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Castañeda-Ruiz, R.F.; Heredia, G.; Arias, M.; McKenzie, E.H.C.; Hyde, K.D.; Stadler, M.; Saikawa, M.; Gené, J.; Guarro, J.; Iturriaga, T.; Minter, D.W.; Crous, P.W.

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## A new species and re-disposed taxa in *Repetophragma*

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Castañeda-Ruiz RF, Heredia G, Arias RM, McKenzie EHC, Hyde KD, Stadler M, Saikawa M, Gené J, Guarro J, Iturriaga T, Minter DW, Crous PW. 2011 – A new species and re-disposed taxa in *Repetophragma*. *Mycosphere* 2(3), 273–289.

A new species of *Repetophragma*, collected on plant material from “Aguita Fria” Veracruz, Mexico, and from Canaima National Park, Bolivar State, Venezuela is described and illustrated. *Repetophragma paracambrense* sp. nov. is characterized by subobclavate to somewhat lageniform, truncate at the base, 8–10-septate, brown, mostly verruculose, sometimes smooth conidia. Twelve new combinations are proposed for taxa previously included in *Sporidesmium* and *Endophragmiella*. A comparative table and key to *Repetophragma* species are provided.

**Key words** – anamorphic fungi – cloud forest – Guiana forest – systematics

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### Introduction

Subramanian (1992) erected the genus *Repetophragma* during a revision of *Sporidesmium* Link, and included nine species. *Repetophragma biseptata* (M.B. Ellis) Subram. was designated as the type species. The diagnostic characters of the genus are macronematous conidiophores with several annellations produced after a few or numerous enteroblastic percurrent proliferations of the conidiogenous cell, and euseptate conidia with a conico-truncate basal cell, which secede schizolytically. The combination of these features

separates the genus *Repetophragma* from *Sporidesmiella* P.M. Kirk, which has disto-septate conidia (McKenzie 1995). Subsequently, ten other species have been added to the genus: *Repetophragma cambrense* (M.B. Ellis) McKenzie (McKenzie 1995), *R. cubense* (Mercado) J. Mena (Mena et al. 2000), *R. goidanichii* (Rambelli) W.P. Wu (Wu & Zhuang 2005), *R. inflatum* (Berk. & Ravenel) W.P. Wu (Wu & Zhuang 2005), *R. ontariense* (Matsush.) W.P. Wu (Wu & Zhuang 2005), *R. sinense* W.P. Wu (Wu & Zhuang 2005), *R. fasciatum* (R.F. Castañeda) R.F. Castañeda, Gusmão &

Saikawa (Castañeda et al. 2006), *R. filiferum* (R.F. Castañeda) R.F. Castañeda et al. (Castañeda et al. 2006), *R. calongei* J. Mena, Silvera & Gené (Silvera-Simón et al. 2009, and *R. gondwanamycetis* Marinc., M.J. Wingf. & Crous (Marincowitz et al. 2008).

During an expedition in February 2010 through the protected areas of Veracruz State, Mexico, a conspicuous fungus from the genus *Repetophragma* was collected on decaying wood. A specimen collected in a tropical forest in southern Venezuela during 2005 proved to be the same fungus. These specimens showed differences from previously described taxa and are herein described and illustrated as a new species of *Repetophragma*.

### Materials and methods

During February 2010 around 80 samples of microfungi were collected in “Aguita Fria”, Veracruz, Mexico (Fig. 21). Individual collections were placed in paper bags, taken to the laboratory, and incubated at 25°C in Petri dishes placed in a moist chamber composed of plastic containers (50 L capacity) with 200 mL of sterile water plus 2 mL of glycerol, and examined at regular intervals for the presence of microfungi. Aeration was supplied by opening the containers for 5 to 10 minutes at 45 minutes intervals during a week. Mounts were prepared in polyvinyl alcohol-glycerol (8.0 g in 100 mL of water, plus 5 mL of glycerol) and measurements made at a magnification of  $\times 1000$ . The same methodology was followed for specimens collected during an expedition in April 2005 to Luepa, Gran Sabana area, Canaima National Park, as part of a series of expeditions to collect wood decomposing fungi in a tropical forest in southern Venezuela.

Micrographs were obtained with a Zeiss Axioskop 40 microscope and a Leitz Dialux 20 EB microscope. Holotype material is deposited in the Herbarium of the “Instituto de Ecología A.C., Xalapa (XAL) and a paratype at Herbario Nacional de Venezuela in Caracas (VEN).

