CHAPTER IX

REFERENCES


Canada 438 pp. Lafayette Indiana.

Arthur, J.C. and Cummins, G.B. (1933) Rusts of the North
West Himalayas Mycologia, 25: 397-406.

Phyllachora from India Curr.Sci. 41: 31-33.

Bagchee, K. (1929). Investigation on the Infection of
Peridermium complanatum Barch. on the needes
and of Peridermium himalayense n.sp. on the
stem of Pinus longifolia Roxb. Indian Forest

Bagchee, K. (1931). Problem of Forest mycology and
pathology in India. Indian Forester, 57(4):
166-179.

Bagchee, K. (1933). Investigations on the infestation of
Peridermium himalayense Bagchee on Pinus
longifolia Pt.II. Cronartium himalayense n.sp.
on Swerelia spp. Destrubtion, morphology of
the parasite, pathological study of the
infection, biological relationship with the
pine rest and control. Indian Forest Record
(Botany Series) 18 : 66 pp.

Bagchee, K. (1941). Contribution to our knowledge of the
morphology, cytology and biology of Indian
coniferous rusts. Pt. I. Indian Forest Rec.
(N.S.) Botany, No. 1, 7, 247-266.

Bagchee, K. (1950) - Contribution to our knowledge of
the morphology, cytology and biology of Indian
Coniferous rusts. Pt. II. Indian Forests Rec.
(N.S.) Botany IV, No. 1, 41.

Bagchee, i.. (1950a). Contribution to our knowledge of
morphology, cytology and biology of Indian
coniferous rests. Pt. III, Indian Forest Rec.
(N.S.)Botany IV, 2, 43-64.

Bagchee, K. (1950b). Progress of Forest pathology in
India during the quinquennium 1944-49 Indian
Forester 76; 219.

diseases and decay of timber and methods of


Boerema, G.H. and Bollen, G.J. (1975). Conidiogenesis and conidial septation as differentiating criteria between **Phoma** and **Ascochyta** Persoonia 8: 111-144.


Chinnapa, B. (1968): A new leaf blight of rose wood (Dalbergia sissoo Roxb.) from India.


Dowv Boxter (1943). Pathology in Forest Practice.


Kamal, Kumar, P & Shukla, D.N. (1980b). Fungi of Gorakhpur XII. Indian phytopath, 33 ; 54-60.


Mathur, R.S. (1979). The Coelomycetes of India. Bishen Singh Mahendrapal Singh, Cannaught Place, Dehra Dun, India.


Ramkrishnan, T.S. and Sundaram, N.V. (1952). Notes on some fungi from South India, I.Indian Phytopath., 511-513.


Troup, R.S. (1914). Pedermium cedri as a destructive fungus Indian Forester, 40: 469-472.


* Original not seen.
LIST OF PUBLICATIONS


7. New host record from India. Indian Phytopathological Society, 43(2) : 238 (1990).

8. New Cercospora sp. in Monocotyledons from India. Indian Phytopath. Socieity, 44(2) : (1991).

9. New species of Cercospora from India Kavak. Indian Mycological Society, Madras (Communicated).


Pseudocercospora gymnosporiae sp. nov. from India

R. K. DUBEY, S. A. FIRDOUSI, A. N. RAI AND K. M. VYAS
A simple baiting technique to detect and isolate *Phytophthora capsici* (‘P. palmivora’ MF₄) from soil

M. ANANDARAJ AND Y. R. SARMA
National Research Centre for Spices, Calicut-673 012, India


A rapid technique for detection and isolation of *Phytophthora capsici* (‘P. palmivora’ MF₄) from soil is described. It facilitates implementation of early control measures.

Key words: *Phytophthora capsici*, Baiting, Techniques.

Phytophthora diseases on black pepper (*Piper nigrum* L.) in India occur mainly during the south-west monsoon period (June–Sept.) when weather conditions are favourable (Anandaraj, Ramachandran & Sarma, 1988). During the inter-monsoon dry period the fungus remains inactive in the soil. The exact mode of survival is not clearly understood, although survival in the form of chlamydospores, inactive mycelium, oospores, etc., have been postulated (Sarma & Nambiar, 1982; Sastry & Hegde, 1988). Detection and isolation of this fungus from soil poses serious problems. There are several baiting techniques and selective media to isolate and quantify *Phytophthora* from soil (Tsao, 1983; Dingra & Sinclair, 1985).

