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CALONECTRIA COLHOUNII SP.NOV., A COMMON PARASITE OF TEA IN MAURITIUS

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(With Plate 15)

Calonectria colhounii sp.nov., parasitic on *Thea sinensis*, is described. It produces yellow perithecia and 4-spored asci with 3-septate ascospores. The conidial state is a species of *Cylindrocladium* having narrowly clavate vesicles and 1- to 3-septate conidia.

A number of surveys of tea plantations at Wooton, Mauritius, since 1970 has revealed a species of *Cylindrocladium* as quite prevalent, particularly during wet periods. The organism was constantly isolated from leaves showing brown spots. When incubated in a moist chamber such leaves developed *Cylindrocladium* fruiting bodies profusely. Ten to fifteen days later numerous yellow perithecia of a *Calonectria* (Pl. 15, fig. 7) appeared.

A study of the morphology and pathogenicity of the *Cylindrocladium* and its relationship with the *Calonectria* was undertaken, preliminary investigation having revealed it to be different from other species.

Several *Cylindrocladium* spp. have frequently been reported as pathogenic since the genus was originally established. *Calonectria theae* Loos, the perfect state of *Candelospora theae* (Petch) Wakefield ex Gadd (syn. *Cercospora theae* Petch) causes a well-known foliage disease of tea. According to a report by Gadd (1927) it was responsible for the most serious leaf disease of tea in Ceylon, being particularly severe during wet weather. Subba Rao (1945) reported it as causing a leafless condition of large areas of tea during continuous wet weather. *Cylindrocladium floridanum* Sobers & Seymour, the conidial state of *Calonectria kyotensis* Terashita, has recently been described as causing a serious disease of tea cuttings in nursery propagation beds (Peerally, 1972*a*) and to be associated with a decline of tea bushes (Peerally, 1972*b*). A root rot of tea has been found to be due to *Cylindrocladium camelliae* Venkataramani & Venkata Ram (Venkataramani & Venkata Ram, 1961). From Ceylon, *C. scoparium* Morgan was described as a pathogen of tea (Van Emden & Reitsma, 1950). *C. parvum* Anderson and *C. macrosporum* Sherbakoff have been also reported on tea in Mauritius (Orieux & Felix, 1968).

MATERIALS AND METHODS

The *Cylindrocladium* and *Calonectria* investigated in this work were obtained from diseased tea leaves collected at Wooton, Mauritius. Cultures on potato dextrose agar (PDA) were obtained from leaf surfaces sterilized in

sodium hypochlorite solution (1–2 % available chlorine) or 0.1 % mercuric chloride solution. Perithecia were removed from leaves, an ascospore suspension prepared and monoascospore cultures obtained. The morphology of the fungus was studied from materials obtained both in vivo and in vitro. Naturally infected and artificially inoculated excised leaves were maintained in a moist box to induce profuse sporulation. Cultures on PDA were grown at 25 °C.

Pathogenicity tests were conducted on 1-year-old tea seedlings of var. H 1 and 1-month-old plants of groundnut (*Arachis hypogaea* L.) artificially selected. The foliage was atomized with a conidial suspension and the plants were kept in a moist atmosphere under bell jars.

RESULTS

Pathogenicity tests

Leaf infection and disease development on groundnut were rapid and severe, the fungus causing a wet rot. Conidial formation started on the second day after infection and perithecia were visible within a week. The attacked leaves turned black, softened and finally were abscised.

Brown spots appeared on infected tea leaves and enlarged until the entire leaf tissue became dark brown. The softening observed for groundnut was not seen in tea. Conidial formation occurred within a few days after inoculation and perithecia appeared about two weeks later. Attacked leaves were abscised soon after the petiole was invaded.

The pathogen

Conidia and ascospores germinated giving identical colonies which are initially hyaline, later turning brown. Fructifications of the *Cylindrocladium* appear in the second day of growth. In 3- to 4-week-old cultures numerous yellow perithecia of *Calonectria* appear, arising from the surface of black stromatal masses. The fungus is homothallic, for single spore cultures produce perithecia. Ascospores from culture and from leaves produced a similar *Cylindrocladium* species in culture and on inoculated excised tea leaves.

