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BROWN LEAF MOULD OF *CANAVALIA* CAUSED BY *STENELLA CANAVALIAE* (H. & P. SYD.) COMB. NOV.

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(With 3 Text-figures)

A brown leaf mould of *Canavalia*, caused by *Stenella canavaliae* (H. & P. Syd.) comb.nov. (syn. *Cercospora canavaliae* H. & P. Syd.), is redescribed from several collections and its distribution is discussed. The fungus is known from tropical Asia, Africa and America, on *C. ensiformis* (L.) DC. and *C. rosea* (Sw.) DC., and has also been recorded on *C. plagiosperma* Piper in South America.

A brown leaf-mould fungus, *Stenella canavaliae*, is known on *Canavalia* spp. from tropical America, Asia and West Africa. It has been collected only a relatively few times and its distribution is probably more widespread in the tropics than is at present known. The fungus was originally described by H. & P. Sydow on *Canavalia ensiformis* from the Philippines, as *Cercospora canavaliae*, but its rough-walled, repent external secondary mycelial hyphae, rough-walled brown catenulate conidia, together with the method of origin of the conidiophores on which the old conidial scars are conspicuous and thickened, place this species in the genus *Stenella* H. Sydow.

S. canavaliae is also known from Taiwan (where Sawada recorded it as *Cercospora canavaliae*, *Dendryphium canavaliae* and *Acrothecium canavaliae*), Malaysia, Honduras, Costa Rica, Trinidad and Sierra Leone, parasitizing the cultivated sword bean, *Canavalia ensiformis*, and the wild sea-shore species, *C. rosea*. It has also been recorded, probably correctly, on *C. ensiformis* from Brazil (Muller & Chupp, 1935), Venezuela (Muller & Chupp, 1942) and India (Thirumalachar & Govindu, 1953), and on *C. plagiosperma* in South America (Viégas, 1961), though I have not had the opportunity of examining the specimens on which these records were based. Thirumalachar & Govindu (1953) record the fungus as inciting severe defoliation of the plants at the time when young legumes are being formed, which would seem to indicate a heavy attack of *S. canavaliae*.

An examination of the specimens on which other records have been based – from India (Mundkur & Ahmad, 1946; Vasudeva, 1963), Bermuda (Waterston, 1947) and Japan (Katsuki, 1953, 1965) – has, however, shown that the fungus in these cases was misidentified and is not *S. canavaliae*.

S. canavaliae is the hyphomycete described and figured by Stevens (1927; 18 and pl. III, fig. 19) associated with *Dimeriellopsis costaricensis* Stev. Stevens suggested that this hyphomycete might be parasitic on *D. costaricensis* or might be genetically connected with it, but an examination of the material shows that neither suggestion is correct.

For making available collections in their keeping, I wish to thank the curators of the mycological collections in the following herbaria: **CUP**, **ILL**, **K**, **S** and **TAI**. I am also very grateful to Dr S. Katsuki for presenting to Herb. **IMI** parts of three of his own collections on *Canavalia* from Japan.

Stenella canavaliae (H. & P. Syd.) Deighton, comb.nov.

≡ *Cercospora canavaliae* H. & P. Sydow, *Annls mycol.* **12**, 203 (1914).

≡ *Dendryphion canavaliae* (H. & P. Syd.) Sawada, *Spec. Publ., Coll. Agric., nat. Taiwan Univ.* **8**, 199 (1959) ('*Dendryphium*').

= *Acrothecium canavaliae* Sawada, *Spec. Publ., Coll. Agric., nat. Taiwan Univ.* **8**, 196 (1959), a name not validly published (no Latin description provided).

