15

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Entomology and Plant Quarantine

University of California — Hawaii Agricultural Experiment Station

Territorial Board of Agriculture and Forestry

Pineapple Research Institute — Hawaiian Sugar Planters' Association Experiment Station

ORIENTAL FRUIT FLY INVESTIGATIONS

QUARTERLY REPORT

January 1 - March 31, 1950.

o0o

ECOLOGY AND BIOLOGY - Work Project I-c-1 - K. L. Maehler, Project Leader

SUMMARY

In the comparative altitude studies on Maui and Hawaii, initial findings have indicated that factors other than lethal low temperatures are responsible for high mortality. The studies made in large out-door cages gave strikingly different results from Davis' prior studies using small cloth covered cages. Temperatures in both studies were quite comparable, but such factors as wind, action of rain, and amount of sunlight were vastly different. At Haleakala (9200') three thousand flies quickly succumbed in the large out-door cage, but one hundred flies placed in a small cage within the large cage had seven flies alive after forty days. The difference here again was not in temperature but in protection from the wind and the rain.

The rate at which sexual maturity is attained by males and females is correlated with temperature. High protein diet accelerates the rate at which sexual maturity is attained in the females.

Mortality studies in which 13,000 flies were used indicate that when the absolute minimum drops below 40 degrees F., high mortality takes place. Temperatures between 60 and 80 degrees seem to offer the most optimum conditions for survival.

Larval studies on Hawaii showed a larval period (1st to 3rd instar) at Hilo of 10 days. At Kaumana the period was 15 to 18 days. The temperature difference at these two stations was mainly in the mean minimum, being 63 at Hilo and 53 at Kaumana. Larval period from egg hatch to pupation at Kula was 24 days in banana and 20 days in grapefruit.

Pupal studies show that within certain limits temperature determines the duration of this stage and may also reflect mortality when the stage becomes extended. Humidity, particularly at the time of pupation, seems to determine mortality but has little effect on duration. A certain amount of mortality is reflected in the nutrition of the larval stage for forced pupation frequently results in death. Although moisture is a critical factor in the pre-pupal period, it is the writer's opinion that extremely dry conditions in an area would not necessarily result in great mortality. First, the amount of moisture required is very small and is apt to be found beneath a fallen fruit even in a "bone dry" orchard. Second, moisture content in the soil beneath a tree, where pupation is most likely to take place, would usually be higher than in an unshaded area. And finally pupation can and occasionally does take place within the fruit on the tree, assuring the larva of sufficient moisture to pupate.

Low temperature greatly increases mortality and lengthens the adult emergence span, but some emergence occurs even up to 60 days. This would infer that the pupal stage would be apt to tide the fly over any short "cold spell" in an area where more moderate temperatures usually prevail. In an experiment to simulate short "cold spells" puparia were held at Haleakala (9200') for 25 days where temperatures dropped to 30 degrees. These puparia were then held at Kula (3750') where a minimum mean of 49 and a maximum mean of 66 prevailed, and 56 days later an adult emerged. These puparia were from one to twelve days old. The time spent in the pupal stage by this adult was from 56 to 68 days. At Hilo the usual pupal period is 14 days while at Kula it is about thirty.

Nutritional studies using adult male flies indicate there is a great variation in the degree certain fruit will sustain the fly. The fruit tested, to date, show show that avocado will not keep flies alive for any considerable time, while apple has proven to be the best fruit tested. Of California fruit tested, Rhapiolepsis surpassed all the rest in its effectiveness as a food for the flies.

Mission Olive and Castor Bean Fruit were the most undesirable food.

Nutritional studies testing the suitability of different hosts for larval development showed that apple greatly retarded the larval growth but there was less mortality in this fruit.

To properly evaluate the relative importance of the wide variety of fruit attacked by the Oriental Fruit Fly a vast amount of quantitive data needs to be assembled. A total of 1074 lots of fruit have been collected on Maui and Hawaii in the period covered by this report.

Particular emphasis has been placed on citrus because of its commercial value on the mainland and because it was propitious to make the study at the peak of the fruiting season. Indexes indicate there is a wide range in the degree of infestation of different fruit. The citrus survey made on Hawaii and Maui shows that citrus cannot compare as a host with loquat. From 183 lots of citrus weighing 162,465 grams, 610 puparia were recovered; while 116 lots of loquat weighing 183,021 grams yielded 34,761. Loquat has been shown to be the most heavily infested fruit thus far studied.

Fly emergence for April, the bulk of which came from loquat, show that from the 11,032 adults that emerged, 6803 (61.6%) were D. dorsalis, 1089 (9.8%) were C. capitata, 2760 (25%) were D. longicaudatus, and 380 (3%) were D. persulcatus.

A revised host list for Dacus dorsalis indicates there are now 124 known hosts.

It was pointed out in the previous report that the population of dorsalis was on the decline. It is now equally evident that the low leveling off point has been reached and the fly is at present rapidly increasing. During the decline period an effort was made to ascertain what factors were instrumental in causing this drop in fly incidence. Host availability, climate and parasites, all have been credited by various workers with causing the decline. In the writer's opinion host availability was the factor most responsible for the decline and is likewise responsible for the increase in population.

Some sage has said that a picture is worth a thousand words. It is hoped then, that the policy of graphically portraying data wherever possible will save the reader his valuable time.

ECOLOGY-BIOLOGY PROJECT, N. E. Flitters, Assistant Project Leader

Line Project 1-o-1-1 - Effect of Temperature and Humidity on the Oriental Fruit Fly under Controlled Conditions .

SUMMARY

In room temperature ♀♀ flies fed standard food media plus protein hydrolysate had a preoviposition period of from 6 to 14 days, with an average daily total of 39 eggs. Fertile eggs were recovered in the period of from one to nine days after oviposition began.

The highest daily egg recovery from an individual female was 99 eggs. The longest consecutive laying period by an individual female was 19 days in which time a total of 912 eggs was deposited, 47.8 percent of which hatched.

The total eggs recovered from 34 producing females held in room temperature and fixed temperature cabinets and fed protein supplement was 13,075.

The 24 control flies held at room temperature have only one individual ♀ ovipositing, 2 eggs were recovered, the preoviposition period was 21 days.

No eggs were recovered from cabinets 12.5° C. (54° to 55° F.) or 15° C. (59° F.), control or test (with or without protein). Indications presently point to shorter preoviposition periods and increased egg production, with the addition of protein hydrolysate to the food medium of *D. dorsalis*.

Line Project 1-c-1-1.1

An experiment to determine the influence of protein hydrolysate upon the preoviposition, rate of oviposition, fertility and longevity of D. dorsalis in fixed temperature cabinets and room temperature has been begun.

Freshly emerged flies were randomized, and one female and two males placed together in small sections (3" x 3" x 3") of cheesecloth cages specially constructed for life history studies. Each cage contains six individual sections each with a sliding glass front to facilitate stocking, feeding and removal of oviposition materials.

Twenty such cages were stocked with a total of one hundred and twenty females and two hundred and forty males. The cages were then equally divided into control and test groups, ten cages to each.

One control and one test cage were placed in each of the following cabinets:

12.5° C. or 54° to 55° F.
15.0° C. or 59° F.
17.5° C. or 63° to 64° F.
20.0° C. or 68° F.
22.5° C. or 72° to 73° F.
35.0° C. or 95° F.

Four cages each of both test and control were held in the laboratory at room temperature. The basic food media consists of macerated papaya and honey and is the only food supplied to the control group of flies. The flies in the test group received protein supplement in solution (40 percent) in addition to the base medium.

Oviposition material in the form of tangential sections of orange rind secured to a glass plate with paraffin was placed in each section. These oviposition sections are removed and replaced with fresh sections daily.

Preoviposition, rate of oviposition and fertility can be determined by recovery of the first egg, the number of eggs recovered daily, and the percentage of hatch from the recoveries.

The eggs are transferred from the orange sections by means of a camel's hair brush, and placed upon ink blackened filter paper moistened with cupric chloride (1/10 of 1 percent) and held in covered petri dishes.

The following tables show the initial results obtained to date:

TABLE 1. Preoviposition, Rate of Oviposition and Fertility of Flies Fed Protein Hydrolysate (MRT) Held at Room Temperature.

Number of Flies	Date of Emergence	Preoviposition Period - Days	Egg Deposition (Daily Average)	Percent Fertile
1	3/6/50	8	64	41.6
2	"	9	44	71.1
3	"	11	11	37.6
4	"	-	-	-
5	"	12	42	92.4
6	"	6	48	47.8
7	"	9	43	71.6
8	"	12	18	34.8
9	"	10	53	75.0
10	"	9	33	80.1
11	"	12	31	79.0
12	"	8	41	20.9
13	"	8	27	-
14	"	9	47	72.7
15	"	7	53	44.3
16	"	9	28	-
17	"	8	40	25.3
18	"	10	38	85.2
19	"	10	20	67.6
20	"	9	54	81.7
21	"	-	-	-
22	"	9	32	66.1
23	"	14	24	-
24	"	10	43	14.4
TOTALS -	24 flies	6-14 days	Average = 39	Average 54.0%

TABLE 2. Preoviposition, Rate of Oviposition and Fertility of Flies Fed No Protein Hydrolysate (MRT) Held at Room Temperature.

Number of Flies	Date of Emergence	Preoviposition Period - Days	Egg Deposition (Daily Average)	Percent Fertile
1	3/6/50			
2	"			
3	"			
4	"			
5	"	21	2	——
6	"			
7	"			
8	"			
9	"			
10	"			
11	"			
12	"			
13	"			
14	"			
15	"			
16	"			
17	"			
18	"			
19	"			
20	"			
21	"			
22	"			
23	"			
24	"			
TOTALS - 24 flies		21 days	Average = 2	

TABLE 3. Preoviposition, Rate of Oviposition and Fertility of Flies Fed Protein Hydrolysate (MRT) in Cabinets, 12.5°, 15.0°, 17.5°, 20.0°, 22.5° and 35.0° C.

Number of Flies	Cabinet ° C.	Date of Emergence	Preoviposition Period - Days	Egg Deposition (Daily Average)	Percent Fertile
1-6	12.5°	3/7/50	-		
7-12	15.0°	"	-		
13	17.5°	"	21	2	0
14	17.5°	"	-		
15	17.5°	"	-		
16	17.5°	"	-		
17	17.5°	"	-		
18	17.5°	"	-		
19	20.0°	"	-		
20	20.0°	"	18	19	-
21	20.0°	"	18	21	-
22	20.0°	"	-	-	
23	20.0°	"	19	22	-
24	20.0°	"	14	33	-
25	22.5°	"	16	23	-
26	22.5°	"	-	-	
27	22.5°	"	12	16	-
28	22.5°	"	16	19	-
29	22.5°	"	12	24	-
30	22.5°	"	-	-	-
31	35.0°	"	7	18	-
32	35.0°	"	10	5	-
33	35.0°	"	7	16	2.52
34	35.0°	"	-	-	-
35	35.0°	"	-		
36	35.0°	"	-		
TOTALS - 36 flies			7-21 days	Average = 20	Average = 0.26%

TABLE 4. Preoviposition, Rate of Oviposition and Fertility of Flies Fed No Protein Hydrolysate (MRT) in Cabinets 12.5°, 15.0°, 17.5°, 20.0°, 22.5° and 35.0° C.

Number of Flies	Cabinet ° C.	Date of Emergence	Preoviposition Period - Days	Egg Deposition (Daily Average)	Percent Fertile
1-6	12.5°	3/7/50			
7-12	15.0°	"			
13-18	17.5°	"			
19	20.0°	"			
20	20.0°	"	23	8	
21	20.0°	"	-		
22	20.0°	"			
23	20.0°	"			
24	20.0°	"			
25	22.5°	"			
26	22.5°	"			
27	22.5°	"			
28	22.5°	"			
29	22.5°	"			
30	22.5°	"			
31	35.0°	"			
32	35.0°	"			
33	35.0°	"	22	11	
34	35.0°	"	-		
35	35.0°	"	20	10	
36	35.0°	"	-	-	
TOTALS - 36 flies			20-23 days	Average = 10	

Line Project I-c-1-2 - Effect of Climate . (K. L. Maehler)

AN OUTLINE OF COMPARATIVE ALTITUDE CAGE STUDIES

Certain changes in the studies as previously outlined have been necessitated by the decision to furnish two types of diets to the caged flies at the stations. In one chamber a high protein diet will be provided by using protein hydrolysate and in the other chamber a subsistence diet of honey and fruit will be used.

STATION	ELEV.	CAGE	OBJECTIVES	DIET
Kula, Insectary	3750'	1	California Fruit : Nutrition	
Kula, Insectary	3750'	21	Hawaiian Lowland Fruit : Nutrition	
Kula, Insectary	3750'	2	Longevity, Sexual Maturity	Protein
Kula, Insectary	3750'	3	Longevity, Sexual Maturity	
Haleakala	7030'	5	California Fruit : Nutrition	
Haleakala	7030'	6	Hawaiian Lowland Fruit : Nutrition	
Haleakala	7030'	4	Longevity, Sexual Maturity	
Haleakala	7030'	22	Longevity, Sexual Maturity	Protein
Haleakala	9200'	7	Climate and Mortality	
Haleakala	9200'	23	Climate and Mortality	Protein
Waikamoi	4250'	8	Longevity, Sexual Maturity	Protein
Waikamoi	4250'	9	Longevity, Sexual Maturity	
Haiku	500'	10	Longevity, Sexual Maturity	
Haiku	500'	24	Longevity, Sexual Maturity	Protein
Hilo	40'	11	Longevity, Sexual Maturity	
Hilo	40'	12	Longevity, Sexual Maturity	Protein
Kaumana	2000'	13	Longevity, Sexual Maturity	
Kaumana	2000'	14	Longevity, Sexual Maturity	Protein
Pohakuloa	6500'	15	Longevity, Sexual Maturity	
Pohakuloa	6500'	16	Longevity, Sexual Maturity	Protein
Waikii	4700'	17	Longevity, Sexual Maturity	
Waikii	4700'	18	Longevity, Sexual Maturity	Protein
Keanakolu	5200	19	Longevity, Sexual Maturity	
Keanakolu	5200	20	Longevity, Sexual Maturity	Protein

Mortality Studies. To study the effect of climate on populations of Dacus dorsalis a series of experiments were undertaken using male, field flies of unknown age and releasing them in the cages at the altitude stations. The flies were counted, placed in the cages and periodically checked and the dead flies recorded. In most cases 1000 flies were released in a cage. Five stations ranging from 500' to 9200' were used and the experiments run in January, February, and March. A total of 13,000 flies were used in these initial experiments.

It was hoped that these experiments would indicate what environmental factors were more critical. Liebig has pointed out that when there are a multiplicity of factors present and only one near the limits of tolerance, this one factor will be the controlling one. However in placing populations in areas which are on the perimeter of the survival circle there are usually several factors which may be limiting. In this case it is not always convenient to apply Leibig's Law.

It appears that factors other than temperature may play an important role in causing mortality. The pelting action of the rain, high winds, inadequate protection and maximum temperatures below the threshold of activity seem to be equally important as low temperature.

The graphic information following shows the mortality curve, correlated with the absolute maximum and absolute minimum temperatures which are plotted as red and blue lines respectively.

All the stations showed a close correlation between the three studies with the exception of Haleakala (9200') which reversed itself in Experiment 63. This is indicated in Fig. No. 8.

The Waikamoi Station (Fig. No. 4 & 9) which has a high relative humidity and heavy rain showed a rather surprisingly high survival rate.

At Haleakala Station (7030') the cage was exposed to high winds and these appear to be more critical than low temperature. In Experiment No. 63 this station had a greater mortality than the 9200' station although the low temperatures occurred at the higher station.

At the highest station, Haleakala 9200', the absolute maximum temperatures were in most cases below the threshold of activity of the adult fly which is about 64 degrees. In this case no lethal low temperatures were required to kill the fly because he would ultimately starve for the temperatures were seldom high enough for him to move and feed himself.

The steep trajectory of the mortality curve initially and the leveling off following, seems to indicate that after the first number of non-resistant individuals are killed, the more hardy flies tend to stand up under the adverse conditions. This would suggest that this fly may after a number of years in these islands tend to further acclimate itself to higher elevations and more severe temperatures. If this be the case and the fly is gradually conditioned as a species the threat of the fly becoming established on the mainland will increase rather than diminish.

Experiment No. 61

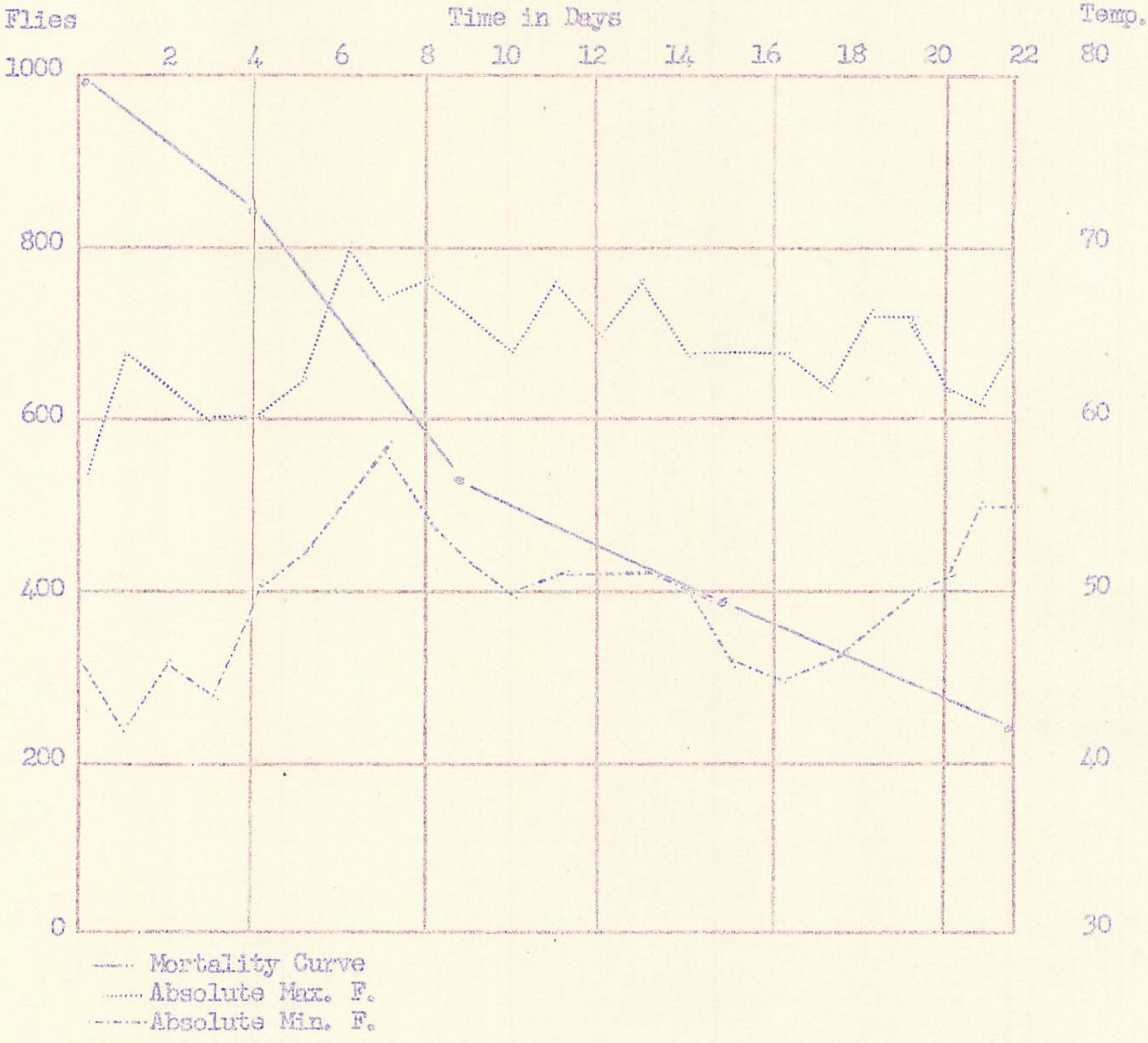
TABLE NO. 1

Station	KULA		HALEAKALA		HALEAKALA		WAIKAMOI		HAIKU	
Elevation	3750'		7030'		9200'		4250'		500'	
Ppt.	9.26		11.26		-		10.73		10.68	
Abs. Max	70		66		57		68		80	
Max Mean	64		58		49		61		76	
Min Mean	50		45		38		47		62	
Abs. Min	42		37		33		40		58	
Date	Days	Flies	Days	Flies	Days	Flies	Days	Flies	Days	Flies
1/16	0	1000	0	869			0	1000	0	1000
1/17					0	870				
1/19	3	942	3	497	2	0	3	924	3	938
1/23			7	195			7	854		
1/24	8	529								
1/25									9	896
1/26									10	805
1/30	14	391	14	13			14	762	14	733
2/1									16	647
2/3									18	515
2/6	21	238	21	0			21	658	21	461

I-o-1-2 Effect of Climate

Experiment No. 61

FIGURE 1.



KULA STATION

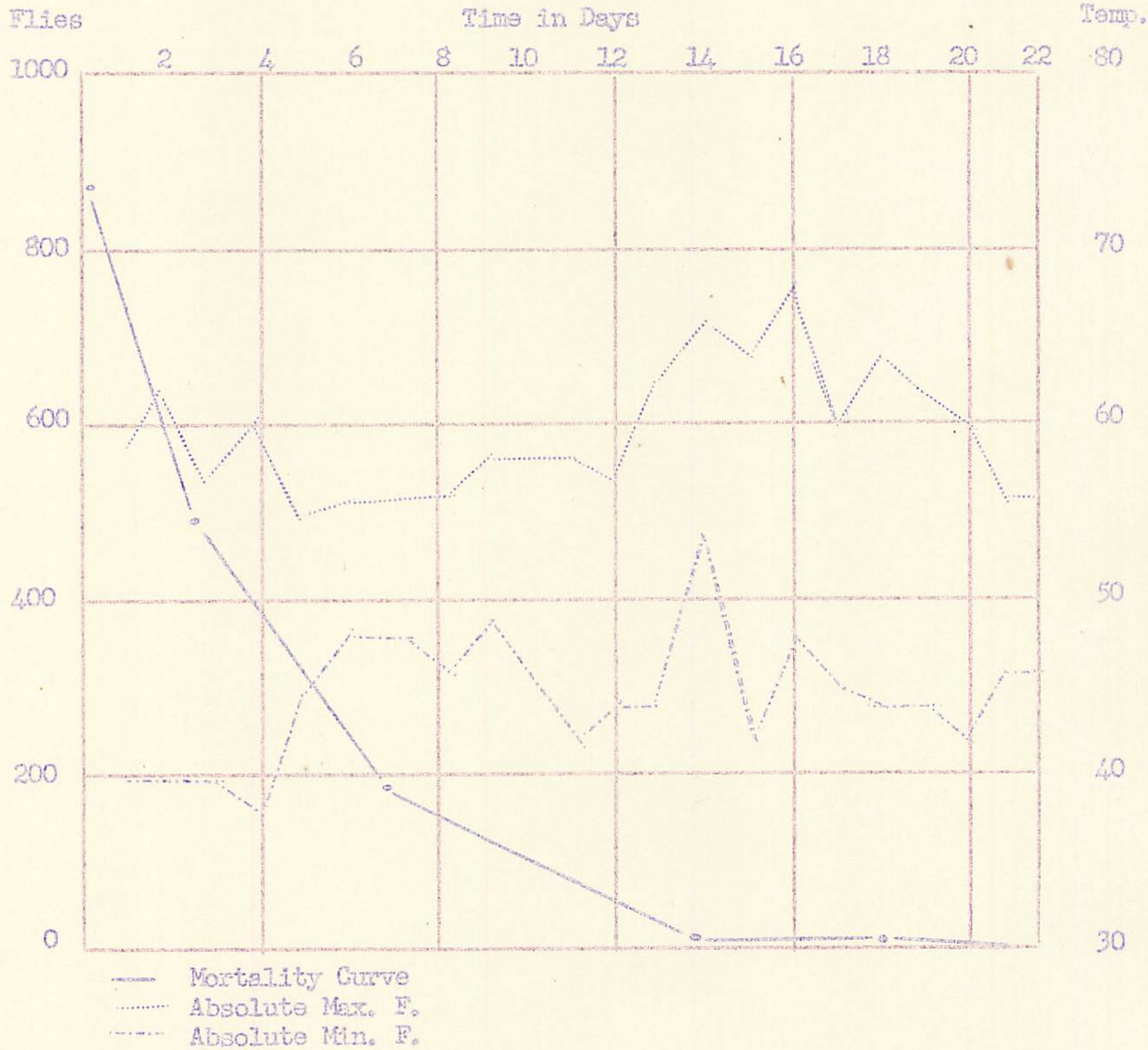
3750'

Note: This mortality study was conducted from January 16th to January 21st. One thousand male field flies of unknown age were placed in cage 1 at this station.

I-c-1-2 Effect of Climate Under Field Conditions

Experiment No. 61

FIGURE 2.



HALEAKALA STATION

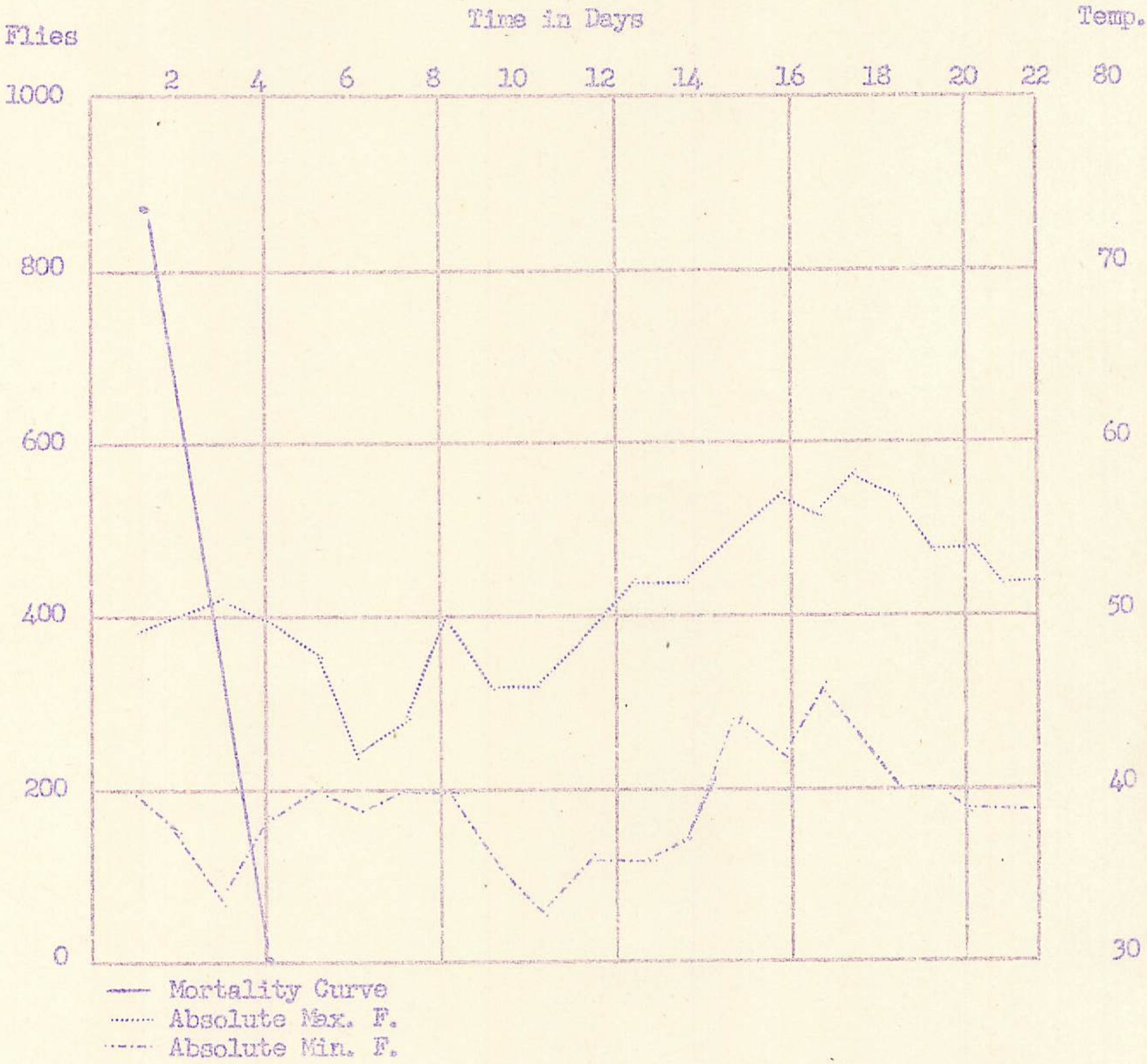
7030'

Note: This mortality study was conducted from January 16th to January 21st. Eight hundred and sixty-nine male field flies of unknown age were placed in cage 4 at this station.

I-c-1-2 Effect of Climate Under Field Conditions

Experiment No. 61

FIGURE 3.



HALEAKALA STATION

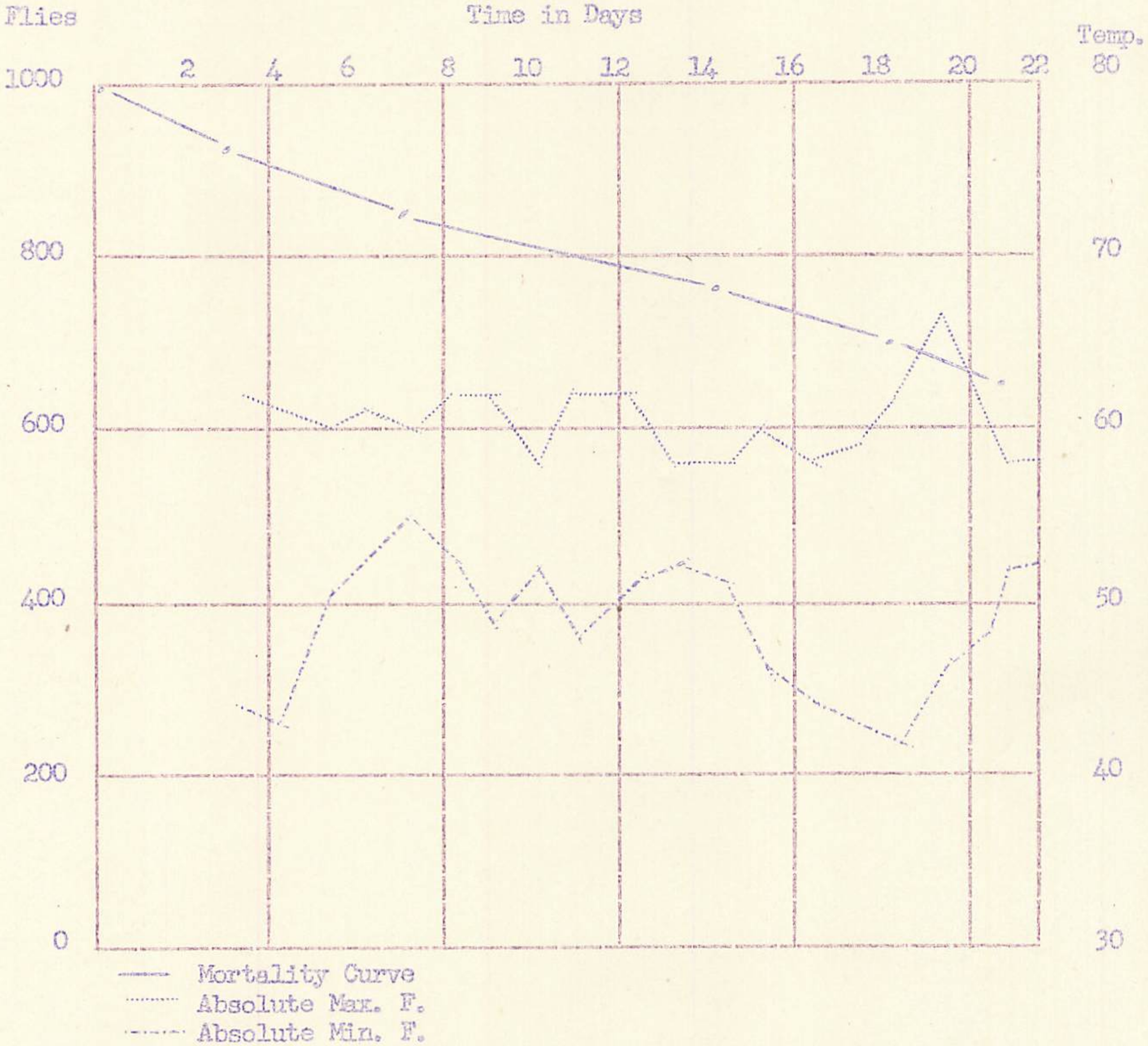
9200'

Note: This mortality study was conducted from January 16th to January 21st. Eight hundred and seventy male field flies of unknown age were placed in cage 7 at this station.

I-o-l-2 Effect of Climate

Experiment No. 61

FIGURE 4.



WAIKAMOI STATION

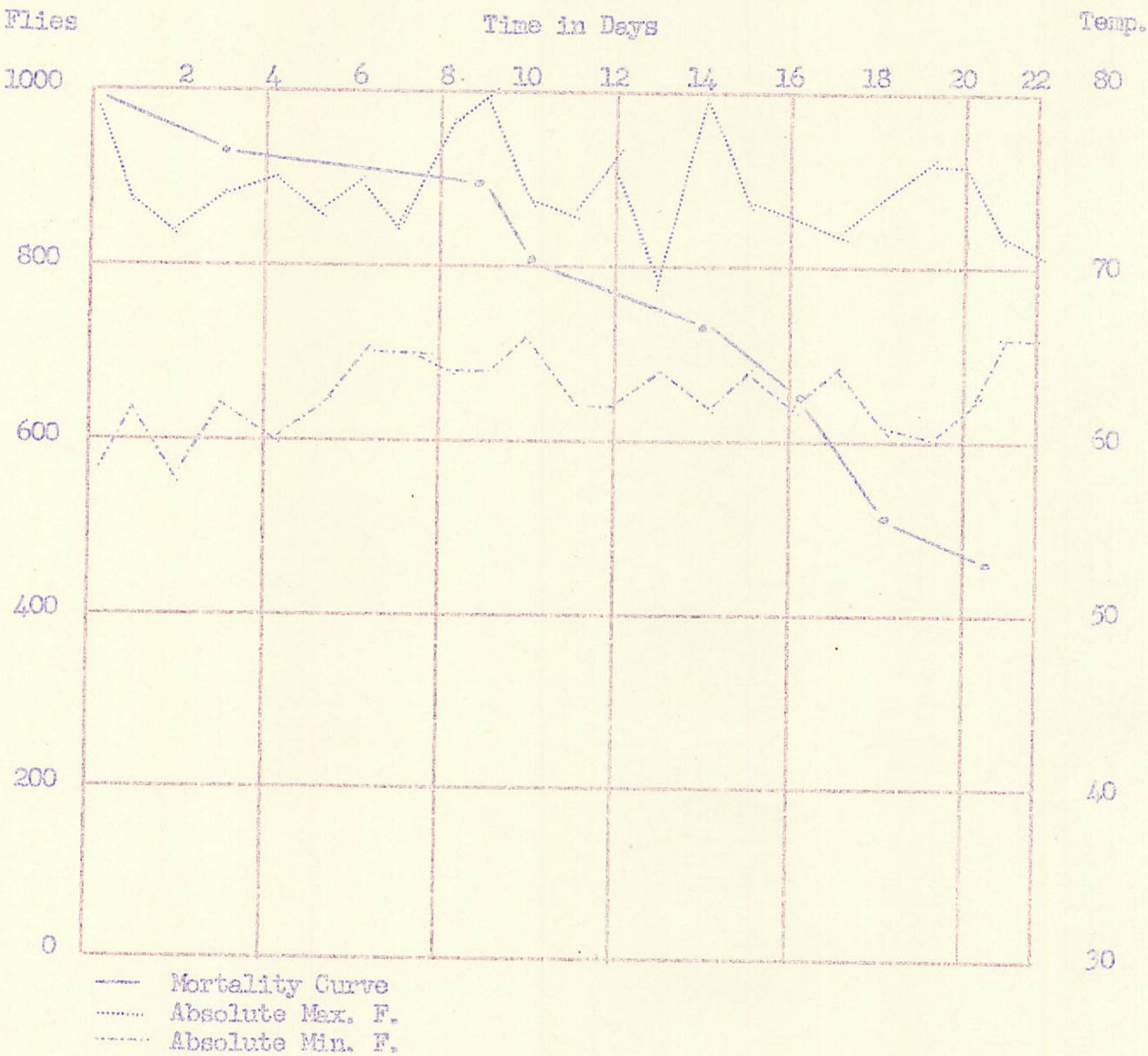
4250'

Note: This mortality study was conducted from January 16th to January 21st. One thousand male field flies of unknown age were placed in cage 9 at this station.

I-c-1-2 Effect of Climate

Experiment No. 61

FIGURE 5.



HAIKU STATION

500'

Note: This mortality study was conducted from January 16th to January 21st. One thousand male field flies of unknown age were placed in cage 10 at this station.

Experiment No. 63

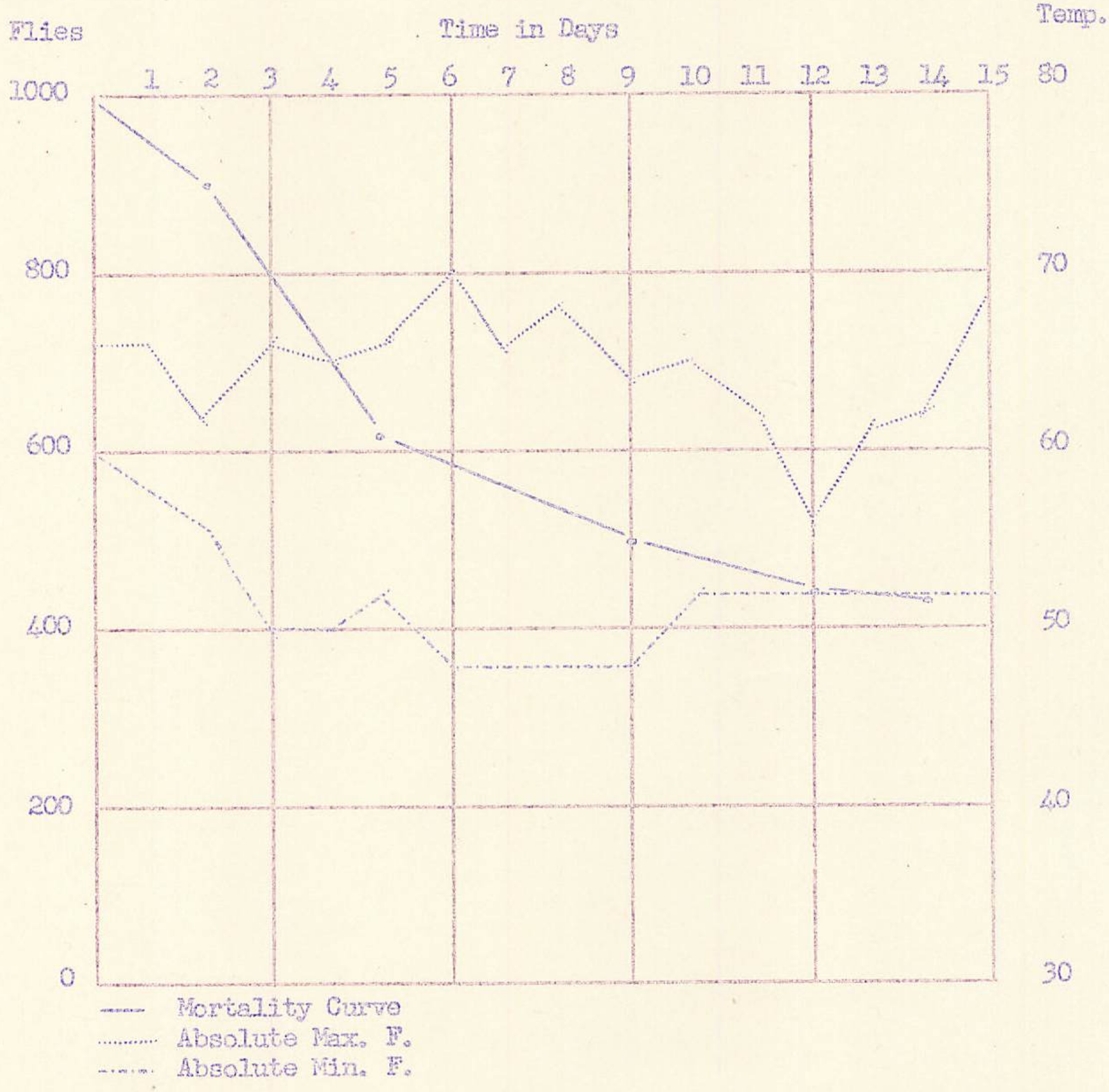
TABLE NO. 2

Station	KULA		HALEAKALA		HALEAKALA		WAIKAMOI		HAIKU	
Elev.	3750'		7030'		9200'		4250'		500'	
Ppt.	.89		5.44		-		19.34		5.44	
Abs. Max	72		68		58		67		77	
Max. Mean	66		59		52		58		73	
Min. Mean	51		46		39		49		65	
Abs. Min	44		42		32		42		60	
Date	Days	Flies	Days	Flies	Days	Flies	Days	Flies	Days	Flies
2/8	0	1000	0	998	0	990	0	1000	0	1000
2/10	2	903	2	803	2	960	2	913	2	813
2/13	5	726	5	148	5	684	5	750	5	771
2/15							7	675		
2/16			8	45	8	426				
2/17	9	613							9	685
2/20	12	554	12	6	12	46	12	370		
2/21									13	582
2/22	14	539	14	2	14	6				

I-o-1-2 Effect of Climate under Field Conditions

Experiment No. 63

FIGURE 6.



KULA STATION

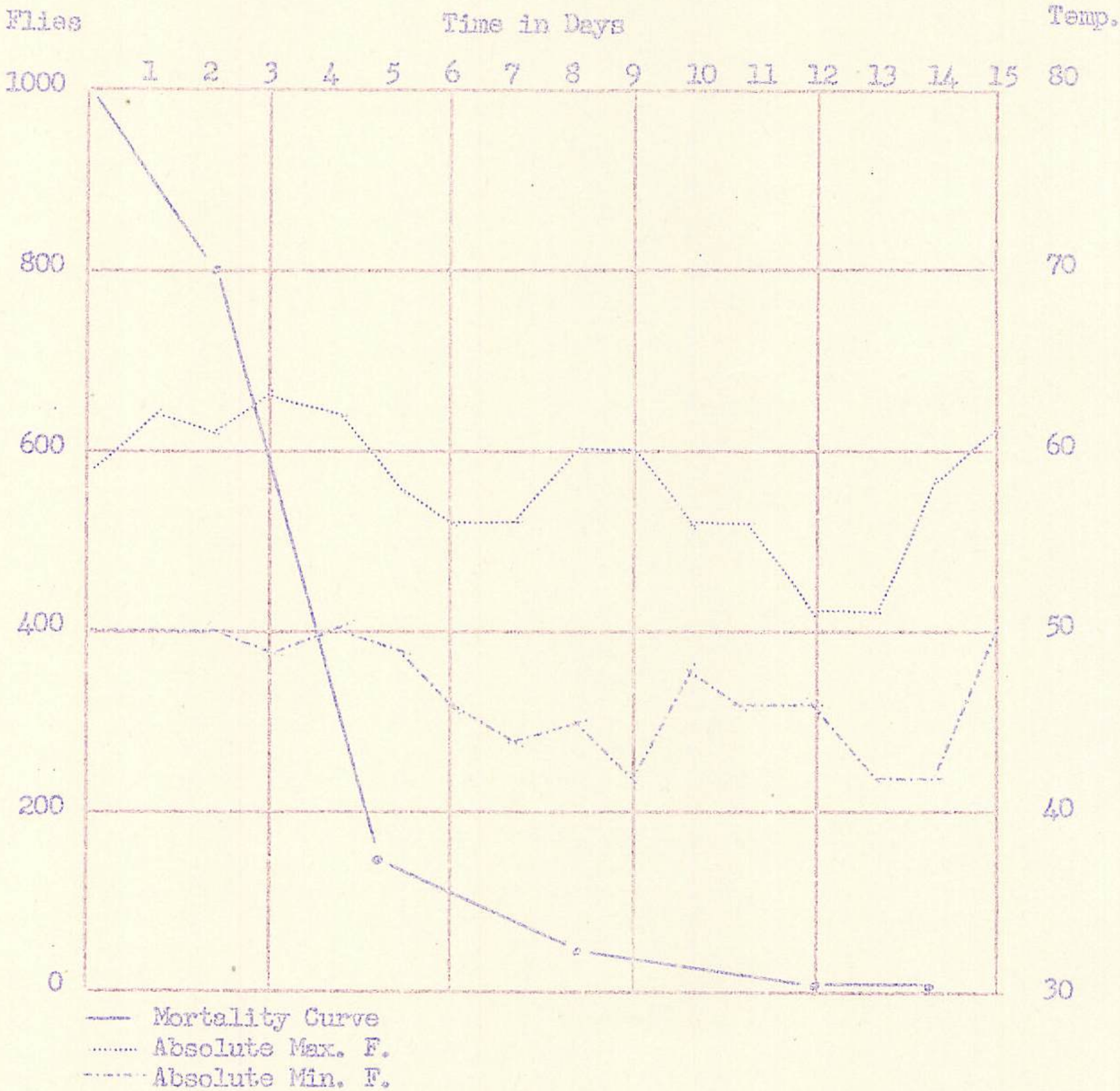
3750'

Note: This mortality study was conducted from February 8 to 22. Five thousand flies were used. One thousand placed in each of five cages at different altitudes. Male field flies of unknown age liberated in the cages were collected and counted as they died.

I-o-1-2 Effect of Climate under Field Conditions

Experiment No. 63

FIGURE 7.



