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宽阔水自然保护区的虫草及其相关真菌 II.

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摘要 采自贵州省宽阔水自然保护区的另6种虫草, 它们是娄山虫草新种(*Cordyceps loushanensis* Liang & Liu sp. nov.), 绿核虫草新种(*Cordyceps aeruginosclerota* Liang & Liu sp. nov.), 拟暗绿虫草(*Cordyceps pseudoatrovirens* Kob. & Shim.), 布氏虫草(*Cordyceps brongniartii* Shimazu), 金针虫虫草(*Cordyceps agriota* Kawam), 和幼虫虫草 [*Cordyceps larvarum* (Westwood) Olliff]. 还报道了多颈被毛孢(*Hirsutella polycolluta* Liang), 云南被毛孢丝梗新变种(*Hirsutella yunnanensis* var. *tenuisynnemi* Liang et Liu var. nov.), 巨大被毛孢(*Hirsutella gigantea* Petch) 和枝多头霉 [*Polycephalomyces ramosum* (Peck) Mains] 等几种束梗孢科的虫生真菌, 及娄山拟青霉新种(*Paecilomyces loushanensis* Liang & Liu sp. nov.).

关键词 娄山虫草, 绿核虫草, 拟暗绿虫草, 布氏虫草, 金针虫虫草, 多颈被毛孢, 云南被毛孢丝梗变种, 巨大被毛孢, 枝多头霉, 娄山拟青霉

10. 娄山虫草 新种 图1和图3-1

Cordyceps loushanensis Liang & Liu sp. nov. Fig.1 & Fig.3-1

Stromata 6 ~ 7 fasciculata e cocoonibus insectorum directe oriunda, clavata, 40mm longa. Stipes cylindricus albus vel alutaceus. Pars fertilis onco-cylindrica, 8 ~ 15 × 2 ~ 3mm, aurantiaca. Perithecia confertim superficialia, ovoidea vel pyriformia, 360 ~ 420 × 140 ~ 240 μm, ostiolo abtumento incrassato. Asci longissimi parvi, 300 × 3 μm, capitibus 0.8 ~ 2 μm altis 2.5 ~ 3 μm crassis. Ascosporae filiformes utrinque subattenuatae ad septum nec secedentes nec constrictae. Articuli (4.8 ~)5.4 ~ 13 (~ 18) μm longi, (0.6 ~) 0.8 ~ 1 μm crassi.

Hab. in insectis Coleopteris 20 ~ 28 × 6 ~ 8mm.

Typus: CGAC89-7071, Kuankuoshui Preserve, Suiyang, Guizhou Prov., VII, 1989, Z-Q. Liang, A-Y. Liu et al.

子座6~7根丛生, 多从蛹茧一端生出, 棒状, 长达40mm, 柄柱状, 白色至米黄色, 内实, 可孕部膨大, 柱形, 8~15×2~3mm, 桔黄色。子囊壳密集表生, 倒梨形或卵圆形, 360~420×40~240 μm,

组成孔口的菌丝顶端膨大, 使具有扁球形帽状加厚的喙部。子囊柱状, 300×3 μm, 子囊帽高0.8~2 μm 宽2.5~3 μm。子囊孢子线形, 两端尖, 多隔, 长90~260 μm, 不断裂, 隔细胞一般(4.8~)5.4~13×(0.6~)0.8~1 μm。

