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## Vermiculariopsiella Bender : Present Status of Species Diversity

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Genus *Vermiculariopsiella* Bender is briefly reviewed in this paper. Three new species, *V. elegans*, *V. parva* and *V. indica*, producing solitary, cylindrical, straight or slightly curved, smooth, aseptate, thick-walled, colourless, phialoconidia with rounded ends at the tip of conidiogenous cells arranged in palisade manner in setose sporodochium, recovered as litter and endophytic fungi from various plant species in India, are added. A taxonomic key is provided to the species in the genus.

**Key Words:** Biodiversity, tropical fungi, taxonomy.

**H**ohnel (1918) transferred *Excipula immersa* Desm. into *Vermiculariopsis* v. Hohnel, as *V. immersa* (Desm.) Hohnel. The new genus being a later homonym of *Vermiculariopsis* Torrend, Bender (1932) proposed *Vermiculariopsiella* Bender for *Excipula immersa* Desm. as *Vermiculariopsiella immersa* (Desm.) Bender. The original diagnosis of the genus included species with one-celled conidia. Considering the greater pertinence of this feature at the specific rather than generic level, Pasqualitti and Zucconi (1992) suggested inclusion of species also with septate conidia in the genus. This provided room for retention of *V. falcata* Nawawi *et al.* (1990) characterized by the presence of 3-septate conidia in the genus.

While adding two more new species, *V. falcata* Nawawi, Kuthubutheen and Sutton and *V. parvula* Nawawi Kuthubutheen and Sutton, Nawawi *et al.* (1990) revised the genus *Vermiculariopsiella* with three new combinations and provided a key for then recognised species. *V. immersa* var. *ramosa* Sutton was elevated to the species level as *V. ramosa* (Sutton) Nawawi Kuthubutheen and Sutton, *Oramasia hirsuta* Urries var. *cubensis* Castaneda and *Gyrothrix cornuta* V. Rao & de Hoog were recognized as *V. cubensis* (Castaneda) Nawawi Kuthubutheen and Sutton and *V. cornuta* (V. Rao & de Hoog) Nawawi Kuthubutheen and Sutton, respectively. Pasqualitti and Zucconi (1992) added *V. arcicula* Pasqualitti and Zucconi into the genus.

Till date, *Vermiculariopsiella* accommodates 7 species. Of these, 3 species,

viz., *V. cornuta*, *V. cubensis* and *V. ramosa* possess branched setae. The other 4 species produce unbranched setae and narrow conidia with less than 4  $\mu\text{m}$  width. Of these, *V. falcata* produces falcate, 3-septate hyaline conidia of 36-47  $\times$  1.5-2  $\mu\text{m}$ . *V. immersa* and *V. parvula* produce aseptate hyaline conidia of 13-23  $\times$  1.5-2.5  $\mu\text{m}$  and 8-13  $\times$  2-2.5  $\mu\text{m}$ , respectively with rounded base and pointed, slightly curved apex. The apex of conidiogenous cell is recurved in the former while it is narrow, long and straight in the latter. *V. arcicula* produces aseptate hyaline fusiform conidia of 15-19.5  $\times$  2.5-4  $\mu\text{m}$ .

During studies on the taxonomy and diversity of microfungi, three new hyphomycetous fungi belonging to *Vermiculariopsiella* were recovered as endophytes from *Saraca asoca* (Roxb.) De Wilde from forests of Western Ghats in Goa State and *Pimenta dioica* (L.) Merr. from a mixed plantation in north Malabar region of Kerala State, India. Two of these were also isolated from leaf litter of the respective plants. The fungi are described below.

Fresh leaves of *Saraca asoca* and *Pimenta dioica* were thoroughly washed and subjected to a 'three-step-isolation' process of Fisher and Petrini (1986) for isolation of endophytic fungi. Decaying leaves of the plants were thoroughly washed in deionized tap water and subjected to (i) 'moist chamber incubation' (Hawksworth, 1974) and (ii) 'particle plating technique' (Bills and Polishook, 1994) for recovery of litter fungi. Conidiophores with a crown of conidia appeared on the surface of the twigs from 4<sup>th</sup> day and on culture media after two weeks of incubation.

