

Five new species of *Hypoderma* (Rhytismatales, Ascomycota) with a key to *Hypoderma* species known from China

by

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With 32 figures

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Abstract: Five new species of *Hypoderma* are described from China. They are *Hypoderma berberidis* on living prickles of *Berberis jamesiana*, *H. cuspidatum* on twigs of *Rhododendron* sp., *H. linderae* on leaves of *Lindera glauca*, *H. shiqii* on twigs of *Rhododendron* sp., and *H. smilacicola* on leaves of *Smilax bracteata*. They differ from known species mainly by the shape and position of their ascomata as well as characteristics of ascospores. A key to nine *Hypoderma* species known for China is provided.

Key words: Berberidaceae, Ericaceae, Lauraceae, morphology, Rhytismataceae, Smilacaceae, taxonomy.

Introduction

With more than 30 species, *Hypoderma* is the third largest genus of the Rhytismatales, following *Lophodermium* and *Coccomyces*. The genus *Hypoderma* is separated from *Lophodermium* based on characteristics of asci and ascospores. Species of *Hypoderma* have more or less clavate asci and ellipsoid to clavate ascospores while those of *Lophodermium* have cylindrical asci and filiform ascospores (Cannon & Minter 1986, Darker 1967, Powell 1974). The long-standing nomenclatural problem concerning the generic name of *Hypoderma* was solved by Cannon & Minter (1983). Powell (1974) contributed a monograph on species of *Hypoderma* worldwide and recognized eight species. According to him, the lectotype of the type species of *Hypoderma*, *H. rubi* (Pers.) DC. ex Chev., has a wide host spectrum including 14 different families

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of gymnosperms and angiosperms, but some authors doubt the conspecificity of all taxa involved (Cannon & Minter 1986, Hou 2004). Johnston (1988, 1989) considered that ascospore shape is not useful to define genera within the Rhytismataceae and suggested that patterns of ascomatal development might be more indicative of phylogenetic relationships. Johnston (1990) revised *Hypoderma* and enumerated nine key characteristics thought to be important for species in this genus. Among these, subcuticular ascomata, the presence of lip cells, and ascospores with thin gelatinous sheaths are particularly important. He placed many species with bifusiform spores in *Hypoderma*. He excluded, however, *H. scirpinum* DC. which has a poorly developed lower wall and paraphyses with swollen tips. He erected the new genus *Hypohelion* to accommodate this species. According to Johnston (1990), ascomata of *Hypoderma* species have the same developmental pattern as some *Lophodermium* species on broadleaf trees; so these species might be closely related to each other. Recent molecular data (LSU rDNA) show that both genera, *Hypoderma* and *Lophodermium*, as presently circumscribed are polyphyletic (Hou 2004). Molecular data available for species of Rhytismatales (Gernandt et al. 2001, Ortiz-García et al. 2003, Hou 2004) do not yet allow to define a new phylogenetic generic system for species of Rhytismatales, because first of all we need molecular data of many more species.

The species described as new in the present publication are morphologically rather similar to certain known species of *Hypoderma*, but some of them differ from the general characteristic by morphological details including intraepidermal ascomata, ascospores with thick gelatinous sheaths, or lacking lip cells. Although the latter characteristics were considered important for the placement of species in the genus *Hypoderma* by Johnston (1990), we place the new species in this genus, because they do not fit into any other existing genus and we do not want to erect too many new genera at present.

Eight species of *Hypoderma* have been reported for China up to now (Tai 1979, Lin et al. 2004, Hou et al. 2004). Four of them are synonyms, *H. desmazierii* Duby is now classified as *Meloderma desmazierii* (Duby) Darker (1967), *H. cunninghamiae* Teng and *H. handelii* Petrak are synonyms of *Ploioderma handelii* (Petrak) Y.-R. Lin & C.-L. Hou (1994), and *H. commune* (Fr.) Duby was treated as a synonym of *H. rubi* (Pers.) DC. ex Chev. by Powell (1974). Consequently, there are only four species of *Hypoderma* known for China.

During field work in the Anhui and Yunnan provinces, China, we collected five further species of *Hypoderma* which are new for science. In addition, we provide a key to the species so far recognized for China.

Materials and methods

Sections of different thickness of ascomata were made by hand using a razor blade. Microscopic preparations were made in water, Melzer's reagent, 5% KOH, or 0.1% (w/v) cotton blue in lactic acid. For the observation of ascomatal outlines in vertical section, sections were mounted in lactic acid or cotton blue with pretreatment in water. Gelatinous sheaths surrounding ascospores and

paraphyses were observed in water or cotton blue in lactic acid. Ascospore contents are drawn based on observations in water.

Measurements were made using material mounted in 5% KOH or Melzer's reagent. For each species 20 ascospores and asci were measured.

Results and discussion

Hypoderma berberidis C.-L.Hou & M.Piepenbr., sp. nov.

Figs 1-7

ETYMOLOGY: referring to the host genus *Berberis*.

Ascomata 550-920 × 240-320 μm, ad spinas vivas, nigra, elliptica, intraepidermalia; paraphyses filiformes; asci (50-)60-100 × 10-12 μm, clavati; ascosporae 20-29 × 2-4 μm, bifusiformes, tunica gelatinosa inclusae.