寄主: 一种鳞翅目昆虫的茧。

研究标本 CGAC89-7071, 梁宗琦和刘爱英等, 1989, 7, 采自贵州省绥阳县, 宽阔水自然保护区。

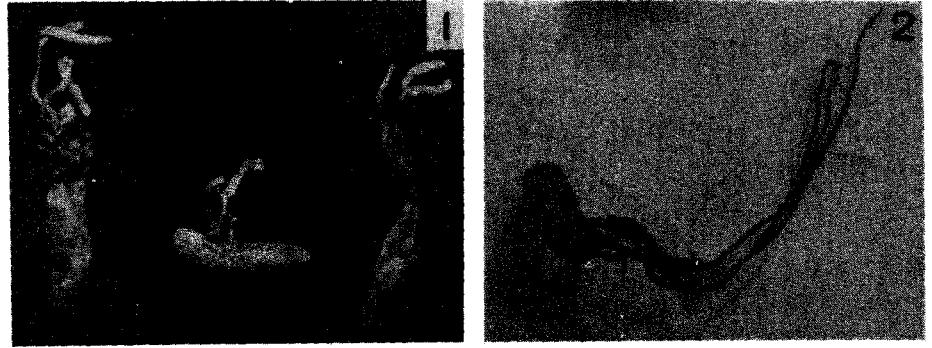


图1 娄山虫草 CGAC89-7071 和图2 绿核虫草 CGAC89-7102

Fig.1 *Cordyceps loushanensis* Liang & Liu CGAC 89-7071 and

Fig.2 *Cordyceps aeruginosclerota* Liang & Liu CGAC89-7102

在线虫草菌亚属(Subgen. *Ophiocordyceps*)子囊壳表生组(*Epicarposoma*)中,象娄山虫草这样可孕部长圆形至拟梭形,顶端无附属物且子囊壳密集表生的种仅有拟暗绿虫草(*Cordyceps pseudoatrovirens* Kob. & Shim.),白虫草(*C. alba* Kob. & Shim.),西玛虫草(*C. shimaensis* Kob.)和橄榄绿虫草(*C. pallidolivacea* Kob. & Shim.)等几个种^[1,2]。本种以子囊壳喙部菌丝顶端膨大形成的扁球形结构,及细长隔细胞与已知种相别。

无性型: 娄山拟青霉 新种 图3-2

Anamorph: *Paecilomyces loushanensis* Liang & Liu sp. nov. Fig.3-2

Synnemata claviformia e cocoonibus insectorum directe oriunda 3 ~ 10 fasciculata ramificantia, 35 × 1mm. Stipes cylindricus levis flavus ad bruneolum. Pars fertilis eburnea ad alutaceum 7 ~ 13 × 1 ~ 1.5mm.

Coloniae in agaro Czapekii ad 45mm diam. 14 diebus 25 °C albae ad vitellinum, zonis annularibus anobvis. Conidiophora complexa verticilla penicillaria vel solitaria. Phialis e parte basilari cylindrica, pyriformis vel subglobosa in collum attenuatum angustata Conidia prolato-cylindrica aliquando curvata, (5.4 ~)6 ~ 13 × 2 ~ 3.6µm, in catenam formata bifaria alternativa, bi-cellularia plerumque 12 × 2.5µm.

孢梗束从茧的端部或中部生出,簇生,3 ~ 10余根,基部和上部皆可分枝,棍棒状,基部不孕,光滑,黄色至棕色,粗约1mm,全长可达35mm,上部可孕,蚌肉白至豆汁黄色,一般7 ~ 13 × 1 ~ 1.5mm。

在查氏琼脂上,25 °C 14天菌落直径达45mm,白色至近蛋壳黄色,具不明显的轮纹。分生孢子梗复杂,可呈轮状,帚状或单生。产孢细胞基部柱形,梨形或近球形膨大,上部明显变细。分生孢子长柱形,一端可稍狭,亦可略弯曲,(5.4 ~)6 ~ 13 × 2 ~ 3.6µm,聚集成拟交互双列生的分生孢子链。偶有双细胞,一般12 × 2.5µm。

在拟青霉属的中温,虫生类群种中,与娄山拟青霉相近的大型分生孢子(长度近10µm,宽度近3µm)的种尚有甲虫拟青霉(*paecilomyces coleopterorum* Samson & Evan),蝉拟青霉[*Paecilomyces cicadae* (Miqel) Samson]和撑拟青霉[*Paecilomyces suffultus* (Petch) Samson]等几个种^[3]。它们皆能以无典型的拟交互双列生分生孢子链与本种相区别。

