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Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

Dr. Popov, this is that report on avocados in Mexico. I have asked Mr. Stone and Mr. Bush to attend our Horticultural Institute and Mr. Bush will be on the program.

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service
Entomology Research Branch
Fruit Insects Section
Apartado Postal Num. 28971
Mexico 17, D.F. Mexico

AIR MAIL

November 1, 1956

To: W. C. Cooper, Horticultural Crops Research Branch, ARS,
Box #144, Weslaco, Texas

From: W. E. Stone, In Charge, Mexican Fruit Fly Research

Subject: Information on Avocados in the Republic of Mexico *By Mr. Bush.*

You will find enclosed the information you requested of Mr. Bush on last month's field trip. We have included a list of avocado growing areas that the Agricultural Attache's office in the American Embassy obtained from the Mexican Government. All figures on the number of trees listed in this report should be regarded as only rough estimates, but it will give you an idea of the number of trees in a given area. There are also many areas on this list that we have not covered as yet. Many areas covered, however, are not listed in the government report. These are areas 5, 9, 19, 22, 23, 25, 28, 29, 30 and 32 on the map. They are covered in Mr. Bush's reports and information about these areas can be found there.

Areas 11, 19 and 29 have not been covered but information obtained about these areas may prove interesting to you. Area 11 is about 7,300 feet in altitude and Mr. Bush has been informed that there are avocados grown in this area. Area 19 is said to have a huge avocado tree growing in a town called Teetitlan del Camino and might prove worth visiting. Area 29 is located in the Chiapas back country and the avocados here are said to be of a very good quality.

There are several other areas that should be brought to your attention. Area 3 is the locality that has the very old and large trees. Local inhabitants say that some are 200 years old. The town in which these avocado trees are found is called San Angel Ziracuaretiro. The avocados were of average size and probably pure Mexican or Mexican x Guatemalan.

Areas 7, 8 and 9 had a very heavy freeze last year and about 60 to 70% of the trees were damaged. Many, however, came through with little or no noticeable bad effects and managed to produce a fair crop.

Avocados here are probably of all three types as many seedling groves can be found similar to the one you are using near Llera. This region is your best bet for locating new varieties and is not far from other areas you are familiar with.

Areas 17 and 18 cover the slopes of Orizaba mountain. This region is said to be the home of the avocado and might prove to be a place to find cold resistant varieties.

2-WCCooper-November 1, 1956

The aeronautical charts Mr. Bush uses in his work can be obtained by writing to the following address:

Commanding Officer
Aeronautical Chart Service, U.S.A.F.
Washington 25, D. C.

These give more detail than most Mexican maps and have proved of some use in obtaining approximate altitude readings. Another set of maps that is very useful is the ones put out by the Mexican Automobile Association.

The book on Mexican plants you wanted information on is called "Catalogo de Nombres Vulgares y Cientificos de Plantas Mexicanas" by Prof. Maximino Martinez, printed in 1937 by Imprenta Mexicana, Republica de Salvador #96, Mexico, D.F. This book contains most of the known plants in Mexico, listing them first by their common name and then by their scientific name, giving other information as to medicinal purposes, tree or shrub, etc.

Mr. Bush hopes you will find this information helpful and that he has included most of the things you requested. He also hopes you will let him know whenever you plan to make future trips into Mexico as he would appreciate being included in order to obtain more information regarding avocados. He was able to pick up a great deal on the last field trip and we wish to thank you for the help.

