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# CARIBBEAN FOOD CROPS SOCIETY

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MEETING HOST:



**Poster #73**

**Airline Passenger Baggage as a Pathway for Exotic Plant Pest Movement through the Greater Caribbean Region**

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**ABSTRACT.**

International air travel has long been considered a significant means of moving pest organisms. Passengers may carry pests (*e.g.*, snails, weed seeds), or items that are infested with pests (*e.g.*, fruits or vegetables). Our objective was to use data collected by the U.S. federal government to estimate plant quarantine material (QM) approach rates (the percentage of sampling units containing QMs) and the annual number of plant QMs entering the United States in airline passenger baggage. We concluded that the pest risk associated with passenger baggage may be considerable. In the United States, the risk from international airline passenger baggage can be mainly attributed to travelers who are visiting family or friends (about one third of the travelers). Several Caribbean countries were among the 25 countries of passenger origin with the highest plant QM approach rates.

**KEYWORDS:** luggage, human-mediated pest movement, plane travel

**INTRODUCTION**

International air travel has served as a conduit for the movement of pest species (Liebhold *et al.*, 2006; NRC, 2002). For example, Laird (1951) pointed out that aircraft are a pathway for insect introductions. Evans *et al.* (1963) found significant numbers of arthropods in both baggage compartments and passenger cabins of international aircraft. Takahashi (1984) reported finds of insect vectors of human diseases in airplane cabins, and Takeishi (1992) found 5% of the fresh fruits carried illegally by airplane passengers from Thailand to Japan to be infested with fruit flies. Our objective was to estimate the pest risk associated with the airline passenger baggage, based on United States Department of Agriculture (USDA) and Department of Homeland Security (DHS) data.

**MATERIALS AND METHODS**

We used U.S. Agricultural Quarantine Inspection Monitoring (AQIM) (USDA, 2006) data to estimate approach rates of plant quarantine materials (QMs) associated with international airline passenger baggage arriving in the United States. Plant QMs are any plants or plant parts that are prohibited from entering the United States. AQIM data are collected through a detailed inspection of randomly selected sampling units, *i.e.*, they are unbiased and thus suitable for risk quantification. AQIM data do not include useable information on pest interceptions.

The AQIM data used in this study were collected at 30 U.S. airports between Jan. 1, 2005 and Aug. 22, 2007. The plant QM approach rate is the percentage of sampling units in which plant QMs are found. The sampling unit is the group of airline passengers traveling together under one U.S. customs declaration. Estimates are presented as 95% binomial confidence intervals, *i.e.*, the limits within which the actual approach rates lie with 95% certainty (Steel *et al.*, 1997). Treatment groups with sample sizes under 30 were not considered for this analysis.

## RESULTS AND DISCUSSION

An estimated 1.4 million QMs enter the United States annually in airline passenger baggage (Table 1). Only a fraction of these QMs will be infested with pests, and for most countries, the pest risk associated with airline passengers is probably not comparable to the commodity import pathway; however, the risks associated with this pathway may nevertheless be considerable. Since the worldwide air transportation network can quickly connect geographically distant but climatically similar regions (Tatem and Hay, 2007), the plant QMs that do move may carry exotic plant pests that can easily adapt to the new environment. In the United States, the risk from international airline passenger baggage can be mainly attributed to travelers who are visiting family or friends (Figure 1) (about one third of the travelers). In contrast, tourists or business travelers represent a smaller risk to the United States. For most other countries in the Greater Caribbean Region, the majority of visitors are tourists.

A total of 237 different countries of origin were represented in the AQIM data set. Of these, 164 had sample sizes of 30 or higher and were therefore included in the following analysis. Twenty-nine countries of origin with sample sizes of 30 or higher are located in the Greater Caribbean Region. Plant QM approach rate estimates for the countries of origin ranged between zero (lowest lower CL) and 62% (highest upper CL). Figure 2 shows the 25 countries with the highest plant QM approach rates. In some cases, the 95% binomial confidence intervals were large, due to relatively small sample sizes. For Angola, Botswana, French Guyana, Georgia, Luxembourg, Mongolia, Oman, Samoa, and Sudan, binomial confidence intervals included zero, *i.e.*, the plant QM approach rates were not significantly different from zero. Out of the 25 countries with the highest approach rates, ten were Caribbean countries: Haiti (21%), Bonaire (18%), St. Vincent (13%), Grenada (13%), Guadeloupe (12%), St. Lucia (11%), Antigua (9%), Bahamas (9%), Jamaica (8%), and Dominica (8%). The plant QM approach rates for all available Caribbean countries of origin are depicted in Figure 3.

