

Investigations of the medically important insects carried by the international aircrafts to Tokyo International Airport*

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Abstract : In order to clarify the actual situation of insects of medical importance carried into Japan by aircrafts, the survey was conducted by checking the inside of the international aircrafts just after arriving at Tokyo International Airport, during the period from July 1972 to August 1973.

Of 42 aircrafts surveyed, 10 species of the pest insects, excluding several unidentified species, were captured in 24 aircrafts. *Musca domestica* Linné and *Culex fatigans* Wiedemann were col-

lected most abundantly, 59 and 24, respectively. Of 10 species identified, 5 species were exotic ones and the other 3 were either the exceptional or rare ones around Tokyo. It is worth to note that an engorged female of *Aedes aegypti* (Linné), an important vector of yellow fever, and *Anopheles subpictus* Grassi, a malaria vector, were caught.

With vast increase and speedy movement in international travel and exchange of goods in trade, the chance of invasion of diseases and their vectors from one country to another is presumed to remarkably be increasing. There have been a number of reports regarding the insects carried by aircrafts (Whitfield¹, Laird²). In Japan, several records have been made about rodents and their parasitic fleas principally by the quarantine officials (Ikeda et al³)⁴, Ohtomo⁵). Nevertheless, there was no

In order to know the possible place where the pests embarked on the aircrafts, the experiments and a discussion were made.

report about the other insects, excepting a single paper of the cockroaches taken from overseas vessels (Hitomi⁶). Even the quarantine has made no investigation on the situation of pest insects carried by international air transport. Therefore, through a period from July 1972 to August 1973, we conducted surveys to examine inside of the international aircrafts just after arriving at Tokyo International Airport.

Method and procedure

1. Selection of aircrafts surveyed

On the selection of aircrafts surveyed, special attention was paid to the aircrafts coming from and through Southeast Asia, South America and Africa, where the insect-borne diseases

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are endemic. Though the intention was to include both passenger and cargo aircrafts equally, it resulted in that the majority of the surveyed aircrafts were the passenger ones due to the arrival schedules.

2. Aircrafts surveyed

The aircrafts investigated belonged to 18 airlines such as Air France, Aeroflot Soviet Air Lines, Air Siam, Alitalia Airlines, BOAC British Airways, Egyptair, Flying Tiger, Japan Airlines, Korean Air Lines, KLM Royal Dutch Airlines, Lufthansa German Airlines, Pan American World Airways, Philippines Air Lines, Sabena Belgian World Airlines, Swissair, Thai Airways International, Varig-Blazilian Airlines and Air Vietnam. Forty two aircrafts, including 7 cargoes were checked during the period from July 1972 to August 1973.

3. Search and capture of insects

Effort was made to enter the aircrafts as soon as possible after they arrived, and actually we entered the aircrafts as the passengers and the crews disembarked. Flying, crawling or resting insects were hunted using flash lights, nets, forceps and the other tools, all the places such as passenger cabins, baggage and cargo compartments, cockpits, toilets, galleys and the others.

Results

The species and number of insects captured during the survey are shown in Table 1. Of 42 aircrafts surveyed, 10 species of the pest insects, excepting several unidentified species, were captured in 24 aircrafts. House flies, *Musca domestica* Linné, followed in ab-

undance by the common mosquitoes, *Culex fatigans* Wiedemann, were collected

Table 1. Insect pests of medical importance captured in the international aircrafts at Tokyo International Airport, 1972-1973

species	male	female	larva	egg capsule	total
** <i>Musca domestica</i>	27	32			59
* <i>Culex fatigans</i>	9	15			24
** <i>Culex gelidus</i>	0	2			2
* <i>Culex pseudovishnui</i>	0	1			1
* <i>Culex sitiens</i> group	0	1			1
* <i>Culex</i> spp.	—	—			3
* <i>Aedes aegypti</i>	0	1			1
** <i>Mansonia uniformis</i>	0	1			1
* <i>Anopheles subpictus</i>	0	1			1
* <i>Supella longipalpa</i>	1	0	1	1	3
<i>Blattella germanica</i>	0	(3)	1		1
* <i>Blatta</i> spp.	0	—	3		3
*Unknown flies	—	—			2
total					102

* Species not occurring in Japan

** Species not occurring in Tokyo area

() Number of dead collected

most abundantly, 59 and 24, respectively.