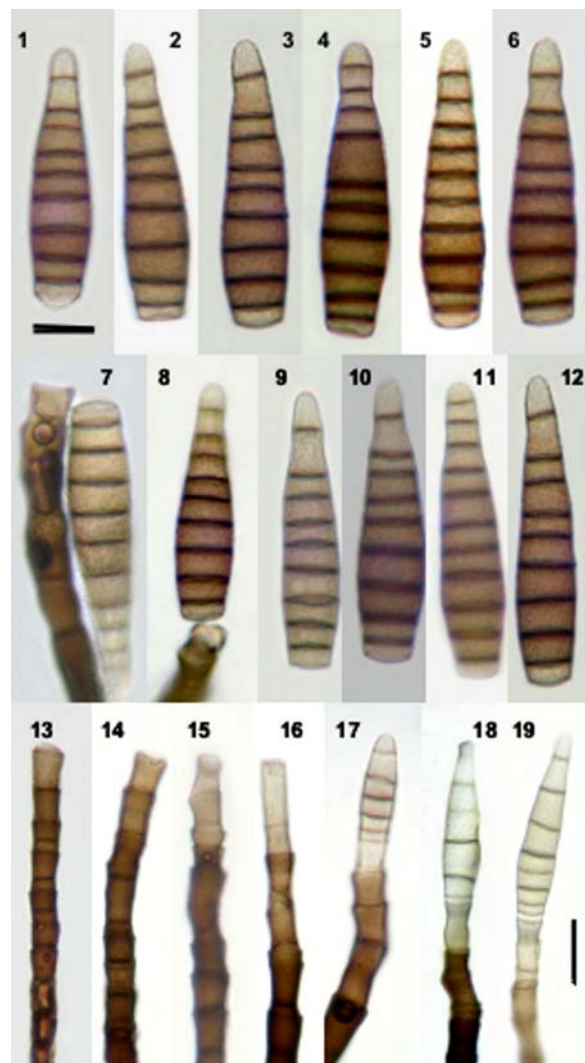
### Taxonomy

*Repetophragma paracambrense* R.F. Castañeda, Heredia & McKenzie, **sp. nov.**

Figs 1–20

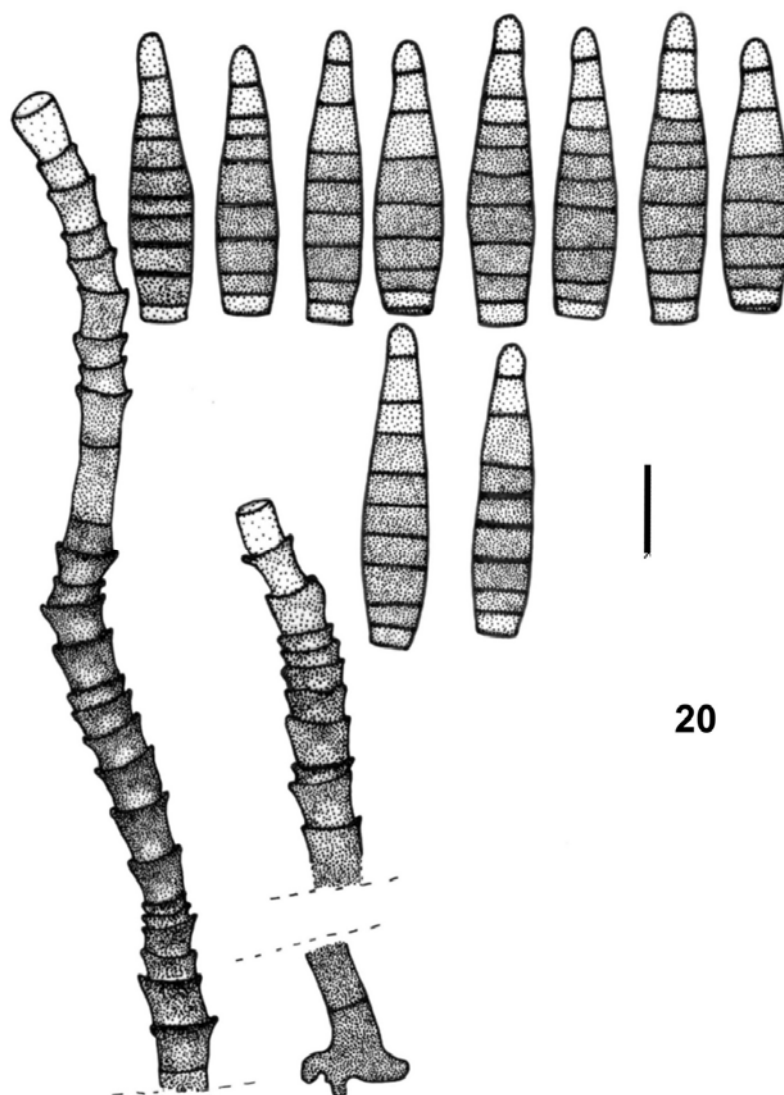
MycoBank 519657

Etymology – Greek, *para-* similar to, by the side of; *cambrense*, epithet of similar species in the genus *Repetophragma*.



**Figs 1–19** – *Repetophragma paracambrense*, photomicrographs from holotype (XAL CB1700). 1–12 Conidia. 13–19 Conidiogenous cells and conidia. Scale bars = 10  $\mu$ m.

Coloniae in substrato naturali effusae, pilosae, nigrae vel atrobrunneae. Mycelium partim superficiale et partim in substrato immersum, ex hyphis septatis, ramosis, brunneis, verruculosus vel laevibus. *Conidiophora* macronematoso, mononematoso, erecta, recta vel leviter geniculata, 5–8-septata, sursum perproliferata, ad usque 10 proliferationes successivas, 180–350  $\times$  7–10  $\mu$ m, atrobrunnea ad basim, pallidiora ad apicem. *Cellulae conidiogenae* monoblasticae, terminales, in conidiophoris incorporatae, indeterminatae, cum proliferationes enteroblasticis percurrentis deinde



**Fig. 20** – *Repetophragma paracambrense*, drawings from holotype (XAL CB1700). Conidiophores, conidiogenous cells and conidia. Scale bar = 10  $\mu$ m.

aliquot cyathiformibus et annuliformibus visae. Conidiorum secessio schizolytica. *Conidia* solitaria, subobclavata vel aliquot lageniformia, truncata ad basim, leviter constricta ad cellula subapicale et rotundata ad apicem, 8–10-septata, utrimque laevia et subhyalina, verruculosa et brunnea cetero, sed atrobunnea vel nigra ad septa, sicca, 35–55  $\times$  10–13  $\mu$ m. Teleomorphosis ignota.

Colonies on the natural substratum effuse, hairy, black or dark brown. Mycelium superficial and immersed, composed of septate, branched, brown, verruculose or smooth hyphae. *Conidiophores* macronematous, mononeematous, simple, erect, straight or slightly geniculate towards the apex, 5–8-septate, annellate above, with up to 10 annellations, 180–350  $\times$

7–10  $\mu$ m, dark brown at the base and pale brown towards the apex. *Conidiogenous cells* monoblastic, terminal, integrated, indeterminate, annellidic with numerous cyathiform enteroblastic percurrent proliferations. Conidial secession schizolytic. *Conidia* solitary, subobclavate to somewhat lageniform, truncate at the base, slightly constricted at the subapical cell and rounded at the apex, 8–10-septate, septa black, subhyaline and smooth at the ends, other cells verruculose and brown, 35–55  $\times$  10–13  $\mu$ m, dry. Teleomorph unknown.

Habitat – on decaying twig of unidentified plant, on fallen decomposing decorticated branch.

Known distribution – Mexico, Venezuela. *Material examined*: Mexico, Veracruz, “Aguita

Fria", 19°31'N; 96°59'W, 8 February 2010, G. Heredia and V. Sosa. (**Holotype**, XAL CB1700). Venezuela, Bolivar State, Tropical forest, Luepa, Sector Gran Sabana, Parque Nacional Canaima, Estado Bolívar, 5°50'52"N, 61°27'59"W, 880–1250 m alt., April 2005, T. Iturriaga and H. Urbina (Paratype, VEN 108368).

Notes – *Repetophragma paracambrense* is similar to *R. cambrense*, but the latter species is easily differentiated by its conidia, which are subfusiform, smooth, not constricted near the apex, and are (47–)53–63(–70) µm long.

After study and re-examination of several previously described taxa such as *Sporidesmium terminaliae* (Deighton 1969), *S. ellisii* (Pirozynski 1972), *S. laxisporum* (Castañeda 1985), *S. longiphorum*, *S. perproliferatum* (Castañeda & Kendrick 1991), and several other described species under the genera *Sporidesmium* and *Endophragmiella*, the authors concluded that these are best treated under the generic concept of *Repetophragma*, and the following new combinations are proposed:

***Repetophragma apiceinflatum*** (Matsush.) R.F. Castañeda, McKenzie & K.D. Hyde, **comb. nov.** Fig. 24  
Mycobank 519658

Basionym – *Sporidesmium apiceinflatum* Matsush., Matsushima Mycological Memoirs 8: 36, 1995.

***Repetophragma ellisii*** (Piroz.) R.F. Castañeda, McKenzie & K.D. Hyde, **comb. nov.** Fig. 34  
Mycobank 519659

Basionym – *Sporidesmium ellisii* Piroz., Mycological Papers 129: 25, 1972.

***Repetophragma filisporum*** (Matsush.) R.F. Castañeda, McKenzie & K.D. Hyde **comb. nov.** Fig. 38  
Mycobank 519660

Basionym – *Sporidesmium filisporum* Matsush., Matsushima Mycological Memoirs 7: 68, 1993.

***Repetophragma fragmentisporum*** (Matsush.) R.F. Castañeda, McKenzie & K.D. Hyde, **comb. nov.** Fig. 39  
Mycobank 519661

Basionym – *Sporidesmium fragmentisporum* Matsush., Matsushima Mycological Memoirs 7: 68, 1993.

***Repetophragma laxisporum*** (R.F. Castañeda) R.F. Castañeda **comb. nov.** Fig. 44, 45  
Mycobank 519662

Basionym – *Sporidesmium laxisporum* R.F. Castañeda [as '*laxusporum*'], Deuteromycotina de Cuba, Hyphomycetes (La Habana) 3: 35, 1985.

