Inoculum Sources of Pyricularia grisea, the Cause of Pitting Disease of Bananas

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Wind dissemination of *Pyricularia grisea* (Cooke) Sacc., the causal organism of pitting disease of bananas, was suggested by Wardlaw & McGuire in 1932 (6) and was first demonstrated by Meredith in 1962 (3). Wardlaw (5) observed sporulation of *P. grisea* on transition leaves and flower bracts of bananas and recommended their removal. However, microscopic examination of leaf scrapings did not yield *Pyricularia* spores (6), and *P. grisea* was not found on decaying banana leaves in Jamaica (2) or Costa Rica (4). Also, sporulation does not occur on the typical spots produced on the banana fruit.

A search was made for other possible sources of inoculum. First, common weeds with leaf spots in and around banana plantations were examined. Leaf segments of *Callisia repens* L., *Commelina erecta* L., *Commelina diffusa* Burm. fils, *Momordica charantia* L., *Pennisetum* sp., *Solanum scabrum* Vahl. and *Tripogandra cumanensis* (Kunth) Woodson showing spot symptoms were placed on moistened filter paper in petri dishes. After incubation at room temperature (24 C ± 1.5 C), they were examined with a low-power dissecting microscope. *P. grisea* sporulation was observed occasionally on *Helminthosporium* lesions on leaves of *Pennisetum* sp. Sporulation was invariably found in abundance on senescent leaves of *Commelina erecta* (Fig. 1). *Pyricularia* sporulation was not evident on other weed leaves examined.

Detached, healthy green leaves of *C. erecta,* when inoculated with a spore suspension of *P. grisea,* failed to become necrotic or support sporulation in 14 days. However, when autoclaved green or senescent leaves were inoculated with conidia or mycelial suspensions of *P. grisea,* excellent sporulation was observed after 3 to 4 days. Apparently, *P. grisea* is a saprophytic colonizer of senescent or dead *Commelina erecta* leaves which provide a suitable substrate for abundant spore production.

Since *C. erecta* is not present in all banana plantations where pitting disease occurs, other sources of inoculum were sought. Samples from partially decayed banana leaves on the ground and dead trash leaves hanging from the plants were examined. Sporulation of *P. grisea* was sometimes observed on both sources during the wet season, but not during dry periods. The dry season in northern Honduras starts in March and lasts until early June.

The importance of weed and banana leaf trash as inoculum sources was not fully assessed until spore trap sampling in the field was initiated. Dampened *Commelina erecta* plants, decaying banana leaf trash from the ground, and hanging dead trash leaves cut from banana plants were sampled. Sampling was carried out under a 1.5 × 3.0 × 0.6-m plastic enclosure in the field, used to exclude spores from other sources. A Hirst spore trap was placed inside at the end of the enclosure. The intake orifice of the spore sampler was 45 cm above ground level and approximately 15 cm above the sporulating plant material. A hygrothermograph was also enclosed to record humidity and temperature during periods of spore production. Each experiment was started between 1600 to 1800 hr to insure the high humidity necessary for sporulation (3). One hundred per cent relative humidity prevailed under the enclosure for 14 hr after sampling started. The temperature during this period varied between 24 and 26 C. After each 24 hr of continuous sampling, spore trap slides were removed, stained, and *Pyricularia grisea* spores were counted at 2-hr intervals according to Hirst's method (1).

The conidial counts from different spore sources are presented in Table 1. The first spores trapped appeared 4 hr after the sampling started, and their numbers increased and reached a peak between 8 and 12 hr from all spore sources. After 16 hr, when the air temperature usually rose above 27 C, relative humidity in the plastic enclosure gradually declined, along with the number of *Pyricularia* spores trapped.