## Taxonomic Part

### *Vermiculariopsiella elegans* sp.nov. (Fig.1)

*Coloniae* irregularise, rhizoidacea ad marginis, nigra ad centrum et hyalinae ad ambitum, cum fructificatum mucosum, inverto incoloris vel pallide brunneus, 5.4 cm in diam. in 7 dies. *Mycelium* partim superficiale, ex hyphis laevis, tenuitunicatus, septatis, ramosis, pallide brunneus, 3.5  $\mu\text{m}$  lat., compositum. *Sporodochia* disseminata, dissita, punctiformia, circumscripta, irregulariter circularia, nonnumquam coalescentia, conidis agglutinatis cremea, 80-130  $\mu\text{m}$ . *Setae* numerosae, laeves, 1-3-septata, ereta, curvata vel modice flexuosa, simplex, 103-165  $\mu\text{m}$  longa, 6-7  $\mu\text{m}$  lat. ad basim, 5-5.5  $\mu\text{m}$  ad supra et 3.5  $\mu\text{m}$  ad apicem, prope basim crassae, crassitunicatae, brunneae, gradatim tenuiores tunicatae et pallidiores ad angustiolem et leviter rotundatum apicem. *Conidiophora* laevia, septata, ramosa, atrobrunnea ad nigra, crassitunicata, 8-12  $\times$  3-5  $\mu\text{m}$ . *Cellulae conidiogenae* monophialidicae, intergrata vel discretatae, 15-30  $\mu\text{m}$  long, 4-5  $\mu\text{m}$  lat. ad basim, 4.8-6.2  $\mu\text{m}$  lat. ad supra et 1.3  $\mu\text{m}$  lat. ad apicem, experse collarettis. *Conidia* solitaria, cylindricale, aseptata, levia, hyalina 20-27  $\times$  6-8  $\mu\text{m}$ .