Leaf spot none, caespituli hypophyllous, also epiphyllous in older infections, dense, subvelutinous or woolly, moderate to deep olivaceous, more or less orbicular and 1–5 mm diam, or larger and confluent and sometimes covering the whole of the lower leaf surface. *Primary mycelium* internal; hyphae more or less colourless, septate, branched, 1–6 μm wide. From a small aggregation of somewhat thicker hyphae in a substomatal cavity, a few stout (4–5 μm wide) olivaceous hyphae arise which penetrate the stoma; on emergence, these give rise to the *secondary mycelium*, composed of superficial repent pale olivaceous, septate, much branched, asperulate hyphae, 2–3 μm wide, which bear the conidiophores as lateral branches. Some hyphae of the primary mycelium penetrate and ramify within the guard cells of the stomata and there proliferate to form a fan-like mycelial plate in the cuticle around the stoma, at first one cell thick, later two cells thick. This intracuticular plate arises entirely from the penetration of the internal mycelial hyphae via the stomatal guard cells: no evidence was seen of penetration of the leaf, by haustoria or otherwise, from the external secondary mycelium. Later, numerous closely aggregated hyphal branches may grow out at right angles from the intracuticular plate and penetrate and fill the epidermal cells. The intracuticular plate in places may become two or more cells thick and brown and then pushes up the cuticle, sometimes bursting through it and giving rise to an external stroma of olivaceous cells, above a stoma or apparently sometimes elsewhere, up to 40 μm wide and 20 μm high, and from this stroma dense fascicles of 15 or more conidiophores are produced together with repent secondary mycelial hyphae. *Conidiophores* mostly originating from deeper brown, smooth, swollen cells, 4–6 μm wide, of the secondary mycelium, sometimes from contiguous cells, and also directly from the external stomata, erect, straight or slightly flexuous, occasionally with one or two geniculations usually (but not always) at an old conidial scar, smooth, moderate to deep olivaceous, paler towards the apex, normally simple, 32–325 μm long, 3–4.5 μm (usually about 4 μm) wide at the base, sometimes with one or two slight swellings (–5 μm) along the length and sometimes slightly swollen (–6 μm) about the apex where a cluster of old conidial scars is situated, with a septum at or just above the base and up to twelve more distal septa. Conidial scars slightly prominent, conspicuous

