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Note

Thysanoptera as apparent pollinators of West Indies mahogany, *Swietenia mahagoni* (Meliaceae)

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Summary — Studies were conducted to elucidate the putative role of insects in pollination of West Indies mahogany, *Swietenia mahagoni* Jacquin, in Florida. Thrips (Thysanoptera), including *Franklin-iella bispinosa* (Morgan), *F insularis* (Franklin), *Frankliniella* sp, *Pseudothrips inequalis* (Beach) (Thripidae), and an unidentified thrips larva (Phlaeothripidae), were the only insects found to be associated with the flowers. Thrips were found in 12 to 59% of the flowers from 7 different collecting sites 27–82 km apart. Most of the flowers sampled were staminate. The thrips were observed inside the staminal tube, where there was abundant pollen, and entered and left the staminal tube through the space between this structure and the stigma, usually through a marginal cleft, thus forcing them into contact with an anther and the edge of the stigma. This behavior may assist pollination. Most thrips sampled had mahogany pollen adhering to them. The identification of pollen was verified by scanning electron microscopy. The evidence that thrips are important pollinators of mahoganies is discussed in relation to flower biology and pollination ecology and application of this knowledge to breeding for improvement of mahoganies.

Thysanoptera / thrips / pollination / mahogany / *Swietenia* / tropical tree

Résumé — Thysanoptera comme pollinisateurs apparents de l'acajou de Saint-Domingue, *Swietenia mahagoni* (Meliaceae). *Les études suivantes ont été menées en vue d'élucider le rôle pressenti de certains insectes dans la pollinisation de l'acajou de Saint-Domingue,* Swietenia mahagoni *Jacquin, en Floride. Les seuls insectes présents en association avec les fleurs ont été les thrips (Thysanoptera), incluant* Frankliniella bispinosa *(Morgan) dans la plupart des spécimens,* F insularis *(Franklin),* Frankliniella *sp,* Pseudothrips inequalis *(Beach) (Thripidae) et une forme larvaire non-identifiée de thrips (Phlaeothripidae) (tableau I). Les thrips étaient présents dans 12–59% des fleurs provenant de 7 sites de récolte séparés de 27–82 km. La plupart des fleurs échantillonnées étaient des fleurs staminées. Les thrips ont été observés à l'intérieur du tube staminique, où le pollen était présent en abondance, et pénétraient et sortaient du tube staminique par l'espace présent entre cette structure et le stigmate, habituellement par une fente marginale qui les forçait à entrer en contact avec une anthère et le bord du stigmate (fig 1). Ce comportement pourrait favoriser la pollinisation. Des grains de pollens de l'acajou adhéraient à la plupart des thrips échantillonnés. L'identification du pollen a été vérifiée par microscope électronique (figs 2, 3). L'existence d'un rôle important des thrips dans la pollinisation des acajous est discutée en relation avec la biologie des fleurs et l'écologie de la pollinisation des acajous.*

Thysanoptera / thrips / pollinisation / acajou /* Swietenia */ arbres tropicaux

INTRODUCTION

West Indies mahogany (*Swietenia mahagoni* Jacquin) has been assumed to be pollinated by insects because the pollen is sticky (Yang, 1965; Lee, 1967a; Tomlinson, 1980). Yang (1965) observed unidentified bees visiting mahogany flowers in Taiwan and collected an unidentified insect with pollen grains adhering to the body from a flower of *Swietenia* sp. Yang's published photograph of this insect does not clearly show diagnostic characters; it is apparently the propupa of a thrips.

The flowers of West Indies mahogany are small, about 5 mm across the petals, white, virtually non-fragrant to human olfaction, and borne on thyrses of several flowers. Flowers are unisexual, with similar staminate and pistillate flowers, but the ovules of staminate flowers never develop and the anthers of pistillate flowers do not produce pollen. Mahogany trees are monoecious, with far more staminate than pistillate flowers. Usually all of the flowers on a thyrse are of the same sex (Lee, 1967a, b). The trees appear to be self-compatible (Lee, 1968), but cross-pollination can occur, as demonstrated by the occurrence of hybrids where different species of *Swietenia* have been grown in proximity (Lee, 1968; Styles, 1972; Whitmore and Hinojosa, 1977).

