

## Agricultural Insect Pest Hitchhikers on Aircraft<sup>1</sup>

H IVAN RAINWATER

PLANT QUARANTINE DIVISION, ARS, U.S.D.A.

HONOLULU, HAWAII

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Entomologists and Plant Quarantine officials who have watched the development of world-wide air transportation, from the advent of propeller-driven aircraft to present high speed jets, to date have not found satisfactory answers to the following questions involving insect stowaways: What is the hazard associated with hitchhiking insect pests on aircraft? What percent of incoming aircraft carry insect stowaways? Are hitchhikers important in the accidental introduction of pests in agricultural areas? Do streamlined air operations increase the hazards of accidental introductions of stowaway insects not protected by host materials?

An airplane carrying a large number of live insect stowaways from one country to another with similar crops, plants, and climate can introduce a new insect pest. However, large numbers of living insects are rarely found on aircraft; usually only small numbers of different insects are found on a few aircraft arriving in the United States from foreign origins. The short ground time of jet aircraft and the trend toward clean, selective ground planting at International Airports help prevent all but an occasional pest from getting aboard an aircraft. Sometimes, unusually favorable environmental conditions may result in an extremely local high population and flight of an insect species around an international airport. This may result in large numbers of flying pests stowing away on aircraft. In 1961 during April, 120 live specimens of a chafer, *Melolontha melolontha* (L.), were found on 38 aircraft landing at eastern United States airports from Paris, France. An immediate cooperative program by French and United States Plant Quarantine officials around the Paris airport quickly ended this species' hitchhiking opportunities. Each aircraft from Paris was given a special aerosol treatment during the period the beetles were in flight in Paris. When the flight season was over and the chafer was no longer found on arriving aircraft, the treatment was discontinued.

Statistics from Plant Quarantine interception records show that live insect stowaways of agricultural importance are found only occasionally on arriving aircraft. The infrequency of hitchhiking arrivals and the fact

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that insects not associated with a plant host find it difficult to locate a plant host in a new environment, reduce probability of establishment to a minimum. Records also show that most of these hitchhikers found on aircraft are dead. This low risk is further reduced because every aircraft arriving from a foreign origin is carefully inspected by plant quarantine inspectors.

In fiscal 1962, every 16 minutes an inbound plant pest was stopped at United States ports of entry by plant quarantine inspectors. These intercepted pests included some of the world's most damaging insects and diseases. A total of 33,033 interceptions of plant pests, insects, mites, snails, viruses, nematodes, and plant diseases was found in passenger baggage, ships stores, mail, and cargo. Most plant pests and unauthorized plant material arrived in passenger baggage. Plant quarantine inspectors, cooperating with customs inspectors, examined more than 23.5 million pieces of baggage and quarantine inspectors cooperating with postal and customs authorities cleared nearly 40 million incoming packages of mail.

In 1961, 104,027 aircraft entering the United States were inspected and cleared. There were 7,968 interceptions of insects and snails arriving by air during this period; however, only 199 of these were hitchhikers of significance. Table 1 summarizes the number of times important insects were intercepted in hosts or as air hitchhikers compared to the same species intercepted in hosts on ships during fiscal 1962. Specimens were larvae unless otherwise indicated (List of Intercepted Plant Pests, 1961, U.S.D.A.).

TABLE 1.—Insect Hitchhikers Intercepted on Ships and Aircraft, 1962

	No. of Times Intercepted	In Hosts Ships	In Hosts Aircraft	Hitchhikers Aircraft
<i>Trogoderma granarium</i> Everts (Khapra beetle)	200*	197*	3*	—
<i>Ceratitidis capitata</i> (Wied.) (Mediterranean fruit fly)	194	84	109	1**
<i>Anastrepha ludens</i> (Loew) (Mexican fruit fly)	151	144	7	—
<i>Anastrepha mombinpraeoptans</i> Sein (West Indian fruit fly)	142	70	72	—
<i>Ragoletis cerasi</i> (L.) (European cherry fruit fly)	69	—	69	—
<i>Dacus oleae</i> Gmelin (olive fruit fly)	57	27	30	—
<i>Pectinophora gossypiella</i> (Saunders) (pink bollworm)	33	18	15	—
<i>Melolontha melolontha</i> (L.)	28**	—	—	28**
<i>Dacus dorsalis</i> Hendel (Oriental fruit fly)	22	18	4	—

