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**NOTES ON THE GENUS CYLINDROCLADIUM
(Fungi: Mucedinaceae)**K. B. BOEDIJN¹ and J. REITSMA -

INTRODUCTION.—The genus *Cylindrocladium* was erected by Morgan in 1892 for a Mucedinaceous fungus with *Penicillium-like* branching and long, cylindrical, two-celled conidia. The original diagnosis runs: —

Cylindrocladium Morgan. "Hyphae steriles repentes, fertiles erectae, dichotomice ramosae, septatae, basidia in apice ramorum subterna fusioidea, conidia cylindracea, 1-septata."

The type and only species, *Cylindrocladium scoparium* Morgan, was found on dead pods of *Gleditschia triacanthos* L.

In 1900 the same fungus was reported by Ellis and Everhart on dead leaves of *Asimina triloba* Dun. They considered it a new species of the genus *Diplocladhim* Bonord. and described it accordingly as *Diplocladium cylindrosporium* Ell. & Everh.

In 1912 Hawley (*see* Rea and Hawley) erected the genus *Candelospora* with the following diagnosis: —

Candelospora Hawley. "Hyphae steriles repentes. Conidiophoris erectis, septatis, hyalinis, irregulariter ramosis vel etiam simplicibus, supra penicillatim divisivis. Conidiis singulis in *ultimis* ramulis ortis, hyalinis, multiseptatis."

The type species, *Candelospora ilicicola* Hawley, was growing on dead leaves of *Ilex aquifolium* L.

A similar fungus was found by us on potato tubers. Through the kindness of Dr J. Ramsbottom, we were able to study part of the type material of *Candelospora ilicicola*. A close comparison with our material showed it to be absolutely identical with this species. As can be seen from the description, *Candelospora* and *Cylindrocladium* are the same; the only difference is to be found in the conidia, which in *Cylindrocladium*, are two-celled, and many-celled in *Candelospora*. In our opinion both genera should be fused under the oldest name, *Cylindrocladium*.

In 1917 Petch mentions a new species found on the leaves of *Pithecolobium saman* (Jacq.) Benth. [= *Samanea saman* (Jacq.) Merr.] and gives the following description: —

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Cylindrocladium pithecolobii Petch. "Maculis albis, rotundatis, ad 4 mm. diam.; conidiophoris et mycelio albis, hypophyllis; hyp his repentibus, hyalinis, 3 II, diameter; conidiophoris hyalinis, ad 160 \times alt. basi 8 μ , diam., septatis, dichotome furcatis, sterigmatibus apicalibus vel verticillatis; sterigmatibus subovalibus vel fusoides, curvis vel inaequilateralibus, acutis, 7—16 X 3 μ .. Conidiis hyalinis, solitariis, cylindraceis vel subfusoides, obtusis, uniseptatis, raro leniter constrictis, 36—60 X 5—7 μ ..

According to the diagnosis this is no new species, but certainly only *Cylindrocladium scoparium*.

Massey (1917) found this latter species to be a parasite on roses and the same was stated by Anderson (1919). The parasitic nature of *Cylindrocladium scoparium* was furthermore acknowledged by Wormald (1943, 1944), who found the species on plums and cherries in Britain, and by Jauch (1943), who reported the species in the Argentine, where it parasitizes roses, apricots, *Eucalyptus* sp., and *Ilex paraguayensis* St. Hil.

In Java we found the species several times, often as a saprophyte. So it seems that *Cylindrocladium scoparium* has a world-wide distribution.

Anderson (1917) found another species on roses, distinguished by much shorter conidia, which he named *Cylindrocladium parvum* Anderson.

In 1928 Sherbakoff also described a new species under the name of *Cylindrocladium macrosporum*. It was isolated from leaves of the palm "*Washingtonia robusta* Parish."

Fawcett and Klotz (1937) reported a species on *Citrus-fruit*, which they named *Candelospora citri* Fawcett & Klotz on account of the three-septate conidia. As was already stated we do not recognize the genus *Candelospora* and consequently consider this a species of *Cylindrocladium*.