/s/ W. E. Stone

Enclosures - as stated

AVOCADO PRODUCTION BY LEADING MUNICIPALITIES
WHICH PRODUCED 100 TONS OR OVER

Final Figures for 1953

	TREES	TONS		TREES	TONS
AGUASCALIENTES			HIDALGO		
Calvillo	2300	161	Tlahuiltontepec	1500	105
BAJA CALIFORNIA			Huazalingo	3000	255
San Jose del Cabo	900	117	Huejutla	8600	430
CAMPECHE			Orizatlan	1800	108
Campeche	2200	154	Tlanchinol	3700	259
Carmen	5200	468	Jaltocan	2000	120
COAHUILA			Chilcuautla	2500	125
Parras	2600	195	10 Mezquititlan	1500	150
COLINA			10 Metzquitlan	1550	170
2 Comala	2000	180	Tianguistengo	2800	224
2 Coquimatlan	1300	117	Huehuetla	2500	175
CHIAPAS			9 Tecozautla	14000	1050
Sabanilla	1100	121	Acexochitlan	5900	354
San Pedro Chenalho	1400	168	JALISCO		
Chalchihuitan	1000	100	Santa Ma. de los		
Villa Flores	2640	185	Angeles	2400	192
30 Chamula	1350	122	1 Tequila	3500	315
30 Oxchuc	1400	126	MEXICO		
Acapetahua	1500	105	Ixtapan del Oro	2300	207
31 Huixtla	2000	120	Valle de Bravo	2000	200
Mazatan	1570	126	Almoleya de Alq.	3000	240
DURANGO			Tejupilco	1200	120
Topia	1200	108	Malinalco	10150	1015
Pueblo Nuevo	1500	135	Tenancingo	15000	1200
GUANAJUATO			Villa Guerrero	35845	2437
7 Silao	1200	114	MICHOACAN		
7 Comonfort	1200	108	Tacintaro	1500	135
7 Guanajuato	2000	200	Tinguindin	5000	350
7 Penjamo	1500	135	3 Uruapan	28000	2800
7 Celaya	3500	135	Tingambato	2000	160
7 Salamanca	1500	105	6 Querendaro	5000	400
7 Tarandacuao	1500	120	5 Tuxpan	2000	160
GUERRERO			6 Zinapécuaro	3400	255
Ixcateopan	1988	179	6 Zitacuaro	14000	1120
San Luis Acatlan	1000	110	Apatzingan	1200	108
Tlacoachistlahuaca	1800	162	3a Pariban	2000	120
Xochitlahuaca	2000	190	4 Tacambare	8000	720
			4 Ziracuaratiro	15000	900
			5 Jungapeo	6000	420
			Villa Madero	5000	300
			Coalcoman	3000	300

	TREES	TONS		TREES	TONS
MORELOS			SAN LUIS POTOSI (Cont'd.)		
21 Cuernavaca	1000	100	Tamazunchale	4700	470
Ocuituco	5000	500	Tampamolón	1500	120
Tlanepantla	2500	175	Tanlañas	3000	120
21 Yautepec	8000	600	SINALOA		
Yecapixtla	3500	210	Culiacán	6500	455
Zacualpan de Amilpas	2000	140	TABASCO		
Tetela del Volc.	1000	120	Cardenas	4500	315
Tlaltizapan	2000	150	Villahermosa	4000	280
Xochitepec	3000	240	Cunduacan	1650	116
Ayala	5000	375	Teapa	2000	200
NAYARIT			Jonutla	2500	188
Tepec	1800	180	Tenosique	1800	198
Sta. Ma. del Oro	4000	500	Tamaulipas		
NUEVO LEON			Cd. Victoria	2700	189
Bustamanta	2000	100	Ocampo	2000	100
Hualahuises	3500	245	VERACRUZ		
Montemorelos	1500	120	Citlaltepec	5000	300
Rayones	2000	160	Chicontepec	2500	200
OAXACA			Platon Sanchez	3000	210
26 Tuxtpec	3000	180	13 Tuxpan	1800	216
Guelache	3000	210	Chalma	2000	140
PUEBLA			14 Gutierrez Zamora	1800	144
Chilconcuautla	2000	120	Jalancingo	4200	210
12 Huauchinango	2500	125	15 Misantla	2000	140
Pahuatlan del V.	2000	140	14 Papantla	5000	450
20 Atlixco	20000	1460	Tlapaceyan	2000	138
Tochimilco	2500	200	Amatlan de los R.	2000	200
Hueyapan	8000	240	Calcahualco	1700	136
16 Zacapoaxtla	8000	440	Maltrata	2000	100
Zacatlan	3000	300	Ursulo Galvan	2000	160
QUERETARO			Tomalan	1000	100
Cadereyta	1900	124	Alvarado	4500	225
Tolimán	8000	400	Medellin	2000	200
8 Queretaro	15300	1224	24 Sn. Andres Tuxtla	2100	168
8 San Juan del Rio	25000	2500	Tesechoacan	2500	175
V. Corregidora	13000	1040	Pajapan	3000	330
La Canada	2000	140	YUCATAN		
QUINTANA ROO			Merida	2400	120
Felipe Carrillo	3000	240	Temozon	3000	360
SAN LUIS POTOSI			Oxkitzoab	2400	216
Rio Verde	4000	300	Peto	1400	112
Sta. Ma. del Rio	3000	150	Tecax	2100	189
Cd. Valles	4600	240	ZACATECAS		
Coxcatlan	3000	225	Cd. Garcia	2000	140
Sn. Martin Ch.	2000	200			