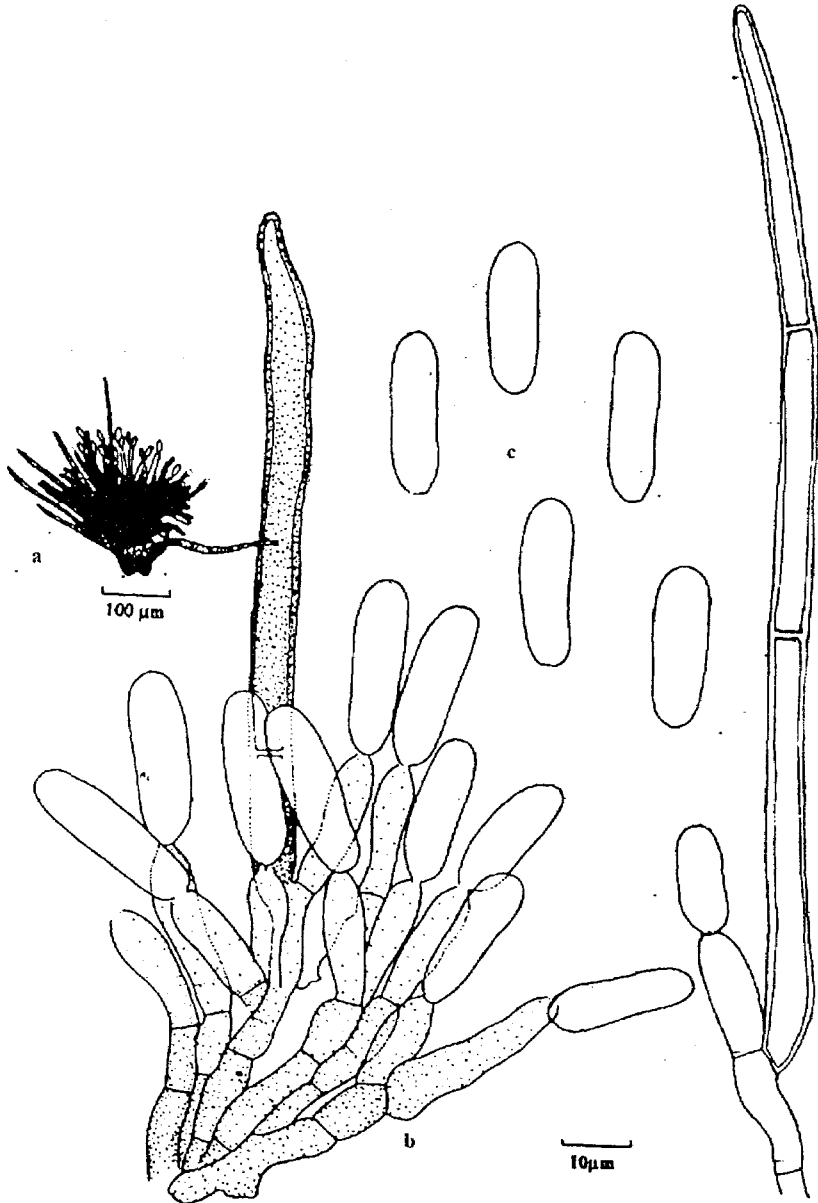


Fig.1. *V. elegans* sp.nov: a. Habit, b. A sporodochium with setae, c. Conidia.

HOLOTYPUS On fallen dead and decaying leaves of *Saraca asoca*, Bondla Wildlife Sanctuary, Goa, India, leg. Maria D'Souza, 25-10-1999, Herb. GUBH No.1496.

Terrestrial, conidial fungus, Hyphomycete. Colonies irregular, with rhizoidal margin, blackish in the centre and colourless towards the periphery, with distinct creamish fructification, fast growing, attaining a diam. of 5.4 cm in 7 days; reverse of the colony brown to white. Mycelium partly superficial, composed of smooth, septate, thin-walled, branched, pale brown, 3.5 µm wide hyphae. Conidiomata sporodochial, scattered, punctiform, round, sometimes coalescing to form irregular patches of pale cream mass of conidia, setose, stromatic at the base, 80-130 µm. Setae many, smooth, 1-3-septate, unbranched, dark brown at the base, paler towards the apex, 100-165 µm long, 6-7 µm wide at the base, 5-5.5 µm wide in the middle and 3.5 µm wide at the apex, arising from basal thick-walled, rounded stromal cells. Conidiophores smooth, septate, branched, dark brown to black, thick-walled, 8-12 x 3-5 µm. Conidiogenous cells monophialidic, integrated or discrete, 15-30 µm long, 4-5 µm wide at the base, 4.8-6.2 µm wide in the middle and 1.5 µm wide at the tip, without a conspicuous collarette. Conidia solitary, cylindrical rounded at both ends, slightly narrower and truncate at the base, smooth, aseptate, hyaline, 20-21 x 6-8 µm.