We now can add two new forms, so that up till the present the actual number of species is seven. They are all very much alike, the distinguishing characters being chiefly found in the dimensions and septation of the conidia. There are species with one-septate, three-septate, and even five-septate conidia. Nevertheless we do not place the species with many-celled conidia in the genus *Candelospora*.

A similar case is encountered in the genus *Fusarium* Link ex Fr., in which the species with two-celled conidia are not separated either from the species with many-celled conidia. However, there is more than a superficial resemblance between the genera *Cylindrocladium* and *Fusarium*.

In our opinion both genera are closely related. They show the same mycelial growth with abundant formation of chlamydospores, whereas the conidiophores have a similar mode of branching. The most convincing fact to support our view is to be seen in the perfect stage, which in *Cylindrocladium ilicicola* is a species of *Calonectria*. As there are a number of *Fusarium*-species which have a species of *Calonectria* as their asciform, the relationship between our genera seems well established.

The fact that *Cylindrocladium* has been placed in the Mucedinaceae, whereas *Fusarium* belongs to the Tuberculariaceae, is not of great im-

portance. In the future many changes will be necessary in the arrangement of the Deuteromycetes.

Cylindrocladium citri we only know from the original description. Of *C. parvum* and *C. macrosporum* we received pure cultures from the "Centraalbureau voor Schimmelcultures," Baarn, but this material, though growing luxuriously, hardly produced any conidia. The remaining species were isolated by us from dead and living plant material. Unfortunately some of these cultures were lost; the rest was placed by us in the collection of the "Centraalbureau voor Schimmelcultures," Baarn.

ACKNOWLEDGEMENTS.—The writers take this opportunity of thanking Dr J. Ramsbottom, British Museum (Natural History), London, for supplying material of *Cylindrocladium ilicicola* Hawley, required in connection with this investigation. Acknowledgement is also made to Prof. Dr J. Westerdijk at Baarn for her kindness in forwarding us cultures of *Cylindrocladium parvum* Anderson and *C. macrosporum* Sherb. Moreover we want to express our gratitude to Dr H. C. D. de Wit, Flora Malesiana Office, Leiden, for help with the Latin diagnoses.

Cylindrocladium quinqueseptatum was isolated in Indonesia for the first time in 1941 by Miss W. Ch. Slooff, from leaves of clove seedlings. The pathogenicity of this fungus was established and has been the subject of a companion paper by Reitsma and Slooff (1950).

Cylindrocladium Morgan

in Bot. Gaz. 17: 191. 1892 *mutatis charact.*

Candelospora Hawley *apud* Eea & Hawley in Proc. R. Irish Acad. 31 (13): 11. 1912.

Aerial mycelium well developed, at first white and cottony, later on achieving some shade of brown in the center. Submerged mycelium brown to red-brown, with numerous chlamydospores either in chains or irregularly arranged. Large compact masses of chlamydospores giving rise to sclerotial bodies. Conidiophores erect, dichotomously branched near the apex, the ultimate branches bearing the phialides, the main axis mostly forming a long, unbranched thread terminating in a globose to club-shaped apex. In some species this torch-like structure, characteristic for our genus, is often only to be found in a limited number of the conidiophores. Conidia solitary on the phialides, cylindrical, one to many-septate, mostly glued together by a colourless substance. In germinating the conidia may anastomose freely.

In order to get a description of the cultural characters of our species, we started cultures in petri-dishes with toge-agar. They were then studied seven days after inoculation, especially on the reverse, where the colours show most clearly. The colour notes were made with the aid of R. Ridgway's "Color standards and color nomenclature," Washington, 1912.

KEY TO THE SPECIES OF CYLINDROCLADIUM

1. Conidia 1-septate
 • 2. Conidia 15—21 x 2—3 μ1. *C. parvum*
 2. Conidia much longer
 3. Conidia slightly bent.....2. *C. curvatum*
 3. Conidia straight
 4. Conidia 50—58 X 5—6 μ3. *C. scoparium*
 4. Conidia 60—131 X 4.5—6 μ4. *C. macrosporum*
 1. Conidia 3—5-septate
 5. Conidia 3-septate
 6. Conidia 43—48 X 4—4.8 μ5. *C. oitri*
 6. Conidia 49—69 X 4.5—6 μ6. *C. ilicicola*
 5. Conidia 5-septate.....7. *C. quinqueseptatum*

1. *Cylindrocladium parvum* Anderson in Mass. Agric. Exp. Sta. Bull. No. 183: 37. 1919..