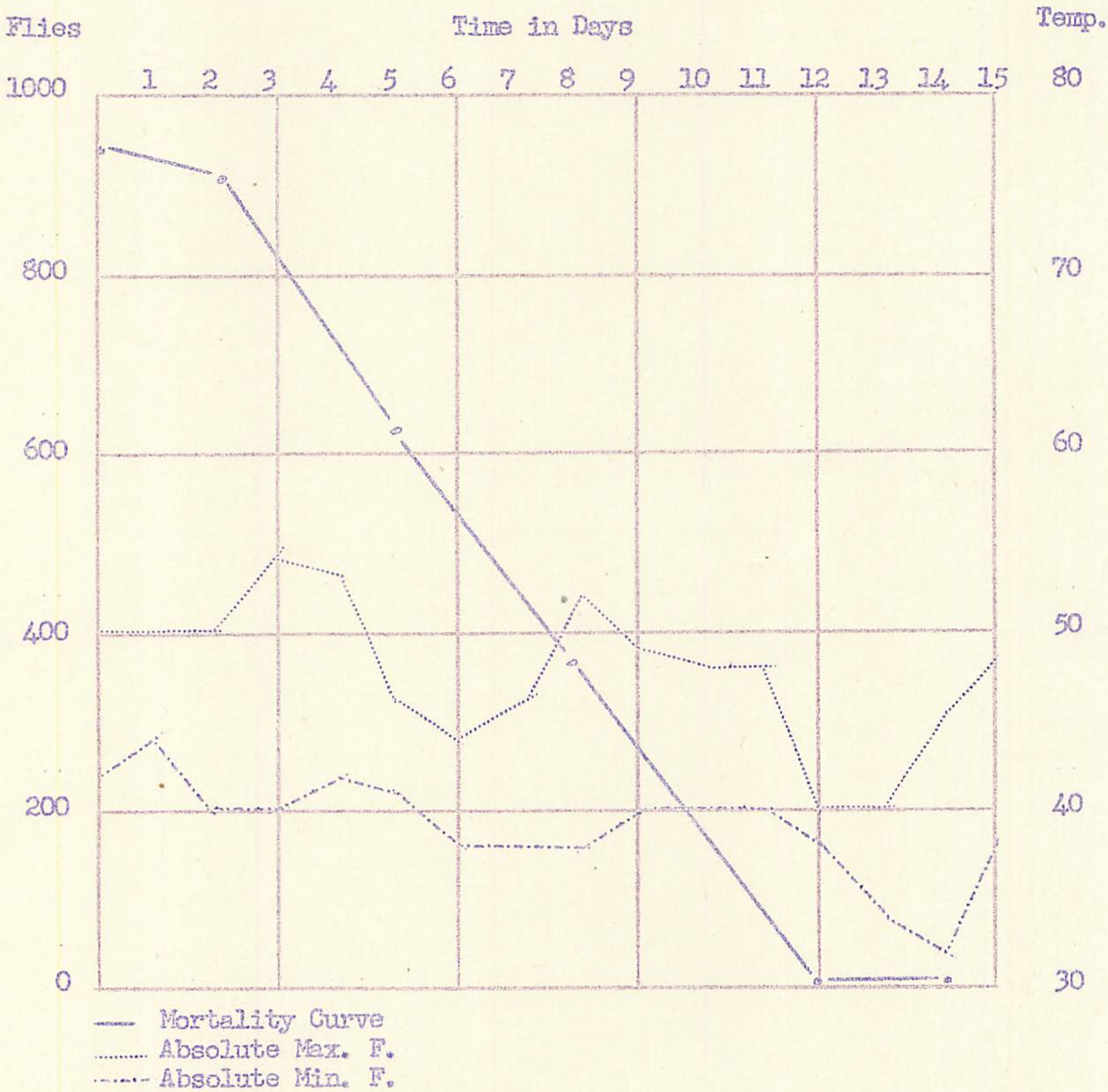
HALEAKALA STATION
7030'

Note: This mortality study was conducted from February 8th to 22nd. Five thousand male field flies of unknown age were used. One thousand were placed in each cage and collected and counted as they died.

I-o-1-2 Effect of Climate under Field Conditions

Experiment No. 63

FIGURE 8.



HALEAKALA STATION

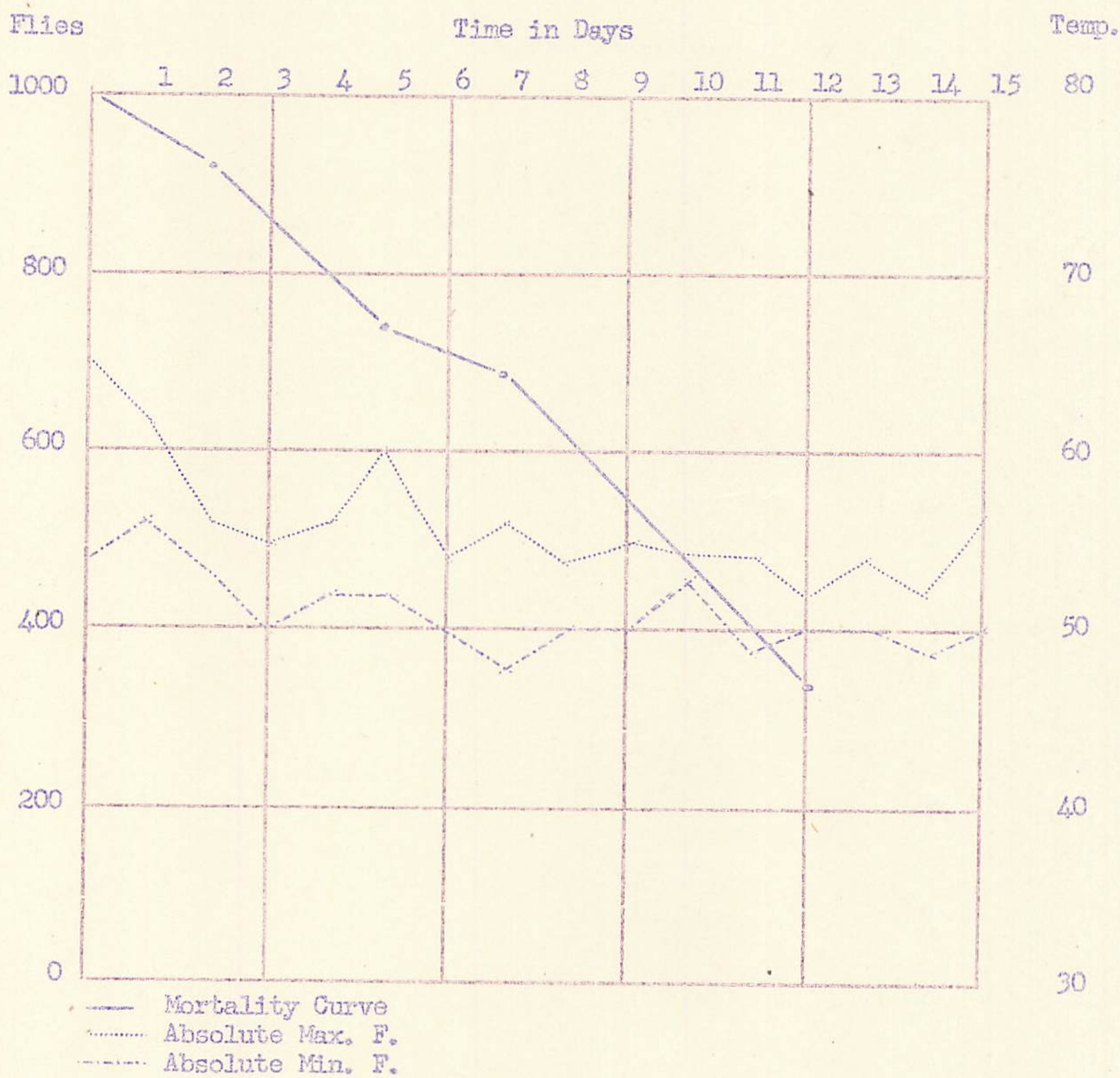
9200'

Note: This mortality study was conducted from February 8th to 22nd. Five thousand male field flies of unknown age were used. One thousand were placed in each cage and collected and counted as they died.

I-c-1-2 Effect of Climate Under Field Conditions

Experiment No. 63

FIGURE 9.



WAIKAMOI STATION

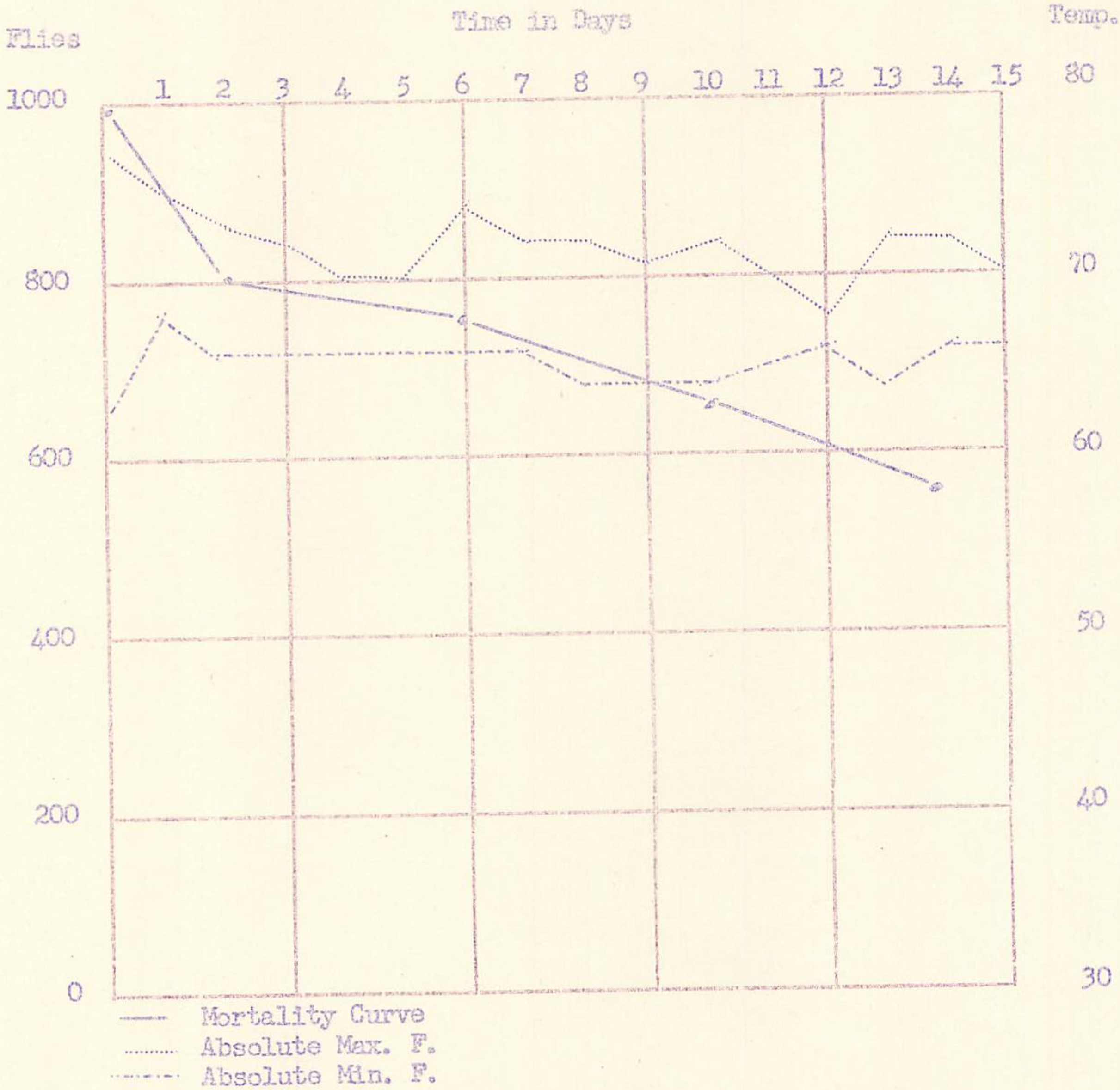
4250'

Note: This mortality study was conducted from February 8th to 22nd. Five thousand male field flies of unknown age were used. One thousand were placed in each cage and collected and counted as they died.

I-c-1-2 Effect of Climate Under Field Conditions

Experiment No. 63

FIGURE 10.



HAIKU STATION

500'

Note: This mortality study was conducted from February 8th to 22nd. Five thousand male field flies were used. One thousand were placed in each cage and collected and counted as they died.

Experiment No. 81

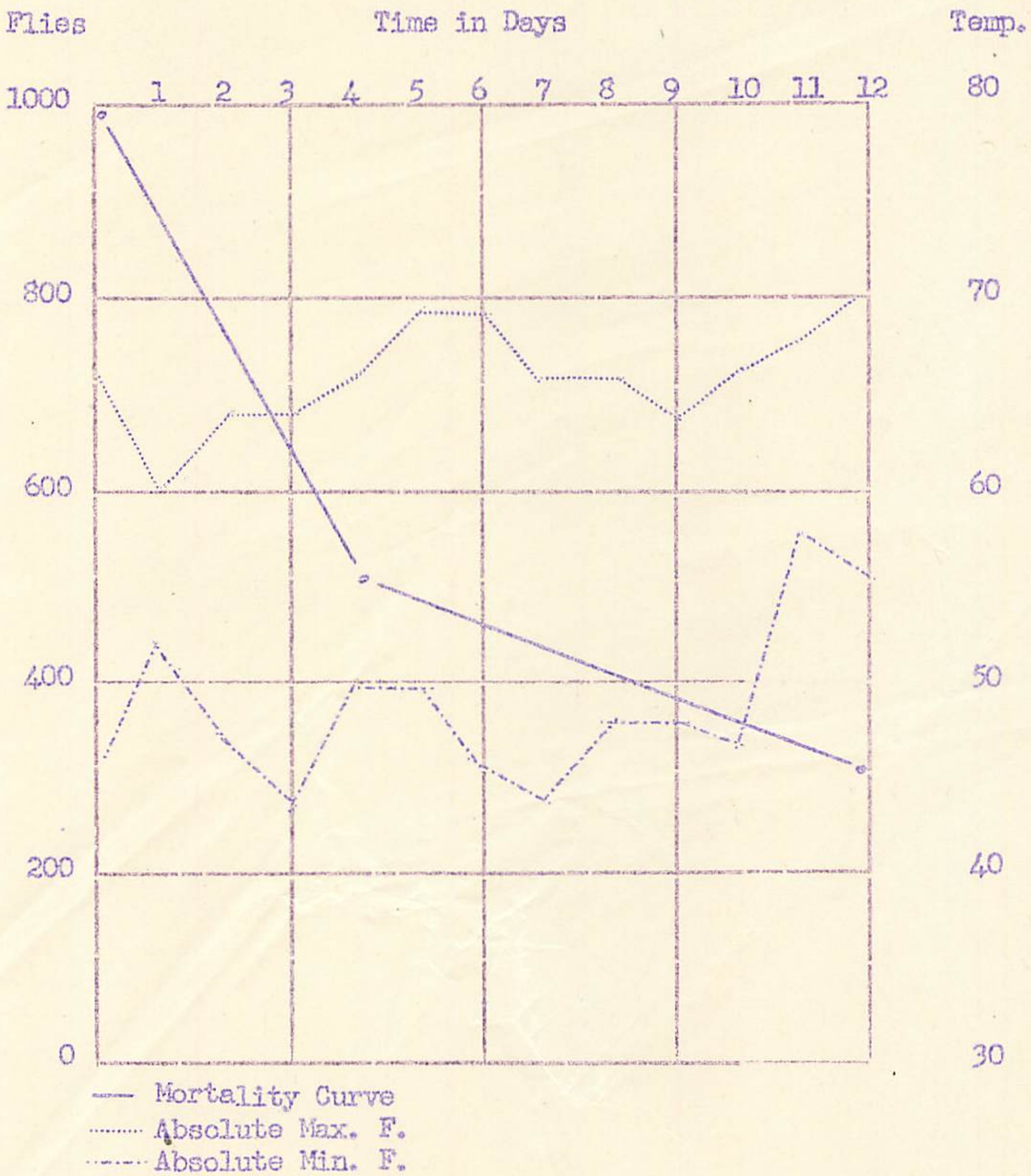
TABLE NO. 3

Station	KULA		HALEAKALA		HALEAKALA		WAIKAMOI		HAIKU	
Elev.	3750'		7030'		9200'		4250'		500'	
Ppt.	.81		5.04		2.11					
Abs. Max	70		68		58					
Max. Mean	66		59		52					
Min. Mean	47		43		38					
Abs. Min	42		36		32					
Date	Days	Flies	Days	Flies	Days	Flies	Days	Flies	Days	Flies
3/8			0	991	0	996				
3/9	0	1000								
3/13	4	472	4	366	4	106				
3/20			12	0	12	0				
3/21	12	304								

I-o-1-2 Effect of Climate

Experiment No. 81

FIGURE 11.



KULA STATION

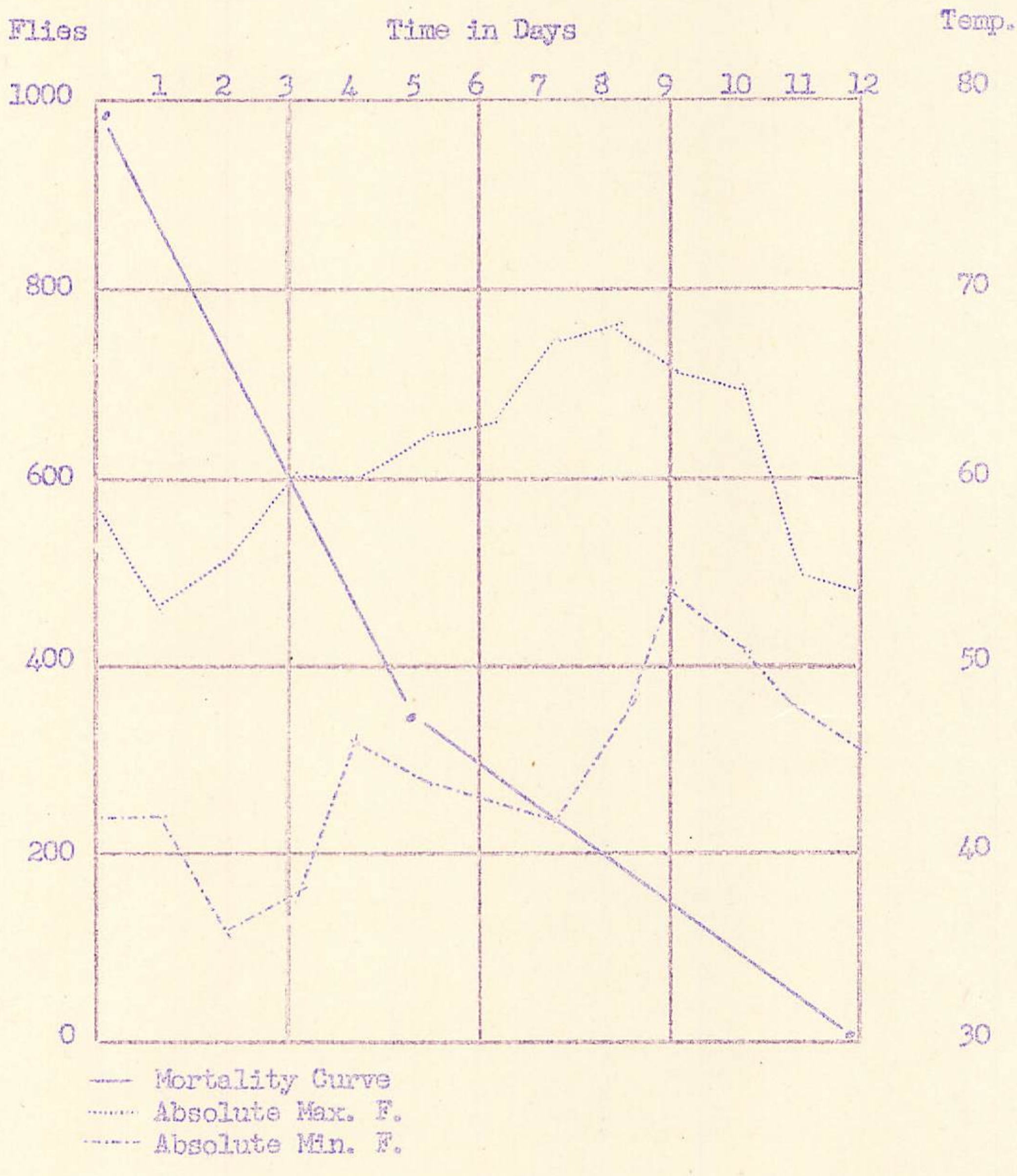
3750'

Note: This mortality study was conducted from March 9 to March 21. One thousand male field flies of unknown age were released in cage 1 at this field.

I-o-1-2 Effect of Climate

Experiment No. 81

FIGURE 12.



HALEAKALA STATION

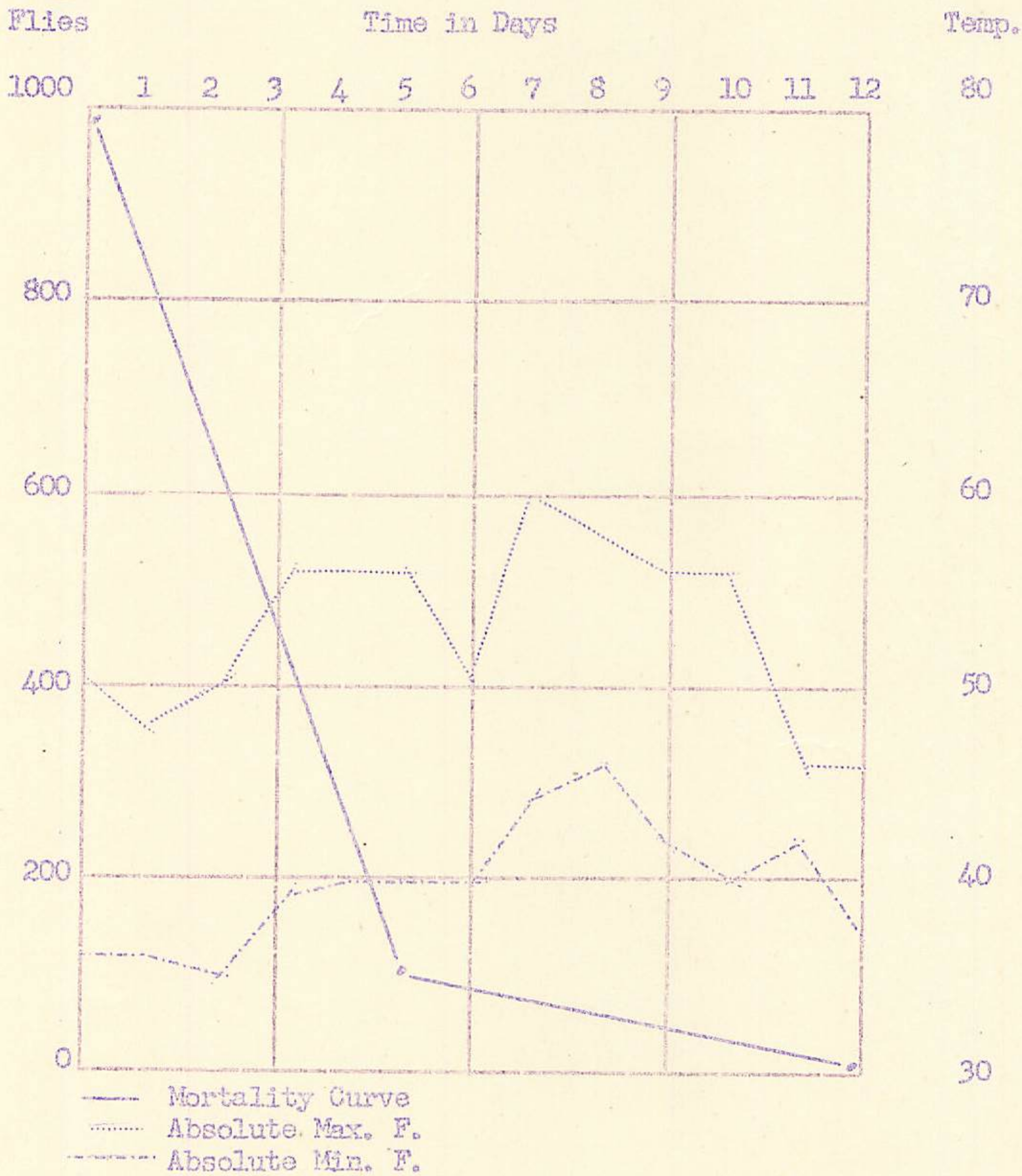
7030'

Note: This mortality study was conducted from March 8th to the 20th. Nine hundred and ninety-one male flies of unknown age were liberated in cage 4 at this station.

I-o-1-2 Effect of Climate

Experiment No. 81

FIGURE 13.



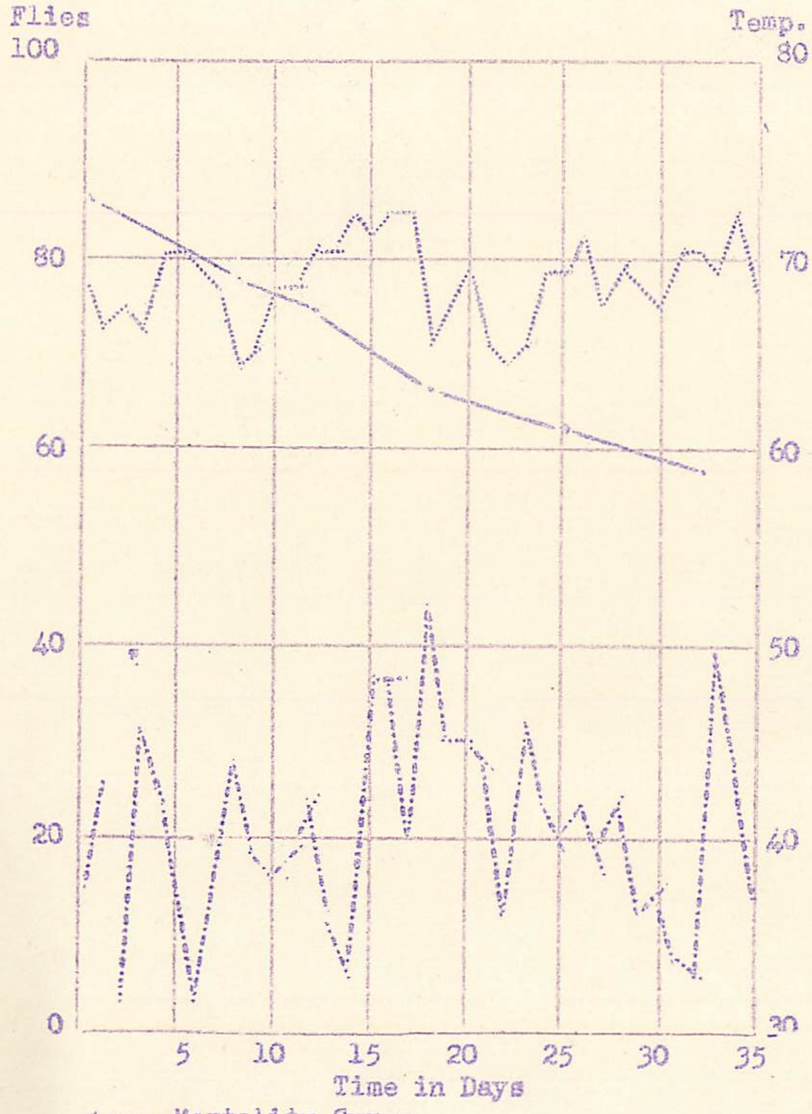
HALEAKALA STATION

9200'

Note: This mortality study was conducted from March 8th to 20th. Nine hundred and ninety-six male field flies of unknown age were liberated in cage 7 at this station.

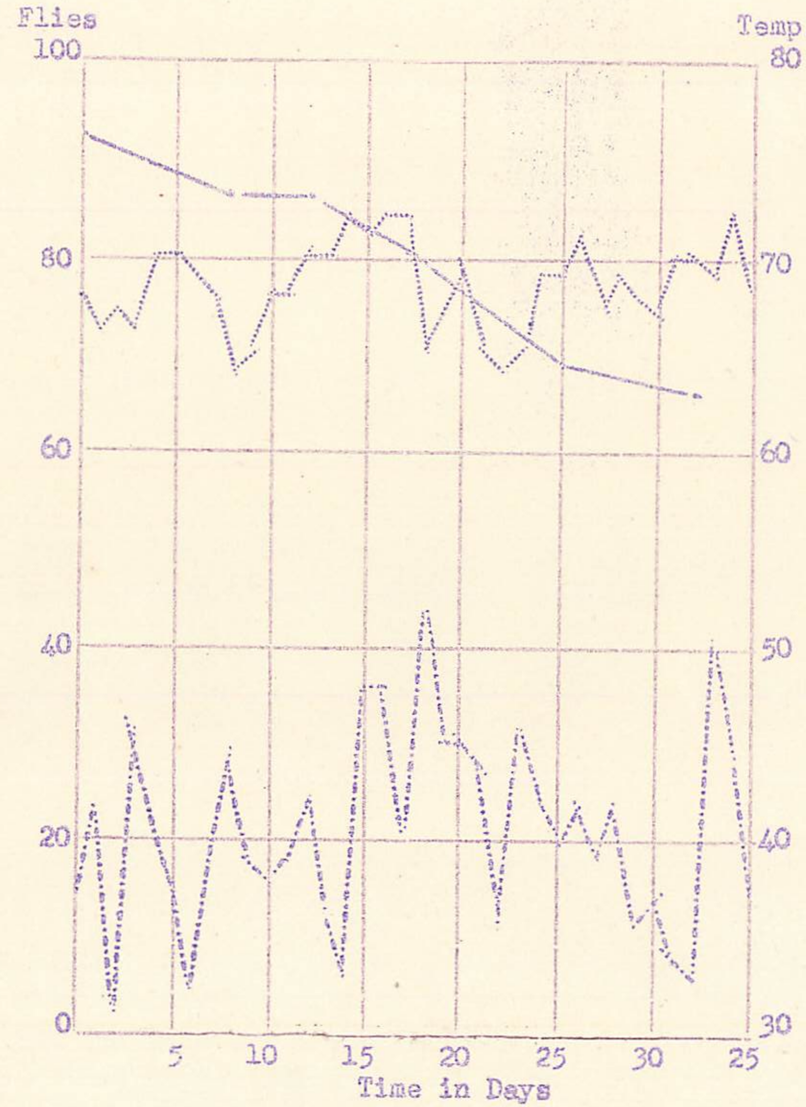
MORTALITY STUDY - POHAKULOA (6511')
(From March 3 to April 3, 1950.)

FIGURE 14 - HILO FLIES (75')



Mortality Curve
Absolute Max. F.
Absolute Min. F.

FIGURE 15- M.L.T.T. FLIES (4600')



Longevity Studies. As outlined in the previous report the purpose of these studies is to ascertain how long the fly will live under different climatic conditions. Marked flies are liberated each month in two cages at each station to observe how seasonal variations effect longevity. These studies have been further enlarged so that the factor of nutrition may also be taken into consideration. Two cages are maintained at each station and one provided with a high protein diet in addition to the usual honey and fruit

These studies were not very far advanced before it was manifest that we were going to get some strinkingly different results from Mr. Davis' prior studies using small cloth covered cages and keeping them in open buildings. These marked differences appear to be not so much a matter of temperature as they are of protection. Temperature checks indicate that the temperature within the buildings and outside were quite comparable. The factors which were changed were wind, pelting action of the rain and amount of sunlight.

At the Haleakala Station (7030') population after population of flies succumbed within a few weeks although no really critical low temperatures were indicated. When the cage was covered on the sides with glazed sheeting and the wind cut down, the flies were able to live in the cage. Assuming that this was too artificial a condition the cage was moved from its windy site to one which was more protected. Under these new conditions we have had flies live 56 days at this station.

Stations checked after heavy rains have shown a sudden increased mortality due to the pelting action of the rain. Flies knocked to the floor of the cage have in many cases been able to avoid being drowned.

In further support of the matter of protection the case of the studies at the Haleakala (9200') Station might be cited. About 3000 flies have been used in three mortality studies there. One population of about 1000 succumbed within two days (Fig. No. 3). All populations showed a very high mortality and most of the flies were dead within two weeks. At this same station a small control cage in which 100 flies were placed 40 days ago still has seven flies alive. The difference here again was not temperature but protection from the wind and rain.

A few extracts from Mr. Davis' numerous reports are pertinent here. "Except for coconut fronds on the top of each cage to protect the flies from the pelting action of the rain, and potted Jerusalem cherry plants in each cage, there is little to protect the flies from the rigorous weather at the higher stations."

"Between March 7 and 10th an unusually high mortality occurred at Waikii, Pohakuloa and to some extent at Keanakolu. There were high winds and low temperatures during this period and a combination of these weather elements probably contributed to the mortality. At Keanakolu, heavy rains drowned many of the flies. This also occurred at Laumana during the latter part of the month.

"Under sheltered conditions, year old Oriental Fruit Flies have been able to survive two winters at Pohakuloa (651[illegible]'). As of March 11, 1950, five females remained out of twenty five and at the end of the month this number had dwindled to two.

TABLE No. 4. Longevity Studies - Red Marked Flies - February Release

Experiment No.	24			22			23					
Station	KULA			HALEAKALA			WAIKAMOI			HAIKU		
Elev.	F	3750'	M	F	7030'	M	F	4250'	M	F	500'	M
Ppt.	.89		.81	5.44		5.04	19.34		41.73	5.44		6.61
Abs.Max	72		70	68		69	67		70	77		80
Max.Mean	66		66	59		59	58		58	73		73
Min.Mean	51		47	46		43	49		49	65		62
Abs.Min.	44		42	42		36	42		42	60		55
Age Flies	6-13 days			2-7 days			2-7 days			4-12 days		
Date	Days	Flies		Days	Flies		Days	Flies		Days	Flies	
		♂	♀		♂	♀		♂	♀		♂	♀
2/13	1	52	60	1	64	64	1	63	63	1	43	61
2/14	2	49	57									
2/20				8	49	47	8	56	56			
2/22				10	45	39						
2/24	12	48	53									
2/27	15	47	48	15	42	35	15	42	41	4 1/	42	61
3/6	22	23	22	22	5	6	22	0	0			
3/13	29	21	20	29	5	5						
3/20	36	18	19	36	5	2						
3/27	43	14	17	43	5	1						
3/29	45	13	17									
4/4	51	11	16									
4/6				53	0	1						
4/7	54	10	16									

1/ Ants invaded the cage and the study was discontinued

TABLE No. 5. Longevity Studies - White Marked Flies - March Release

Experiment No. 76 77

Station	KULA			HALEAKALA			WAIKAMOI		
Elev.	3750'			7030'			4250'		
Ppt.	.81			5.04			41.31		
Abs.Max.	70			68			70		
Max.Mean	66			59			58		
Min.Mean	47			43			49		
Abs.Min	42			36			42		
Age Flies	1-2 days			1-2 days			2-6 days		
Date	Days	Flies ♂	Flies ♀	Days	Flies ♂	Flies ♀	Days	Flies ♂	Flies ♀
3/6	1	107	97				1	66	68
3/8				1	75	75			
3/13	7	82	75	5	56	58	7	34	41
3/15				7	42	48			
3/20	14	74	69	12	24	33	14	30	38
3/27	21	66	61	19	17	30	21	24	32
4/3				26	12	25	28		
4/4	29	58	50						
4/6	31	50	47	29	5	4			
4/10	35	46	40	33	4	3			

Status of sheltered longevity studies carried over from the last quarter and completed are shown as follows:

	Hilo(75') Lot 1	Kaumana(2000') Lot 2	Pohakuloa(6511') Lot 3	Keanakolu(5200') Lot 4
Longevity	103 days(F.)	109 days(M.)	*	121 days(M.&F.)
	Lot 5	Lot 6		
Longevity	83 days(F.)	131 days(M.&F.)		
	Lot 7			
Longevity	67 days(F.)			

* In Lot 3 at this station, 69 out of 200 flies remain after 196 days.

The data presented on longevity studies seem to indicate that outdoor cage studies show a trend toward greater longevity at the lower stations. Conversely, sheltered studies have consistently demonstrated greater longevity at the higher levels, particularly at Pohakuloa.

Sexual Maturity

On February 15, 1950 two hundred fifty male and two hundred fifty day-old female dorsalis were liberated in the maturity cells of the outdoor cages at Hilo, Kaumana, Pohakuloa, Waikii and Keanakolu. Shelter, nutrition and potted plants were the same as described in longevity. Maturity was to be determined by (1) dissection (2) providing fruit for oviposition.

The mortality described in the longevity study also applied to this study as the cells are adjacent to each other. By March 20 all females at Waikii and Keanakolu had died before attaining maturity. The few females that remained in the cages at the other stations had not attained maturity by the end of the month.

Maturity of the males in this study is shown on the following table:

Maturity of males at all stations, based on orange tests.

	Hilo 75'	Kaumana 2000'	Pohakuloa 6511'	Waikii 4700'	Keanakolu 5200'
	Cage #11	Cage #13	Cage #15	Cage #17	Cage #19
No. of days	13	20	27	20	22

*Extracted from Davis' quarterly report

Oviposition Study*

To determine whether Oriental fruit flies will oviposit in mainland apples at all stations apples were exposed to gravid females for a week and then removed. Bananas were used after March 7th.

Table 6 - Oviposition

	Hilo (75')	Kaumana (2000')	Pohakuloa (6511')	Keanakolu (5200')
Lot No.	(1)	(2)	(3)	(4)
Eggs & Punct. Obs.	+	+	+	+
Mean Max	77	73	68	68
Mean Min.	62	55	48	48
Lot No.	(5)	(6)	(7)	(8)
Eggs & Punct. Obs.	-	-	+	+
Mean Max.	73	68	65	61
Mean Min.	61	54	43	45
Lot No.	(9)	(10)	(11)	(12)
Eggs & Punct. Obs.	+	-	+	-
Mean Max.	72	68	65	62
Mean Min.	62	55	42	45
Lot No.	(13)	(14)	(15)	(16)
Eggs & Punct. Obs.	+	-	+	+
Mean Max.	73	71	67	61
Mean Min.	62	52	39	41
Lot No.	(17)	(18)	(19)	(20)
Eggs & Punct. Obs.	+	-	+	-
Mean Max.	74	69	68	60
Mean Min.	62	53	39	44
Lot No.	(21)	(22)	(23)	(24)
Eggs & Punct. Obs.	+	-	-	+
Mean Max.	74	71	70	67
Mean Min.	62	52	40	48
Lot No.	(25)	(26)	(27)	(28)
Eggs & Punct. Obs.	+	-	+	+
Mean Max.	72	73	70	61
Mean Min.	64	52	47	47

Bananas were used from lots 21 to 28.

* Extract from Davis' quarterly report

Hatching Studies. Fruit fly eggs are obtained by a technique developed in the Fruit Fly Laboratory at Honolulu. Using a gasket punch, small discs, about one inch in diameter, are cut from citrus fruit. These are scraped down so that the rag of the fruit is removed and perforated with a few holes. They are then attached to small glass slides by means of hot paraffin. These ovipositional slides are put in cages with mature females and they readily oviposit through the disc. The best temperature for oviposition seems to be about 80 degrees.

In the following experiments the eggs were placed on "squares" of filter paper which had previously been blacked with india ink. A square hole was cut in the skin of the fruit and the tiny "square" placed in the hole. A cover glass slide was then sealed in place using paraffin. It was then possible to observe egg hatch through the small "window".

Hatching results are tabulated in Table No. 7 for Maui and Davis' work is shown on Table No. 8.

TABLE NO. 7 - Egg Hatch Studies - Experiment 88

n--negative

Date / Hour		Laid 3/22 1-4	Laid 3/23 11-12	Laid 3/23 1-2	Laid 3/25 8-11	Laid 3/27 12-4	Hatch 3/26 1	Hatch 3/27 11	Hatch 3/27 2	Hatch 3/27 8pm	Hatch 3/28 10 am
Lot	Fruit										
1	Banana	22					20	20	21	21	21
2	Apple		9				n	2	4	4	4
3	Avocado		8				n	2	2	3	7*
4	Grapefruit		10				n	9	9	10	
5	Opuntia			5			n	5			
6	Lemon			11			n	2	4	8	
7	Orange			11			7*	11			
8	Orange				15		n	n	n	n	n
9	Grapefruit				10		n	n	n	n	n
10	Orange				20		n	n	n	n	n
11	Orange				10		n	n	n	n	n
12	Grapefruit					10					n
13	Grapefruit					10					n

*Larvae observed leaving egg.

Date / Hour	3/28 5pm	3/29 1	3/30 11	3/30 2	3/30 4:30	3/31 9	3/31 4:00
Lot							
8	8	13	14				
9	7	8	9				
10	11	16	16				
11	n	n	5				
12	n	n	n	n	1	8	8
13	n	n	1	1	3	8	8

lot	Total Eggs	% Hatch	Lot	Total Eggs	% Hatch
1	21	95%	8	14	93%
2	4	44%	9	9	90%
3	7	87%	10	16	80%
4	10	100%	11	5	50%
5	5	100%	12	8	80%
6	8	72%	13	8	80%
7	11	100%			

Lot	1	2	3	4	5	6	7	8	9	10	11	12	13
Hours	96	94	94	94	93	96	72	78	78	78	120	72	70

HATCHING STUDIES ON HAWAII

TABLE NO. 8

	Hilo (75')	Kaumana (2000')	Pohakuloa (6511')	Waikii (4700')	Keanakolu (5200')
Lot No.	(1)	(2)	(3)		
No. of days	2 to 3	3 to 4	Negative		
Mean Max.	79*				
Mean Min.	58*				
Lot No.	(4)	(5)	(6)		
No. of Days	2 to 3	3 to 4	3 to 5		
Mean Max.	74*	70*	67*		
Mean Min.	63*	55*	42*		
Lot No.	(7)	(8)	(9)		(10)
No. of Days	2	3	3 to 5		Negative
Mean Max.	80	80*	68*		
Mean Min.	64	44*	34*		
Lot No.	(11)	(12)	(13)		(14)
No. of Days	Negative	3 to 4	Negative		Negative
Mean Max.		79*			
Mean Min.		54*			
Lot No.	(15)	(16)	(17)		(18)
No. of Days	3	3 to 4	3 to 5		Negative
Mean Max.	76	73*	66		
Mean Min.	62	51*	42		
Lot No.	(19)	(20)	(21)		
No. of Days	2	3 to 4	3 to 4		
Mean. Max.	78	74	70		
Mean Min.	63	53	49		
Lot No.	(22)	(23)	(24)		(25)
No. of Days	3	3	4 to 7		Negative
Mean Max.	74	71	65		
Mean Min.	63	53	45		
Lot No.	(26)	(27)	(28)		(29)
No. of Days	3	3 to 4	4 to 8		Negative
Mean Max.	74	67	64		
Mean Min.	63	55	46		
Lot No.	(30)	(31)	(32)		(33)
No. of Days	3	3 to 4	Negative		Negative
Mean Max.	75	71			
Mean Min.	65	55			

HATCHING STUDIES ON HAWAII - CONT.

TABLE NO. 8 - CONT.

	Hilo (75')	Kaumana (2000')	Pohakuloa (6511")	Waikii (4700')	Keanakolu (5200')
Lot No.	(34)	(35)	(36)		(37)
No. of Days	3	Negative	Negative		Negative
Mean Max.	75				
Mean Min.	63				
Lot No.	(38)	(39)	(40)		(41)**
No. of Days	Negative	4 to 5	Negative		4 to 7
Mean Max.		75			67
Mean Min.		63			48
Lot No.	(42)**	(43)**	(44)**	(45)**	(46)**
No. of Days	2	3 to 4	3 to 4	4 to 7	4 to 7
Mean Max.	75	73	70	67	61
Mean Min.	62	51	42	43	37
Lot No.	(47)**	(48)**	(49)**	(50)**	(51)**
No. of Days	3	3 to 5	4 to 8	3 to 4	4 to 7
Mean Max.	75	70	66	69	58
Mean Min.	65	55	41	42	42
Lot No.	(52)**	(53)**	(54)**	(55)**	
No. of Days	Negative	3 to 4	4 to 5	3 to 4	
Mean Max.		66	68	67	
Mean Min.		51	37	42	

** Bananas

Note. Eggs laid in Hilo are transferred on blackened discs to apple and banana and taken to all stations.

Larval Studies. Shown in Table No. 9 are data furnished by Davis on some preliminary studies on larval development. The larval studies on Maui were made mostly with California Fruit and are therefore submitted under 1-o-1-3 under the heading "Nutritional Studies Testing California and Hawaiian Fruit for Suitability for Larval Development."

LARVAL STUDIES ON HAWAII

TABLE NO. 9

Larval Development

	Hilo(75')	Kaumana(2000')
Lot No.	(1)	(3)
Total larval period	11 days	15 to 18 days
Mean Max.	74	71
Mean Min.	63	52
Lot No.	(5)	(6)
Total Larval period	10 days	15 to 18 days
Mean Max.	75	71
Mean Min.	63	53
Lot No.	(8)	(9)
Total larval period	10 days	18 to 21 days
Mean Max.	75	71
Mean Min.	63	53

Note. Approximately 20 first instar larvae were transferred to each banana and subsequent development recorded. Duration indicated is from the 1st to the 3rd instar. Data is incomplete for the higher stations.

Davis

Pupal Studies. Within certain limits temperature determines the duration of this stage and may also reflect mortality when the stage becomes greatly extended. Humidity particularly at the time of pupation, seems to determine mortality but has little effect on duration. A certain amount of mortality is however reflected in the nutrition of the larval stage, for forced pupation as a result of starvation may cause death or at least result in a depauperized adult. Controlled conditions in the laboratory make it possible to accurately predict the time of emergence of adults under certain temperature conditions. In the field, prediction of adult emergence is apt to be less accurate although for a given locality, at a particular time of the year, predictions within several days may safely be made.