This information was provided by the
Agricultural Attache's Office,
American Embassy, Mexico, D.F.

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(4) Host studies for *A. ludens* (G. L. Bush, Jr. and R. H. Rhode)

During the past month a survey was initiated to locate areas for study of hosts of *A. ludens*. Particular attention is being given to the avocado and its infestation by the Mexican fruit fly. Much appreciation is extended at this time to Mr. J. M. Ramirez of the Mexican Fruit Fly Control Project for the invaluable information obtained by him last year on a survey of avocado areas of Mexico.

As of the time of writing only 445 ripe avocados, collected at Jungapeo, Michoacan, have been held for study. Ten fruits were dissected in the field and found to contain clusters of eggs in and under the skin. Closer examination by microscope disclosed they had a marked resemblance to *A. ludens*.

From the avocados placed in holding boxes 34 larvae and pupae having *A. ludens* characteristics were recovered. Several of the larvae died before pupation and were preserved for future study and reference. Though the larvae appear to be *A. ludens* identification cannot be confirmed until adults emerge from the pupae collected.

The following table lists the towns and villages, by state, that have been covered up to date. Altitude is included, for there seems to be a correlation between elevation and the occurrence of *A. ludens*, primary hosts, and avocados together in a given area. The most ideal altitude for collecting suspected infested avocados is between 4,000 and 5,500 feet.

See table next page.

It is interesting to note that the smaller, less marketable Mexican races of avocado are found at high elevations and mature between April and July. The larger, were preferred Guatemalan strains and Guatemalan-Mexican hybrids, usually grow at lower altitudes with fruit maturing between June and August. As *A. ludens* is not found in abundance in low, hot regions it is doubtful that much infestation will be found in these low altitude varieties.

It has also been noticed that a greater number of *A. ludens* adults are collected in avocado trees than mango trees within the same area. A reason for this might be the slightly sweet white powder that accumulates on the back at the point where an avocado tree is injured. This powder is said to be a sugar-alcohol called Dulcitol which is closely related to the 6 carbon sugars. (Chandler, W. H., Evergreen Orchards, 212, 1950).

A great deal of dying back of avocados has been found in the States of Queretaro, Michoacan and Jalisco. All symptoms point to the fungus *Phytophthora cinnamomi*. In Queretaro, where damage is heaviest, about 80% of the avocados are affected. Samples are being taken for further study to determine the exact cause.

Next month will be spent covering Puebla, Chiapas, Oaxaca and the southern part of Veracruz. As soon as fruit begins to mature in May and June, avocados will be collected and held for observation and infestation studies.

Table. Data on avocado areas visited on host studies during March 1956.