***Repetophragma longiphorum*** (R.F. Castañeda & W.B. Kendr.) R.F. Castañeda **comb. nov.** Fig. 46  
Mycobank 519663

Basionym – *Sporidesmium longiphorum* R.F. Castañeda & W.B. Kendr., University Waterloo Biology Series 35: 105, 1991.

***Repetophragma moniliforme*** (Matsush.) R.F. Castañeda, McKenzie & K.D. Hyde, **comb. nov.** Fig. 47  
Mycobank 519664

Basionym – *Sporidesmium moniliforme* Matsush., Matsushima Mycological Memoirs 7: 69, 1993.

***Repetophragma omahutaense*** (Matsush.) R.F. Castañeda, McKenzie & K.D. Hyde, **comb. nov.** Fig. 48  
Mycobank 519665

Basionym – *Sporidesmium omahutaense* Matsush., Matsushima Mycological Memoirs 4: 16, 1985.

***Repetophragma perproliferatum*** (R.F. Castañeda & W.B. Kendr.) R.F. Castañeda **comb. nov.** Fig. 50  
Mycobank 519666

Basionym – *Sporidesmium perproliferatum* R.F. Castañeda & W.B. Kendr., University Waterloo Biology Series 35: 112, 1991.

***Repetophragma peruamazonicum*** (Matsush.) R.F. Castañeda & McKenzie, **comb. nov.** Fig. 51  
Mycobank 519667

Basionym – *Sporidesmium peruamazonicum* Matsush., Matsushima Mycological Memoirs 7: 69, 1993.

***Repetophragma quadriloculare*** (Matsush.) R.F. Castañeda, McKenzie & K.D. Hyde, **comb. nov.** Fig. 52  
MycoBank 519668

Basionym – *Endophragmiella quadriloculare* Matsush, Matsushima Mycological Memoirs 7: 51, 1993.

***Repetophragma terminaliae*** (Deighton) R.F. Castañeda, McKenzie & K.D. Hyde, **comb. nov.** Fig. 56  
MycoBank 519669

Basionym – *Sporidesmium terminaliae* Deighton, in Deighton & Cejp, Mycological Papers 117: 25, 1969.

The ability to generate one or numerous elongations of the conidiogenous cells can be

used to separate taxa at the generic level, but cannot be used to differentiate species, since the number of proliferations (annellations) can be influenced by environmental conditions. Wang (1990) pointed out that “the annellations on an annellophore are the results of the regeneration of entire new conidiogenous cells, originating either from the penultimate cells or from endohyphae”, it can be confirmed with the pale or colorless pigmentation of apical proliferation that characterized new material formed during the conidiogenous events and regeneration of the conidiogenous cells.

To assist in identification of species a synoptic table with the principal diagnostic features is provided (Table 1), along with a key to the species.

**Table 1 Comparison of described and re-disposed *Repetophragma* species.**

Species	Conidiophores Morphology and size (µm)	Conidia Morphology and size (µm)	References
<i>R. aburiense</i>	Brown, up to 14 annellations, 7–80 × 4–6	Obclavate, rostrate, 2–4-septate, brown, paler towards apex, smooth or verruculose, 40–65 × 6–7	Ellis (1958, 1976), Subramanian (1992)
<i>R. afrormosiae</i>	Pale brown or olivaceous brown, up to 5 annellations, 8–30 × 4–6	Obclavate, often rostrate and curved, 7–12-septate, sometimes 1–2 oblique septa, brown, paler towards apex, smooth, 60–100 × 8–10	Ellis (1963, 1976), Subramanian (1992)
<i>R. apiceinflatum</i>	Pale brown, subhyaline towards apex, 1–7 annellations, 20–45(–110) × 3–4	Cylindrical, globose to slightly inflated at apex, 4–12-septate, pale brown with hyaline basal cell, smooth, 27–80(–110) × 4–5.5	Matsushima (1995)
<i>R. biseptatum</i>	Mid to dark brown, 0–18-annellations, 55–190 × 4.5–6	Navicular, 2-septate, brown to dark brown, basal cell subhyaline, smooth, 17–23 × 7–8	Ellis (1963, 1976), Subramanian (1992)
<i>R. calongei</i>	Brown to dark brown, 4–9 annellations, 32–75 × 5–7	Subcylindrical to subfusiform, 12–27-septate, brown to mid brown, smooth, 80–165 × 8–10.5	Silvera-Simón et al. (2009)
<i>R. cambrense</i>	Reddish brown or dark brown, paler towards apex, up to 6 annellations, 60–300 × 7–11	Subfusiform, 7–10-septate, brown with paler end cells, smooth, (47–)53–63(–70) × 10–14	Ellis (1958), McKenzie (1995)
<i>R. cubense</i>	Dark brown, 3–17 annellations, 50–180 × 6–9	Obclavate, rarely fusiform, rostrate, 6–13-septate, dark golden brown, pale at base and towards apex, obscure band at septa, smooth, 50–200 × 13–18, rostrum up to 130 long	Mercado (1984a, b), Mena-Portales et al. (2000)

**Table 1 (Continued) Comparison of described and re-disposed *Repetophragma* species.**

Species	Conidiophores Morphology and size ( $\mu\text{m}$ )	Conidia Morphology and size ( $\mu\text{m}$ )	References
<i>R. dennisii</i>	Brown, pale brown towards apex, 7–27 annellations, 80–310 $\times$ 6–8	Ellipsoid to oval, (2–)3–4-septate, brown, apical cell pale brown, smooth, 23–32 $\times$ 11–13	Kirk (1983), Subramanian (1992), Castañeda-Ruiz et al. (2003), Wu & Zhuang (2005)
<i>R. ellisii</i>	Yellow-brown near base, pale straw towards apex, 3–8 annellations, 60–180 $\times$ 3.5–5.0	Obclavate, acicular rostrate, 4–5-septate, yellow-brown, two middle cells darker straw-coloured, apical cell hyaline, basal cell subhyaline, smooth, 40–90 $\times$ 7–9, rostrum up to 60 long	Pirozynski (1972), Ellis (1976)
<i>R. fasciatum</i>	Dark brown, pale brown towards apex, 4–8 annellations, 100–150 $\times$ 5–9	Ellipsoid to oval, with a filiform, straight apical appendage, 5-septate, brown, dark brown at middle cells, black band at septa, smooth, 22–27 $\times$ 10–12, appendage 80–90 long	Castañeda-Ruiz (1985), Grandi & Silva (2003), Castañeda-Ruiz et al. (2006)
<i>R. filiattenuatum</i> (*)	Dirty brown, pale at apex, up to 7 annellations, 30–150 $\times$ 6–10	Obclavate, cylindrical-rostrate above, 7–23-septate, brown, subhyaline towards apex, smooth, 80–520 $\times$ 10–16, rostrum up to 400 long. On natural substratum 68–165 $\times$ 12–14	Matsushima (1983), Subramanian (1992), Wu & Zhuang (2005)
<i>R. filiferum</i>	Brown, 4–10 annellations, 60–100 $\times$ 4–6	Broad fusiform to navicular, with a filiform, straight or flexuous apical appendage, 6–8-septate, mid pale brown, smooth, 28–40 $\times$ 8–10, appendage up to 100 long	Pirozynski (1972), Ellis (1976), Castañeda-Ruiz et al. (2006)
<i>R. filisporum</i> (**)	Dirty brown, pale towards apex, up to 4 annellations, 20–50(–100) $\times$ 3.5–5	Narrow obclavate to subcylindrical, 6–40-septate, dirty brown, pale brown or subhyaline towards apex, smooth, 50–300 $\times$ 4–5. On natural substrate 27–70 $\times$ 4–5.5	Matsushima (1993)
<i>R. fragmentisporum</i> (**)	Dirty brown, pale near apex, 3–6 annellations and sometimes with some sympodial elongations, up to 40 $\times$ 3–4	Cylindrical, 6–20-septate, pale olivaceous, smooth, 36–85 $\times$ 4–5	Matsushima (1993)
<i>R. goidanichii</i>	Brown to dark brown, 5–11 annellations, 40–78 $\times$ 5–8	Cylindrical, 7–9-septate, brown, smooth, 40–52 $\times$ 5–7	Hughes (1979), Wu & Zhuang (2005)
<i>R. gondwanamycetis</i>	Brown, pale near apex, 0–1 annellations, 70–160 $\times$ 5–6	Cylindrical or fusiform, slightly curved or straight, 3–12-septate, pale to dark brown, subhyaline end cells, smooth, (25–)31–34(–45) $\times$ 5–9	Marinowicz et al. (2008)
<i>R. indicum</i>	Dark brown, 7–12 annellations, 50–100 $\times$ 5–8	Obclavate, slightly constricted at septum, 1-septate, pale golden brown, smooth, 30–42 $\times$ 7–9	Ellis (1976), Subramanian (1992)