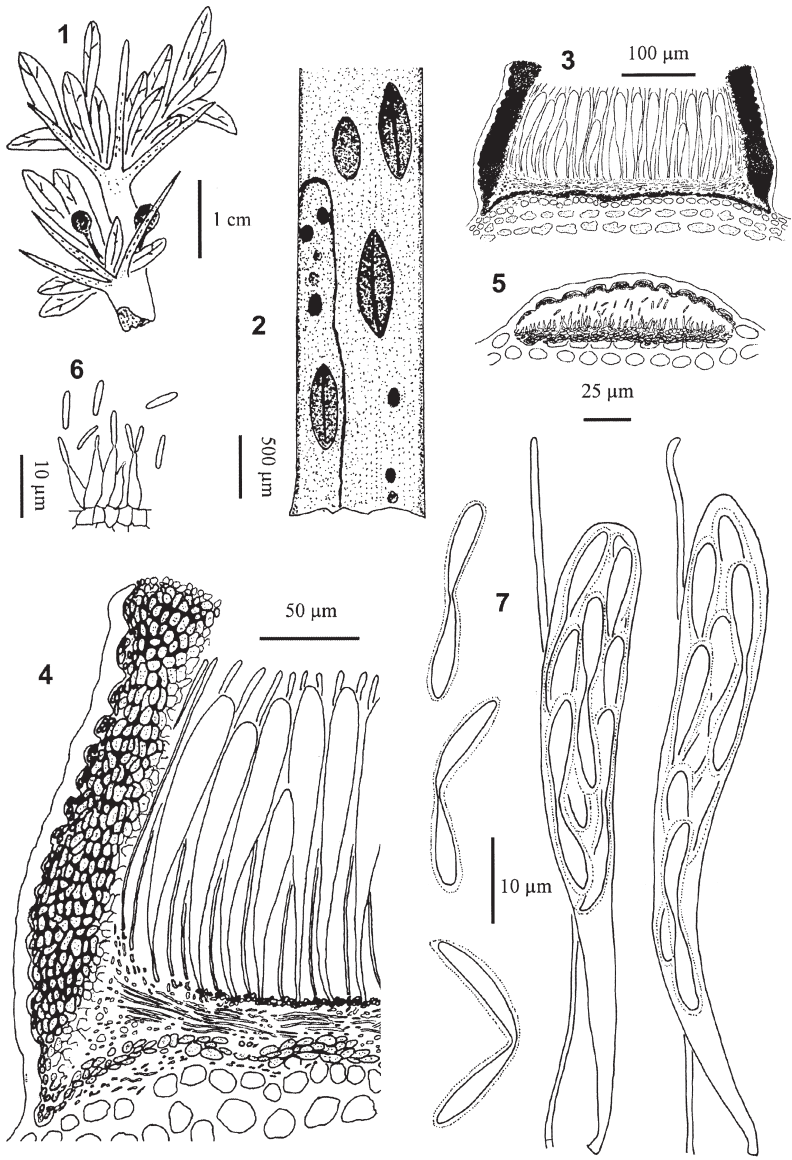
HOLOTYPE: On *Berberis jamesiana* Forrest et W.W.Smith (Berberidaceae), China, Yunnan province, Jianchuang, Laojunshan, alt. ca. 2400 m, 25 July 2001, C.-L.Hou, M.Piepenbring, R.Kirschner, and Z.-L.Yang 120 (HMAS).

Ascomata on living prickles of twigs. In surface view, ascomata 550-920 × 240-320 μm, elongated-elliptical, hardly raising above the surface of the substratum, opening by a longitudinal split which extends almost along the entire length of an ascoma. Lips absent. Whole surface of the ascoma black, shiny. Perimeter lines absent. In median vertical section, ascomata intraepidermal, 180-240 μm deep. Covering stroma up to 40-60 μm thick near the centre of the ascomata, constant in thickness but thinner near the basal layer, extending to the basal stroma, consisting of an outer layer of host cuticle and remains of epidermal cells, an inner layer of strongly blackened, thick-walled *textura angularis* and *textura globulosa* with cells of 4-7 μm diam., and an innermost layer of hyaline, thin-walled cells. Lip cells absent, but some hyaline, thin-walled cells visible near the opening. Basal stroma flat, composed of brown *textura globulosa*, 10-15 μm thick. Subhymenium 20-30 μm thick, consisting of mostly hyaline *textura porrecta* and filled with some round to ellipsoidal cells. Paraphyses 100-130 × 1 μm, filiform, septate at the base, unbranched, simple, not swollen at the apex. Asci ripening sequentially, (50-)60-110 × 8-12 μm, clavate, stalked, thin-walled, J-, without circumapical thickening, 8-spored. Ascospores biseriate, 20-29 × 2-4 μm, bifusiform, hyaline, aseptate, with 2-4 μm thick gelatinous sheath, in the constricted part thinner than 1 μm.

Conidiomata on living prickles of twigs, usually near ascomata. In surface view conidiomata circular to elliptical, 40-100 μm diam., brown to black, shiny, opening by one to several ostioles. In vertical section conidiomata intraepidermal, 30-50 μm deep, upper layer 2-5 μm thick and composed of small fungal cells, basal wall 13-25 μm thick and composed of *textura globulosa-angularis*. Conidiogenous cells 5-6 × 2-3 μm, ovoid-cylindrical, often tapering towards the apex, hyaline. Conidia 4-6 × 0.8-1 μm, cylindrical, hyaline, aseptate.