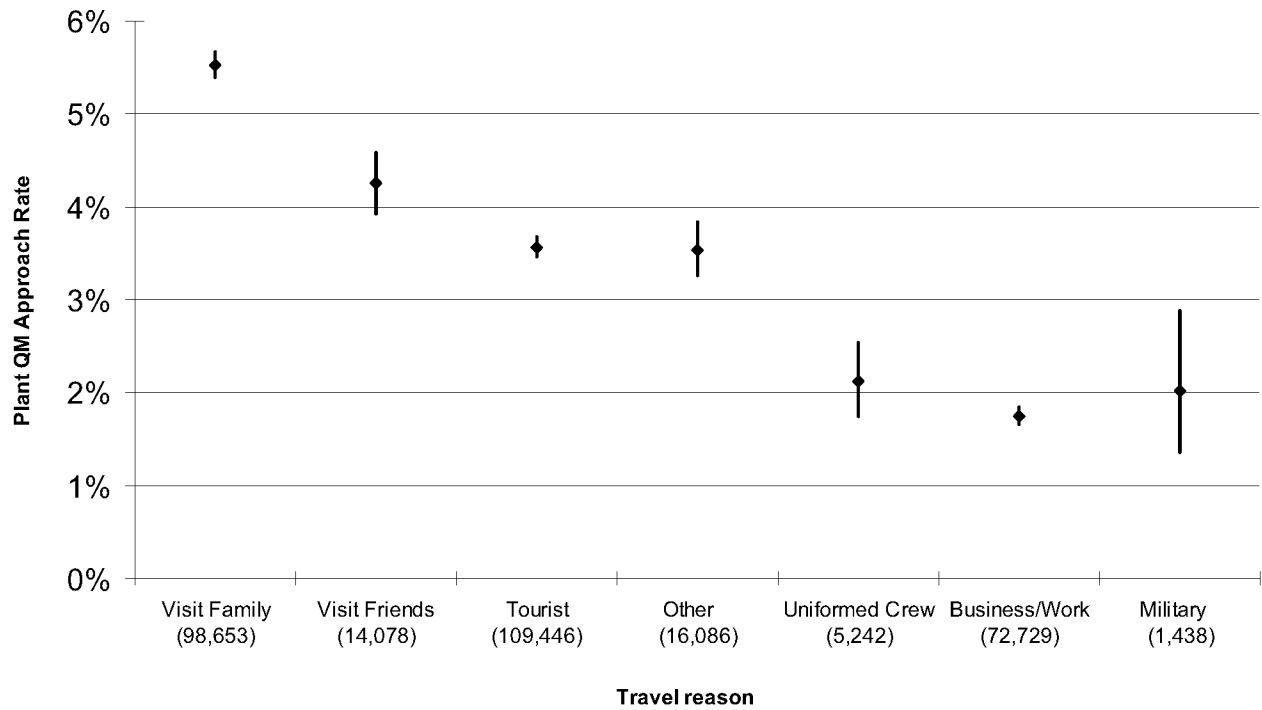
Port inspections can discover only a fraction of what is entering. Thus, it is unlikely that the existing pest risk associated with airline passenger pathways can be mitigated effectively by inspection alone. It may be possible to improve inspection efficiency by increasing the number of inspectors and by providing them with more adequate inspection equipment and facilities. However, additional ways of preventing exotic species introduction will have to be pursued. Many travelers are unaware of existing laws concerning plant QMs and the potential consequences of introducing plant pests. Public awareness programs may help to keep travelers from unknowingly introducing exotic species, and larger fines may help to deter intentional smuggling.