**Table 1 (Continued) Comparison of described and re-disposed *Repetophragma* species.**

Species	Conidiophores Morphology and size ( $\mu\text{m}$ )	Conidia Morphology and size ( $\mu\text{m}$ )	References
<i>R. inflatum</i>	Brown, 4–8 annellations, 80–400 $\times$ 6–9	Obclavate, sigmoid, 3–5-septate, dark reddish-brown or dark brown second and occasionally third cells, pale brown or subhyaline other cells, smooth, 45–90 $\times$ 11–18	Ellis (1958, 1971), Matsushima (1975), Wu & Zhuang (2005)
<i>R. laxisporum</i>	Brown, up to 10 annellations, 25–85 $\times$ 3.5–7.0	Fusiform to obclavate, subulate at apex, 6–7-septate, brown, end cells subhyaline, smooth, 25–39 $\times$ 7–9	Castañeda-Ruiz (1985)
<i>R. longiphorum</i>	Dark brown, brown towards apex, up to 14 annellations, 350–800 $\times$ 7–10	Obclavate, rostrate, 3–6-septate, frequently 4-septate, median cells transversely striate and brown, end cells smooth and pale brown, 45–85 $\times$ 9–10	Castañeda-Ruiz & Kendrick (1991)
<i>R. moniliforme</i>	Brown, dark brown near base, 1–4 annellations, 9–50 $\times$ 4–5	Moniliform, 8–22-septate, brown and verrucose at base and middle body, pale brown and smooth towards apex, 55–280 $\times$ 6–10	Matsushima (1993)
<i>R. omahutaense</i> (***)	Brown, with 3–10-annellations, up to 70 long and 3–4 wide	Cylindrical, 2–5-septate, pale brown, smooth, 8–28 $\times$ 4–5	Matsushima (1985)
<i>R. ontariense</i>	Pale brown to brown, with 6–14-annellations, 30–50 $\times$ 5–7	Fusiform or obclavate, 8–11-septate, pale brown to mid brown, smooth, 100–140 $\times$ 15–20	Wu & Zhuang (2005)
<i>R. paracambrense</i>	Dark brown at the base and pale brown towards the apex, with up to 10-annellations, 180–350 $\times$ 7–10	Sub-obclavate to somewhat lageniform, truncate at the base, slightly constricted at the subapical cell and rounded at the apex, 8–10-septate, subhyaline and smooth at the ends, other cells verruculose and brown, with black septa, 35–55 $\times$ 10–13	Present paper.
<i>R. perproliferatum</i>	Brown, pale brown towards the apex, with 1–3-annellations, up to 70 long and 3–4 wide	Obclavate, with a narrow, tapered apical appendage, 2–3-septate, second cell brown, the other cells paler, smooth, 18–35 $\times$ 3, apical cell 6–21 long	Castañeda-Ruiz & Kendrick (1991)
<i>R. peruamazonicum</i> (***)	Brown, with 1–4-annellations, 25–65 $\times$ 4–6	Obclavate to slightly cylindrical, 5–8-septate, brown and pale brown at the end cells, smooth, 23–32 $\times$ 6–8	Matsushima (1993)
<i>R. quadriloculare</i> (***)	Brown, pale brown towards apex, 2–5-annellations, up to 70 $\times$ 3–4	Obovate to subglobose, 3-septate, dark brown middle and basal cells, pale brown at apex, smooth, 16–21 $\times$ 8–13. On natural substrate 20–24 $\times$ 11–14	Matsushima (1993)



**Table 1 (Continued) Comparison of described and re-disposed *Repetophragma* species.**

Species	Conidiophores Morphology and size (µm)	Conidia Morphology and size (µm)	References
<i>R. sinense</i>	Pale brown to brown, 4–5-annellations, 40–150 × 4–6	Obclavate, rostrate, slightly curved, 6–9-septate, pale brown to mid brown, smooth, 35–45 × 7–9	Wu & Zhuang (2005)
<i>R. subulatum</i>	Olivaceous brown, up to 7 annellations, 20–90 × 8–10	Obclavate to subfusiform, 7–10-septate, dark olivaceous brown, pale brown towards apex, smooth, 90–160 × 15–19	Ellis (1958, 1976), Subramanian (1992)
<i>R. terminaliae</i>	Pale olivaceous, up to 8 annellations, 20–80 × 4–5.5	Cylindrical, curved, 4–5-septate, pale olivaceous, smooth, 50–75 × 6.5–8	Deighton (1969), Ellis (1976)
<i>R. wroblewskii</i>	Pale to mid golden brown, up to 8 annellations, 7–40 × 5–8	Obclavate or subfusiform, 3–4-septate, pale to mid golden brown, smooth or verruculose, 30–46 × 9–11	Ellis (1958, 1976), Subramanian (1992)
<i>R. zambiense</i>	Pale olivaceous, slightly sinuous, 2–5 annellations, 11–50 × 4–6.5	Subcylindrical, often curved, slightly wider at middle cells, 4–13-septate, occasionally with a longitudinal septum in one or two central cells, pale olivaceous to deep olivaceous, smooth, 39–104 × 7–11	Deighton (1969), Ellis (1976), Subramanian (1992)

