Synchytrium desmodii, Cause of Wart Disease of the Tropical Pasture Legume *Desmodium ovalifolium* in Colombia

JILLIAN M. LENNÉ, Tropical Pastures Program, Centro Internacional de Agricultura Tropical (CIAT), Apartado Aéreo 6713, Cali, Colombia

ABSTRACT

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Desmodium wart, caused by *Synchytrium desmodii*, was found producing damage on the tropical pasture legume *Desmodium ovalifolium* 'CIAT 350' in the eastern plains of Colombia. The pathogen appears to be restricted to several species of *Desmodium*. It was apparently introduced as resting spores on plant and soil debris associated with seed imported from Singapore.

Desmodium ovalifolium Wall. 'CIAT 350' (syn. *D. heterocarpon* (L.) DC.), a perennial subshrub native to Southeast Asia, has shown great potential as a productive pasture legume in association with various grasses in Colombia (1) and other countries of tropical South America (5). Since its introduction to Panama in the early 1970s (2), *D. ovalifolium* has remained relatively disease-free in Latin America. In 1983, however, severe damage caused by stem gall nematode was reported from Colombia (3). This paper reports another damaging disease of *D. ovalifolium* caused by *Synchytrium desmodii* Munasinghe. Distribution, symptomatology, known host range, and seed association are summarized.

The disease caused by *S. desmodii* was first reported in cover crops of *D. ovalifolium* in several rubber plantations in the Ratnapura and Kalutara districts of Sri Lanka in 1952 (4). The pathogen could not be identified as any of the three species previously described on *Desmodium* and consequently was named as a new species and assigned to the subgenus *Mesochytrium* (4). A search of the literature has revealed no other reference to this disease in Asia.

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In 1981, a *Synchytrium* sp. was found causing severe damage in a planting of *D. ovalifolium* 'CIAT 350' at the ICA-CIAT Research Station at Carimagua in the eastern plains of Colombia. Seed for this planting was imported from Singapore. Samples of diseased plant material were sent to the Commonwealth Mycological Institute, United Kingdom, and the causal agent was identified as *S. desmodii* by D. J. Stamps.

FIELD OBSERVATIONS

From December 1981 to September 1983, seven plantings (1–10 ha in area) of *D. ovalifolium* 'CIAT 350' in the eastern plains of Colombia were periodically surveyed for diseases. All plantings were sown from seed imported from Singapore. Desmodium wart was detected in five of seven plantings; 20–30% of the area was severely affected in two plantings and 50–70% of the area was severely affected in the other three. Damage was rated severe when 50–100% of stems on mature plants showed galling and subapical to apical leaf deformation and when 50–100% of young plants showed severe stunting and deformation. Moderate damage was assessed when 25–49% of mature plant stems were galled and deformed.

As of September 1983, Desmodium wart was not present in any Colombian plantings sown from locally harvested seed. Subsequent surveys throughout Central America, Brazil, Colombia, Peru, Venezuela, and Bolivia have failed to detect *S. desmodii* in CIAT 350 plantings sown from seed produced in Latin America. Apart from its occurrence in Asia, this disease is restricted to the eastern plains of Colombia.

Symptomatology. Observations were made on plants in various developmental stages in field plantings. Initial symptoms appear as pale minute swellings on young stems, petioles, and lower leaf surfaces, particularly along the midrib, veins, and leaf borders. They are especially common just below young shoot apices. Swellings develop into yellow-orange, and later, yellow-brown pustules that produce masses of orange-yellow sporangia filled with zoospores and brown, thick-walled resting spores.

Pustules develop into galls. Infected apices and stems cease growing and the subapical parts become distorted, twisted, and stunted. Small twisted leaves proliferate on distorted stems (Fig. 1). Chlorosis of affected leaves is common. Individual galls become indistinguishable and merge as continuous swellings on affected stems (Fig. 2). Affected stem apices and entire young plants often die, whereas adult plants usually regrow healthy stems even after severe attack.

Although galls have not been detected on flowers, they are common on flowering stems and pods. Flowering and seed production are greatly reduced.

Seedlings emerging in affected plantings are usually stunted and deformed with pustules and galls on cotyledons, leaves, and petioles.

Causal agent. Sporangia produced by *S. desmodii* on petioles and leaves are polyhedral to spherical, 16–25 μm in diameter, with thin hyaline walls and bright yellow contents (2,4). Zoospores are spherical, uniflagellate, thin-walled, 1–6 μm in diameter, with flagella 2–6 μm long, whereas resting spores are ovoid, thickwalled, 50–100 × 60–180 μm with smooth brown walls 6–15 μm thick (2,4). *S. desmodii* belongs to the subgenus *Mesochytrium*, but all other *Synchytria* described on *Desmodium* species belong to other subgenera (2).

Conditions favoring disease development. Moderate to high temperatures (24–30 C), high relative humidity (>90%), and frequent rain showers, common conditions in the eastern plains of Colombia during May to August, appear to favor disease development. Periodic flooding of low areas in fields of *D. ovalifolium* 'CIAT 350' favors zoospore release and helps to explain the association of severe damage with dips and depressions in the pasture. Resting spores are commonly observed in pustules and galls from September onward. Presumably, the pathogen survives as resting spores during the dry season from November to March.