Conidiophores erect, about 200 μ , long, 2.5—4 μ . broad at the base, septate, dichotomously branched near the apex; primary branches 14—30 X 2.5—3 μ .; secondary branches 15—17 X 2 μ .; ultimate branches bearing 2—4 phialides which are 11—14 X 2—2.5 μ .; main axis mostly forming a long thread 1.5—2.5 μ . broad, terminating in a club-shaped part, 25—36 X 4—5 μ .; this thread is distinctly thick-walled except for a small part near the base and the club-like swelling, which are thin-walled. Conidia cylindrical, 1-septate, with rounded poles 15—21 x 2—3 μ .

Culture about 8 cm in diameter. Border rather sharp, white, very finely radiating, 5—7 mm broad. The rest of the colony is brown, between tawny and ochraceous tawny, with a number of narrow, concentric zones and distinctly radially arranged, darker fibers. In the center granular, caused by sclerotial bodies.

HABITAT.—On dead stems and roots of roses, Massachusetts, U.S.A. — On male flowers of *Arenga pinnata* (Wurmb) Merr., March 1949, Bogor. Culture B.R. Nr. 34-/49 deposited in the collection of the "Centraal Bureau voor Schimmelcultures," Baarn, Netherlands.

From the "Centraal Bureau voor Schimmelcultures," Baarn, we received an original culture of this species. Unfortunately it formed only a few conidia, whereas we did not find any conidiophores. In the following subcultures this strain became wholly sterile.

Nevertheless we consider our isolation from Java identical with the American material as the conidia neatly agree in their dimensions, and the colours on the reverse are showing the same arrangement.

Often rather large numbers of the conidia are not septate.

2. *Cylindrocladium curvatum* Boedijn & Reitsma nov. spec.

Conidiophoris 200—250 μ . longis, basi 4—5 μ , latis, apicem versus dichotome ramosis; rami primarii 25—31 X 2.5—4 μ ., secundarii 9—12.5 X 2—2.5 μ ., rami ultimi 2—4 phialides gerentes, 7.5—10 X 2.5 μ .; axis

principalis plerumque continuus ca 2.5 μ . latus, apice globose, 6—7 X 5 μ .. Conidia leviter tamen distincte curvata, cylindrica, 1-septata, 40—46 X 3—4 μ .

Conidiophores 200—250 μ . long, 4—5 μ . broad near the base, septate, dichotomously branched near the apex; primary branches 25—31 X 2.5—4 μ .; secondary branches 9—12.5 X 2—2.5 μ .; ultimate branches bearing 2—4 phialides, which are 7.5—10 X 2.5 μ .; main axes mostly forming a long thread about 2.5 μ . broad, terminating in a portion of 6—7 X 5 μ .. Conidia cylindrical, distinctly bent, 1-septate, 40—46 X 3—4 μ ..

Culture showing on the reverse a brown colour formed by numerous chlamydospores and sclerotial bodies, which are distinctly radially arranged.

HABITAT.—On leaves of seedlings of *Hibiscus Sabdariffa* L., Bogor, March 1941.

Unfortunately our culture was lost and the species not found again. The species, however, is easy to recognize on account of its slightly bent conidia.

3. *Cylindrocladium scoparium* Morgan in Bot. Gaz. 17: 191. 1892.

Diploeladium cylindrosporum Ell. & Everh. in Bull. Torrey Bot. Cl. 27: 58. 1900.

Cylindrocladium pithecolobii Petch in Ann. R. Bot. Gard. Peradeniya 6: 244. 1917.