Of 10 species identified, 5 were the exotic ones and 3 do not occur or very rare in Tokyo and its vicinities, though they occur in the other areas of Japan. As the remaining unidentified species seem also to be exotic, all captured pests, excluding house flies and German cockroaches, are presumably aliens in Tokyo. It is worth to mention that an engorged female of *Aedes aegypti* Linné, an important vector of yellow fever, and *Anopheles subpictus* Grassi, a malaria vector, were caught.

Table 2 shows the results of the capture of insects according to the different original or final transit ports of the flights. Five hundred and twelve regular passenger flights arrived at Tokyo International Airport weekly, on July 1973. Half of them belonged to the flights from Manila, Hongkong, Taipei and Bangkok (50.9%), a quarter from Seoul and Moscow (21.0%). Of 41 air-

Table 2. Original or final transit ports of the passenger aircrafts surveyed at Tokyo International Airport, 1972 - 1973

ports	% of arrival per week**	% of surveyed flights	% of flights pests were found
1. MNL HKG TPE BKK	261	23	13
2. MOW SEL	108	4	3
3. ANC FAI SEA	64	3	0
4. HNL	58	0	—
5. Latin America*	10	3	2
6. Africa*	8	8	6
7. SYD	3	0	—
total	512	41	24

* indicates the original ports, the others show the final transit ports to Japan

** on July, 1973

crafts surveyed (excluding one in the hanger), 24 (58.4%) lodged the pests.

The considerable number of mosquitoes were found in the flights flown through either Cairo, Bombay, Bangkok, Hongkong or Manila. On the other hand, numerous flying house flies were captured in the cabins of the aircrafts from Seoul and Khabarovsk.

1. House flies

The house flies were the most abundant pests found in the passenger cabins. In an instance, when the investigators entered the cargo aircraft, which just flown in from Khabarovsk, 20-30 house flies were found flying in the cargo compartment, which was empty, but scattered with vegetable wastes on the floor.

As it is morphologically impossible to distinguish them whether the flies captured are domestic or foreign. Therefore, the susceptibility tests of those flies against some insecticides were conducted. After colonization of the females collected in the aircrafts,

the knockdown-time tests on the insecticide residues were conducted. Flies originated from two aircrafts, Antonov (No. 1) from Khabarovsk and B 747 (No. 2) from Hongkong through New York, London and Delhi, were tested. The susceptibility of F_1 , F_2 and F_3 colonies to DDT and Diazinon residues, 50 ml/m^2 of 0.5% acetone solution on filter paper each, were evaluated with KT-50 values. The "Denken" strain, which is susceptible to organo-phosphorus compounds and highly resistant to organo-chlorine compounds, was exposed to the same residues, as the control for comparison.

As shown in Table 3, the insects brought from Antonov (No. 1) showed quicker knockdown time on Diazinon residues and lower resistant level to DDT than those from B 747 (No. 2) and of the "Denken" strain. We concluded from the data that the flies from Antonov (No. 1)

Table 3. Susceptibility tests of the house flies, captured in the international aircrafts, to insecticides

Aircrafts	KT-50 values (min.) to diazinon			Resistance to DDT
	F_1	F_2	F_3	
Antonov (No. 1)	13	12	16	low
PAA (No. 2)	25	17	—	high
Denken strain (Japanese)	25.1	—	—	high

is most likely to be the intruder from U. S. S. R.. However, we could not distinguish those from B 747 (No. 2) from the Japanese strain, since both the colonies showed a similar tendency of susceptibility to the insecticides. Nevertheless, considering scarcity of house flies in the apron of Tokyo International Airport and the capturing time just after the landing, it is also reasonable to consider those flies are the intruders.