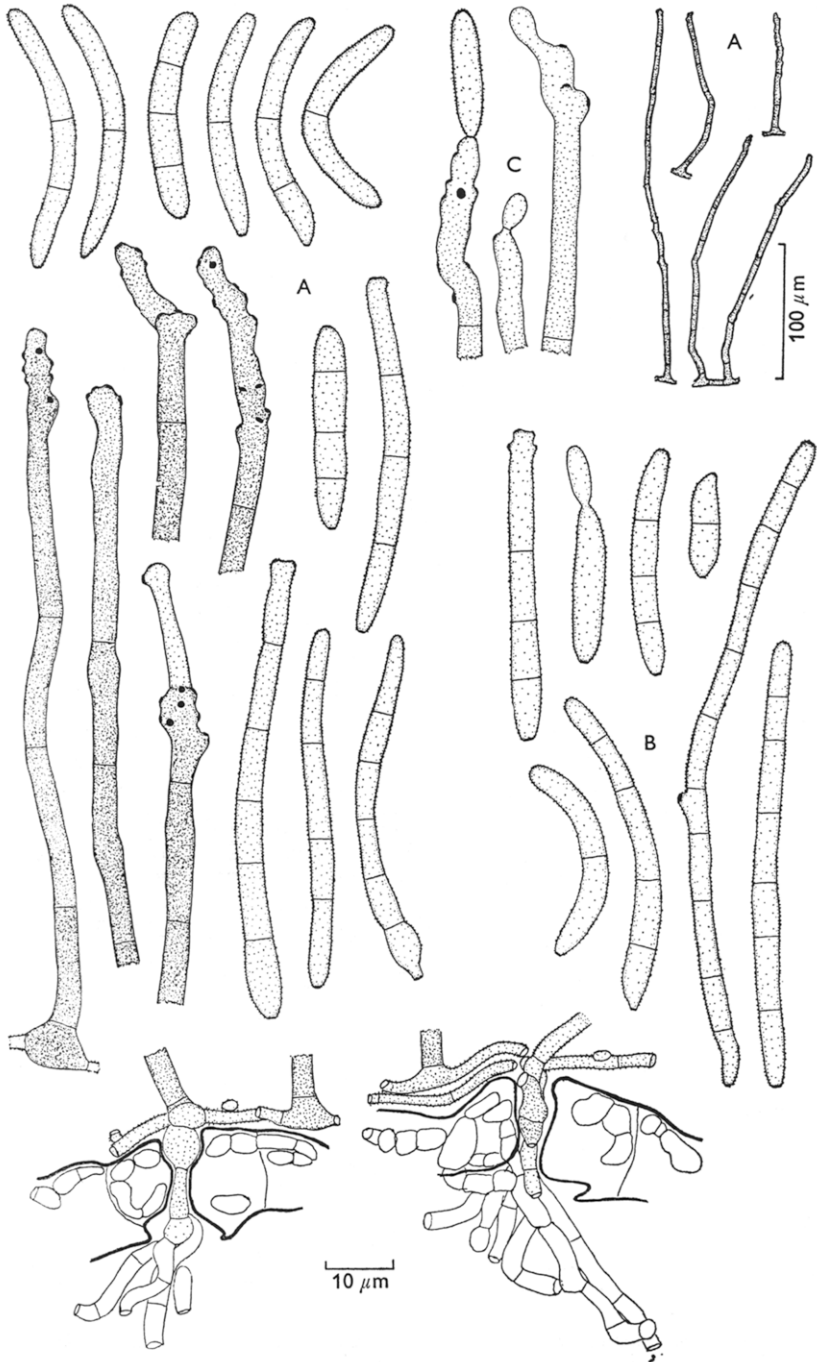


Fig. 1. *Stenella canavaliae*. Sections showing emergence through stomata: conidiophores and conidia. A, from the type; B, from IMI 41180; C, from IMI 40256a.