Zone lines dark brown to black.

Distribution: This new species is only known from the type locality.



Figs 1-7. *Hypoderma berberidis* on *Berberis jamesiana*. 1. Part of a living twig with prickles bearing ascomata. 2. Ascomata, conidiomata, and a zone line as seen under a dissecting microscope. 3. Ascoma in vertical section. 4. Detail of an ascoma in vertical section. 5. Conidioma in vertical section. 6. Conidiogenous cells and conidia. 7. Paraphyses, mature asci with ascospores, and liberated ascospores with gelatinous sheaths.

Notes: *H. berberidis* is macroscopically similar to *H. cordylines* P. Johnston (Johnston 1990). However, *H. cordylines* has subcuticular ascomata and ellipsoidal ascospores. Ascospore shape of *H. berberidis* is similar to that of some other species of *Hypoderma*

described by Johnston (1990). However, *H. berberidis* differs from them by its intraepidermal ascomata and conidiomata. A further *Hypoderma* species on fallen leaves of *Berberis ilicifolia* Forst., *H. brachysporum* (Rostrup) Tubeuf, differs from *H. berberidis* by subcuticular ascomata and ellipsoidal ascospores (Powell 1974).

***Hypoderma cuspidatum* C.-L.Hou & M.Piepenbr., sp. nov.**

Figs 8-13

ETYMOLOGY: *cuspidatum* = cuspidate; referring to acute ends of the ascomata.

Ascomata 600-1200 × 400-600 μm, corticicola, nigra, elliptica, utrinque acuta, intraepidermalia; paraphyses filiformes; asci 90-150 × 10-15 μm, cylindrici; ascosporae 12-17 × 4-6 μm, ellipsoideae, tunica gelatinosa inclusae.

YPES: On *Rhododendron* sp. (Ericaceae), China, Yunnan province, Lijiang, Baishui, alt. ca. 3000 m, 25 July 2001, C.-L.Hou, M.Piepenbring, R.Kirschner, and Z.-L.Yang 150a (Holotype, HMAS). On *Rhododendron* sp., *ibid.*, 25 July 2001, C.-L.Hou, M.Piepenbring, R.Kirschner, and Z.-L.Yang 147 (Paratype, HMAS).

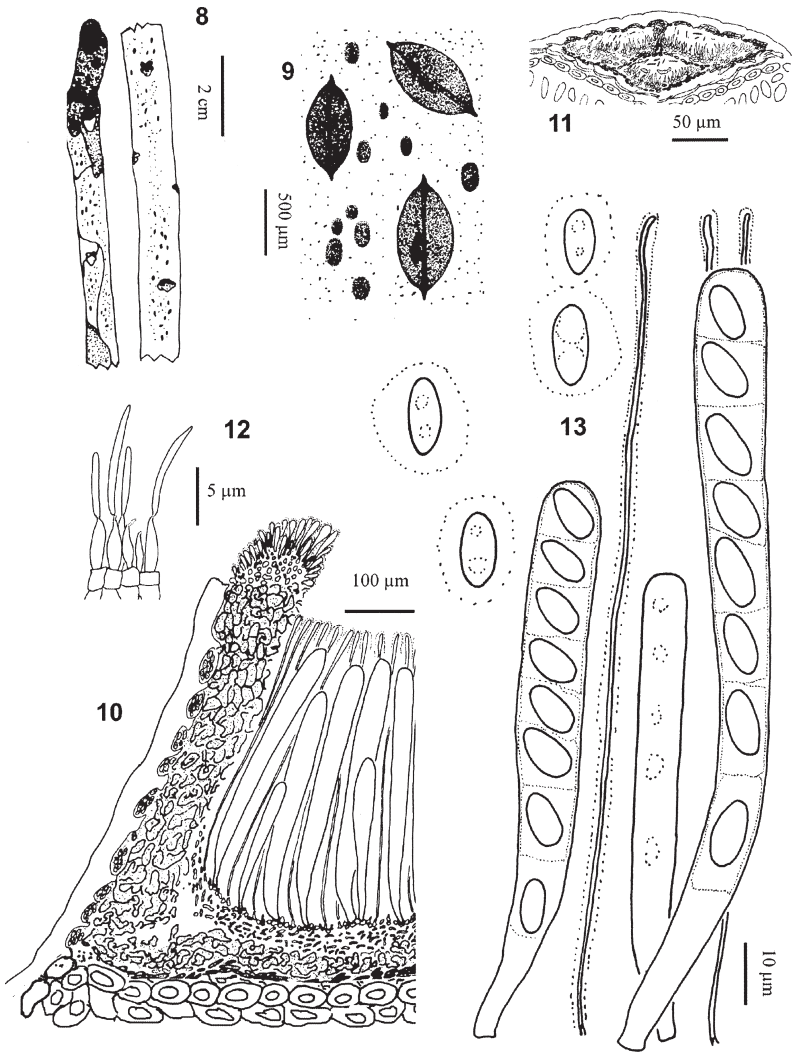
Ascomata on living stems or twigs, the twig surface bleached around the fruiting bodies. In surface view, ascomata 600-1200 × 400-600 μm, elliptical, often acute at both ends, at maturity up to 40-160 μm long, slightly raising above the surface of the substratum, opening by a longitudinal split, extending over the entire length of the ascomata, often very close to the acute ends. Lips present, pale brown to brown. Entire surface of the ascomata black. In median vertical section, ascomata intraepidermal, covering stroma up to 40 μm thick near the centre of the ascomata, constant in thickness, extending to the basal stroma, consisting of an outer layer of host cuticle and remains of epidermal cells which are filled with brown, thick-walled ellipsoidal hyphal cells, and an inner layer of dark brown, thick-walled, somewhat disorganized textura epidermoidea. Lip cells clavate, 20-70 × 2-6 μm, hyaline, embedded in hyaline gelatinous sheaths. Basal stroma well developed, flat, 10-25 μm thick, composed of an outer layer of dark brown, thick-walled, short hyphae and an inner layer of dark brown textura epidermoidea. Subhymenium composed of textura intricata, 10-15 μm thick. Paraphyses 120-160 × 1 μm, filiform, unbranched, not swollen at the apex. Asci ripening sequentially, 90-150 × 10-15 μm, cylindrical, apex obtuse, short-stalked, thin-walled, J-, without circumapical thickening, discharging spores through a small apical hole, 8-spored. Ascospores arranged in a single row, 12-17 × 4-6 μm, ellipsoidal, hyaline, aseptate, with two guttules of different size, with 4-9 μm thick gelatinous sheaths.