\*Larvae and Adults

\*\*Adults

Table 2 summarizes other frequently intercepted insect pests in or on hosts and as airborne hitchhikers for the same period (List of Intercepted Plant Pests, 1961, U.S.D.A.).

TABLE 2.—Other Frequently Intercepted Insect Pests in or on Hosts and as Airborne Hitchhikers, 1962

Insect Pest	Times Intercepted	Aircraft Hitchhikers
<i>Unaspis yanonensis</i> (Kuwana)	467	—
<i>Chilo loftini</i> Dyar	76	—
<i>Parlatoria zizyphus</i> (Lucas)	49	—
<i>Sternochetus mangiferae</i> (F.)	45	—
<i>Coccus viridis</i> (Green)	50	—
<i>Maruca testulalis</i> (Geyer)	35	—
<i>Ectomyelois ceratoniae</i> (Zell.)	33	—
<i>Laspeyresia splendana</i> (Hubner)	29	—
<i>Stenoma catenifer</i> Wlsm.	23	—
<i>Metamasius hemipterus sericeus</i> (O1.)	20	—

Tables 3 and 4 list hitchhiking insects of possible agricultural importance collected in aircraft arriving in Hawaii from foreign areas from

TABLE 3.—Insects of Possible Agricultural Significance Collected Alive on Aircraft Arriving in Hawaii from Foreign Areas

Date	Determination	Sex	Origin
V/11	Tethinidae	1 male	Christmas Island
V/19	Elateridae, <i>Cardiophorus</i> sp.	1 male	Guam, Philippine Islands, Wake
V/20	Tenebrionidae, <i>Mesomorphus</i> sp.	2 males 3 females	Unknown Unknown
V/10	Aphidae	1 adult <sup>1</sup>	Unknown
VI/15	Scarabaeidae, <i>Anomala albipilosa</i> Hope	1 female <sup>1</sup>	Japan
VI/16	Chrysomelidae, <i>Monolepta</i> sp.	1 male	Philippines, Wake
VI/22	Curculionidae	1 male	Saigon
VI/29	Chrysomelidae	1 male	Guam
VII/4	Sphingidae, <i>Clanis phalaris</i> (Cramer)	1 female	Philippine Islands
VII/7	Curculionidae	1 male	Philippine Islands
VII/13	Noctuidae	1 male	Japan
VII/12	Formicidae, <i>Camponotus</i> sp. <sup>2,3</sup>	4 workers	Japan, Guam, Wake
VII/12	Elateridae, <i>Conoderus</i> sp. <sup>3</sup>	1 female	Japan, Guam, Wake
VII/12	Cydniidae, <i>Aethus indicus</i> (Westm.) <sup>3</sup>	1 female	Japan, Guam, Wake
VII/15	Noctuidae, <i>Spodoptera pecten</i> Guenee	1 male	Japan, Wake
VII/24	Oecophoridae <sup>4</sup>	1 male	Vietnam, Philippine Islands, Midway
VII/24	Noctuidae, <i>Spodoptera pecten</i> Guenee <sup>4</sup>	1 female	Vietnam, Philippine Islands, Midway
VII/25	Scarabaeidae, <i>Popillia japonica</i> Newman	1 male	Japan
VII/25	Noctuidae, <i>Chalciopse hyppasia</i> (Cramer)	1 male	Japan?

<sup>1</sup>Graavid.

<sup>2</sup>Reported in Hawaii.

<sup>3</sup>Collected on same aircraft.

<sup>4</sup>Collected on same aircraft.