Location	Reported $\frac{1}{2}$ maturation dates	Estimated $\frac{1}{2}$ number of avocado trees	Elevation in feet	Primary hosts noted	
<u>STATE OF MICHOACAN</u>					
5	Jungapeo	April-July Nov.-Dec.	3,000	4,900	Mango, citrus
5	Tuxpan	April-July	1,000	6,300	Few mango, citrus
6	Bocaneo	April-July	?	7,000	None
6	Querendaro	April-July	5,000	7,000	None
(4)	4 Tacambaro	April-July	8,000	5,173	Mango, citrus
3	Uruapan & vicinity	April-July	20,000	5,281	Mango
3	Ziracuaretiro	April-July	10,000	5,000	Mango, citrus, others
3	San Angel Ziracuaretiro	April-July	25,000	5,000	Mango, citrus
3a	San Francisco Periban	April-July	2,000	5,300	Mango, citrus
3a	Periban	April-July	10,000	5,300	Mango, citrus
<u>STATE OF JALISCO</u>					
1	Tequila	July-August	5,000	2,800	Mango, citrus
<u>STATE OF GUANAJUATO</u>					
7	Comonfort	May-August	10,000	6,000	None
<u>STATE OF QUERETARO</u>					
8	Queretaro	May-August	15,000	5,973	None
8	San Juan del Rio	May-August	20,000	6,488	None
<u>STATE OF VERACRUZ</u>					
22	La Antigua Veracruz	June-August	12,000	500	Mango, citrus
16	Jalacingo	May-July	5,000	6,700	None
16	Tlapacoyan	May-July	800	2,000	None
14	Gutierrez Zamora	June-August	800	400	Mango, citrus
14	Papantla	June-August	1,500	800	Mango, citrus

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C O P Y	14 Poza Rica	June-August	1,000	800	None of importance
	13 Tuxpan	June-August	1,800	100	Mango, citrus
	12 Huauchinango	June-August	2,500	4,600	Mango, citrus
<u>STATE OF HIDALGO</u>					
	10 Metztitlan	May-July	1,500	4,000	Mango, citrus
	10 San Agustin Metzquititlan	July-August	4,000	4,000	Mango
<u>STATE OF PUEBLA</u>					
	16 Tezuitlan	May-June	500	6,300	None
	16 Jacapcoxtla & vicinity	May-June	1,500	6,600	None

1/ Maturation dates and to some extent estimate of number of avocado trees based on information obtained from local growers.

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(3) Host studies for A. ludens (G. L. Bush, Jr.)

The States of Puebla, Oaxaca, Chiapas and southern Veracruz were covered during the month in connection with the A. ludens studies. Travel, however, was limited to some extent by the early start of the rainy season. Areas covered are on table following this report.

Three areas stand out as possible collecting points. These are the Atlixco-Izucar de Matamoros region in Puebla, Tapachula and vicinity in Chiapas, and the area bordering the Papaloapan River in Oaxaca and Veracruz.

The Atlixco-Matamoros area is the home of the Fuerte avocado. This is believed to be a natural Mexican-Guatemalan hybrid that is most preferred and grown in the state of California. Many other fruits are found in the region, such as mangoes, peaches, pears, plums and apples.

Tapachula is interesting due to its tropical vegetation. Numerous wild and cultivated fruits are to be found in abundance. Avocados in this area are predominantly of the Guatemalan strain. The fruit is large and thick-skinned and not as marketable as the smaller Mexican varieties. Another interesting feature of these avocados is the absence of the psyllid gall. Besides avocados, almost every tropical fruit of Central America is represented in and around the town. Tapachula is also located on the Mexican-Guatemalan border. Until the completion of the Pan American Highway in Guatemala, this town is the only port for vehicular travel between Mexico and Central American countries. Due to this fact, there is a great deal of traffic through the area which makes it a possible point of entry for the Mediterranean fruit fly now found in Costa Rica.

The Papaloapan River basin is similar to Tapachula with numerous varieties of fruit trees cultivated and growing wild. Fruit here ripens about two months later than in Tapachula. Avocados are a major crop in some towns with mangoes taking the lead in others.

In last month's report, it was stated that 34 larvae and pupae were obtained from avocados gathered at Jungapeo, Michoacan. Only 4 females and 1 male A. ludens emerged from these. The remaining pupae have failed to develop, but will be held in case of delayed emergence. The 5 adult ludens that did emerge indicate that avocados do become infested naturally in the field. To further check these results, 1,600 avocados were collected from the Jungapeo area and placed in holding boxes. So far 5 pupae having the characteristics of A. ludens have been recovered from this lot of avocados.

