

Net Spot of Cucumbers

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ABSTRACT

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A cucumber (*Cucumis sativus*) leaf disease caused by *Leandria momordica* not previously reported in Florida is described. The disease was first attributed to *Stemphylium cucurbitacearum* when it was observed in Ohio and Indiana in cucumber fields in 1915 and 1916. In Florida, the pathogen caused severe defoliation of cucumber plants in the fields during the 1974-1975 season, producing lesions that appeared first as white leaf spots with reddish margins on both surfaces of the leaf. In early stages, lesions have an angular appearance and later enlarge into round indistinct lesions. The veins and veinlets in the white center of the lesion acquire a brownish red discoloration with a ringlike form, giving the lesion a netlike appearance. The net-spot disease was first observed on cucumber leaves and later, on leaves of balsam pear (*Momordica charantia*), a wild cucurbit vine.

A disease of cucumber (*Cucumis sativus* L.) caused by *Leandria momordica* Rangel (7) was first observed occurring in Indiana and Ohio in 1915 and 1916. Osner (6) determined the causal agent to be a fungus, *Stemphylium cucurbitacearum* Osner, a new species confirmed by W. G. Farlow (6). Both scientists were unaware of Rangel's (7) description of the same fungus observed in Niteroi, Brazil, during 1915 on leaves of balsam pear (*Momordica charantia* L.), a wild cucurbit vine.

Although Osner (6) had published his observations of the 1915-1916 outbreaks of the disease and his experiments with the fungus in 1918, surprisingly enough, no further reports of the disease were found in the literature since that time, a lapse of 66 years. I first observed the disease in Florida in association with lesions of target spot (*Corynespora cassiicola* (Berk. & Curt.) Wei) during the 1973-1974 season and again in the 1974-1975 season, when target spot was not present. The disease was also observed on balsam pear on both occasions.

This paper reports the first observed occurrence of the disease in Florida, describes the causal organism, suggests the name "net spot" for the disease, and reports a series of observations and inoculations on various cucumber cultivars.

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MATERIALS AND METHODS

Disease occurrence. In weekly surveys of cucumber fields in Florida while involved in a project associating disease occurrence and weather parameters initiated in 1973 (2), a disease not previously observed on cucumber leaves was found near the Immokalee South weather station (2). Although some of the young angular lesions were similar to those of target spot caused by *C. cassiicola*, the older lesions were quite distinct in their netlike appearance on older leaves of Poinsett cucumber vines.

During the summer of 1973, the disease was found on the leaves of balsam pear growing in nearby citrus groves. No disease was observed during the fall and winter months of 1973.

In the weekly surveys during March 1974, a few lesions were observed in cultivar Poinsett cucumber fields within a 3-km (1.9-mile) radius, and by April 1974, the disease was observed on experimental cucumber plots at the Immokalee Agricultural Research Center about 5 km from where it was initially observed.

The pathogen initially did not appear to defoliate the vines as rapidly as the target spot fungus (*C. cassiicola*) but did reduce the number and size of fruit of the affected vines.

Conidia found in the centers of the lesions were of particular interest because of their strikingly dark color in contrast with the hyaline conidiophores and the granular appearance of the hyaline mycelium growing mostly on lesions on the lower surfaces of the leaves.

Inoculations. Single-conidia isolations were made on water agar from conidia growing on mycelium in the centers of the lesions. Two aerial transfers were made to eliminate the possibility of contamination, with subsequent transfers to potato-dextrose agar (PDA) and V-8 juice agar (V8A). Inoculum was prepared from pure

20- to 30-day cultures of *L. momordica*. Culture surfaces were scraped with a sterile scalpel and sterile deionized water was added to form a concentrated mycelium-conidial suspension that was filtered through two layers of cheesecloth and applied to cucumber plants with a DeVilbiss atomizer. Five groups of five 15-day-old pot-grown greenhouse cucumber plants of the cultivars Marketer, Poinsett, Galaxy, Ashley, and Victory were covered with plastic bags 24 hr before inoculation.

Four groups of five plants each were sprayed with a conidial suspension of *L. momordica* (20 conidia/ μ L). One group was sprayed with deionized water only and served as uninoculated controls. The inoculated plants were then placed on greenhouse benches. Temperatures in the greenhouse ranged from 24 C during the day to 16 C at night. Leaf percent disease ratings were based on the Brown-Barratt-Horsfall System (3).