*Additional specimens examined:* (i) On dead and decaying leaves of *Careya arborea*, Mollem Wildlife Sanctuary, Goa, India, leg. Maria D'Souza, 11-03-1999, Herb. GUBH 324. (ii) On fallen dead and decaying leaves of *Mangifera indica*, Taleigao, Goa, India, leg. Maria D'Souza, 2-7-1999, Herb. GUBH 1038. (iii) On fallen dead leaves of *Flacourtia montana*, Cotigao Wildlife Sanctuary, Goa, India, leg. Maria D'Souza, 11-04-1999, Herb. GUBH 344. (iv) On fresh leaves of *Sanseiviera zeylanica*, Bondla Wildlife Sanctuary, Goa, India, leg. Maria D'Souza, 15-09-1999, GUFCC No.1370; recovered by endophytic isolation method. (v) On fallen dead and decaying leaves of *Dendrocalamus strictus*, Bondla Wildlife Sanctuary, Goa, India, leg. Maria D'Souza, 15-08-1999, Herb. GUBH 1190. (vi) On fresh leaves of *Bambusa arundinaceae*, Bondla Wildlife Sanctuary, Goa, India, leg. Maria D'Souza, 15-08-1999, Herb. GUBH 1195. (vii) On dead and decaying leaves of *Ficus benghalensis*, Baga, Goa, India, leg. Maria D' Souza, 11-10-1999, Herb. GUBH 1405. (viii) On fallen dead leaves of *Helictris ixoray* Alorna, Goa, India, leg. Maria D'Souza, 19-11-1999, Herb GUBH 1566.

*Vermiculariopsiella parva* sp. nov. (Fig.2)

*Coloniae* irregularise, levia, subhyalina ad centrum et hyalina ad ambitum, cum fructificatum mucosum, aurantium, disseminatum, 6 cm diam. in MEA

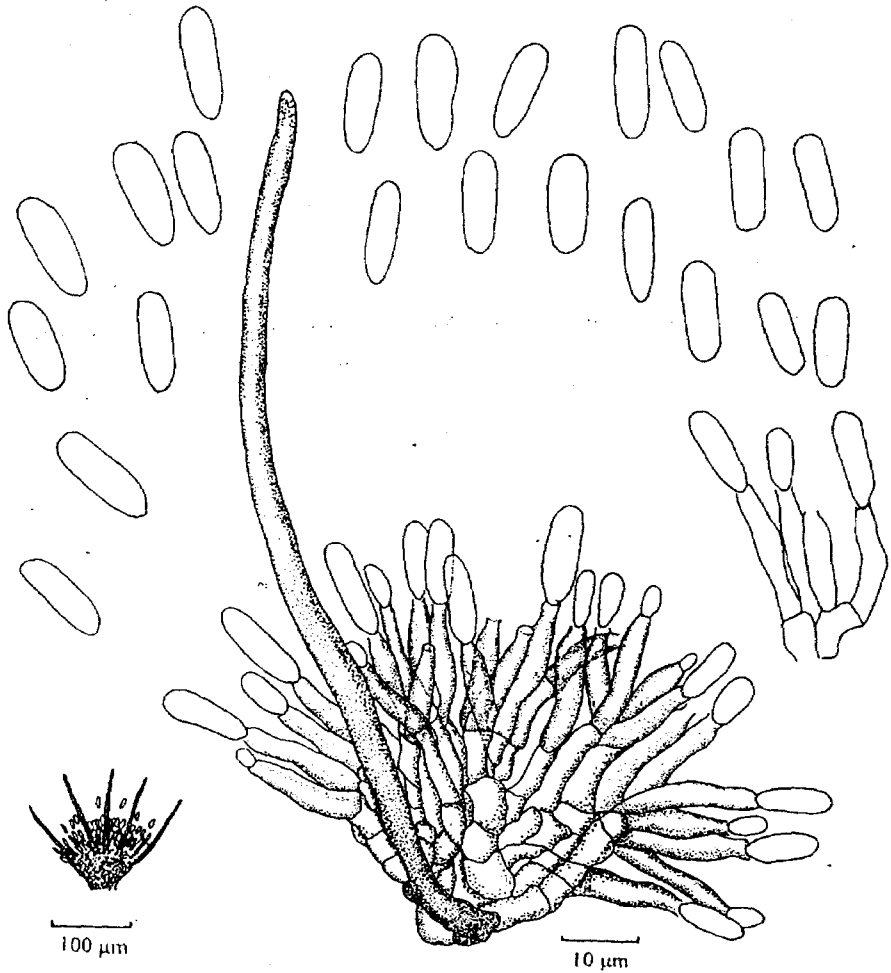


Fig. 2. *V. parva* sp. nov. a. Habit, b. A sporodochium with a seta, c. Conidiogenous cells with conidia, d. Conidia.