Conidiomata on living twigs. In surface view conidiomata circular to elliptical, 160-400 μm diam., black, shiny, opening by several ostioles. In vertical section, conidiomata intraepidermal, 60-100 μm deep, upper layer composed of small-celled, dark brown textura angularis, 2-5 μm thick, basal wall composed of textura angularis, 13-25 μm thick. The conidiomata are divided into three chambers by dark brown walls composed of textura angularis. Conidiogenous cells 5-6 × 2-3 μm, ovoid-cylindrical, tapering towards the apex, hyaline. Conidia 8-15 × 0.8-1 μm, cylindrical, hyaline, aseptate.

Zone lines infrequent, dark brown.

Distribution: *H. cuspidatum* is only known from the type locality.

Habitat: The fungus was collected on living stems or twigs.



Figs 8-13. *Hypoderma cuspidatum* on *Rhododendron* sp. 8. Twigs bearing ascomata, conidiomata, and zone lines. 9. Ascomata and conidiomata as seen under a dissecting microscope. 10. Detail of an ascoma in vertical section. 11. Conidioma in vertical section. 12. Conidiogenous cells and conidia. 13. Paraphyses, a young ascus, mature asci with ascospores, and liberated ascospores with gelatinous sheaths.

Notes: Because of intraepidermal ascomata, the structure of the covering stroma, and ascospores with thick gelatinous sheaths, the new taxon is not a typical species of *Hypoderma*. Molecular data show that it is not closely related to *Hypoderma linderiae* and *H. shiqii* (Hou 2004). However, there is no other genus in the Rhytismatales available to accommodate this new taxon. We preliminarily place this new taxon in *Hypoderma* based on macroscopical characteristics and shapes of asci and ascospores.

H. cuspidatum differs from all other known species of *Hypoderma* by ascomata with more or less cuspidate ends. The shapes of asci and ascospores of *H. cuspidatum* are similar to those of *H. bihospitum* P. Johnston (Johnston 1990). However, both species are different in many aspects, such as cellular structure of the covering stroma, lip cells, conidiomata, and conidia.

H. cuspidatum often occurs together with *H. shiqii* (see description of *H. shiqii*).

Hypoderma linderæ C.-L.Hou & M.Piepenbr., sp. nov.

Figs 14-19

ETYMOLOGY: referring the host genus *Lindera*.

Ascomata 700-1100 × 400-620 µm, epiphylla, elliptica, nigra, depressa, subcuticularia; paraphyses filiformes; asci (60-)70-90 × 7-9.5 µm, cylindrici vel clavati; ascosporae 14-20 × 2-3 µm, cylindricae vel fusiformes, 2-guttulatae, tunica gelatinosa inclusae.