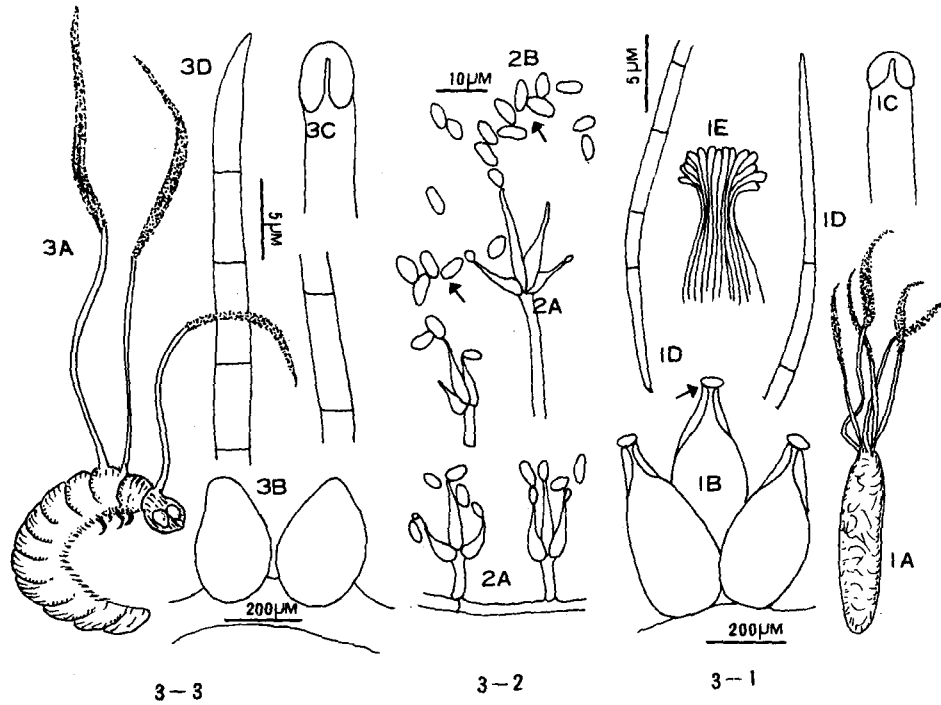


图3-1 娄山虫草 CGAC89-7071, 图3-2 娄山拟青霉和图3-3 绿核虫草 CGAC89-7102
 1A. 感染的寄主昆虫; 1B. 表生子囊壳; 1C. 子囊上部; 1D. 子囊孢子; 1E. 扁球形帽状加厚的孔口;
 2A. 产孢结构; 2B. 交互双列生的分生孢子链; 3A. 感染的寄主昆虫; 3B. 表生的子囊壳;
 3C. 子囊上部; 3D. 子囊孢子

Fig.3-1 *Cordyceps loushanensis* Liang & Liu CGAC89-7071, Fig.3-2 *Paecilomyces loushanensis* Liang & Liu and Fig.3-3 *Cordyceps aeruginosclerota* Liang & Liu CGAC89-7102

1A. Infected host insect; 1B. Superficial perithecia; 1C. Upper portion of an ascus; 1D. Ascospores; 1E. Ostiole with an oblate cap; 2A. Conidiogenous structure; 2B. An alternate bifarious chain of conidia; 3A. Infected host insect; 3B. Superficial perithecia; 3C. Upper portion of an ascus; 3D. Ascospores

11. 绿核虫草 新种 图2和图3-3

Cordyceps aeruginosclerota Liang & Liu sp. nov. Fig.2 & Fig.3-3

Stromata e abdomibus insectorum directe oriunda 3-caespitosa cylindrata gracilia 100 ~ 140 × 4 ~ 5mm; apicibus sterilibus spadiceis. Perithecia superficialia densa ovoidea 260 ~ 300 × 160 ~ 240µm. Asci cylindratici vel clavati 150 × 4.5 ~ 7.5µm, capitibus brevicylindricis 3µm crassis 3.6µm altis. Ascosporae filiformes ad basin subattenuatae multiseptatae. Articuli 6 ~ 14 × 1.2 ~ 1.8µm.

Hab. in larvis Coleopteris.

Typus: CGAC89-7102, Kuankuoshu Preserve, Suiyang, Guizhou Prov., VII, 1989, Z-Q. Liang, A-Y. Liu et al.