The proportion of total daily spore count when compared from different sources indicated their relative importance. *Commelina erecta* released only a small

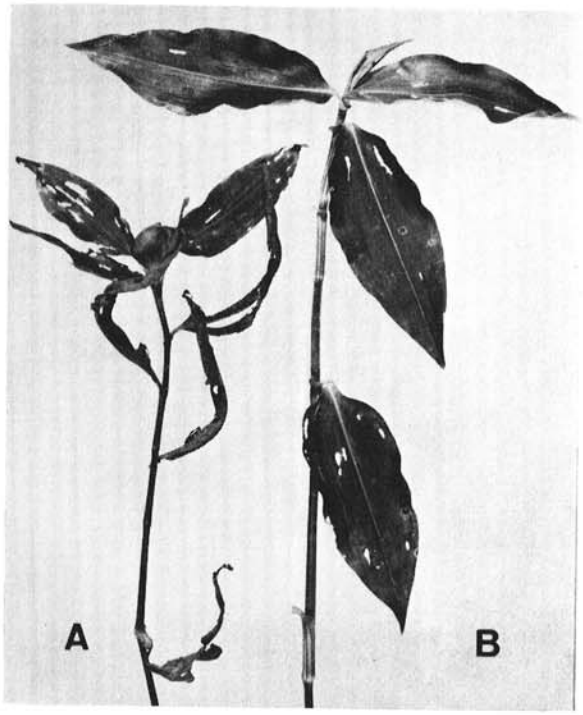

Fig. 1. *Commelina erecta* (approximately one-third natural size). **A)** Senescent, withering leaves which support sporulation of *Pyricularia grisea.* **B)** Normal leaves.

TABLE 1. No. *Pyricularia grisea* conidia trapped from different sporulating sources

Spore source[b]	No. *Pyricularia* spores counted/2-hr intervals[a]												Avg daily spore count /slide[d]
	2	4	6	8	10	12	14	16	18	20	22	24[c]	
Commelina	0	0	2	21	23	12	6	11	8	6	5	1	95
Decaying banana trash leaves on ground	0	1	30	48	42	41	28	10	1	0	0	0	201
Hanging trash leaves from banana plants	0	10	50	185	244	302	213	103	14	6	3	1	1,131

[a] Standard counting method of Hirst spore trap slide.
[b] Sampled surface area was 1.5 × 3.0 m.
[c] Hours elapsed from the time the Hirst spore trap operation started.
[d] Avg of replicate 1-day trials, 3 for *Commelina* and 12 for both the decaying banana trash leaves from the ground and hanging trash leaves from banana plants.

number of *Pyricularia* conidia in comparison with banana trash leaves. Decaying trash leaves from the ground produced twice as many spores as *C. erecta*. In banana plantations, ground level sources of inoculum such as decaying trash leaves on the ground or *C. erecta* are potentially less dangerous than inoculum from dead leaves hanging from the plants. The latter are close to the fruit, on which spores can readily impinge when they become airborne by night convection currents and wind. Moreover, sporulation does occur on both surfaces of hanging dead leaves in the field, while trash leaves on the ground have only one sporulating surface exposed. The total surface area of senescent or dead *Commelina* leaves was approximately 500 times less when compared to banana leaf surfaces sampled. The spore production potential of hanging trash leaves on the banana plant is probably more important than is indicated by the sampling methods, because only one sporulating surface was exposed during sampling and there was no appreciable air movement under the enclosure to aid spore dispersal.

LITERATURE CITED

1. HIRST, J. M. 1952. An automatic volumetric spore trap. Ann. Appl. Biol. 39:257-265.
2. MEREDITH, D. S. 1962. Some fungi on decaying banana leaves in Jamaica. Trans. Brit. Mycol. Soc. 45:335-347.
3. MEREDITH, D. S. 1962. Spore dispersal in *Pyricularia grisea* (Cooke). Sacc. Nature 195:92-93.
4. MEREDITH, D. S. 1963. *Pyricularia grisea* (Cooke) Sacc. causing pitting disease of bananas in Central America. I. Preliminary studies on pathogenicity. Ann. Appl. Biol. 52:453-463.
5. WARDLAW, C. W. 1934. Banana diseases. 6. The nature and occurrence of pitting disease and fruit spots. Trop. Agr. 11:8-15.
6. WARDLAW, C. W., & L. P. MCGUIRE. 1932. Pitting disease of bananas. Its nature and control. Trop. Agr. 9:193-195.