Fruiting bodies of the *Cylindrocladium* (Pl. 15, fig. 2) are 309–413 μm long but are much shorter when the sterile filament is lacking. The stipe becomes narrower towards the upper end which bears a very slender vesicle (Pl. 15, figs. 4, 5) 7.8–82.0 \times 2.0–5.2 μm . Primary conidiophore branches are aseptate, rarely 1-septate, 13.0–26.0 μm long, secondary branches aseptate, 7.8–18.2 μm long, and tertiary branches aseptate, 7.8–10.4 μm long. Phialides occur in groups of 2–4, occasionally arising directly from the stipe and are 7.6–13.6 μm long. Conidia (Pl. 15, fig. 6) are hyaline, cylindrical, straight, 3-septate, rarely 1- or 2-septate, never 4- or 5-septate, 38.3–84.2 \times 3.4–5.7 μm , the average size being 66.0 \times 5.0 μm .

Perithecia are superficial, yellow, 247–463 μm high, 309–515 μm diam, scattered or rarely gregarious, globose, subglobose or oval, arising from a small stroma, which only slightly emerges through the leaf epidermis.

Table 1. Comparison of four species of *Calonectria* with *Cylindrocladium imperfect states*

	<i>Calonectria theae</i> Loos	<i>Calonectria hederæ</i> Booth & Murray	<i>Calonectria quinquesepitata</i> Boedijn & Reitsma	<i>Calonectria colhounii</i> sp.nov.
Conidia	80–120 × 8 μm (Petch, 1917) 62–100 × 3·5–6·5 μm (Loos, 1950) 3-septate (Loos, 1950)	44·2–102·0 × 5·6–9·2 μm (author's examination of IMI 75300) 1- to 5-septate, mostly 3-septate (author's examination of IMI 75300)	In vivo, 59·8–104·6 × 5·2–7·0 μm In vitro, 72·8–119·6 × 5·2–7·8 μm (Perally, unpublished) 75–106 × 5–7 μm (Boedijn & Reitsma, 1950) 1- to 6-septate, usually 5-septate (Perally, unpublished) 3- to 6-septate, usually 5-septate (Boedijn & Reitsma, 1950)	38·3–84·2 × 3·4–5·7 μm 1–3 septate, never 4 or 5 septate
Vesicle	Clavate, width not mentioned (Loos, 1950) (Loos, 1950)	Clavate or oval, 6·4–14·4 μm wide (author's examination of IMI 75300) (Booth & Murray 1960)	Clavate 2·5–3·0 μm wide (Perally, unpublished; Boedijn & Reitsma, 1950) (Figueiredo & Namekata, 1967)	Clavate, 2·0–5·2 μm wide
Perithecia	Orange red to red, 340–440 μm diam	Orange to red, 300–370 μm high, 200–300 μm diam	Orange to chestnut, 360–580 μm high, 300–440 μm diam	Yellow, 247–463 μm high, 309–515 μm diam
Asci	8-spored	8-spored	8-spored	4-spored
Ascospores	42–70 × 5·8 μm 3-septate	45–65 × 6–8 μm 3-septate	30–80 × 4–7 μm 1–6 septate, mostly 3-septate	33·8–84·2 × 4·4–7·8 μm 3-septate

The perithecial wall is roughened by irregular masses of large pseudo-parenchymatous cells leaving a smooth papillate ostiole. Asci (Pl. 15, fig. 8) are clavate with an indistinct wall, $104-156 \times 13.0-18.2 \mu\text{m}$ and are 4-spored. The ascospores are usually aggregated in the distal end of the asci but sometimes one lies in the proximal half. Ascospores (Pl. 15, fig. 9) are hyaline, 3-septate, rarely 1- or 2-septate, with a slight constriction at the middle septum when examined in lactophenol (in water they appear more deeply constricted), straight or variously curved, $33.8-84.2 \times 4.4-7.8 \mu\text{m}$. The average length is $60.0 \times 6.2 \mu\text{m}$. Morphology is similar in vitro and in vivo.

DISCUSSION

The species of *Cylindrocladium* described in this work is pathogenic to both tea and groundnut leaves. It has a *Calonectria* perfect state. A comparison of the main morphological features of the pathogen with other species of *Cylindrocladium* possessing a clavate vesicle and forming a *Calonectria* perfect state is given in Table 1.