(\*) On V8 agar media (\*\*) On banana leaf piece (\*\*\*) On CMA media

**Key to *Repetophragma* species**

- |   |  |
|---|--|
| <p>1 Conidia 1-septate, obclavate, slightly constricted at the septum, pale golden brown, smooth, 30–42 × 7–92 µm.....<br/>.....<i>R. indicum</i> (Fig. 42)<br/>Conidia with more than 1 septum..... 2</p> <p>2(1) Conidia with an apical rostrum (rostrate) ..... 3<br/>Conidia without an apical rostrum (not rostrate or tapering to the apex)..... 8</p> <p>3(1) Conidia usually with fewer than 6 septa.. ..... 4<br/>Conidia usually with more than 5 septa. 5</p> <p>4(3) Conidia obclavate, with a narrow, tapered apical appendage, 2–3-septate, second cell brown, other cells paler, smooth, 18–35 × 3 µm, apical cell 6–21 µm long .....<br/>.....<i>R. perproliferatum</i> (Fig. 50)<br/>Conidia obclavate, 2–4-septate, brown, paler towards apex, smooth or verruculose, 40–65 × 6–7 µm .....<br/>.....<i>R. aburiense</i> (Fig. 22)</p> | <p>Conidia obclavate, acicular, 4–5-septate, yellow-brown, with two middle cells darker straw-coloured, apical cell hyaline, basal cell subhyaline, smooth, 40–90 × 7–9 µm, rostrum up to 60 µm long .....<i>R. ellisii</i> (Fig. 34)</p> <p>Conidia obclavate or subfusiform, 3–4-septate, pale to mid golden brown, smooth or verruculose, 30–46 × 9–11 µm .....<br/>..... <i>R. wroblewskii</i> (Fig. 57)</p> <p>Conidia ellipsoid to oval, with a filiform, straight apical appendage, 5-septate, brown and dark brown at the middle cells, with a black band at the septa, smooth, 22–27 × 10–12 µm, appendage 80–90 µm long.....<i>R. fasciatum</i> (Fig. 35)</p> <p>5(3) Conidia usually with fewer than 10 septa ..... 6<br/>Conidia sometimes with more than 10 septa..... 7</p> <p>6(5) Conidia obclavate, 3–6-septate, frequently 4-septate, median cells transversely striate and brown, end cells smooth and pale brown, 45–85 × 9–10 µm .....<br/>..... <i>R. longiphorum</i>(Fig. 46)</p> |
|---|--|

- Conidia broad fusiform to navicular, with a filiform, straight or flexuous apical appendage, 6–8-septate, mid pale brown, smooth,  $28\text{--}40 \times 8\text{--}10 \mu\text{m}$ , appendage up to  $100 \mu\text{m}$  long.....*R. filiferum* (Fig. 37)
- Conidia obclavate, slightly curved, 6–9-septate, pale brown to mid brown, smooth,  $35\text{--}45 \times 7\text{--}9 \mu\text{m}$  .....*R. sinense* (Fig. 53)
- Conidia fusiform to obclavate, subulate at the apex, 6–7-septate, brown, with subhyaline end cells, smooth,  $25\text{--}39 \times 7\text{--}9 \mu\text{m}$ .....*R. laxisporum* (Fig. 45)
- 7(5) Conidia obclavate, curved, 7–12-septate, sometimes 1–2 oblique septa, brown, paler towards the apex, smooth,  $60\text{--}100 \times 8\text{--}10 \mu\text{m}$  .....*R. afrormosiae* (Fig. 23)
- Conidia obclavate, rarely fusiform, 6–13-septate, dark golden brown, pale at the base and towards the apex, with obscure band at the septa, smooth,  $50\text{--}200 \times 13\text{--}18 \mu\text{m}$ , rostrum up to  $130 \mu\text{m}$  long ...  
.....*R. cubense* (Fig. 29)
- Conidia obclavate, cylindrical-rostrate above, 7–23-septate, brown and subhyaline towards the apex, smooth,  $80\text{--}520 \times 10\text{--}16 \mu\text{m}$ , rostrum up to  $400 \mu\text{m}$  long ...  
.....*R. filiattenuatum* (Fig. 36)
- 8(2) Conidia mostly cylindrical or subcylindrical, not curved ..... 9
- Conidia mostly cylindrical or subcylindrical, curved ..... 10
- Conidia mostly obclavate, not curved or not sigmoid, 6–40-septate, dirty-brown, pale brown or subhyaline towards the apex, smooth,  $50\text{--}300 \times 4\text{--}5 \mu\text{m}$ .....  
.....*R. filisporum* (Fig. 38)
- 9(8) Conidia 4–5-septate, pale olivaceous, smooth,  $50\text{--}75 \times 6.5\text{--}8.0 \mu\text{m}$  .....  
.....*R. omahutaense* (Fig. 48)
- Conidia 7–9-septate, brown, smooth,  $40\text{--}52 \times 5\text{--}7 \mu\text{m}$ .....  
.....*R. goidanichii* (Fig. 40)
- Conidia globose to slightly inflated at the apex, 4–12-septate, pale brown with hyaline basal cell, smooth,  $27\text{--}80\text{--}110 \times 4.0\text{--}5.5 \mu\text{m}$  ..*R. apiceinflatum* (Fig. 24)
- Conidia 6–20-septate, pale olivaceous, smooth,  $36\text{--}85 \times 4\text{--}5 \mu\text{m}$  .....  
.....*R. fragmentisporum* (Fig. 39)
- Conidia 12–27-septate, brown to mid brown, smooth,  $80\text{--}165 \times 8\text{--}10.5 \mu\text{m}$ .....  
.....*R. calongei* (Fig. 26)
- 10(8) Conidia 4–5-septate, pale olivaceous, smooth,  $50\text{--}75 \times 6.5\text{--}8.0 \mu\text{m}$  .....  
.....*R. terminaliae* (Fig. 56)
- Conidia slightly wider above the middle cells, 4–13-septate, occasionally with a longitudinal septum in one or two central cells, pale olivaceous to deep olivaceous, smooth,  $39\text{--}104 \times 7\text{--}11 \mu\text{m}$  .....  
.....*R. zambiense* (Fig. 58)
- Conidia 3–12-septate, pale to dark brown, with subhyaline end cells, smooth,  $(25\text{--})31\text{--}34\text{--}(45) \times 5\text{--}9 \mu\text{m}$  .....  
.....*R. gondwanamycetis* (Fig. 41)
- 11(8) Conidia 5–8-septate, brown and pale brown at the end cells, smooth,  $23\text{--}32 \times 6\text{--}8 \mu\text{m}$  .....*R. peruamazonicum* (Fig. 51)
- Conidia 3–5-septate, dark reddish-brown or dark brown second and occasionally third cells, other cells pale brown or subhyaline, smooth,  $45\text{--}90 \times 11\text{--}18 \mu\text{m}$ .....*R. inflatum*..... (Fig. 43)
- Conidia 7–10-septate, dark olivaceous brown and pale brown towards the apex, smooth,  $90\text{--}160 \times 15\text{--}19 \mu\text{m}$  .....  
.....*R. subulatum* (Fig. 54, 55)
- 12(8) Conidia 8–11-septate, pale brown to mid brown, smooth,  $100\text{--}140 \times 15\text{--}20 \mu\text{m}$ ....  
.....*R. ontariense* (Fig. 49)
- Conidia 7–10-septate, brown with paler end cells, smooth,  $(47\text{--})53\text{--}63 \text{--}(70) \times 10\text{--}14 \mu\text{m}$  .....*R. cambrense* (Figs 27–28)
- Conidia slightly constricted at the subapical cell and rounded at the apex, 8–10-septate, subhyaline and smooth end cells, verruculose, and brown in the other cells, with black septa,  $35\text{--}55 \times 10\text{--}13 \mu\text{m}$ .....  
.....*R. paracambrense* (Figs 1–20)
- 13(8) Conidia navicular 2-septate, with subhyaline basal cell, other cells brown to dark brown, smooth,  $17\text{--}23 \times 7\text{--}8 \mu\text{m}$ .....