Conidiophores up to 0.5 mm high, 7.5 μ . broad near the base, dichotomously branched near the apex; primary branches 21—45 X 5—7 μ ., secondary branches 16—20 X 3.5—5 μ ., tertiary branches, if present, 7—12 X 3—4 μ .; ultimate branches bearing 2—4 phialides, which are 6—10 X 3—4 μ .; main axis mostly forming a long thread 2.5—3.5 μ . broad, terminating into a club-shaped swelling 19—22 X 8—10 μ .. Conidia cylindrical with rounded poles, 1-septate, 50—58 X 5—6 μ ..

Culture about 3.5 cm in diameter with irregular, white margin about 3 mm broad. The remaining part brown, between chestnut brown and hazel. This part finely radially striate on account of thin, darker fibers. Central portion, moreover, granular on account of abundant sclerotial bodies. Sometimes a few, very indistinct, concentric zones are formed.

HABITAT.—On seedlings of *Sesbania sesban* (L.) Britt., February 1941, Bogor. Culture B.R. Nr. 30/48 deposited in the collection of the "Centraal Bureau voor Schimmelcultures," Baarn, Netherlands.

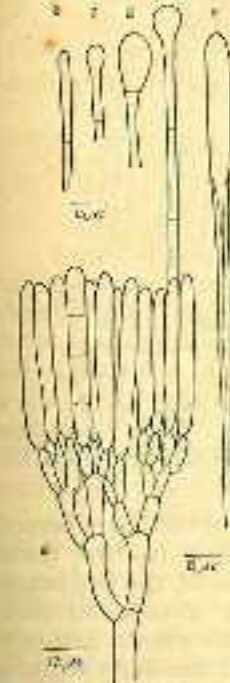


FIG. 7. — a: Conidiophore of *Cylindrocladium ilicicola*. The main axis forms a long thread, terminating in a globose swelling. — The various types of swelling occurring in the various species of *Cylindrocladium* are from left to right: b, *C. quinqueseptatum*; c, *C. curvatum*; d, *C. scoparium*; e, *C. ilicicola*; f, *C. parvum*.

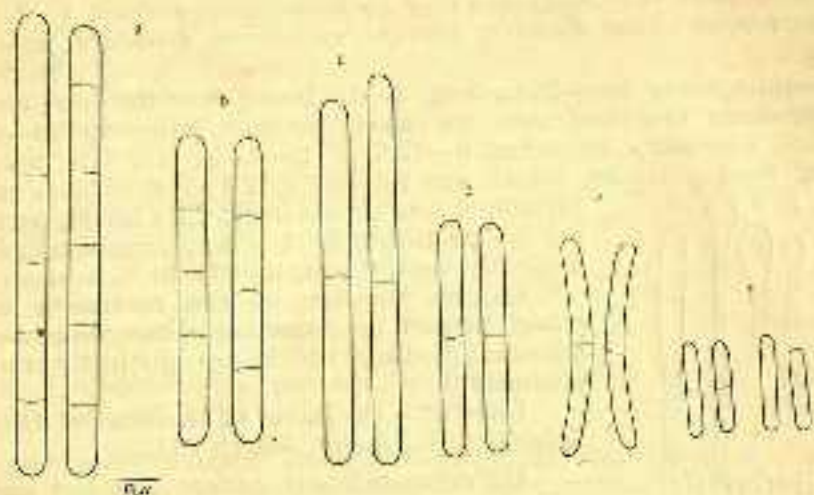


FIG. 2. Conidia of the described species of *Cyliandrocladium*. From left to right: a, *C. quinqueseptatum*; b, *C. ilicicola*; c, *C. macrosporum*; d, *C. scoparium*; e, *C. curvatum*; f, *C. parvium* with one and non-septate conidia.

4. *Cyliandrocladium macrosporum* Sherbakoff in *Phytopathology* 18: 222. 1928.

