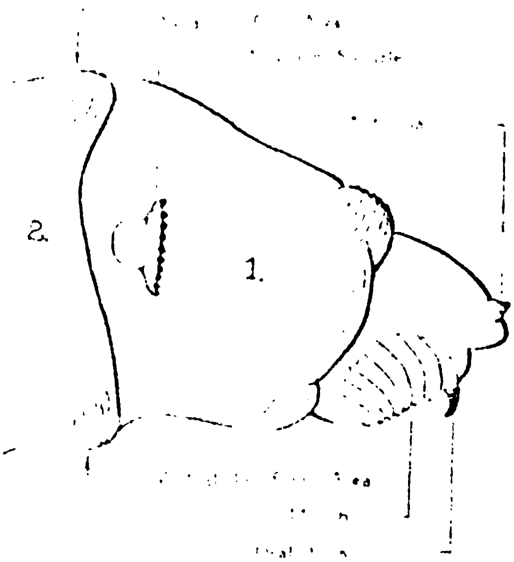
Illustrations from "Major Fruit Flies of the World" by Dr. Howard V. Weems, Jr., Florida Department of Agriculture and Consumer Services, Division of Plant Industry.

CERATITIS CAPITATA (WIED.)

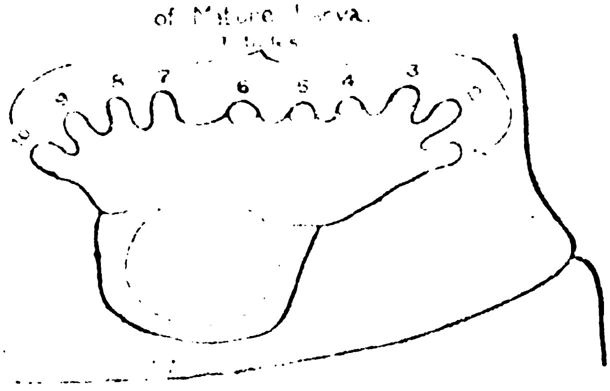


1. Lateral View of Mature Larva.

3. Lateral View of Oral Hook of Mature Larva.

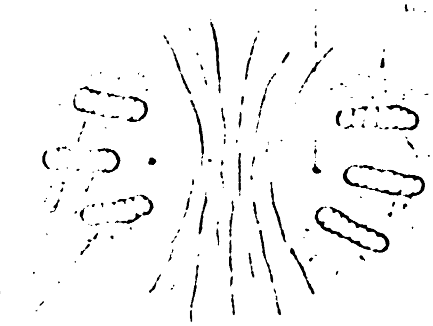


2. Lateral View of Head of Mature Larva.

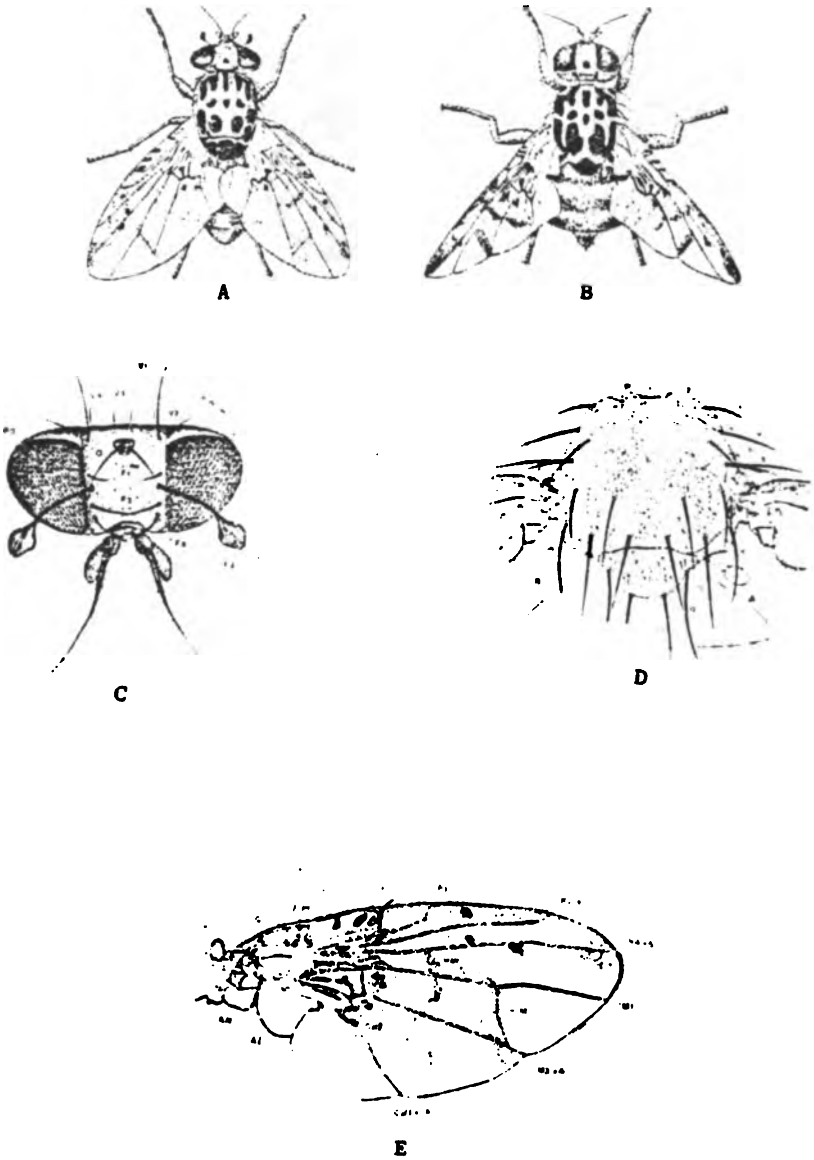


4. Lateral View of Anterior Spiracle of Mature Larva.

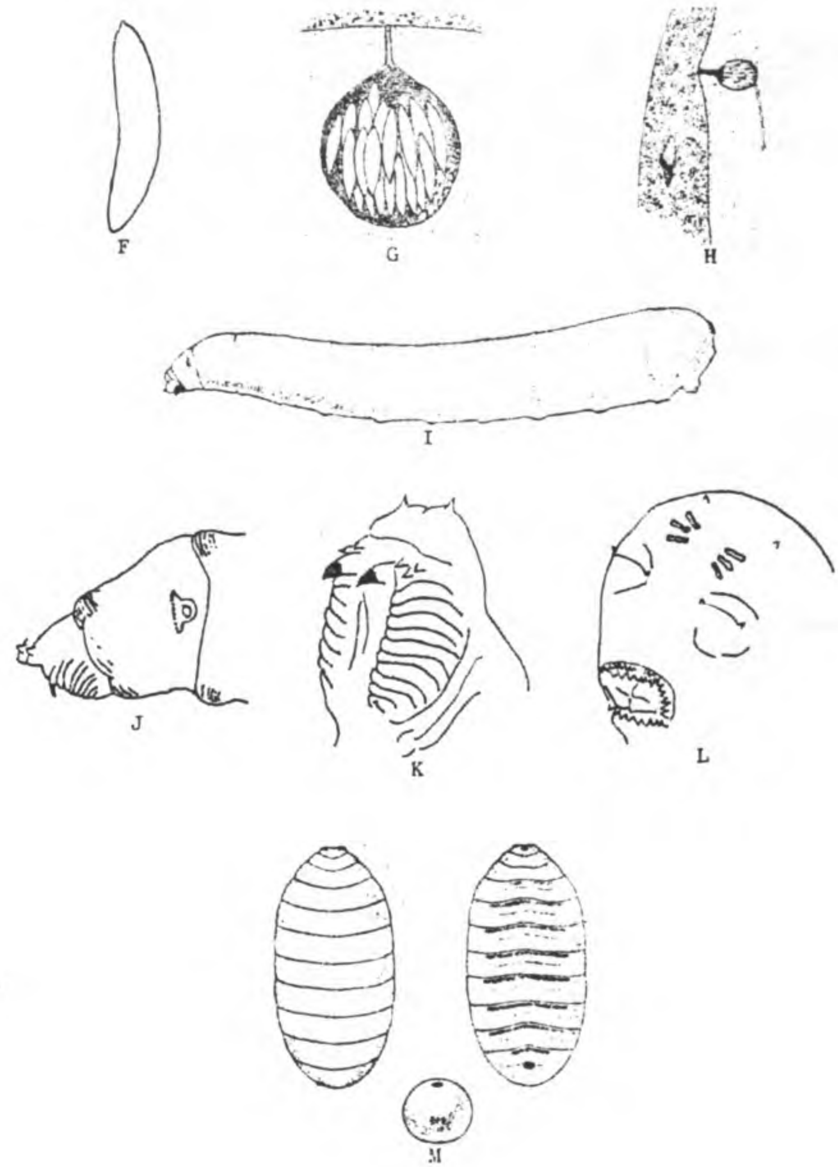
5. Dorsal View of Posterior End of Mature Larva.



6. Posterior Spiracles of Mature Larva.



Figs. A-E, Ceratitis capitata (Wiedemann) adult: A, male; B, female; C, head of male showing ocellar bristles and spatulate-tip bristles; D, dorsal view of thorax showing key bristles; E, wing showing extension of apex of anal cell.



Figs. F-M, Immatures of Ceratitis capitata (Wiedemann): F, egg showing tubercular area of micropyle; G, egg cavity in peach; H, egg cavity in orange; Figs. I-L Third-instar larva--I, lateral view, J, lateral view of head, K, oblique lateral view of head, L, oblique view of hind end; Fig. M, pupae.

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