Airline passenger baggage may present an important pathway for the movement of exotic pests into and within the Greater Caribbean Region. The following measures for improved safeguarding may be considered:

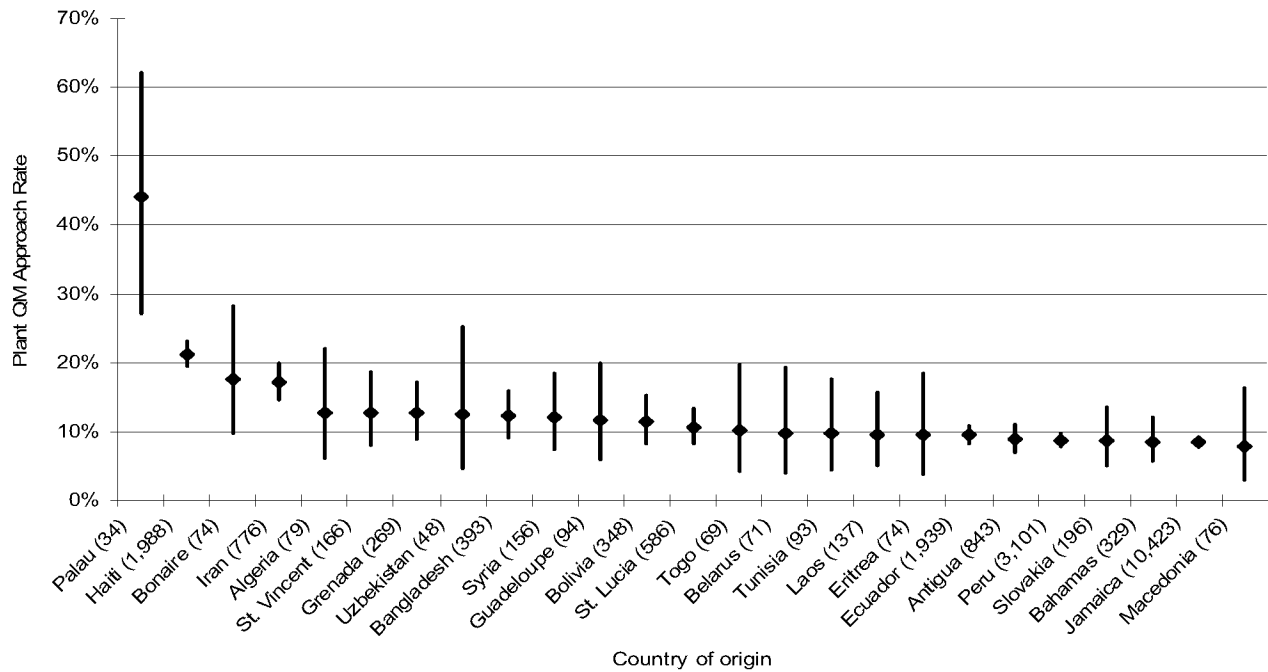
- **Show educational videos** in airplanes and in airports to ensure that travelers understand what materials are prohibited and what the biological and economic consequences of unintentional pest introduction may be. Articles in airline magazines, as well as posters at airports, may serve the same educational purpose.
- **Remind plane passengers to consume or discard prohibited materials** during the flight. The flight crew could make repeated announcements reminding travelers that they are not allowed to take certain materials into the destination countries. When collecting trash before landing, the flight crew could also specifically ask for fruits, vegetables, seeds, plants, meats, *etc.*
- **Print statement on international flight tickets** making travelers aware of the regulations and giving them a contact phone number or website address where they can find details.
- **Assess severe fines** for introducing prohibited materials. These fines should be widely advertised to serve as a deterrent to intentional smuggling.