At more optimum conditions adults usually emerge within a comparatively short span of days from the first to the last adult. However, under low temperature conditions, in addition to increased mortality, there is also a greatly extended span of adult emergence.

It has been pointed out by several observers that extremely dry conditions during the pre-pupal period would result in high mortality in this stage. It is the writer's opinion, however, that extremely dry conditions in an area would not necessarily result in great mortality for several reasons. First, the amount of moisture required is very small and is apt to be found beneath a fallen fruit even in a "bone dry" orchard. Moisture content of the soil beneath a tree, where the pupation is most likely to take place, would usually be higher than in the unshaded areas. And finally the pupation can and often does take place within the furit itself assuring the larvae of sufficient moisture to pupate. Field observations have shown that not infrequently the larvae pupate in the fruit of loquat on the tree. If the puparia are within the fruit on the tree this would greatly diminish the effectiveness of flooding, drying out, or applying insecticides to the soil in an effort to control the fly.

The information to date indicates that low temperatures greatly increase mortality but that emergence may result from puparia up to 60 days. This would infer that this stage would be apt to carry the fly over any short cold spell in an area where more moderate temperatures usually prevail.

In the following tables pupal duration correlated with temperature is shown.

The following experiments were carried on in an attempt to simulate short "cold spells" as they are experienced on the mainland. This was accomplished by holding lots of puparia at Haleakala (9200') for varying periods of time and them removing to the Kula Station. At Haleakala the puparia were held in containers which allowed the puparia to be buried in the ground to the depth of one inch. A soil thermograph recorded the temperatures. At Kula the puparia were held in the weather shelter where a standard hygrothermograph recorded the temperature.

TABLE NO. 10

	Exp. No. 44		Exp. No. 45		Exp. No. 46		Exp. No. 47	
Station	HALEAKALA		HALEAKALA		HALEAKALA		HALEAKALA	
Abs. Max.	55		55		55		55	
Max. Mean	51		48		46		43	
Min. Mean	38		36		35		35	
Abs. Min.	36		33		30		30	
Haleakala Exposure	2/2 to 2/6 4 days		2/2 to 2/13 11 days		2/2 to 2/20 18 days		2/2 to 2/27 25 days	
Station	KULA		KULA		KULA		KULA	
Abs. Max.	72		72		72		72	
Max. Mean	65		65		65		66.	
Min. Mean	51		50		49		49	
Abs. Min.	44		44		42		42	
Kula Exposure	2/6 to 3/29 52 days		2/13 to 3/19 36 days		2/20 to 3/24 32 days		2/27 to 3/30 31 days	
Puparia Age	34 1-12 days old		34 1-12 days old		34 1-12 days old		34 1-12 days old	
	Date	Adults	Date	Adults	Date	Adults	Date	Adults
	3/2	neg.	3/5	neg.	3/18	neg.	3/29	neg.
	3/3	2	3/6	1	3/19	(1)	3/30	1
	3/4	3(1)	3/10	2	3/24	1		
	3/5	3	3/17	1				
	3/6	2	3/19	1				
	3/14	2						
	3/15	2(1)						
	3/16	(1)						
	3/23	(1)						
	3/29	(1)						
1st Adult	29 days +-12		32 +- 12		50 +- 12		56 +- 12	
Emergence Span	12 days		13		none		none	
Longest Period	42 to 53 days		46 to 57		51 to 62		57 to 68	
% Emer.	41 % dorsalis *14 % parasite		14 % dorsalis No parasites		3 % dorsalis **3 % parasite		3 % dorsalis No parasites	

* Two O. persulcatus and three O. longicaudatus

** O. persulcatus

(1): Parasites

TABLE NO. 11

Station	KULA	HAIKU	HALEAKALA	WAIKAMOI
Elevation	3750'	500'	7030'	4250'
Abs. Max.	70	80	66	68
Max. Mean	64	76	58	61
Min. Mean	50	62	45	47
Abs. Min.	42	58	37	40
Exp. No.	34	33	32	35
Date Started	12/21	12/21	12/21	12/21
Puparia	100	100	100	39
Age	1 day	1 day	1 day	1 day
1st Adult	2/18	1/6	100% mortality	100% mortality
Emergence Span	none	4 days		
Duration	51 days	18 days		
% Emergence	1%	24%		
1st Par.	2/20 O.p.	none		
Emergence Span	28 days			
Duration	53 to 80 da.			
% Parasitism	3% 2 O.p. 1 O.l.			

Note. These puparia were placed in the ground in screen cages

TABLE NO. 12

Station	KULA	HAIKU	HALEAKALA	
Exp. No.	38	37	36	
Date started	12/21	12/21	12/21	
Puparia	10	10	10	
Age	1 day	1 day	1 day	
1st Adult	1/30	1/6	none	
Duration	42	18		
% Emergence	40%	30%		
1st Parasite	2/8 O.p.	none		
Duration	51			

Note. These experiments were run concurrently with the above but the puparia were held in glass containers in the weather shelters.

TABLE NO. 13

Station	KULA	HAIKU	HAIKU	HAIKU
Elevation	3750'	500'	500'	500'
Abs. Max.	72	77	80	80
Max. Mean	66	73	73	73
Min. Mean	51	65	62	62
Abs. Min.	44	60	55	55
Exp. No.	39	40	70	82 Lot 1
Date started	2/3	2/3	3/2	3/14
Puparia	34	36	50	49
Age	0 days	2 days	0 days	0 days
1st Adult	3/15	2/20	3/20	4/1
Emergence Span	2 days	none	3 days	none
Duration	40	17 to 20	18	17
% Emergence	11%	11%	12%	8% dorsalis 18% capitata
1st Par.	none	none	none	4/3
Emergence Span				2 days
Duration				20 days
% Parasitism				22% O.1.

Note. Experiments 41, 42, 43, at Haleakala 7030', Haleakala 9200' and Waikamoi 4250' carried on concurrently with 39 & 40 have yielded negative results to date.
Experiments 73, 71, 72, 69, at Kula, Haleakala 9200', Haleakala 7030', and Waikamoi 4250' carried on concurrently with Experiment 70 have shown negative results to date.
Experiment 82 Lots 2, 3, 4, 5 carried on concurrently with Lot 1 at Kula, Haleakala 7030', Haleakala 9200' and Waikamoi 4250' have shown negative results to date.

Abs. Max. 7
Max. Mean 6
Min. Mean 4
Abs. Min. 4

DURATION OF THE PUPAL PERIOD AT KULA (3750')

TABLE NO. 14

Lot	Fruit	Pupated	Emergence First Adult	Days	Last Adult	Days	Span Emergenc
347	Eugenia uniflora	1/5	2/6	32			
391	Gourd	1/11	2/8	28	(Melon fly)		
364	Avocado	1/20	2/15	26	2/20	31	5
366	Tangerine	1/5	2/27	53	(Opius longicaudatus)		
474	Guava	2/3	2/27	24	3/8	33	9
474	Guava	2/3	3/15	40	(Opius longicaudatus)		
480	Guava	2/3	2/27	24	3/1	26	
480	Guava	2/3	3/5	30	3/9	34	(O. persulcatus
476	Guava	2/3	3/1	26	3/2	27	2
481	Guava	2/3	3/1	26	3/3	27	3
481	Guava	2/3	3/7	32	3/14	39	7(O. long
482	Guava	2/3	3/1	26	3/3	28	3
487	Guava	2/3	3/1	26	3/3	28	3
487	Guava	2/3	3/9	34	(O. longicaudatus)		
498	Guava	2/4	3/1	25	3/5	29	
448	Guava	2/2	3/2	28	3/4	30	
473	Guava	2/4	3/3	27			
475	Guava	2/3	3/3	28			
475	Guava	2/3	3/3	28	(O. longicaudatus)		
479	Guava	2/3	3/4	29	3/6	31	3
485	Guava	2/3	3/4	29	3/8	33	5
485	Guava	2/3	3/8	33	3/10	35	3
491	Guava	2/3	3/4	29	3/5	30	
491	Guava	2/3	3/9	34	(O. longicaudatus)		
486	Guava	2/3	3/7	32			
493	Guava	2/3	3/7	32			

Pupal Studies on Hawaii

DURATION OF PUPAL PERIOD

TABLE NO. 15

Station	HILO	KAUMANA	POHAKULOA	WAIKII	KEANAKOLU
Elevation	75'	2000'	6511'	4700'	5200'
Max. Mean.	84	72	67	69	
Min. Mean	64	54	42	45	
Lot. No.	(1)	(2)	(3)	(4)	
Duration	14 days	20 days	37-43 days	28-31 days	
Max. Mean	74	70			
Min. Mean	63	54			
Lot No.	(5)	(6)	(7)		
Duration	14 days	26 days	negative		
Max. Mean	73	70			
Min. Mean	63	52			
Lot No.	(8)	(9)	(10)		
Duration	15-16 days	20-24 days	negative		
Max. Mean	74				62
Min. Mean	63				45
Lot. No.	(11)	(12)	(13)		(14)
Duration	16-17 days	negative	negative		32-39 days
Max. Mean	75				
Min. Mean	63				
Lot No.	(15)	(16)	(17)		
Duration	14 days	negative	inc.		
Max. Mean	77	75			
Min. Mean	63	62			
Lot No.	(18)	(19)	(20)		
Duration	14 days	15-18 days	inc.		

Note. In brief, the pupal period at Hilo is 14 days; Kaumana, 18 to 26 days; Pohakuloa, 37 to 43 days; Waikii, 28 to 31 days; and Keanakolu, 32 to 39

Davis

METEOROLOGICAL DATA ON MAUI STATIONS

TABLE NO. 16

STATION	JANUARY	FEBRUARY	MARCH	TEMPERATURE
KULA INSECTARY 3750'	70	72	70	Absolute Max.
	64	66	66	Max. Mean
	50	51	47	Min. Mean
	42	44	42	Absolute Min.
	9.26	.89	.81	Ppt.
	57%	68%	73.2%	Aver. Rel. Hum.
HALEAKALA 7030'	66	68	68	Absolute Max.
	58	59	59	Max. Mean
	45	46	43	Min. Mean
	37	42	36	Absolute Min.
	11.26	5.44	5.04	Ppt.
	63.3%	47%	45.6%	Aver. Rel. Hum.
HALEAKALA 9200'	57	58	58	Absolute Max.
	49	52	52	Max. Mean
	38	39	38	Min. Mean
	33	32	32	Absolute Min.
	-	-	2.11	Ppt.
	63.2%	47%	44.2%	Aver. Rel. Hum.
WAIKAMOI 4250'	68	67	70	Absolute Max.
	61	58	58	Max. Mean
	47	49	49	Min. Mean
	40	42	42	Absolute Min.
	10.73	19.34	41.73	Ppt.
	85.6%	89.2%	86.5%	Aver. Rel. Hum.
HAIKU 500'	80	77	80	Absolute Max.
	76	73	73	Max. Mean
	62	65	62	Min. Mean
	58	60	55	Absolute Min.
	10.68	5.44	6.61	Ppt.
	82%	81.2%	73.6%	Aver. Rel. Hum.
OLINDA, EXP. STATION 2160'	75	77	75	Absolute Max.
	70	70	69	Max. Mean
	57	58	56	Min. Mean
	48	53	49	Absolute Min.
	7.43	7.31	13.07	Ppt.
				Aver. Rel. Hum.

METEOROLOGICAL DATA ON HAWAII STATIONS

TABLE NO. 17

STATION	JANUARY	FEBRUARY	MARCH	TEMPERATURE
HILO INSECTARY 75'	84	80	78	Absolute Max.
	76	75	75	Max. Mean
	63	63	63	Min. Mean
	60	63	60	Absolute Min.
	8.87	20.71	9.04	Ppt.
	84%	88%	86%	Aver. Rel. Hum.
KAUMANA 2000'	82	80	84	Absolute Max.
	76	70	71	Max. Mean
	53	61	53	Min. Mean
	51	49	48	Absolute Min.
	5.12	20.31	20.71	Ppt.
	-	92%	89%	Aver. Rel. Hum.
POHAKULOA 6511'	78	76	72	Absolute Max.
	69	67	68	Max. Mean
	34	44	41	Min. Mean
	30	32	31	Absolute Min.
	1.28	2.45	.34	Ppt.
	-	70%	69%	Aver. Rel. Hum.
WAIKII 4700'	81	76	73	Absolute Max.
	77	70	67	Max. Mean
	42	45	42	Min. Mean
	37	39	36	Absolute Min.
	1.45	1.46	0	Ppt.
	-	83%	79%	Aver. Rel. Hum.
KEANAKOLU 5200'	68	71	72	Absolute Max.
	62	63	62	Max. Mean
	44	45	45	Min. Mean
	36	37	36	Absolute Min.
	8.00	5.02	12.24	Ppt.
	81%	74%	91%	Aver. Rel. Hum.
KIPUKA KI 4250'	68	70	80	Absolute Max.
	65	64	70	Max. Mean
	46	50	47	Min. Mean
	43	41	41	Absolute Min.
	10.00	10.96	2.56	Ppt.
	-	91%	84%	Aver. Rel. Hum.

Line Project I-o-1-3 - Miscellaneous Biological Studies. (K. L. Maehler)

Nutritional Studies using California Fruit - Experiment 56.

TABLE 18

Fruit	Date checked and flies found alive							
	Date	Flies	Date	Flies	Date	Flies	Date	Flies
Avocado (whole)	1/26	100	1/30	52	2/2	17	2/7	0
Avocado (whole	1/26	100	1/30	47	2/2	15	2/7	0
Avocado (half)	1/26	100	1/30	62	2/2	53	2/7	0
Avocado (half)	1/26	100	1/30	68	2/2	28	2/7	0
Honey (control)	1/26	100	1/30	97	2/2	92	2/7	88
Honey (control)	1/26	100	1/30	87	2/2	83	2/7	78

In this experiment and in the nutritional studies following, male field flies were used 100 to a cage. Periodic checks were made and the dead flies counted. Honey or apple were used as controls.

In Experiment 56 it is quite obvious that avocado will not sustain the male flies for any considerable time. Other experiments have likewise demonstrated the fact that the adult flies apparently are unable to survive on avocado.

In Experiment 57, Table No. 20, a variety of California fruit, most of them small, were used. It was not surprising that a large fruit like Pomegranate maintained the flies for over a month but it was rather unusual that the small fruit of Rhapiolepsis (about the size of a pea) surpassed all the rest in its effectiveness as a food. Mission olive and the Castor bean fruit (R. communis) were the most undesirable foods for the fly.

In Experiment 89, Table No. 19, avocado were again demonstrated as undesirable for food. Citrus fruit used, although showing better results than avocado, could not compare with apples as food. The general tendency to break down very slowly and retain a moist condition without an excessive mold development coupled with its sugar content appears to be some of the reasons apple excels as a food for the flies.

All the fruit used in experiment 68 (Table No. 21) with the exception of the guava and banana were mainland fruit. A slice of the fruit was placed in a covered petri dish and the 1st instar larvae which had been taken from False Kamani were placed on the fruit, 25 to a lot.

TABLE NO. 19 - Nutritional Study Using California Fruit (Experiment 39)

Fruit	Lot	Date checked and flies found alive 3/23	3/27	3/29	4/2	4/4	4/6	4/7
Avocado (Fuerte)	30	100	69	27	3	2	0	
Avocado (Fuerte)	40	100	64	41	5	1	1	1
Avocado (Mex. Seedling)	28	100	50	24	1	0		
Avocado (Warsham)	29	100	61	31	1	1	0	
Grapefruit	37	100	82	76	56	9	3	0
Orange	35	100	80	73	67	36	9	7
Apple (Control)		100	90	87	86	85	80	76
Honey (Control)		100	100	100	96	94	93	93

TABLE NO. 20 - Nutritional Study Using California Fruit (Experiment 57)

Fruit	Lot	Date checked and flies found alive 2/3	2/5	2/7	2/8	2/10	2/12	2/14	2/20	3/8
Toyon	12	100	73	68	55	52	51	46	39	
Rose Hips	2	100	85	79	63	50	26	2	0	
Mission Olive	3	100	71	46	21	6	3	0		
English Ivy	4	100	68	51	32	19	16	2	0	
Cotoneaster	5	100	66	40	20	8	4	0		
Ricinus communis	13	100	69	48	30	11	1	0		
Pomegranate	16	100	94	88	85	83	79	77	56	0
Rhapiolepsis	8	100	93	85	81	79	75	53	25	17
Eugenia sp.	10	100	79	58	43	23	14	0		
Honey (Control)		100	94	93	93	93	90	88	82	68

TABLE NO. 21 - Nutritional Studies Testing California and Hawaiian Fruit for Suitability for Larval Development - Experiment No. 68

Lot	1	2	3	4	5	6	7	8	9
Fruit	Opuntia	Lemon	Banana	Guava	Grape-fruit	Green Avocado	Ripe Avocado	Orange	Apple
Date	2/20	2/20	2/20	2/20	2/20	2/20	2/20	2/20	2/20
	25	25	25	25	25	25	25	25	25
Stage	1st In.	1st In.	1st In.	1st In.	1st In.	1st In.	1st In.	1st In.	1st In.
Date	3/1	3/2	3/2	3/2	3/2	3/2	3/2	3/2	3/2
	8		1	1		all	1		
Stage	3rd In.	3rd In.	Pupae	pupae	2nd In.	dead	Pupae	3rd In.	2nd In.
Date	3/2	3/6	3/6	3/6	3/6		3/6	3/6	3/6
	2	1	2	3			2	1	
Stage	Pupae	Pupae	Pupae	3rd In.	Pupae		Pupae	Pupae	2nd In.
Date									3/20
									6
Stage									2rd In.
Date	4/5		4/6		4/5		4/5	4/6	3/23
	5		1		2		2	1	6
Stage	Adults		Adult		Adult		Adult	Adult	Pupae
Date	4/7								3/27
	1								7
Adult	Par.								Pupae
Total	5	0	1	0	2		2	1	1
Parasite	1	0	0	0	0		0	0	0

The rapid development of molds, particularly on the citrus fruit killed many of the young larvae. The larvae appeared unable to feed on the green avocado. Apple sustained the least mold growth, broke down most slowly and the larval development in this fruit was strongly retarded although there was less mortality.

These studies took place at Kula with temperature range between 50 and 70 degrees F.

An Experiment to ascertain the effect of fruit floating on water on subsequent fly development. To establish whether or not water could be an important vehicle of transportation of this fruit fly in irrigation ditches, streams or large bodies of water ten lots of guava of similar size and degree of ripeness were used. Nine of the lots were placed in tubs of fresh water and allowed to float. Each day one lot was removed and placed in a holding box. The first lot was used as a control and placed directly into the holding box without being submerged.

TABLE NO. 22

Lot	Weight	Count	Sunk	Date Removed	Dead Larvae	Days in Water	Puparia Recovered	Adults Emer.	Par. Emer.	First Adult
				2/1 (in holding box)						
1	1330	19	-	Control	0	0	230	90	13	3/15
2	1330	18	2	2/2	0	1	33	9	5	3/19
3	1316	17	6	2/3	5	2	11	2	1	3/21
4	1316	21	8	2/4	15	3	1	1	0	3/21
5	1330	18	3	2/5	5	4	8	0	0	
6	1330	19	5	2/6	51	5	7	0	0	
7	1316	17	4	2/7	26	6	3	0	0	
8	1330	17	2	2/8	25	7	7	1	0	3/22
9	1330	18	4	2/9	36	8	0	0	0	
10	1330	18	2	2/10	57	9	3	0		

If we allow for a certain degree of variation of infestation of our ten lots it is still rather obvious that the floating fruit had a much higher larval mortality than our control. However, it is also important to note that although the adult emergence was greatly diminished in the lots taken from the water it was still possible to get a good many puparia and ultimately adults from fruit soaked for one day. In Lot 8 an adult was recovered from fruit which had been floating for seven days. It would appear then that irrigation ditches or streams could carry floating fruit for considerable distance and incidentally the fruit fly.

<u>A study to ascertain the effect of etherizing and marking flies with Chinese lacquer</u>. The purpose of the following experiment was to find out if there was any immediate or delayed effect resulting from etherizing and marking flies on the thorax with Chinese lacquer. Fifty flies, 25 males and 25 females, were used in each cage. One cage was used as a control and these individuals were merely aspirated into the cage. The second cage contained etherized flies and the third, flies which had been etherized and marked.

Flies were etherized about 25 at a time and half placed in Cage 2 and the remaining marked and placed in Cage 3. A test tube was used in the operation and the flies held in the tube until the last fly stopped moving. The flies were marked with blue lacquer.

TABLE NO. 23

Cage	Date	JANUARY 3	4	5	6	7	8	9	10	11	31
1 Control	♂	25	25	25	23	23	23	22	22	21	16
	♀	25	24	22	20	19	19	16	16	14	11
2 Etherized	♂	25	25	25	24	24	24	23	22	21	11
	♀	25	25	23	23	22	22	21	21	19	16
3 Etherized & Marked	♂	25	25	23	21	20	20	19	17	17	12
	♀	25	25	24	22	22	22	21	21	19	14

Note: These figures indicate the males and females remaining alive.

After 28 days all cages had lost roughly 50% of their initial population. The cages were checked daily for the first 9 days to see if there was any immediate effect from the ether or the marking. There did not seem to be any significant difference except in the case of the males which were etherized and marked. There was a greater mortality in this particular experiment of the males. To see if there was any delayed effect the cages were checked 28 days after the flies had been placed in them. There did not appear to be any significant difference here. Undoubtedly if the flies are over-etherized or roughly handled there will be an increased mortality, however if the operation is done properly there appears to be little damage effected.

Line Project-I-o-1-4 - Hosts of the Oriental Fruit Fly.

To properly evaluate the relative importance of the wide variety of fruit attacked by the Oriental fruit fly a vast amount of quantative data needs to be assembled. In the period covered by this report a total of 1074 lots of fruit have been collected on Maui and Hawaii. Particular emphases have been placed on citrus because of its commercial value on the mainland and because it was propitious to make these studies at the peak of the fruiting season. Citrus growers would like to know what significance the appearance of this fly would have on their crops. The answers to some of their questions may be found in the tables and summaries following.

In tables 24 and 25 are tabulated the complete data on the fruit collections for Maui and Hawaii. In order to compare the different host fruits, which vary greatly in size, weight, volume, rind thickness, size of seed, etc., an index has been established based on the number of puparia recovered per gram of fruit. If one gram of fruit produced one pupa the index would be "1." Usually the index is not this high so it is indicated as a decimal. A "lot" of fruit is ordinarily the amount of fruit collected which will conveniently fit in a holding box and varies with the availability of the fruit, size and other practical considerations. This index figure which appears on the extreme right on this table is reflective of the degree with which the fruit are infested.

Following the Fruit Collections and Citrus Survey is a Loquat Survey (Table No. 42) which was made on Maui. It was not possible to include the emergence data on these collections but it was felt desirable to include this portion of the survey so that it might be compared with the two citrus surveys.

Of the 116 lots of loquat collected, which weighed about 400 pounds and contained some 16,457 fruit, there were recovered 34,761 puparia. The average index on the total number of lots was .189. Loquat has been shown to be the most heavily infested fruit thus far studied.

Fly emergence for April, the bulk of which came from loquat, showed that from 11,032 adults that emerged, 6803 (61.6%) were dorsalis, 1089 (9.8%) were C. capitata, 2760 (25%) were O. longicaudatus and 380 (3%) were O. persulcatus.

Since the beginning of this investigation the following new hosts have been reported:

Diospyros ferrea (Willd.)
Juglans hindsii
Passiflora mollissima
Wikstroemia phillyraefolia
Vaccinium reticulatum
Feijoa sellowiana Berg.
Juglans regia L.
Santalum paniculatum
Wikstroemia uva-ursi

These have been included in a new host list which brings up to date all the host records of this fly. This is presented in Table No. 43.

Davis reports the following: "A total of 636 lots of fruit were collected and of these approximately 73% were citrus. It is significant that the three highest indexes .18, .14 and .15 were obtained from tangerines and kumquats. The next highest index, .08, was obtained from loquat. The citrus infestations began to pick up in January and February and this may have been due to the scarcity of other fruit during this period. Twenty-four lots of native fruit were collected and from these two new records, Vaccinium reticulatum and Diospyros ferrea were recorded. V. reticulatum is also a new altitude record for an infested host, having been collected at 6200' on the north slope of Mauna Loa."

MAUI FRUIT COLLECTIONS

TABLE NO. 24

Note:

Lots 1 to 300 are included in the December Quarterly Report.
Lots 301 to 508 are included in this report.
Lots 509 to 848 which are not complete at this time will be included in the next report.

KEY

Index: Puparia recovered per gram of fruit
S: Stage of fruit
W: Weight in grams
N: Number of fruit
G: Green R: Ripe
DOR: D. dorsalis
MED: C. capitata
PAR: Opius
gr : Ground fruit, usually over ripe

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	Emergence DOR	Emergence MED	Emergence PAR	INDEX
301	12/21	Kula	2640'	Tangerine	R	622	20	31	3	12	3	.05
302	"	"	"	Persimmon	R	820	14	13		6		.015
303	"	"	"	Lemon	R	870	9	0				0
304	"	"	"	Apple	G	650	6	0				0
305	"	"	2680'	Lemon	R	347	12	0				0
306	"	"	2640'	Loquat	R	707	57	9	4			.012
307	"	"	"	Tangerine	G	438	12	1				.002
308	"	"	"	Loquat	R	368	46	48	16	5		.13
309	"	"	2690'	Guava	R	935	21	19	19			.02
310	"	"	"	Pomegranate	R	453	4	0				0
311	"	"	3020'	P. edulis	R	650	21	0				0
312	"	"	"	Lemon	R	1245	9	0				0
313	"	"	"	Tangerine	R	127	24	15	1	5		.12
314	12/22	"	3200'	Guava	R	1170	48	127	4	5	1	.10
315	"	"	"	Guava	R	1400	39	52	11		2	.04
316	"	"	"	Guava	R	1712	46	68	15		3	.04
317	"	"	"	Guava	R	1531	55	20	4			.13
318	"	Makawao	1800'	Loquat	R	1725	76	55	16		1	.03
319	"	"	"	Loquat	R	1540	70	42	11		1	.03
320	"	"	"	Loquat	R	2125	113	66	32			.03

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
321	12/22	Haiku	500'	Terminalia chebula	R	877	120	38	2		14	.04
322	"	"	"	"	R	1450	204	32	12		9	.02
323	"	"	"	P. laurifolia	G	410	11	0				0
324	"	"	"	Ginger	R	225	85	0				0
325	12/27	Kula	2650'	Lemon	R	664	18	0				0
326	"	"	"	Avocado	G	1673	10	0				0
327	"	"	"	Lemon	R	877	11	0				0
328	"	"	"	Avocado	G	2026	7	2				.001
329	"	"	"	Lemon	R	198	6	0				0
330	"	"	"	Avocado	G	1630	6	0				0
331	"	"	"	Lime	R	892	17	0				0
332	"	Paia	750'	Star Fruit gr	R	1403	14	0				0
333	"	"	"	Annona squamosa	G	566	2	0				0
334	"	"	"	Avocado gr	G	2154	4	7	5			.003
335	"	"	"	Avocado gr	R	3756	6	5				.001
336	"	"	"	Avocado gr	G	2238	6	20	8			.008
337	"	"	"	Date gr	R	467	94	0				0
338	"	"	"	Loquat gr	R	495	30	110	32		18	.222
339	"	"	"	Eugenia uniflora gr	R	269	60	10			2	.04
340	"	"	"	Star Fruit gr	R	1700	19	2				.001
341	"	"	"	Avocado	G	1531	2	0				0
342	"	Kula	3600'	Orange	R	481	6	0				0
343	"	"	"	Orange	R	481	5	0				0
344	"	"	"	Lemon	R	552	5	0				0
345	"	"	"	Quince	R	403	5	0				0
346	"	"	"	Apple	R	481	6	0				0
347	12/29	Paia	750'	Eugenia uniflora gr	R	636	177	50	18		5	.07[illegible]

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
348	12/29	Paia	750'	Cestrum	R	57	-	0				0
349	"	"	"	Avocado gr	R	2438	6	0				0
350	"	"	"	Star Fruit gr	R	1700	20	5				.005
351	"	"	"	Lime	R	127	2	0				0
352	"	"	"	Mulberry	R	57	39	0				0
353	"	"	"	Loquat	R	495	37	93	16	1	17	.187
354	"	"	"	Orange	R	622	6	0				0
355	"	"	"	Grapefruit gr	R	1259	6	1				.001
356	"	"	"	Avocado gr	R	1119	2	22	11			.019
357	"	"	"	Avocado gr	R	2820	5	1				0
358	"	"	"	Pyrancantha	R	170	-	0				0
359	"	"	"	Grapefruit gr	R	863	4	0				0
360	"	"	"	Orange gr	R	650	6	0				0
361	"	"	"	Avocado gr	R	3870	8	3				.001
362	"	"	"	Grapefruit	G	636	2	0				0
363	"	Makawao	1700'	Avocado gr	R	2268	7	0				0
364	"	"	"	Avocado gr	R	1474	3	142	21			.096
365	"	"	"	Annona cherimola	R	2495	15	302	83		2	.121
366	"	"	"	Tangerine gr	R	3314	77	134	45		23	.040
367	"	Hailiimaile	1050'	Opuntia(red)	R	1602	15	29				.018
368	"	Kokomo	1483'	Guava gr	R	3260	35	606	61	1	22	.119
368b	"	"	"	Guava gr	R	3629	58	219				0
369		Kula		Fig	R	156	6	0				0
370		Kula	3600'	Apple gr	R	2026	24	45		17		.022
371	"	"	"	Apple gr	R	1347	24	1				.001
372	"	"	"	Apple gr	R	1460	21	26		21		.017
373	"	"	"	Apple gr	R	1814	36	16		16		.008

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	FAR	INDEX
374	12/30	Kula	3600'	Apple gr	R	764	14	33				.043
375	"	"	"	Orange gr	R	1316	15	0				0
376	"	"	"	Orange gr	R	566	7	59		40		.104
377	"	"	"	Orange gr	R	764	8	0				0
378	"	"	"	Orange	R	1315	8	18		15		.013
379	"	"	"	Fig	R	1188	104	0				0
380	"	"	"	Tomato	R	650	11	0				0
381	"	"	"	Chayote	R	650	2	0				0
382	"	"	2650'	Banana	R	1856	26	71	5	(1 Melon)		.038
383	"	"	"	Lemon	R	1531	15	0				0
384	"	"	"	Tree tomato	R	1728	11	0				0
385	"	"	"	Loquat	R	311	62	0				0
386	1/1	Pauwela	500'	Guava	R	1899	48	172	3			.09
387	1/4	Paia	750'	Star Fruit gr	R	2139	29	0				0
388	"	"	"	Loquat gr	R	630	55	157	25		29	.201
389	"	Lahaina	50'	Papaya gr	R	1980	11	49	22		4	.024
390	"	Olowalu	15'	Kamani,false	R	2139	104	408	107	13	2	.19
391	"	Lahaina	50'	Gourd	R	1955	1	978		(331 Melon)	7	.50
392	"	Lahaina	"	Guava gr	R	880	20	399	96		6	.453
393	"	Olowalu	15'	Acacia farnesiana	G	834	-	0				0
394	"	"	"	Prosopis juliflora	G	141	-	0				0
395	1/5	Kaupakalua	1050'	Grapefruit gr	R	978	5	4				.004
396	"	"	"	Tangerine	R	297	2	1				.003
397	"	"	"	Orange gr	R	834	4	9	5			.01
398	"	"	"	Lemon gr	R	949	4	0				0
399	"	"	"	Lemon	R	1091	5	0				0
400	"	"	"	Grapefruit	R	481	2	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	COR	MED	PAR	INDEX
401	1/5	Kaupakalua	1050'	Orange	R	1062	6	6			1	.005
402	"	"	"	Orange	R	792	4	0				0
403	"	"	"	Orange	R	935	4	0				0
404	"	Huelo	580'	Lemon	R	594	4	0				0
405	"	"	"	Guava gr	R	978	14	29	4		1	.029
406	"	Keanae	240	Breadfruit gr	R	1417	2	0				0
407	"	"	"	Breadfruit gr	R	1970	2	0				0
408	"	"	"	Guava	G	368	8	17	11		2	.046
409	"	"	"	Coffee	G	85	49	0				0
410	"	Makawao	1700'	Avocado gr	R	1573	3	3				.001
411	"	"	"	Avocado gr	R	2593	8	0				0
412	"	"	"	Avocado gr	R	2083	8	11	1			.005
413	"	"	"	Persimmon	R	978	9	6	1			.006
414	"	"	"	Loquat	R	2210	116	141	11		10	.063
415	1/6	Haiku	650'	Mango	R	749	4	0				0
416	1/10	Paia	750'	Banana	R	978	10	0				0
417	1/12	Paia	"	Eugenia uniflora gr	R	269	84	1				.003
418	"	"	"	Star Fruit gr	R	1259	15	0				0
419	"	"	"	Avocado gr	R	2424	4	0				0
420	"	"	"	Loquat gr	R	877	55	28	6	(1 Melon)	2	.031
421	"	"	"	Loquat gr	R	806	58	23	1		3	.028
422	"	"	"	Avocado gr	R	2154	4	0				0
423	"	"	"	Avocado gr	R	2325	6	0				0
424	"	"	"	Avocado gr	R	2664	5	0				0
425	"	"	"	Lemon gr	R	650	9	0				0
426	"	"	"	Lemon gr	R	877	8	0				0
427	"	"	"	Grapefruit gr	R	1347	6	0				0
428	"	"	"	Grapefruit gr	R	2282	5	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
429	1/12	Kula	3800'	Passiflora	R	170	2	0				0
430	1/15	Makawao	1700'	Annona cherimola	R	1347	7	172				.127
431	1/17	"	"	Loquat gr	R	438	23	30	8		6	.068
432	"	"	"	Avocado gr	R	580	3	0				0
433	"	"	"	Guava gr	R	1231	16	43	9		4	.034
434	"	"	"	Guava gr	R	2932	47	184	14		2	.062
435	"	Haiku	650'	Terminalia chebula gr	R	792	119	166	19		1	.209
436	1/18	Haiku	"	Papaya	R	453	11	95	14			.209
437	"	"	"	Papaya	R	538	1	0				0
438	"	"	"	Avocado gr	R	693	2	0				0
439	"	"	"	Avocado	R	1091	4	0				0
440	"	Kula	2640'	Loquat	R	650	60	46	6	1		.07
441	"	Haiku	650'	Mangosteen	G	127	2	0				0
442	"	Kaupakalua	1050'	Guava, strawberry	R	170	14	1				.064
443	"	"	"	Guava gr	R	3260	42	28	6			.008
444	"	"	"	Guava gr	R	2537	42	22	0			.008
445	"	"	"	Guava gr	R	2763	42	11	1			.003
446	"	"	"	Guava gr	R	2975	42	62	13			.020
447	"	"	"	Guava gr	R	3470	60	205	1			.059
448	"	"	"	Guava gr	R	4181	84	163	16		2	.038
449	1/20	Kula	2650'	Avocado	G	2367	5	0				0
450	"	"	"	Avocado	G	1785	6	0				0
451	"	"	"	Avocado	G	1658	7	0				0
452	"	"	"	Lime	R	481	12	0				0
453	"	"	"	Lime	R	396	11	41				.103
454	"	"	"	Orange	R	552	8	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
455	1/20	Kula	2650'	Lemon	R	340	6	0				0
456	1/20	"	"	Lemon	R	721	9	0				0
457	"	"	"	Loquat	R	156	34	0				0
458	"	"	3600'	Orange gr	R	410	6	0				0
459	"	"	"	Orange	R	396	4	0				0
460	"	"	"	Lime	R	255	15	0				0
461	"	"	"	Lemon	R	849	5	0				0
462	"	"	"	Apple gr	R	467	6	0				0
463	"	Kaupakalua	1050'	Tangerine gr	R	566	15	0				0
464	"	"	"	Cucumber	R	1588	12	278	(170 Melon)			.175
465	"	"	"	Poha	R	113	30	0				0
466	1/24	Paia	750'	Guava	R	2139	20	306	73		75	.143
467	"	"	"	Annona squamosa	G	354	1	10	4			.028
468	"	"	"	Grapefruit gr	R	2664	9	6	4			.002
469	"	"	"	Loquat gr	R	594	45	61	9		6	.102
470	"	"	"	Loquat gr	R	721	52	74	3		13	.102
471	"	"	"	Avocado gr	R	2680	7	4				.001
472	"	Haiku	650'	Papaya	R	1871	2	0				0
473	1/25	Kaupakalua	1050'	Guava gr	R	3217	56	266	15		1	.070
474	"	"	"	Guava gr	R	2523	37	191	23		11	.075
475	"	"	"	Guava gr	R	2509	38	169	22		18	.067
476	"	"	"	Guava gr	R	2551	41	278	69		6	.108
477	"	"	"	Guava gr	R	3246	67	169	12		2	.052
478	"	"	"	Guava gr	R	3003	49	179				.059
479	"	"	"	Guava gr	R	2409	43	213	22		4	.088
480	"	"	"	Guava gr	R	2452	36	212	20		16	.086
481	"	"	"	Guava gr	R	1955	37	158	16		10	.080

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
482	1/25	Kaupakalua	1050'	Guava gr	R	2466	40	198	24		2	.080
483	"	"	"	Guava gr	R	2551	43	263	38		15	.103
484	"	"	"	Guava gr	R	1814	34	212	30		13	.116
485	"	"	"	Guava gr	R	3359	65	138	24		11	.041
486	"	"	"	Guava gr	R	3274	55	190	46		2	.058
487	1/26	"	"	Guava gr	R	2735	38	218	36		15	.079
488	"	"	"	Guava gr	R	4988	63	210	14		1	.042
489	"	"	"	Guava gr	R	3598	54	127	11		1	.035
490	"	"	"	Guava gr	R	3387	45	58	5	1	1	.017
491	"	"	"	Guava gr	R	2834	45	142	9		6	.050
492	"	"	"	Guava gr	R	4082	60	93	10		5	.022
493	"	"	"	Guava gr	R	3940	50	182				.046
494	"	"	"	Guava gr	R	2650	38	49	2			.018
495	"	Makawao	1700'	Guava gr	R	608	12	50	11			.082
496	"	"	"	Loquat	R	778	75	196	13		46	.251
497	"	"	"	Orange gr	R	1259	11	15			2	.011
498	"	"	"	Guava gr	R	1034	13	403	84		40	.389
499	"	"	"	Annona cherimola gr	R	1020	5	187	75			.183
500	"	"	"	Orange gr	R	396	6	2	1			.005
501	2/2	"	"	Lemon	R	580	4	0				0
502	"	"	"	Lemon gr	R	1417	11	4				.002
503	"	"	"	Lemon	R	877	5	0				0
504	"	"	"	Lime	R	664	10	0				0
505	"	"	"	Annona cherimola	R	283	2	191	12		3	.674
506	"	Haiku	650'	Cotton	G	255	14	0				0
507	"	"	"	Papaya	R	525	1	37	5			.07
508	"	Kokomo	1480'	Coffee	R	255	204	12			2	.047

FRUIT COLLECTION AND FLY EMERGENCE ON HAWAII (C. J. Davis)

TABLE NO. 25

Note: Lots 1 to 210 were included in the December Quarterly Report.
Lots 211 to 636 are included in this report.
Lots 637 to 737 which are incomplete will be included in the next report.