子座细柱状, 三根从寄主的近尾部生出, 100 ~ 140 × 4 ~ 5mm, 可孕部无明显膨

大, 无不孕顶端, 红棕色, 与柄有明显界限。子囊壳密集表生, 短拟卵形, $260 \sim 300 \times 160 \sim 240 \mu\text{m}$ 。子囊柱状或棒状, $150 \times 4.5 \sim 7.5 \mu\text{m}$, 子囊帽短柱状, 多数高 $3.6 \mu\text{m}$, 宽 $3 \mu\text{m}$ 。子囊孢子丝状, 两端细胞尖, 多隔, 长 $150 \mu\text{m}$, 不断裂, 隔细胞, $6 \sim 14 \times 1.2 \sim 1.8 \mu\text{m}$ 。

寄主: 一种金龟子幼虫, 内菌核绿色。研究标本 CGAC89-7102, 梁宗琦和刘爱英 1989, 7, 采自贵州省绥阳县, 宽阔水自然保护区王家水库。

与娄山虫草相似, 绿核虫草也是线虫草菌亚属, 子囊壳表生组 (*Epicarposoma*) 中, 线形子囊孢子呈细长梭形, 且隔细胞也较长的种。本种与前者主要区别在于子座是细长柱状, 且内菌核的菌丝为绿色, 这在已报道的虫草中未见。

12. 拟暗绿虫草 国内新纪录

Cordyceps pseudoatrovirens Kob. & Shim., Bull. Natn. Sci. Mus. 8: 111, 1982.

子座棒状, 1~3个, 从寄主头部, 腹部或尾部发出, 10~30mm, 香绿色, 头部扁平, 柱状或拟卵形膨大, $6 \sim 10 \times 2 \sim 5 \text{mm}$, 可孕部贴生, 皮层菌丝型。子囊壳埋生, 拟卵形, $500 \sim 560 \times 240 \sim 320 \mu\text{m}$ 。子囊梭形, $141 \times 7 \mu\text{m}$, 子囊帽短柱状, 多数高 $3 \sim 3.6 \mu\text{m}$, 宽大多 $3.6 \mu\text{m}$ 。子囊孢子梭形, 不等长地扭曲排列于子囊中, 长达 $45 \mu\text{m}$, 分隔, 一般8个隔细胞, $4.2 \sim 4.8 \times 2.4 \sim 3 \mu\text{m}$ 。

寄主: 一种栖居于腐木中的金针虫。研究标本 CGAC89-7101, 梁宗琦和刘爱英采自贵州省绥阳县, 宽阔水自然保护区王家水库。

拟暗绿虫草的近缘种是暗绿虫草 (*Cordyceps atrovirens* Kob. & Shim.), 二者的主要区别是后者的子囊壳为倾斜排列^[4]。

13. 幼虫虫草 国内新记录

Cordyceps larvarum (Westwood) Olliff, in Agricult. Gazett. New South Wales VI p. 410, 1895.

Syn. *Sphaeria larvarum* Westwood in Proc. Ent. Soc. Lond. II p. 6, 1836.

子座柱状, 单生, 近桂皮淡棕色, $90 \times 3.5 \text{mm}$, 从寄主腹部生出, 柄与可孕部有明显界限, 并具螺旋状沟纹。子囊壳假埋生, 长椭圆形, $340 \sim 380 \times 160 \sim 200 \mu\text{m}$ 。子囊 $180 \sim 200 \times 8.5 \mu\text{m}$, 具有宽 $4.2 \sim 4.8 \mu\text{m}$, 高 $3 \sim 4 \mu\text{m}$ 的半球状子囊帽。子囊孢子柱状, 分隔, $4 \sim 9 (\sim 20) \times 2 \sim 2.5 \mu\text{m}$ 。

寄主: 一种鳞翅目幼虫。研究标本 CGAC90-8101, 吴兴亮采自贵州省绥阳县, 宽阔水自然保护区。

Kobayasi 详细的描述并讨论了幼虫虫草 [*Cordyceps larvarum* (Westwood) Olliff] 与近缘种的关系, 将 *C. huegelii* (Corda) Corda, *C. selkirkii* Olliff, *C. forbesii* (Berk.) Lloyd 和 罗伯茨虫草 [*C. robertsii* (Hook) Gray] 等都作为它的同物异名^[7]。随后 Willis 在描述澳洲的虫草时, 又将罗伯茨虫草作为幼虫虫草的同物异名^[8], 因而各家在对这些标本宏观和微观特征的描述上差异都较大。我们采自贵州的标本, 子囊孢子虽尚未断裂成次生子囊孢子, 但其隔细胞量度和子囊壳假埋生于网状菌丝层中的特征, 与罗伯茨虫草和亨利虫草 (*C. henleyae* Masse) 有明显区别。作者采纳 Kobayasi 的分类观点^[7], 将其鉴定为幼虫虫草 [*C. larvarum* (Westwood) Olliff]。

14. 布氏虫草

Cordyceps brongniartii Shimazu, Trans. Mycol. Soc. Japan 29: 323 ~ 330, 1988.