**Fig. 21** – Dr. Vinicio Sosa during a foray in “Aguita Fria” cloud forest, Veracruz, Mexico, taking some pictures from the samples.

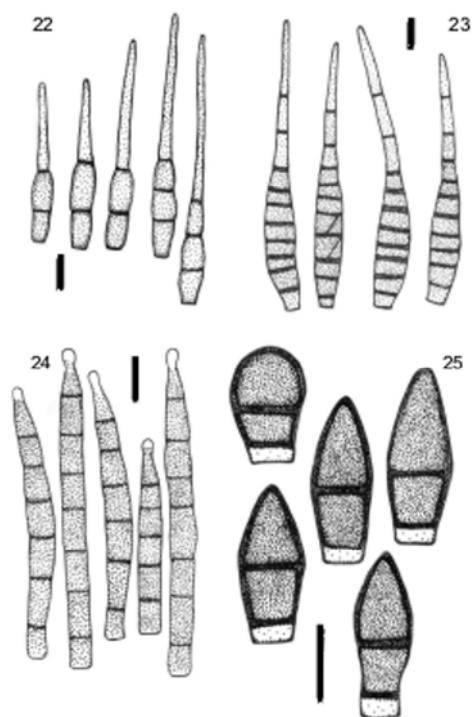
..... *R. biseptatum* (Fig. 25)  
 Conidia not navicular ..... 14

apex, 55–280 × 6–10 μm .....  
 ..... *R. moniliforme* (Fig. 47)

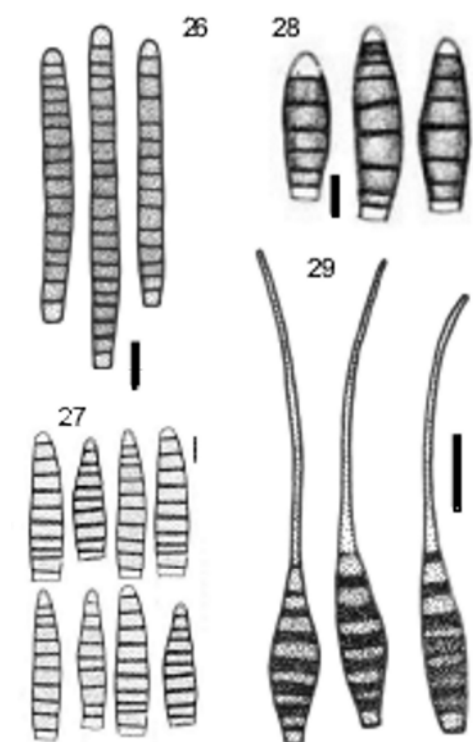
- 14(13) Conidia ellipsoid to oval, (2–)3–4-septate, brown, apical cell pale brown, smooth, 23–32 × 11–13 μm .....  
 ..... *R. dennisii* (Figs 30–33)  
 Conidia obovate to subglobose, 3-septate, with dark brown middle and basal cells, and pale brown at the apex, smooth, 16–21 × 8–13 μm .....  
 ..... *R. quadriloculare* (Fig. 52)  
 Conidia moniliform, 8–22-septate, brown and verrucose at the base and middle part, and pale brown and smooth towards the

**Acknowledgements**

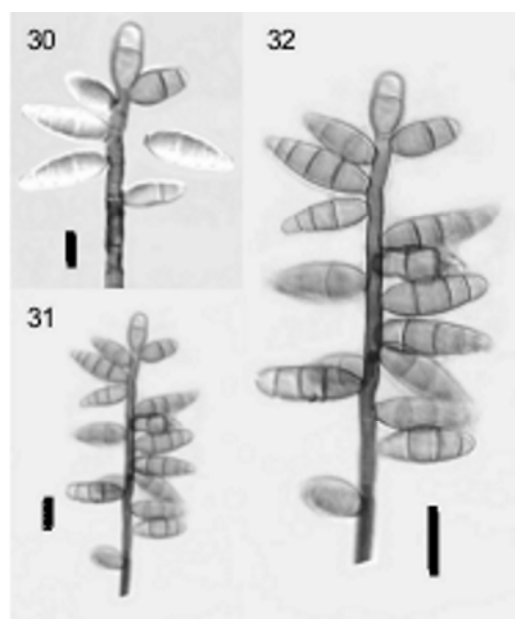
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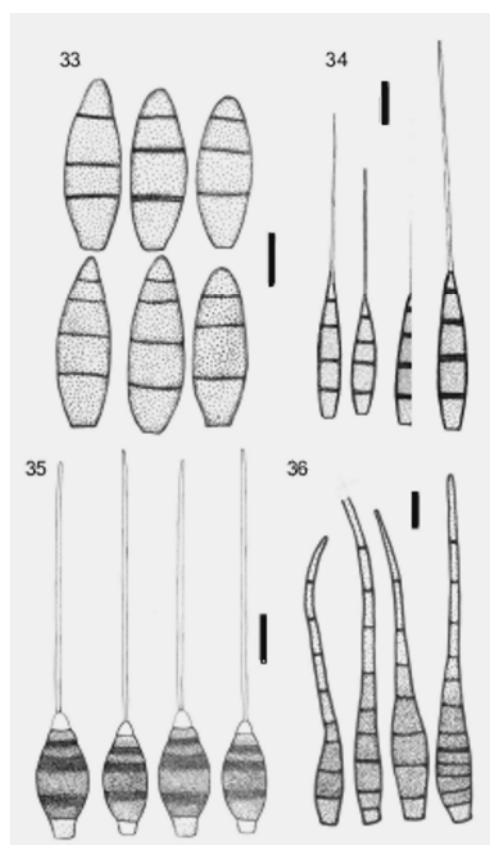
**Figs 22–25** – *Repetophragma* spp. conidia. Redrawn from the original descriptions. **22** *R. aburiense*. **23** *R. afrormosiae*. **24** *R. apiceinflatum*. **25** *R. biseptatum*. Scale bars = 10  $\mu$ m.



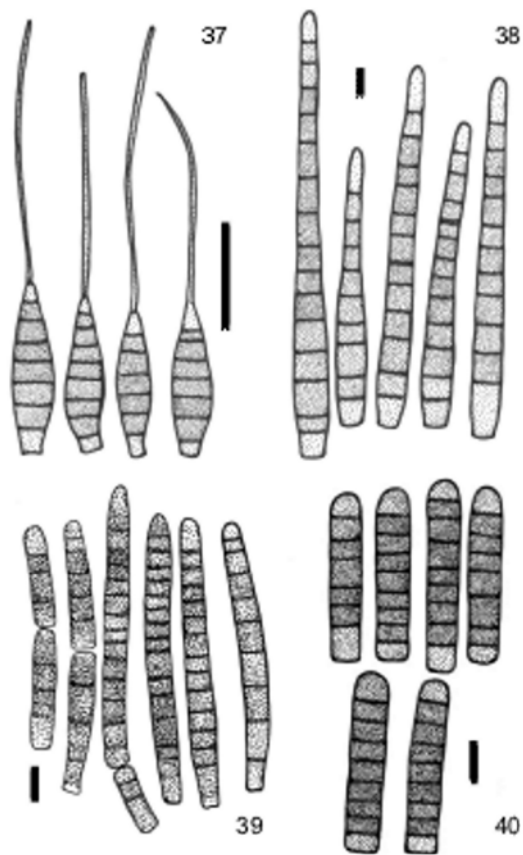
**Figs 26–29** – *Repetophragma* spp. conidia. Redrawn from the original descriptions. **26** *R. calongei*. **27–28** *R. cambrense*. **29** *R. cubense*. Scale bar 27, 28 = 10  $\mu$ m. 26, 29 = 20  $\mu$ m.