KEY
S: Stage of fruit
W: Weight in grams
N: Number of fruit
G: Green R: Ripe
Index: Puparia recovered per gram of fruit
Dor: *Dacus dorsalis*
Med: *Ceratitis capitata*
Par: *Opius*
gr: Ground fruit

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
211	12/7	Pahoa	250'	Tangerine	R	901	12	0				0
212	"	"	"	Navel Orange	R	1336	4	0				0
213	"	"	"	Orange	R	1231	12	7	4			.005
214	"	"	"	Tangerine gr	R	561	7	0				0
215	"	"	"	Orange	R	1780	12	0				0
216	"	"	"	Tangerine gr	R	647	13	0				0
217	"	"	"	Tangerine	R	667	7	0				0
218	"	"	"	Mt. Apple gr (E. malaccensis)	R	740	14	0				0
219	"	"	"	Tangerine	R	571	7	0				0
220	"	"	"	Duncan grapefruit	R	1798	6	0				0
221	"	"	"	Tangerine	R	731	13	0				0
222	"	"	"	Navel Orange gr	R	746	3	4	3			.005
223	"	Hilo	75'	Sweet Lemon	R	998	12	0				0
224	"	Pahoa	250'	Tangerine gr	R	838	12	0				0
225	"	"	"	Tangerine	R	1022	12	0				0
226	"	"	"	Orange gr	R	1665	12	0				0
227	"	"	"	Tangerine	R	988	12	0				0
228	"	"	"	Orange	R	1028	8	10	10			.009

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
229	12/7	Pahoa	250'	Val. Orange gr	R	2171	18	0				0
230	"	"	"	Val. Orange	R	1094	6	0				0
231	"	"	"	Tangerine	R	912	7	0				0
232	"	"	"	Tangerine	R	748	10	0				0
233	"	"	"	Tangerine	R	1007	12	0				0
234	"	"	"	Navel Orange	R	2265	13	0				0
235	"	"	"	Orange gr	R	1544	10	0				0
236	"	Hilo	75'	Val. Orange gr	R	1596	11	9	4			.005
237	"	"	"	Val. Orange gr	R	1499	12	15	9		2	.01
238	"	"	"	Navel Orange gr	R	1183	5	0				0
239	"	"	"	Marsh gragefruit gr	R	1601	6	27	17		8	.02
240	"	"	"	Navel Orange	R	1215	5	0				0
241	"	"	"	Val. Orange gr	R	1677	12	0				0
242	"	"	"	Kusae Lime	R	744	13	0				0
243	"	"	"	Tahitian lime	R	429	5	0				0
244	"	"	"	Val orange	R	1558	12	0				0
245	"	"	"	Tahitian lime gr	R	876	12	0				0
246	"	"	"	Navel orange gr	R	1473	6	20	17			.01
247	"	"	"	Kusae lime gr	R	486	7	0				0
248	"	Pahoa	250'	Val. orange gr	R	1313	11	3	2			.002
249	"	"	"	Val. orange	R	1568	11	0				.0
250	"	"	"	Pummelo gr	R	1583	3	0				0
251	"	Hilo	75'	Kusae Lime	R	1084	12	0				0
252	"	Pahoa	250'	Val. orange	R	1471	12	5	4			.003
253	"	"	"	Tahitian lime	R	918	8	0				0
254	"	Hilo	75'	Marsh grapefruit	R	1575	6	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
255	12/7	Hilo	75'	Kusae lime gr	R	795	9	0				0
256	"	Pahoa	250'	Tangerine gr	R	849	10	0				0
257	"	Hilo	75'	Valencia orange gr	R	1097	12	1	1			.001
258	"	"	"	Kusae lime gr	R	594	10	0				0
259	"	Pahoa	250'	Valencia orange	R	927	9	0				0
260	"	Hilo	75'	Valencia orange	R	1556	12	0				0
261	"	Pahoa	250'	Hawaiian orange	R	808	5	0				0
262	"	Hilo	75'	Navel orange	R	1007	4	0				0
263	"	"	"	Val. orange gr	R	1362	13	1				.001
264	"	"	"	Kusae lime	R	1090	12	0				0
265	"	"	"	Val. orange gr	R	817	7	0				0
266	"	"	"	Kusae lime	R	953	12	0				0
267	"	"	"	Navel orange gr	R	1226	6	1	1			.001
268	"	"	"	Sweet lemon gr	R	454	4	8				.02
269	"	"	"	Navel orange gr	R	1135	5	0				0
270	"	"	"	Navel orange	R	1044	4	0				0
271	"	Pahoa	250'	Pineapple orange gr	R	681	11	8	1		3	.01
272	"	"	"	Orange	R	1271	9	2	1		1	.001
273	"	"	"	Navel orange	R	1634	6	0				0
274	"	"	"	Valencia orange gr	R	1816	12	0				0
275	"	"	"	Valencia orange gr	R	999	9	3	3			.003
276	"	"	"	Hamlin orange	R	1090	9	0				0
277	"	"	"	Duncan grapefruit gr	R	1952	5	35	26		2	.02
278	"	"	"	Orange	R	863	7	0				0
279	"	"	"	Tangerine	R	863	12	0				0
280	"	"	"	Orange gr	R	1725	12	6	2			.003

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
281	12/7	Pahoa	250'	Orange gr	R	1180	8	4	1			.003
282	"	"	"	Tangerine gr	R	681	12	1				.001
283	"	"	"	Tangerine	R	1135	9	0				0
284	"	"	"	Val. orange gr	R	1137	9	2	1		1	.001
285	"	"	"	Tangerine gr	R	636	12	0				0
286	"	"	"	Tangerine gr	R	908	15	0				0
287	"	"	"	Tangerine	R	681	7	0				0
288	"	"	"	Orange	R	999	7	2				.002
289	"	"	"	Pummelo gr	R	1362	2	9	5			.006
290	"	"	"	Tangerine gr	R	1090	19	4				.003
291	"	"	"	Tangerine	R	636	12	1				.001
292	"	"	"	Tangerine	R	545	5	0				0
293	"	"	"	Tangerine gr	R	636	14	0				0
294	"	"	"	Orange	R	908	10	0				0
295	"	"	"	Tangerine	R	590	7	0				0
296	"	Hilo	75'	Kusae lime gr	R	499	7	0				0
297	"	"	"	Pummelo	R	1544	1	0				0
298	"	"	"	Pummelo gr	R	2588	2	2	2			.001
299	"	Pahoa	250'	Tangerine	R	409	6	0				0
300	"	"	"	Tangerine gr	R	908	14	0				0
301	"	"	"	Valencia orange	R	2043	14	0				0
302	"	"	"	Tangerine	R	817	12	0				0
303	"	"	"	Tangerine gr	R	726	12	2				.003
304	"	"	"	Valencia orange gr	R	545	5	0				0
305	"	"	"	Tangerine	R	636	7	1				.001
306	"	"	"	Orange gr	R	1180	9	8	5			.006

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDE
307	12/7	Pahoa	250'	Tangerine	R	545	6	0				0
308	"	"	"	Tangerine gr	R	817	14	0				0
309	"	"	"	Navel orange gr	R	545	4	10	5			.02
310	"	Hilo	75'	Pummelo gr.	R	2542	2	8	6			.00
311	"	Pahoa	250'	Valencia orange gr	R	1271	13	8	5			.00
312	"	"	"	Valencia orange gr	R	1135	8	1	1			.00
313	"	Hilo	75'	Pummelo gr	R	2361	2	6	3			.00
314	"	Pahoa	250'	Kumquat	R	91	6	0				0
315	"	Hilo	75'	Pummelo	R	1907	1	0				0
316	"	Pahoa	250'	Tangerine gr	R	272	6	0				0
317	"	Hilo	75'	Pummelo	R	1544	3	9	9			.00
318	"	Pahoa	250'	Orange	R	1226	9	7	4		1	.00
319	"	"	"	Tangerine	R	1225	12	1				.00
320	"	"	"	Tangerine	R	545	6	0				0
321	"	Hilo	75'	Kusae lime	R	636	12	0				0
322	"	"	"	Pummelo gr	R	2043	3	1				.00
323	"	Pahoa	250'	Orange	R	908	8	0				0
324	"	"	"	Tangerine gr	R	545	12	0				0
325	"	"	"	Orange gr	R	1362	11	0				0
326	"	"	"	Valencia orange	R	1816	12	0				0
327	"	"	"	Orange gr	R	908	8	3	3			.00
328	"	"	"	Valencia orange gr	R	1589	12	22	10		3	.01
329	"	"	"	Valencia orange	R	1453	11	1	1			.00
330	"	M.L.T.T.	6200'	Ohelo berries	R	28	95	4	1			.14
331	"	Mt. View	2000'	Tangelo gr	R	573	8	17	1			.02

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
332	12/15	Puuwaawaa	3500'	Osmanthus (olopua) sandwicensis	R	205	204	0				0
333	"	"	"	Straussia (kopiko) sandwicensis	R	221	1231	0				0
334	"	"	"	Osteomeles (ulei) anthyllidifolia	R	178	213	0				0
335	"	"	"	Coprosma sp (pilo)	R	42	226	0				0
336	"	"	"	S. psuedocapsicum	R	147	158	4	3			.02
337	"	"	3300'	Passiflora mollissima	R	551	24	0				0
338	"	"	"	O. sandwicensis	R	519	535	0				0
339	"	"	"	Pleomele aurea (halapepe)	R	539	337	0				0
340	"	"	"	Sideroxylon auahiense (Alaa-hua-nunui)	R	469	41	0				0
341	12/16	"	2600'	Diospyros (lama) ferrea	R	182	116	1	1			.005
342	"	"	2000'	Xylosma (maua) Hillebrandii	R	73	195	1				.005
343	"	"	"	Yellow fruit cactus .megacantha	R	1167	8	0				0
344	"	"	"	Red fruit cactus O. megacantha	R	355	6	0				0
345	"	"	"	S. auahiense	R	1181	58	0				0
346	"	"	"	P. aurea	R	346	190	0				0
347	"	"	"	Passiflora ligularis (lemi-wai)	R	750	12	0				0
348	"	Kuainiho	2500'	Wikstroemia (akia) phillyraefolia	R	284	429	0				0
349	12/17	Kipuka Puaulu	4000'	Sapinda saponaria (Manele)	G	472	214	0				0
350	"	"	"	M. sandwicense(naio)	R	175	743	0				0
351	"	"	"	O. anthyllidifolia (ulei)	R	114	150	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N'	PUPAE	DOR	MED	PAR	INDEX
352	12/17	K.M.C.	4000'	V. reticulatum (Ohelo)	R	319	398	0				0
353	"	"	"	S. paniculatum (sandalwood)	R	108	98	0				0
354	12/19	Kaumana	2000'	A. platyphyllum (Mehame)	G	207	378	0				0
355	"	"	2000'	Astelia (Painiu) (sandwicensis	R	37	160	0				0
356	12/16	Waikii	4700'	S. psuedocapsicum	R	95	100	162		128		1.70
357	"	Hilo	300'	Choko	G	1818	7	0				0
358	12/13	Waikii	4700'	S. pseudocapsicum	R	119	100	0				0
359	12/23	"	"	S. pseudocapsicum	R	125	100	2		1		.02
360	12/27	"	"	S. pseudocapsicum	R	135	100	249		134		1.84
361	12/29	Mt. View	2000'	Arizona grapefruit	R	2497	10	0				0
362	"	"	"	Wainaku grapefruit	R	3269	14	0				0
363	"	"	"	Robinson orange	R	2361	8	0				0
364	"	"	"	Tangerine	R	1317	15	6	2			.004
365	"	"	"	Mandarin	R	1226	12	16	4		4	.012
366	"	"	"	Samson tangelo	R	1861	15	10	9			.005
367	"	"	"	Wainaku grapefruit	R	1271	5	26	16	2		.014
368	"	"	"	Samson tangelo	R	1453	14	14	9			.009
369	"	"	"	Navel orange	R	1317	7	0				0
370	12/30	Kipuka Nene	3000'	Guava	R	454	19	0				0
371	1/3	Waikii	4700'	S. pseudocapsicum	R	102	100	52		43		.51
372	"	Keanakolu	5200'	P. mollisima	R	437	12	0				0
373	1/10	Waikii	4700'	S. pseudocapsicum	R	152	100	63	3	55		.38
374	1/13	Mt. View	2000'	Navel orange	R	3178	13	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
375	1/13	Mt. View	2000'	Lime	R	908	11	0				0
376	"	"	"	Lime gr	R	863	12	0				0
377	"	"	"	Lemon gr	R	1861	16	0				0
378	"	"	"	Tangerine	R	953	15	0				0
379	"	"	"	Tangerine gr	R	999	16	0				0
380	"	"	"	Pummelo gr	R	3133	9	0				0
381	"	"	"	Valencia orange gr	R	1498	15	4	3			.002
382	1/16	"	"	Orange gr	R	1907	14	0				0
383	"	"	"	Tangerine	R	272	12	0				0
384	"	"	"	Orange	R	1180	12	0				0
385	"	"	"	Tangerine	R	545	14	2				.003
386	"	"	"	Navel orange	R	1317	8	0				0
387	"	"	"	Orange gr	R	1634	12	7			3	.004
388	"	"	"	Tangerine gr	R	590	11	0				0
389	"	"	"	Orange gr	R	1271	13	0				0
390	"	"	"	Orange gr	R	1090	12	0				0
391	"	"	"	Orange	R	1407	13	0				0
392	"	Olaa	200'	Rough skin lemon	R	1952	12	0				0
393	"	"	"	Rough skin lemon gr	R	2134	12	0				0
394	"	Mt. View	2000'	Hawaiian orange gr	R	1861	12	0				0
395	1/18	Hilo	75'	Siamese pomelo gr	R	2179	8	0				0
396	"	"	"	Shaddock gr	R	2951	6	0				0
397	"	"	"	Grapefruit gr	R	2808	12	0				0
398	"	"	"	Lue-gin-gong orange	R	1908	12	0				0
399	"	"	"	Pink-fleshed lemon	R	1725	12	0				0
400	"	"	"	Meyer lemon	R	2724	12	3	3			.001

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
401	1/18	Hilo	75'	Lisbon lemon	R	681	8	0				0
402	"	"	"	Lemon	R	1498	8	0				0
403	"	"	"	Kusae lime	R	1362	15	0				0
404	"	"	"	Valencia orange	R	2179	11	0				0
405	"	"	"	Satsumu Owaki orange	R	454	4	5	4			.01
406	"	"	"	Kusae lime gr	R	499	14	0				0
407	"	"	"	Lemon	R	772	15	1	1			.001
408	"	"	"	Mandarin	R	681	13	0				0
409	"	"	"	Armstrong seedless lemon	R	1953	9	0				0
410	"	"	"	Armstrong seedless lemon gr	R	2270	11	0				0
411	"	"	"	Villa Franca lemoh	R	2270	12	0				0
412	"	"	"	Lime gr	R	817	12	4	4			.004
413	"	"	"	Villa Franca lemon	R	1816	13	0				0
414	"	"	"	Lemon gr	R	1498	9	0				0
415	"	"	"	Lime	R	726	12	0				0
416	"	"	"	Orange gr	R	1498	9	7	3		4	.004
417	"	"	"	Rough skin lemon	R	908	6	0				0
418	"	"	"	Navel orange	R	1090	5	0				0
419	"	"	"	Lemon	R	999	13	0				0
420	"	"	"	Lemon	R	772	6	0				0
421	"	"	"	Lime	R	863	12	0				0
422	"	"	"	Maderin	R	499	10	0				0
423	"	"	"	Valencia orange gr	R	1725	11	0				0
424	"	"	"	Lemon gr	R	999	12	3	3			.003
425	"	"	"	Eustic limequat	R	96	7	5	1			.05
426	"	"	"	Kumquat gr	R	181	12	2	1			.01

LOT	DATE	LOCALITY	ELEV.	FRUIT		S	W	N	PUPAE	DOR	MED	PAR	INDEX
427	1/18	Mt. View	2000'	Robinson navel orange	gr	R	1317	7	1			1	.001
428	"	"	"	Samson tangelo	gr	R	999	12	7	2		5	.007
429	"	"	"	Tangerine	gr	R	953	9	2	1			.002
430	"	"	"	Navel orange	gr	R	1544	8	8	5			.005
431	"	"	"	Navel orange	gr	R	1362	5	0				0
432	"	"	"	Navel orange	gr	R	1090	7	0				0
433	"	Volcano	4000'	Manele	gr	R	142	29	0				0
434	"	Waikii	4700'	S. pseudocapsicum		R	128	100	252		231		1.96
435	1/20	Mt. View	2000'	Kumquat		R	1680	19	143	121		3	.08
436	"	"	"	Tangerine		R	227	12	16	16			.07
437	"	"	"	Tangerine		R	499	12	1	1			.002
438	"	"	"	Lemon		R	863	12	16	15		1	.02
439	"	"	"	Tangerine	gr	R	817	16	15	12		3	.02
440	"	"	"	Orange		R	772	7	0				0
441	"	"	"	Orange	gr	R	1226	11	1	1			.001
442	"	"	"	Lemon	gr	R	590	9	1	1			.002
443	1/23	Pahoa	250'	Tangerine	gr	R	908	12	11	1		6	.01
444	"	"	"	Tangerine		R	726	12	12	9		1	.02
445	"	"	"	Tangerine		R	681	12	11	10			.02
446	"	"	"	Tangerine	gr	R	999	12	18	7		1	.02
447	"	"	"	Tangerine	gr	R	863	12	31	18		3	.04
448	"	"	"	Tangerine		R	1044	12	3	2		1	.002
449	"	"	"	Tangerine	gr	R	681	11	18	15			.03
450	"	"	"	Tangerine	gr	R	590	12	23	17			.04
451	"	"	"	Tangerine	gr	R	1271	12	229	178		6	.18

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
452	1/23	Pahoa	250'	Lime	R	1090	12	0				0
453	"	"	"	Kusae lime gr	R	636	12	0				0
454	"	"	"	Kusae lime	R	772	12	0				0
455	"	"	"	Valencia orange	R	1816	12	0				0
456	"	"	"	Valencia orange gr	R	1498	10	10	1		6	.006
457	"	"	"	Valencia orange	R	1271	10	0				0
458	"	"	"	Valencia orange gr	R	1453	10	0				0
459	"	"	"	Navel orange	R	1317	6	6	6			.004
460	"	"	"	Navel orange gr	R	2588	12	0				0
461	"	"	"	Navel orange	R	2452	10	24	18			.009
462	"	"	"	Navel orange gr	R	1771	7	0				0
463	"	"	"	Valencia orange	R	1498	12	0				0
464	"	"	"	Tangerine gr	R	681	12	35	31		4	.05
465	"	"	"	Tangerine	R	726	12	9	9			.01
466	"	"	"	Tangerine	R	863	12	8	3		1	.009
467	"	"	"	Valencia orange	R	1861	12	22	13			.01
468	"	"	"	Duncan grapefruit gr	R	1816	6	15	10			.008
469	"	"	"	Duncan grapefruit	R	2134	7	7	7			.003
470	"	"	"	Kusae lime gr	R	817	12	0				0
471	"	"	"	Valencia orange gr	R	1680	13	0				0
472	"	"	"	Valencia orange gr	R	1907	12	19	18			.009
473	"	"	"	Kusae lime	R	863	12	0				0
474	"	"	"	Tangerine gr	R	590	14	10	4		3	.02
475	"	"	"	Tahitian lime	R	908	7	0				0
476	"	"	"	Tahitian lime gr	R	817	9	0				0
477	"	"	"	Tangerine	R	863	12	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
478	1/23	Pahoa	250'	Tangerine	R	409	12	8	5			.02
479	"	"	"	Valencia orange gr	R	1861	12	2	1			.001
480	"	"	"	Pummelo gr	R	681	1	0				0
481	"	"	"	Tangerine	R	636	12	1				.001
482	"	"	"	Rough skin lemon	R	908	5	1				.001
483	"	"	"	Rough skin lemon gr	R	1180	8	0				0
484	"	"	"	Tangerine gr	R	817	12	0				0
485	"	"	"	Tangerine gr	R	772	12	4	4			.005
486	"	"	"	Tangerine gr	R	953	12	5	4			.005
487	"	"	"	Valencia orange gr	R	1816	12	0				0
488	"	"	"	Tangerine	R	681	12	3				.004
489	"	"	"	Tangerine gr	R	726	12	0				0
490	"	"	"	Tangerine	R	590	12	2	2			.003
491	"	"	"	Tangerine gr	R	636	12	11	7		2	.02
492	"	"	"	Valencia orange	R	1634	12	0				0
493	"	"	"	Tangerine	R	636	12	28	26			.04
494	"	"	"	Tangerine gr	R	863	13	110	105		2	.14
495	"	"	"	Valencia orange	R	1544	12	0				0
496	"	"	"	Tangerine	R	772	12	59	41		8	.07
497	"	"	"	Tangerine gr	R	545	12	6	3	1		.007
498	"	"	"	Valencia orange	R	1725	12	3	3			.002
499	"	"	"	Tangerine	R	817	11	54	47			.06
500	"	"	"	Navel orange gr	R	1634	8	0				0
501	"	"	"	Navel orange	R	1253	6	0				0
502	"	"	"	Tangerine gr	R	863	12	49	43		1	.05
503	"	"	"	Tangerine	R	726	12	6	5			.008

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
504	1/23	Kalapana	50'	Akia	R	70	146	25	17		2	.35
505	1/24	Waimea	3500'	Navel orange	R	1861	15	1	1			.001
506	"	"	"	Lemon	R	1589	8	43	35			.02
507	"	"	"	Tree tomato gr	R	1407	31	0				0
508	"	"	"	Kusae lime	R	409	12	0				0
509	"	"	"	Hawaiian orange	R	1317	16	0				0
510	"	"	"	Kusae lime gr	R	363	12	0				0
511	"	"	"	Lemon	R	272	7	2			1	.007
512	"	"	"	Navel orange	R	1180	7	26	23		1	.02
513	"	"	"	Hawaiian orange gr	R	908	12	0				0
514	"	"	"	Lemon	R	863	12	0				0
515	"	"	"	Orange gr	R	772	12	0				0
516	"	"	"	Orange	R	1090	11	0				0
517	"	"	"	Orange	R	1998	9	0				0
518	"	"	"	Grapefruit	R	999	9	0				0
519	"	"	"	Grapefruit	R	1725	6	10	9			.005
520	"	Kaumana	1500'	Navel orange gr	R	1498	10	12	8		2	.008
521	"	Waimea	3500'	Lemon gr	R	1044	11	0				0
522	"	"	"	Lemon	R	999	12	0				0
523	"	"	"	Valencia orange gr	R	1090	12	0				0
524	"	Kaumana	1500'	Tangerine	R	1453	22	8	4			.005
525	"	Waimea	3500'	Grapefruit gr	R	2497	9	0				0
526	"	"	"	Navel orange	R	1180	9	0				0
527	"	"	"	Lemon	R	908	12	0				0
528	"	"	"	Waiawi	R	136	15	0				0
529	"	"	"	Navel orange gr	R	1453	12	7		2		.005

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	OR	MED	PAR	INDEX
530	1/24	Waimea	3500'	Grapefruit	R	2769	11	167	98		12	.06
531	"	"	"	Tangerine	R	182	12	0				0
532	"	"	"	Tangerine gr	R	136	12	0				0
533	"	"	"	Grapefruit	R	2270	9	0				0
534	"	"	"	Tangerine	R	590	20	42	31	1	2	.05
535	"	"	"	Navel orange	R	2588	10	0				0
536	"	"	"	Valencia orange	R	1135	10	0				0
537	"	"	"	Lime	R	817	18	1	1			.001
538	"	Kaumana	2000'	Navel orange	R	1998	12	27	24			.01
539	"	Waimea	3500'	Orange gr	R	1407	12	0				0
540	"	"	"	Orange	R	1044	13	0				0
541	"	Kaumana	1500'	Tangerine gr	R	409	13	3	3			.008
542	"	Waikii	4700'	S. pseudocapsicum	R	92	100	0				0
543	"	"	"	Akia	R	121	72	0				0
544	1/25	Mt. View	2000'	Navel orange gr	R	1861	8	0				0
545	"	"	"	Navel orange	R	817	4	2	2			.002
546	"	"	"	Orange gr	R	681	6	1				.001
547	"	"	"	Navel orange gr	R	953	6	0				0
548	1/26	Hilo	75'	Kumquat	R	182	14	0				0
549	"	"	"	Orange	R	1907	13	2				.001
550	"	"	"	Orange gr	R	1407	11	17	14			.01
551	"	"	"	Kumquat gr	R	817	36	124	32		63	.15
552	"	"	"	Lime	R	1180	13	0				0
553	"	"	"	Lime gr	R	863	12	0				0
554	2/1	Mt. View	2000'	Orange gr	R	1952	10	18	6			.009

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
555	2/1	Mt. View	2000'	Tangerine gr	R	863	14	12	7		2	.01
556	"	"	"	Navel orange gr	R	953	5	1				.001
557	"	"	"	Valencia orange gr	R	1725	11	3	2			.002
558	1/31	Ninole	200'	Spondias dulci gr (wi)	R	908	7	11	3			.01
559	1/26	Waimea	3500'	Grapefruit gr	R	2815	12	0				0
560	2/2	M.L.T.T.	6200'	Pukiawe	R	54	167	0				0
561	1/26	Waimea	3500'	Grapefruit gr	R	2088	7	1	1			.001
562	2/3	Waikii	4700'	S. pseudocapsicum	R	133	100	12	1	8	1	.06
563	2/10	Hilo	75'	Rang pur lime	R	1135	12	6	6			.005
564	"	"	"	Villa Franca Lemon	R	2179	12	0				0
565	"	"	"	Armstrong seedless lemon	R	2724	11	21	18			.008
566	"	"	"	Villa Franca lemon	R	1816	11	0				0
567	"	"	"	Rough skin lemon	R	772	6	0				0
568	"	"	"	Lue-gin-gong orange	R	1271	8	0				0
569	"	"	"	Pink-fleshed lemon	R	980	8	0				0
570	"	"	"	Rang-pur lime	R	1135	12	0				0
571	"	"	"	Mandarin	R	726	10	10	8			.01
572	"	"	"	Wase Satsuma orange	R	590	13	32	17		10	.05
573	2/7	Waikii	4700'	S. pseudocapsicum	R	75	100	122		109	1	1.62
574	2/14	"	"	S. pseudocapsicum	R	85	100	196		175		2.31
575	2/15	M.L.T.T.	4450'	S. pseudocapsicum	R	66	40	0				0
576	"	"	4250'	S. pseudocapsicum	R	3	3	0				0
577	"	"	6200'	Pukiawe	R	51	147	0				0
578	"	"	"	Pukiawe	R	58	96	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
579	2/20	Waikii	4700'	S. pseudocapsicum	R	115	100	193	1	149		1.30
580	"	Mt. View	2000'	Lemon	R	1453	12	0				0
581	"	"	"	Tangerine gr	R	454	8	10	5		1	.02
582	"	"	"	Orange gr	R	1725	12	34	21			.02
583	"	"	"	Orange	R	1317	10	7	3			.005
584	"	"	"	Valencia orange gr	R	1180	12	0				0
585	"	"	"	Lemon gr	R	1090	12	0				0
586	"	"	"	Navel orange gr	R	2225	12	0				0
587	"	"	"	Tangerine	R	409	7	14	10			.03
588	"	M.L.T.T.	6200'	Ohelo berries	R	5	24	0				0
589	"	"	4200'	S. pseudocapsicum	R	134	100	55	6	41		.35
590	2/23	Kona	1500'	Lemon	R	863	10	0				0
591	"	"	"	Rough skin lemon	R	2361	12	0				0
592	"	"	"	Lemon	R	590	11	0				0
593	"	"	"	Lemon	R	1453	10	5	2			.003
594	"	"	"	Rough skin lemon	R	1493	8	0				0
595	"	"	1600'	Kusae lime	R	817	12	0				0
596	"	"	1500'	Armstrong lemon	R	1362	10	0				0
597	"	"	"	Armstrong lemon	R	499	3	0				0
598	"	"	"	Armstrong lemon	R	1362	11	0				0
599	"	"	1800'	Armstrong lemon	R	1816	8	0				0
600	"	"	1800'	Rough skin lemon	R	1589	6	0				0
601	"	"	1500'	Lemon	R	908	11	0				0
602	"	"	1800'	Lemon	R	726	8	0				0
603	"	"	1700'	Rough skin lemon gr	R	1317	5	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
604	2/23	Kona	1800'	Kusae lime	R	545	12	0				0
605	"	"	"	Lemon	R	2270	18	0				0
606	"	"	1500'	Lime	R	908	15	0				0
607	"	"	1300'	Kona orange	R	2769	12	3	3			.001
608	"	"	"	Kona orange	R	1907	12	2	2			.001
609	"	"	"	Kona orange	R	2452	13	26	16	2	1	.007
610	"	"	"	Kona orange	R	908	8	54	29		3	.06
611	"	"	1500'	Tangerine	R	227	7	9	2	5	1	.03
612	"	"	"	Tangerine gr	R	409	16	3		1		.007
613	"	"	"	Tangerine	R	499	23	25		1	8	.05
614	"	"	1700'	Kona orange gr	R	227	4	0				0
615	"	"	1800'	Siamese pomelo	R	2769	12	0				0
616	"	"	"	Siamese pomelo	R	1407	6	0				0
617	"	"	"	Duncan grapefruit	R	1271	6	0				0
618	"	"	1600'	Duncan grapefruit	R	3067	7	2	1			.001
619	"	"	"	Duncan grapefruit gr	R	1816	5	28	15			.02
620	"	"	"	Duncan grapefruit	R	2724	6	48	25	8	3	.01
621	"	"	1500'	Duncan grapefruit	R	908	6	25	18			.03
622	"	"	"	Duncan grapefruit	R	1271	7	0				0
623	"	"	"	Duncan grapefruit gr	R	2179	12	72	42	16		.02
624	"	"	"	Duncan grapefruit	R	3587	10	17	3	1	1	.001
625	"	"	"	Undetermined	R	454	582	0				0
626	"	"	1800'	Pears, Fuerte gr	R	2270	8	8	4		1	.004
627	"	"	1500'	Loquats	R	454	37	124	37	1	31	.08
628	"	"	1900'	Diospyros ferrea	R	102	81	2	2			.02
629	2/27	Waikii	4700'	S. pseudocapsicum	R	83	100	114		91		1.37

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
630	2/27	Mt. View	2000'	Tangerine gr	R	318	8	24	15			.07
631	"	"	"	Navel orange	R	1861	12	0				0
632	"	"	"	Lemon	R	1180	9	0				0
633	"	"	"	Lemon gr	R	1407	12	4	2			.001
634	"	"	"	Navel orange gr	R	863	6	15	11			.02
635	"	Kalapana	50'	Ficus gr.	R	454	17	0				0
636	"	Kalapana	20'	Solanum sp.	R	101	21	0				0

CITRUS SURVEY ON MAUI, T. H.

Field observations have shown that citrus of all kinds is a favorite resting place for the adult fruit flies. They may be observed on leaf surfaces which are covered with sooty mold, scale, and honey dew, apparently feeding on this material. The large number of flies commonly associated with citrus and the fact that the fruit is frequently stung would imply that the fruit itself is heavily infested with larvae. Casual observers who watch the flies swarm out of citrus trees, note the stung fruit, pick up a few ground fruit and find larvae, are easily convinced that the fly does great damage to citrus and that the fruit is an excellent host. This, however, is not the case.

If *Dacus dorsalis* were to become established in California or some other part of the United States, it would cause damage in three ways: (1) It would indirectly cause havoc to the agriculture of the region by the probable quarantines that would be placed on the fruit. (2) It would affect the quality of the citrus fruit by the sting marks. (3) It would result in a loss of some fruit by larval infestation. If the data gathered on Maui is any criterion of how the fly would act elsewhere, the above have been placed in their correct position insofar as their importance is concerned. Citrus fruit does not constitute a good host for *Dacus dorsalis* on Maui.

In November of 1949 the writer was impressed by the fact that heavily stung citrus seldom yielded any puparia of *Dacus dorsalis*. It was decided to conduct a citrus survey on Maui and Hawaii to see if these suggestive findings were true or false. On Maui 183 lots of citrus have been collected which include 1946 fruit. In December, Mr. Davis and the writer collected over a 100 lots of citrus on Hawaii and Davis has subsequently collected a good number more. This particular phase of the citrus report will concern itself with the information gathered on Maui and will be followed by Mr. Davis' findings.

It will be apparent from the following data that citrus does not compare as a host with such fruit as guava, false kamani, loquat, or Santalum (Sandalwood). Ground fruit is more heavily infested than tree fruit. This is probably due to the fact that ground fruit is usually over ripe and frequently cracked when collected.

Of all the citrus collected Tangerines are the most heavily infested, both on the ground and on the tree. This may be due to the thin skin of the fruit or the oil cells or some other physical factor. Lemons and limes in these collection were less subject to infestation than some of the sweeter citrus fruit.

Although there is no quantitive data on stung fruit, as such, it is very apparent that citrus fruit, although heavily stung, does not afford a good host for the developments of the eggs or larvae. Field examination of many fruit show that the larvae in most case do not get through the "rag" of the fruit. Larvae which reach the pulp do not develop in the same measure as they do in certain other fruit. Molds which tend to quickly develop on citrus may have some deleterious effect on the larvae.

It would be climbing out on the proverbial limb to state that because citrus does not constitute a good host on Maui it would not elsewhere. Citrus could be very important in carrying fly populations over a period when there was no deciduous fruit in an area. There it would assume an importance out of all proportion to the amount of infested fruit.

Summary. The data included in the following pages may be summarized and evaluated as follows:

TABLE NO. 26

FRUIT		TOTAL LOTS	TREE FRUIT	GROUND FRUIT	PUPAE	INDEX
Orange	Collected	64	41	23	T 57	.008
	Infested	14(21.8%)	7(17%)	7(30%)	G 233	.032
Lemon	Collected	50	42	8	T 35	.012
	Infested	5(10%)	5(10%)	0	G 0	0
Lime	Collected	25	23	2	T 43	.022
	Infested	2(8%)	2(8.6%)	0	G 0	0
Grapefruit	Collected	27	19	4	T 8	.001
	Infested	7(25.9%)	3(16%)	4(50%)	G 25	.004
Tangerine	Collected	14	10	4	T 61	.010
	Infested	9(64%)	7(70%)	2(50%)	G 155	.030
Pummelo	Collected	3				
	Infested	0				
Totals	Collected	183	135	45	T 204	.010(aver.)
	Infested	37(20%)	24(17.7%)	13(28%)	G 413	.013(aver.)

Note: These figures represent "lots" and not fruit. While the "lots" vary they average 10.7 fruit per lot. One individual fruit in a lot if infested results in an infested lot, therefore, these percentages are higher than would be indicated if each fruit were handled separately. For practical purposes of collecting, holding, screening, etc., the "lot" method furnishes greater opportunities for doing a comprehensive survey and has less limitations.

On the right hand side of the page under pupae and index are listed the number of puparia recovered from tree fruit (T) and ground fruit (G).

The index is based on puparia recovered per gram of fruit.

Citrus compared to other hosts

In order to properly evaluate the role of citrus as a host of *Dacus dorsalis* it would be well to compare it with other hosts. Guava (*Psidium guajave*), False Kamani (*Terminalia catappa*) and Loquat (Eriobotrya japonica) are all hosts of this fly and the former two are well known as good hosts. Recent collections of loquat indicate that it may well be the best host known of this fly.

TABLE NO. 27

FRUIT	TOTAL LOTS	NO. OF FRUIT	WEIGHT	PUPARIA RECOVERED	INDEX*
Citrus fruit	183	1,964	162,465	610	.017
Kamani	6	594	10,311	3,085	.299
Guava	5	175	11,055	1,654	.149
Santalum	1	109	90	112	1.24
Loquat	39	4,673	47,435	11,462	.241

* The index of citrus is based on infested lots only. It will be recalled that of the total number of lots collected only 20% were infested. Of the other fruit listed, an uninfested lot is a rarity.

The tables in the summary list puparia and these include not only *D. dorsalis* but also *Ceratitis capitata*. In a number of lots no adults emerged and it was therefore impossible to determine which species was represented. It is rather safe to state, however, that infestations below 1500' elevation are usually D. dorsalis. The following table indicates the relative role of the two species.

TOTAL LOTS	INFESTED LOTS	DORSALIS	CAPITATA	D & C	PAR.	UNDET.
183	37 (20%)	14 (37%)	8 (21%)	2(5%)	5(13%)	10(27%)

Note: The percentages indicated are based on the infested lots and not the total lots collected.

FRUIT FLY INFESTATION ON CITRUS FRUIT ON MAUI

BASED ON PUPAL RECOVERY (K. L. Maehler)

TABLE NO. 28

KEY
S: Stage of fruit
W: Weight in grams
N: Number of fruit
G: Green, R: Ripe
Index: Puparia recovered per gram of fruit
DOR: Dacus dorsalis
MED: Ceratitis capitata
PAR: Opius
gr: ground fruit

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
2	9/17	Kula Farm	2850'	Orange	R	735	10	0				0
7	9/20	" "	"	Orange	R	849	9	0				0
14	9/20	" "	"	Lime	R	255	7	0				0
21	9/27	" "	"	Lemon	R	368	4	2				.005
22	"	" "	"	Lime	R	255	5	0				0
28	10/1	Haiku	500'	Lime	R	1431	92	2				.001
50	10/25	Keokea	2800'	Grapefruit	G	1630	5	4		1		.002
55	10/26	Kula	3650'	Orange	R	495	8	0				0
60	10/27	Kula	"	Orange	R	255	5	0				0
64	"	"	"	Orange	G	525	5	0				0
65	"	"	"	Orange	G	749	6	0				0
66	"	"	"	Orange	R	636	8	0				0
67	"	"	3550'	Orange	G	693	4	0				0
74	10/28	"	3650'	Orange	G	594	6	1				.001
75	"	"	"	Orange	R	580	6	0				0
76	"	"	"	Lemon	R	749	6	0				0
102	11/3	Makawao	1700'	Orange	R	3373	62	0				0
103	"	Waiakoa	2800'	Lemon	G	749	7	1	1			.001
114	11/4	Iao Valley	700'	Orange	gr R	1770	14	117	73		3	.07
118	"	" "	940'	Lemon	G	940	7	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDE
123	11/3	Maliko G.	15'	Grapefruit	G	1573	6	0				0
124	"	Haiku	650'	Pomelo	R	1280	2	0				0
131	11/4	Paia	50'	Pomelo	R	2160	3	0				0
135	"	Kula	2600'	Lemon	G	650	8	0				0
142	11/3	Kula	2850'	Lime	R	354	12	0				0
143	"	"	"	Lemon	R	340	6	0				0
144	"	"	"	Lime	G	405	9	0				0
145	"	"	"	Lemon	R	255	11	0				0
159	11/8	"	3500'	Lemon	R	721	4	0				0
162	"	"	"	Lemon	R	749	5	0				0
165	"	"	2900'	Lemon	R	849	4	0				0
169	11/9	Makawao	1700'	Tangerine	R	1842	37	9				.004
187	11/14	Iao Valley	800'	Orange	R	892	7	16	1			.017
198	11/18	"	"	Orange gr	R	608	6	7	4			.011
202	"	Olinda	2100'	Orange	R	820	11	0				0
207	11/23	Kula	3650'	Orange	R	481	6	0				0
210	"	"	"	Lime	R	453	23	0				0
212	"	"	"	Orange	R	742	6	0				0
213	"	"	"	Lemon	R	806	6	0				0
215	11/28	Kaupakalua	1050'	Orange	R	1316	9	4	1			.003
216	"	"	"	Orange gr	R	1302	8	0				0
217	"	"	"	Lime	R	1238	15	0				0
218	"	Makawao	1700'	Tangerine gr	R	1714	33	21	2			.012
219	"	"	"	Tangerine	R	877	22	1				.001
231	12/1	Kula	2850'	Orange	R	566	9	0				0
232	"	"	"	Lemon	R	764	14	0				0
234	"	"	"	Lime	R	714	15	0				0
236	"	"	"	Lemon	R	354	13	6		1		.016

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
271	12/7	Paia	600'	Lemon gr	R	664	7	0				0
272	"	"	"	Orange gr	R	707	6	0				0
273	"	"	"	Orange	G	834	6	9		4		.010
274	"	"	"	Orange	G	1516	7	0				0
275	"	"	"	Orange	R	792	9	0				0
276	"	"	"	Lime	R	877	9	0				0
277	"	"	"	Lime	G	949	7	0				0
278	"	"	"	Lime	G	1034	9	0				0
279	"	"	"	Grapefruit	G	1545	5	0				0
280	"	"	"	Grapefruit	G	1644	5	0				0
281	"	"	"	Grapefruit	G	949	5	0				0
282	"	Iao Valley	100'	Orange	R	594	4	11	2			.018
283	11/27	Kaheka	400'	Pomelo	R	892	1	0				0
285	12/2	Paia	600'	Lime gr	R	806	9	0				0
286	"	"	"	Grapefruit gr	R	964	6	14	2			.014
287	"	"	"	Grapefruit	R	1174	5	3				.002
288	"	"	"	Grapefruit	G	820	2	0				0
289	"	"	"	Lime	R	1231	11	0				0
290	"	"	"	Lime	R	778	7	0				0
293	"	"	"	Orange	R	849	8	0				0
301	12/21	Kula	2640'	Tangerine	R	622	20	31	3	12	3	.049
303	"	"	"	Lemon	R	870	9	0				0
305	"	"	2680'	Lemon	R	347	12	0				0
307	"	"	2640'	Tangerine	G	438	12	1				.002
312	"	"	3020'	Lemon	R	1245	9	0				0
313	"	"	"	Tangerine	R	127	24	15	1	5		.118
325	12/27	Kula	2650'	Lemon	R	664	18	0				0
327	"	"	"	Lemon	R	877	11	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
329	12/27	Kula	2650'	Lemon	R	198	6	0				0
331	"	"	"	Lime	R	892	17	0				0
342	"	"	3650'	Orange	R	481	6	0				0
343	"	"	"	Orange	R	481	5	0				0
344	"	"	"	Lemon	R	552	5	0				0
351	12/29	Paia	750'	Lime	R	127	2	0				0
354	"	"	"	Orange	R	622	6	0				0
355	"	"	"	Grapefruit gr	R	1259	6	1				.001
359	"	"	"	Grapefruit gr	R	863	4	0				0
360	"	"	"	Orange gr	R	650	6	0				0
362	"	"	"	Grapefruit	G	536	2	0				0
366	"	Makawao	1700'	Tangerine gr	R	2154	77	134	45		23	.062
375	12/30	Kula	3650'	Orange gr	R	1316	15	0				0
376	"	"	"	Orange gr	R	566	7	59		40		.104
377	"	"	"	Orange gr	R	764	8	0				0
378	"	"	"	Orange	R	1316	8	18		15		.013
383	"	"	2650'	Lemon	R	1531	15	0				0
395	1/5	Kaupakalua	1500'	Grapefruit gr	R	978	5	4				.004
396	"	"	"	Tangerine	R	297	2	1				.003
397	"	"	"	Orange gr	R	834	4	9	5			.010
398	"	"	"	Lemon gr	R	949	4	0				0
399	"	"	"	Lemon	R	1091	5	0				0
400	"	"	"	Grapefruit	R	481	2	0				0
401	"	"	"	Orange	R	1062	6	6			1	.005
402	"	"	"	Orange	R	792	4	0				0
403	"	"	"	Orange	R	935	4	0				0
404	"	Huelo	580'	Lemon	R	594	4	0				0
425	1/12	Paia	750'	Lemon gr	R	650	9	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
426	1/12	Paia	750'	Lemon gr	R	877	8	0				0
427	"	"	"	Grapefruit gr	R	1347	6	0				0
428	"	"	"	Grapefruit gr	R	2282	5	0				0
452	1/20	Kula	2650'	Lime	R	481	12	0				0
453	"	"	"	Lime	R	396	11	41		2	13	.103*
454	"	"	"	Orange	R	552	8	0				0
455	"	"	"	Lemon	R	340	6	0				0
456	"	"	"	Lemon	R	721	9	0				0
458	"	"	3650'	Orange gr	R	410	6	0				0
459	"	"	"	Orange	R	396	4	0				0
460	"	"	"	Lime	R	255	15	0				0
461	"	"	"	Lemon	R	849	5	0				0
463	"	Kaupakalua	1050'	Tangerine gr	R	566	15	0				0
468	1/24	Paia	750'	Grapefruit gr	R	2664	9	6	2			.002
497	1/26	Makawao	1700'	Orange gr	R	1259	11	15	4		2	.011
500	"	"	"	Orange gr	R	396	6	2	1			.005
501	2/2	"	"	Lemon	R	580	4	0				0
502	"	"	"	Lemon gr	R	1417	11	0				0
503	"	"	"	Lemon	R	877	5	0				0
504	"	"	"	Lime	R	664	10	0				0
562	2/21	Kula	3600'	Lemon	R	410	12	0				*
563	"	"	"	Orange	R	721	6	0				*
564	"	"	"	Orange	R	935	7	0				*
565	"	"	"	Orange gr	R	2268	35	0				*
566	"	"	"	Grapefruit	R	978	8	0				*
567	"	"	"	Orange gr	R	1828	21	0				*
568	"	"	"	Tangerine	R	863	26	4				*
569	"	"	"	Orange gr	R	1531	25	0				*
570	"	"	"	Grapefruit	R	679	6	0				*

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
571	2/21	Kula	3600'	Lemon	G	949	8	0				*
572	"	"	"	Orange	R	622	7	0				*
573	"	"	"	Orange gr	R	2353	32	0				*
574	"	"	"	Orange gr	R	1134	20	0				*
575	"	"	"	Lemon	R	721	4	24				*
576	"	"	"	Orange	R	707	6	0				*
577	"	"	"	Grapefruit	R	949	3	0				*
578	"	"	"	Lime	R	311	8	0				*
579	"	"	"	Orange	R	877	8	8				*
580	"	"	"	Orange gr	R	1020	19	0				*
581	"	"	"	Grapefruit gr	R	1006	27	0				*
582	"	"	"	Orange gr	R	1160	16	0				*
583	"	"	"	Orange gr	R	538	12	0				*
584	"	"	"	Grapefruit	R	764	6	0				*
585	"	"	"	Lemon	R	424	11	0				*
586	"	"	"	Lemon	R	580	21	0				*
630	2/24	Paia	750'	Grapefruit	R	1417	5	0				*
631	"	"	"	Grapefruit	R	1380	6	1				*
683	3/1	"	"	Tangerine	R	693	4	0				*
684	"	"	"	Orange gr	R	1105	8	0				*
685	"	"	"	Lime gr	R	834	12	0				*
686	"	"	"	Lemon gr	R	1105	6	0				*

* Lots for which the data is incomplete at this date.

TABLE NO. 29

SUMMARY BY LOTS, SHOWING % OF INFESTATION IN TREE FRUIT AND GROUND FRUIT

	Total lots ground fruit	Total lots ground fruit inf.	Total lots tree fruit	Total lots tree fruit inf.
ORANGES				
Hilo	14	9 (64%)	14	4 (28%)
Pahoa	29	16 (55%)	31	10 (32%)
Mt. View	27	12 (44%)	8	2 (25%)
Kona	1	0	4	4 (100%)
Waimea	5	1 (20%)	9	2 (22%)
TOTAL	76 lots	38 (50%)	66 lots	22 (33 1/3%)
LEMONS				
Hilo	5	3 (60%)	18	4 (22%)
Pahoa	1	0	1	1 (100%)
Mt. View	3	1 (33%)	2	0
Kona	1	0	14	1 (7%)
Waimea	1	0	5	2 (40%)
TOTAL	11	4 (36%)	40	8 (20%)
GRAPEFRUITS				
Hilo	2	1 (50%)	1	0
Pahoa	2	2 (100%)	0	0
Mt. View	2	0	2	1 (50%)
Kona	2	2 (100%)	6	4 (66%)*
Waimea	2	1 (50%)	3	1 (33%)
TOTAL	10	6 (60%)	12	6 (50%)
TANGERINES				
Hilo	1	1 (100%)	1	1 (100%)
Pahoa	30	17 (56%)	35	16 (45%)
Mt. View	8	6 (75%)	5	3 (60%)
Kona	1	1 (100%)	2	2 (100%)
Waimea	1	0	2	1 (50%)
TOTAL	41	25 (62%)	45	23 (51%)
LIMES				
Hilo	7	1 (14%)	13	1 (7%)
Pahoa	2	0	4	0
Kona	0	0	3	0
Waimea	1	0	1	1 (100%)
TOTAL	10	1 (10%)	21	2 (9%)
KUMQUATS				
Hilo	1	1 (100%)	1	0
Mt. View	0	0	1	1 (100%)
TOTAL	1	1 (100%)	2	1 (50%)
TANGELO				
Mt. View	2	2 (100%)	2	2 (100%)
PUMELO				
Hilo	6	4 (66%)	3	1 (33%)

*Med. fly - dorsalis complex

TABLE NO. 30

CITRUS INFESTATION by DACUS dorsalis in VARIOUS LOCALITIES ON ISLAND OF HAWAII

	HILO(75')		PAHOA(700')		MT. VIEW(1500')		KONA(1500')		WAIMEA(3000')		TOTAL FRUIT	TOTAL PUPAE
	No. fruit	Pupae	No. fruit	Pupae	No. fruit	Pupae	No. fruit	Pupae	No. fruit	Pupae		
Oranges(1)	265	131	606	202	324	118	49	85	160	34	1404	536
Lemons(2)	231	52	13	1	57	4	140	5	62	45	503	107
Grapefruit(3)	24	27	11	50	39	26	59	192*	45	168	178	463
Tangerines	35	11	725	784	157	101	46	37	44	42	1007	975
Limes(4)	206	9	63	0	—	—	39	0	30	1	338	10
Kumquats	50	124	—	—	19	143	—	—	—	—	69	267
Tangelo(5)	—	—	—	—	49	48	—	—	—	—	49	48
Pummelo	28	26	—	—	—	—	—	—	—	—	28	26
TOTALS	839	380	1418	1037	645	440	333	319	341	290	3576	2432

1
- Valencia
- Washington Navel
- Lue Gin Gong
- Mandarin
- Satsuma
- Hawaiian
- Hamlin
- Pineapple
- Robinson

2
- Pink flesh
- Meyer
- Lisbon
- Armstrong Seedless
- Villa Franca
- Roughskin

3
- Duncan
- Wainaku
- Arizona
- Marsh

4
- Kusae
- Rangpur
- Tahitian

5
- Sampson

* Med. fly - dorsalis complex

SUMMARY OF VARIOUS CITRUS FRUITS COLLECTED

TABLE NO. 40

FRUIT		TOTAL LOTS	TREE FRUIT	GROUND FRUIT	PUPAE	INDEX
Orange	Collected	155	75	80	T: 455	.012
	Infested	73(47%)	27(36%)	46(58%)	G: 448	.008
Lemon	Collected	52	40	12	T: 92	.008
	Infested	12(23%)	8(20%)	4(33%)	G: 16	.005
Lime	Collected	38	23	15	T: 6	.006
	Infested	4(11%)	2(9%)	2(13%)	G: 7	.004
Grapefruit	Collected	30	16	14	T: 302	.017
	Infested	16(53%)	8(50%)	8(57%)	G: 211	.014
Tangerine	Collected	92	50	42	T: 354	.017
	Infested	54(59%)	27(54%)	27(64%)	G: 675	.032
Pummelo	Collected	12	2	10	T: 0	0
	Infested	6(50%)	0	6(60%)	G: 35	.003
Totals	Collected	378	206	172	T: 1209	.010(Aver.)
	Infested	162(43%)	69(33%)	93(54%)	G: 1392	.011(Aver.)