May 1 through July 31, 1962. Records were kept of total aircraft inspected; aircraft with hitchhikers of agricultural interest taken alive and dead; species collected; if alive their sex; if females whether or not they were gravid. A total of 2,662 aircraft were inspected.

During this period 19 species were intercepted alive on 16 aircraft (table 3). Three species on one aircraft, two species on another, and the remaining were single specimens. Of the 26 specimens collected alive, eight (30 percent) were females and 14 (54 percent) were males. The four worker ants were not considered as either sex and the adult aphid was considered as gravid. Of the female specimens collected, six (75 percent) were not gravid and two (25 percent) were gravid. Twenty dead insects were collected from 18 aircraft (table 4). The origins listed reflect the previous recent itinerary stops of the aircraft prior to arrival in Hawaii and cannot necessarily be accepted as the actual origin of the insects.

TABLE 4.—Insects of Possible Agricultural Significance Collected Dead on Aircraft Arriving in Hawaii from Foreign Areas May 1—July 31, 1962

Date	Determination	Origin
V/3	Hyponomeutidae	Tahiti
V/3	Coleoptera	Tahiti
V/6	Noctuidae, <i>Euxoa</i> sp.	Korea, Okinawa, Wake
V/10	Noctuidae, <i>Achaea janata</i> (L.) <sup>1</sup>	Fiji
V/25	Noctuidae, <i>Spodoptera mauritia acronyctoides</i> (Guenee) <sup>1</sup>	West Pacific?
V/26	Noctuidae, <i>Pseudaletia</i> sp. <sup>1</sup>	Okinawa, Guam
V/25	Lepidoptera	Fiji, Australia
V/29	Noctuidae, <i>Spodoptera exigua</i> (Huebner) <sup>1</sup>	Philippine Islands, Guam, Wake
V/28	Agonoxenidae, <i>Agonoxena</i> sp.	Australia, Wake
VI/2	Lepidoptera	Wake
VI/11	Elateridae	Japan, Wake
VI/12	Noctuidae, <i>Drasteria</i> sp.	Wake?
VI/16	Phycitidae, <i>Caristanius decoloralis</i> (Walker)	Philippine Islands?
VI/16	Noctuidae, <i>Ericcia</i> sp.	Wake
VI/16	Olethreutidae, <i>Anchylopera</i> sp.	Japan?
VI/22	Miridae, <i>Lygus</i> sp.	Saigon, Philippine Island
VI/26	Scarabaeidae, <i>Phyllophaga</i> sp.	Japan
VII/22	Noctuidae, <i>Spodoptera mauritia acronyctoides</i> (Guenee) <sup>1</sup>	Saigon
VII/31	Noctuidae, <i>Spodoptera mauritia acronyctoides</i> (Guenee) <sup>1,2</sup>	Saigon
VII/31	Noctuidae, <i>Chalciope hyppasia</i> (Cramer) <sup>2</sup>	Saigon

<sup>1</sup>Reported in Hawaii

<sup>2</sup>Collected on same aircraft

During the three-month study, only 16 of the 2,662 arriving aircraft carried live insects of possible agricultural importance and only two

carried live gravid females. When this small potential is diminished by factors such as climate, host availability, and biological factors which make it difficult for a species to establish itself in a new area, it appears that the occasional insect hitchhiker presents a very negligible risk in the introduction of new species into a new area.

Table 5 summarizes 10-year records (July 1, 1952 to June 30, 1961) showing only 509 hitchhiking insects recorded while 50,146 insect pest interceptions were found in, on, or with plants and plant products. Taken from List of Intercepted Plant Pests, 1952 to 1961, U.S.D.A.

