

A Systematic Review of Mosquitoes Aboard International Conveyances: Implications of Risks for Migrating Refugees

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INTRODUCTION

• Arthropod vectors and the diseases they transmit can be disseminated globally via aircraft, marine vessels, rail cars, and other ground conveyances.

• Recent data on the threat of mosquitoes aboard conveyances is limited. To address this, we conducted a systematic review of studies reporting mosquito detections on international conveyances.

METHODS

• A systematic review of literature reporting studies of mosquitoes identified at international ports for all modes of transportation was conducted according to PRISMA guidelines

• Searched from inception to July 2025 without language restriction

Inclusion	Exclusion
all studies reporting on the identification of mosquitoes on or in a conveyance.	- conducted in putative models of conveyances that did not fully replicate the conveyance environment (e.g., non-pressurized shed as a model of an aircraft cabin). - Epidemiological studies of airport malaria where the mechanism of transmission was not unequivocally aircraft related - epidemiological studies reporting only on larval surveillance activities as a proxy for vector-competent adult mosquitoes.

Table 1: Inclusion and exclusion criteria

Key Findings



one report of airplane malaria with a clear link to airplane exposure



Notable detections of *Aedes aegypti* aboard aircraft in non-endemic regions (e.g., Japan, UK, Belgium, Germany) highlight the global risk of vector transport.



The novel detection of *Aedes albopictus* and *Aedes japonicus* aboard ships in New Zealand highlights the risk of marine conveyance of exotic species.



Studies surveying air land and sea conveyances report vector competent species such as: *Aedes*, *Anopheles*, *Culex*, and other genera