Mycelium, conidiophores and conidia hyaline. Conidiophores erect, usually with one, two or more side-branches, each ending in two, three or more slightly curved, cyme-forming sterigmata; some of the branches, instead of producing sterigmata, give rise to very long usually terminal hyphae, which are slightly swollen at the tip; on the sterigmata are produced singly, long, cylindrical, straight, obtuse, often at the ends slightly swollen and at their base somewhat narrower 1-septate conidia, which are apparently glued together with a soluble, colourless substance, so that when placed in water they separate easily. The conidia in strain 1 from seedling palm leaves, measures $103.8 \times 5.35 \mu$ ($71-131 \times 5.15-5.94 \mu$) and those in strain 2 from leaf-spots of mature palm, measure $82 \times 5.25 \mu$ ($60-105 \times 4.5-6.2 \mu$). Description after Sherbakoff.

The fungus in culture, especially in old cultures, usually produces chlamydospores in clusters and chains and some minute, submerged, brown sclerotia, though the latter were never observed to be so numerous and dark as in *C. scoparium*. The colour of the species on the same media is noticeably lighter than that of *C. scoparium* and is free from the red colour of the latter species observed in some cultures.

HABITAT.—Found in Florida, U.S.A., on leaves of "*Washingtonia robusta* Parish," causing leaf-spots.

Sherbakoff also depicts conidia with 2—3 crosswalls, without mentioning this in his description.

In a culture obtained by us from the "Centraal Bureau voor Schimmelcultures," Baarn, we also found several conidia with three septae. Our measurements are $66-82 \times 5-6 \mu$. It seems therefore that this species is a transitional form between the species with two-septate and those with many-septate conidia.

Culture 7 cm in diameter with very irregular, floccose, white-coloured margin, 1 cm broad. Remaining portion also with an irregular delimitation, brown, between tawny and ochraceous tawny, radially striate on account of darker fibers.

5. *Cyliandrocladium citri* (Fawcett & Klotz) Boedijn & Reitsma *nov. comb.*

Candelospora citri Fawcett & Klotz in *Mycologia* 29: 213, 1937.

Conidiophores $14-23 \mu$ in length, occurring singly or severally on a torch-like hypha which terminates in a swollen cell. Fructification beyond the conidiophore $83-93 \mu$, divided into rami, metulae, and sterigmata producing conidia. Conidia 3-septate, cylindrical, obtuse at the ends, $43-48 \times 4.1-4.8 \mu$. Torch-like projection $240-275 \mu$ long and $5-6 \mu$ wide at the base and $2.5-3 \mu$ wide at the narrowest point, with swollen ends which are $19-21 \times 11-12.5 \mu$. NO mucus was observed on *Citrus-fruits* or on glucose-potato agar. — Described from cultures on glucose-potato agar. Description after Fawcett and Klotz.

On glucose-potato agar the fungus produces an abundant fluffy cottony growth, both in the media and in the air. Viewed from the top, the colour matched Ridgway's cinnamon rufous to hazel; seen from the underside the colour was found to vary from hazel to Kaiser brown, to hay russet and liver brown.

HABITAT.—On decaying fruits of *Citrus sinensis* Osbeck in Florida, U.S.A.

6. *Cyliandrocladium ilicicola* (Hawley) Boedijn & Reitsma *nov. comb.*

Candelospora ilicicola Hawley *avud* Rea & Hawley in *Proc. R. Irish Acad.* 31 (13): 11. 1912.

Conidiophores $170-350 \mu$ long, $5-6 \mu$ broad near the base, dichotomously branched near the apex; primary branches $22-25 \times 4-5.5 \mu$; secondary branches $10-25 \times 2.5-4 \mu$; tertiary, if present, $9-14 \times 2.5-4 \mu$; ultimate branches bearing 2—4 phialides, which are $8-16 \times 3-4 \mu$; main axis often forming a long, $2.5-3 \mu$ broad thread, terminating in a globose swelling which is $5-8 \mu$ in diameter. Conidia cylindrical, with 1—3, mostly 3, crosswalls, $49-69 \times 4.5-6 \mu$

Culture about 8 cm in diameter with a sharp, white edge about 1 cm wide. Remaining part brown, between tawny and zinc orange, with a few, 3—4 mm broad, concentric zones of a darker colour. This part finely radially striate and with central portion granular through the formation of sclerotial bodies.