2. Mosquitoes

Seven mosquito species, excepting unidentified species, were captured during the survey. Of them, *C. fatigans* was most common both in the cabins and the cargo compartments and it was distinguished clearly from *Culex pipiens pallens* Coquillett, which is common in Japan, by the morphological character of the male genitalia. It is noteworthy that *Ae. aegypti*, *An. subpictus* and some other species, which do not occur in Japan, were found out. They were captured when flying and resting on the wall, and some of them were fully engorged. It must be emphasized that the majority of the aircrafts carried such important pest species were the flights from Bangkok, Hongkong or Manila.

It seems rather difficult to decide the place where the mosquitoes entered the aircrafts. In order to reason that place to some degree, the actual time of the flights in which important vectors were collected are shown in Table 4. No. 3 flight, in which 4 *fatigans* and 1 *aegypti* were collected, landed in Manila and Cairo in the morning, and in Bombay and Bangkok at night. It seems very likely that *Ae. aegypti* entered the stationary aircraft in Manila, because of their diurnal flying activity. Whereas, in No. 4 and No. 5 flights, it is surmised that *Culex*, *Anopheles* and *Mansonia* mosquitoes invaded into the aircrafts in Bangkok or Bombay, due to their nocturnal activity. As another reason, *Ae. aegypti*, *Culex gelidus* Theobald, *An. subpictus* and *Mansonia uniformis* (Theobald) are known to be the commonest species at the environs of those airports, respectively.

Table 4. The time schedule of the flights carried the important pests

No. Flights	Scheduled time (local time)					
	CAI	BOM	BKK	HKG	MNL	T K O
No. 3	arr.	19:35	02:15		07:50	13:35(14:35)*
	dep.	11:45	20:50	03:00	08:45	
No. 4	arr.	19:35	02:15	09:00		13:25(13:40)*
	dep.	11:45	20:50	03:00	09:45	
No. 5	arr.			14:55	12:40	18:10(18:45)*
	dep.			09:00	13:30	

*Actual arrival time due to delay

3. Cockroaches

Two species, *Supella longipalpa* (Fabricius) and *Blattella germanica* (Linné), were collected, but the individual number collected was small. It was difficult, however, to catch alive cockroaches, due to their hiding habit in lighted condition. According to the witness of the land service personnels, the cockroach infestation is suspected to be heavier.

Discussion

The insects of medical importance introduced to Japan from abroad on ships and aircrafts are controlled by quarantines, under the International Health Regulation and National Quarantine Law. At Tokyo International Airport, according to the general declarations, which are submitted to the quarantine by captains of aircrafts, most of them have been treated with insecticides about 30 minutes prior to departure or before landing. Nevertheless, unexpectedly abundant insect pests were found in the aircrafts just after their landing on Tokyo International Airport. The insects captured by the investigations in the aircrafts, do not always mean insects which invade the country. But, on the other hand, it seems likely that many overlooked insects remained there, escaping the examinations.

Recently, Ohtomo et al⁷⁾ reported a case of malaria occurred near Tokyo International Airport. They presumed probably to be such an introduced case, as the parasite relapse after a long time incubation period, or as a new infection by imported infective mosquito vector. From this connection, it is very important fact that several vector mosquitoes as *An. subpictus* and *Ae. aegypti* were captured during the present survey.

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東京国際空港における海外からの 侵入害虫調査

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国際線航空機でわが国に持ちこまれる衛生害虫の実態を明らかにするために、1972年7月から1973年8月にかけて約1年間、東京国際空港において、着陸直後の機内を捜索することによって調査した。調査した42機中、24機から約100頭の衛生害虫を得た。これらは、いくらかの未同定種を除き、10種に分類された。多かったのは、イエバエとネッタイエカで、それぞれ59、24頭であった。10種中、5種はわが国に分布しないもの、3種は東京付近に分布しないもので、イエバエと、チャバネゴキブリのみが、東京付近のものとの共通種であるにすぎなかった。なかでも、黄熱のベクターであるネッタイシマカと、マラリアベクターの *Anopheles subpictus* が得られたことは注目に値しよう。

これらの侵入個体が、どの地域由来のものか、イエバエについては、殺虫剤に対する感受性レベルを調べることにより、蚊の場合は、フライトスケジュールを検討することにより推定された。