Detection of adult mosquitoes aboard spacecraft

RESULTS

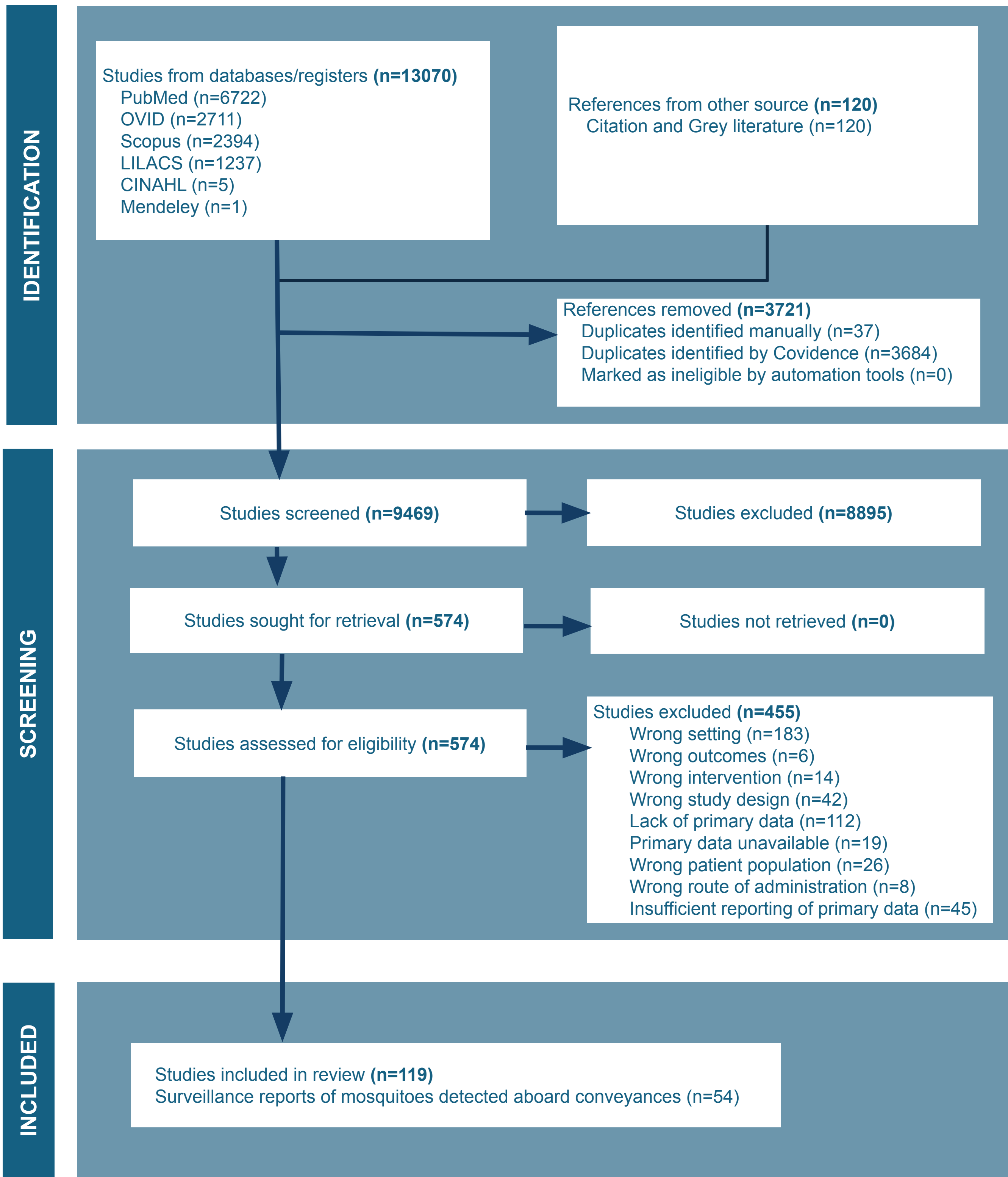


Figure 1: PRISMA Flow Chart with modification

Author (Year)	Study Design	Country Setting	Conveyances Surveyed (n)	Point of Entry	Route of Travel	Total Detected (n)	Seasonality
Air Conveyances							
Carneiro de Mendonca (1947)	Surveillance Report	Brazil	Flying boats (831) Landplanes (10,698)	Belém, Fortaleza, Natal, and Recife (Brazil)	Africa to Brazil	352	Season 1: 1939-1941 Season 2: 1942-1944
Cimerman (1997)	Case Report	Brazil	Aircraft (1)	Brazil	Lebanon to São Paulo (Brazil) via Abidjan (Cote d'Ivoire)	4	Aug 31-Sep. 4, 1996
Danis (1996)	Surveillance report	Belgium, France, Germany, Italy, Netherlands, Spain, Switzerland, UK	Aircraft (NS)	London (UK)	Rome (Italy) to London (UK)	2	NS
Dethier (1945)	Surveillance Report	Central Africa	Aircraft (11)	Parked planes between India and West coast of Africa	Parked planes between India and West coast of Africa	10	1943 to 1945
Duguet (1949)	Review	Various Countries	US Public Health Service - Aircraft (Civilian and Military): 26,694 1946: 21,830	US Public Health Service: Miami, Florida 1946: Miami, Florida, San Juan, Puerto Rico, Brownsville, Texas, Honolulu, Hawaii (US)	NS	US Public Health Service: 2343 (168 alive) 1946: NS; 4% of flights transported mosquitoes, averaging 160/100 aircraft	1939-1944 and 1946

Table 2: Preliminary summary of findings of characteristics of included empirical studies of mosquitoes carried by international conveyances². ND: data not reported; NS: data not specified.

Evans (1963)	Surveillance Report	USA	Aircraft (New Orleans: 210 Hawaii: 89 Florida: 1831 Total: 2130)	Moisant International Airport (New Orleans), Honolulu International Airport (Hawaii), Miami International Airport (Florida) (found in luggage hold and passenger cabins)	NS	New Orleans: 88 Hawaii: 32 Florida: 100 Total: 220	NS
Farrell (1948)	Review/ Surveillance Report	Brazil	Aircraft (NS)	Brazil	South America to West Africa. Included US army posts in Nigeria, Gold Coast, Liberia, and Senegal.	NS	Oct, 1943
Goh (1995)	Surveillance Report	Singapore	Aircraft (330)	Changi Airport (Singapore) (found in passenger cabins)	Indian subcontinent	100	Jan, 1983 – Jan, 1984
Gratz (2000)	Review	Pillai (1984): New Zealand Ogata (1974): Tokyo, Japan Mayers (1983): Bermuda	Aircraft (NS)	Pillai (1984): New Zealand Ogata (1974): Tokyo (Japan) Mayers (1983): Bermuda	Pillai (1984): Fiji Ogata (1974): NS Mayers (1983): NS	NS	Pillai (1984): 1970 to 1974 Ogata (1974): 1972 to 1973 Mayers (1983): 1983
Griffitts (1931)	Surveillance Report/ Experimental Trial	USA	Aircraft Experiment: Fokker Trimotors, Sikorsky amphibians, and Commodores Surveillance: 102	Surveillance: Between Miami (US) and airports in Cuba, Haiti, Dominican Republic, Puerto Rico, Colombia, Panama, Salvador, British Honduras (Belize), Honduras, Yucatan (Mexico), and Jamaica Experiment: San Juan (Puerto Rico) to Santo Domingo (Dominican Republic) to Port-Au-Prince (Haiti) to Miami (USA) via Camaguey (Cuba) (found in luggage hold)	Surveillance: Cuba, Haiti, Dominican Republic, Puerto Rico, Colombia, Panama, Salvador, British Honduras (Belize), Honduras, Yucatan (Mexico), Jamaica Experiment: San Juan (Puerto Rico) to Santo Domingo (Dominican Republic), Dominican Republic to Port au Prince (Haiti), Haiti to Camaguey (Cuba), Cuba to Miami (US)	Surveillance: NS	Surveillance: Jul 23-Sep 12, 1931 Experiment: Sep 1931 (Trial 1: Sep 13, Trial 2: Sep 16, Trial 3: Sep 18)

Table 2 (continued): Preliminary summary of findings of characteristics of included empirical studies of mosquitoes carried by international conveyances². ND: data not reported; NS: data not specified.

CONCLUSIONS

• The compiled literature strongly supports surveillance of aircraft and marine vessels for adult mosquitoes capable of transmitting disease.

• This should be expanded to include systematic, large-scale screening for pathogen carriage and importation of pathogens in refugee-hosting areas

REFERENCES

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