in 7 dies, invertio pallide brunneus vel. Incoloris. *Mycelium* partim superficiale, ex hyphis septatis, ramosis, crassitunicatus, incoloris vel pallide olivaceis, 2-6  $\mu\text{m}$  lat. compositum. *Conidiomata* sporodochia, setosa, dissita, punctiformia, circumscripta, irregulariter circularia, nonnumquam coalescentia, conidis agglutinatis cremea, 25-125  $\times$  55-75  $\mu\text{m}$ . *Setae* numerosa, ereta, curva vel modice flexuosa, simplex, septata, laeves, 80-125  $\times$  3-6  $\mu\text{m}$ , prope basim crassa, crassitunicata, brunneae, gradatim tenuiores tunicatae et pallidiores ad

angustiolem et leviterrotundatum apicem. *Conidiophora* erecta, recta vel modice flexuosa, ramosa, laevia, septata, pallide ad atrobrunnea tenuitunicata, 40-80 x 3-4  $\mu\text{m}$ , inter setas densum vallum formantia. *Cellulae conidiogenae* monophialidicae, discreta, determinata, leves, cylindrica, 12-23 x 3-5  $\mu\text{m}$ . *Conidia* solitaria, cylindrica, levia, aseptata, hyalina 12-15 (10-19) x 4-6  $\mu\text{m}$ .

HOLOTYPE, Dried culture on MEA, isolated from fresh leaves of *Pimenta dioica*, 11-11-2001, Pookala, Kasaragod, Kerala, India, leg. Keshavaprasad, Herb. GUBH No. 5201

*Colonies* irregular, smooth, pale brown in the centre, colourless towards the periphery, wet, with distinct orange-coloured fructification scattered all around, fast growing, attaining a diam. of 6 cm in 7 days; reverse of the colony pale brown to colourless. *Mycelium* partly superficial, composed of smooth, branched, septate, thick-walled, pale to dark brown, 2-6  $\mu\text{m}$  wide hyphae. *Conidiomata* sporodochial, setose, scattered, punctiform, sometimes coalescing to form irregular patches with pale cream mass of conidia, 25-125 x 55-75  $\mu\text{m}$ ; *setae* arising laterally from the basal cells of sporodochium, solitary, unbranched, swollen and thick-walled at the base, smooth with wavy surface, erect, slightly curved to flexuose, septate, dark brown, progressively paler and thin-walled towards slightly rounded and tapered apex, 80-125 x 3-6  $\mu\text{m}$ . *Conidiophores* erect, straight or slightly flexuose, smooth, septate, branched, light to orange brown, progressively thin-walled, 40-80 x 3-4  $\mu\text{m}$ . *Conidiogenous cells* monophialidic, discrete, determinate, narrow, cylindrical, 12-23 x 3-5  $\mu\text{m}$ , without a distinct collarette. *Conidia* solitary, cylindrical, rounded at the tip, rounded and narrow at the base, smooth, aseptate, unbranched, hyaline, 12-15 (10-19) x 4-6  $\mu\text{m}$ .

*Vermiculariopsiella indica* sp. nov. (Fig.3)