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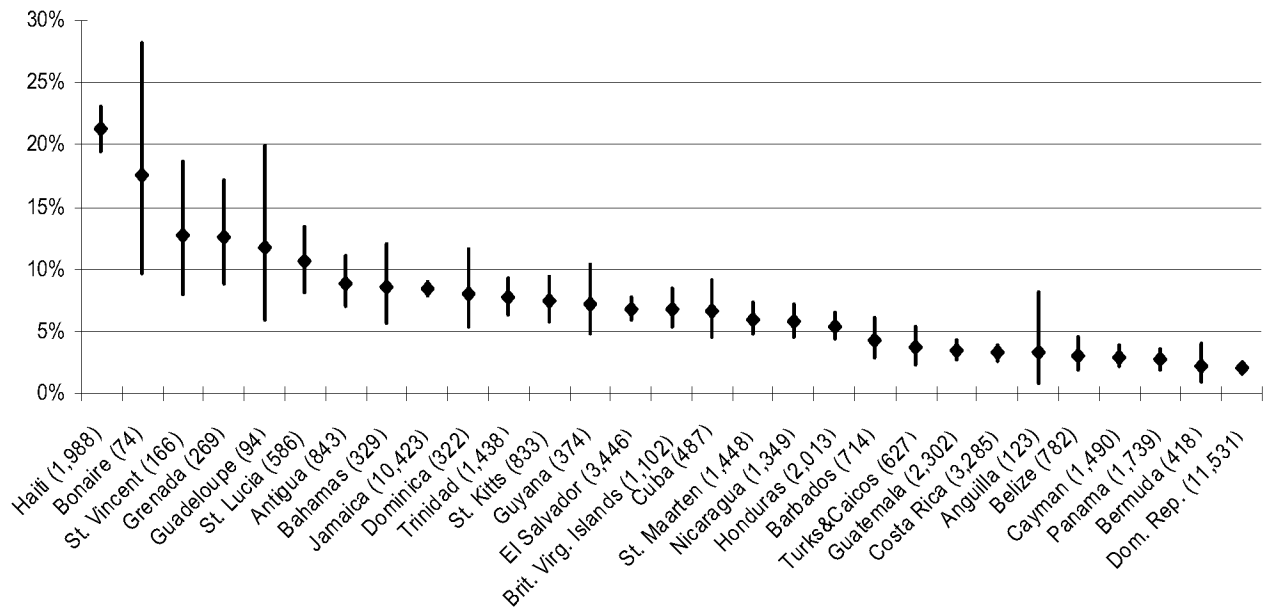
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**Figure 1.** 95% binomial confidence intervals for plant QM approach rates in international airline passenger baggage at U.S. ports-of-entry. Sample sizes in parentheses. Sample sizes < 30 were excluded from the analysis. Data source: Agricultural Quarantine Inspection Monitoring (AQIM) data of the USDA collected between Jan. 1, 2005 and Aug. 22, 2007.



**Figure 2.** 95% binomial confidence intervals for plant QM approach rates in international airline passenger baggage at U.S. ports of entry. By country of passenger origin (sample sizes in parenthesis). Shows the 25 countries of origin with the highest approach rates. Countries with samples sizes < 30 were omitted. Data source: Agricultural Quarantine Inspection Monitoring (AQIM) data of the U.S. Department of Agriculture collected between January 1, 2005 and August 22, 2007.



**Figure 3.** 95% binomial confidence intervals for plant QM approach rates in international airline passenger baggage across U.S. ports of entry. Caribbean countries of passenger origin (sample sizes in parenthesis). Countries with samples sizes < 30 were omitted. Data source: Agricultural Quarantine Inspection Monitoring (AQIM) of the U.S. Department of Agriculture collected between January 1, 2005 and August 22, 2007.

**Table 1.** AQIM results of international air passengers arriving at U.S. airports between January 1, 2005 and August 22, 2007.

Passenger groups with QMs <sup>1</sup>	Passengers Inspected <sup>2</sup>	Approach Rate <sup>3</sup>	Passenger groups Entering <sup>4</sup>	QMs Entering <sup>5</sup>
11,977	319,599	3.75%	37 million	1.4 million

<sup>1</sup> Number of passenger groups where QMs were found.

<sup>2</sup> Number of passenger groups inspected.

<sup>3</sup> Percentage of passenger groups inspected where QMs were found.

<sup>4</sup> Number of passenger groups entering the United States annually.

<sup>5</sup> Predicted number of QMs entering the United States annually.