Fig. 1. Proliferation of small, twisted leaves on stems of *Desmodium ovalifolium* affected with *Synchytrium desmodii*.

GLASSHOUSE OBSERVATIONS

Known host range. In addition to *D. ovalifolium* 'CIAT 350,' *S. desmodii* has been observed on plants of native *D. barbatum* (L.) Benth. within affected plantings of CIAT 350 in the eastern plains of Colombia. Cross-inoculation studies were made with small pieces (3×3 mm) of leaf material of CIAT 350 with abundant young pustules of *S. desmodii* on seedlings of several *Desmodium* spp. One-week-old seedlings were exposed to conditions of 27–28 C, 100% RH, and 12 hr of light/12 hr of darkness for 24 hr before inoculation. Infected leaf pieces were placed on cotyledons and emerging first leaves of seedlings and incubated under the described conditions for 72 hr. Seedlings were removed to the glasshouse and evaluations were made 14 days after inoculation. *S. desmodii* was readily transferred to several accessions of closely related *D. heterocarpon* but not to *D. canum* (Gmel.) Schinz & Thellung, *D. gyroides* (Roxb. ex Link) DC., *D. heterophyllum* (Willd.) DC., *D. intortum* (Mill.) Jawc. & Rendle, *D. uncinatum* (Jacq.) DC., or accesssions of a range of species of promising tropical forage legumes in the genera *Centrosema*, *Stylosanthes*, and *Zornia*. Local fresh collections of *S. citrinum* (Pat. & Lagerh.) Gaümann from *D. intortum* from Quisquina in the Cauca Valley of Colombia did not infect *D. ovalifolium* 'CIAT 350,' using the same inoculation technique.

Association with seed. Although surveys of seed from lots imported from Singapore and harvested from affected plantings of CIAT 350 in Colombia revealed no spores of *S. desmodii* on seed testas or within seed, resting spores were commonly found on and within leaf, stem, and pod material associated with harvested seed. Sections of this material showed deeply embedded resting spores. Treatment with concentrated sulfuric acid for 8 min, a standard method of scarification for small-seeded (600–800 seeds per gram) tropical legumes, failed to reduce the viability of embedded resting spores; plantings sown from treated seed lots developed typical Desmodium wart within 3 mo. Because seed of *D. ovalifolium* is often suction-harvested from the ground and it is considered impossible to remove all associated debris, seed harvested from infected plantings will almost invariably be a source of *S. desmodii* infection.

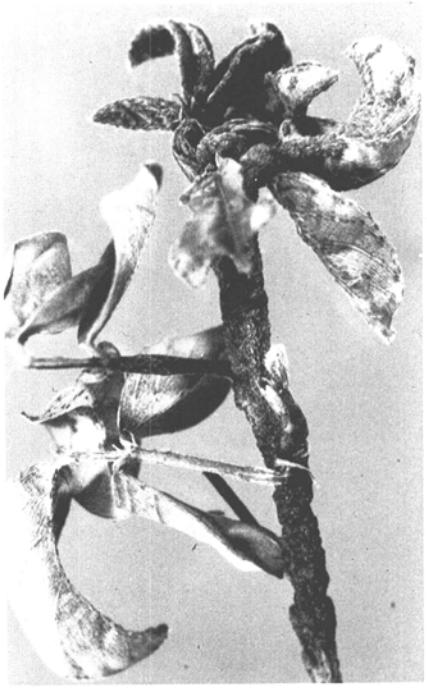

Fig. 2. Pustule and gall production on leaves and continuous swellings on stems of *Desmodium ovalifolium* affected with *Synchytrium desmodii*.

DISCUSSION

S. desmodii, apparently introduced into Latin America from Asia on infected debris associated with seed of *D. ovalifolium*, is causing moderate to severe damage in plantings of CIAT 350, a promising tropical pasture legume in the eastern plains of Colombia. Because areas of severe damage are variable in size and distribution, it is difficult to accurately evaluate losses caused by this disease. Studies are in progress, however, to measure yield from unaffected, moderately affected, and severely affected areas of several CIAT 350 plantings.

In pastures of *D. ovalifolium* 'CIAT 350' in the eastern plains of Colombia, Desmodium wart is generally not a killing disease. From May to August, it can cause severe damage with associated forage loss; however, as the wet season progresses and rain showers and periodic flooding in low-lying areas become less frequent, affected adult plants usually regrow healthy stems and are productive during the late wet season and during the dry season. Munasinghe (4) made similar observations in cover crops of *D. ovalifolium* in Sri Lanka.

In a pasture, however, if a disease affects the legume component, it is less able to compete with the associated grass. Not only is forage lost but the

productivity and persistence of the legume may be permanently reduced in a perennial pasture. Loss studies in progress will aid in understanding the effect of *S. desmodii* on productivity and persistence.

A search for resistant germ plasm is also in progress. Artificial inoculation methods were recently developed and the reactions of 90 accessions of *D. ovalifolium* under glasshouse conditions are being evaluated.

At present, there is great interest in *D. ovalifolium* as a tropical forage legume in Latin America, especially in the humid tropics. The proven association of resting spores of *S. desmodii* with soil and plant debris in seed lots from infected plantings and the great difficulty in removing this source of contamination should be noted by all agronomists with interest in this legume. Only seed harvested from plantings free of *S. desmodii* should be used.

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