Calonectria quinqueseptata Figueiredo & Namekata differs markedly from the other species in size and septation of conidia. *Calonectria theae* has much larger conidia than *C. colhounii* and differs in colour of perithecia and in the 8-spored asci. *Calonectria hederæ* Booth & Murray also differs in several respects. An examination of the type material in Herb. IMI (IMI 75300) has shown it to have larger conidia and vesicles. It also differs in colour and size of perithecia, and in number of ascospores per ascus.

Based on these differences, the *Calonectria* and its *Cylindrocladium* state isolated from tea leaves in Mauritius is considered morphologically distinct and distinguishable from published species. The name *Calonectria colhounii* sp.nov. is proposed for the perfect state and *Cylindrocladium colhounii* sp.nov. for the imperfect state.

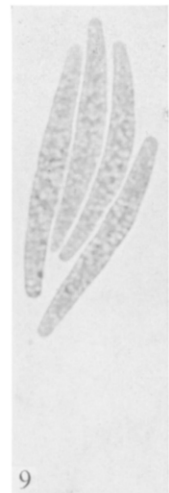
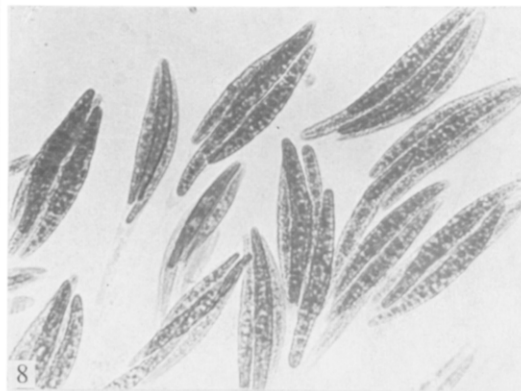
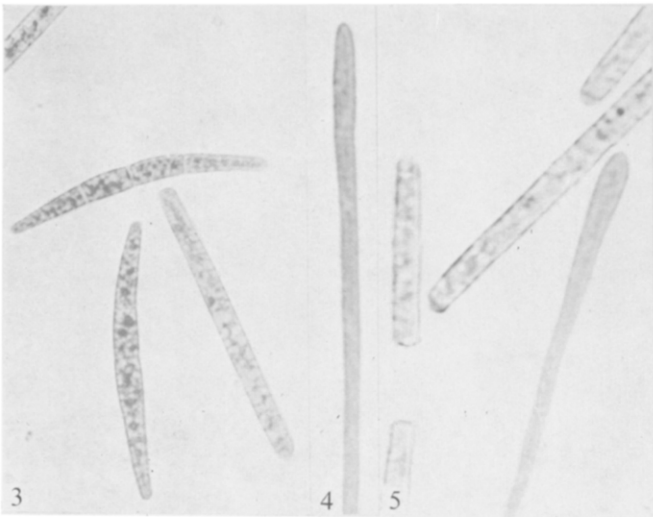
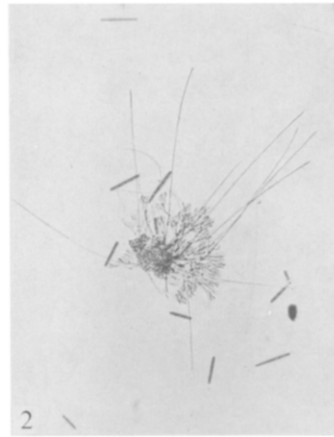
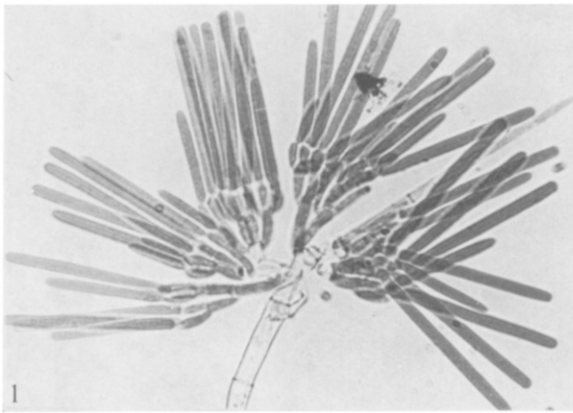
***Calonectria colhounii* Peerally sp.nov.**

Stromata vestigialia. *Perithecia* lutea, superficialia, singula vel rarius gregaria, globosa, subglobosa, vel ovoidea, $247-463 \mu\text{m}$ altis, $309-515 \mu\text{m}$ latis; ostiolum papillatum; parietes peritheciolorum pseudoparenchymatici. *Asci* hyalini, clavati, parietibus tenuibus, tetraspori, $104-156 \times 13.0-18.2 \mu\text{m}$. *Ascosporæ* hyalinae, 3-septatae, elongato-fusoideae, rectae vel varie curvatae, in medio leviter constrictae, $33.8-84.2 \times 4.4-7.8 \mu\text{m}$.