MATERIALS AND METHODS

The first author has frequently observed flowers of West Indies mahogany on various sites in southern Florida each year throughout the bloom period (*ie* June–July) from 1985 to 1993. Observations were made at different times throughout daylight hours, but were concentrated between 0800 and 1600 h.

During the 1991 bloom period, a total of 200 flowers collected locally from 10 West Indies mahoganies were dissected under a stereoscopic microscope and the insects in them were extracted and preserved. From 24 June to 6 July 1993, flowers were collected from West Indies mahogany trees at the following 7 localities in Florida (listed from south to north), which are a mean of about 52 km (range 27–82 km) apart: Key West, Key Vaca, Key Largo, Miami, Fort Lauderdale, Boca Raton and Lake Worth. As evidence that pollination occurred on these trees, on some of them the pistillate flowers had been fertilized and early-stage fruits of the current year were present. On all the trees sampled remains of fruits from the previous year were still present. At each locality 25–100 flowers, usually about 4 m from the ground, were collected with a pruning pole from 1–3 trees and sealed in a polyethylene bag which was kept away from direct sunlight during transport to the laboratory. Collection times were between 0800 and 1400 h, varying with site. Within 1–48 h of each collection, the flowers were examined under a stereoscopic microscope in the laboratory. During the intervals between collections and examinations, the flowers appeared to remain fresh, but in some bags insects may have redistributed themselves among the flowers. Specimens of insects from the flowers were preserved in a solution consisting of 70% ethanol, 2% acetic acid and 28% H_2O, and were later slide-mounted in Hoyer's medium and identified. Pollen was removed from anthers and mounted on scanning electron microscope (SEM) stubs. One thrips larva with clusters of pollen adhering to the thorax was mounted dorsal side up to show the pollen clusters. Specimens for SEM examination were air-dried, gold-sputter-coated and examined and photographed with a Hitachi S-400 field emission SEM.

RESULTS AND DISCUSSION

In the field, no insects were observed visiting flowers of West Indies mahoganies, while concurrently, diverse insects frequently visited flowers of nearby trees of other species. Insects associated with the flowers of West Indies mahoganies were only seen when the flowers were examined in the laboratory and were found to be minute thrips (Thysanoptera). Those collected in Fort Lauderdale in 1991 were identified as *Frankliniella bispinosa* (Morgan) (Thysanoptera: Thripidae). Species collected in 1993 are shown in table I. There were 1–6 thrips, mostly larvae, per infested flower. A few adults were found from each locality.

In infested flowers, thrips occupied the urn-like staminal tubes (fig 1). The sticky pollen grains were stuck singly and in clumps to floral surfaces within the tubes and to most of the thrips observed. Pollen grains on thrips and those removed from anthers appeared identical under the SEM (figs 2 and 3). They were 19.4–20.25 μm in diameter, smooth, each with 2–5 sulci. Thrips entered or left the tube most frequently through its marginal clefts, where the anthers are located and separated from the stigma by a gap, which we measured as 0.2 mm wide (fig 1). This was wide enough for most thrips observed (*eg,* fig 2) to barely pass through while in contact with the anther and the edge of the stigma. In addition to pollen acquisition while foraging in staminal tubes, thrips may acquire pollen through contact with the anthers when leaving staminate flowers, or deposit pollen onto the stigma while entering pistillate flowers. We observed that pollen grains were clustered on the edge of the stigma in both staminate and pistillate flowers.