RESULTS

Pathogenicity. *L. momordica* produced distinct small necrotic spots on young leaves of all cultivars during the first 5 days after inoculation (Fig. 1A). Spots became angular in appearance 7-10 days after inoculation as they increased in size (Fig. 1B). The lesions became circular in the advanced stages of infection 10-15 days after inoculation and, at this time, each developed a distinct netted appearance in the white center of the lesion (Fig. 1C). These symptoms suggested the proposed "net spot" designation. As the infection spread, the circular lesions increased size with the veins and veinlets developing a ringlike appearance and a netlike reddish discoloration in the white center of the lesion. Increased coalescing of the lesions as the disease progressed caused disintegration of the dry white center, resulting in a tattered effect to the leaf.

Conidia were generally produced in the centers of advanced lesions and normally were not observed on young angular lesions. Under very humid conditions, however, great masses of conidia were observed on both angular and advanced lesions. Conidia were produced only on the lower surfaces of the leaves under both dry and humid conditions (40 and 90% RH, respectively).

Lesions produced on leaves that had become somewhat hardened (mature) formed small necrotic spots with white centers and reddish margins but did not

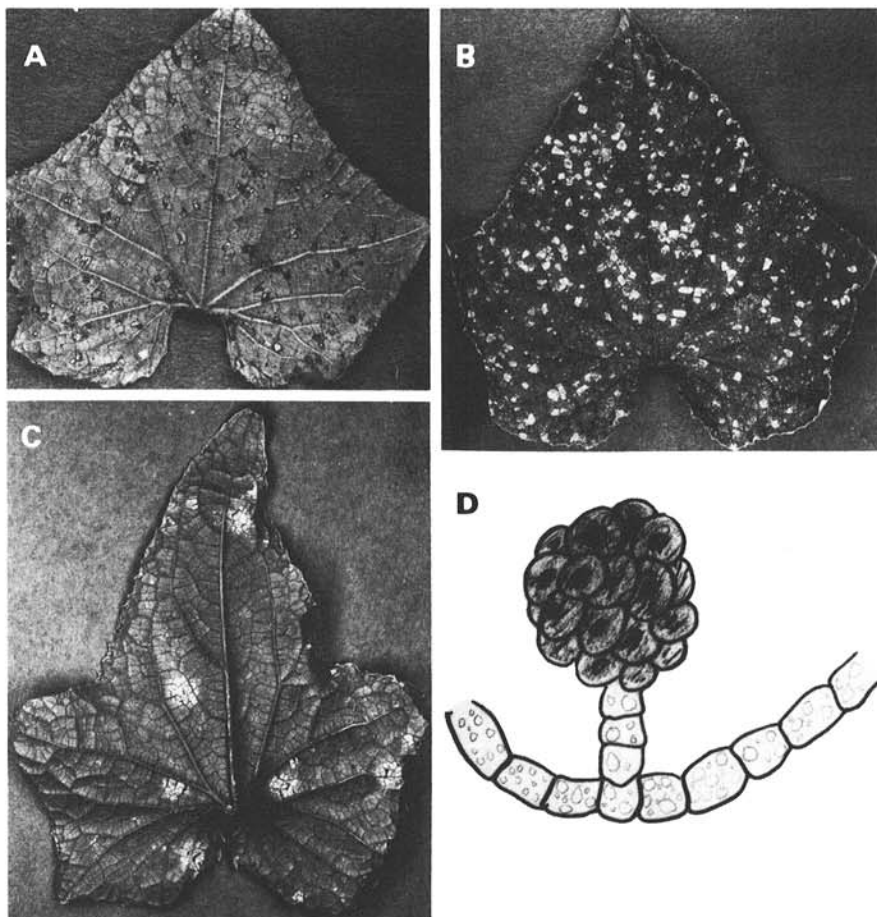


Fig. 1. Pinpoint, angular, and large circular lesions of *Leandria momordica* on the surfaces of Ashley cucumber leaves: (A) small necrotic pinpoint early lesions with white centers on adaxial surface, (B) angular lesions with reddish marginal borders, (C) large circular advanced lesions with dark reddish veins giving a netlike appearance to the center of the lesion, and (D) camera lucida drawing of a typical conidiophore and the many-celled muriform nearly black conidium varying in diameter from 27 to 50 μm and in the number of globose cells from 7 to 18, each with a diameter from 6 to 20 μm ($\times 600$).

develop the netlike appearance as observed in larger lesions. No petiole or stem infections were observed in most of the cultivars inoculated; however, in Marketer and Galaxy cultivars, a few flecks were observed on petioles of leaves inoculated when very young. Lesions on plants maintained under humid (90% RH) conditions developed faster and were larger than those maintained under dry (40% RH) conditions.