HABITAT.—On potato tubers, Bogor, February 1948. Culture *B.R. Nr. 9/49* deposited in the collection of the "Centraal Bureau voor Schimmelcultures," Baarn, Netherlands. Type from Clare Island, Ireland, on dead leaves of *Ilex aquifolia* L.

Type material received from Dr J. Ramsbottom.

In our cultures in Petri-dishes numerous, orange-coloured perithecia were formed. This perfect fructification is a species of *Calonectria* De Not., the description of which is given below.

Calonectria ilicicola Boedijn & Reitsma *nov. spec.*

Perithecia aurantiacis, ovoideis vel ellipticis, ostio papilliformibus, 400—500 μ. altis, 320—370 μ. latis; ostium 45—80 μ. diam. Parietes perithecii pseudoparenchymataceus, cellulis exsertis scabratus; cellulae 11—30 μ. altae. Cellulae circumstiolares minores, in orbis concentricis positae. Asci clavati, longe stipitati, pariete tenuissimi 8 sporis, 110—140 X 16—18 μ., stipite 3—4 μ. lati, sporae irregulariter fasciculatae. Sporis fusoides, leviter curvatis vel inaequilateralibus, intus granulatis in medio septatis, non vel vix constrictis, relictis ascis 4—6, plerumque 4-cellulatis, 38—57 X 5—7 μ. Paraphyses 0.

Perithecia oval to elliptical, of an orange colour and provided with a papillate ostium, 400—500 μ high, 320—370 μ broad; ostium 45—80 μ in diameter. Perithecial wall pseudo-parenchymatic, the individual cells 11—30 μ long; this wall distinctly rough on account of projecting cells; round the perithecia there are a number of concentric rings of much smaller cells. Asci club-shaped, long-stalked and very thin-walled, 8-spored, 110—140 X 16—18 μ;

stalk 3—4 μ broad. Paraphyses absent. Spores irregularly crowded, fusoid, faintly bent or unequal-sided, with granular contents, 2-celled, hardly constricted at the septum, 38—57 X 5—7 μ. The extruded spores becoming 4—6, mostly 4-celled. They readily germinate in water, even in the 2-celled stage, by forming a germtube at each pole.

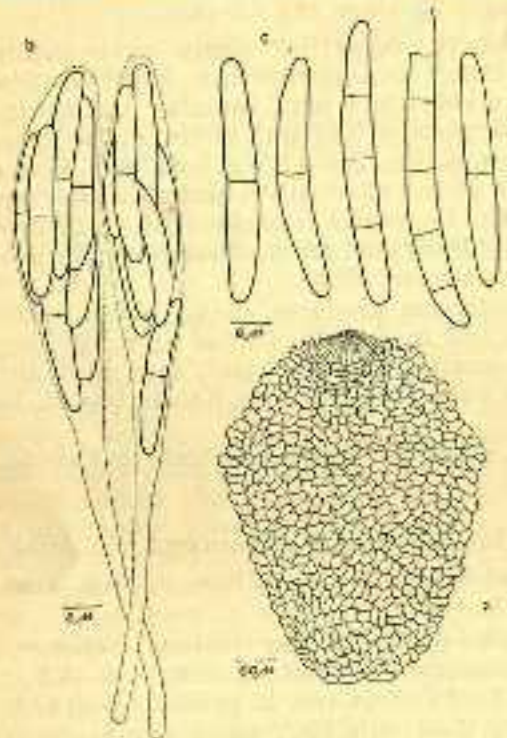


FIG. 3. *Calonectria ilicicola*: a, perithecium, b, asci, and c, ascospores.

HABITAT.—This perfect state developed in cultures of *Cylindrocladium ilicicola* (Hawley), isolated from potato tubers by Boedijn and Reitsma, Bogor, February 1948. Type culture *B.R. 9/49* deposited in the collection of the "Centraal Bureau voor Schimmelcultures," Baarn, Netherlands.