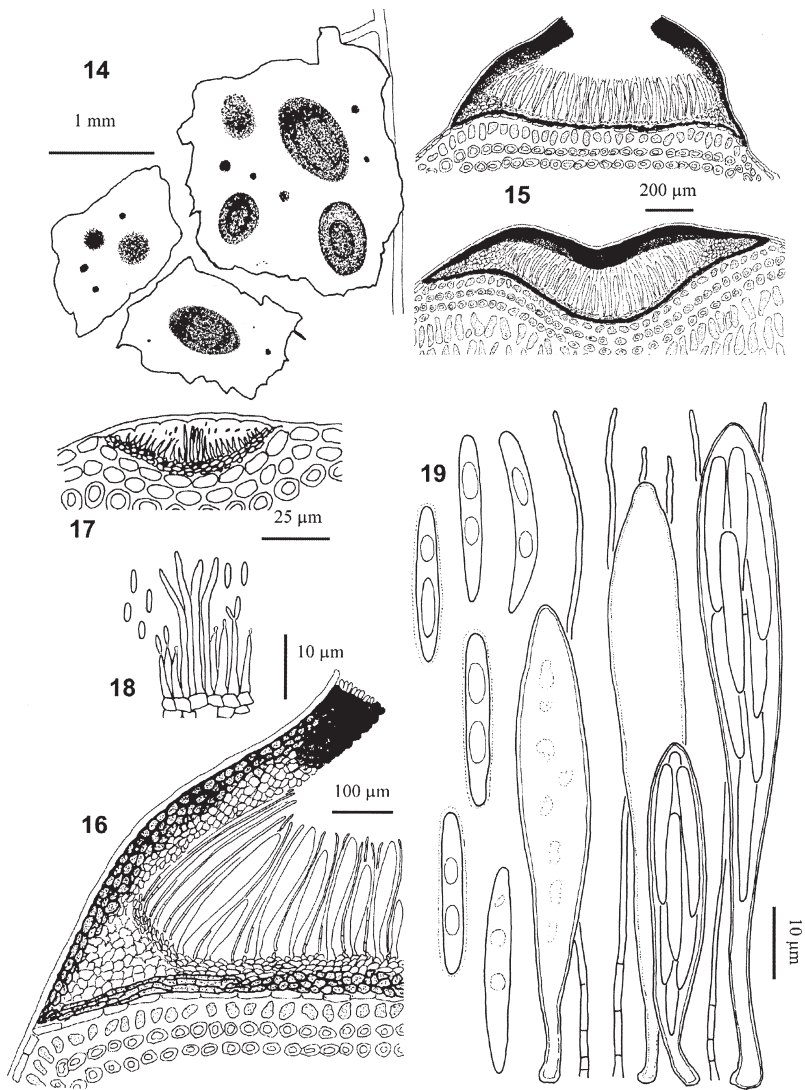
HOLOTYPE: On *Lindera glauca* (Sieb. & Zucc.) Bl. (Lauraceae), China, Anhui province, Jinde, Yunle, alt. ca. 400 m, 26 August 2001, C.-L.Hou 222 (HMAS).

Ascomata developing on fallen leaves, epiphyllous, in slightly bleached, pale brown areas. Ascomata 700-1100 × 400-620 µm, elliptical, black, shiny, not raising above the surface of the substratum, opening by a longitudinal split, the central part of the ascomata depressed when young, young ascomata broadly elliptical to round. In median vertical section, ascomata subcuticular, 250-300 µm deep, covering stroma 35-55 µm thick, consisting of an outer layer of host cuticle, an inner layer of dark brown, thick-walled *textura angularis* with cells of 4-7 µm diam., and an innermost layer close to the hymenium composed of almost hyaline, thick- or thin-walled cells. Paraphyses absent. Lip cells present but disappearing when old. Inner part of the covering stroma adjacent to the hymenium less blackened. Basal stroma 13-18 µm thick, medium- to well-developed, almost flat at maturity, composed of 3-4 layers of dark brown, thick-walled *textura angularis* near the centre and *textura prismatica* near the covering stroma. Excipulum absent. Subhymenium consisting of *textura intricata*, 10-15 µm thick, with cells of 3-6 µm diam. Triangular space in vertical section between the covering stroma and the basal stroma filled with thin-walled, large-celled *textura angularis*. Paraphyses 90-105 × 1 µm, filiform, septate, not branched, not swollen at the apex. Asci ripening sequentially, (60-)0-90 × 7-9.5 µm, clavate, with a short stalk, thin-walled, slightly acute at the apex, J-, without circumapical thickening, discharging spores through a small apical hole, 8-spored. Ascospores cylindrical to slightly fusiform, straight or slightly curved, 14-20 × 2-3 µm, hyaline, usually with two big guttules, young ascospores without guttules, with thin gelatinous sheaths.

Conidiomata in bleached areas near ascomata, light brown to dark brown, round, 80-160 µm diam., opening by one ostiole. In vertical section, conidiomata subcuticular, 25-35 µm deep, upper layer poorly developed, 4-7 µm thick, composed of host cuticle and a layer of thin brown fungal tissue. Basal wall 5-8 mm thick, composed of brown, thick-walled *textura angularis*. Conidiogenous cells 5-10 × 1-2 µm. Conidia 2-3 × 1 µm.

Zone lines thin, black.

Distribution: This species is known from the type locality.



Figs 14-19. *Hypoderma linderiae* on *Lindera glauca*. 14. Ascomata, conidiomata, and zone lines on a fallen leaf as seen under a dissecting microscope. 15. A mature ascoma (above) and an unopened ascoma (below) in vertical section. 16. Detail of an ascoma in vertical section. 17. Conidioma in vertical section. 18. Conidiogenous cells and conidia. 19. Paraphyses, a young ascus, mature asci with ascospores, an ascus after the liberation of the ascospores, and liberated ascospores with gelatinous sheaths or without visible gelatinous sheaths.

Habitat: *H. linderiae* was collected from leaves in litter.

Notes: The shapes of the ascospores of the present species as well as ascospores with two big guttules are similar to those of *H. gaultheriae* R.S.Hunt (Hunt 1980). However, *H. gaultheriae* has hypophyllous ascomata associated with necrotic leaf

spots on living leaves, conspicuous lips, and the veins in necrotic leaf spots are always associated with thick black fungal tissue, which is similar to zone lines of species of other Rhytismatales. The macroscopical characteristics of both species are also different: Ascomata of the present species are more round and have a depressed central zone, while those of *H. gaultheriae* are more or less rhomboid and raised in the central part.