TABLE 5.—Insect Hitchhikers Intercepted in Aircraft Arriving from Foreign Compared to Total Number of Insect Interceptions from all Sources Recorded at U. S. Entry Ports

Fiscal Year	Number Hitchhikers Hawaii	Total A/C Hawaii	No. Hitchhikers All Other U.S. Ports	Total A/C All U.S. Ports	Total Insect Pests on Plants or Plant Products Offered for entry
1952	5	7,211	4	0	4,182
1953	5	7,762	26	0	5,305
1954	37	6,547	25	64,918	4,018
1955	47	5,913	33	76,965	3,988
1956	51	6,653	17	83,992	4,284
1957	7	7,416	7	95,375	3,784
1958	21	7,809	17	105,342	5,760
1959	27	8,712	37	112,705	6,306
1960	39	8,170	22	116,830	6,201
1961	30	7,941	52	104,027	6,775
Totals	269	74,134	240	760,154	50,603

Table 6 covers the same 10-year period for Hawaii and summarizes the number of times a hitchhiking species was found. It is to be expected that the greater the number of times a species arrives, the greater its chances are of successfully establishing itself. Seventy-five of the 108 species listed were intercepted only once. The six species intercepted six or more times were *Popillia japonica* Newman, *Conoderus pallipes*

TABLE 6.—Frequency of Hitchhiking Insect Pest Species Found on Aircraft Arriving in Hawaii, July 1, 1952 to June 30, 1961

No. of Times Intercepted	Number of Species Intercepted
1	75
2	11
3	6
4	7
5	3
6 or more	6

Total 108

(Eschscholtz), *Neophotettix apicalis* (Motsch.), *Nomophila noctuella* (D. & S.), *Perkinsiella vitiensis* Kirkaldy and *Prodenia litura* (F.). Records were taken from List of Intercepted Plant Pests 195?-1961, U.S.D.A.

Other records from Hawaii and west coast International Airports from 1957 through 1961 show 54,278 aircraft were inspected and only 213 planes were found with hitchhiking pests. Records from 1948 through 1961 involved precleared aircraft to the U. S. mainland from Hawaii and live adult Oriental fruit fly interceptions. A total of 123,409 aircraft were precleared during this period and 81 Oriental fruit flies found, mostly in the years 1948 and 1949 when this fruit fly was at its peak in Hawaii. No adult fruit flies have been found on precleared aircraft for the past five years although routine trapping on the airport grounds has shown a continuous but relatively low fruit fly population level. An eight-year period, October 1953 through March 1961, was studied and live insects of agricultural significance intercepted from Japan compared to total number of arriving aircraft inspected. Thirteen insect pests were recorded from a corresponding number of military aircraft out of a total of 6,147 military aircraft inspected. Nine different insect pests were recovered from nine commercial aircraft out of a total of 5,235 planes from Japan.

The present studies have dealt with data involving possible agricultural insect hitchhikers found on aircraft. Data relating to insects of no or little agricultural importance have not been included.

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The following observations can be drawn from a study of the data in this paper:

1. The number of aircraft with hitchhikers is very small compared to total number of arriving aircraft.
2. Most insect stowaways found on aircraft are dead.
3. Very few agricultural insect pests are found on arriving aircraft.
4. Very few insect species are intercepted repeatedly.
5. Almost two thirds of insects intercepted are males.
6. Less than one third of females intercepted were gravid.

The present procedures are in effect:

1. Aerosoling. Public Health aerosol is applied to baggage and cargo compartments, and cabins of aircraft prior to arrival.
2. Inspection. Plant Quarantine Inspectors carefully inspect all arriving aircraft from foreign origins and will apply special aerosol treatments if significant agricultural pests are observed.
3. Survey and detection. These practices, including light trapping, are carried out in the vicinity of airports by Plant Quarantine personnel. Japanese beetle traps ring airports during summer months.
4. Environmental and climatic factors near Hawaiian airports are

not conducive to establishment of certain species. Airports are located on dry side of the Island where normal prevailing trade winds blow out to sea.

We can conclude that although increased air traffic has also increased the chances of plant pests arriving in airborne host materials in cargo, stores, and baggage, the hazard of introducing an agricultural pest as a chance stowaway or hitchhiker remains relatively unimportant when the above precautions are maintained.

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