7. *Cylindrocladium quinqueseptatum* Boedijn & Reitsma *nov. spec.*

Conidiophores usque ad 0.5 mm longis, basi 5—6 μ, latis, apicem versus dichotome ramosis; rami primarii 22—31 X 3.5—5 μ; secundarii 17—21 X 3—3.5 μ; tertiarii 15—17 X 2—μ; rami ultimi 2—4 phialides gerentes, 11—12 X 2—3 μ; axis principalis interdum continuus, ca 2 μ, latus, ad apicem gradatim expandens, leviter clavatus 12 X 2.5—3 μ. Conidia recta, cylindrica, polis rotundatis 3—6, plerumque 5-septatis, 75—106 X 5—7 μ.

Conidiophores up to 0.5 mm long, 5—8 μ broad near the base, dichotomously branched near the apex; primary branches 22—31 X 3.5—5 μ, secondary branches 17—21 X 3—3.5 μ, tertiary branches, if present, 15—17 X 2—3 μ; ultimate branches bearing 2—4 phialides, which are 11—12 X 2—3 μ; main axis sometimes forming a long thread about 2 μ broad, terminating gradually into a club-shaped part, which is 12 X 2.5—3 μ. Conidia cylindrical, with rounded poles and 3—6, mostly 5, cross-walls, 75—106 X 5—7 μ. In germinating, the conidia form many mutual anastomoses.

Culture 8.5—9 cm in diameter. Edge white, 5—7 mm broad, of a loose texture. Remaining part brown, between tawny and zinc orange. Typically radially striate through darker fibers; moreover, with some indistinct concentric zones.

HABITAT.—On leaves of clove seedlings (*Syzygium aromaticum* (L.) Merr. & Perry), February 1941, Tjiomas near Bogor. Type culture *B.R. Nr. 31/48* deposited in the "Centraal Bureau voor Schimmelcultures," Baarn, Netherlands.

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**NOTE SUR LES GENRES PALEOTROPICAUX AFZELIA,
INTSIA ET PAHUDIA
(Legum.-Caesalp.)**

par

J. J. G. LEONARD *

SUMMARY

1. *Afzelia*, *Intsia*, *Pahudia*, and *Afrazelia* are very close to each other and not well defined genera.
2. *Intsia* is a good genus, but the three, other ones are congeneric with each other.
3. *Afzelia* Smith is a nomen conservandum and, therefore, must be maintained against *Pahudia*, generally used in Asiatic and Malaysian floras.
4. An enumeration of all species of *Afzelia* is given. In this connection some new combinations are made.

1. Parmi les Leguminosae-Caesalpinieae-Amherstieae existent des arbres, répandus en Afrique, en Asie et en Malaisie, dont les fleurs sont caractérisées par la présence d'un grand pétale onguculé, les 4 autres étant rudimentaires ou nuls ainsi que par des staminodes en nombre variable. Ces arbres ont été rangés dans les genres *Afzelia* Smith (1), *Intsia* Thouars (2), *Pahudia* Miq. (3) et *Afrazelia* Pierre (4) qui présentent entre eux d'étroites affinités et au sujet des delimitations desquels les avis ont été très partagés. C'est ainsi que de nombreuses espèces ont été classées dans l'un ou l'autre genre selon les auteurs [ex.: *Afzelia africana* Smith ex Pers., *Intsia africana* (Smith ex Pers.) O. Kuntze, *Afrazelia africana* (Smith ex Pers.) Pierre et *Pahudia africana* (Smith ex Pers.) Prain] ! La situation s'est compliquée du fait de l'existence de deux genres *Afzelia* antérieurs à celui de Smith: *Afzelia* Ehrhart (5) et *Afzelia* Gmelin (6).

2. Examinons tout d'abord les différences existant entre les genres *Afzelia* Smith, *Intsia* Thouars et *Pahudia* Miq.

Le genre *Intsia*, répandu de la Polynésie à Madagascar, se caractérise par ses étamines fertiles libres au nombre de 3 seulement et par ses graines non arillées. Les genres *Afzelia* (Afrique) et *Pahudia* (Asie, Malaisie), par contre, possèdent 7 étamines fertiles et des graines arillées; chez le premier, les filets sont libres tandis que chez *Pahudia* (d'après la descrip-

* I.N.E.A.C., Bruxelles.