To isolate *Phytophthora* spp. responsible for diseases of black pepper from soil, baits such as apples (Holliday & Mowat, 1963), black-pepper leaves (Kueh & Khew, 1982), black-pepper leaf discs (Ramachandran et al., 1986) and castor seeds (Sastry & Hegde, 1988) have been used. In these cases positive baiting could be confirmed only after subsequent plating of the infected baits on selective media. In the present study *Albizia falcataria* (L.) Fosberg leaflets have been used as baits to isolate black pepper *Phytophthora* from soil. The advantage of this method is that the fungus infects the baits and sporulates profusely on the bait within 72 h, which enables easy confirmation of positive baiting.

The test soil was sieved to < 2 mm fractions, 25 g placed in a Petri dish and 40–50 ml of glass distilled water added to make a soil–water suspension, so that 2–3 mm of free water stood above the soil when the particles settled. Two replicates of twenty leaflets of *Albizia falcataria* were floated with the adaxial surface in contact with water. Plates were incubated in the laboratory at 26°C (±2°C) for 72 h. Depending on the density of the inoculum, all or some of the baits became infected. The infected baits turned black and mycelium emerged at the edges and sporulated. If all the baits were not infected within 72 h, they all became infected subsequently, due to release of zoospores. To isolate the fungus into pure culture, infected baits were surface-sterilized with mercuric chloride 0.1% for 1 min, rinsed with four changes of sterile water and plated either on to water agar or PVPH selective medium (Tsao & Guy, 1977). The infected sporulating baits, when placed on black-pepper leaves and incubated in a humid chamber, produced characteristic lesions with limbricate margins within 48 h. Tsao (1983) suggested the use of a large quantity of water in a beaker instead of Petri dishes. His results were confirmed in the present studies.

Test soil, 300 g, was taken and half of this was distributed into six containers of 25 g each (two Petri dishes and four polythene containers). The remaining 150 g soil was used for making a serial dilution with autoclaved soil to give a final dilution of 1/2048 – the serial dilution end-point method (Tsao, 1960). Soil, 25 g, from each dilution was placed in one of the six containers. Different quantities of water ranging from 25 to 400 ml were added and baited with *Albizia falcataria* leaflets. The Disease Potential Indexes (DPI), defined as the reciprocal of the highest dilution which produce positive baiting under test conditions (Tsao, 1960) obtained, are given in Table 1.

Soil:water (ratio 1:4) gave the highest DPI value and this ratio is being used for further studies. The baiting efficiency of *Albizia falcataria* leaflets was compared with three other baits, namely *Leucaena leucocephala*, young and mature leaf discs of black pepper. The DPI values obtained are given in Table 2. The advantages which *A. falcataria* leaflets as baits have over others are: greater sensitivity compared with pepper-leaf discs, and direct sporulation on the baits, facilitating easy

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Quantity of water</th>
<th>Disease potential index</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>25 g + 25 ml water</td>
<td>128 2</td>
</tr>
<tr>
<td>B</td>
<td>25 g + 25 ml water</td>
<td>128 1</td>
</tr>
<tr>
<td>C</td>
<td>25 g + 50 ml water</td>
<td>256 1</td>
</tr>
<tr>
<td>D</td>
<td>25 g + 100 ml water</td>
<td>512 4</td>
</tr>
<tr>
<td>E</td>
<td>25 g + 200 ml water</td>
<td>64 1</td>
</tr>
<tr>
<td>F</td>
<td>25 g + 400 ml water</td>
<td>128 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bait</th>
<th>Disease potential index</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Albizia falcataria</em> leaflets</td>
<td>8</td>
</tr>
<tr>
<td><em>Leucaena leucocephala</em> leaflets</td>
<td>2</td>
</tr>
<tr>
<td>Black pepper: young leaf discs</td>
<td>1</td>
</tr>
<tr>
<td>Black pepper: mature leaf discs</td>
<td>1</td>
</tr>
</tbody>
</table>
infection confirmation, which reduces time. Since whole leaflets are used, saprophytic colonization is minimized. However, when the tissue is dead it becomes colonized by *Pythium* and other saprotophates and should not be used longer than 5 d. The presence of typical sporangia confirms positive baiting by *Phytophthora*. In black pepper, if the root system is infected, it takes several weeks before the aerial symptoms become visible, when it may be too late for any control measures to be taken. By this method, once the presence of pathogen and the DPI has been established, control measures could be taken earlier, preventing infection.