寄主: 一种鳞翅目幼虫。研究标本 CGAC89-7104, 梁宗琦和刘爱英等 1989, 7, 采自贵州省绥阳县, 宽阔水自然保护区。此种在云南昆明地区和陕西秦岭地区亦有分布^[5~6]。

15. 金针虫虫草

Cordyceps agriota Kawam, Icon. Jap. Fung. 8: 837, 1955.

寄主: 一种金针虫。研究标本 CGAC89-7112, 梁宗琦和刘爱英等 1989, 7, 采自贵州省绥阳县, 宽阔水自然保护区。在宽阔水自然保护区, 金针虫草 (*Cordyceps agriota* Kaw.) 常和宏观特征上与它十分相似的针孢虫草 (*C. acicularis* Rev. & Berk.) 分布在一起^[2]。

16. 云南被毛孢丝梗变种 新变种 图4

Hirsutella yunnanensis var. *tenuisynnemi* Liang et Liu var. nov. Fig.4

Synnemata filiformia 50×0.6mm, singularia vel caespitosa simplicia, e corpo hospitis oriunda, fuliginea. Mycelia 3μm crassa. Phialis basi inflata fusiformis vel cylindracea, 7.2~9×4.2~6μm, in collum 2.4~10.5×0.5μm angustata, plerumque polyphialidica. Conidia hyalina continua cylindracea ad claviformem 4.5~7.2×1.5~1.8μm, non muco.

Hab. in larvis lepidopteris, 10×3mm.

Typus: CGAC89-7103, Kuankuoshui Preserve, Suiyang, Guizhou Prov., VII, 1989, Z-Q. Liang, A-Y. Liu et al.

孢梗束丝状, 50×0.6mm, 单生或丛生, 不分枝, 从虫体各处发出, 黑褐色。菌丝宽 3μm。瓶梗基部梭形或柱形膨大, 7.2~9×4.2~6μm, 向上突然变细, 一般再育一

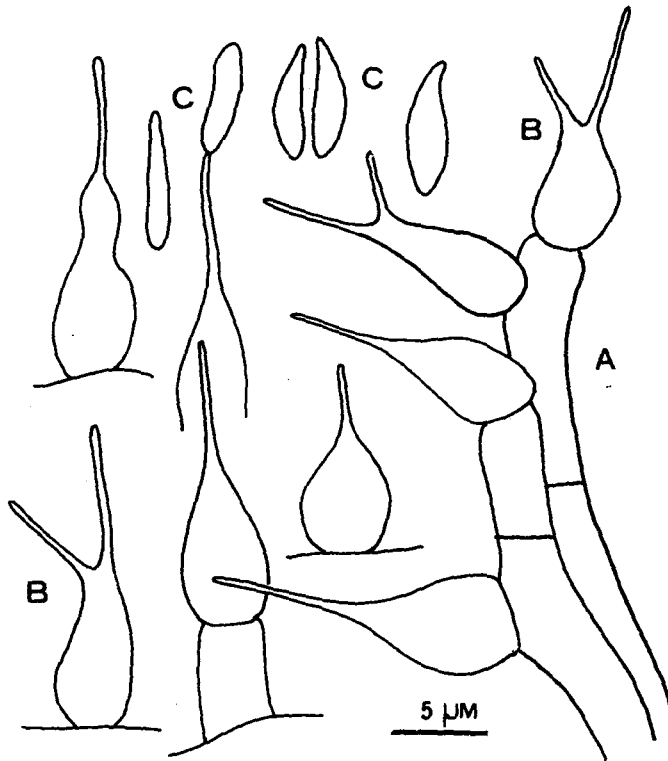


图4 云南被毛孢丝梗变种 CGAC89-7103

A. 产孢结构; B. 再育的产孢细胞; C. 分生孢子

Fig.4 *Hirsutella yunnanensis* var. *tenuisynnemi* Liang et Liu

A. Conidiogenous structure; B. Proliferous phialides; C. conidia

个小颈, 个别 4 个, $2.4 \sim 10.5 \times 0.5 \mu\text{m}$ 。分生孢子柱形至拟棒状, $4.5 \sim 7.2 \times 1.5 \sim 1.8 \mu\text{m}$, 无明显黏液层。