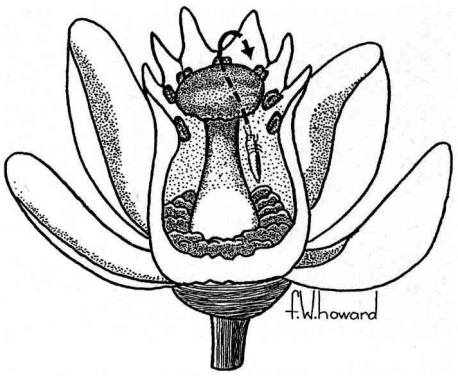

Fig 1. Lateral view of staminate flower of *S mahagoni* with some petals and portion of the staminal tube removed, showing usual path of thrips emerging at marginal cleft of staminal tube, through space between staminal tube and stigma. Drawn from a photograph.

The pollen of mahoganies appears to be adapted to insect pollination, but not particularly well adapted for the major pollinator taxa, *ie* Lepidoptera, Hymenoptera or Diptera, and on the basis of our observations are rarely, if ever, visited, at least during the day, by insects other than thrips. Thus far, thrips are the only group of insects

Table I. Sample localities, numbers of flowers of West Indies mahogany examined and percentage of flowers with thrips, and thrips specimens identified to genus or species, Florida 1993.

Locality sampled	*Number of flowers examined*	*Percentage of flowers*	*Identifications and number of specimens*
Key West	170	13.5	*F bispinosa* (Morgan), 1 adult *F insularis* (Franklin), 1 adult *Frankliniella* sp, 6 larvae *Pseudothrips inequalis* (Beach), 1 adult
Key Vaca	150	26.0	*P inequalis* (Beach), 1 adult *Frankliniella* sp, 8 larvae
Key Largo	73	19.1	*Frankliniella* sp, 6 larvae
Miami	94	27.6	*F bispinosa,* 1 adult
Fort Lauderdale	100	59.0	*F bispinosa,* 2 adults, 8 larvae 1 unidentified Phlaeothripidae larva
Boca Raton	25	20.0	*Frankliniella* sp, 2 larvae
Lake Worth	100	12.0	*Frankliniella* sp, 3 adults, 2 larvae

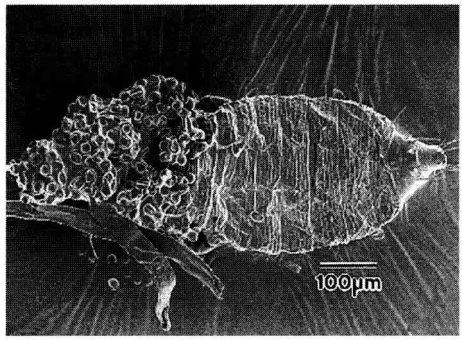

Fig 2. Thrips larva with adherent mahogany pollen.

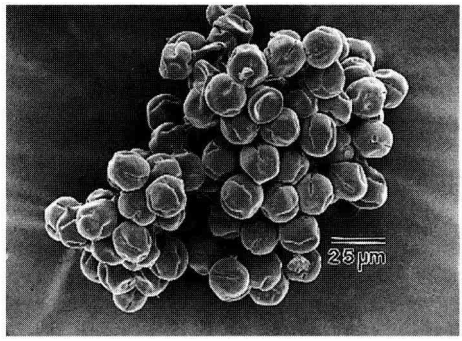

Fig 3. Pollen collected from anther of *S mahagoni.*

for which there is any evidence suggesting a role in pollination of mahoganies. Different species of thrips may be involved in different localities. The frequency of *F bispinosa* in our samples undoubtedly reflects its current abundance in southern Florida and polylectic feeding habits (Frantz and Mellinger, 1990) rather than a specific association with mahogany flowers.

Only a few of the 712 flowers sampled were pistillate. A high ratio of staminate/pistillate flowers, a condition previously noted in mahoganies (Lee, 1967a), probably ensures that a high percentage of insects that eventually visit pistillate flowers bear pollen. West Indies mahoganies may frequently self-pollinate, because they appear to be self-compatible (Lee, 1968) and the wingless immature stages, which apparently constituted most of the thrip populations on the trees, are most apt to accomplish within-tree pollination. Cross-pollination is more problematical, given the infrequency of both pistillate flowers and winged adult thrips.

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