Contribution No. 121 of National Research Centre for Spices, Calicut-673 012, Kerala, India.

REFERENCES


---

**Pseudocercospora gymnosporea** sp. nov. from India


*Department of Botany, Dr H. S. Gour University, Sagar (M.P.), India*


*Pseudocercospora gymnosporea* sp. nov. is described and illustrated from leaves of *Gymnospora spinosa* and compared with published accounts of similar species.

**Key words:** *Pseudocercospora gymnosporea*, *Gymnospora*, New species.

**Pseudocercospora gymnosporea** R.K. Dubey et al. (Fig. 1)


---

**Table 1. Comparison between Pseudocercospora calatoni and P. gymnosporea**

<table>
<thead>
<tr>
<th>Strama</th>
<th>Considilophora</th>
<th>Considilophora</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Colour and size</td>
<td>Colour and size</td>
</tr>
<tr>
<td>P. calatoni</td>
<td>Well-developed, 20 μm wide</td>
<td>Light brown, olive-brown, 100–250 × 3.5–6 μm</td>
</tr>
<tr>
<td>P. gymnosporea</td>
<td>Well-developed, 22–148 μm, mid to dark olivaceous</td>
<td>Light to mid olive-brown, 20–185 × 3.5–6 μm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stroma</th>
<th>Considilophora</th>
<th>Considilophora</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Colour, septations, size</td>
<td>Colour, septations, size</td>
</tr>
<tr>
<td>P. calatoni</td>
<td>Brown to olive brown, 2–9</td>
<td>Oblongate, olive brown, 30–120 × 3–10 μm</td>
</tr>
<tr>
<td>P. gymnosporea</td>
<td>Light to mid olive-brown, 2–9</td>
<td>Oblongate clypeate or lenticular, olive-brown, 9–180 × 2.5–6 μm</td>
</tr>
</tbody>
</table>

---
Fig. 1. *Pseudocercospora gymnosporiae*. A, Struma; B, conidiophores; C, conidia.

Bandri, North Sagor Forest Division, India. R.K. Dubey AR-12, holotypus IMI 323366.

Infection amphigenous, in the form of numerous, almost circular to sometimes irregular spots with concentric rings, eventually coalescing, each with a brick-red halo. Colonies amphigenous, confined to the spots in the form of distinct innumerable small dots, dark greyish, Mycelium of immersed, narrow, septate, branched hyphae. Stromata well-developed, partly immersed and partly erumpent, sometimes superficial, pseudoparenchymatous, mid- to dark olivaceous, 22–148 μm diam. Conidiophores caespitose, macronematous, mononematous, erect to suberect, septate, unbranched, smooth or sometimes with a sinuous wall, light to mid olivaceous 20–185 × 3.5–6 μm. Conidiogenous cells integrated, terminal with solitary to multiple loci. Conidia holoblastic, simple, solitary, dry, acrogenous to acropseudogenous, obclavate cylindric to cylindric or lenticular, smooth, up to 28 transversely septate, apices subacute to obtuse, bases obconico-truncate, scars unthickened, light olivaceous, 9–180 × 2.5–6 μm.

A thorough survey of the literature shows that *P. celastri* Singh (1979) is the only species of *Pseudocercospora* described so far from the host family Celastraceae. However, this collection is quite different from *P. celastri* (Table 1). The two species show some minor similarities in structure of stroma, conidiophores and conidia but differ in the diameter of the stroma, size and colour of conidiophores and size and number of septa in conidia.

The authors are grateful to the Director, CAB International Mycological Institute, Kew, for confirming the identity of the fungus. The financial assistance to SAF from U.G.C., New Delhi, is also acknowledged.

REFERENCE

Pythium acanthophoron, a mycoparasite, rediscovered in India and Britain

B. C. LODHA  
Department of Plant Pathology, Rajasthan Agricultural University, Udaipur 313001, Rajasthan, India

J. WEBSTER  
Department of Biological Sciences, University of Exeter, EX4 4PS


A description of Pythium acanthophoron is given. It has spiny oogonia, but no zoosporangia were observed. It can grow as a mycoparasite on Fusarium solani and on Pythium myriotylum (two fungal pathogens causing rhizome rot of ginger) and a range of other fungi.

Key words: Pythium, Spiny oogonia, Mycoparasite.