One hundred and fifty avocados from Tapachula, consisting of 3 different Guatemalan varieties, are being held for observation. Forty-one of these were artificially infested in the laboratory and the rest were placed in holding boxes to determine any natural infestation.

The following fruit also collected in Tapachula is being held:

Jobo (Spondias lutea L.)
 Jecote (S. purpurea L.)
 Caimito (Chrysophyllum caimito L.)
 Mamey (Colocarpum mammosum P.)
 Mango (Mangifera indica L.)

Pupae have been recovered from jobo, caimito and mango and are being held for identification upon emergence of the adults.

Table 3. - Data on avocado areas visited on host studies during April 1956.

Location	Reported Maturation dates	Estimated number of trees	Elevation in feet	Other hosts present
<u>STATE OF PUEBLA</u>				
20 Atlixco	June-July	20,000	6,400	Few mangoes & other fruits
20 Tochimilco	June-July	?	7,000	Few mangoes
20 La Trinidad Tepango	June-July	3,000	6,000	Sweet limes & few mangoes
20 Axopan	June-July	2,000	5,000	White sapote & sweet limes
20 San Hueluca	June-August	3,000	4,500	Mangoes & sweet limes
20 Teyusa	June-August	4,000	4,000	Mangoes
20 San Martin Alchichun		1,000	4,000	mangoes
20 Izucar de Matamoros	June-August	3,000	4,000	Mangoes Peaches & sweet limes
<u>STATE OF OAXACA</u>				
28 Tehuantepec	June-July	500	50	Mangoes
26 Tuxtepec	June-July	3,000	400	Mangoes & many other fruit trees
<u>STATE OF CHIAPAS</u>				
31 Tapachula	April-July	20,000	356	Mangoes & many others
31 Huixtla	April-July	4,000	500	Mangoes & many others
31 Mazatan	April-July	2,000	100	Mangoes & many others
32 Villa Corzo	July-August	1,000	1,500	Few mangoes

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STATE OF VERACRUZ

Y	27 Minatitlan	June-July	2,000	83	Mangoes (Manilla)
	27 Jaltipan	June-July	3,000	100	Mangoes (Manilla)
	24 San Andres Tuxtla	June-July	3,000	900	Mangoes

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(4) Parasite shipments (R. H. Rhode)

Shipments of parasites consigned to Costa Rica for the Mediterranean Fruit Fly have been terminated for the present. During their transshipment the insects were fed and mortalities noted in Mexico City. Handling of the parasites was done under the direction of H. D. Smith.

(5) Host relationship studies of Mexican fruit flies (G. L. Bush, Jr.)

The following species of fruit flies emerged from the fruit collected April 27-29 at Tapachula, Chiapas:

Jobo (<u>Spondias lutea</u> L.)	<u>A. mombinpraeoptans</u>
Mango (<u>Mangifera indica</u> L.)	<u>A. mombinpraeoptans</u>
Caimito (<u>Chrysephyllum cainito</u> L.)	<u>A. serpentina</u>
Avocado (<u>Persea americana</u> var.)	<u>A. serpentina</u>

The infestation of A. serpentina in avocados provides another host record for this species which has not previously been reported.

Only one adult A. ludens emerged from 5 pupae recovered from the 1600 avocados collected at Jungapeo, Michoacan. The 150 avocados picked from the tree in Tapachula, Chiapas failed to produce any fruit flies. However, the same fruit collected from the ground and held produced 48 adults A. serpentina. Forty-one picked avocados were artificially infested in the laboratory and 89 pupae were recovered from these.

Fungus usually causes rapid decomposition of fruit held for extended periods of time. To retard this break-down the fruit was given a 30-second dip in a solution containing the following:

95% Ethyl alcohol	95 parts
Bichloride of mercury	0.5 parts
Glycerine	5.0 cc.

This gives some protection and does not seem to harm the larvae. It is far from a suitable solution to the problem, however, and other compounds and dips should be tried.

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studies. The olfactometer was stocked with 160,000 flies; 4,000 adults were used in diet studies and 4,000 puparia were given to commodity treatment studies. The laboratory in Brownsville, Texas, was supplied with several shipments of puparia this month. The total amounted to 8,100 puparia recovered from field infested mangoes and 10,000 puparia from our stock.