Status conidicus *Cylindrocladium colhounii* Peerally sp.nov. *Stipes* septatus, apicem versus attenuatus, $309-413 \mu\text{m}$, apice hyalinus tenuiorque in hyalinum clavatum vesiculum $7.8-82.0 \times 2.0-5.2 \mu\text{m}$. Rami primarii aseptati vel raro 1-septati, $13.0-26.0 \mu\text{m}$; rami rami secundarii aseptati, $7.8-18.2 \mu\text{m}$; rami tertiarii aseptati, $7.8-10.4 \mu\text{m}$; phialides hyalinae, $7.8-13.6 \mu\text{m}$. *Conidia* cylindracea, recta, hyalina, 3-septata, raro 1-vel 2-septata, $38.3-84.2 \times 3.4-5.7 \mu\text{m}$.

In foliis *Theae sinenses* L., Wootton, Mauritius, 1970. Holotypus IMI 167581.

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REFERENCES

- BOEDIJN, K. B. & REITSMA, J. (1950). Notes on the genus *Cylindrocladium* (Fungi: Mucedinaceae). *Reinwardtia* **1**, 51-60.
- BOOTH, C. & MURRAY, J. S. (1960). *Calonectria hederæ* and its *Cylindrocladium* conidial state. *Transactions of the British Mycological Society* **43**, 69-72.
- FIGUEIREDO, M. B. & NAMEKATA, J. (1967). Constatacquo de *Calonectria quinqueseptata* n.sp., forma perfeita de *Cylindrocladium quinqueseptatum* Boedijn & Reitsma, sobre *Annona squamosa* L. e *Eucalyptus* sp. *Archivos do Instituto biológico, São Paulo* **34**, 91-96.
- GADD, C. H. (1927). Report of the Mycologist for 1926. *Report. Tea Research Institute of Ceylon, Bull.* **1**, 7-15.
- LOOS, C. A. (1950). *Calonectria theae* n.sp. - the perfect stage of *Cercospora theae* Petch. *Transactions of the British Mycological Society* **33**, 13-18.
- ORIEUX, L. & FELIX, S. (1968). List of plant diseases in Mauritius. *Phytopathological Papers* **7**, 1-48.
- PEERALLY, A. (1972a). A new disease of tea. *Revue agricole et sucrière de l'Ile Maurice* **51**, 115-117.
- PEERALLY, A. (1972b). A decline of tea bushes associated with a root rot. *Revue agricole et sucrière de l'Ile Maurice* **51**, 147-152.
- PETCH, T. (1917). Additions to Ceylon Fungi. *Annals of the Royal Botanic Gardens, Peradeniya* **6**, 246.
- SUBBA RAO, M. K. (1945). Report of the Mycologist 1943-1944. *Administration Report. Scientific Department. United Planters' Association of Southern India, 1943-1944.*
- VAN EMDEN, J. H. & REITSMA, J. (1950). Verslag Van een studiereis naar Ceylonen Zuit Indii, teneinde de blister-blight - ziekte van de Thee te bestuderen. *Archief voor de Theecultuur* **17**, 5-70.
- VENKATARAMANI, K. S. & VENKATA RAM, C. S. (1961). A new species of *Cylindrocladium* parasitic on tea roots. *Current Science* **30**, 186.

EXPLANATION OF PLATE 15

Calonectria colhounii

- Fig. 1. Conidiophore branches. $\times 350$.
- Fig. 2. Stipes and vesicles. $\times 75$.
- Fig. 3. Ascospores and conidium. $\times 550$.
- Figs. 4, 5. Vesicles. $\times 650$.
- Fig. 6. Conidia. $\times 650$.
- Fig. 7. Perithecia on tea leaf. $\times 0.75$.
- Fig. 8. Asci. $\times 500$.
- Fig. 9. Ascospores. $\times 500$.

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