T: Tree fruit
G: Ground fruit

FRUIT FLY INFESTATION OF CITRUS FRUIT ON HAWAII

BASED ON PUPAL RECOVERY

(C. J. Davis)

TABLE NO. 41

KEY

S: Stage of fruit
W: Weight in grams
N: Number of fruit
G: Green R: Ripe
Index: Puparia recovered per gram of fruit
Dor: *Dacus dorsalis*
Med: *Ceratitis capitata*
Par: Opius
gr: Ground fruit

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
4	7/30	Ninole	400'	Grapefruit gr	R	1758	11	30	9			.02
64	9/15	Hakalau	200'	Orange gr	R	1030	2	7	7			.006
73	9/23	Hilo	75'	Lime gr	R	230	5	3				.01
87	10/5	Volcano	3000'	Orange gr	R	1587	4	3	2			.002
103	10/13	Hilo	75'	Orange gr	R	2724	20	13	11			.005
104	10/12	Pahoa	250'	Orange gr	R	1816	27	0				0
117	10/27	Hilo	75'	Orange gr	R	1170	10	15	12			.013
183	11/20	Mt. View	2000'	Grapefruit gr	R	836	3	0				0
184	"	"	"	Orange gr	R	378	2	0				0
197	12/1	"	"	Grapefruit gr	R	2072	8	3	1			.001
198	12/1	"	"	Orange gr	R	364	2	0				0
202	12/5	"	"	Lime gr	R	1427	14	0				0
204	"	"	"	Mandarin gr	R	961	12	7	2		1	.007
207	"	"	"	Tangelo gr	R	1309	12	6	5			.004
208	"	"	"	Orange gr	R	2370	10	0				0
209	"	"	"	Grapefruit gr	R	2588	10	0				0
210	"	"	"	Orange gr	R	2370	6	14	7			.006

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
211	12/7	Pahoa	250'	Tangerine	R	901	12	0				0
212	"	"	"	Orange	R	1336	4	0				0
213	"	"	"	Orange	R	1231	12	7	4			.005
214	"	"	"	Tangerine gr	R	561	7	0				0
215	"	"	"	Orange	R	1780	12	0				0
216	"	"	"	Tangerine gr	R	647	13	0				0
217	"	"	"	Tangerine	R	667	7	0				0
219	"	"	"	Tangerine	R	571	7	0				0
220	"	"	"	Grapefruit	R	1798	6	0				0
221	"	"	"	Tangerine	R	731	13	0				0
222	"	"	"	Orange gr	R	746	3	4	3			.005
223	"	Hilo	75'	Lemon	R	998	12	0				0
224	"	Pahoa	250'	Tangerine gr	R	838	12	0				0
225	"	"	"	Tangerine	R	1022	12	0				0
226	"	"	"	Orange gr	R	1665	12	0				0
227	"	"	"	Tangerine	R	988	12	0				0
228	"	"	"	Orange	R	1028	8	10	10			.009
229	"	"	"	Orange gr	R	2171	18	0				0
230	"	"	"	Orange	R	1094	6	0				0
231	"	"	"	Tangerine	R	912	7	0				0
232	"	"	"	Tangerine	R	748	10	0				0
233	"	"	"	Tangerine	R	1007	12	0				0
234	"	"	"	Orange	R	2265	13	0				0
235	"	"	"	Orange gr	R	1544	10	0				0
236	"	Hilo	75'	Orange gr	R	1596	11	9	4			.005
237	"	"	"	Orange gr	R	1499	12	15	9		2	.01
238	"	"	"	Orange gr	R	1185	5	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
239	12/7	Hilo	75'	Grapefruit gr	R	1601	6	27	17		8	.02
240	"	"	"	Orange	R	1215	5	0				0
241	"	"	"	Orange	R	1677	12	0				0
242	"	"	"	Lime	R	744	13	0				0
243	"	"	"	Lime	R	429	5	0				0
244	"	"	"	Orange	R	1558	12	0				0
245	"	"	"	Lime gr	R	876	12	0				0
246	"	"	"	Orange gr	R	1473	6	20	17			.01
247	"	"	"	Lime gr	R	486	7	0				0
248	"	Pahoa	250'	Orange gr	R	1303	11	3	2			.002
249	"	"	"	Orange	R	1568	11	0				0
250	"	"	"	Pummelo gr	R	1583	3	0				0
251	"	Hilo	75'	Lime	R	1084	12	0				0
252	"	Pahoa	250'	Orange	R	1471	12	5	4			.003
253	"	"	"	Lime	R	918	8	0				0
254	"	Hilo	75'	Grapefruit	R	1575	6	0				0
255	"	"	"	Lime gr	R	795	9	0				0
256	"	Pahoa	250'	Tangerine gr	R	849	10	0				0
257	"	Hilo	75'	Orange gr	R	1097	12	1	1			.001
258	"	"	"	Lime gr	R	594	10	0				0
259	"	Pahoa	250'	Orange	R	927	9	0				0
260	"	Hilo	75'	Orange	R	1556	12	0				0
261	"	Pahoa	250'	Orange	R	808	5	0				0
262	"	Hilo	75'	Orange	R	1007	4	0				0
263	"	"	"	Orange gr	R	1362	13	1				.001
264	"	"	"	Lime	R	1090	12	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
265	12/7	Hilo	75'	Orange gr	R	817	7	0				0
266	"	"	"	Lime	R	953	12	0				0
267	"	"	"	Orange gr	R	1226	6	1	1			.001
268	"	"	"	Lemon gr	R	454	4	8				.02
269	"	"	"	Orange gr	R	1135	5	0				0
270	"	"	"	Orange	R	1044	4	0				0
271	"	Pahoa	250'	Orange gr	R	681	11	8	1		3	.01
272	"	"	"	Orange	R	1271	9	2	1		1	.001
273	"	"	"	Orange	R	1634	6	0				0
274	"	"	"	Orange gr	R	1816	12	0				0
275	"	"	"	Orange gr	R	999	9	3	3			.003
276	"	"	"	Orange	R	1090	9	0				0
277	"	"	"	Grapefruit gr	R	1952	5	35	26		2	.02
278	"	"	"	Orange	R	863	7	0				0
279	"	"	"	Tangerine	R	863	12	0				0
280	"	"	"	Orange gr	R	1725	12	6	2			.003
281	"	"	"	Orange gr	R	1180	8	4	1			.003
282	"	"	"	Tangerine gr	R	681	12	1				.001
283	"	"	"	Tangerine	R	1135	9	0				0
284	"	"	"	Orange gr	R	1137	9	2	1		1	.001
285	"	"	"	Tangerine gr	R	636	12	0				0
286	"	"	"	Tangerine gr	R	908	15	0				0
287	"	"	"	Tangerine	R	681	7	0				0
288	"	"	"	Orange	R	999	7	2				.002
289	"	"	"	Pummelo gr	R	1362	2	9	5			.006
290	"	"	"	Tangerine gr	R	1090	19	4				.003

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
291	12/7	Pahoa	250'	Tangerine	R	636	12	1				.001
292	"	"	"	Tangerine	R	545	5	0				0
293	"	"	"	Tangerine gr	R	636	14	0				0
294	"	"	"	Orange	R	908	10	0				0
295	"	"	"	Tangerine	R	590	7	0				0
296	"	Hilo	75'	Lime gr	R	499	7	0				0
297	"	"	"	Pummelo	R	1544	1	0				0
298	"	"	"	Pummelo gr	R	2588	2	2	2			.001
299	"	Pahoa	250'	Tangerine	R	409	6	0				0
300	"	"	"	Tangerine gr	R	908	14	0				0
301	"	"	"	Orange	R	2043	14	0				0
302	"	"	"	Tangerine	R	817	12	0				0
303	"	"	"	Tangerine gr	R	726	12	2				.003
304	"	"	"	Orange	R	545	5	0				0
305	"	"	"	Tangerine	R	636	7	1				.001
306	"	"	"	Orange gr	R	1180	9	8	5			.006
307	"	"	"	Tangerine	R	545	6	0				0
308	"	"	"	Tangerine gr	R	817	14	0				0
309	"	"	"	Orange gr	R	545	4	10	5			.02
310	"	Hilo	75'	Pummelo gr	R	2542	2	8	6			.003
311	"	Pahoa	250'	Orange gr	R	1271	13	8	5			.006
312	"	"	"	Orange gr	R	1135	8	1	1			.001
313	"	Hilo	75'	Pummelo gr	R	2361	2	6	3			.002
314	"	Pahoa	250'	Kumquats	R	91	6	0				0
315	"	Hilo	75'	Pummelo	R	1907	1	0				0
316	"	Pahoa	250'	Tangerine gr	R	272	6	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
317	12/7	Hilo	75'	Pummelo	R	1544	3	9	9			.005
318	"	Pahoa	250'	Orange gr	R	1226	9	7	4		1	.005
319	"	"	"	Tangerine	R	1225	12	1				.001
320	"	"	"	Tangerine	R	545	6	0				0
321	"	Hilo	75'	Lime	R	636	12	0				0
322	"	"	"	Pummelo gr	R	2043	3	1				.001
323	"	Pahoa	250'	Orange	R	908	8	0				0
324	"	"	"	Tangerine gr	R	545	12	0				0
325	"	"	"	Orange gr	R	1362	11	0				0
326	"	"	"	Orange	R	1816	12	0				0
327	"	"	"	Orange gr	R	908	8	3	3			.003
328	"	"	"	Orange gr	R	1589	12	22	10		3	.01
329	"	"	"	Orange	R	1453	11	1	1			.001
331	"	Mt. View	2000'	Tangelo gr	R	573	8	17	1			.02
361	12/29	"	"	Grapefruit	R	2497	10	0				0
362	"	"	"	Grapefruit	R	3269	14	0				0
363	"	"	"	Orange	R	2361	8	0				0
364	"	"	"	Tangerine	R	1317	15	6	2			.004
365	"	"	"	Mandarin	R	1226	12	16	4		4	.012
366	"	"	"	Tangelo	R	1861	15	10	9			.005
367	"	"	"	Grapefruit	R	1271	5	26	16	2		.014
368	"	"	"	Tangelo	R	1453	14	14	9			.009
369	1/13	"	"	Orange	R	1317	7	0				0
374	"	"	"	Orange	R	3178	13	0				0
375	"	"	"	Lime	R	908	11	0				0
376	"	"	"	Lime gr	R	863	12	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
377	1/13	Mt. View	2000'	Lemon gr	R	1861	16	0				0
378	"	"	"	Tangerine	R	953	15	0				0
379	"	"	"	Tangerine gr	R	999	16	0				0
380	"	"	"	Pummelo gr	R	3133	9	0				0
381	"	"	"	Orange gr	R	1498	15	4	3			.002
382	1/16	"	"	Orange gr	R	1907	14	0				0
383	"	"	"	Tangerine	R	272	12	0				0
384	"	"	"	Orange	R	1180	12	0				0
385	"	"	"	Tangerine	R	545	14	2				.003
386	"	"	"	Navel orange	R	1317	8	0				0
387	"	"	"	Orange gr	R	1634	12	7			3	.004
388	"	"	"	Tangerine gr	R	590	11	0				0
389	"	"	"	Orange gr	R	1271	13	0				0
390	"	"	"	Orange gr	R	1090	12	0				0
391	"	"	"	Orange	R	1407	13	0				0
392	"	Olaa	200'	Lemon	R	1952	12	0				0
393	"	"	"	Lemon gr	R	2134	12	0				0
394	"	Mt. View	2000'	Orange gr	R	1861	12	0				0
395	1/18	Hilo	75'	Pomelo gr	R	2179	8	0				0
396	"	"	"	Shaddock gr	R	2951	6	0				0
397	"	"	"	Grapefruit gr	R	2808	12	0				0
398	"	"	"	Orange	R	1908	12	0				0
399	"	"	"	Lemon	R	1725	12	0				0
400	"	"	"	Lemon	R	2724	12	3	3			.001
401	"	"	"	Lemon	R	681	8	0				0
402	"	"	"	Lemon	R	1498	8	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDE
403	1/18	Hilo	75'	Lime	R	1362	15	0				0
404	"	"	"	Orange	R	2179	11	0				0
405	"	"	"	Orange	R	454	4	5	4			.01
406	"	"	"	Lime gr	R	499	14	0				0
407	"	"	"	Lemon	R	772	15	1	1			.001
408	"	"	"	Mandarin	R	681	13	0				0
409	"	"	"	Lemon	R	1953	9	0				0
410	"	"	"	Lemon gr	R	2270	11	0				0
411	"	"	"	Lemon	R	2270	12	0				0
412	"	"	"	Lime gr	R	817	12	4	4			.004
413	"	"	"	Lemon	R	1816	13	0				0
414	"	"	"	Lemon gr	R	1498	9	0				0
415	"	"	"	Lime	R	726	12	0				0
416	"	"	"	Orange gr	R	1498	9	7	3		4	.004
417	"	"	"	Lemon	R	908	6	0				0
418	"	"	"	Orange	R	1090	5	0				0
419	"	"	"	Lemon	R	999	13	0				0
420	"	"	"	Lemon	R	772	6	0				0
421	"	"	"	Lime	R	863	12	0				0
422	"	"	"	Mandarin	R	499	10	0				0
423	"	"	"	Orange gr	R	1725	11	0				0
424	"	"	"	Lemon gr	R	999	12	3	3			.003
425	"	"	"	Limequat	R	96	7	5	1			.05
426	"	"	"	Kumquat gr	R	181	12	2	1			.01
427	"	Mt. View	2000'	Orange gr	R	1317	7	1			1	.001
428	"	"	"	Tangelo gr	R	999	12	7	2		5	.007

LOT	DATE	LOCALITY	ELEV.	FRUIT		S	W	N	PUPAE	DOR	MED	PAR	INDE
429	1/18	Mt. View	2000'	Tangerine	gr	R	953	9	2	1			.002
430	"	"	"	Orange	gr	R	1544	8	8	5			.005
431	"	"	"	Orange	gr	R	1362	5	0				0
432	"	"	"	Orange	gr	R	1090	7	0				0
435	1/20	"	"	Kumquat		R	1680	19	143	121		3	.08
436	"	"	"	Tangerine		R	227	12	16	16			.07
437	"	"	"	Tangerine		R	499	12	1	1			.002
438	"	"	"	Lemon		R	863	12	16	15		1	.02
439	"	"	"	Tangerine	gr	R	817	16	15	12		3	.02
440	"	"	"	Orange		R	772	7	0				0
441	"	"	"	Orange	gr	R	1226	11	1	1			.001
442	"	"	"	Lemon	gr	R	590	9	1	1			.002
443	1/23	Pahoa	250'	Tangerine	gr	R	908	12	11	1		6	.01
444	"	"	"	Tangerine		R	726	12	12	9		1	.02
445	"	"	"	Tangerine		R	681	12	11	10			.02
446	"	"	"	Tangerine	gr	R	999	12	18	7		1	.02
447	"	"	"	Tangerine	gr	R	863	12	31	18		3	.04
448	"	"	"	Tangerine		R	1044	12	3	2		1	.002
449	"	"	"	Tangerine	gr	R	681	11	18	15			.03
450	"	"	"	Tangerine	gr	R	590	12	23	17			.04
451	"	"	"	Tangerine	gr	R	1271	12	229	178		6	.18
452	"	"	"	Lime		R	1090	12	0				0
453	"	"	"	Lime	gr	R	636	12	0				0
454	"	"	"	Lime		R	772	12	0				0
455	"	"	"	Orange		R	1816	12	0				0
456	"	"	"	Orange	gr	R	1498	10	10	1		6	.006

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
457	1/23	Pahoa	250'	Orange	R	1271	10	0				0
458	"	"	"	Orange gr	R	1453	10	0				0
459	"	"	"	Orange	R	1317	6	6	6			.004
460	"	"	"	Orange gr	R	2588	12	0				0
461	"	"	"	Orange	R	2452	10	24	18			.009
462	"	"	"	Orange gr	R	1771	7	0				0
463	"	"	"	Orange	R	1498	12	0				0
464	"	"	"	Tangerine gr	R	681	12	35	31		4	.05
465	"	"	"	Tangerine	R	726	12	9	9			.01
466	"	"	"	Tangerine	R	863	12	8	3		1	.009
467	"	"	"	Orange	R	1861	12	22	13			.01
468	"	"	"	Grapefruit gr	R	1816	6	15	10			.008
469	"	"	"	Grapefruit	R	2134	7	7	7			.003
470	"	"	"	Lime gr	R	817	12	0				0
471	"	"	"	Orange gr	R	1680	13	0				0
472	"	"	"	Orange gr	R	1907	12	19	18			.009
473	"	"	"	Lime	R	863	12	0				0
474	"	"	"	Tangerine gr	R	590	14	10	4		3	.02
475	"	"	"	Lime	R	908	7	0				0
476	"	"	"	Lime gr	R	817	9	0				0
477	"	"	"	Tangerine	R	863	12	0				0
478	"	"	"	Tangerine	R	409	12	8	5			.02
479	"	"	"	Orange gr	R	1861	12	2	1			.001
480	"	"	"	Pummelo gr	R	681	1	0				0
481	"	"	"	Tangerine	R	636	12	1				.001
482	"	"	"	Lemon	R	908	5	1				.001

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
483	1/23	Pahoa	250'	Lemon gr	R	1180	8	0				0
484	"	"	"	Tangerine gr	R	817	12	0				0
485	"	"	"	Tangerine gr	R	772	12	4	4			.005
486	"	"	"	Tangerine gr	R	953	12	5	4			.005
487	"	"	"	Orange gr	R	1816	12	0				0
488	"	"	"	Tangerine	R	681	12	3				.004
489	"	"	"	Tangerine gr	R	726	12	0				0
490	"	"	"	Tangerine	R	590	12	2	2			.003
491	"	"	"	Tangerine gr	R	636	12	11	7		2	.02
492	"	"	"	Orange	R	1634	12	0				0
493	"	"	"	Tangerine	R	636	12	28	26			.04
494	"	"	"	Tangerine gr	R	863	13	119	105		2	.14
495	"	"	"	Orange	R	1544	12	0				0
496	"	"	"	Tangerine	R	772	12	59	41		8	.07
497	"	"	"	Tangerine gr	R	545	12	6	3	1		.007
498	"	"	"	Orange	R	1725	12	3	3			.002
499	"	"	"	Tangerine	R	817	11	54	47			.06
500	"	"	"	Orange gr	R	1634	8	0				0
501	"	"	"	Orange	R	1253	6	0				0
502	"	"	"	Tangerine gr	R	863	12	49	43		1	.05
503	"	"	"	Tangerine	R	726	12	6	5			.008
505	1/24	Waimea	3500'	Orange	R	1861	15	1	1			.001
506	"	"	"	Lemon	R	1589	8	43	35			.02
508	"	"	"	Lime	R	409	12	0				0
509	"	"	"	Orange	R	1317	16	0				0
510	"	"	"	Lime gr	R	363	12	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
511	1/24	Waimea	3500'	Lemon	R	272	7	2			1	.007
512	"	"	"	Orange	R	1180	7	26	23		1	.02
513	"	"	"	Orange gr	R	908	12	0				0
514	"	"	"	Lemon	R	863	12	0				0
515	"	"	"	Orange gr	R	772	12	0				0
516	"	"	"	Orange	R	1090	11	0				0
517	"	"	"	Orange	R	1998	9	0				0
518	"	"	"	Grapefruit	R	999	9	0				0
519	"	"	"	Grapefruit	R	1725	6	10	9			.005
520	"	Kaumana	1500'	Orange gr	R	1498	10	12	8		2	.008
521	"	Waimea	3500'	Lemon gr	R	1044	11	0				0
522	"	"	"	Lemon	R	999	12	0				0
523	"	"	"	Orange gr	R	1090	12	0				0
524	"	Kaumana	1500'	Tangerine	R	1453	22	8	4			.005
525	"	Waimea	3500'	Grapefruit gr	R	2497	9	0				0
526	"	"	"	Orange	R	1180	9	0				0
527	"	"	"	Lemon	R	908	12	0				0
529	"	"	"	Orange gr	R	1453	12	7		2		.005
530	"	"	"	Grapefruit	R	2769	11	167	98		12	.06
531	"	"	"	Tangerine	R	182	12	0				0
532	"	"	"	Tangerine gr	R	136	12	0				0
533	"	"	"	Grapefruit	R	2270	9	0				0
534	"	"	"	Tangerine	R	590	20	42	31	1	2	.05
535	"	"	"	Orange	R	2588	10	0				0
536	"	"	"	Orange	R	1135	10	0				0
537	"	"	"	Lime	R	817	18	1	1			.001

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
538	1/24	Kaumana	1500'	Orange	R	1998	12	27	24			.01
539	"	Waimea	3500'	Orange gr	R	1407	12	0				0
540	"	"	"	Orange	R	1044	14	0				0
541	"	Kaumana	1500'	Tangerine gr	R	409	13	3	3			.008
544	1/25	Mt. View	2000'	Orange gr	R	1861	8	0				0
545	"	"	"	Orange	R	817	4	2	2			.002
546	"	"	"	Orange gr	R	681	6	1				.001
547	"	"	"	Orange gr	R	953	6	0				0
548	1/26	Hilo	75'	Kumquat	R	182	14	0				0
549	"	"	"	Orange	R	1907	13	2				.001
550	"	"	"	Orange gr	R	1407	11	17	14			.01
551	"	"	"	Kumquat gr	R	817	36	124	32		68	.15
552	"	"	"	Lime	R	1180	13	0				0
553	"	"	""	Lime gr	R	863	12	0				0
554	2/1	Mt. View	2000'	Orange gr	R	1952	10	18	6			.009
555	"	"	"	Tangerine gr	R	863	14	12	7		2	.01
556	"	"	"	Orange gr	R	953	5	1				.001
557	"	"	"	Orange gr	R	1725	11	3	2			.002
559	1/26	Waimea	3500'	Grapefruit gr	R	2815	12	0				0
561	"	"	"	Grapefruit gr	R	2088	7	1	1			.001
563	2/10	Hilo	75'	Lime	R	1135	12	6	6			.005
564	"	"	"	Lemon	R	2179	12	0				0
565	"	"	"	Lemon	R	2724	11	21	18			.008
566	"	"	"	Lemon	R	1816	11	0				0
567	"	"	"	Lemon	R	772	6	0				0
568	"	"	"	Orange	R	1271	8	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
569	2/10	Hilo	75'	Lemon	R	980	8	0				0
570	"	"	"	Lime	R	1135	12	0				0
571	"	"	"	Mandarin	R	726	10	10	8			.01
572	"	"	"	Orange	R	590	13	32	17		10	.05
580	2/20	Mt. View	2000'	Lemon	R	1453	12	0				0
581	"	"	"	Tangerine gr	R	454	8	10	5		1	.02
582	"	"	"	Orange gr	R	1725	12	34	21			.02
583	"	"	"	Orange	R	1317	10	7	3			.005
584	"	"	"	Orange gr	R	1180	12	0				0
585	"	"	"	Lemon gr	R	1090	12	0				0
586	"	"	"	Orange gr	R	2225	12	0				0
587	"	"	"	Tangerine	R	409	7	14	10			.03
590	2/23	Kona	1500'	Lemon	R	863	10	0				0
591	"	"	"	Lemon	R	2361	12	0				0
592	"	"	"	Lemon	R	590	11	0				0
593	"	"	"	Lemon	R	1453	10	5	2			.003
594	"	"	"	Lemon	R	1493	8	0				0
595	"	"	"	Lime	R	817	12	0				0
596	"	"	"	Lemon	R	1362	10	0				0
597	"	"	"	Lemon	R	499	3	0				0
598	"	"	"	Lemon	R	1362	11	0				0
599	"	"	"	Lemon	R	1816	8	0				0
600	"	"	"	Lemon	R	1589	6	0				0
601	"	"	"	Lemon	R	908	11	0				0
602	"	"	"	Lemon	R	726	8	0				0
603	"	"	"	Lemon gr	R	1317	5	0				0

LOT	DATE	LOCALITY	ELEV.	FRUIT	S	W	N	PUPAE	DOR	MED	PAR	INDEX
604	2/23	Kona	1800'	Kusae lime	R	545	12	0				0
605	"	"	"	Lemon	R	2270	18	0				0
606	"	"	1500'	Lime	R	908	15	0				0
607	"	"	1300'	Kona orange	R	2769	12	3	3			.001
608	"	"	"	Kona orange	R	1907	12	2	2			.001
609	"	"	"	Kona orange	R	2452	13	26	16	2	1	.007
610	"	"	"	Kona orange	R	908	8	54	29		3	.06
611	"	"	1500'	Tangerine	R	227	7	9	2	5	1	.03
612	"	"	"	Tangerine gr	R	409	16	3		1		.007
613	"	"	"	Tangerine	R	499	23	25		1	8	.05
614	"	"	1700'	Kona orange gr	R	227	4	0				0
615	"	"	1800'	Siamese pomelo	R	2769	12	0				0
616	"	"	"	Siamese pomelo	R	1407	6	0				0
617	"	"	"	Duncan grapefruit	R	1271	6	9				0
618	"	"	"	Duncan grapefruit	R	3087	7	2	1			.001
619	"	"	"	Duncan grapefruit gr	R	1816	5	28	15			.02
620	"	"	"	Duncan grapefruit	R	2724	6	48	25	8	3	.01
621	"	"	1500'	Duncan grapefruit	R	908	6	25	18			.03
622	"	"	"	Duncan grapefruit	R	1271	7	0				0
623	"	"	"	Duncan grapefruit gr	R	2179	12	72	42	16		.02
624	"	"	"	Duncan grapefruit	R	3587	10	17	3	1	1	.001
630	2/27	Mt. View	2000'	Tangerine gr	R	318	8	24	15			.07
631	"	"	"	Navel orange	R	1861	12	0				0
632	"	"	"	Lemon	R	1180	9	0				0
633	"	"	"	Lemon gr	R	1407	12	4	2			.001
634	"	"	"	Navel orange gr	R	863	6	15	11			.02

FRUIT FLY INFESTATION OF LOQUAT ON MAUI
(K. L. Maehler)

KEY
S: Stage
W: Weight in grams
N: Number of fruit
G: Green
R: Ripe
OR: Over Ripe
HR: Half Ripe
Index: Puparia recovered per gram of fruit

TABLE NO. 42

LOT	DATE	LOCALITY	ELEV.	S	W	N	PUPARIA	INDEX
388	1/4	Paia	750'	R	630	55	127	.201
414	1/5	Makawao	1700'	R	2210	116	141	.063
420	1/12	Paia	750'	R	877	55	28	.031
421	"	"	"	R	806	58	23	.028
431	1/17	Makawao	1700'	R	438	23	30	.068
440	1/18	Kula	2640'	R	650	60	46	.070
457	1/20	Kula	2650'	R	156	34	0	0
469	1/24	Paia	750'	R	594	45	61	.102
496	1/26	Makawao	1700'	R	778	75	196	.251
523	2/12	Kula	2640'	R	764	100	219	.286
524	"	"	"	R	749	100	256	.361
525	"	"	"	R	834	100	277	.332
526	"	"	"	R	721	100	339	.470
527	"	"	"	R	749	100	223	.297
528	"	"	"	R	764	100	260	.340
529	"	"	"	R	764	100	276	.361
530	"	"	"	R	1630	150	488	.299
531	"	"	"	R	1403	150	463	.330

LOT	DATE	LOCALITY	ELEV.	S	W	N	PUPARIA	INDEX
532	2/16	Kala	2600'	R	1347	150	403	.299
533	"	"	"	R	1474	150	495	.235
534	"	"	"	R	1119	150	392	.350
535	"	"	"	R	525	69	134	.255
536	"	"	"	R	1814	100	254	.140
537	2/17	"	"	R	1062	100	139	.130
538	"	"	"	R	1899	125	485	.255
539	"	"	"	R	1077	125	203	.188
540	"	"	"	R	1389	125	443	.218
541	"	"	"	R	1119	150	405	.361
542	"	"	"	G	1217	125	368	.302
543	"	"	"	R	1347	150	530	.393
544	"	"	"	R	1316	125	182	.138
545	"	"	"	R	1516	125	287	.189
546	"	"	"	R	1516	125	237	.156
547	"	"	"	R	1077	125	85	.078
548	"	"	"	R	1105	125	352	.318
549	"	"	"	R	1559	125	409	.262
550	"	"	"	R	1048	125	259	.247
551	"	"	"	R	1231	125	378	.307
552	"	"	"	R	1287	125	494	.383
553	"	"	"	R	1273	125	163	.128
554	"	"	"	R	1287	125	377	.292
555	"	"	"	R	1245	125	332	.266
556	"	"	"	R	1559	125	308	.197
557	"	"	"	R	1259	125	477	.378
558	"	"	"	R	1091	106	303	.277
559	"	"	"	R	1160	125	440	.379

LOT	DATE	LOCALITY	ELEV.	S	W	N	PUPARIA	INDEX
560	2/17	Kula	3000'	R	1799	100	64	.035
561	"	"	"	R	1347	73	51	.037
593	2/24	"	2800'	HR	525	59	176	.335
594	"	"	"	R	849	36	63	.074
595	"	"	"	OR	636	51	20	.031
596	"	"	"	R	863	56	85	.098
597	"	"	"	R	1062	49	25	.023
598	"	"	"	HR	949	55	63	.066
599	"	"	"	OR	1119	97	370	.330
600	"	"	"	HR	664	37	46	.069
601	"	"	"	G	1090	97	111	.101
602	"	"	"	HR	1375	106	86	.062
603	"	"	"	G	992	95	165	.166
604	"	"	"	R	1217	111	208	.170
605	"	"	"	R	636	29	23	.036
606	"	"	"	R	622	66	130	.209
607	"	"	"	R	1389	92	48	.034
608	"	"	"	R	1105	57	44	.039
609	"	"	"	R	1188	47	113	.095
610	"	"	"	R	820	110	103	.125
611	"	"	"	HR	820	58		inc.
612	"	"	"	OR	792	91	256	.323
613	"	"	"	HR	566	63	41	.072
614	"	"	"	HR	1431	86	168	.117
615	"	"	"	HR	608	60	151	.248
616	"	"	"	OR	820	91	334	.407
617	"	"	"	HR	1105	116	149	.134
618	"	"	"	OR	907	99	329	.362

LOT	DATE	LOCALITY	ELEV.	S	W	N	PUPARIA	INDEX
619	2/24	Kula	2800'	G	1330	135	38	.028
639	2/28	Kanaio	2000'	HR	806	92	105	.130
640	"	"	"	HR	693	100	159	.229
641	"	"	"	HR	849	100	107	.126
642	"	"	"	HR	552	100	112	.202
643	"	"	"	HR	849	100	158	.186
644	"	"	"	OR	863	100	162	.187
645	"	"	"	OR	1006	100	153	.152
646	"	"	"	OR	707	100	114	.161
647	"	"	"	OR	525	100	70	.133
648	"	"	"	R	650	100	137	.210
649	"	"	"	R	636	100	143	.226
650	"	"	"	R	636	100	118	.185
651	"	"	"	R	834	100	64	.076
652	"	"	"	R	877	100	155	.176
653	"	"	"	R	594	100	161	.271
654	"	"	"	R	707	100	169	.239
655	"	"	"	R	1188	100	146	.122
656	"	"	"	R	964	100	224	.232
657	"	"	"	R	1006	100	125	.124
658	"	"	"	R	1062	100	137	.129
659	"	"	"	R	949	100	167	.175
666	3/2	Kula	2600'	OR	2253	125	302	.134
667	"	"	"	OR	1941	125	195	.100
668	"	"	"	R	1630	100	218	.133
669	"	"	"	R	1672	100	249	.148
670	"	"	"	R	1742	100	219	.125
671	"	"	"	R	1756	100	216	.123

LOT	DATE	LOCALITY	ELEV.	S	W	N	PUPARIA	INDEX
672	3/2	Kula	2600'	R	1644	100	134	.081
673	"	"	"	R	1700	100	301	.170
674	"	"	"	R	1728	100	200	.115
675	"	"	"	R	1871	100	317	.169
676	"	"	"	R	1488	100	172	.115
677	"	"	"	R	1588	100	217	.136
678	"	"	"	R	1756	100	380	.216
679	3/1	Kula	3100'	R	2035	130	648	.318
680	"	"	"	R	1658	77	319	.192
688	"	Kanaio	2000'	R	1403	132	199	.141
689	"	"	"	R	992	100	109	.109
690	"	"	"	R	1105	100	208	.188
691	"	"	"	R	1020	100	699	.685
692	"	"	"	R	964	100	206	.213
693	"	"	"	R	1174	100	231	.196
694	"	"	"	R	1034	100	120	.116
695	"	"	"	R	1105	100	208	.188
696	"	"	"	R	1105	100	148	.133
697	"	"	"	R	1091	100	185	.169
698	"	"	"	R	806	100	201	.249
699	"	"	"	R	1091	100	214	.196
700	"	"	"	R	1119	100	233	.208
701	"	"	"	R	1077	100	130	.120
702	"	"	"	R	1217	100	212	.174
703	"	"	"	R	1020	100	136	.133
704	"	"	"	R	992	100	240	.241
705	"	"	"	R	1389	100	208	.149
706	"	"	"	OR	1174	100	176	.149
707	"	"	"	OR	693	100	193	.278
708	"	"	"	OR	650	100	187	.287

LOT	DATE	LOCALITY	ELEV.	S	W	N	PUPARIA	INDEX
709	3/2	Kanaio	2000'	OR	735	100	209	.284
710	"	"	"	OR	636	100	169	.265
711	"	"	"	OR	1245	100	215	.172
712	"	"	"	OR	1259	100	211	.167
713	"	"	"	OR	1105	100	161	.145
714	"	"	"	OR	1217	100	159	.130
715	"	"	"	HR	834	100	226	.270
716	"	"	"	HR	764	100	163	.213
717	"	"	"	HR	863	100	138	.159
718	"	"	"	HR	992	100	225	.226
719	"	"	"	HR	552	100	205	.371
720	3/3	Ma luhia	1840'	OR	1885	133	365	.193
721	"	"	"	R	1431	100	289	.201
722	"	"	"	R	1202	100	262	.217
723	"	"	"	R	1559	100	323	.207
724	"	"	"	R	1502	100	349	.232
725	"	"	"	HR	1259	100	350	.277
726	"	"	"	HR	1531	100	333	.217
727	"	"	"	HR	1403	100	311	.221
728	3/9	Kanaio	2000'	R	992	100	190	.371
729	"	"	"	R	992	100	344	.346
730	"	"	"	R	1188	100	120	.351
731	"	"	"	R	949	100	170	.179
732	"	"	"	R	1105	100	131	.118
733	"	"	"	R	1048	100	178	.170
734	"	"	"	R	1174	100	170	.144
735	"	"	"	R	964	100	187	.193

LOT	DATE	LOCALITY	ELEV.	S	W	N	PUPARIA	INDEX
736	3/9	Kanaio	2000'	HR	877	100	281	.320
737	"	"	"	HR	849	100	205	.241
738	"	"	"	OR	1048	100	145	.138
739	"	"	"	OR	1020	100	117	.114
740	"	"	"	OR	1062	100	47	.044
741	"	"	"	OR	1034	100	45	.043
742	"	"	"	H R	978	100.	205	.209

Note. A hundred lots which are incomplete insofar as pupal data is concerned will be included in the next report.

SUMMARY

Total fruit collected - - - - 16,457
Weight of fruit - - - - - - - -183,021 grams (404 pounds)
Puparia recovered - - - - - - - 34,761
Average index - - - - - - - - .189
Lots of fruit - - - - - - - - 166

TABLE NO. 43

A HOST LIST OF *DACUS DORSALIS* Hendl.

1.	*Achras zapota* L.	(Chicle Tree, Chico, Sapodilla)
2.	*Anacardium occidentale* L.	(Cashew)
3.	*Ananas comosus* L.	(Pineapple)
4.	*Annona muricata* L.	(Soursop)
5.	*Annona reticulata* L.	(Custard Apple)
6.	*Annona squamosa* L.	(Sugar Apple)
7.	*Artabotrys odoratissimus* R. Br.	(Climbing Ylang-Ylang)
8.	*Artocarpus incisus* (Thunb.)	(Breadfruit)
9.	*Artocarpus heterophyllus* Lam.	(Jack Fruit)
10.	*Averrhoa carambola* L.	(Carambola)
11.	*Bumelia lanuginosa* Pers.	(Chittim Wood)
12.	*Bunchosia armeniaca* (Cav.)	(Bunchosia, Ciruelo)
13.	*Calophyllum inophyllum* L.	(Alexandrian Laurel, Kamani)
14.	*Cananga odorata* (Lam.)	(Ylang-Ylang)
15.	*Capsicum frutescens* var. *abbreviatum* L.	(Nioi Lei, Red Pepper)
16.	*Capsicum frutescens* var. *grossum* L.	(Bell Pepper, Sweet Pepper)
17.	*Carica papaya* L.	(Papaya, Pawpaw)
18.	*Carissa grandiflora* A.DC.	(Natal Plum)
19.	*Casimiroa edulis* Llave and Lex.	(White Sapote)
20.	*Cestrum diurnum* L.	(Day Cestrum)
21.	*Chrysobalanus icaco* L.	(Coco Plum)
22.	*Carysophyllum cainito* L.	(Caimito, Star Apple)
23.	*Chrysophyllum oliviforme* L.	(Coimitillo, Satin Leaf)
24.	*Citrullus vulgaris* Schrad.	(Watermelon)*
25.	*Citrus aurantiifolia* (Christmann)	(Lime)
266.	*Citrus aurantium* L.	(Sour orange)
27.	*Citrus limonia* Osbeck	(Lemon)
28.	*Citrus maxima* (Burm.)	(Pummelo, Shaddock)
29.	*Citrus mitis* Bloc.	(Calamondin)

30.	*Citrus nobilis* var. *deliciosa* (Ten)	(Kid Glove Orange, Tangerine)
31.	*Citrus paradisi* Macf.	(Grapefruit, Pomelo)
32.	*Citrus sinensis* (L)	(Common Orange, Kona Orange, Sweet Orange)
33.	*Coccolobis uvifera* (L)	(Sea Grape)
34.	*Cocos nucifera* L.	(Coconut Tree, Coco Palm)
35.	*Coffea arabica* L.	(Arabian Coffee)
36.	*Coffea liberica* Bull.	(Liberian Coffee)
37.	*Cordia sebestena* L.	(Foreign Kou, Kou Ha ole, Geiger Tree)
38.	*Cordyline terminales* (L.)	(Ti)
39.	*Diospyros discolor* Willd.	(Mabolo, Velvet Apple)
40.	*Diospyros ferrea*	(Lama , Native persimmon)
41.	*Diospyros kaki* L.	(Kaki, Oriental Persimmon)
42.	*Dovyalis hebecarpa* (Gardn.)	(Ceylon Gooseberry, Ketambilla)
43.	*Eriobotrya japonica* (Thunb.)	(Loquat)
44.	*Eugenia cumini* (L.)	(Jambolan Plum, Java Plum)
45.	*Eugenia dombeyi* (Spreng.)	(Brazilian Plum)
46.	*Eugenia jambos* L.	(Rose Apple)
47.	*Eugenia malaccensis* L.	(Mountain Apple, Malay Apple)
48.	*Eugenia uniflora* L.	(Surinam Cherry)
49.	*Euphoria longan* (Lour.)	(Dragon's Eye, Longan)
50.	*Feijoa sellowiana* Berg.	(Guavasteen)
51.	*Ficus carica* L.	(Common Fig)
52.	*Ficus lyrata* Warb.	
53.	*Ficus macrophylla* Desf.	(Moreton Bay Fig)
54.	*Ficus retusa* L.	(Chinese Banyan Fig, Malayan Fig)
55.	*Ficus rubiginosa* Desf.	(Port Jackson)
56.	*Flaucotia indica* (Burm.)	(Governor's Plum)
57.	*Fortunella japonica* (Thunb.)	(Chinese orange, Kumquat)
58.	*Fragaria chiloensis* (L.)	(Strawberry)
59.	*Garcinia mangostana* L.	(Mangosteen)
60.	*Garcinia xanthochymus* Hook.	(Gourka)
61.	*Gossypium barbadense* L.	(Cotton Plant, Sea Island Cotton)

62. Hydnocarpus kurzii (King) (Chaulmoogra)

63. Inga laurina (Sw.) (Guama)

64. Inocarpus edulis Forst. (Tahitian Chestnut)

65. Juglans hindsii (California Walnut)

66. Juglans regia L. (English Walnut)

67. Latania loddigesii Mart (Blue Lantan Palm)**

68. Litchi chinensis Sonn. (Litchi)

69. Lucuma nervosa A. DC. (Canistel. Egg Fruit)

70. Lycopersicon esculentum Mill. (Tomato)

71. Macadamia ternifolia F. (Macadamia Nut, Queensland Nut)***

72. Mammea americana L. (Mammee Apple)

73. Mangifera indica L. (Mango)

74. Manilkara Hexandra (Roxb.) (Cow Tree)

75. Melia azedarach L. (Bead Tree, Chinaberry Tree, Pride of India)

76. Mimusops elengi L. (Elengi, Pogodo)

77. Momordica balsamina L. (Balsam Apple)

78. Momordica charantia L. (Balsam Pear, Bittermelon)

79. Morus nigra L. (Black Mulberry)

80. Murraya exotica L. (Jessamine Orange, Mock Orange)

81. Musa nana Lour. (Chinese Banana)

82. Musa paradisiaca var. sapientum (L) (Common Banana)

83. Noronhia emarginata (Lam.) (Madagascar Olive)

84. Ochrosia elliptica Labill. (Ochrosia)

85. Olea europaea L. (Olive)

86. Opuntia megacantha Salm-Dyck (Prickly Pear)

87. Passiflora edulis Sims (Lilikoi, Purple Granadilla)

88. Passiflora foetida L. (Love-in-a-mist, running-pop)

89. Passiflora laurifolia L. (Bell Apple, Yellow Granadilla)

90. Passiflora mollissima (HBK)

91. Passiflora subpeltata Ortega (White Passion Flower)

92. Persea americana Mill. (Avocado, Alligator Pear)
93. Phoenix dactylifera L. (Date Palm)
94. Pimenta acris Kostel (Bay Rum Tree)
95. Pimenta officinalis Lindl. (Allspice)
96. Pithecellobium dulce (Roxb.) (Manila, Tamarind, Opiuma)
97. Polyalthia longifolia Benth (Custard Apple)
98. Prunus cerasifera Ehrh. x salicina Lindl. (Methley Plum)
99. Prunus persica (L) (Peach)
100. Psidium cattleianum Sabine (Purple Strawberry Guava)
101. Psidium cattleianum var. lucidum Dengener (Yellow Strawberry Guava)
102. Psidium guajava L. (Common Guava)
103. Punica granatum L. (Pomegranate)
104. Pyrus malus L. (Apple)
105. Pyrus serotina var. culta Rehd. (Sand Pear)
106. Santalum album L. (Sandalwood)
107. Santalum paniculatum
108. Scaevola frutescens var. sericea (Forst. (Beach Naupaka)
109. Solanum aculeatissimum Jacq. (Kikania Lei)
110. Solanum muricatum Ait. (Pepino)
111. Solanum pseudocapsicum L. (Jerusalem Cherry)
112. Solanum tuberosum L. (Potato)****
113. Spondias dulcis Forst. (Otaheite Apple, Wi Apple)
114. Spondias mombin. L. (Hog Plum)
115. Terminalia belerica Roxb. (Myrobalam Nut)
116. Terminalia catappa L. (False Kamani)
117. Terminalia melanocarpa Muell. (Myrobalam Nut)
118. Thevetia peruviana (Pers.) (Be-Still, Yellow Oleander)
119. Triphasis trifolia (Burm.) (Limeberry)
120. Vaccinium reticulatum Smith (Ohelo Berry)

121. *Wikstroemia phillyraefolia* Gray

122. *Wikstroemia uva-ursi* Gray

123. *Yucca sp.* (*alnifolia* ?)

124. *Zizyphus mauritiana* Lam. (Indian Jujube)

Note: This list is based on a list compiled by the writer in September, 1948 and a list compiled by Mr. O.O. Stout in December, 1948. These records were compiled from records of the Division of Foreign Plant Quarantine, U.S. Department of Agriculture; Board of Agriculture and Forestry, Territory of Hawaii; Hawaiian Sugar Planters Association; Fruit Fly Laboratory, U.S. Department of Agriculture; and present work carried on by the Oriental Fruit Fly Investigations. Dr. C.L. Ritchie, of the Division of Foreign Plant Quarantine has kindly reviewed the present list and added a number of records which were unknown to the writer.

Line Project I-o-1-4 - Hosts of the Oriental Fruit Fly

Report on Vanda Miss Agnes Joaquim as a Host of Dacus Dorsalis.
by Norman E. Flitters

Introduction

The attention of the writer was first drawn to reports of *D. dorsalis* infestation in flowers of field grown Vanda Miss Joaquim in March, 1949.

An inspection trip was made to Mr. Robert Warne's Nuuanu Valley orchid nursery on March 21, 1949 and an examination made of the Vanda blooms present on some forty five thousand Vanda plants.

A careful examination of both Vanda buds and flowers revealed a very low incidence of infestation. The discovery of what appeared to be perfectly normal *D. dorsalis* eggs, presumably viable, on the lip of open Vanda flowers, appeared to be of sufficient importance to justify the attention of Dr. C. L. Ritchie, Inspector In Charge, Bureau of Entomology and Foreign Plant Quarantine, who was duly informed.

As a result the shipment of Vanda blooms from the Territory of Hawaii was restricted by a quarantine effective March 23, 1949.

The first attempt to rear *D. dorsalis* from buds or open flowers of Vanda orchids was undertaken on March 21, 1949 when twenty three field infested buds were collected from the Warne's orchid nursery and placed in a petri dish, covered, and held in an incubation cabinet at 25° C. and high humidity. Five larvae were observed in the buds five days later. One larva was found to be alive and almost full grown when the decayed bud was examined on April 1st. The following day it was found to have pupated in the decayed remains of the bud, and emergence of a male *Dacus dorsalis* fly was recovered from it on April 10, 1949. It was evident that extremely suitable conditions had to be provided if *D. dorsalis* were to be reared from infested buds.

An attempt to discover the possibility of larval migration of *D. dorsalis* from the Vanda flower to another host in close proximity to it was also undertaken.