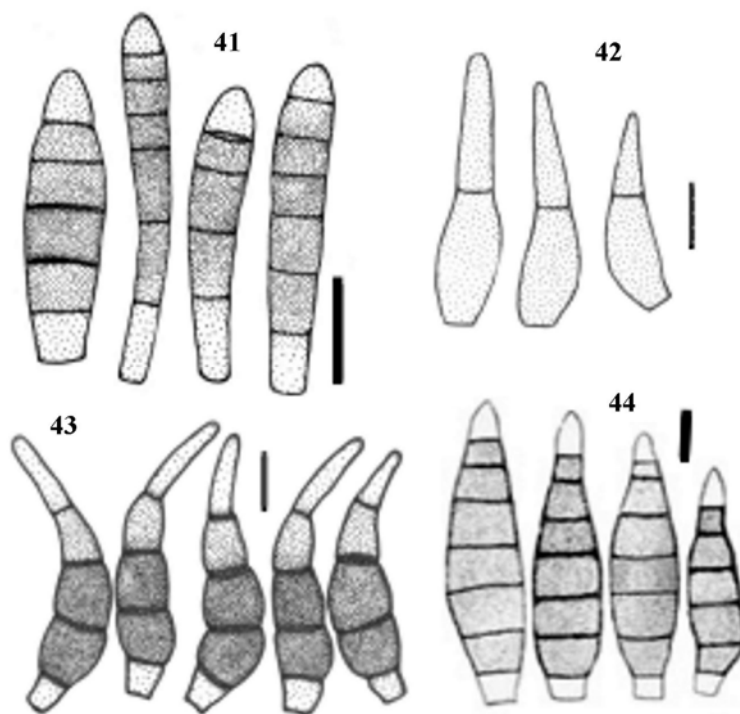
**Figs 30–32** – *Repetophragma dennisii*, conidiophores, conidiogenous cells and conidia, photomicrographs from (USB C99/199). Scale bars 30, 31 = 10  $\mu$ m, 32 = 20  $\mu$ m.



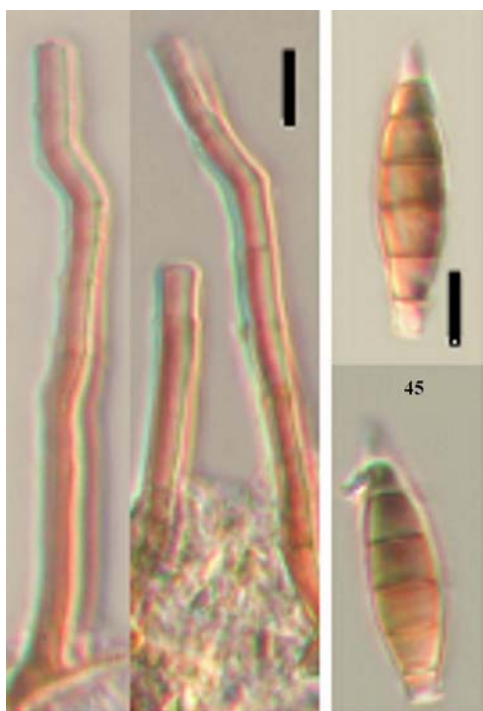
**Figs 33–36** – *Repetophragma* spp. conidia. Redrawn from the original descriptions. **33** *R. dennisii*. **34** *R. ellisii*. **35** *R. fasciatum*. **36** *R. filiattenuatum*. Scale bar 33, 34, 35 = 10  $\mu$ m, 36 = 40  $\mu$ m.



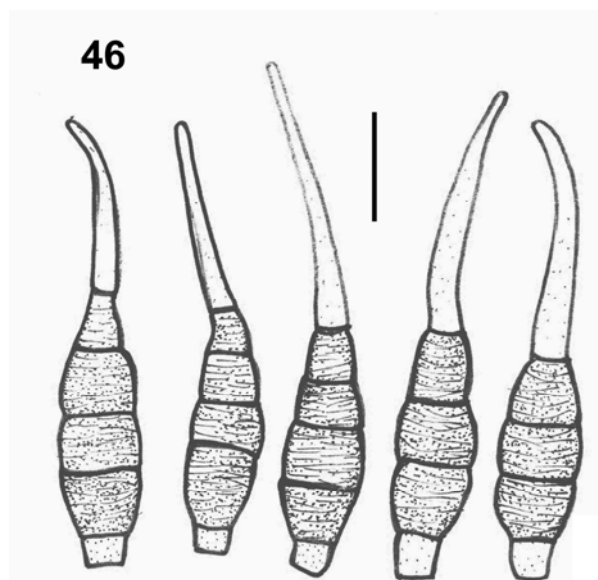
**Figs 37–40** – *Repetophragma* spp. conidia. Redrawn from the original descriptions. **37** *R. filiferum*, **38** *R. filisporum*, **39** *R. fragmentisporum*, **40** *R. goidanichii*. Scale bar 37, 39, 40 = 10  $\mu\text{m}$ , 38 = 20  $\mu\text{m}$ .



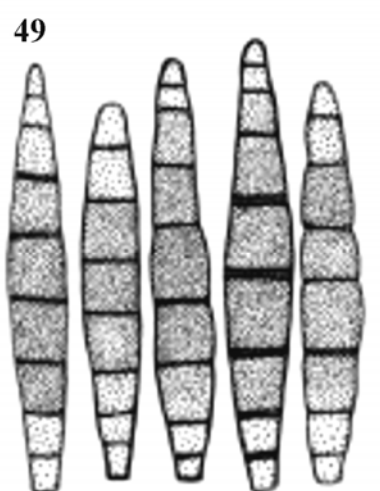
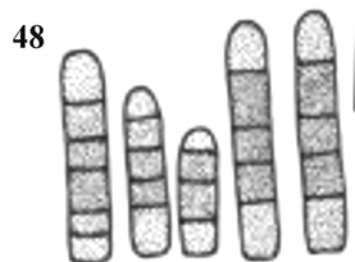
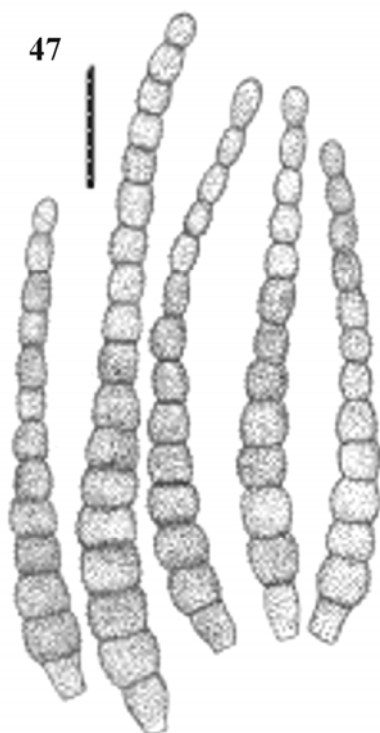
**Figs 41–44** – *Repetophragma* spp., conidia. **41** *R. gondwanamycetis* conidia. Adapted and redrawn from the original descriptions. **42** *R. indicum*. **43** *R. inflatum*, **44** *R. laxisporum*. Scale bars = 10  $\mu\text{m}$ .