*Coloniae* effusae, irregularise, leviae, nigra cum fructificatum mucosum, 6-8 cm diam. in MEA in 7 dies, inverto pallide brunneus vel nigrum. *Mycelium* partim superficiale, ex hyphis septatis, ramosis, incoloris vel pallide olivaceis 2  $\mu\text{m}$  lat., et hyphis atrofucus, crassitunicatus, 3-6  $\mu\text{m}$  lat., compositum. *Conidiomata* sporodochia, setosa, disseminata, punctiformia, circumscripta, irregulariter circularia, nonnumquam coalescentia, conidis agglutinatis cremea, 120-150 x 100-200  $\mu\text{m}$ . *Setae* numerosa, erecta, curva vel modice flexuosa, simplex, septata, leves, 125-300 x 4-6  $\mu\text{m}$  prope basim crassae, crassitunicata, brunnea, gradatim tenuiores tunicatae et pallidiores ad angustiolem et leviterrotundatum apicem. *Conidiophora* erecta, recta vel modice flexuosa, laevia, septata, ramosa, pallide brunnea, tenuitunicata, 60-100 x 6-10  $\mu\text{m}$  longa. *Cellulae conidiogenae* monophialidicae, integrata vel discreta, determinata, cylindricales, laeves, tenuitunicata, hyalina, expers colleretis, 15-26 x

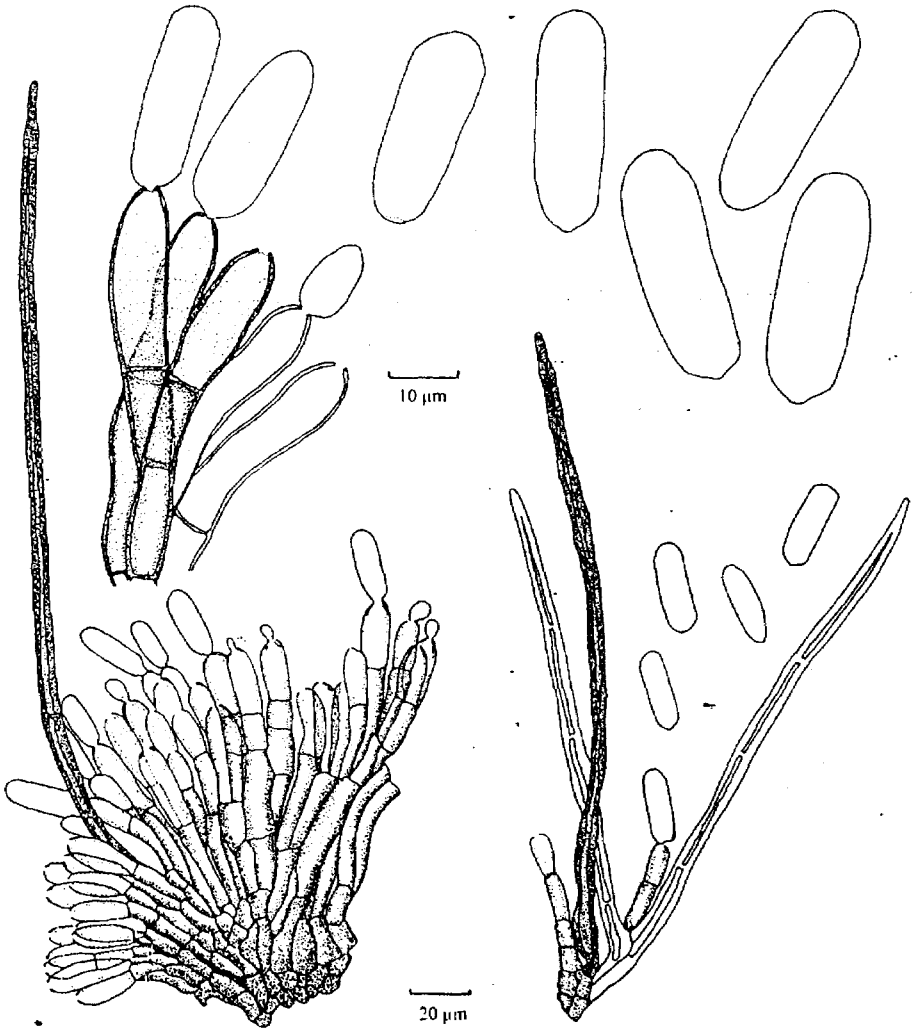


Fig.3. *V. indica* sp. nov.: a. A sporodochium with a seta, b. Setae with condiophores, c. Condigenous cells with conidia, d. Conidia.