Twelve infested blooms (nine fully open and three half open) were placed in one end of a cardboard box 9 x 4 x 5 inches high. A slice of an apple 1/2 inch thick was placed at the opposite end three inches from the Vanda flowers. The box was then sealed in pliofilm and placed in an incubation cabinet, temperature 25° C. and high humidity. Periodic observations of the apple section were made through the pliofilm and larvae observed feeding in its decaying stage after the test had been in operation for a period of seven days. However, it is not known at what stage the larvae migrated from the flowers or by what motive force. With the excessive accumulation of moisture causing a flow of water on the bottom of the box it would be possible for an early instar larva to be carried from the flowers to the apple by this method, or the larvae could have left the Vanda and successfully navigated to the apple under the favorable conditions present in the box. The fruit was removed and placed in a specimen jar over sand to allow the larvae every facility for pupation. One pupa was later recovered from the sand and a female D. dorsalis fly was recovered.

With continued information on the index of infestation and experience with the biology of the Oriental fruit fly it became increasingly apparent that the status of the Vanda flower as a host was very dubious and should be subject to rigid experimentation.

Experiments.--These were of three types:

I. A large scale experiment using artifically infested flowers and buds.

II. Experiments with artificially infested Vanda blooms in incubation cabinets and room temperature.

III. Experiments with induced oviposition in Vanda buds.

STUDIES ON VANDA MISS JOAQUIM AS A HOST OF DACUS DORSALIS

I. To determine the status of Vanda flowers as host of Dacus dorsalis when spikes of commercial flowers and buds were artificially infested with eggs.

The experiment was planned to cover a period of ten weeks. Each week comparable commercially grown spikes of Vanda orchids were selected, picked fresh from the nursery of Mr. Robert Warne, Nuuanu Avenue, Honolulu, removed to the laboratory, and one thousand D. dorsalis eggs attached to the throat of open flowers, (Fig. 1) or beneath the upper petal of advanced buds through the suture, (Fig. 2) at the rate of ten eggs to each bud or flower.

The technique followed was rather simple but proved very satisfactory. Two 1 gallon cans were attached to each other by a section of discarded automobile inner tube (Fig. 3). The upper can had a hole pierced through the centre, one half inch in diameter, or just sufficiently large to receive a florists orchid tube, the lower can contained sufficient sand to act as ballast and prevent knocking over. Black circles six inches in diameter were cut from heavy art board and the centres punctured to receive the spike of the orchids. The purpose of the black disc was to provide a suitable background for observing any eggs or larvae that should become dislodged or otherwise move from the spikes during the initial stages of the test. The orchid spike was first inserted through the black disc and into the rubber capped florist's orchid tube full of water (Fig. 4). The whole was then placed in the upper can, care being exercised to insure the tube being centered and suspended through the hole in the bottom of the can. Sand was sifted evenly over the bottom of the can and the spikes were ready for infestation.

Eggs were obtained from caged laboratory reared flies by the expedient of providing tangential orange skin sections for them for oviposition. Eggs were removed from the sections with the aid of a fine camel's hair brush and transferred to petri dishes containing ink blackened filter paper moistened with one tenth of one percent cupric chloride. The eggs so removed were counted and placed in groups of ten to facilitate the process of infestation (Fig. 5). The infestation was done with a fine camel's hair brush dipped before each infestation in clear egg albumen (Fig. 6). The latter served as a very suitable adhering agent and prevented any dislocation

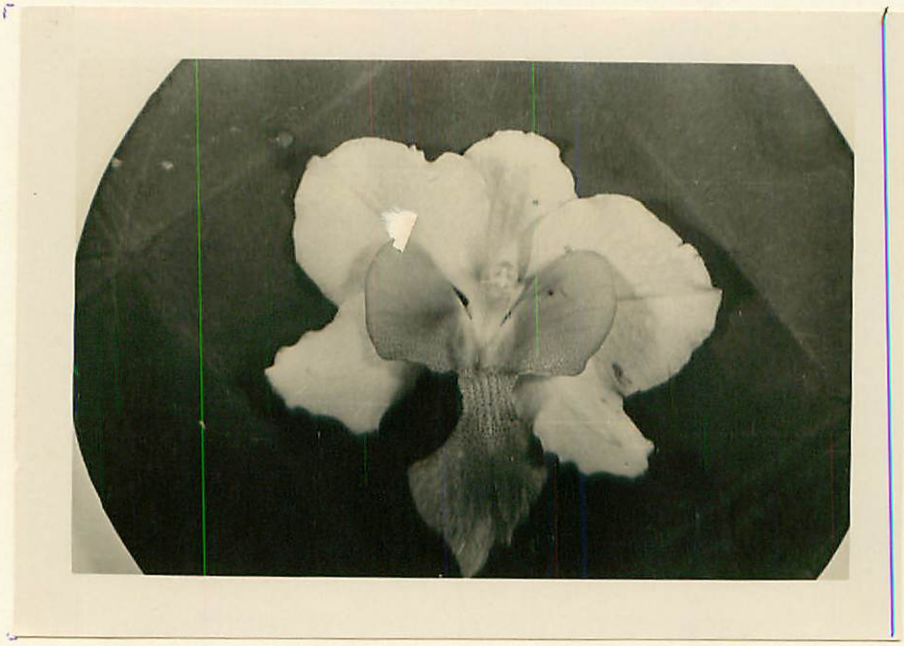


Figure 1.--*D. dorsalis* eggs attached to the throat of open flowers.

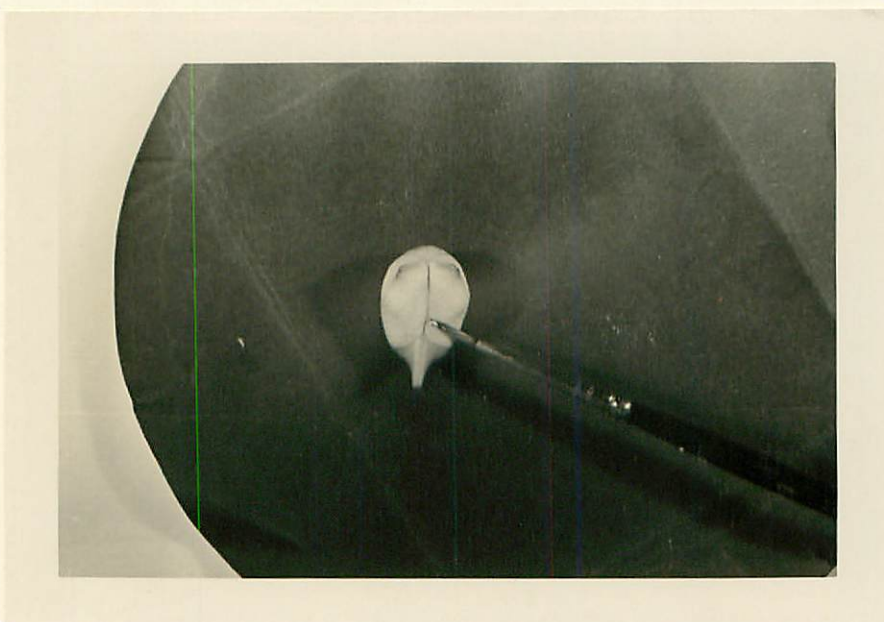


Figure 2.--Suture through which infestation was made in Vanda buds.

Figure 3.—Attaching cans by means of rubber tubing.

Figure 4.—Orchid inserted through black disc and
seated in glass florist's tube.

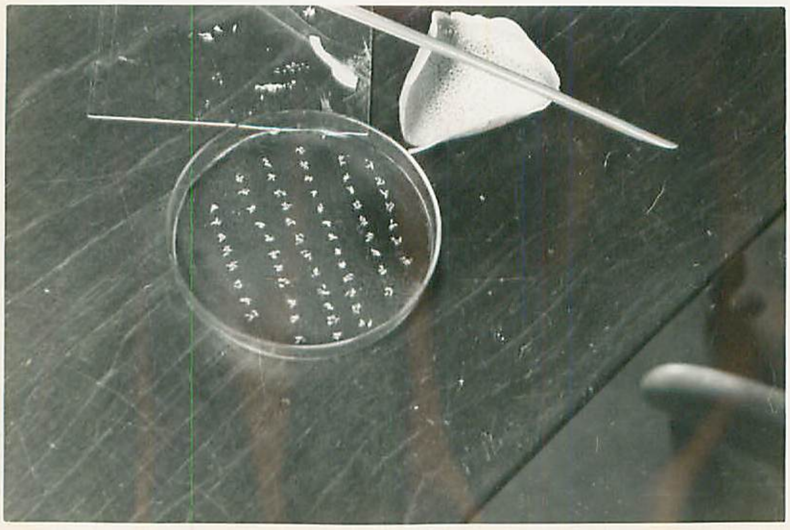


Figure 5.--Orange sections with eggs removed and counted into petri dish.

Figure 6.--Infesting blooms with eggs of D. dorsalis.

of eggs from the blooms in the process of handling. Upon completion of the infestation the cans containing the spikes were removed to a fine mesh, ant proof, screened cage outdoors. The top of the cage was covered with palm fronds to afford sufficient shade and protection from the elements (Fig. 7-8). A hygrothermograph was placed in the cage and a record kept for each weekly run. Temperature ranges were so slight that a complete table would be superfluous. (Fig. 9)shows hygrothermograph records showing the close range of temperature recordings made in December and January. The spikes were inspected daily and hatch and larval development very closely followed. After exposure in the cage for one week the spikes were removed from there to tables in the laboratory and observation continued from there.

The Vanda spikes do not appear to lose any of their good keeping qualities when subjected to this form of treatment, flowers are present on the spikes up to thirty days after infestation proving that the flower should be still sufficiently suitable for larval development, (Fig. 10), if suitable as a host.

Egg hatch has been observed in every case and varied from 24-72 hours depending upon weather conditions. Larval activity has not been observed beyond the second day after hatch and no indications of larval activity has been observed in the tissue, column, or peduncle indicating that the flowers are not conducive to normal larval development and apparently not particularly appealing to the young larvae as a food source.

In every case the size of the flower appeared sufficient to provide enough space for the ten early instar larvae to occupy, and the weight of each bloom would indicate that sufficient vegetative matter was present to support the larvae if it were acceptable to them. From a test conducted in the laboratory where ten larvae were placed upon one gram of prepared agar base media the larvae were able to survive for a period of five days indicating that larvae could have survived on the Vanda bloom and vegetative spike should it have had the necessary host properties required for normal larval development.

Figure 7.—Cans containing infested orchids placed in screen cage.

Figure 8.—Screen cage covered with palm fronds to afford sufficient shade and protection from the elements.

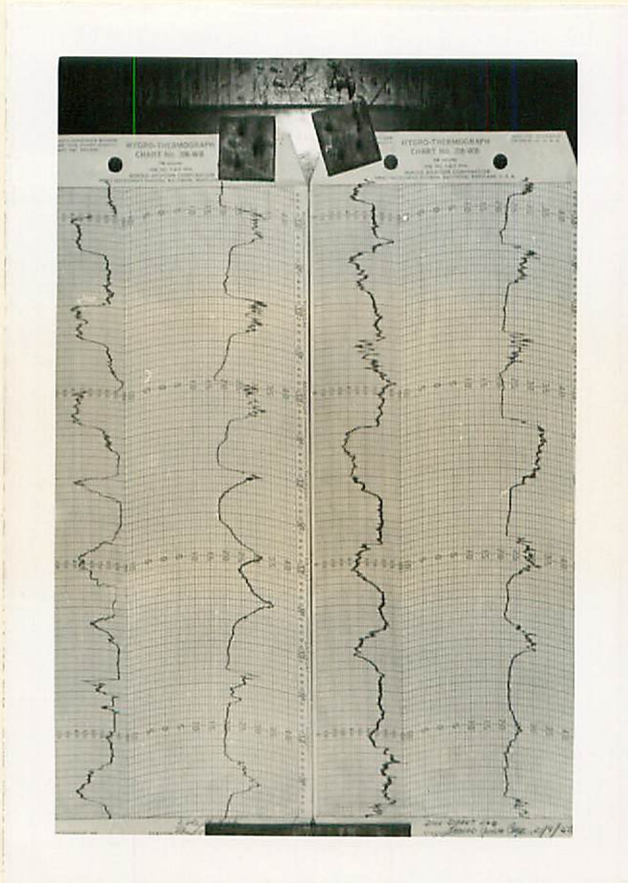


Figure 9.--Hygrothermograph records showing the close range of temperature recordings made in December and January.

Figure 10.--Flowers and spikes thirty days after infestation.

II. Experiments with infested Vanda blooms in incubation cabinets and room temperature.

Test No. 1

Test with infested Vanda blooms held at temperature and humidity optimum for larval development.

1/27/50.--Five standard commercially packed shipping boxes, each with a capacity for 25 Vanda blossoms, were packed with infested Vanda blooms, 10 eggs to each bloom. Each box was sealed with a pliofilm cover and then placed in an incubation cabinet with a fixed temperature of 25° C. and a humidity of 74 percent.

However, mechanical difficulty was encountered in the operation of the circulating system in the cabinet and the boxes were removed to the laboratory on 2/2/50 and held at room temperature.

2/10/50.--The appearance of mold on the blooms necessitated the removal of the pliofilm wrappers from the boxes and an inspection of the blooms was made. Due to the saturated condition of the boxes together with the mold, it was impossible to obtain an accurate count of collapsed and hatched eggs, however, from the total of 1,250 eggs only 26 larvae were discovered, everyone dead and none beyond the first instar.

Test No. 2

Test with Vanda blooms infested in fleshy column.

1/28/50.--Fifty Vanda Joaquim blooms were infested with 10 eggs each. An incision was made on the upper side of the column well down toward the base of 25 blooms and 10 eggs inserted into each incision. On the remaining 25 blooms an incision was made in relatively the same position on the column but on the under surface. The same number, 10 eggs, was inserted into each incision. The blooms were infested without removal from the spikes in order to insure ease of observation and handling. Hatch was observed on 1/31/50 but it is significant that the larvae were discovered at the point of incision and not at the base of it as was expected. In other words there was no entry into the tissue. However, the observation made on the under side of the column was done with the aid of a mirror and daily inspections were omitted in favor of thorough examination of the bloom at the end of seven days at which time it was hoped that any larval activity would be very pronounced.

2/8/50.--The blooms of infested Vandas were completely bleached, shrivelled, and dry (Figs. 11, 12, 13). A careful examination of each bloom revealed no live larvae and the dead recovered were completely dessicated and discolored.

Figure 11.--First stage in typical decadence of Vanda flowers showing progression to shrivelled dried condition.

Figure 12.--Second stage in typical decadence of Vanda flowers showing progression to shrivelled dried condition.

Figure 13.--Third stage in typical decadence of Vanda flowers showing progression to shrivelled dried condition.

III. Experiments with induced oviposition in Vanda buds.

Test No. 3

1/24/50.--Six well developed Vanda Joaquim buds were inserted through cheesecloth into four water filled petri dishes and then placed in rearing cages containing gravid D. dorsalis ♀♀ (one dish to each cage). Flies were observed ovipositing in them frequently.

1/27/50.--Buds removed from cages just prior to opening. One egg and one live larva were observed on a semi-open bud. Two dishes were kept in the laboratory at room temperature, the other two placed in cabinet at 25° C.

2/1/50.--Flowers all open and inspection made of infestation.

Dish No. 1 - Laboratory - room temperature.--Flowers contained a total of 35 eggs. Of these 15 had hatched, 12 collapsed and 8 unhatched. Larvae recovered 14, of which only 4 were alive.

2/3/50.--No survivors.

Dish No. 2 - Laboratory - room temperature.--A total of 9 eggs were discovered, 5 of which had hatched the remaining 4 had collapsed. All 5 larvae were discovered, 3 alive.

2/4/50.--No survivors.

Dish No. 3 - Cabinet 25° C.--A total of 14 eggs were discovered of which 10 had hatched and the remaining 4 collapsed. All 10 larvae were alive but not very active. All larvae were discovered dead two days later.

Dish No. 4 - Cabinet 25° C.--Only evidence of seven eggs was discovered. Five of which had collapsed and the remaining two hatched. One larva was dead, the other alive but inactive.

After examination, all blooms were kept at room temperature because of difficulty experienced in maintaining cabinet temperature. Daily inspections were made and there was no larval survival beyond 2/4/50. The flowers were not in a condition considered adequate for larval development although physically the blooms were still fresh, they failed to become sufficiently decomposed and succulent to be conducive to normal larval feeding.

Test No. 4

2/1/50.--Twenty four well developed buds of Vanda Miss Joaquim were selected and placed 6 to a petri dish, cheesecloth covered, and filled to capacity with water. The buds so arranged were exposed to gravid ♀♀ dorsalis for a period of 24 hours. Upon removal from the cages the petri dishes were packed two to a standard Vanda shipping box, (25 flower capacity) sealed in a pliofilm cover and placed in an incubation cabinet, temperature 27° C. with a relative humidity of 80 percent.

Because of the weakened condition of the boxes, caused by the high humidity and overflow of water from the petri dishes sustained during transit from the laboratory, they were removed for examination on 2/10/50.

The buds were in an advanced stage of decomposition. They had not opened and their shape, character, color, and composition resembled a decadent fruit much more than a flower. (Fig. 14, 15, 16) show the stages of decadence of a Vanda bud necessary to provide a medium sufficiently succulent and infested with microorganisms to support a larva under what are considered near optimum conditions.

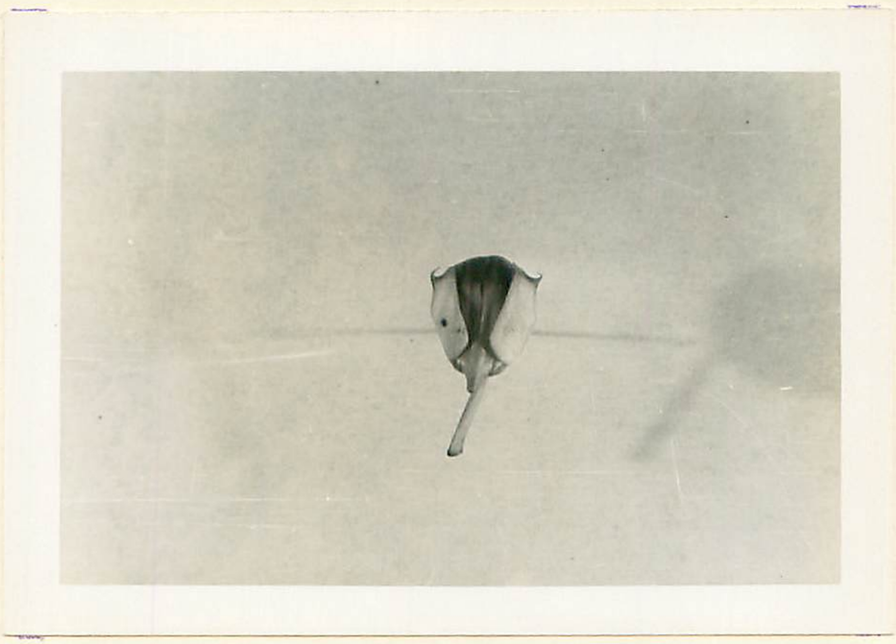


Figure 14.--First stage of decadence of a Vanda bud.

Figure 15.--Second stage of decadence of a Vanda bud.

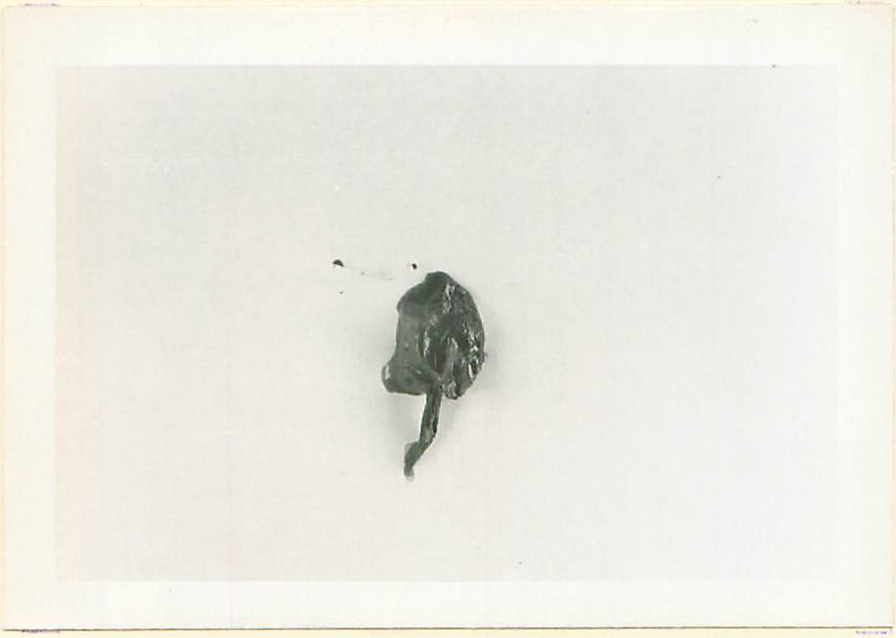


Figure 16.--Third stage of decadence of a Vanda bud.

It was immediately evident that only larvae could be recognized in the putrefying media. Of the recoveries made only 6 dead and 8 live larvae were discovered. The media containing the live larvae was transferred by means of a spatula to a petri dish and covered. Observations were made through the glass daily and larval activity, although restricted and sluggish, was clearly visible. On 2/12/50 there were only 2 live larvae present, and one of these appeared on the verge of succumbing. On 2/14/50 only 1 larva remained alive. On 2/17/50 an abnormally small pupa was recovered and placed in an isolation jar containing moist sand. This finally emerged as an aborted very much undersized male.

The results obtained bear out the fact that the selection of Vanda Joaquim by D. dorsalis for oviposition is done while the blooms are still in the bud stage. Eggs and larvae of D. dorsalis are naturally protected by the succulent media present in hosts generally selected, but in the case of the Vanda this media does not become favorable unless the bud putrefies. Of the ten thousand D. dorsalis eggs, (Fig. 17), placed in Vanda blooms and buds, 80.7 percent were found to have collapsed (Fig. 18) and only 8.7 percent hatched (Fig. 19). All larvae recovered were upon the surface of the petals and no larval activity was ever discovered in the fleshy column or in the stem.

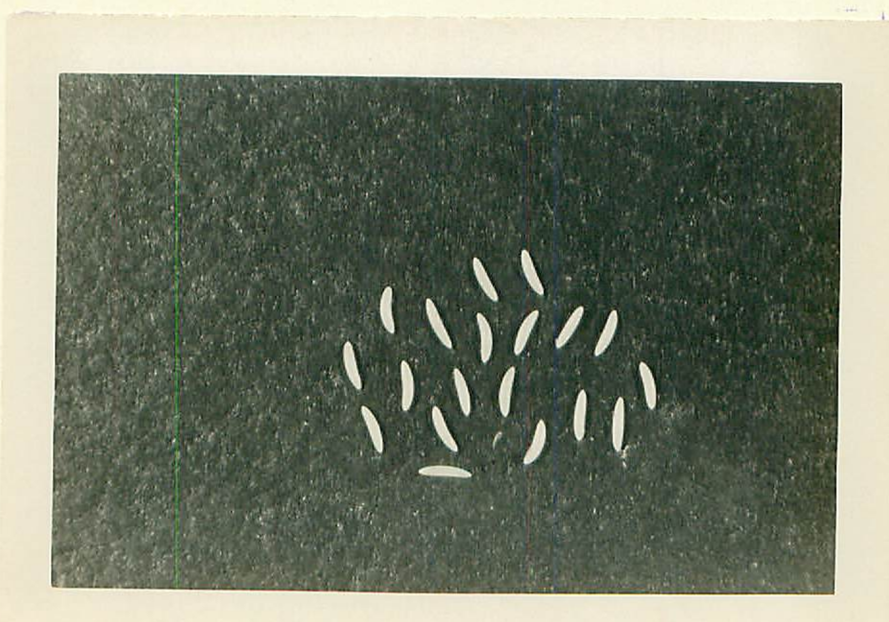


Figure 17.--Eggs of D. dorsalis used for infesting of Vanda blooms.

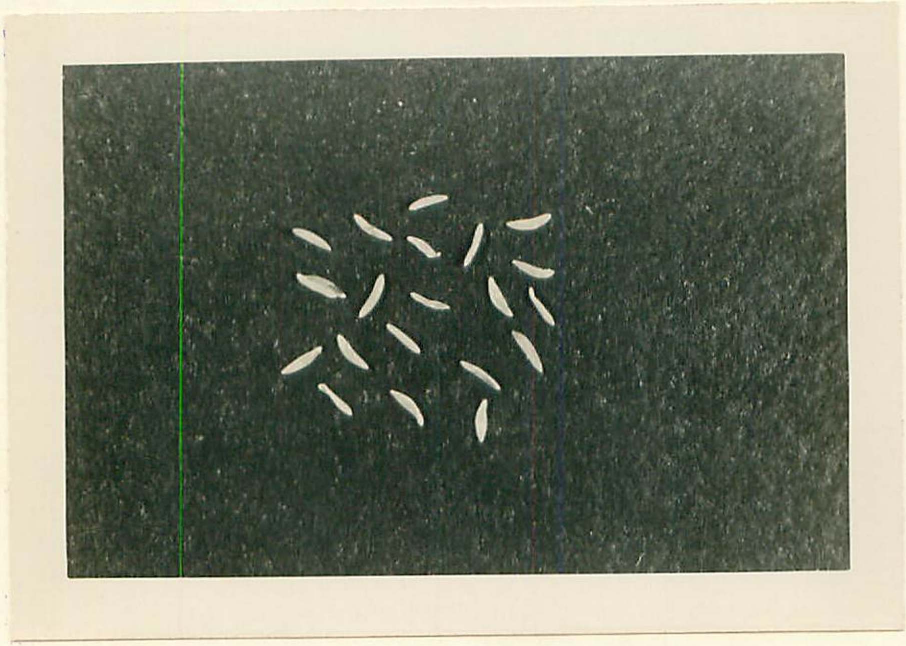


Figure 18.--Collapsed eggs of D. dorsalis.

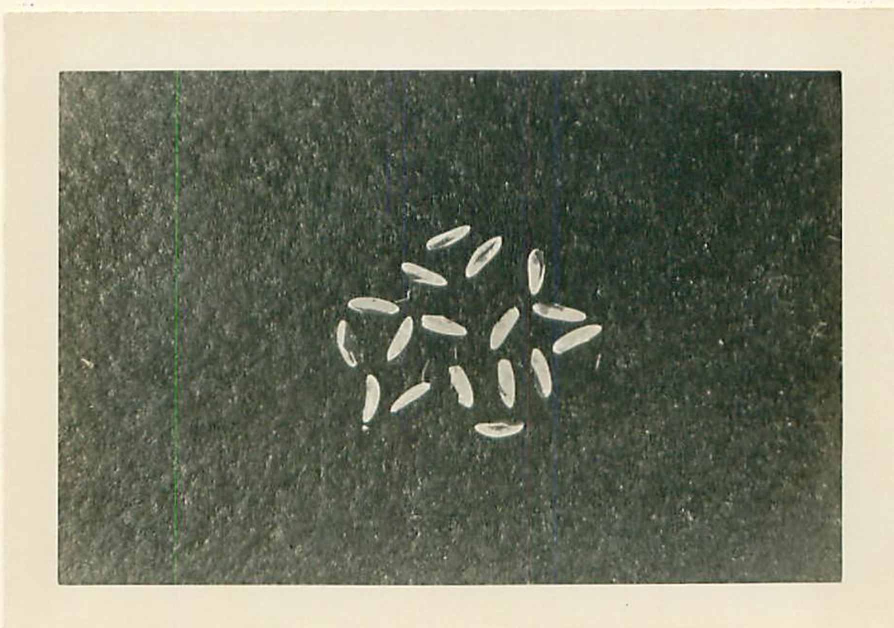


Figure 19.--Hatched eggs of D. dorsalis.

TOTALS

TABLE I.—INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SERIES	NO. FLS.	NO. BUDS	NO. EGGS UNHATCHED	NO. EGGS COLLAPSED	NO. LARVAE DEAD	NO. LARVAE ALIVE	PERCENT EGGS UNHATCHED	PERCENT EGGS COLLAPSED	PERCENT LARVAE DEAD	PERCENT LARVAE ALIVE
12/ 8/49	1	89	11	49	809	114	28	4.9	80.9	11.4	2.8
12/15/49	2	92	8	42	866	75	17	4.2	86.6	7.5	1.7
12/22/49	3	78	22	77	790	107	26	7.7	79.0	10.7	2.6
12/29/49	4	84	16	114	768	84	32*	11.4	76.8	8.4	3.2
1/ 5/50	5	80	20	108	797	60	32**	10.8	79.7	6.0	3.2
1/12/50	6	87	13	117	782	77	24	11.7	78.2	7.7	2.4
1/19/50	7	80	20	116	785	66	33	11.6	78.5	6.6	3.3
1/26/50	8	94	6	86	824	69	21	8.6	82.4	6.9	2.1
2/ 2/50	9	86	14	77	822	70	31	7.7	82.2	7.0	3.1
2/ 2/50	10	90	10	80	826	53	40***	8.0	82.6	5.3	4.0
GRAND TOTAL:		860	140	866	8,069	775	284	86.6	806.9	77.5	28.4

* 1 egg unaccounted for.
** 2 eggs unaccounted for.
*** 3 eggs unaccounted for.

INFESTATION INDEX OF *DACUS DORSALIS* IN VANDA JOAQUIM

	MONTH	GRADE	NO. EXAMINED	NO. INFESTED	EGGS Collapsed	EGGS Hatched	EGGS Unhatched	LARVAE Dead	LARVAE Alive	TOTAL UNHATCHED EGGS & LIVE LARVAE
Vandas Inspected	April	A	2,180	20	18	30	7	8	1	8
% Insp. Infested							.321		.046	.367
% Infest. Having							35.00		5.00	40.00
Vandas Inspected		Culls	2,973	31	24	33	4	15		4
% Insp. Infested							.135			.135
% Infest. Having							12.9			12.9
Total-% Insp. Infest.							.213		.019	.233
% Infest. Having							21.57		1.96	23.53
Vandas Inspected	July	A	—	—	—	—	—	—	—	—
Vandas Inspected		Culls	1,067				1			1
% Insp. Infested							.094			.094
Total-%Insp. Infest.							.094			.094
Vandas Inspected	August	A	—	—	—	—	—	—	—	—
Vandas Inspected		Culls	3,290	12		5	20			20
% Insp. Infest.							.608			.608
% Infest. Having							166.67			166.67
Total-% Insp. Infest.							.608			.608
% Infest. Having							166.67			166.67
Vandas Inspected	September	A	500	—	—	—	—	—	—	—
Vandas Inspected		Culls	1,460	1			1			1
% Insp. Infested							.2			.2
% Infest. Having							100.00			100.00
Total-% Insp. Infest.							.051			.051
% Infest. Having							100.00			100.00
Vandas Inspected	October	A	1,000	—	—	—	—	—	—	—
Vandas Inspected		Culls	1,485	—	—	—	—	—	—	—
Vandas Inspected		Field Insp.	3,100	1	1					

INFESTATION INDEX OF DACUS DORSALIS IN VANDA JOAQUIM

	MONTH	GRADE	NO. EXAMINED	NO. INFESTED	EGGS Collapsed	EGGS Hatched	EGGS Unhatched	LARVAE Dead	LARVAE Alive	TOTAL UNHATCHED EGGS & LIVE LARVAE
Vandas Inspected	November	A	1,000	—	—	—	—	—	—	—
Vandas Inspected		Culls	1,000	—	—	—	—	—	—	—
Vandas Inspected		Field Insp.	5,280	2						
Total										
Vandas Inspected	December	A	1,500	1	1	1		1		
Vandas Inspected		Culls	1,500	21	4	4	1	8	5	6
% Insp. Infest.							.067		.33	.40
% Infest. Having							4.76		23.81	28.57
Total-% Insp. Infest.							.033		.167	.20
% Infest. Having							4.55		22.73	27.27
Vandas Inspected	January	A	500	—	—	—	—	—	—	—
Vandas Inspected		Culls	1,000	—	—	—	—	—	—	—
Vandas Inspected	February	A	1,000	4		3	1			1
% Insp. Infest.							.001			.001
% Infest. Having							25.00			25.00
Vandas Inspected		Culls	1,000	68	16	38	15		4	19
% Insp. Infest.							.015		.004	.019
% Infest. Having							22.06		5.88	27.94
Vandas Inspected	March	A	1,000	2	1	1				1
% Insp. Infest.							.001			.001
% Infest. Having							50.00			50.00
Vandas Inspected		Culls	1,000	32	25	16	5		8	13
% Insp. Infest.							.005		.008	.013
% Infest. Having							15.63		25.00	40.63

INFESTATION INDEX OF DACUS DORSALIS IN VANDA JOAQUIM

DATE	SOURCE	GRADE	NUMBER EXAMINED	NUMBER INFESTED	PARTS: PETAL	PARTS: PISTIL	EGGS: COLLAPSED	EGGS: HATCHED	EGGS: UNHATCHED	LARVAE: DEAD	LARVAE: ALIVE	TOTAL UNHATCHED EGGS & LIVE LARVAE
1/12/50	Hilo, Hawaii	A	500	none								
1/12/50	Hilo, Hawaii	B	500	none								
1/27/50	Hilo, Hawaii	B	500	none								
2/10/50	Hilo, Hawaii	A	500	none								
2/10/50	Hilo, Hawaii	B	500	36	3	33	12	6	5	1	2	7
2/24/50	Hilo, Hawaii	A	500	4		4		3	1			1
2/24/50	Hilo, Hawaii	B	500	32	2	30	4	32	10		2	12
3/10/50	Hilo, Hawaii	A	500	2		2	1		1			1
3/10/50	Hilo, Hawaii	B	500	13	7	6	10	12	5		4	9
3/24/50	Hilo, Hawaii	A	500	0								
3/24/50	Hilo, Hawaii	B	500	19	8	11	15	4	—	—	4	4
			32,835	195	20	86	90	130	56	33	18	74
								43.08%		54.55%		

TABLE III.—INFESTATION INDEX OF DACUS DORSALIS IN COMMERCIAL FLOWERS OF VANDA ORCHID MISS AGNES JOAQUIM.

Flowers of commercial shipping grade together with a representative sample of culls have been examined biweekly since April of 1949 and the infestation indices to date are compiled in the following table:

Total number of blooms inspected	27,335
% Vandas inspected infested with live larvae	0.022%
% " " " " unhatched eggs	0.124%
% " " " " " " & live larvae	0.146%
Total number of Grade A blooms	6,180
% Grade A inspected infested with live larvae	0.016%
% " " " " unhatched eggs	0.097%
% " " " " " " & live larvae	0.113%
Total number of Culls inspected	12,775
% Culls inspected infested with live larvae	0.039%
% " " " " unhatched eggs	0.220%
% " " " " " " & live larvae	0.258%
Total number of Field inspected blooms	8,380
1 bloom infested with a collapsed egg.	

DISCUSSION

The correct evaluation of the host relationships of an insect is important at any time but doubly so when far-reaching quarantine action is involved. When Vanda flowers were first reported as a host, quarantine officers had no alternative but to immediately embargo the shipment of these flowers until treatment could be devised. Actually, however, the data establishing the flower as a host was fragmentary and incomplete and the evaluation of it was made when very little was known concerning the insect's biology.

We now know that Dacus dorsalis will choose almost any suitable niche or surface in which to deposit eggs even though it belongs to a group which has very specific food requirements for normal development. The wastage in oviposition in unsuitable hosts we now know to be enormous. These facts being known, it then became necessary to determine into what host category the Vanda flower fell and whether the fact that the flower is an oviposition point is significant.

From the data obtained from all the experiments it would appear that the only possible means of rearing D. dorsalis from Vanda orchid is by the selection of infested buds and placing them in a covered container and providing them with what are considered optimum conditions for larval development, a constant temperature of 25° C. and with high humidity, which necessitates the use of an incubation cabinet.

The experiments just completed were performed on a total of 1,223 Vanda blossoms and buds and infested with a total of 11,815 D. dorsalis eggs. Results were negative with the one exception, that obtained from the petri dish of putrified Vanda buds from which one deformed D. dorsalis male fly was reared.

The dead larvae recovered were for the major part located in the throat of the flower in very close proximity to the point of infestation. A few individuals were recovered from the lip of the flower and an occasional one was located in the keel. The flower as a whole represents a very poor host when we consider that the larvae are naturally at home in hosts with soft pulpy media sufficiently succulent to allow easy access for burrowing.

When comparisons of infestation tables are made it is interesting to note that infestation of Vanda blossoms in the field, compiled from examination of 27,335 blooms, amounted to only 89 individual flowers or 0.326 percent of the total. Whereas in the inoculation experiment 1,000 individual blooms were positively infested with a total of 10,000 eggs yet only 1,059 or 10.6 percent larvae were observed and 284 or 2.8 percent of these were alive, none of which were able to survive. To obtain a comparable infestation in field collected blooms would require 3,071,348 flowers.

Grade A commercial blooms of _Vanda Joaquim_ have been found to be very rarely infested. From a total of 6,180 blooms examined the combined total of blooms with unhatched eggs and larva present was only 0.113 percent. Culling is very religiously carried out in the packing houses, blooms showing the slightest indication of damage, discoloration, or fruit fly punctures are immediately discarded indicating that the risk of infested blooms being transported elsewhere is most unlikely. This together with the conditions necessary to insure the successful rearing of _D. dorsalis_ on _Vanda Joaquim_ would appear to substantiate the conclusion that there is no risk of introducing or spreading populations of _D. dorsalis_ by means of Vanda blossoms. The very fact that even under the most favorable conditions it was impossible to rear _D. dorsalis_ through on Vanda flowers is the strongest evidence that commercial Vanda flowers as shipped to mainland markets do not constitute a hazard as far as _Dacus dorsalis_ is concerned.

SUMMARY

1. Infestation of 1,000 flowers and buds of _Vanda_ _Miss_ _Agnes_ _Joaquim_ with 10,000 eggs of _Dacus_ _dorsalis_ gave completely negative results with no larval survival after 48 hours.

2. Infested Vanda flowers maintained under conditions which encouraged rapid rotting failed to maintain any _D. dorsalis_ out of an initial population of 1,250 eggs.

3. Placing of 500 eggs in incisions in the fleshy column of Vanda flowers failed to establish infestation.

4. Vanda buds naturally infested with eggs and kept under conditions permitting normal flower development failed to establish infestation.

5. Vanda buds, naturally infested with eggs, were maintained in high humidities and 27° C. Under these conditions the buds failed to open, rotted down to a putrefying mass and permitted the development of one aborted male.

CONCLUSION

The commercial shipment of Vanda flowers does not constitute a hazard to mainland agriculture and the standard inspection methods could be safely substituted for the present fumigation requirement.

A P P E N D I X

Tabulation showing detailed data on experiments in which *Vanda* flowers were infested with *Dacus dorsalis*.

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
12/ 8/49	R. Warne	1	3	7.8 M.	Throat	10	1	1.2 M.	Beneath	10	12/10/49	1	35	2	2	12/13/49
				8.1 M.	"	10			upper							
				8 M.	"	10			petal							
"	"	2	3	7.6 M.	"	10	1	2.1 M.	"	10	"	3	29	7	1	"
				8 M.	"	10										
				8.1 M.	"	10										
"	"	3	3	7.7 M.	"	10	1	1.4 M.	"	10	"	6	27	6	1	"
				8 M.	"	10										
				8.1 M.	"	10										
"	"	4	4	8.1 M.	"	10					"	2	36	2	-	"
				8.2 M.	"	10										
				8.1 M.	"	10										
				8.3 M.	"	10										
"	"	5	5	8 M.	"	10					"	1	37	9	3	"
				8.1 M.	"	10										
				6.4 M.	"	10										
				5.4 M.	"	10										
				6.7 M.	"	10										

The average weight per spike was -	12 grams
" " " per open flower -	3 grams
" " " per bud -	2 grams
" " " of vegetative parts other than flowers or buds -	3.5 grams

An attempt was made to pick length of stem of a uniform 9 inches and spikes as near uniformity as was physically possible.
First half = Vanda Joaquim var. Juliet, Nos. 1-7, 13-17, 19, 20, 23, 24
Second half = Vanda Joaquim var. Atherton, Nos. 8-12, 21, 22, 25

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS		INFESTED		BUDS		INFESTED		HATCH	EGGS		LARVAE		NO SURVIVORS
			NO.	DIAMETER	PART.	EGGS	NO.	DIAMETER	PART.	EGGS	OBSERVED	UNHATCH.	COL.	DEAD	ALIVE	AFTER
12/ 8/49	R. Warne	6	3	8 M.	Throat	10	1	2 M.	Beneath upper petal	10	12/10/49	0	33	6	1	12/13/49
				8 M.	"	10										
				7.4 M.	"	10										
"	"	7	3	8.1 M.	"	10	1	2.1 M.	"	10	"	3	31	5	1	12/14/49
				7.4 M.	"	10										
				4.7 M.	"	10										
"	"	8	3	7.6 M.	"	10	1	4.3 M.	"	10	"	1	29	7	3	"
				8.1 M.	"	10										
				7.2 M.	"	10										
"	"	9	3	8.1 M.	"	10					"	2	21	6	1	"
				7.3 M.	"	10										
				7.6 M.	"	10										
"	"	10	5	8 M.	"	10					"	6	37	7	-	12/13/49
				8.2 M.	"	10										
				7.6 M.	"	10										
				8.1 M.	"	10										
				7.6 M.	"	10										
"	"	11	3	8.1 M.	"	10					"	4	21	4	1	12/14/49
				7.2 M.	"	10										
				7.6 M.	"	10										
"	"	12	4	8.2 M.	"	10	1	3.4 M.	"	10	"	3	39	5	3	"
				7.1 M.	"	10										
				6.4 M.	"	10										
				8.2 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
12/ 8/49	R. Warne	13	3	6.8 M.	Throat	10	1	3.3 M.	Beneath upper petal	10	12/10/49	6	29	4	1	12/14/49
				7 M.	"	10										
				8.2 M.	"	10										
"	"	14	4	6.2 M.	"	10					"	1	31	5	3	"
				7.3 M.	"	10										
				8 M.	"	10										
				8.2 M.	"	10										
"	"	15	5	7.3 M.	"	10					"	2	45	3	-	12/13/49
				8.2 M.	"	10										
				6.3 M.	"	10										
				8.4 M.	"	10										
				8.1 M.	"	10										
"	"	16	4	6.5 M.	"	10					"	1	36	2	1	"
				7.4 M.	"	10										
				8 M.	"	10										
				6.4 M.	"	10										
"	"	17	4	6.4 M.	"	10	1	3.1	"	10	"	3	39	6	2	"
				7 M.	"	10										
				8.2 M.	"	10										
				6.7 M.	"	10										
"	"	18	4	6.2 M.	"	10					"	-	35	4	1	"
				7.1 M.	"	10										
				8 M.	"	10										
				6 M.	"	10										

INFESTATION OF *VANDA JOAQUIM* SPIKES WITH EGGS OF *D. DORSALIS*

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
12/ 8/49	R. Warne	19	4	6.5 M.	Throat	10			Beneath upper petal		12/10/49	-	34	6	-	12/13/49
				7.2 M.	"	10										
				8.1 M.	"	10										
				7.1 M.	"	10										
"	"	20	6	7.8 M.	"	10					"	2	54	4	-	"
				7.3 M.	"	10										
				6.5 M.	"	10										
				6.7 M.	"	10										
				6.5 M.	"	10										
				7.2 M.	"	10										
"	"	21	3	7.3 M.	"	10	1	3.2 M.	"	10	"	1	36	2	1	12/14/49
				6.4 M.	"	10										
				7 M.	"	10										
"	"	22	3	6.4 M.	"	10					"	-	24	5	1	"
				5.1 M.	"	10										
				7.2 M.	"	10										
"	"	23	2	7.2 M.	"	10	1	2.1 M.	"	10	"	1	23	5	1	"
				6.3 M.	"	10										
"	"	24	3	6.6 M.	"	10					"	-	30	-	-	"
				7.1 M.	"	10										
				8.1 M.	"	10										
"	"	25	2	6.4 M.	"	10					"	-	18	2	-	"
				6.2 M.	"	10										

12/ 8/49 100 eggs held for viability test. Incubation period 36-68 hours. Percentage of hatch 93 percent.