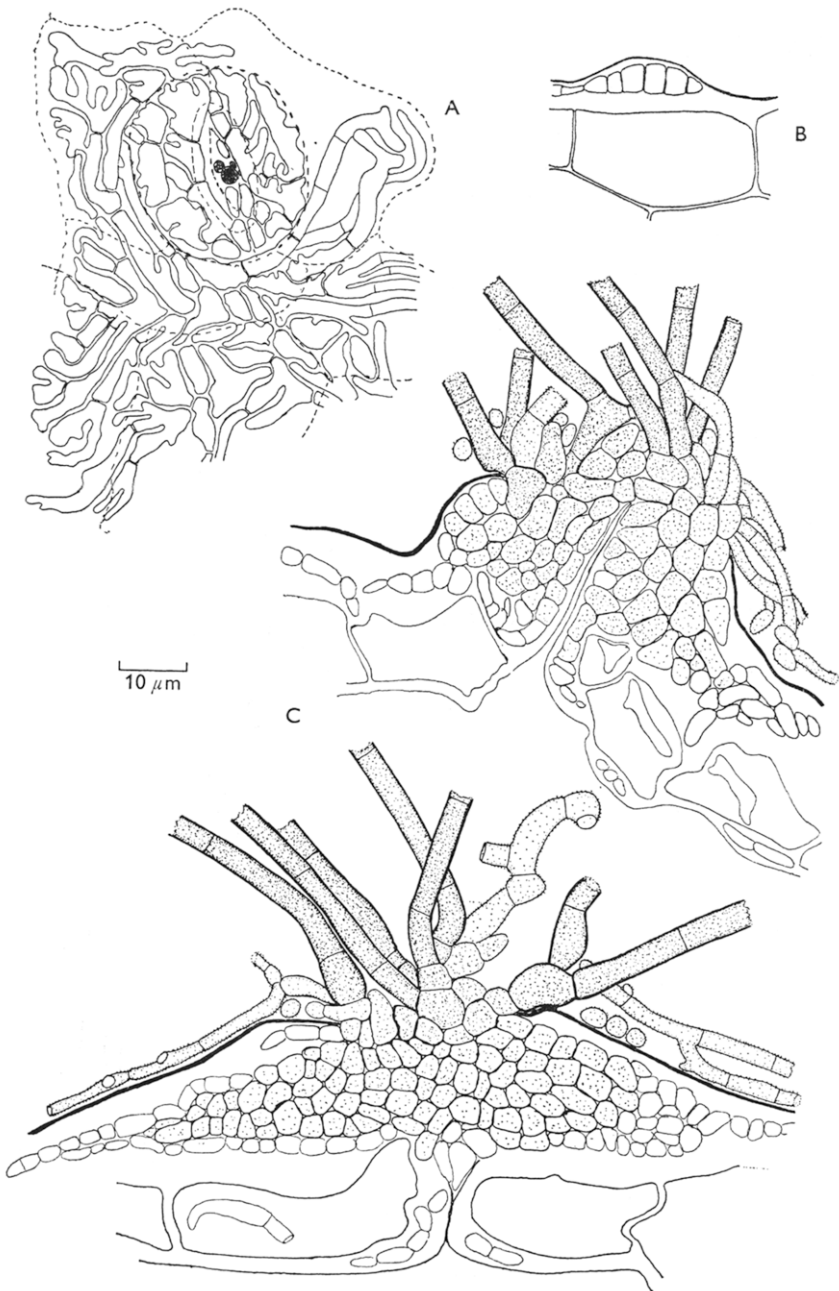


Fig. 2. *Stenella canavaliae*. A, surface view of the area around a stoma, showing the intracuticular mycelial plate. B, section through the epidermis, showing the margin of the intracuticular mycelial plate. C, two sections showing stroma and extensive intracuticular mycelium. A and B from **IMI** 41180; C, from **IMI** 46303b.