Material studied for comparison: *H. gaultheriae* R.S.Hunt on *Gaultheria shallon* Pursh (Ericaceae), Canada, B.C., Copper Canyon Road at Trans Canada Highway, Chemainus, 26 August 1978, C.S.Wood & R.S.Hunt (DAVFP 2089); on *G. shallon*, Canada, V.I.B.C., Lake Cowichan, 21 August 1979, R.S.Hunt (DAVFP 22096).

Hypoderma shiqii C.-L.Hou & M.Piepenbr., sp. nov.

Figs 20-27

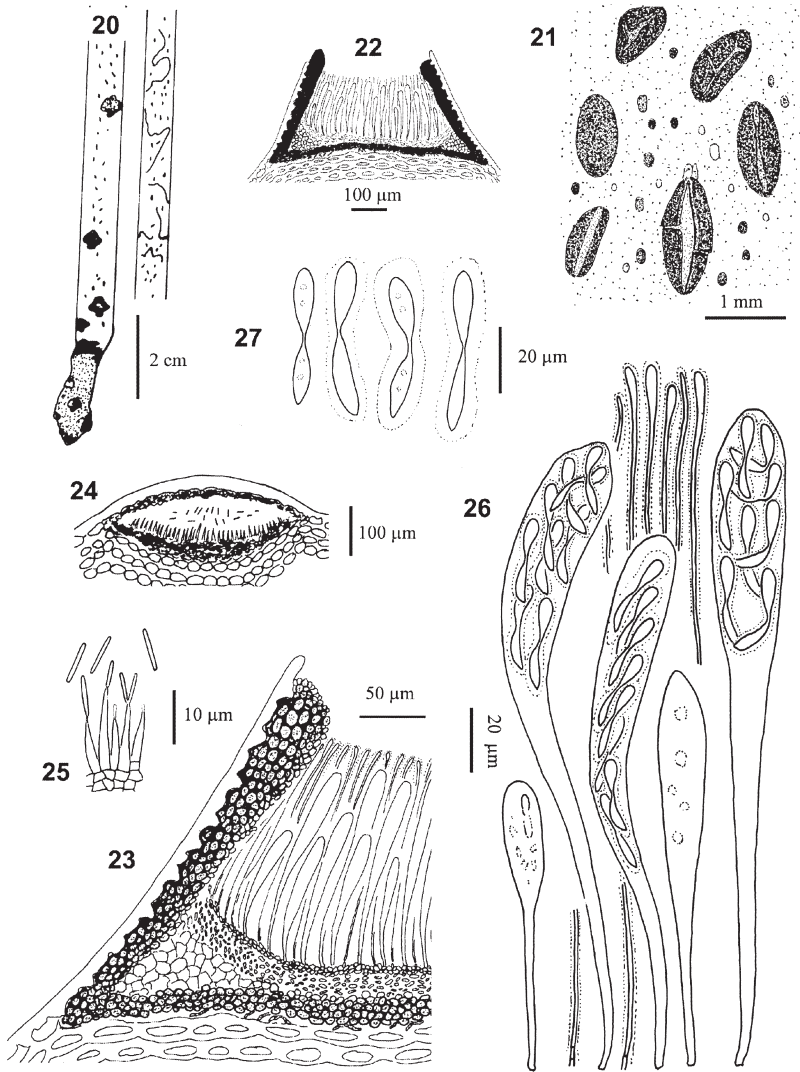
ETYMOLOGY: honouring Prof. Shi-Qi Liu, a famous forest pathologist in China, who was the first author's first teacher of mycology.

Ascomata 760-1500 × (400-)500-600(-700) μm, corticicola, nigra, elliptica, intraepidermalia; paraphyses filiformes; asci 130-230 × 15-25 μm, clavati; ascospores (26-)30-42 × 3.5-5 μm, bifusiformes, tunica gelatinosa inclusae.

HOLOTYPE: On *Rhododendron* sp. (Ericaceae), China, Yunnan province, Jianchuan, Laojunshan, alt. ca. 3500 m, 25 July 2001, C.-L.Hou, M.Piepenbring, R.Kirschner, and Z.-L.Yang 150b (HMAS).

Ascomata developing on dead twigs or young stems, in bleached or pale brown areas. Ascomata 760-1500 × (400-)500-600(-700) μm, elliptical, occasionally triangular, often curved, black to dark brown, shiny, often strongly raised above the surface of the substrate, lips absent, opening by a longitudinal split often with additional lateral fissures. Immature ascomata sometimes macroscopically visible as two black areas separated by a broad, pale brown longitudinal zone. In median vertical section, ascomata intraepidermal, 240-280 μm deep, covering stroma of almost constant thickness, 35-45 μm thick, consisting of an outer layer of host cuticle and remains of epidermal cells, and an inner layer of dark brown, thick-walled textura globulosa-angularis with cells of 4-8 μm diam. Triangular space in vertical section between the covering stroma and the basal stroma filled with thin-walled, hyaline angular cells of 6-11 μm diam. Basal stroma well-developed, slightly flat, composed of dark brown textura globulosa-angularis, 16-24 μm thick. Lip cells absent but some hyaline, thin-walled cells visible near the opening. Subhymenium 16-22 μm thick, consisting of small cells of 2-4 μm diam., embedded in gelatinous sheaths. Paraphyses 200-250 × 1 μm, filiform, covered by gelatinous sheaths, septate at the bases, unbranched, slightly swollen up to 2 μm in width at the apex. Asci ripening sequentially, 130-230 × 15-25 μm, clavate, often with a long stalk, thin-walled, J-, without circumapical thickening, 8-spored. Ascospores (26-)30-42 × 3.5-5 μm, bifusiform, hyaline, aseptate, with a 3-5 μm thick gelatinous sheath.