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
12/15/49	R. Warne	1	4	8 M.	Throat	10	1	1.5 M.	Beneath upper petal	10	12/16/49	2	44	3	1	12/18/49
				5.7 M.	"	10										
				8.1 M.	"	10										
				7.2 M.	"	10										
"	"	2	4	7.1 M.	"	10					"	-	37	3	-	"
				8.2 M.	"	10										
				8 M.	"	10										
				6.3 M.	"	10										
"	"	3	3	7.1 M.	"	10					"	1	25	3	1	"
				7.2 M.	"	10										
				8 M.	"	10										
"	"	4	3	7 M.	"	10	1	2.1	"	10	"	-	34	5	1	12/17/49
				6.7 M.	"	10										
				8 M.	"	10										
"	"	5	5	8.1 M.	"	10					"	4	41	4	1	12/18/49
				6.4 M.	"	10										
				7.3 M.	"	10										
				8.2 M.	"	10										
				7 M.	"	10										
"	"	6	3	8 M.	"	10					"	1	28	1	-	"
				7.2 M.	"	10										
				6.2 M.	"	10										

First half = *Vanda Joaquim* var. Juliet, No. 1-14
Second half = *Vanda Joaquim* var. Atherton, No. 15-25

INFESTATION OF *VANDA JOAQUIM* SPIKES WITH EGGS OF *D. DORSALIS*

			FLOWERS		INFESTED		BUDS		INFESTED		HATCH	EGGS		LARVAE		NO SURVIVORS
DATE	SOURCE	SPIKE	NO.	DIAMETER	PART.	EGGS	NO.	DIAMETER	PART.	EGGS	OBSERVED	UNHATCH.	COL.	DEAD	ALIVE	AFTER
12/15/49	R. Warne	7	4	7.3 M.	Throat	10			Beneath upper petal		12/16/49	2	34	4	-	12/18/49
				8.1 M.	"	10										
				6.6 M.	"	10										
				6.3 M.	"	10										
"	"	8	4	7.9 M.	"	10					"	3	32	3	2	"
				8.1 M.	"	10										
				6.4 M.	"	10										
				6.6 M.	"	10										
"	"	9	3	7.5 M.	"	10					"	-	29	1	-	"
				5.8 M.	"	10										
				6.8 M.	"	10										
"	"	10	3	8.1 M.	"	10					"	3	24	3	-	"
				7.3 M.	"	10										
				8 M.	"	10										
"	"	11	3	8.2 M.	"	10	1	2.4 M.	"	10	"	2	34	2	2	"
				7.3 M.	"	10										
				6.3 M.	"	10										
"	"	12	5	8.2 M.	"	10	1	2.5 M.	"	10	"	4	51	4	1	"
				7 M.	"	10										
				8 M.	"	10										
				6.4 M.	"	10										
				8.3 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
12/15/49	R. Warne	13	4	6.2 M.	Throat	10			Beneath upper petal		12/16/49	2	36	2	-	12/18/49
				7.1 M.	"	10										
				8 M.	"	10										
				6.4 M.	"	10										
"	"	14	4	7.2 M.	"	10					"	-	34	5	1	"
				7.1 M.	"	10										
				6.4 M.	"	10										
				7 M.	"	10										
"	"	15	3	7.1 M.	"	10					"	-	26	3	1	"
				6.7 M.	"	10										
				7.2 M.	"	10										
"	"	16	3	8.1 M.	"	10	1	1.7 M.	"	10	"	2	34	4	-	"
				8 M.	"	10										
				7.6 M.	"	10										
"	"	17	3	8 M.	"	10					"	1	29	-	-	"
				7.2 M.	"	10										
				7.1 M.	"	10										
"	"	18	3	8.1 M.	"	10	1	2.1 M.	"	10	"	4	31	3	2	"
				7.3 M.	"	10										
				7.1 M.	"	10										
"	"	19	3	7.3 M.	"	10					"	-	28	2	-	"
				7.1 M.	"	10										
				8 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
12/15/49	R. Warne	20	2	7.3 M.	Throat	10			Beneath upper petal		12/16/49	1	17	2	-	12/18/49
				8.1 M.	"	10										
"	"	21	2	7.2 M.	"	10					"	-	19	1	-	"
				7.5 M.	"	10										
"	"	22	2	7.4 M.	"	10					"	-	18	1	1	"
				7.3 M.	"	10										
"	"	23	4	7.3 M.	"	10					"	3	32	4	1	"
				7.3 M.	"	10										
				6.5 M.	"	10										
				7 M.	"	10										
"	"	24	3	7.1 M.	"	10	1	2.2 M.	"	10	"	2	36	2	-	"
				6.6 M.	"	10										
				7.3 M.	"	10										
"	"	25	3	7.1 M.	"	10					"	1	28	-	1	"
				7.2 M.	"	10										
				7.1 M.	"	10										
"	"	26	3	8 M.	"	10					"	3	24	3	-	"
				7.3 M.	"	10										
				7.1 M.	"	10										
"	"	27	2	8.1 M.	"	10	1	2.4 M.	"	10	"	-	26	3	1	"
				7.2 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
12/15/49	R. Warne	28	2	5.1 M.	Throat	10			Beneath upper petal		12/16/49	1	18	1	-	12/18/49
				6.3 M.	"	10										
"	"	29	2	5.2 M.	"	10					"	-	17	3	-	"
				6.4 M.	"	10										

12/15/49 100 eggs held for viability test. Incubation period 36-48 hours. Percentage of hatch 89 percent.

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

			FLOWERS		INFESTED		BUDS		INFESTED		HATCH	EGGS		LARVAE		NO SURVIVORS
DATE	SOURCE	SPIKE	NO.	DIAMETER	PART.	EGGS	NO.	DIAMETER	PART.	EGGS	OBSERVED	UNHATCH.	COL.	DEAD	ALIVE	AFTER
12/22/49	R. Warne	7	2	7.2 M. 7.4 M.	Throat "	10 10	1	3.6 M.	Beneath upper petal	10	12/23/49	2	24	4	-	12/26/49
"	"	8	2	7.6 M. 6.4 M.	" "	10 10	1	3.4 M.	"	10	"	-	28	2	-	"
"	"	9	2	8.1 M. 7.4 M.	" "	10 10					"	1	26	2	1	"
"	"	10	3	7.5 M. 7.2 M. 7.3 M.	" " "	10 10 10	1	3.3 M.	"	10	"	2	34	4	-	"
"	"	11	2	7.2 M. 7.3 M.	" "	10 10					"	1	15	3	1	"
"	"	12	1	5.1 M.	"	10	1	3.4 M.	"	10	"	-	17	3	-	"
"	"	13	2	5.4 M. 6.6 M.	" "	10 10					"	3	13	3	1	"
"	"	14	1	6.8 M.	"	10	1	3.5 M.	"	10	"	1	8	1	-	"
"	"	15	1	7.1 M.	"	10	1	4.6 M.	"	10	"	1	17	2	-	12/27/49
"	"	16	1	7 M.	"	10	1	3.2 M.	"	10	"	-	16	3	1	"
"	"	17	1	6.7 M.	"	10	1	3.3 M.	"	10	"	2	15	3	-	"

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
12/22/49	R. Warne	18	2	6.5 Mm. 7 Mm.	Throat "	10 10			Beneath upper petal		12/23/49	1	16	2	1	12/27/49
"	"	19	1	6.7 Mm.	"	10	1	3.3 Mm.	"	10	"	1	16	3	-	"
"	"	20	1	7.1 Mm.	"	10	1	4 Mm.	"	10	"	2	14	3	1	"
"	"	21	1	7 Mm.	"	10	1	3.2 Mm.	"	10	"	-	13	5	2	"
"	"	22	1	6.6 Mm.	"	10	1	3.4 Mm.	"	10	"	3	14	2	1	"
"	"	23	1	7.4 Mm.	"	10	1	3 Mm.	"	10	"	2	13	4	1	"
"	"	24	1	7.3 Mm.	"	10	1	3.2 Mm.	"	10	"	1	18	1	-	"
"	"	25	1	6.8 Mm.	"	10	1	3.4 Mm.	"	10	"	3	14	1	2	"
"	"	26	1	7.2 Mm.	"	10	1	2.7 Mm.	"	10	"	1	13	4	2	"
"	"	27	1	7 Mm.	"	10	1	3 Mm.	"	10	"	4	12	3	1	"
"	"	28	1	6.6 Mm.	"	10	1	2.8 Mm.	"	10	"	1	16	2	1	"
"	"	29	1	6.2 Mm.	"	10	1	2.1 Mm.	"	10	"	2	13	4	1	"
"	"	30	1	6.3 Mm.	"	10					"	2	7	1	-	"
"	"	31	1	6.4 Mm.	"	10					"	-	8	2	-	"

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
12/22/49	R. Warne	32	4	6.5 M.	Throat	10			Beneath upper petal		12/23/49	5	31	3	1	12/27/49
				6.7 M.	"	10										
				7 M.	"	10										
				6.6 M.	"	10										
"	"	33	5	7 M.	"	10	1	3.7 M.	"	10	"	7	48	3	2	"
				7.1 M.	"	10										
				6.1 M.	"	10										
				6.3 M.	"	10										
				6.5 M.	"	10										
"	"	34	6	7 M.	"	10					"	6	49	5	-	"
				7.2 M.	"	10										
				5.6 M.	"	10										
				5.4 M.	"	10										
				5.1 M.	"	10										
				5.7 M.	"	10										
"	"	35	8	7 M.	"	10					"	9	66	5	-	"
				8.1 M.	"	10										
				8 M.	"	10										
				6.4 M.	"	10										
				6.5 M.	"	10										
				6.4 M.	"	10										
				7.1 M.	"	10										
				7 M.	"	10										
"	"	36	2	6.4 M.	"	10					"	1	16	3	-	"
				7.1 M.	"	10										

12/22/49 100 eggs held for viability test. Incubation period 48-72 hours. Percentage of hatch 96 percent.

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
12/29/49	R. Warne	1	3	7 M.	Throat	10	1	3.1 M	Beneath	10	1/ 1/50	3	32	4	1	1/4/50
				6.5 M.	"	10			upper							
				6.7 M.	"	10			petal							
"	"	2	3	6.5 M.	"	10	1	4.1 M.	"	10	2	2	32	4	2	"
				6.6 M.	"	10										
				7 M.	"	10										
"	"	3	2	6.1 M.	"	10					"	1	16	3	-	"
				6.3 M.	"	10										
"	"	4	3	6.7 M.	"	10					"	3	23	3	1	"
				6.8 M.	"	10										
				7.1 M.	"	10										
"	"	5	3	7.1 M.	"	10	1	3.7 M.	"	10	"	5	31	3	1	"
				6.7 M.	"	10										
				6.5 M.	"	10										
"	"	6	4	5.6 M.	"	10	2	3.1 M.	"	10	"	8	44	6	2	"
				5.4 M.	"	10		3 M.	"	10						
				5.7 M.	"	10										
				6 M.	"	10										
"	"	7	3	6.5 M.	"	10					"	1	24	2	3	"
				6.4 M.	"	10										
				6.7 M.	"	10										

12/29/49 100 eggs held for viability test. Incubation period 65-75 hours. Percentage of hatch 92%.
Nos. 1-15 = *Vanda Joaquim* var. Juliet
Nos. 16-31 = *Vanda Joaquim* var. Atherton

INFESTATION OF VANDA JOAQUIN SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
12/29/49	R. Warne	8	4	6.3 M.	Throat	10			Beneath upper petal		1/1/50	6	32	2	-	1/4/50
				6.6 M.	"	10										
				6.5 M.	"	10										
				6.7 M.	"	10										
"	"	9	3	7.1 M.	"	10					"	5	23	2	-	"
				7 M.	"	10										
				6.6 M.	"	10										
"	"	10	7	6.2 M.	"	10	1	3 M.	"	10	"	9	66	4	1	"
				6.3 M.	"	10										
				6.5 M.	"	10										
				6.6 M.	"	10										
				6.7 M.	"	10										
				6.6 M.	"	10										
				7 M.	"	10										
"	"	11	4	6.1 M.	"	10					"	3	36	1	0	"
				6.7 M.	"	10										
				7 M.	"	10										
				6.8 M.	"	10										
"	"	12	3	6.7 M.	"	10	1	3.1 M.	"	10	"	4	31	2	3	"
				6.6 M.	"	10										
				7 M.	"	10										
"	"	13	3	6.8 M.	"	10	1	3.2 M.	"	10	"	5	28	5	2	"
				6.9 M.	"	10										
				6.5 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
12/29/49	R. Warne	14	3	7 M.	Throat	10	1	3.1 M.	Beneath upper petal	10	1/1/50	6	29	3	2	1/4/50
				6.8 M.	"	10										
				6.7 M.	"	10										
"	"	15	2	7.3 M.	"	10	1	3.6 M.	"	10	"	4	23	2	1	"
				7.2 M.	"	10										
"	"	16	2	7 M.	"	10					"	2	16	2	-	"
				7.1 M.	"	10										
"	"	17	2	7 M.	"	10	1	3.1 M.	"	10	"	2	24	1	3	"
				6.8 M.	"	10										
"	"	18	2	7 M.	"	10					"	4	14	2	-	"
				6.7 M.	"	10										
"	"	19	3	6.7 M.	"	10					"	5	21	4	-	"
				6.5 M.	"	10										
				6.8 M.	"	10										
"	"	20	2	6.8 M.	"	10					"	3	15	2	-	"
				7 M.	"	10										
"	"	21	3	7 M.	"	10					"	4	21	4	1	"
				6.5 M.	"	10										
				6.3 M.	"	10										
"	"	22	3	7 M.	"	10					"	-	26	4	-	"
				6.5 M.	"	10										
				6.3 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
12/29/49	R. Warne	23	3	7 M. 6.1 M. 6.3 M.	Throat " "	10 10 10			Beneath upper petal		1/1/50	3	21	4*	-	1/4/50
"	"	24	2	6.7 M. 6.6 M.	" "	10 10					"	3	14	3	-	"
"	"	25	2	6.1 M. 7 M.	" "	10 10					"	2	16	2	-	"
"	"	26	2	6.2 M. 6.5 M.	" "	10 10					"	3	15	2	-	"
"	"	27	2	6.3 M. 7 M.	" "	10 10	1	3.1 M.	"	10	"	5	21	2	2	"
"	"	28	2	7.1 M. 7.3 M.	" "	10 10	1	3.2 M.	"	10	"	4	23	1	2	"
"	"	29	2	6.9 M. 6.7 M.	" "	10 10	1	3.2 M.	"	10	"	3	24	1	2	"
"	"	30	1	6.8 M.	"	10	1	3.6 M.	"	10	"	4	13	1	2	"
"	"	31	1	6.4 M.	"	10	1	3.1 M.	"	10	"	2	14	3	1	"

12/29/49 100 eggs held for viability test. Incubation period 65-75 hours. Percentage of hatch 92%.

* Two eggs remain unaccounted for.

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/5/50	R. Warne	1	3	7.2 M. 7 M. 6.5 M.	Throat " "	10 10 10			Beneath upper petal		1/8/50	2	24	2	2	1/11/50
"	"	2	3	6.4 M. 6.6 M. 7 M.	" " "	10 10 10					"	3	26	1	0	"
"	"	3	3	6.5 M. 7.1 M. 7 M.	" " "	10 10 10					"	3	26	1	-	"
"	"	4	3	6.4 M. 6.8 M. 6.6 M.	" " "	10 10 10					"	-	27	3	-	"
"	"	5	2	6.7 M. 7.1 M.	" "	10 10	1	2.9 M.	"	10	"	1	27	-	2	"
"	"	6	2	7 M. 6.6 M.	" "	10 10	1	3.1 M.	"	10	"	4	22	3	1	"
"	"	7	3	6.7 M. 6.5 M. 6.8 M.	" " "	10 10 10					"	5	21	4	-	"
"	"	8	3	7.1 M. 6.6 M. 6.8 M.	" " "	10 10 10					"	4	23	3	-	"
"	"	9	2	6.4 M. 6.3 M.	" "	10 10	1	2.8 M.	"	10	"	5	22	1	2	"

Nos. 1 - 16 = *Vanda Joaquim* var. Juliet
Nos. 17 - 33 = *Vanda Joaquim* var. Atherton

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/5/50	R. Warne	10	2	7.1 M.	Throat	10	1	3.2 M.	Beneath upper petal	10	1/8/50	5	21	3	1	1/11/50
				6.4 M.	"	10										
"	"	11	3	7.2 M.	"	10					"	1	26	3	-	"
				7.1 M.	"	10										
				6.7 M.	"	10										
"	"	12	3	7 M.	"	10					"	4	23	3	-	"
				6.5 M.	"	10										
				6.8 M.	"	10										
"	"	13	2	6.7 M.	"	10	1	3.4 M.	"	10	"	4	22	2	2	"
				6.4 M.	"	10										
"	"	14	3	6.7 M.	"	10	1	2.8 M.	"	10	"	5	32	1	2	"
				6.2 M.	"	10										
				7 M.												
"	"	15	2	7 M.	"	10	1	2.6 M.	"	10	"	3	24	2	1	"
				6.7 M.	"	10										
"	"	16	2	6.5 M.	"	10	1	2.8 M.	"	10	"	2	20	2	3*	"
				6.3 M.	"	10										
"	"	17	2	7.1 M.	"	10	1	3.1 M.	"	10	"	4	23	2	1	"
				6.6 M.	"	10										
"	"	18	2	7 M.	"	10	1	2.8 M.	"	10	"	4	22	3	1	"
				6.4 M.	"	10										

* Three eggs remain unaccounted for.

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/5/50	R. Warne	19	2	6.7 M.	Throat	10	1	2.7 M.	Beneath upper petal	10	1/8/50	3	24	1	2	1/11/50
				7.2 M.	"	10										
"	"	20	2	5.8 M.	"	10	1	2.3 M.	"	10	"	1	26	2	1	"
				6.4 M.	"	10										
"	"	21	3	7.6 M.	"	10					"	3	27	-	-	"
				7.9 M.	"	10										
				6.7 M.	"	10										
"	"	22	2	6.7 M.	"	10	1	2.7 M.	"	10	"	5	22	2	1	"
				6.8 M.	"	10										
"	"	23	3	7 M.	"	10					"	1	29	-	-	"
				7.5 M.	"	10										
				6.7 M.	"	10										
"	"	24	3	7.2 M.	"	10					"	4	24	2	-	"
				7.5 M.	"	10										
				8 M.	"	10										
"	"	25	2	6.6 M.	"	10	1	2.8 M.	"	10	"	2	25	1	2	"
				7.1 M.	"	10										
"	"	26	3	7.2 M.	"	10					"	3	26	1	-	"
				7.5 M.	"	10										
				7.4 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

			FLOWERS		INFESTED		BUDS		INFESTED		HATCH	EGGS		LARVAE		NO SURVIVORS
DATE	SOURCE	SPIKE	NO.	DIAMETER	PART.	EGGS	NO.	DIAMETER	PART.	EGGS	OBSERVED	UNHATCH.	COL.	DEAD	ALIVE	AFTER
1/5/50	R. Warne	27	2	7.7 M.	Throat	10	1	3.4 M.	Beneath upper petal	10	1/8/50	2	26	-	2	1/11/50
				8 M.												
"	"	28	3	6.5 M.	"	10	1	3.1 M.	"	10	"	6	31	2	1	"
				7.2 M.	"	10										
				7.7 M.	"	10										
"	"	29	2	7.3 M.	"	10	1	3.2 M.	"	10	"	4	23	1	2	"
				7 M.	"	10										
"	"	30	2	7.2 M.	"	10	1	4 M.	"	10	"	4	22	3	1	"
				6.6 M.	"	10										
"	"	31	2	7 M.	"	10	1	3.7 M.	"	10	"	3	24	2	1	"
				7.2 M.	"	10										
"	"	32	2	6.5 M.	"	10	1	3.2 M.	"	10	"	5	21	3	1	"
				7.1 M.	"	10										
"	"	33	2	7 M.	"	10					"	3	16	1	-	"
				6.7 M.	"	10										

1/5/50 100 eggs held for viability test. Incubation period 48-72 hours. Percentage of hatch 86%.

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/12/50	R. Warne	1	3	7.8 M. 8 M. 7.9 M.	Throat " "	10 10 10	1	1.5 M.	Beneath upper petal	10	1/15/50	4	31	4	1	1/18/50
"	"	2	3	7.6 M. 6 M. 8 M.	" " "	10 10 10					"	3	24	3	-	"
"	"	3	3	7.6 M. 7.5 M. 4.2 M.	" " "	10 10 10					"	3	23	4	-	"
"	"	4	3	7.5 M. 7.8 M. 7.4 M.	" " "	10 10 10	1	1.6 M.	"	10	"	4	23	3	-	"
"	"	5	3	7.5 M. 4.6 M. 7.4 M.	" " "	10 10 10					"	5	22	1	2	"
"	"	6	3	7.4 M. 7.6 M. 6.6 M.	" " "	10 10 10					"	4	21	3	2	"
"	"	7	3	6.5 M. 8 M. 7 M.	" " "	10 10 10					"	4	23	3	-	"

Nos. 1 - 15 = *Vanda Joaquim* var. Juliet
Nos. 16 - 31 = *Vanda Joaquim* var. Atherton

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/12/50	R. Warne	8	3	6.4 M.	Throat	10			Beneath upper petal		1/15/50	3	23	4	-	1/18/50
				6.9 M.	"	10										
				4.9 M.	"	10										
"	"	9	3	6.6 M.	"	10					"	4	24	-	2	"
				6.6 M.	"	10										
				6.8 M.	"	10										
"	"	10	2	8.6 M.	"	10	1	1.9 M.	"	10	"	5	22	2	1	"
				6.4 M.	"	10										
"	"	11	3	5.8 M.	"	10					"	1	26	3	-	"
				7.9 M.	"	10										
				8 M.	"	10										
"	"	12	3	8.6 M.	"	10					"	3	26	1	-	"
				7 M.	"	10										
				8.8 M.	"	10										
"	"	13	3	7.6 M.	"	10	1	1.5	"	10	"	5	31	3	1	"
				7.6 M.	"	10										
				7.4 M.	"	10										
"	"	14	3	6.8 M.	"	10	1	1.5 M.	"	10	"	4	31	2	3	"
				7 M.												
				6.6 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/12/50	R. Warne	15	3	6.4 M.	Throat	10	1	1.4 M.	Beneath	10	1/15/50	7	31	-	2	1/18/50
				7.6 M.	"	10										
				7.5 M.	"	10										
"	"	16	3	7.9 M.	"	10	1	1.4 M.	"	10	"	6	28	5	1	"
				8.2 M.	"	10										
				6.7 M.	"	10										
"	"	17	3	8.5 M.	"	10	1	1.7 M.	"	10	"	6	27	4	3	"
				7.1 M.	"	10										
				6.7 M.	"	10										
"	"	18	4	8 M.	"	10					"	8	31	1	-	"
				6.4 M.	"	10										
				6.8 M.	"	10										
				7.4 M.	"	10										
"	"	19	3	7 M.	"	10					"	2	26	2	-	"
				4.4 M.	"	10										
				8.8 M.	"	10										
"	"	20	3	7.3 M.	"	10					"	3	24	3	-	"
				6.6 M.	"	10										
				7.4 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/12/50	R. Warne	21	4	6.6 M.	Throat	10			Beneath upper petal		1/15/50	4	32	4	-	1/12/50
				7.4 M.	"	10										
				5.4 M.	"	10										
				5.5 M.	"	10										
"	"	22	3	7.4 M.	"	10					"	2	26	1	1	"
				6.7 M.	"	10										
				7.5 M.	"	10										
"	"	23	3	7.3 M.	"	10					"	2	25	3	-	"
				6.7 M.	"	10										
				6.9 M.	"	10										
"	"	24	2	7.6 M.	"	10	1	1.9 M.	"	10	"	4	22	2	2	"
				7.3 M.												
"	"	25	3	7.4 M.	"	10	1	1.5 M.	"	10	"	4	22	3	1	"
				7.5 M.	"	10										
				6.9 M.	"	10										
"	"	26	3	7.4 M.	"	10					"	5	22	3	-	"
				4.9 M.	"	10										
				5.3 M.	"	10										
"	"	27	3	7.4 M.	"	10					"	4	24	2	-	"
				7.9 M.	"	10										
				7.7 M.	"	10										
"	"	28	2	7.9 M.	"	10					"	1	28	1	-	"
				8.5 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF *D. DORSALIS*

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/12/50	R. Warne	29	2	6.7 M.	Throat	10	1	1.6 M.	Beneath	10	1/15/50	2	26	-	2	1/18/50
				6.9 M.	"	10										
"	"	30	2	7.5 M.	"	10					"	2	15	3	-	"
				5.7 M.	"	10										
"	"	31	3	5.9 M.	"	10					"	3	23	4	-	"
				7.4 M.	"	10										
				6.8 M.	"	10										

1/12/50 100 eggs held for viability test. Incubation period 48-72 hours. Percentage of hatch 93%.

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/19/50	R. Warne	1	3	7.3 M.	Throat	10	1	1.3 M.	Beneath upper petal	10	1/21/50	5	31	2	2	1/23/50
				4.4 M.	"	10										
				6.6 M.	"	10										
"	"	2	3	6.9 M.	"	10	1	1.8 M.	"	10	"	6	29	3	2	"
				6 M.	"	10										
				7.8 M.	"	10										
"	"	3	3	6.3 M.	"	10	1	1.4 M.	"	10	"	5	31	3	1	"
				7.5 M.	"	10										
				7.7 M.	"	10										
"	"	4	3	7.5 M.	"	10	1	1.7 M.	"	10	"	4	32	2	2	"
				6.5 M.	"	10										
				6.5 M.	"	10										
"	"	5	3	6.2 M.	"	10	1	1.4 M.	"	10	"	5	30	4	1	"
				6.9 M.	"	10										
				7.2 M.	"	10										
"	"	6	3	6.7 M.	"	10	1	1.8 M.	"	10	"	6	28	4	2	"
				7.1 M.	"	10										
				7.2 M.	"	10										
"	"	7	4	6.1 M.	"	10					"	5	32	2	1	"
				7.3 M.	"	10										
				5.9 M.	"	10										
				7 M.	"	10										

Nos. 1-12 = *Vanda Joaquim* var. Juliet
Nos. 13-25 = *Vanda Joaquim* var. Atherton

INFESTATION OF *VANDA JOAQUIM* SPIKES WITH EGGS OF *D. DORSALIS*

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/19/50	R. Warne	8	4	6.2 M.	Throat	10			Beneath upper petal		1/21/50	4	34	2	-	1/23/50
				5.9 M.	"	10										
				7.6 M.	"	10										
				6.9 M.	"	10										
"	"	9	4	7.1 M.	"	10	1	1.7 M.	"	10	"	6	41	2	1	"
				6.2 M.	"	10										
				7.4 M.	"	10										
				7.1 M.	"	10										
"	"	10	3	7.4 M.	"	10	1	1.6 M.	"	10	"	4	32	2	2	"
				6.9 M.	"	10										
				7 M.	"	10										
"	"	11	3	7.2 M.	"	10	1	1.2 M.	"	10	"	5	32	2	1	"
				7.1 M.	"	10										
				7.7 M.	"	10										
"	"	12	3	7.3 M.	"	10	1	1.3 M.	"	10	"	7	30	1	2	"
				7.9 M.	"	10										
				6.3 M.	"	10										
"	"	13	3	7.8 M.	"	10	1	1.4 M.	"	10	"	3	29	6	2	"
				6.6 M.	"	10										
				6.8 M.	"	10										
"	"	14	3	7.9 M.	"	10	1	1.4 M.	"	10	"	6	31	1	2	"
				7.2 M.	"	10										
				7.2 M.	"	10										

INFESTATION OF *VANDA JOAQUIM* SPIKES WITH EGGS OF *D. DORSALIS*

			FLOWERS		INFESTED		BUDS		INFESTED		HATCH	EGGS		LARVAE		NO SURVIVORS
DATE	SOURCE	SPIKE	NO.	DIAMETER	PART.	EGGS	NO.	DIAMETER	PART.	EGGS	OBSERVED	UNHATCH.	COL.	DEAD	ALIVE	AFTER
1/19/50	R. Warne	15	4	8.1 M.	Throat	10			Beneath upper petal		1/21/50	3	32	4	1	1/23/50
				7.9 M.	"	10										
				5.3 M.	"	10										
				8.3 M.	"	10										
"	"	16	3	7.4 M.	"	10	1	1.5 M.	"	10	"	6	30	2	2	"
				7 M.	"	10										
				7.3 M.	"	10										
"	"	17	3	6.7 M.	"	10	1	1.9 M.	"	10	"	3	34	3	-	"
				7.3 M.	"	10										
				7 M.												
"	"	18	3	8.1 M.	"	10	1	1.8 M.	"	10	"	4	32	3	1	"
				7.7 M.	"	10										
				7.1 M.	"	10										
"	"	19	4	7.1 M.	"	10					"	5	33	2	-	"
				7.4 M.	"	10										
				5.6 M.	"	10										
				7.5 M.	"	10										
"	"	20	3	5.7 M.	"	10					"	2	26	2	-	"
				4.9 M.	"	10										
				6.8 M.	"	10										
"	"	21	3	6.1 M.	"	10	1	1.6 M.	"	10	"	6	28	5	1	"
				7.2 M.	"	10										
				6.9 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/19/50	R. Warne	22	3	7.5 M. 8 M. 7.8 M.	Throat " "	10 10 10	1	1.3 M.	Beneath upper petal	10	1/21/50	6	29	3	2	1/23/50
"	"	23	3	7.2 M. 7.1 M. 6.8 M.	" " "	10 10 10	1	1.4 M.	"	10	"	3	31	4	2	"
"	"	24	3	7 M. 6.8 M. 7.8 M.	" " "	10 10 10	1	1.5 M.	"	10	"	5	33	1	1	"
"	"	25	3	6.9 M. 7.1 M. 7.3 M.	" " "	10 10 10	1	1.2 M.	"	10	"	2	35	1	2	"

100 eggs held for viability test. Incubation period 24-48 hours. Percentage of hatch 94%.

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/26/50	R. Warne	7	5	5 M.	Throat	10			Beneath upper petal		1/28/50	4	42	3	1	1/30/50
				7.4 M.	"	10										
				7.3 M.	"	10										
				9.9 M.	"	10										
				6.1 M.	"	10										
"	"	8	4	6.2 M.	"	10	1	1.6 M.	"	10	"	5	40	2	3	"
				5.9 M.	"	10										
				7.1 M.	"	10										
				7.4 M.	"	10										
"	"	9	4	7 M.	"	10					"	4	32	4	-	"
				7.3 M.	"	10										
				6.8 M.	"	10										
				6 M.	"	10										
"	"	10	4	7.2 M.	"	10					"	1	34	4	1	"
				6.8 M.	"	10										
				6.4 M.	"	10										
				7.7 M.	"	10										
"	"	11	4	7.5 M.	"	10					"	6	31	2	1	"
				7.9 M.	"	10										
				5.2 M.	"	10										
				7.4 M.	"	10										
"	"	12	4	7.4 M.	"	10					"	5	32	3	-	"
				7.1 M.	"	10										
				7.2 M.	"	10										
				6.8 M.	"	10										
"	"	13	4	7 M.	"	10					"	3	35	2	-	"
				6.8 M.	"	10										
				7.2 M.	"	10										
				7.4 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/26/50	R. Warne	14	4	6.4 M.	Throat	10			Beneath upper petal		1/28/50	6	31	3	-	1/30/50
				6.1 M.	"	10										
				5.9 M.	"	10										
				7.1 M.	"	10										
"	"	15	4	8.1 M.	"	10					"	2	34	3	1	"
				6.2 M.	"	10										
				8.3 M.	"	10										
				8.3 M.	"	10										
"	"	16	4	7.2 M.	"	10					"	4	33	3	-	"
				6.8 M.	"	10										
				7 M.	"	10										
				7.3 M.	"	10										
"	"	17	4	7.9 M.	"	10					"	3	31	5	1	"
				4.8 M.	"	10										
				6.9 M.	"	10										
				7.2 M.	"	10										
"	"	18	4	6.9 M.	"	10					"	5	33	2	-	"
				7.1 M.	"	10										
				7.4 M.	"	10										
				7.6 M.	"	10										
"	"	19	4	7 M.	"	10	1	1.8 M.	"	10	"	2	43	4	1	"
				7.4 M.	"	10										
				6.8 M.	"	10										
				7.5 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
1/26/50	R. Warne	20	4	3.8 M.	Throat	10			Beneath upper petal		1/28/50	4	31	5	-	1/30/50
				7.4 M.	"	10										
				7 M.	"	10										
				7.1 M.	"	10										
"	"	21	3	7.1 M.	"	10	1	1.8 M.	"	10	"	2	34	1	3	"
				6.9 M.	"	10										
				7.2 M.	"	10										
"	"	22	4	7 M.	"	10					"	3	35	2	-	"
				6.9 M.	"	10										
				6.9 M.	"	10										
				6.8 M.	"	10										
"	"	23	3	3.3 M.	"	10					"	-	22	6	2	"
				6.8 M.												
				7 M.												

1/26/50 100 eggs held for viability test. Incubation period 24-48 hours. Percentage of hatch 90%.

INFESTATION OF *VANDA JOAQUIM* SPIKES WITH EGGS OF *D. DORSALIS*

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
2/2/50	R. Warne	1	4	7.8 M.	Throat	10	1	1.4 M.	Beneath	10	2/5/50	5	38	5	2	2/8/50
				6.5 M.	"	10			upper							
				8.2 M.	"	10			petal							
				6.9 M.	"	10										
"	"	2	4	8.4 M.	"	10	1	1.8 M.	"	10	"	4	39	4	3	"
				7.6 M.	"	10										
				7.2 M.	"	10										
				7 M.	"	10										
"	"	3	5	7.5 M.	"	10					"	4	42	4	-	"
				5.1 M.	"	10										
				7.5 M.	"	10										
				6.4 M.	"	10										
				7.1 M.	"	10										
"	"	4	4	7.4 M.	"	10	1	1.3 M.	"	10	"	6	41	1	2	"
				7.2 M.	"	10										
				6.8 M.	"	10										
				6.9 M.	"	10										
"	"	5	4	7.9 M.	"	10	1	1.6 M.	"	10	"	5	39	4	2	"
				8 M.	"	10										
				6.8 M.	"	10										
				7.1 M.	"	10										
"	"	6	4	7.4 M.	"	10	1	1.4 M.	"	10	"	6	41	1	2	"
				7.2 M.	"	10										
				7.4 M.	"	10										
				8 M.	"	10										

Nos. 1-11 = *Vanda Joaquim* var. Juliet
Nos. 12-23 = *Vanda Joaquim* var. Atherton

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
2/2/50	R. Warne	7	4	7.4 M.	Throat	10	1	1.6 M.	Beneath upper petal	10	2/5/50	4	43	2	1	2/8/50
				7.3 M.	"	10										
				7.2 M.	"	10										
				7.8 M.	"	10										
"	"	8	4	7.1 M.	"	10	1	1.4 M.	"	10	"	3	44	1	2	"
				6.6 M.	"	10										
				7.4 M.	"	10										
				7.1 M.	"	10										
"	"	9	4	7.8 M.	"	10	1	1.3 M.	"	10	"	4	39	4	3	"
				7.2 M.	"	10										
				6.8 M.	"	10										
				7 M.	"	10										
"	"	10	3	8 M.	"	10	1	2.1 M.	"	10	"	2	34	3	1	"
				7.6 M.	"	10										
				6.6 M.	"	10										
"	"	11	3	7.2 M.	"	10	1	1.4 M.	"	10	"	1	36	2	1	"
				7.1 M.	"	10										
				7.6 M.	"	10										
"	"	12	3	7.5 M.	"	10	1	1.3 M.	"	10	"	-	34	4	2	"
				7.6 M.	"	10										
				7.1 M.	"	10										
"	"	13	3	7.6 M.	"	10	1	1.4 M.	"	10	"	2	35	2	1	"
				7.2 M.	"	10										
				7.4 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
2/2/50	R. Warne	14	4	7 M.	Throat	10			Beneath upper petal		2/5/50	3	34	3	-	2/8/50
				7.2 M.	"	10										
				7.8 M.	"	10										
				7.4 M.	"	10										
"	"	15	4	6 M.	"	10					"	2	33	5	-	"
				6.9 M.	"	10										
				7.2 M.	"	10										
				7.6 M.	"	10										
"	"	16	4	7.3 No.	"	10					"	4	32	4	-	"
				5.5 M.	"	10										
				6.9 M.	"	10										
				7.8 M.	"	10										
"	"	17	3	7.2 M.	"	10	1	1.4 M.	"	10	"	3	32	3	2	"
				7.4 M.	"	10										
				7.6 M.	"	10										
"	"	18	3	7 M.	"	10	1	1.9 M.	"	10	"	3	34	1	2	"
				7.2 M.	"	10										
				7.6 M.	"	10										
"	"	19	4	7.1 M.	"	10					"	4	32	3	1	"
				7.3 M.	"	10										
				7.5 M.	"	10										
				7.2 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPKKE	FLOWERS NO.	FLOWERS DIAMETER	INVESTED PART.	INVESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
2/2/50	R. Warne	20	4	7.2 M.	Throat	10			Beneath upper petal		2/5/50	3	31	4	2	2/8/50
				6.9 M.	"	10										
				7.4 M.	"	10										
				7.3 M.	"	10										
"	"	21	4	7 M.	"	10					"	2	33	4	1	"
				7.1 M.	"	10										
				6.8 M.	"	10										
				6.7 M.	"	10										
"	"	22	4	7.1 M.	"	10					"	3	32	4	1	"
				6.9 M.	"	10										
				7.4 M.	"	10										
				7.9 M.	"	10										
"	"	23	3	7.8 M.	"	10					"	4	24	2	-	"
				7.6 M.	"	10										
				6.9 M.	"	10										

2/2/50 100 eggs held for viability test. Incubation period 24-48 hours. Percentage of hatch 90%.

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
2/9/50	R. Warne	6	5	8.3 M.	Throat	10			Beneath upper petal		2/12/50	4	42	4	-	2/15/50
				8.2 M.	"	10										
				8.4 M.	"	10										
				8.4 M.	"	10										
				7.6 M.	"	10										
"	"	7	5	7.8 M.	"	10					"	3	44	2	1	"
				6.8 M.	"	10										
				4 M.	"	10										
				7.3 M.	"	10										
				7.7 M.	"	10										
"	"	8	5	5.5 M.	"	10					"	4	42	3	1	"
				6.8 M.	"	10										
				6 M.	"	10										
				4.9 M.	"	10										
				7.1 M.	"	10										
"	"	9	4	8.2 M.	"	10	1	1.5 M.	"	10	"	5	41	1	3	"
				7.9 M.	"	10										
				7.5 M.	"	10										
				7.8 M.	"	10										
"	"	10	4	7.8 M.	"	10	1	1.6 M.	"	10	"	3	42	3	2	"
				7.6 M.	"	10										
				7 M.	"	10										
				7.6 M.	"	10										

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
2/9/50	R. Warne	11	5	7.2 M.	Throat	10			Benaath upper petal		2/12/50	4	41	2	2*	2/15/50
				5.3 M.	"	10										
				7.5 M.	"	10										
				6.5 M.	"	10										
				6.5 M.	"	10										
"	"	12	5	7.2 M.	"	10					"	8	36	6	-	"
				3.7 M.	"	10										
				7.4 M.	"	10										
				6.9 M.	"	10										
				7.6 M.	"	10										
"	"	13	4	6.9 M.	"	10	1	1.8 M.	"	10	"	3	39	5	3	"
				7.2 M.	"	10										
				6.8 M.	"	10										
				7 M.	"	10										
"	"	14	4	6.2 M.	"	10	1	1.4 M.	"	10	"	4	38	4	4	"
				7.1 M.	"	10										
				6.8 M.	"	10										
				7.6 M.	"	10										
"	"	15	4	8.1 M.	"	10	1	1.4 M.	"	10	"	5	43	-	2	"
				7.6 M.	"	10										
				7 M.	"	10										
				7.8 M.2	"	10										

* 1 egg remains unaccounted for.

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF *D. DORSALIS*

			FLOWERS		INFESTED		BUDS		INFESTED		HATCH	EGGS		LARVAE		NO SURVIVORS
DATE	SOURCE	SPIKE	NO.	DIAMETER	PART.	EGGS	NO.	DIAMETER	PART.	EGGS	OBSERVED	UNHATCH.	COL.	DEAD	ALIVE	AFTER
2/9/50	R. Warne	16	5	7.9 M.	Throat	10			Beneath upper petal		2/12/50	4	42	2	2	2/15/50
				7.6 M.	"	10										
				6.9 M.	"	10										
				8.1 M.	"	10										
				7.6 M.	"	10										
"	"	17	5	4.2 M.	"	10					"	3	44	2	1	"
				6.9 M.	"	10										
				7.8 M.	"	10										
				7.9 M.	"	10										
				7.4 M.	"	10										
"	"	18	4	7.1 M.	"	10	1	1.5 M.	"	10	"	4	42	1	3	"
				7.6 M.	"	10										
				7.9 M.	"	10										
				8.2 M.	"	10										
"	"	19	3	7.9 M.	"	10	1	1.4 M.	"	10	"	2	31	3	4	"
				7.6 M.	"	10										
				8 M.	"	10										

2/9/50 100 eggs held for viability test. Incubation period 37-49 hours. Percentage hatch 91%.

INFESTATION OF VANDA JOAQUIM S IKES WITH EGGS OF D. DORSALIS

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO SURVIVORS AFTER
2/9/50	R. Warne	1	6	6.1 M.	Throat	10	1	1.3 M.	Beneath upper petal	10	2/12/50	7	59	1	3	2/15/50
				8.2 M.	"	10										
				7.6 M.	"	10										
				8.2 M.	"	10										
				7 M.	"	10										
				7.5 M.	"	10										
"	"	2	5	8.1 M.	"	10	1	1.3 M.	- "	10	"	4	52	2	2	"
				7.6 M.	"	10										
				7.9 M.	"	10										
				8.2 M.	"	10										
				8 M.	"	10										
"	"	3	6	7.2 M.	"	10					"	4	51	3	2	"
				7.9 M.	2	10										
				7.6 M.	"	10										
				7.7 M.	"	10										
				7.3 M.	"	10										
				7.5 M.	"	10										
"	"	4	5	6.9 M.	"	10	1	1.6 M.	"	10	"	4	50	3	3	"
				6.8 M.	"	10										
				7.3 M.	"	10										
				6.5 M.	"	10										
				7.9 M.	"	10										
"	"	5	6	7 M.	"	10					"	5	47	6	2	"
				7.4 M.	"	10										
				7.3 M.	"	10										
				7.1 M.	"	10										
				7.6 M.	"	10										
				7.4 M.	"	10										

INFESTATION OF *VANDA JOAQUIM* SPIKES WITH EGGS OF *D. DORSALIS*

DATE	SOURCE	SPIKE	FLOWERS NO.	FLOWERS DIAMETER	INFESTED PART.	INFESTED EGGS	BUDS NO.	BUDS DIAMETER	INFESTED PART.	INFESTED EGGS	HATCH OBSERVED	EGGS UNHATCH.	EGGS COL.	LARVAE DEAD	LARVAE ALIVE	NO. SURVIVORS AFTER
1/26/50	R. Warne	1	5	8.4 M.	Throat	10	1	1.1 M.	Beneath upper petal	10	1/28/50	8	47	4	1	1/30/50
				7.3 M.	"	10										
				8.1 M.	"	10										
				6.2 M.	"	10										
				8.4 M.	"	10										
"	"	2	5	8 M.	"	10	1	1.8 M.	"	10	"	7	49	1	3	"
				7.2 M.	"	10										
				6.4 M.	"	10										
				6.9 M.	"	10										
				7.2 M.	"	10										
"	"	3	4	7.2 M.	"	10	1	1.5 M.	"	10	"	4	42	2	2	"
				6.8 M.	"	10										
				6.4 M.	"	10										
				6.8 M.	"	10										
"	"	4	5	6.6 M.	"	10					"	4	41	4	1	"
				6.8 M.	"	10										
				4.8 M.	"	10										
				6.9 M.	"	10										
				7.1 M.	"	10										
"	"	5	4	6.4 M.	"	10					"	3	36	1	-	"
				7.1 M.	"	10										
				7.1 M.	"	10										
				7.3 M.	"	10										
"	"	6	4	6.5 M.	"	10					"	1	36	3	-	"
				6.6 M.	"	10										
				4.7 M.	"	10										
				7 M.	"	10										

Nos. 1-11 = *Vanda Joaquim* var. Juliet
Nos. 12-23 = *Vanda Joaquim* var. Atherton

INFESTATION OF VANDA JOAQUIM SPIKES WITH EGGS OF D. DORSALIS

			FLOWERS		INFESTED		BUDS		INFESTED		HATCH	EGGS		LARVAE		NO SURVIVORS
DATE	SOURCE	SPIKE	NO.	DIAMETER	PART.	EGGS	NO.	DIAMETER	PART.	EGGS	OBSERVED	UNHATCH.	COL.	DEAD	ALIVE	AFTER
12/22/49	R. Warne	1	4	6.7 M.	Throat	10			Beneath		12/23/49	3	34	3	-	12/26/49
				6.5 M.	"	10			upper							
				6.3 M.	"	10			petal							
				6.4 M.	"	10										
"	"	2	4	5.3 M.	"	10					"	1	33	4	2	"
				7.1 M.	"	10										
				6.7 M.	"	10										
				6.2 M.	"	10										
"	"	3	5	7.1 M.	"	10					"	6	41	2	1	"
				6.4 M.	"	10										
				7.2 M.	"	10										
				6 M.	"	10										
				6.3 M.	"	10										
"	"	4	3	7.1 M.	"	10					"	-	27	3	-	"
				6.4 M.	"	10										
				6.3 M.	"	10										
"	"	5	2	6.2 M.	"	10	1	4.1 M.	"	10	"	2	23	4	1	"
				7 M.	"	10										
"	"	6	2	6.1 M.	"	10	1	2.3 M.	"	10	"	1	22	5	2	"
				7.1 M.	"	10										

Nos. 1-18 = *Vanda Joaquim* var. Juliet
Nos. 19-36 = *Vanda Joaquim* var. Atherton

Line Project I-o-1-5 - Population Trends.

Population Trends on Maui (K. L. Maehler)

It was pointed out in the December Quarterly Report that the population of Dacus dorsalis was on the decline. It is now equally evident that the low leveling off point has been reached during the winter months of December, January and February, and that the fly is at present rapidly increasing. During the decline period an attempt was made to ascertain what factors were instrumental in causing this drop in fly incidence. Host availability, climate, parasites, all have been credited with causing the decline. Now, that the trend is upward, it is possible to balance one factor against another and observe what changes, if any, have taken place in the environment which hasallowed the fly to increase.

If parasites had been instrumental in causing this decline, we would have expected the fly population to level off after an equilibrium had been reached. The number of recoveries of parasites have increased in the last six months which indicates they are exerting more pressure; however, inspite of this pressure, the trend is markedly upward as far as the fly is concerned.

Climate has undoubtedly had an effect on the flies at the higher elevations. At the lower levels where the greater number of flies are ordinarily found, temperature does not appear to be the limiting factor. At Haiku where the lowest absolute temperature recorded was 55 degrees, there has certainly not been any change sufficient to reflect the sharp drop and recovery.

Increased rainfall may have contributed to fly mortality in many localities. At Olinda and at Haiku and Pauwela, the trend downward was marked by an increase in precipitation. In October at Haiku, there were 1.3 inches. In the next four months there were 30 inches of rain. At Olinda in October there were 1.3 inches. In the next four months there were 27 inches. However, in March, Haiku had 13.07 and Olinda 6.61 which would not indicate that the ppt. was any less. In other words, the population is building up inspite of continued heavy rain.