6-10  $\mu\text{m}$ . *Conidia* solitaria, cylindrica, levia, aseptata, tenuitunicata, hyalina 22-30 x 8-11  $\mu\text{m}$ .

HOLOTYPUS, Dried culture on MEA, isolated from fresh leaves of *Sarcococa*, Bondla Wildlife Sanctuary, Goa, India, leg. Maria D'Souza, 11-12-1999, GUFCC No.1502, GUBH No. 1502.

*Colonies* effuse, irregular, smooth, black, wet, with distinct black fruiting bodies scattered on the surface, fast growing, attaining a diam. of 6-8 cm in 7 days; reverse of the colony pale brown to black. *Mycelium* partly superficial, composed of smooth, septate, thick-walled, branched, pale to dark brown, 2-6  $\mu\text{m}$  wide hyphae. *Conidiomata* sporodochial, setose, scattered, punctiform, sometimes coalescing to form irregular patches with cream mass, 120-150 x 100-200  $\mu\text{m}$ ; *setae* many, arising laterally from the basal cells of sporodochium, solitary, unbranched, smooth, erect, slightly curved to flexuose, septate, dark brown, swollen and thick-walled at the base, progressively paler and thin-walled and slightly rounded and tapered apex, 125-300  $\mu\text{m}$  long, 15-25  $\mu\text{m}$  wide at the base, 4-6  $\mu\text{m}$  wide above. *Conidiophores* erect, straight, slightly flexuose, smooth, septate, branched, light brown, thin-walled, 60-100 x 6-10  $\mu\text{m}$ . *Conidiogenous cells* monophialidic, integrated to discrete, determinate, wide cylindrical with rounded apex, without distinct collarette, 15-26 x 6-10  $\mu\text{m}$ . *Conidia* solitary, cylindrical, rounded at the tip, slightly rounded and truncate at the base, smooth, aseptate, unbranched, hyaline, 22-30 x 8-11  $\mu\text{m}$ .

## Discussion

The three new species described here differ from earlier known species in that they produce cylindrical, smooth, unicellular, hyaline conidia with rounded ends and wider than 4  $\mu\text{m}$ . The conidia are sometimes slightly curved and truncate at the base. The sporodochia when mature coalesce into slimy mass. The setae mature at different stages of development and, therefore, number and size of the setae are discernible only in mature sporodochia.

Key to the species of *Vermiculariopsiella* proposed by Nawawi *et al.* (1990) is updated below incorporating the later described taxa.

### Key to the species of *Vermiculariopsiella*

1. Setae unbranched ----- 2
1. Setae branched ----- 6
2. Conida cylindrical with rounded ends ----- 3
2. Conidia with pointed apex ----- 4
3. Conidia 20-25 x 6-8  $\mu\text{m}$  ----- *V. elegans* sp.nov.



3. Conidia 12-15 (10-19) x 4-6  $\mu\text{m}$  ----- *V. parva* sp. nov.
3. Conidia 22-30 x 8-11  $\mu\text{m}$  ----- *V. indica* sp. nov.
4. Conidia falcate, apex curved and pointed ----- *V. falcata* ✓
4. Conidia fusiform, slightly curved, 15-19.5  $\mu\text{m}$  long ----- *V. arcicula* ✓
4. Conidia cylindrical, straight, apex acute, base rounded ----- 5
5. Conidia 14-25  $\mu\text{m}$  long; conidiogenous cell apex recurved - *V. immersa* ✓
5. Conidia 8-13  $\mu\text{m}$  long; conidiogenous cell apex narrow, straight -----  
----- *V. parvula* ✓
6. Setae mostly once dichotomously branched ----- *V. ramosa* ✓
6. Setae thrice dichotomously branched ----- *V. cornuta* ✓
6. Setae with short primary and secondary branches, terminal cells with hair-like appendages ----- *V. cubensis* ✓

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