

Covert Sexual Dimorphism Operative in Jamaican Pimento (*Pimenta dioica* L. Merr.)

Frederick Boyd¹ and Jane Cohen²

^{1, 2} University of the West Indies, Mona Campus, Kgn. 7, Jamaica, WI

Introduction

Pimenta dioica is a tree crop endemic to the Caribbean and Latin American region. Traditionally, it has been quite a valuable spice in Jamaican gastronomy as well as an important export product. Nested within the Myrtaceae, it exhibits cryptic dioecy as the gender of the trees is apparent only at its annual efflorescence. The *Pimenta* genus is composed of at least 15 species which are found mostly in the Caribbean region of Mesoamerica (Chaverri and Ciccio 2015, Paula et al. 2010, Landrum 1986, Farias et al. 2009). *P. dioica* ranks among more significant plants of economic importance in the Myrtaceae (Rema, Krisbamoortby and Matthew 1997, Landrum 1986) and occupies a centre of diversity within the tropical to southern temperate Americas (CABI 2016, Wilson et al. 2001).

Methodology:

The objectives of this floral phenology study of *P. dioica* were threefold:

1. To determine the morphological differences between bearing (female) and non-bearing (male) pimento flowers.
2. To investigate the difference in the physiology of pollen germination in male and female flowers through pollen viability and pollen germinability trials.
3. To elucidate the pollination system involved in the sexual reproduction of *P. dioica* flowers through comparative floral isolation studies.

Mature trees were selected for the study that had been flowering and fruiting for number of years prior to the commencement of this study, with the youngest of the trees in excess of 20 years old. The sampling sites were located within the three counties across the island, viz. Cornwall (Western); Middlesex (Central); Surrey (Eastern).

The cut end of 30 - 50 cm of terminal, flowering branches were immediately immersed in water in a bucket sufficient (aged) tap water and transported to lab from each study site. The data collected from both genders included

- Stamen counts,
- Floret diameter measurement at the receptacle level
- Floral number per terminal polychasial cyme
- Pollen germination trials
- Styler morphology

Results:

The difference in the number of stamens was highly significant ($p < 0.001$) with $SE = 0.37$ for gender means ($df 1,594$), as illustrated in Figure 1. There was no significant interaction between gender and site ($p = 0.684$) ($SE = 0.64$, $df 2,594$), although there was a small but significant difference in the mean number of stamens per flower for the sites ($p < 0.001$).

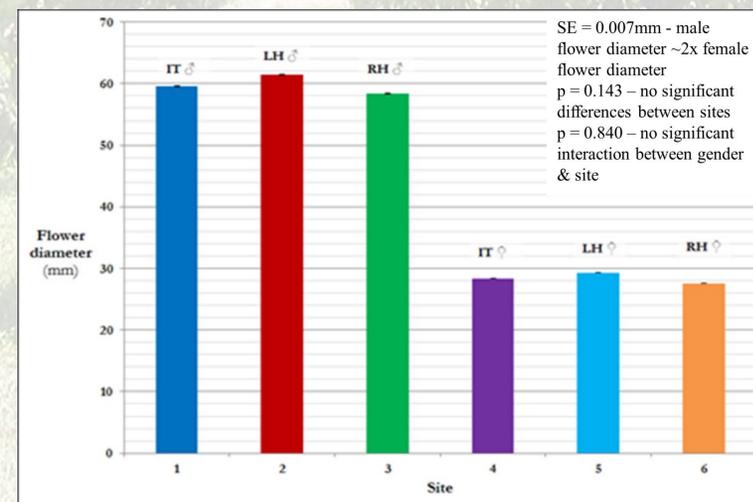


Figure 1: Mean Floral Diameter

Although the data confirms the larger flower size for the male flower, the number of flowers borne on the polychasial inflorescences of both genders also differed. Figure 2 shows that consistently there was a greater (17%) number flowers per inflorescence borne on the female trees ($p = 0.001$, $SE = 1.02$, $df 1288$). There were no site differences in this floral character ($p = 0.874$, $df 2288$), and there was also no interaction between gender and site ($p = 0.999$, $SE = 1.76$, $df 2288$).

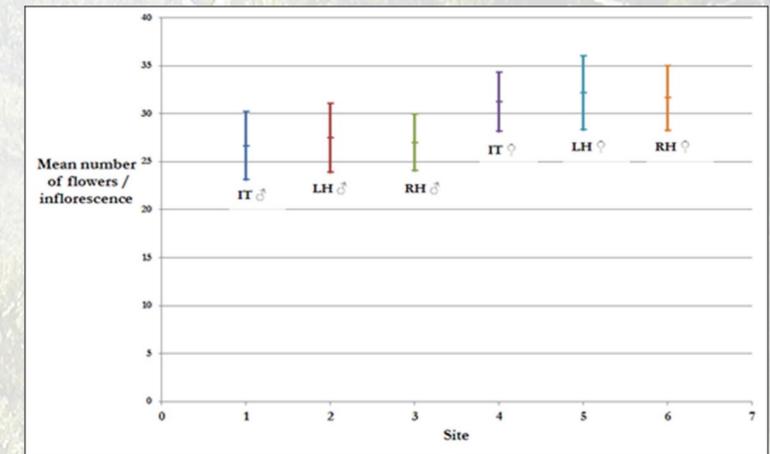


Figure 2: Number of Stamens per Floret

The highest germination of pollen from florets of male trees was obtained at 20 % sucrose at 25 mg L⁻¹ boron and 75 - 150 mg L⁻¹ calcium. Female pollen also germinated optimally under identical sucrose and calcium levels, but at twice the level of boron (50 mg L⁻¹). However, successful pollen tube development was observed in the pollen from male trees, as the pollen tubes of female tree-derived pollen burst within a few hours after pollen tube elongation had begun (see Figure 3 and 4):



Figure 3: Male pollen growth

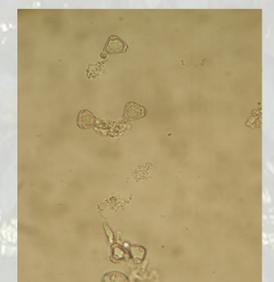


Figure 4: Female pollen tube growth

The styles in the male florets were all straight, while the those in their female counterparts were bent at approximately midway their length.

Discussion:

The results of this floral study comprehensively confirm for the first time the covert dioecy operative in *Pimenta dioica*. Cross pollination is an obligatory reproductive process during the sexual reproductive process, as illustrated in the morphological differences in floral characteristics as well as physiology of pollen tube development.