During the winter months, host availability appears to be the factor which is responsible for the decline. Guava, false kamani, mango all were out of season. Citrus hit its peak of production during this period but in the writer's opinion it does not constitute a good host with the possible exception of tangerine. At any rate, the few yard-grown trees are not at all comparable to a grove of false kamani or a gulch of guava. In March a few early maturing mango were found, guava was beginning to fruit and at the higher elevation loquat, an excellent host, hit its peak.

That appears to be the story. Absolute temperatures have not changed greatly during the rise and fall of the fly population. Parasites have generally increased. Only in the availability of host material has there been a major change in the picture.

In the following graphs an attempt has been made to incorporate some of the factors which might be correlated with population trends. The fly counts have been expressed as flies trapped per day per trap, and the total index indicated for a month. Positional variation has been reduced by getting the total from five traps and daily fluctuation has been masked by showing a monthly index.

Meteorological Conditions and Populations on Hawaii*

Keanakolu Orchard

A total of 174 male flies have been trapped in the orchard since January 3, 1950. The highest weekly total occurred in March when 58 flies were trapped. These populations appear to be steadily increasing. The depression shown on Fig. 26 is probably due to inclement weather. The wild passion fruit (Mohihi), Passiflora mollissima is very abundant in the forests adjacent to the orchard and undoubtedly this is the main reservoir of infestation.

Keanakolu-Ookala Trail

There was a considerable increase in fly population on the Keanakolu-Ookala Trail where the fly count increased from 3,376 to 37,558. The change to Ceylon citronella and dental rolls took place in December and this may have increased the trap catch to some extent. Guava fruit was plentiful in the gulches flanking the lower end of the trail and undoubtedly accounts for much of the upsurge. The mean maximum temperature for the lower portion of the trail (2040') was approximately 86 degrees F. and at the middle of the trail it was 74 degrees. This factor probably stimulated fly activity over a wide area. The population at the higher portion of the trail and in the orchard undoubtedly are being built up by the continuous presence of wild host fruit, Passiflora mollissima. Recoveries have been made from this host at the orchard and recent developments on another native fruit, (Akala), Rubus hawaiiensis, indicates that it too, may be another host and a new record. Some increase is also attributed to methyl eugenol index traps which were removed January 17th.

Mauna Loa Truck Trail

Jerusalem cherries came into season at 4000' and 4250' on the M.L.T.T. about the middle of March and had little, if anything, to do with the large population on the trail. Only one of the many lots of native fruits collected in the vicinity yielded dorsalis and this was the ohelo berry, Vaccinium reticulatum.

The depression and peak of these populations took place on the week ending January 4th and March 20th. On January 4th no flies were recorded above 4360'. On March 20th an unusually big upsurge took place throughout the entire trail. It is known that inclement weather which prevails during the latter part of December and the early part of January was well distributed over this period and apparently restricted fly activity. It is worthy of note that frost occurred in many places in this region shortly before Christmas and killed many of the plants. The apparent scarcity of suitable host material during the months of January and February makes it difficult to account for the steady increase in flies over the area.

Waikii

Low populations of dorsalis continues at this station, which was frequently blanked by fog in the afternoon and stiff winds prevailed from time to time. Weather conditions rather than lack of host availability may be the limiting factors of fly population at the orchard during the winter months.

* Extracted from Davis' Quarterly Report

TABLE NO. 44

Station	Elev.	Days	Traps	TD	Fly Count	Index	Month
Haiku, Nursery	500'	21	5	105	71,960	685	Oct.
		31	5	155	63,458	409	Nov.
		29	5	145	23,080	159	Dec.
		35	5	175	42,919	245	Jan.
		28	5	140	27,879	199	Feb.
		28	5	140	59,317	423	Mar.
Pauwela, Baldwin's	400'	19	5	85	32,320	340	Oct.
		31	5	155	22,768	196	Nov.
		29	5	145	4,261	29	Dec.
		35	5	175	16,452	94	Jan.
		28	5	140	9,542	68	Feb.
		28	5	140	38,050	271	Mar.
Olinda, Guava Gulch	2160'	11	5	55	17,502	318	Nov.
		29	5	145	26,085	179	Dec.
		35	5	175	25,706	146	Jan.
		28	5	140	11,753	83	Feb.
		28	5	140	37,860	270	Mar.
Olinda, Exp. Sta.	2160'	11	5	55	9,852	179	Oct.
		31	5	145	27,655	190	Nov.
		29	5	145	17,651	121	Dec.
		35	5	175	36,318	207	Jan.
		28	5	140	14,120	100	Feb.
		28	5	140	27,227	194	Mar.
Iao Valley (300-1000')		24	5	120	35,681	296	Nov.
		30	5	150	7,987	53	Dec.
		35	5	175	15,038	85	Jan.
		28	5	140	9,149	65	Feb.
		28	5	140	23,840	170	Mar.

TABLE NO. 44 cont'd

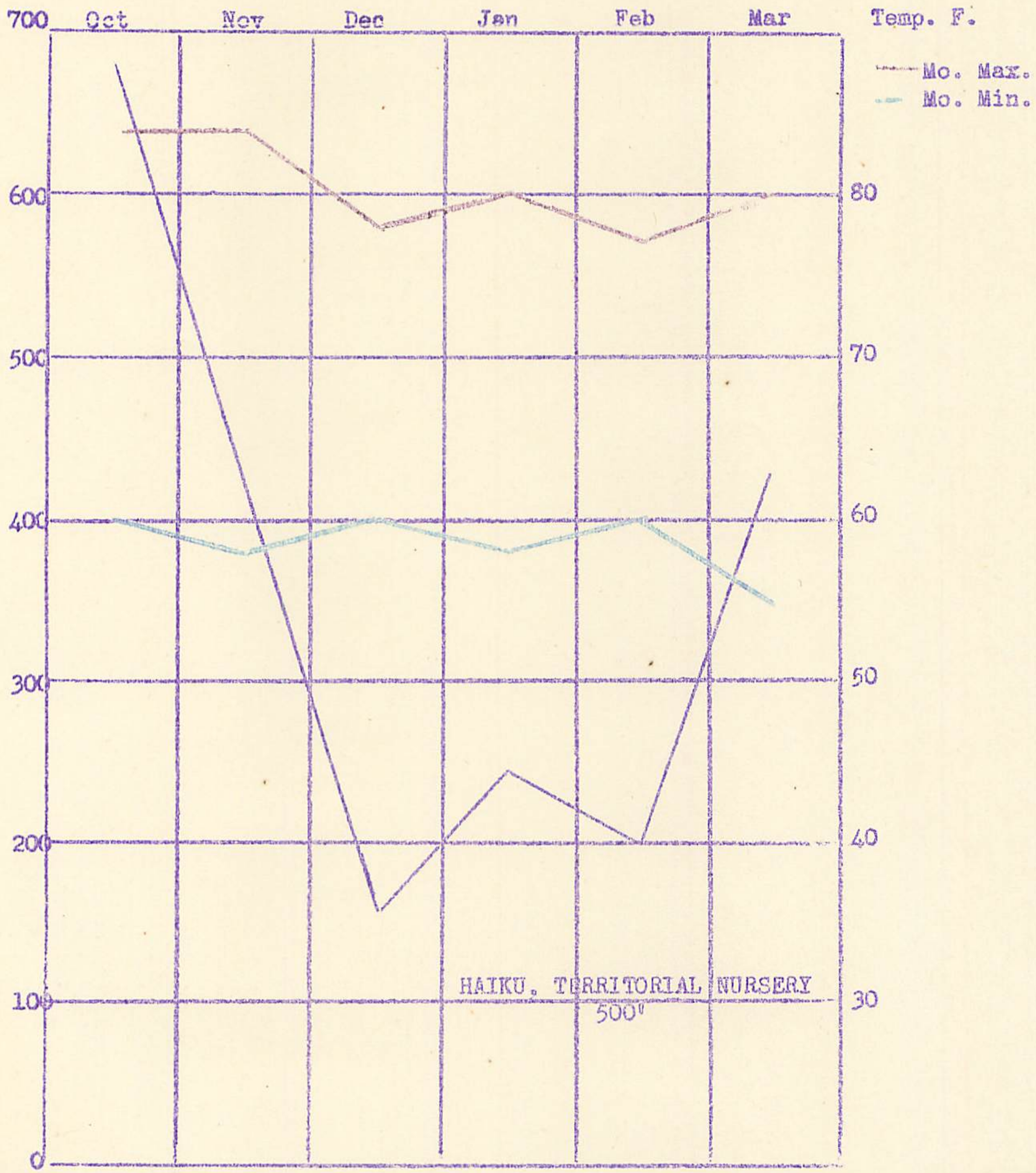
Station	Elev.	Days	Traps	TD	Fly Count	Index	Month
Kula, Farm	2850'	19	5	95	1,335	14	Oct.
		31	5	155	2,196	14	Nov.
		29	5	145	946	6	Dec.
		35	5	75	2,041	13	Jan.
		28	5	140	2,471	17	Feb.
		28	5	140	4,710	33	Mar.
Kula, Lightner's	3 50'	19	5	95	700	7.3	Nov.
		28	5	140	766	5.4	Dec.
		30	5	150	605	4.0	Jan.
		29	5	145	1,094	7.5	Feb.
		28	5	140	653	4.6	Mar.
Kula, Ambrose's	3800'	14	5	70	26	.3	Nov.
		28	5	140	32	.2	Dec.
		30	5	150	24	.16	Jan.
		29	5	145	44	.3	Feb.
		28	5	140	90	.64	Mar.
Olinda, Prison Rd.	1200' to 4000'	14	20	280	2,296	8.2	Jan.
		28	20	560	9,404	16.7	Feb.
		28	20	560	17,395	31.0	Mar.
Kula Road	2800' to 3750'	2	13	26	48	3.6	Oct.
		33	13	429	706	1.6	Nov.
		28	13	364	259	.7	Dec.
		35	13	455	363	.7	Jan.
		28	13	365	554	1.5	Feb.
		27	12	324	1,865	5.7	Mar.

Total flies 789,504

Note:

Day: Days traps were in place
Traps: Number of traps
TD: Trap days or traps times days
Count: Number of flies. Counted or based on weight of 100 flies.
Index: Average trap catch per day. Computed by dividing TD into count of flies.
Lure: Citronella used applied to cotton balls suspended from cork of McPhail Trap. One cc. added every week.

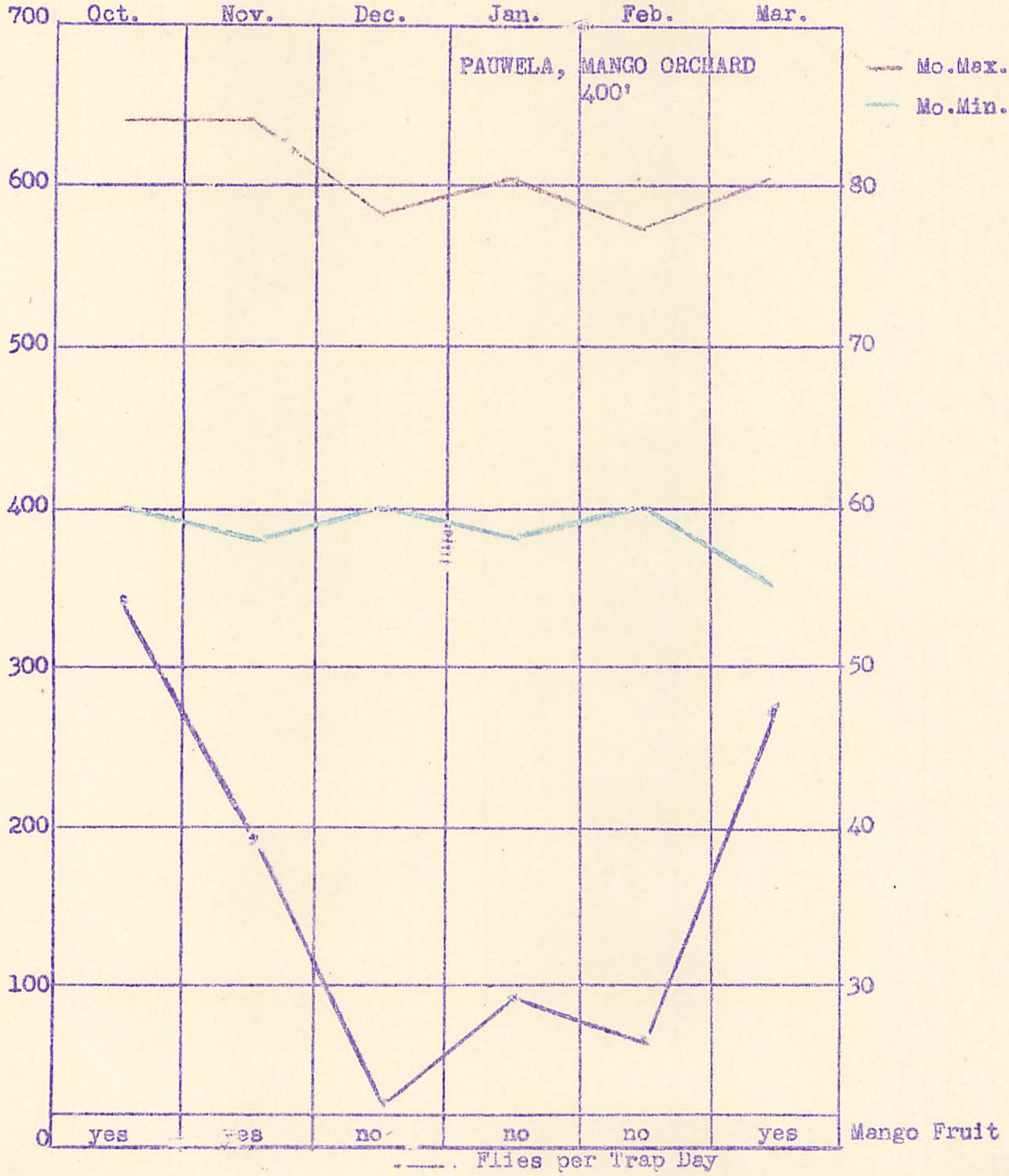
FIG. No. 16 - Experiment No. 4



Flies per trap day ---

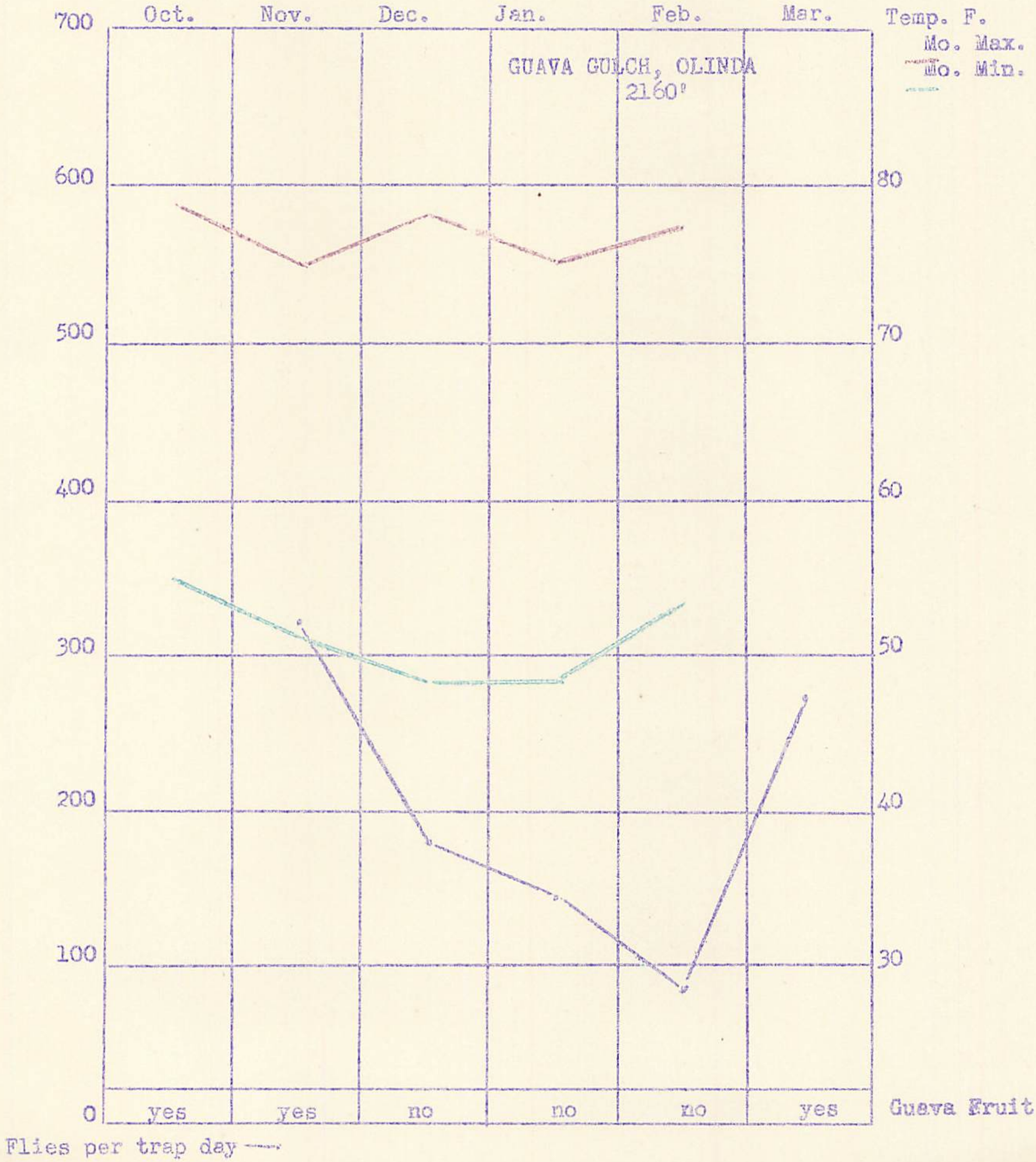
Ppt. 1.3 7.2 5.8 10.6 5.4 6.61

FIG. No. 17 - Experiment No. 3



Ppt. 1.3 7.2 5.8 10.6 5.4 6.61

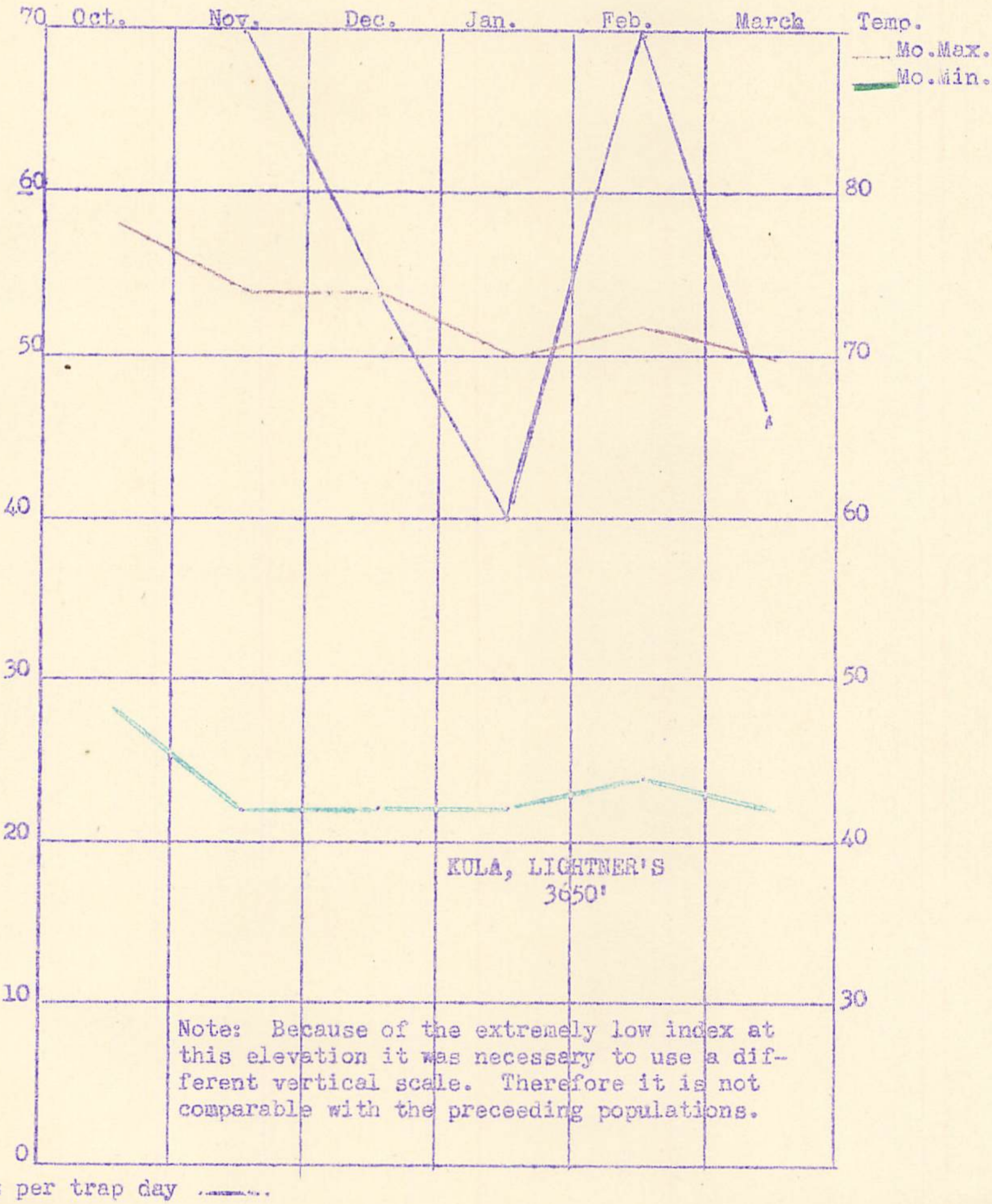
FIG. No. 18 - Experiment No. 11



Ppt. 1.33 8.7 3.7 7.4 7.3 13.07

FIG. No. 19 - Experiment No. 5

FIG. No. 20 - Experiment No. 10



Flies per trap day ——.

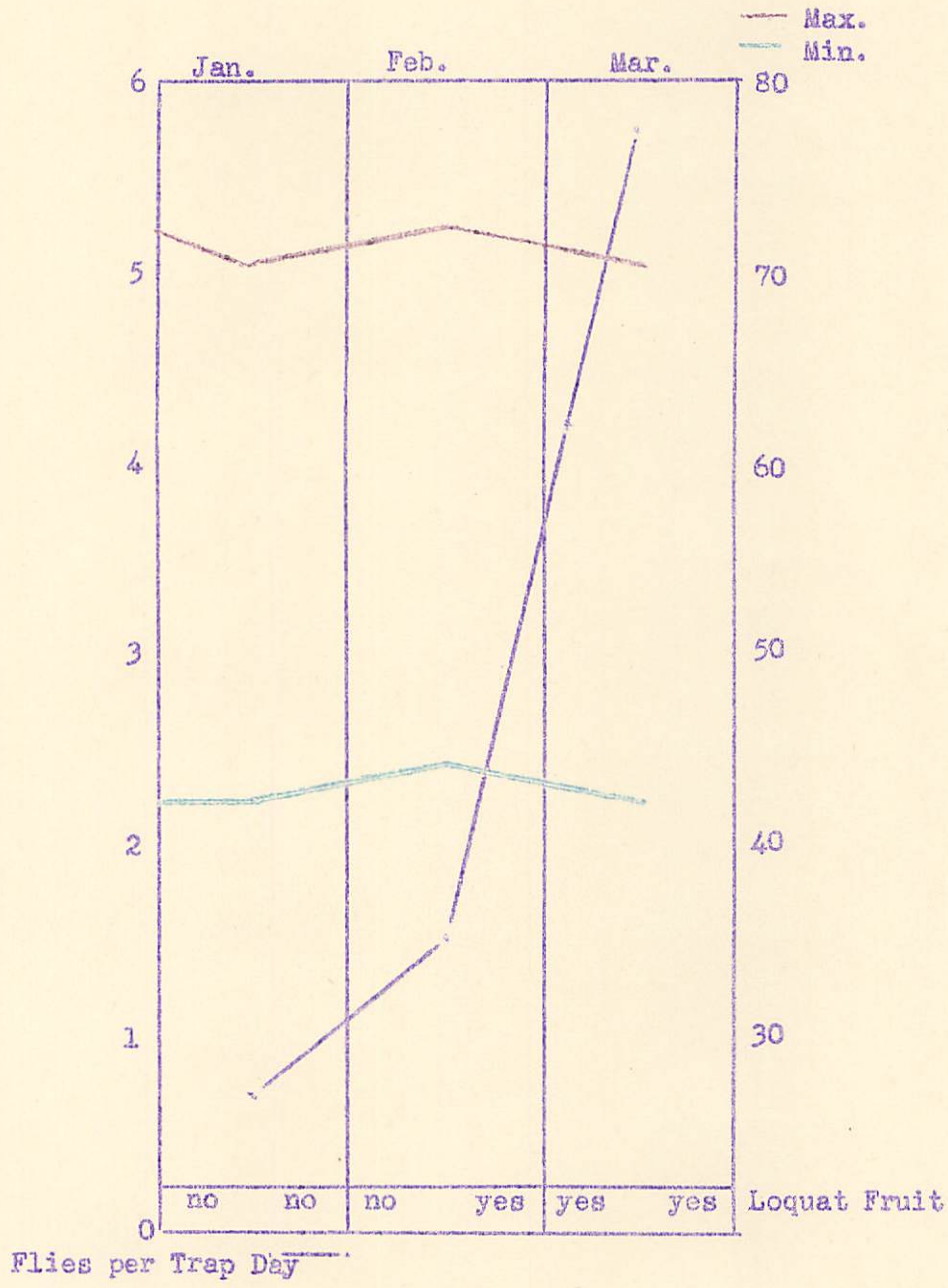
Ppt. .0 .0 1.5 9.2 .89 .81

TABLE No. 45 - Insectory to Kula Sanitarium (3700' to 2925')

Trap	Elev	Total	Date of checking and D. dorsalis trapped												
			1/6	1/12	1/20	1/24	1/31	2/9	2/14	2/21	2/28	3/6	3/13	3/20	3/27
157	3500	5	0	0	0	0	0	0	0	0	0	1	0	2	2
131	3400	3	0	0	0	0	0	0	0	0	0	0	0	2	1
38	3325	52	1	0	0	0	1	0	0	2	1	9	6	14	18
26	3250	341	0	1	0	0	0	0	1	9	6	90	56	81	97
2	3200	118	0	0	0	0	0	0	0	1	0	8	22	41	46
50	3100	72	0	0	0	0	4	3	0	2	1	5	8	30	19
66	3050	16	0	0	1	1	0	0	0	0	0	2	1	9	2
34	3000	8	0	0	0	0	1	0	0	0	0	0	1	3	3
167	3000	31	31	0	0	0	0	0	0	0	0	-	-	-	-
24	3000	1495	0	28	87	83	71	5	0	206	191	293	158	162	211
8	2975	60	0	0	2	5	0	0	0	2	7	3	6	21	14
22	3000	229	0	0	0	0	0	0	0	36	43	58	19	44	29
35	2900	352	27	0	6	4	9	0	0	21	17	69	31	84	84
		2782	59	29	96	93	86	8	1	279	266	538	308	493	526

Month	Total	Index
January	363	.7
February	554	1.5
March	865	5.7

FIG. No. 21 - Insectory to Kula Sanitarium - 3500' to 2900'
Experiment No. 6



Note: Based on total catch of 13 traps spaced .3 mi. apart.

TABLE No. 46 - Olinda Prison Road Traps. "A Study of Population and Elevation."

Total	Trap	Elev.	Date of checking and *D. dorsalis* trapped										
			1/16	1/24	1/30	2/9	2/13	2/20	2/27	3/6	3/13	3/20	3/27
3	17	4200	0	0	0	0	0	0	0	1	0	2	0
1	29	4160	0	0	0	0	0	0	0	0	1	0	0
13	92	4080	0	0	0	0	2	0	1	5	1	4	0
24	122	3880	0	0	0	2	10	0	3	2	2	4	1
4	82	3760	0	0	0	0	2	0	0	0	0	0	2
36	51	3620	0	0	0	0	0	0	8	5	3	17	3
83	83	3500	4	3	2	15	0	0	0	7	11	33	8
103	155	3360	0	3	1	13	5	0	4	7	12	51	7
37	172	3270	0	0	0	10	1	0	5	4	3	12	2
119	95	3190	15	1	0	14	1	0	8	26	3	47	4
260	57	3110	12	8	0	48	11	0	27	35	21	84	14
854	230	2940	97	73	63	174	11	3	123	146	94	49	21
1576	217	2660	104	45	44	481	101	0	319	224	87	144	27
497	211	2500	55	17	17	119	30	0	8	67	58	109	17
1114	113	2360	19	18	23	100	1	0	261	181	126	176	209
4968	168	2260	191	81	79	482	146	369	356	496	611	1672	485
9352	191	2100	203	161	139	731	378	237	1624	2260	771	1748	1100
5439	173	2000	102	132	146	437	29	0	1367	1530	422	1166	108
2188	162	1960	79	42	31	49	8	0	635	358	234	617	135
2424	115	1900	148	66	72	306	187	0	142	266	223	589	425
29096	Total		1029	650	617	2981	923	609	4891	5620	2683	6524	2560

January	2296	8.2
February	9404	16.7
March	17396	31.0

Index (Flies per trap day)

FIG. No. 22 - Olinda Prison Road Traps - Experiment No. 97

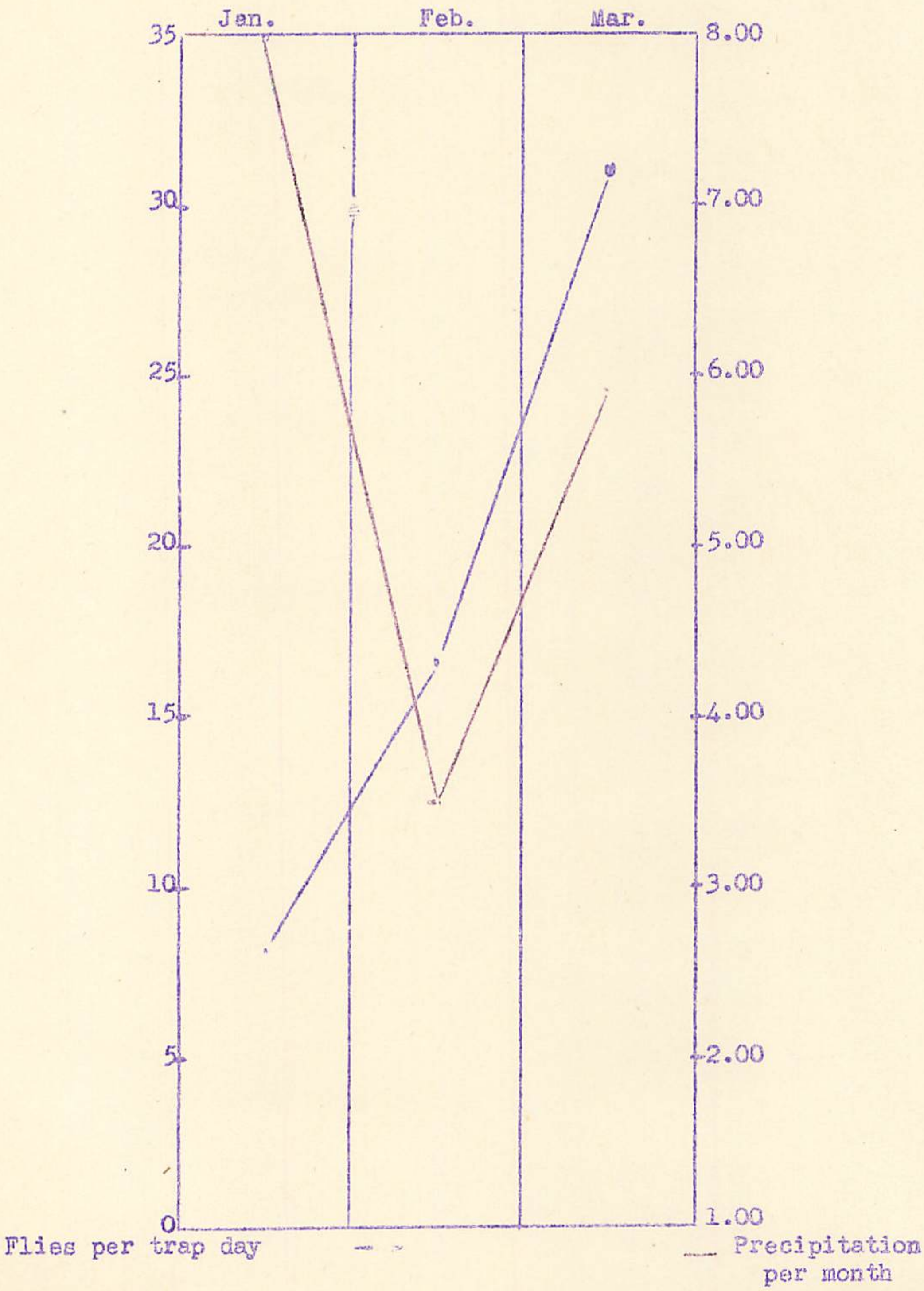


FIG. NO. 23 - OLINDA PRISON ROAD TRAPS

Note: The precipitation given is for the accumulative rainfall for the check period which is a week in all except two cases. The check on 2/9 is 3 days longer than usual and the check on 2/13 is 3 days shorter than usual which probably accounts for the peak and depression on those dates.

The fly counts are for a total of 20 traps.

TABLE No. 47 - Dates of Checking and Dacus dorsalis Trapped - Mauna Loa Truck Trail

Trap No.	Elev.	Miles	1/4 Trap	1/11 Trap	1/18 Trap	1/25 Trap	2/1 Trap	2/8 Trap	2/15 Trap	2/20 Trap	2/27 Trap	3/6 Trap	3/13 Trap	3/20 Trap	3/27 Trap	4/3 Trap	Total
23	6700'	11.0	-	-	-	-	-	-	1	-	-	-	-	3	-	-	4
22	6500'	10.5	-	-	-	-	-	-	-	-	-	-	-	4	-	-	4
21	6200'	10.0	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3
20	6000'	9.5	-	-	-	-	2	-	2	-	-	-	-	7	-	-	11
19	5900'	9.0	-	-	-	1	-	3	12	-	-	-	-	26	1	3	46
18	5800'	8.5	-	-	-	-	-	3	8	-	-	1	-	22	-	-	34
17	5700'	8.0	-	1	4	-	6	7	36	-	-	7	-	114	6	11	192
16	5550'	7.5	-	8	3	-	10	4	21	4	1	2	-	146	4	6	209
15	5260'	7.0	-	-	2	-	-	-	-	-	-	2	1	21	1	-	27
14	5220'	6.5	-	-	-	3	-	2	5	1	-	1	-	23	1	-	36
13	5120'	6.0	-	-	-	-	8	1	4	2	1	-	2	17	1	-	36
12	5020'	5.5	-	1	9	3	8	4	32	2	4	2	3	54	-	5	127
11	4980'	5.0	-	2	7	6	13	6	34	4	3	-	2	91	6	9	183
10	4860'	4.5	-	27	11	7	38	7	104	9	5	1	17	93	3	3	325
9	4760'	4.0	-	6	4	5	33	4	-	7	12	-	2	27	4	6	110
8	4620'	3.5	-	57	-	-	12	1	34	11	4	8	7	66	-	5	205
7	4520'	3.0	-	28	232	9	113	19	119	80	13	19	14	179	11	43	879
6	4420'	2.5	-	53	87	17	37	11	87	32	11	8	3	35	4	6	391
5	4360'	2.0	6	128	182	17	87	38	108	104	6	4	8	83	27	13	811
4	4240'	1.5	730	3220	2030	1476	4505	3831	4595	2390	1455	2430	1830	4730	2835	3620	39,677
3	4150'	1.0	1375	2372	2708	370	2832	3940	2875	2897	873	2955	1134	2370	725	1210	28,636
2	4090'	.5	158	1623	2188	238	3995	4120	3357	2750	1296	3326	1512	4335	432	1345	30,675
1	4000'	.0	342	2163	4183	192	4015	3694	3145	3035	1604	3176	964	4054	2647	2970	36,184
															Total		138,805

Note: Index traps (flasks) containing methyl eugenol removed January 11, 1950.

TABLE No. 48 - Dates of Checking and Dacus dorsalis Trapped - Keanakolu-Ookala Trail.

Trap No.	Elev.	Miles	1/3 Trap	1/3 Index	1/17 Trap	1/17 Index	1/31 Trap	2/14 Trap	2/28 Trap	3/14 Trap	3/28 Trap	Total
15	5200'	0	1	-	5	13	2	18	16	2	17	61
16	4900'	.5	1	5	6	47	3	41	7	1	25	85
17	4650'	1.0	1	3	4	35	7	92	35	-	24	163
18	4450'	1.5	-	-	10	3	5	19	17	2	12	65
19	4200'	2.0	1	14	27	63	13	357	87	3	28	516
20	3900'	2.5	-	8	130	72	22	709	125	17	40	1043
21	3600'	3.0	96	168	65	437	107	834	149	32	51	1334
22	3380'	3.5	74	111	284	512	275	92	223	24	84	1056
23	3100'	4.0	53	143	43	11	42	242	170	47	262	859
24	2800'	4.5	17	272	524	682	233	483	388	225	321	2191
25	2600'	5.0	81	1137	424	732	685	1820	430	2130	480	6050
26	2300'	5.5	194	843	310	715	375	523	320	1674	612	4008
27	2040'	6.0	746	764	220	910	1280	2838	550	2450	365	8449
28	1700'	6.5	352	423	1848	1464	325	320	309	556	157	3867
29	1400'	7.5	294	347	1112	1643	458	1482	230	324	329	4229
30	700'	8.5	334	*	1155	*	642	**	678	773	*	3582
	Totals		2245	4238	6167	7339	4474	9870	3734	8260	2808	37,558***

* Trap Stolen.
** Flies Disintegrated.
*** Total excludes index trap figures.

FIG. No. 24 - KEANAKOLU-OOKALA TRAIL TRAPS

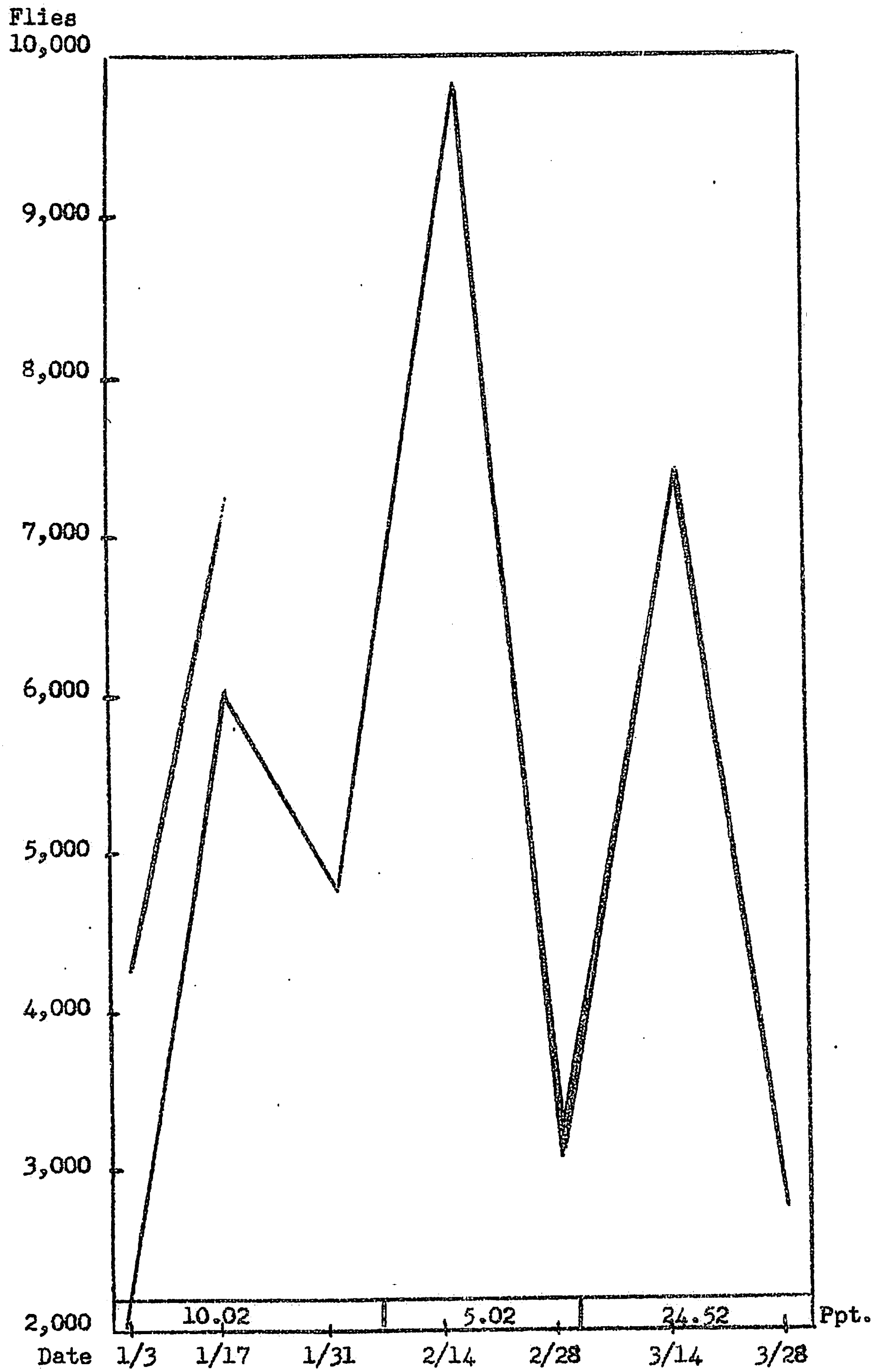


FIG. No. 25

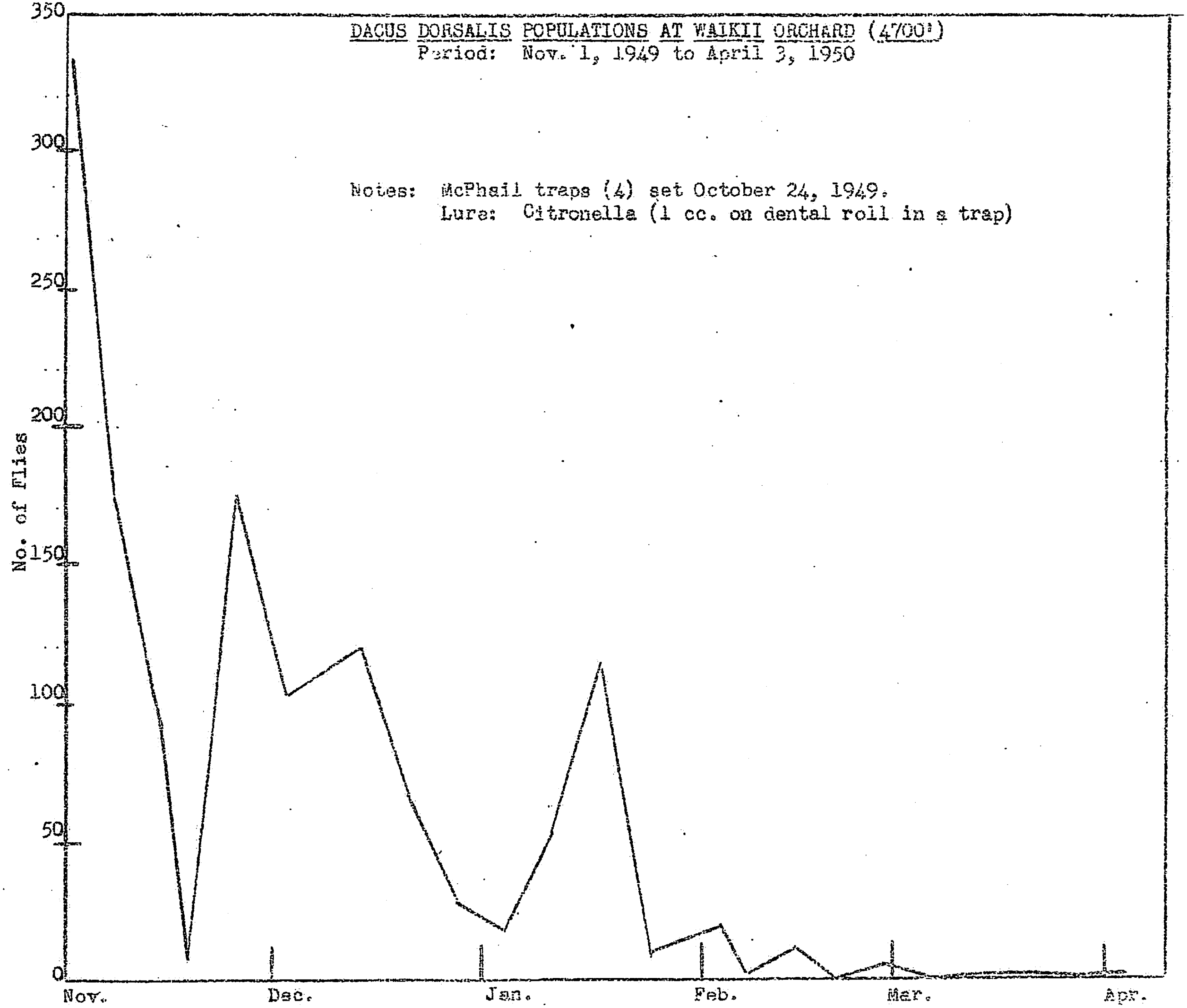

DACUS DORSALIS POPULATIONS AT WAIKII ORCHARD (4700')
Period: Nov. 1, 1949 to April 3, 1950
Notes: McPhail traps (4) set October 24, 1949.
Lure: Citronella (1 cc. on dental roll in a trap)
No. of Flies
350
300
250
200
150
100
50
0
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.

FIG. No. 26 - DACUS DORSALIS POPULATIONS AT KEANAKOLU ORCHARD (5200') - Period: Oct. 3, 1949 to April 4, 1950