The pathogen. Macroscopic and microscopic ($\times 600$) examinations of early distinct necrotic spots, angular spots, and large, advanced, circular lesions established the presence of typical hyaline conidiophores of the genus *Leandria*. The conidiophores were 3–6 septate, 10–30 μm long, and 5–12 μm in diameter. The conidia were globular and muriform, at first hyaline, becoming nearly black later, 27–50 μm in diameter, with 7–18 globose cells, each of which were 6–20 μm in diameter (Fig. 1D). Conidia were produced entirely on the lower surface of the leaf. The size of the mycelium and the conidia fitted Rangel's (7) description of *L. momordica*, including the striking contrast between the hyaline conidio-

phores and granular mycelium with the dark globular conidia. The mycelium remained hyaline on cucumber lesions, but in culture changed to light brown.

Identification of the pathogen was made by M. B. Ellis of the Commonwealth Mycological Institute (CMI), Kew, England (*personal communication*). The assigned CME Accession Number is 162659.

Cultivar resistance. Considerable differences were found in resistance to infection *L. momordica* among the cultivars tested. The older cultivars, Marketer and Galaxy, which are highly susceptible to downy mildew (*Pseudoperonospora cubensis* (Rostow) Berk. & Curt.) and no longer used in the Florida growing area, appeared to be tolerant to *L. momordica* (Table 1). The cultivar Ashley was very susceptible, whereas the cultivars Poinsett and Victory were mildly susceptible to *L. momordica*. Large lesions with the netlike appearance in the center of the white lesion were observed on Ashley, Poinsett, and Victory with abundant sporulation occurring mostly on the lower surface of the leaves.

Table 1. Percent net spot disease incidence in greenhouse-grown cucumber cultivars inoculated with *Leandria momordica* conidia

Cultivar	Percent diseased ^z
Poinsett	30.5 b
Marketer	12.0 a
Ashley	65.5 c
Galaxy	10.0 a
Victory	20.0 ab

^zBased on five replicates of five 15-day-old pot-grown plants each. All plants in the greenhouse, including the controls that remained healthy, were kept under plastic bags for 24 hr after inoculation at 90% relative humidity. Greenhouse temperatures were 24 C during the day and 16 C at night. Numbers within a column followed by the same letter are not significantly different from each other at the 5% level according to Duncan's multiple range test.

DISCUSSION

The reappearance of the disease caused by *L. momordica*, first described by Rangel (7) in 1915 on balsam pear and by Osner (6), who observed it on cucumber leaves in 1915, is rare because it has not been reported on any host plant since that time. Apparently, net spot did not cause any economic loss in either Indiana or Ohio after Osner reported it in 1918 (6). The causal organism has rarely been reported and is listed with the doubtful genera in Clements and Shear (5) and Carmichael et al (4) because they were not certain just where *L. momordica* fit, and it is not listed in Barnett and Hunter's (1) work on Fungi Imperfecti. The appearance of the disease on cucumbers in Florida was also unexpected because the cultivar Poinsett had been under cultivation free of the disease for many years in southwestern Florida.

In his observations and disease reports from Indiana and Ohio, Osner (6) did not identify the cultivars of cucumbers, but he did name the cultivars used in his inoculations that may have been the cultivars commercially grown during 1915–1918. Unfortunately, although they may have been available in Florida at that time, they are no longer grown so no comparisons in susceptibility to *L. momordica* were possible in this investigation. The net spot disease has not been observed or reported in the literature on gourds (*Cucurbita foetidissima* H. B. K.) or squashes (*C. maxima* Dcne.) grown in Florida.

The pathogen first observed on Poinsett cucumbers and subsequent inoculations of the other four cultivars more closely resembles the description given by Rangel (7) than the one given by Osner (6), particularly with regard to the striking contrast between the nearly black conidia and the hyaline conidiophores arising from hyaline, granular mycelium. Rangel (7), however, did not report the netlike reddish discoloration of the veins and veinlets in the center of the white

lesion. Osner (6) did observe the symptom but called it a "mottled" appearance, which can be somewhat misleading.

In his 1915 report, Rangel (7) erected a new genus (*Leandria* Rangel) and a new species (*L. momordica* Rangel) to describe the fungus he found on balsam pear, whereas Osner (6) considered the causal organism a species of *Stemphylium* and named the disease he observed on cucumbers in 1915 "Stemphylium leafspot."

I accept the identification of the causal organism as *L. momordica* and suggest that a more appropriate name for the disease would be "net spot" because one of the outstanding symptoms of the host

is the netlike appearance of the reddish discolored veins and veinlets in the white centers of the older lesions. Net spot may have been attacking the balsam pear in southwestern Florida for some time before its appearance on the cultivar Ashley cucumber, but because balsam pear is of no economic importance, its diseases have not been recorded. It was not possible to associate disease occurrence with any climatic factors because it had not been observed more than two seasons.

ACKNOWLEDGMENT

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