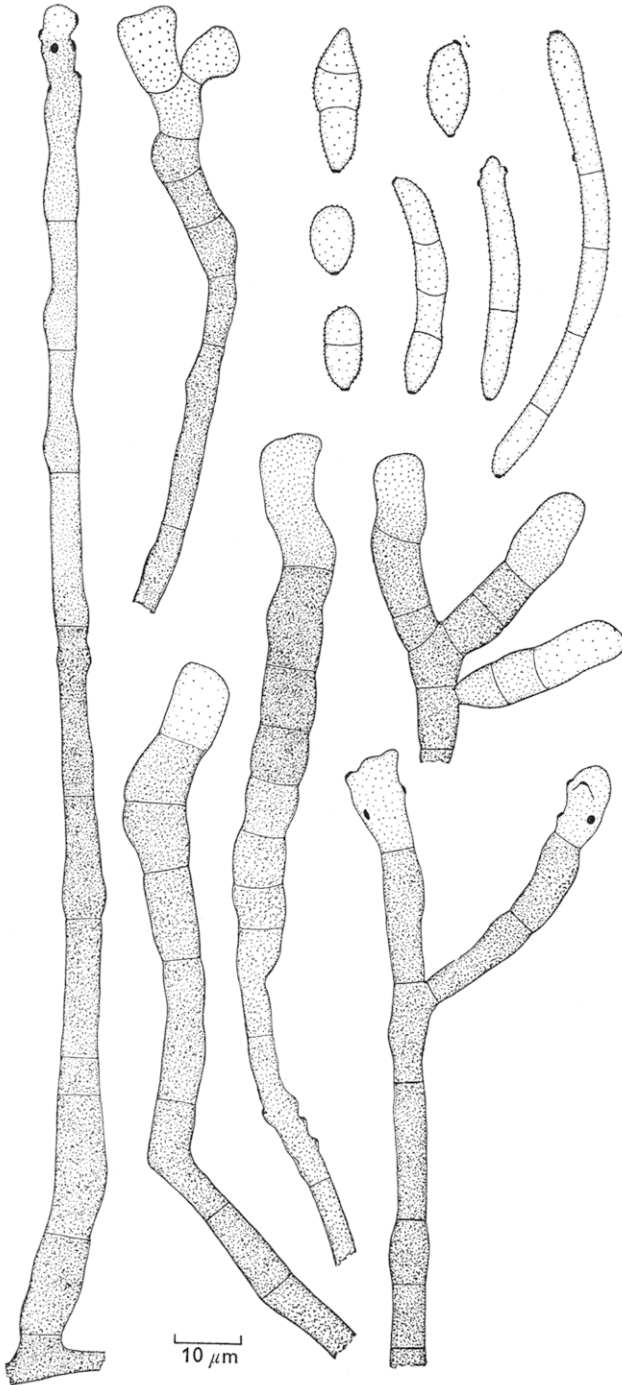


Fig. 3. *Stenella canavaliae*. Conidia and abnormal conidiophores from a luxuriant part of IMI 8176.

and thickened, the older ones lying more or less flat against the side of the conidiophore, which often elongates after bearing one group of conidia and produces the next conidial group a little distance beyond. Scattered conidial scars may occur between the groups of scars on very long conidiophores. The first conidial scar is formed 32–230 μm above the base of the conidiophore. On parts of the very luxuriant growth on one collection (**IMI** 8176) some conidiophores are deep olivaceous, often showing several swellings along their length, sometimes with one or more branches, with a more or less clavate apex swollen sometimes to as much as 20 μm , sometimes 6–8 μm wide near the base and tapering to a narrower and more normal apex: some of the swollen conidiophore apices are very pale olivaceous and seem to be mere vesicles, while others bear normal conidial scars. *Conidia* pale olivaceous, asperulate, subcylindric, rarely slightly obclavate, straight or slightly curved, catenulate in simple or branched chains, the terminal conidia rounded at the apex and usually shortly tapered at the base to the truncate, thickened hilum 1–2 μm diam, the catenulate conidia also shortly tapered or rounded to the truncate apical scar, 0- to 10-septate (mostly 1- to 5-septate), 15–96 μm long, 3–4.5 (occasionally 5) μm wide. Some conidia show a basal hilum and several terminal scars, and lateral scars were seen on some very long conidia.

On leaves of *Canavalia ensiformis* (L.) DC. (syn. *C. gladiata* (Jacq.) DC.) in the Philippines, Taiwan, Malaysia, Sierra Leone and Trinidad, of *C. rosea* (Sw.) DC. (syn. *C. maritima* Thou., *C. lineata* DC.) in Sierra Leone and Honduras, and of *Canavalia* sp. in Costa Rica. Also recorded, probably correctly, on *C. ensiformis* in Brazil, Venezuela and India, and on *C. plagioperma* Piper in South America.

Specimens examined. On *Canavalia ensiformis*. Philippines: Los Baños, 5. xi. 1913, C. F. Baker 2029 (Herb. **S**), type of *Cercospora canavaliae* Syd. (slide, **IMI** 79565); Mt. Maquiling, near Los Baños, Prov. Laguna, xi. 1913, C. F. Baker 119 (Herb. **S**), det. Sydow *Cercospora canavaliae* (slide, **IMI** 79564). Taiwan: Taichung, 14. x. 1913, Y. Fujikuro (Herb. **TAI**), type of *Acrothecium canavaliae* Sawada (slide, **IMI** 82922); Hualien Juisui, 21. iii. 1944, K. Sawada (Herb. **TAI**) sub nom. *Dendryphium canavaliae* (slide **IMI** 82919). Malaysia: Kuala Lumpur, Western Malaysia, 31. viii. 1949, A. Johnston 420 (**IMI** 38876); Keningau, Sabah, 14. vii. 1964, J. Solomon P.P. 497/60 (**IMI** 108408). Trinidad: St Clair, i. 1921, E. M. Wakefield 305 (Herb. **K**, part in **IMI** 133917a). Sierra Leone: Mange (Bure), 1. ii. 1939, F. C. Deighton M 1832 (**IMI** 8177a); Njala (Kori), 13. xi. 1939, F. C. Deighton M 2145 (**IMI** 8176a); Kenema (Nongowa), 29. x. 1949, F. C. Deighton M 3294 (**IMI** 40256a); Newton (Western Area), 17. i. 1950, F. C. Deighton M 3470 (**IMI** 41180).

