First Report of *Erysiphe fallax* Causing Powdery Mildew on Phasey Bean (*Macroptilium lathyroides*) in the United States

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Accepted for publication 3 February 2019.

Keywords: *Erysiphe*, powdery mildew, invasive species, tropical plants, papaya

Phasey bean (*Macroptilium lathyroides* [L.] Urb.), also commonly known as wild bush bean, is a member of the Fabaceae family and is native to tropical America. This species belongs within category II on the Florida Exotic Pest Plant Council 2017 List of Invasive Species (<https://www.fleppc.org/>). Phasey bean has spread throughout Florida and become increasingly abundant in south Florida. During the fall of 2017, the leaves of phasey bean plants in Homestead, FL, showed white powdery fungal growth. Symptoms first appeared as white spots on both sides of the leaves (Fig. 1). Mycelial growth was loose to dense white patches and sometimes effused. As the disease progressed, the mycelial growth became more abundant and, in some cases, covered entire leaf surfaces. When observed under a microscope, abundant conidia resembling *Erysiphe* spp. were present. The conidia were born singly, cylindrical to subcylindrical, apex rounded to subtruncate, and measured 30 to 44 μm in length and 17 to 22 μm wide ($n = 30$). The morphological characteristics suggested that the pathogen was *Erysiphe* sp. For further identification, genomic DNA was extracted from conidia using a DNeasy Plant Mini kit (Qiagen, Germantown, MD). Primers ITS1/ITS4 (White et al. 1990) were utilized to amplify fragments of the internal transcribed spacer region. The nuclear larger subunit region was amplified by using primers LR0R and LR5 (Vilgalys and Hester 1990). The contiguous sequences from the resulting polymerase chain reaction products were obtained using CAP3 sequence assembly program (Huang and Madan 1999). The 1,394-bp sequence was deposited to GenBank as FL-1 isolate with accession number MH560056. BLAST results showed that the sequence of FL-1 shares 99% identity with an *Erysiphe fallax* isolate on papaya (LC228608.1). Utilizing the GenBank sequences of other *Erysiphe* species and the FL-1 sequence, phylogenetic trees were generated in MEGA 7 (Kumar et al. 2016) implementing the maximum likelihood method (Fig. 2), which was confirmed with the neighbor-joining method. A bootstrap value of 1,000 replicates and the Kimura two-parameter model (Kimura 1980) were used in the construction of phylogenetic trees. Based on its morphological characteristics and sequence

identities, this fungus was identified as *E. fallax*. The morphological characteristics also matched those described by Braun et al. (2017), in which only a few germ tubes naturally developed on leaves. To confirm pathogenicity, three repeated experiments were performed on ten 2-week-old phasey bean plants for each experiment, in which five plants were used for Koch's postulates and five plants were used as control plants. In first experiment, plants were sprayed until run-off with a suspension of FL-1 containing 1×10^5 conidia/ml. Control plants were sprayed with sterile distilled water. In a second experiment, the infected leaf tissue was excised in small pieces (5 mm^2), and five pieces were placed directly on each of five healthy leaves. Healthy leaf tissues were excised and placed on leaves of the healthy plants in same manner as a control. In the third experiment, the infected leaves of an infected plant were directly dusted over the healthy plant leaves for 5 s. A healthy plant was taken to dust over healthy plants in same manner as a control. Inoculated and noninoculated plants were covered with plastic bags separately and maintained overnight in a greenhouse at $28 \pm 2^\circ\text{C}$. Symptoms appeared about 12 days after inoculation on all inoculated plants and were similar to those observed on leaves of the originally infected plants. All control plants were symptomless. To our knowledge, this is the first report of *E. fallax* in phasey bean in the United States and worldwide. Phasey bean is an invasive weed and is present year-round in south Florida. Because papaya is a host of this pathogen (Braun et al. 2017) and south Florida has a considerable acreage of papaya production, phasey bean could serve as a reservoir of the pathogen infecting this economically important crop in this region. Control of this invasive plant species may be helpful in management of powdery mildew for the papaya industry.

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The author(s) declare no conflict of interest.

FIGURE 1

A, Conidia of *Erysiphe fallax* under a microscope; **B**, symptoms of *E. fallax* on phasey bean plants; and **C**, conidia of *E. fallax* under a microscope with a reference scale.

FIGURE 2

The evolutionary history was inferred by using the maximum likelihood method based on the Kimura two-parameter model. Branches corresponding to partitions reproduced in less than 50% of bootstrap replicates are collapsed. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1,000 replicates) is shown next to the branches. FL-1 = Florida isolate.

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