Conidiomata in bleached areas near the ascomata, round, pale brown with conspicuous black ostioles, 140-300 μm diam. In vertical section, conidiomata intraepidermal, 40-55 μm deep, upper layer composed of host cuticle and remains of epidermal cells and hyaline textura angularis with cells of 3-5 μm diam. Basal wall 5-8 μm thick, composed of light brown textura angularis. Conidiogenous cells ovoid-cylindrical, 9-13 × 1.5-2 μm, tapering towards the apex, hyaline. Conidia ellipsoidal, hyaline, 1.5-2 × 1 μm.



Figs 20-27. *Hypoderma shiqii* on *Rhododendron* sp. 20. Twigs bearing ascomata, conidiomata, and zone lines. 21. Ascomata and conidiomata as seen under a dissecting microscope. 22. Ascoma in vertical section. 23. Detail of an ascoma in vertical section. 24. Conidioma in vertical section. 25. Conidiogenous cells and conidia. 26. Paraphyses, young asci, and mature asci with ascospores. 27. Liberated ascospores with or without visible gelatinous sheaths.

Zone lines infrequent, black.

Distribution: This species is only known from the type locality.

Habitat: *H. shiqii* was collected from dead stems and twigs with living bases.

Notes: *H. shiqii* is easily distinguished from other species of *Hypoderma* by ascomata often opening with one slit and additional lateral fissures. Shapes of asci and ascospores

of *H. shiqii* are similar to those of *H. sticheri* P. Johnston. However, *H. sticheri* has subcuticular ascomata as well as conidiomata and conspicuous lips (Johnston 1990).

H. shiqii often occurs together with *H. cuspidatum* on the same twigs.

Hypoderma smilacicola C.-L.Hou & M.Piepenbr., sp. nov.

Figs 28-32

ETYMOLOGY: referring the host genus *Smilax*; *-cola* = inhabiting.

Ascomata (300-)450-720 × (240-)300-400 μm, epiphylla, vulgo elliptica, nigra, subcuticularia; paraphyses filiformes; asci 65-100 × 9-12 μm, cylindrici vel leviter clavati; ascospores 24-31 × 3-4 μm, fusiformes, tunica gelatinosa inclusae.

HOLOTYPE: On *Smilax bracteata* C. Presl (Smilacaceae), China, Yunnan province, Chuxiong, Zixishan, alt. ca. 2400 m, 2 August 2001, C.-L.Hou, M.Piepenbring, R.Kirschner, and Z.-L.Yang 170 (HMAS).

Ascomata developing on fallen leaves, in bleached areas, mostly epiphyllous. Ascomata elliptical, slightly kidney-shaped, occasionally triangular, (300-)450-720 × (240)300-400 μm, black but often with small, irregular light brown spots at one or both ends, shiny, slightly raising above the surface of the substrate, without a preformed line of dehiscence, lips absent, opening by a longitudinal split or by three teeth. In median vertical section, ascomata intraepidermal, 120-1500 μm deep, covering stroma up to 16-23 μm thick near the centre of the ascomata, not becoming thinner towards the edges, extending to the basal stroma, consisting of an outer layer of host tissue and an inner layer of dark brown textura angularis. Basal stroma moderately developed, slightly concave, composed of brown textura angularis, 10-15 μm thick. Excipulum absent. Subhymenium consisting of textura intricata, 8-10 μm thick. Paraphyses 100-130 × 1 μm, filiform, septate, unbranched, slightly swollen to 1.5-2 μm width at the apex, covered by gelatinous sheaths but not forming an epithecium. Asci ripening sequentially, 65-100 × 9-12 μm, clavate-cylindrical, almost without a stalk, thin-walled, J-, without circumapical thickening, 8-spored. Ascospores biseriata near the top and more or less uniseriate at the base, 24-31 × 3-4 μm, bifusiform, in the thinnest part near the middle less than 1 μm diam., hyaline, aseptate, with a ca. 2 μm thick gelatinous sheath.

Conidiomata grey-brown to dark brown, round, 90-140 μm diam. Conidia not observed.