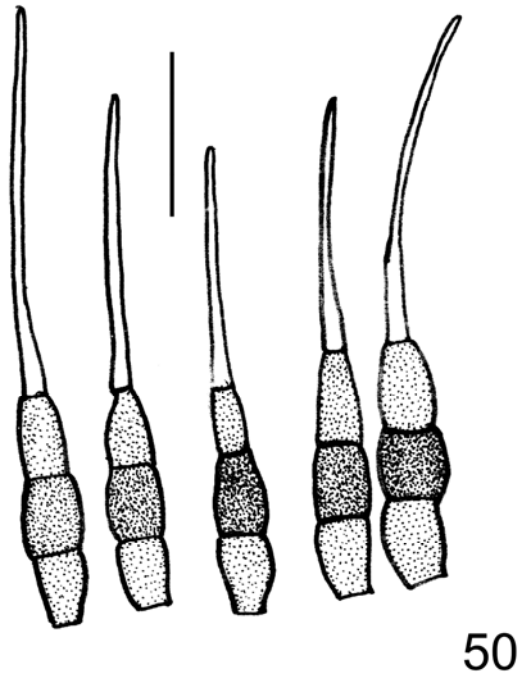
**Fig. 45** – *Repetophragma laxisporum*, photomicrographs from holotype (INIFAT C85/13). Conidiophores, conidiogenous cells and conidia. Scale bars = 10  $\mu$ m.



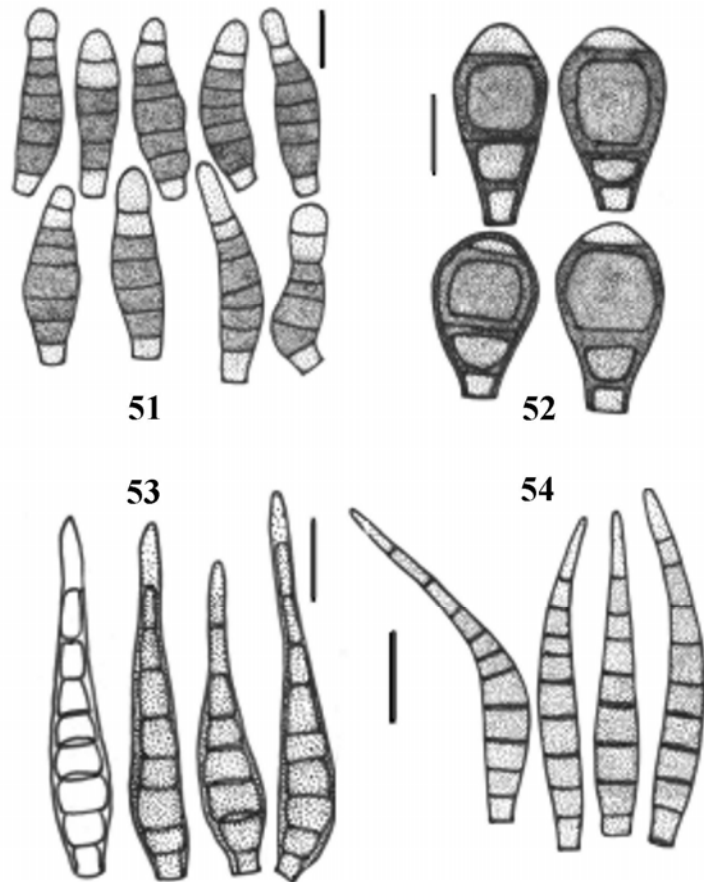
**Fig. 46** – *Repetophragma longiphorum*, drawing of conidia from holotype (INIFAT C85/13). Scale bar = 10  $\mu$ m.



**Figs 47–49** – *Repetophragma* spp., conidia. Redrawn from the original descriptions. **47** *R. moniliforme*. **48** *R. omahutaense*. **49** *R. ontariense*. Scale bar 47, 49 = 40  $\mu$ m, 48 = 10  $\mu$ m.



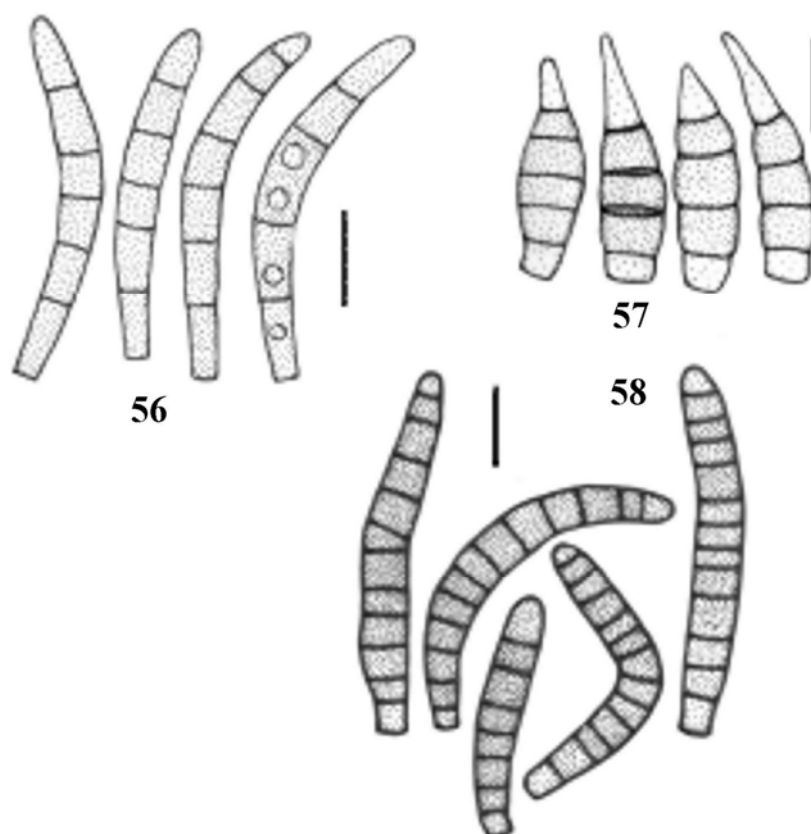
**Fig. 50** – *Repetophragma perproliferatum*, drawing of conidia from holotype (INIFAT C91/10–4). Scale bar = 10  $\mu$ m.



**Figs 51–54** – *Repetophragma* spp., conidia. Redrawn from the original descriptions. **51** *R. peruamazonicum*. **52** *R. quadriloculare*. **53** *R. sinense*. Scale bar = 10  $\mu$ m. **54** *R. subulatum*. Scale bar 51, 52, 53 = 10  $\mu$ m, 54 = 40  $\mu$ m.



**Fig. 55** – *Repetophragma subulatum*. Conidiophores, conidiogenous cells and conidia, photomicrographs from (INIFAT C95/46). Scale bar = 10  $\mu\text{m}$ .



**Figs 56 –58** – *Repetophragma* spp., conidia. Redrawn from the original descriptions. **56** *R. terminaliae*. **57** *R. wroblewskii*. **58** *R. zambiense*. Scale bars = 20  $\mu\text{m}$ .

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