On *Canavalia rosea*. Honduras: Tela, xii. 1927–iii. 1928, P. C. Standley, Herb. **CUP** 39282 (slide, **IMI** 80384), **CUP** 39283 (slide, **IMI** 80385a) and **CUP** 39285 (slide **IMI** 80386a). Sierra Leone: Mama Beach (Western Area), 3. xii. 1936, F. C. Deighton M 1246 (**IMI** 8175a); Lakka (Western Area), 3. v. 1951, F. C. Deighton M 4106B (**IMI** 46303b).

On *Canavalia* sp. Costa Rica: Swamp mouth, 8. viii. 1923, F. L. Stevens 738 pro parte (Herb. **ILL**, mycol. Coll. 3655) sub nom. *Dimeriellopsis costaricensis* Stev. (slide, **IMI** 88268b).

RECORDS MISIDENTIFIED AS *CERCOSPORA CANAVALIAE*

The record on *Canavalia lineata* (= *C. rosea*) from South Shore, Bermuda, viii. 1927, collected by L. Ogilvie, cited by Waterston (1947), was examined (Herb. **CUP** 34818: slide, **IMI** 80383). The host plant is not *Canavalia* but

is very probably *Ipomoea pes-caprae* (L.) Sweet, a plant which grows commonly on the sea-shore in the tropics often mixed with *C. rosea*, and the fungus on the leaf spots is *Cercospora ipomoeae* Wint., a species very similar morphologically to *C. apii* Fresen.

The following collections on *C. ensiformis*, which have in the past been wrongly identified as *Cercospora canavaliae*, have been examined: St Augustine, Trinidad, iv. 1943, C. Thorold T.36 (IMI 8170: CUP 39284); Orai, U. P., India, 27. ii. 1907 (HCIO 10372: slide, IMI 124579); Cawnpore, India, 23. ii. 1907 (HCIO 10373: slide, IMI 124580); Pusa, Bihar, India, 5. ii. 1912 (HCIO 10374: slide, IMI 124581). The three Indian collections are cited as *C. canavaliae* by Vasudeva (1963), and the records from Cawnpore and Pusa are cited by Mundkur & Ahmad (1946). These specimens show a true *Cercospora*, morphologically very similar to *C. apii*, and could well be called *C. canavaliicola* Sawada & Katsuki (in Sawada, 1959, p. 213) the type of which I have examined (Herb. TAI: slide, IMI 82917), though I consider it very doubtful if this can be distinguished from *C. apii*, *C. canescens* Ell. & Mart., or several other morphologically similar species. Two collections on the same host species from Hong Kong (IMI 94790*a* and 99763*a*) are similar, and a similar *Cercospora* is present on two of the three collections by Standley on *C. rosea* from Honduras (CUP 39283 and 39285: slides, IMI 80385*b* and 80386*b*) which also bear *Stenella canavaliae*: also on one collection on *C. ensiformis* from Sierra Leone (IMI 8177*b*) where it seems to be a secondary fungus on a leaf heavily infected by *S. canavaliae*.

Dr S. Katsuki kindly sent me parts of three of his collections from Japan which he had identified as *Cercospora canavaliae*: on *Canavalia ensiformis* var. *gladiata*, Kurume City, Fukuoka Pref., 5. xi. 1947 (IMI 146442); on *C. lineata* (= *C. rosea*), Kikai Island, Amami, Kagoshima Pref., 2. x. 1954 (IMI 146443); Anbo, Yaku Island, Kagoshima Pref., 29. xii. 1952 (IMI 146444). The specimen on *C. ensiformis* is one cited by Katsuki (1965): the ones on *C. rosea* are from the same localities as those cited by Katsuki (1953, 1965) but were collected at slightly different dates. The fungus present is not *Stenella canavaliae* but represents an apparently undescribed species of *Cercospora*-like fungus, with pale brown conidiophores and conidia, and unthickened conidial scars.

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