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Poster #71

Natural Spread of Pests within and into the Greater Caribbean Region

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ABSTRACT.
Natural spread of exotic pest organisms mediated by wind may play a significant role in the movement of pests throughout the Greater Caribbean Region. Biological and atmospheric events and processes interact to facilitate aerial dispersal of organisms over long distances. Our objective was to review the scientific literature to answer questions about natural spread of exotic plant pests into and within the Greater Caribbean Region, *e.g.*, whether it occurs, patterns of movement, types of pests prone to natural spread, and possible methods for reducing the likelihood of establishment. Certain plant pathogens seem to have wind-dispersed from Africa into the Caribbean, and wind-assisted dispersal within the Greater Caribbean Region occurs on an ongoing basis. The effects of natural dispersal may be mitigated through stringent surveys supported by predictive modeling. Knowing which pests are capable of becoming established and causing economic damage within a given area and intervention as soon as a pest is introduced may reduce the likelihood of establishment.

KEYWORDS: wind dispersal, natural movement, pest spread

INTRODUCTION

Natural spread of pests throughout the Greater Caribbean Region seems likely, given the close proximity of islands and land masses. Biological and atmospheric events and processes often facilitate aerial dispersal of plant pathogens, insects, and mites, which can be transported over long distances and cause widespread infections or infestations.

Once a pest is established in a new area, it is difficult to determine the pathway of introduction. The route of natural movement between close land masses most likely follows prevailing winds, which move from the Windward Islands (the most southeasterly islands), toward the northwest to the Leeward Islands, and on to the Greater Antilles and the southeastern United States. Hurricanes and tropical storms are also potential conduits for pest movement. In the Greater Caribbean Region, tropical storms and hurricanes can occur at any time from June through November, but most develop during August, September, and October (**Figure 1**). An average of 15 tropical cyclones occur each year, including seven or eight hurricanes, but many do not reach land (Quantick, 2001).

EXAMPLES OF EXOTIC PEST MOVEMENT

Pest Movement from within the Greater Caribbean Region. *Spodoptera frugiperda*, the fall armyworm, follows "rainy" seasons and migrates from the Caribbean islands to the United States each year (Luginbill, 1928). The moth survives year-round in Puerto Rico, the U.S. Virgin Islands, Guadeloupe, and French Guiana, but it cannot survive the winter in the United States, except in southern Florida and southern Texas (Luginbill, 1928).

Raoiella indica, the red palm mite, was detected in Martinique in 2004. Less than a year later, the mite appeared on coconut palms on nearby islands. Finding *R. indica* populations on tall and established coconut palms in St. Lucia strongly supports the premise that wind currents dispersed the mite (Hoy *et al.*, 2006). Soon after, *R. indica* became established in Dominica, Guadeloupe, St. Martin, St. Lucia, and Trinidad and Tobago. It was found in Puerto Rico in November of 2006 and in West Palm Beach, Florida, in December of 2007. The pest is spreading rapidly, aided by winds as well as commerce, and it is expected to become established throughout the subtropical and tropical regions of the Western Hemisphere.

Pest Movement from outside of the Greater Caribbean Region. Some exotic plant pests are capable of long-distance migration from Africa to the Greater Caribbean Region (**Figure 2**). A few significant plant pathogens, including sugarcane smut (*Ustilago scitaminae*), sugarcane rust (*Puccinia melanocephala*), and possibly blue mold of tobacco (*Peronospora tabacina*), were carried by wind from Africa into the Greater Caribbean Region (Purdy *et al.*, 1985; Nagarajan and Singh, 1990).

Schistocerca gregaria, the migratory locust, has probably been carried repeatedly from Africa to the Caribbean by tropical cyclones, though it never became established (Richardson and Nemeth, 1991).

Thomas (2000) showed that only a small percentage of the exotic arthropods in Florida originated in Africa and that the major sources are Asia, the Pacific Islands, and the Neotropics. Thus, although there are some examples of pests that have exhibited long-distance migration, other pathways (*i.e.,* trade, commerce, and tourism) appear to be of greater importance for the introduction of plant and animal pests and diseases into the Greater Caribbean Region.

COUNTERING NATURAL DISPERSAL

When plant pests and pathogens move naturally without human assistance, little can be done to stop them without investing considerable resources. National Plant Protection Organizations (NPPOs) should emphasize alternative strategies to reduce the risk of establishment of these pests.

- **A surveillance and diagnostic network is necessary** to monitor the arrival of any new pests. Predictive modeling works well for some plant pathogens and arthropods. Risk mitigation must be handled on a case-by-case basis, with foresight given to the likelihood of new pest establishment.