Results of tests with dehydrated carrot and of tests with additional nutrients to the standard media will be given in the following report. It was mentioned in the last report that a comparative study of two different kinds of yeasts was begun. Now, partially hydrolyzed yeast protein has been included in this test. Results will be given when more data have been obtained.

(3) Host studies (G. L. Bush, Jr.)

Three survey trips were made during the past month. Several new areas were covered and will be listed at the end of this report.

The first region visited was Tuxtpec, Oaxaca. This town with its surrounding groves proved to be an excellent collecting point comparable to Tapachula, Chiapas. Avocados (Persea Americana var.), jiniquila (Inga. xalopensis Benth.), mamey (Colocarpum mammosum P.) and mangoes (Mangifera indica L.) were returned to the laboratory for holding. Only the mangoes produced any pupa and these turned out to be A. mombinpraeoptans. This does not give a good indication of the degree of infestation present as local growers complained of heavy losses due to larval damage.

A swing through the states of Hidalgo, Queretaro, Jalisco, Colima and Michoacan was made with few results due to constant rains. However, two new collecting areas were located. Of these Tecozautla, Hidalgo can be regarded as a suitable area for future investigation. Growers have had trouble in the past with infested fruit. Due to a severe freeze last winter no fruit was available for study. A great many peaches are grown along with avocados, oranges and mangoes. It is hoped that this region can be used next year for host studies.

In Colima the towns of Comala and Coquimatlan had large groves of interplanted mangoes and avocados. Several other varieties of fruit are also grown but are of minor importance. A heavy larval infestation was noted and growers in both towns complained that no mangoes are marketed because of the poor condition of the fruit. No fruit could be picked due to heavy rains so the area will have to be revisited at a later date. Both mangoes and avocados in Colima are of distinctly different varieties than those encountered in other parts of Mexico.

Two boxes of avocados totaling 900 fruits were picked at Jungapeo, Michoacan. It is from this area that 42 pupae and 6 adults A. ludens have emerged from picked avocados. However, no pupae have been recovered from the last lot of avocados. The absence of infestation may be caused by the nearby maturing mango crop which is a primary host. Avocados will be obtained from Jungapeo at regular intervals to see if the harvesting of the mango crop has any relationship to the degree of infestation in the avocados.

The last trip made was to the Atlixco, Puebla region. There is a fair peach crop maturing this year which already shows some infestation. Mangoes are heavily infested as are mameys and a few oranges. Ten traps were set out in two towns with 3 species of Anastrepha being collected. There were A. ludens, A. serpentina and A. mombinpraeoptans. One hundred and forty-five avocados are being held from this area along with a few peaches. No pupae have emerged from either.

Table 7. Possible Host Study Sites visited During June 1956.

Location	Reported maturat@on dates	Estimated number of avocado trees	Elevation in feet	Other hosts present
9 Tecozautla Hidalgo	May-July	14,000	5,500	Mango, peach
2 Comala Colima	May-Sept.	2,000	1,600	Mango, mamey
2 Coquimatlan Colima	May-Sept.	1,300	1,500	Mango, mamey

(4) Biological Studies (R. H. Rhode, M. Sanchez R.)

A survey to determine the degree of infestation in the fruits of Sargentia greggii by A. ludens was undertaken this month. The sites inspected were limited to those areas in which more or less extensive growths of the host tree were found by McPahil, Gingrass and Hensley in 1937. The most important locations are listed along with their degrees of infestation as determined by the examination of fruits selected at random:

Burgos area - Location 23 road miles from Burgos on way to San Carlos. Rather extensive area in canyon on northern slope of hills. Fruit is plentiful and found to be 13.8 percent infested. From 5 fermenting bait traps placed in a line about 75 yards up the canyon at 5:00 p.m. June 16 and inspected at 12:00 noon June 17, 34 adult A. ludens were recovered.

Hacienda Santa Engracia - Fruit 15 percent infested - not must fruit present. In 11 days, 6 bait traps yielded a total of 14 fruit flies.