寄主: 一种鳞翅目幼虫。研究标本 CGAC89-7103, 梁宗琦和刘爱英等 1989, 7, 采自贵州省绥阳县宽阔水自然保护区。

在被毛孢属中, 孢梗束长度近 50mm, 孢梗束干后具褐色和分生孢子非典型梭状的种有棒孢被毛孢(*H. clavisporea* Petch), 巴贝被毛孢[*H. barberi* (Gird) Petch], 桔孢形被毛孢(*H. citriformis* Speare), 长颈被毛孢(*H. longicolla* Stron. Evel. et Roy.), 钻形被毛孢(*H. subulata* Petch) 和云南被毛孢 8 个种^[10~13]。其中, 钻形被毛孢和云南被毛孢(*H. yunnanensis* Liang et Liu) 与本种更为接近。但前者以分生孢子具有 $6 \sim 7 \mu\text{m}$ 粘液层和瓶梗不再育, 后者以孢梗束明显双色和粗大与本种不同。根据本属的分类依据^[13~14], 研究标本 CGAC89-7103 可定为新变种。

17. 多颈被毛孢

Hirsutella polycolluta Liang, 西南农业学报 4: 51 ~ 56, 1991.

多颈被毛孢(*Hirsutella polycolluta*)是一种子囊壳表生虫草的无性型。它的主要特征是分生孢子梗常分枝, 由 4~5 个细胞组成, 可再育出产孢小颈^[9]。

寄主: 一种鳞翅目幼虫。研究标本 CGAC84-803, 李子忠 1984, 8, 采自贵州省绥阳县, 宽阔水自然保护区太阳山半坡。

18. 巨大被毛孢

Hirsutella gigantea Petch, Trans. Br. Mycol. Soc. 21: 48, 1937.

在宽阔水自然保护区, 巨大被毛孢(*Hirsutella gigantea*)能寄生多种鳞翅目昆虫的幼虫和蛹^[5]。

寄主: 多种鳞翅目幼虫。研究标本 CGAC84-601 和 CGAC89-701, 梁宗琦和刘爱英等 1984, 6 和 1989, 7, 采自贵州省绥阳县, 宽阔水自然保护区。

19. 枝多头霉

Polycephalomyces ramosum (Peck) Mains, Mycologia 40:412 ~ 414, 1948.

Syn. *Stilbum ramosum* peck, Twenty Sixth Rep. State Mus. pp. 35 ~ 91, 1874.

寄主: 一种鳞翅目幼虫。研究标本 CGAC84-602, 梁宗琦和刘爱英等 1984, 6, 采自贵州省绥阳县, 宽阔水自然保护区^[15]。

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THE GENUS *CORDYCEPS* AND ITS ALLIES FROM KUANKUOSHUI PRESERVE IN GUIZHOU II .

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ABSTRACT Additional 6 species of *Cordyceps* from Kuankuoshui Preserve in Guizhou were reported. They are *Cordyceps loushanensis* Liang & Liu sp. nov., *Cordyceps aeruginosclerota* Liang & Liu sp. nov., *Cordyceps pseudoatrovirens* Kob. & Shim., *Cordyceps brongniartii* Shimazu, *Cordyceps agriota* Kawam, and *Cordyceps larvarum* (Westwood) Olliff. *Hirsutella polycolluta* Liang, *Hirsutella yunnanensis* var. *tenuisynnemi* var. nov. Liang et Liu, *Hirsutella gigantea* Petch, *Polycephalomyces ramosum* (Peck) Mains and *Paecilomyces loushanensis* Liang & Liu sp. nov. also were recorded in this paper.

KEY WORDS *Cordyceps loushanensis*, *C. aeruginosclerota*, *C. pseudoatrovirens*, *C. brongniartii*, *C. agriota*, *C. larvarum*, *Hirsutella polycolluta*, *H. gigantea*, *H. yunnanensis* var. *tenuisynnemi*, *Polycephalomyces ramosum*