- **Sterile insect technique** has successfully been used to prevent pests from invading and spreading further into the United States.

- **Host-free zones** work well for pests and pathogens with only a few hosts, but they may not be feasible for highly polyphagous pests.

- **Classical biological control** has proven to be an important means to mitigate the impacts of some exotic pests.

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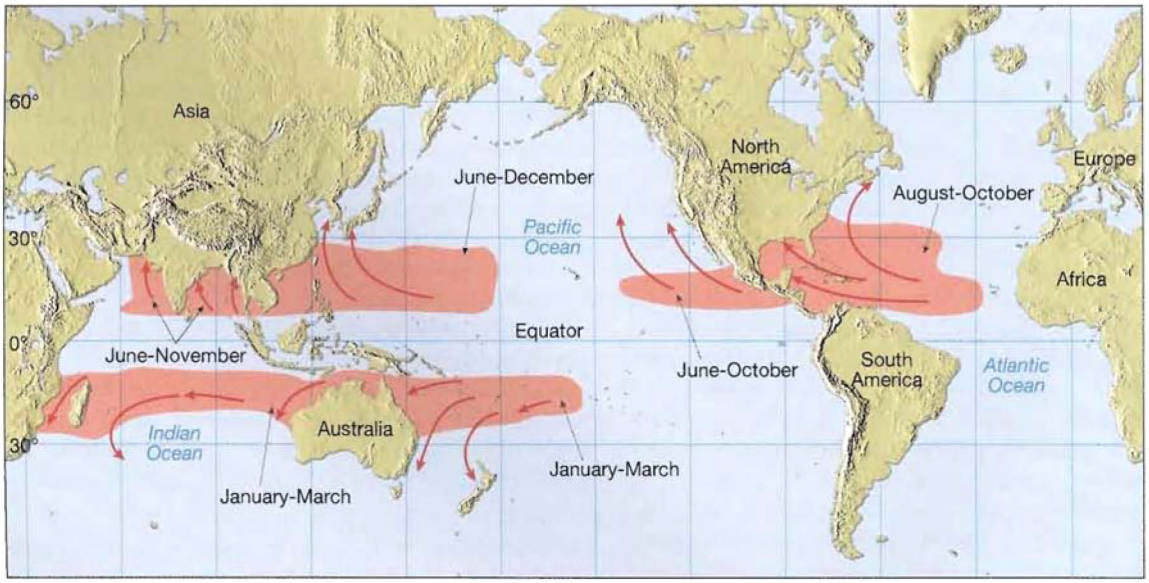

Figure 1. Areas and times of hurricane formation and directions of prevailing winds (or likely track for hurricane movement?) (Lutgens and Tarbuck, 2007)

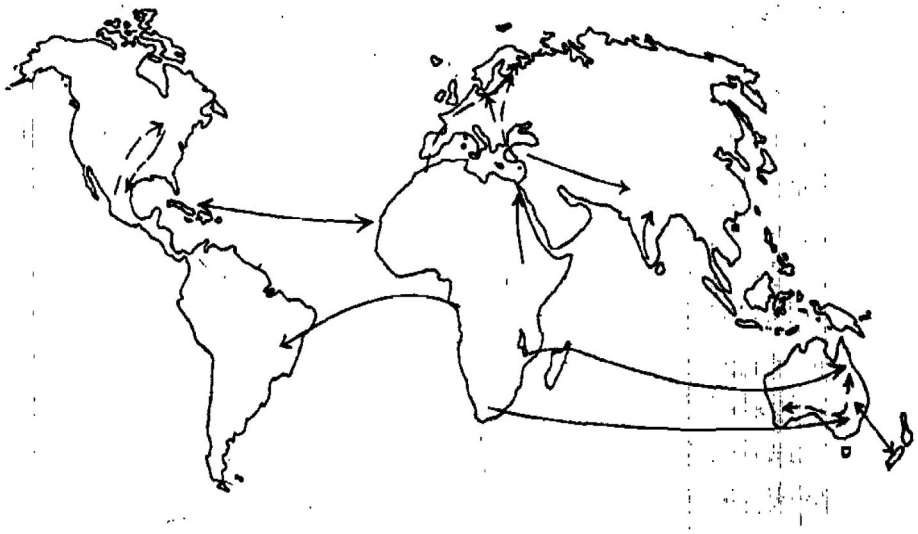

Figure 2. Pathways for long-distance dispersal (Nagarajan and Singh, 1990)