Horsetail Falls - Fruit rather sprase - 45 percent infested.

Cerralvo - Extensive growths of Sargentia. Fruit not too abundant. One hundred fruit inspected with no infestation found; 700 fruits being held in laboratory for possible larval emergence.

In the Burgos and Santa Engracia areas the larvae were found to be pupating. The average number of larvae present per fruit seed in these locations were 2.9 and 3 respectively. These larvae were all found to be robust and vigorous. Extracts from the seeds of these fruits will be sent to Washington for protein, carbohydrate and fat content analyses.

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
~~ENTOMOLOGY RESEARCH DIVISION~~
~~FRUIT INSECTS SECTION~~
APARTADO POSTAL NUM. 28971
MEXICO 17, D. F. MEXICO

AIR MAIL

September 27, 1957

Dr. F. W. Popence
Antigua, Guatemala

Dear Dr. Popence:

We are glad to have the information regarding infestation of mangoes by Anastrepha which you gave in your letter of August 26.

Here in Mexico the Manila mango is not generally observed to be heavily infested with the Mexican fruit fly. This is undoubtedly due to two factors, (1) the Manila mango is grown almost exclusively in the lower tropical regions where the Mexican fruit fly populations are not as great as in the subtropical regions such as Morelos; (2) the fruit is harvested in the green-ripe stage about 10 to 12 days before ripening and before the flies have had an opportunity to heavily infest it.

As shown in Miscellaneous Publication No. 531 of the Department, A Review of Studies of the Mexican Fruitfly and Related Mexican Species, by Baker, Stone, Plummer and McPhail, 1944, p. 11, in 1937 Dyfrig McH. Forbes of El Potrero, Veracruz, observed fruits from 6 Manila trees in each of 7 localities using 2 boxes of 200 fruits from each. The infestation ranged from 12 to 41 percent with an average of 26 percent. According to Mr. Forbes infestation was 3 to 5 percent in 1936. This compares to practically 100 percent infestation in common mangoes in localities such as Cuernavaca.

In the light of our knowledge at present, the infestation at El Potrero may have been due to Anastrepha mombinpraecoptans which is more abundant in the lower, warmer altitudes and which has been found infesting Manila and other mangoes quite heavily at times.

With regard to control of fruit flies in mango the results we have obtained in our studies in the state of Morelos, 4800 ft., during the past several years with the Mexican fruit fly, show that excellent control can be obtained with both 50 percent wettable powder methoxychlor and 25 percent wettable powder malathion applied with hydraulic equipment as light or incomplete coverage sprays.

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With methoxychlor as little as 0.2 percent of the fruit has been recorded as infested with .02 larvae per pound compared to 75 percent of the fruit in the control with 40 larvae per pound.

Methoxychlor 50% WP was used at 8 pounds per 100 gallons applied in 3 sprays, April 20, May 3 and May 24. The last fruit records were taken July 27. Application was approximately at 3 gallons per large tree. Total cost for 3 applications was approximately 10 pesos or about \$0.75 U.S.Cy. per large tree. Methoxychlor 50% WP costs about \$0.60 U.S.Cy. per pound.

Although the methoxychlor tests were made against the Mexican fruit fly there is no reason to doubt that it would not be effective against other Anastrepha. Methoxychlor has extended residual values and it has the great advantage of being only slightly toxic to man and animals compared to most insecticides and the official tolerance for residues is high at 15 parts per million.

Methoxychlor can not be used on citrus because of build up of injurious insects such as scales and mealybugs due to the effect on beneficial insects. In the state of Morelos, the only place where methoxychlor has been tested on mangoes, there has been no increase of injurious insects during the 4 years that tests have been made.

As conditions in Central America may be somewhat different from those in Mexico it would be wise to make an observation to determine the presence of such insects as scales and mealybugs on the mango trees before treatment with methoxychlor and then observe the trees for possible build up. If a tendency to build up is observed, malathion may be used.

Malathion 25 percent wettable powder used at the same rate and in the same manner has also given good results in control experiments with the Mexican fruit fly. Cost of 25 percent malathion is \$0.40 U.S.Cy. per pound which results in a cheaper formula but more applications are needed.