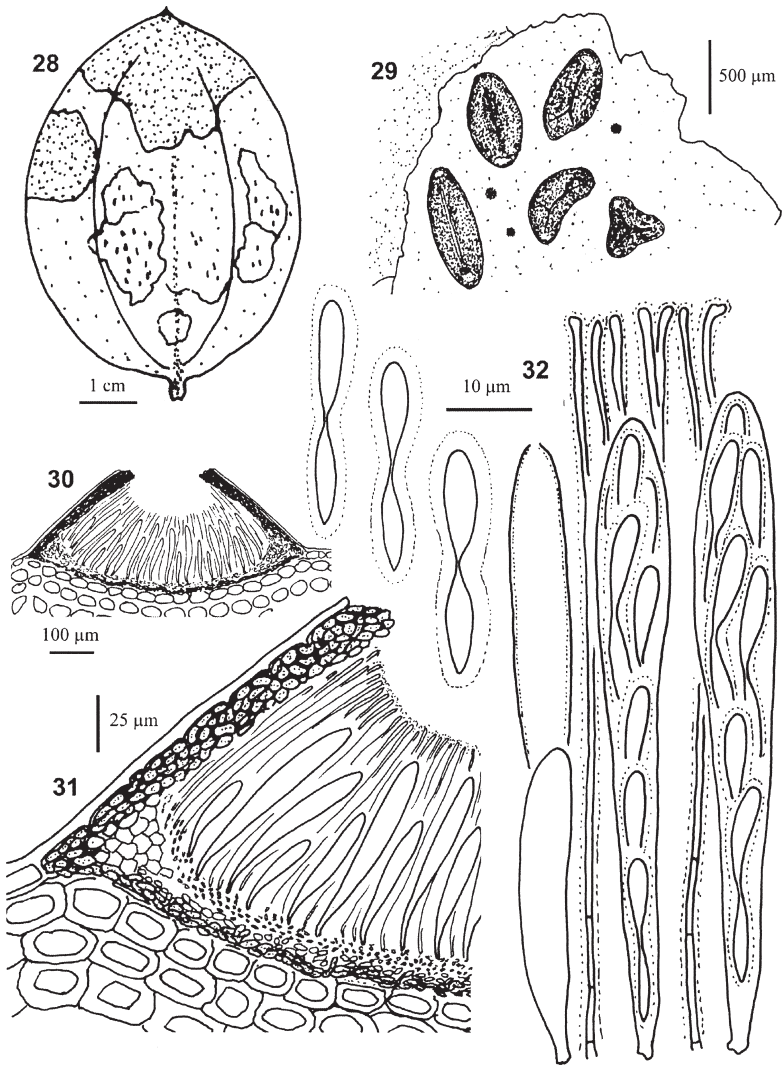
Zone lines frequent, black.

Distribution: *H. smilacicola* is only known from the type locality.

Habitat: *H. smilacicola* was collected from leaves fallen on the ground.

Notes: The new taxon is characterized by intraepidermal ascomata without lips, almost cylindrical asci, and bifusiform ascospores with thick gelatinous sheaths. Therefore, the new species deviates from the typical concept of *Hypoderma* sensu Johnston (1990). We preliminarily accommodate the new species in *Hypoderma* based on shapes of ascomata and ascospores because no other suitable genus is available.

H. smilacicola is similar to *H. cookianum* P. Johnston on *Phormium cookianum* Le Jolis (Liliaceae) (Johnston 1990). *H. smilacicola* differs from *H. cookianum* by ascomata with elliptic, reniform, or round triangular shapes, by one light brown spot at one or both ends of the ascomata, and by ascospores with thick gelatinous sheaths.



Figs 28-32. *Hypoderma smilacicola* on *Smilax bracteata*. 28. Ascomata, conidiomata, and zone lines on a leaf. 29. Ascomata, conidiomata, and zone lines as seen under a dissecting microscope. 30. Ascoma in vertical section. 31. Detail of an ascoma in vertical section. 32. Paraphyses, a young ascus, mature asci with ascospores, an ascus after the liberation of the ascospores, and liberated ascospores with gelatinous sheaths.

In addition to the five new species described above, four further species of *Hypoderma* are known from China. Their names and host plants are:

H. rubi on culms of a grass; *H. rhododendri-mariesii* Y.-R.Lin & S.-J.Wang on leaves of *Rhododendron mariesii* Hemsl. & Wils. (Ericaceae); *H. stephanandrae* Y.-R.Lin & S.-J.Wang on twigs of *Stephanandra chinensis* Hance (Rosaceae), and *H.*

junipericola C.-L.Hou, Y.-R.Lin & M.Piepenbr. on *Juniperus squamata* Buch.-Ham. (Cupressaceae).

Key to species of *Hypoderma* in China

1	Ascomata subcuticular.....	2
1'	Ascomata intraepidermal.....	5
2	Ascomata narrowly elliptical; on conifers or grass.....	3
2'	Ascomata broadly elliptical; on leaves of broadleaf trees.....	4
3	Ascospores bifusiform.....	<i>H. junipericola</i>
3'	Ascospores cylindrical to slightly fusiform.....	<i>H. rubi</i>
4	Lip cells inconspicuous.....	<i>H. linderiae</i>
4'	Lip cells conspicuous.....	<i>H. rhododendri-mariesii</i>
5	Ascomata with conspicuous lips.....	6
5'	Ascomata without conspicuous lips.....	7
6	Ascomata with acute ends.....	<i>H. cuspidatum</i>
6'	Ascomata without acute ends.....	<i>H. stephanandrae</i>
7	Mean length of asci > 150 μm	<i>H. shiqii</i>
7'	Mean length of asci < 150 μm	8
8	Mean thickness of covering stroma < 25 μm	<i>H. smilacicola</i>
8'	Mean thickness of covering stroma > 30 μm	<i>H. berberidis</i>

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