A species of Pythium with spiny oogonia was isolated from soil around a healthy rhizome of ginger (Zingiber officinale Roscoe) collected at Udaipur, Rajasthan, India, on 25 Oct. 1988. Small crumbs of soil were placed on one side of a Petri dish containing 0.1% corn meal agar (CMA), and the opposite side of the dish was inoculated with Fusarium solani (Mart.) Saccardo, one of the fungi known to cause rhizome rot of ginger. The crude cultures were incubated at room temperature (ca 20 °C) and after several days characteristic oogonia were noted growing among the hyphae of F. solani. A pure culture of the Pythium was prepared, and its potential as a mycoparasite was tested by pairing it on 0.1% CMA against cultures of F. solani and another fungal pathogen known to cause rhizome rot of ginger, Pythium myriotylum Drechsler. In both cases, clear evidence of mycoparasitism was obtained. When opposed to F. solani, the Pythium overgrew it, killing its hyphae and developing abundant oogonia. Rows of oogonia following lengths of Fusarium hyphae were found (Fig. 1), oogonial production appearing to occur earlier in those parts of the Pythium culture associated with the Fusarium than in regions where Fusarium was absent. The species of Pythium with spiny oogonia also grew parasitically on hyphae of P. myriotylum. Its branches encircled the hyphae of P. myriotylum, penetrated (Fig. 2) and killed them. Spiny oogonia were also found in association with host hyphae.

The ability of the Pythium to grow as a mycoparasite was tested on 0.1% CMA against a range of filamentous fungi selected to represent most of the major taxa. Members of the Zygomycotina were especially susceptible. Coiling of the Pythium hyphae was observed around those of Absidia glauca Hagem, Mucor hiemalis Wehmer, Beauitobolus ranarum Eidam and Entomophthora coronata (Constr.) Kevorkian; penetration of the host hypha was observed in the latter three species.

Following the keys and descriptions provided by Plaats-Niterink (1981) and Waterhouse (1968), our attention was drawn to P. acanthophoron isolated by Sideris (1932) from the base of diseased pineapple leaves in Hawaii, which we believe is the same as our fungus. Unfortunately Sideris' description is confusing, and although a 'type' culture is maintained at C. B. S., Baarn, according to Plaats-Niterink it is sterile. The fungus has also been reported from soil in the Philippines (Quimio & Abilay, 1977), but they provide no description, so a new description of P. acanthophoron was made based on the culture isolated from Udaipur soil by B. C. Lodha.

Pythium acanthophoron Sideris, Mycologia 24: 36 (1932).

Colonies on CMA submerged and flat, on Potato Dextrose Agar (PDA) with both submerged and aerial hyphae, radiating and circular, fast-growing, showing 45 mm colony diam increase in 24 h at 20°C. 

Mycelium highly vacuolated with oil globules, coenocytic and often with streaming cytoplasm when young, becoming granular later, empty and sometimes septate. Main hyphae up to 7 μm wide but most lateral hyphae finer, 2–3 μm wide with a characteristic dendroid branching pattern. Branches widely spaced and usually arising at right angles to the main axis. The secondary or tertiary branches have terminal lateralals with peg-, spine- or hook-like projections or branches, (1)–2–4–(6) μm long. 1.5–2.0 μm wide, arising close by at a distance of 2–5–(1) μm from each other, with 30–50 such branches on a hyphal length of 100 μm (Fig. 3). In some cultures, the hyphae form conspicuous flat spiral coils about 100 μm diam.

Zoosporangia or any other kind of asexual reproductive structures were neither seen in any of the agar media tested (PDA, CMA, Malt Agar, CMA with wheat-germ oil) nor when pieces of culture on these media were transferred to sterile pond water with or without a split hemp seed floated in it and incubated at 15, 20, 25, 31 or 34°C.

Oogonia echinulate when mature, but smooth-walled when young (Fig. 4), numerous, produced on lateral branches 10–20 μm long or sometimes on short peg-like branches, globose, 20–28 μm diam excluding spines, with conspicuous crowded conical tooth-like spines (Figs 5–7). Spines 2–3 μm long, 2.0–2.5 μm wide at the base, with narrowly rounded tips. Oogonia often aborted or not fertilized, even if attached to one or two antheridia. Such aborted or unfertilized oogonia more often empty, smooth and small, 12–25 μm diam (Fig. 8). 

Antheridia monoclinois or diconiis, broadly globose to