As you know, malathion is also much less toxic than most insecticides and the official tolerance for residues is 7 parts per million.

Malathion was proved highly effective in Hawaii against the three highly injurious fruit fly species there, using a protein bait in the formula. Large scale, intensive experiments are continuing with malathion without protein bait against the Mexican fruit fly. Application has been made by airplane, mist duster, Buffalo turbine, speed sprayer and ordinary hydraulic equipment. In all of the experiments almost as good results or better have been obtained in the use of malathion alone as with malathion plus the protein bait which is expensive at around \$1.00 U.S.Cy. per pound.

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Invaginated glass fruit fly traps with a capacity of 300 ml. are very useful for checking the need for insecticide treatment. They may be procured from a Mexican firm in Monterrey at approximately \$0.70 U.S.Cy. each, delivered in Mexico City. These traps, suspended in fruiting trees at the rate of 6 per plot, ranging in size from half an acre to two acres, have been excellent indicators of the need for application of insecticide.

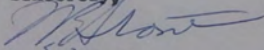
The traps are baited with a fermenting lure made up of sugar and water. We recommend the use of crude brown sugar (piloncillo in Mexico) at the rate of 80 grams to the liter of water. This is a good cheap preparation and will catch a number of different species of Anastrepha. When the catch in the spring, at the time mangoes are about $\frac{2}{3}$ grown, reaches one fly per trap per day the first spray application should be made. Traps should be kept in the fruiting trees and succeeding sprays should be timed in accordance with the index of one fly per trap per day.

Enclosed is a paper on some of the early work by J. G. Shaw. It is now considerably out of date, but we thought you would like to have it.

If you have need of further information please do not hesitate to call on us.

With kindest regards to both you and Mrs. Popenoe,

Sincerely,



W. E. Stone
In Charge,
Mexican Fruit Fly Research

Antigua, Guatemala, 16 January 1958

Dr W E Stone
Apartado 28971, Mexico 17, D.F.

Dear Doctor Stone:

I do not believe I have ever thanked you for your most interesting and useful letter of last September, about the mango fruit flies. I used the information in connection with my work in El Salvador, as you will note from the report I made to the Minister of Agriculture, copy of which I am sending you under separate cover (though it seems to me I may have mailed you one previously). On talking things over with the boys at the Centra Nacional de Agronomia in Santa Tecla, I get the impression that they feel Anastrepha mombinpraetans is the principal sinner in Salvador. I guess the best thing to do, for the moment, is to emphasize the resistant varieties of mango, of which Julie seems to be the best; but Haden is such a superior fruit, from the market standpoint, and is reasonably resistant, we will push it harder, probably, than any other. Unfortunately the Philippine or Cambodiana group, to which your Manila belongs, is or seems to be just the most susceptible to attack of all the mangos we have in this area.

Mrs Popenoe and I are packing up, preliminary to flying to the States for a meeting of the Board of Trustees of Escuela Agricola Panamericana at New York on 5 February, after which I want to spend a few days in Washington to see if any of my old colleagues are still alive. I will acquire negative information in the main, though George Barrow is still around. Then we are going over to Spain. I have hooked up with a guy down on the Medieterranean coast, Almuñecar is the name of the spot, and we are going to introduce and attempt to propagate a lot of good avocados and some kakis and loquats and lychees and maybe a few other things. I have become very fond of Spain, during my three summers spent there in the last 7 years, and Almuñecar is an ideal place for many subtropicals. There must be more than 50 acres of grafted cherimoyas in the valley; with the possible exception of southern California I believe the largest area in grafted cherimoyas in the world. I am hoping also to get over to Israel to see what the boys are doing there against odds which would discourage even a guy from Death Valley. While in southern Spain I shall be interested in seeing what the Medfly is doing to my favorite fruits. You know all about it but I dont and shall be glad to see at first hand. When I get back here again I hope to continue in the plant introduction field as long as I have the breath of life in my body. Only the good Lord knows how long that may be and he wont tell.

Sincerely,