

キンカクイチメガサ(新称)の日本における発生について

誌名	財団法人日本きのこセンター菌蕈研究所研究報告 = Reports of the Tottori Mycological Institute
ISSN	03888266
著者	長沢, 栄史 下野, 義人 本郷, 次雄
巻/号	38号
掲載ページ	p. 6-13
発行年月	2000年12月

The occurrence of *Hypholoma tuberosum* (Agaricales, Strophariaceae) in Japan*

E. NAGASAWA, Y. SHIMONO** and T. HONGO***

Abstract

Hypholoma tuberosum, originally described from Canada and subsequently recorded from Australia and Belgium, is reported for the first time from Japan with a full illustrated description. In Japan, it has been found from four well separated localities in the Mainland (Honshu) growing on fertilized soil in a cultivated field, lawns and parks, from late September to October. Judging from the present data on ecology and distribution of the fungus in Japan, it is probable that *H. tuberosum* had been introduced to Japan and is more widely distributed in the country than the present records indicate.

Key Words: agarics, biogeography, ecology, morphology, new record, *Psilocybe*, saprotrophic fungi.

Hypholoma tuberosum Redhead & Kroeger is an agaric species of the Strophariaceae. It was originally described from Canada (Vancouver, B.C.) based on material collected on mulch beds and compost piles (Redhead and Kroeger, 1987). Since it has been reported from Australia (Priest and Simpson, 1992) and Belgium (Noordeloos, 1999). It is well characterized by producing irregularly shaped, subterranean sclerotia and represents the only known, sclerotium-forming member of the genus *Hypholoma* (Fr.)

Kummer (= *Naematoloma* P. Karsten).

This paper presents the first documented record of *H. tuberosum* from Japan along with a full illustrated description and accounts on its ecology and distribution in the country. In the following description, color names and codes, where they are used together [e.g., brownish orange (6C8)] are from Kornerup and Wanscher (1967) and capitalized color names (e.g., Fulvous) are from Rayner (1970); those not as above are general approximations.

* Contribution No. 344 of the Tottori Mycological Institute, 211 Kokoge, Tottori, 689-1125 Japan.

** Osaka Prefectural Kourioka Senior High School, 2-18-1, Higashi-nakaburi, Hirakata, 573-0093 Japan.

*** Ogaya 3-3-7, Otsu, 520-2144 Japan.

Microscopical characters are based on rehydrated dried specimens mounted in 2.5 % aqueous solution of potassium hydroxide (KOH) and examined under a light microscope. In reporting basidiospore measurements, the notation [n=105/6/6] stands for "105 spores from 6 specimens of 6 collections measured." The ratio of length to width (Q) is calculated for individual spores.

Hypholoma tuberosum Redhead & Kroeger, Mycotaxon **29**: 457. 1987. Figs. 1–5.
=*Psilocybe tuberosa* (Redhead & Kroeger) Walley, Sterbeekia **18**: 11. 1998.

Descriptions: Redhead and Kroeger (1987: 457–462); Noordeloos (1999: 72)

Colored illustration: Priest and Simpson (1992: Fig. 1)

Basidiocarps (Figs. 1B and 2A–C) small to relatively small, slender, developing from a subterranean sclerotium singly or in small groups. **Pileus** 20–45 mm broad, at first obtusely conical, later campanulate to planoconvex, often dull or distinctly umbonate, at times shallowly depressed around the umbo when mature, margin incurved then decurved; surface subviscid when wet, usually moist to dry, smooth or finely granular-punctate over the disc, often scattering fugacious, fibrillose patches or scales (veil remnants) at margin, somewhat hygrophanous but not translucent-striate when wet; color brownish orange (6C8) to reddish golden (6C7), light brown (6D8) to raw Sienna (6D7), or Fulvous to ± Sienna, discoloring golden brown (5D7) to yellow ochre (5C7), Pompeian yellow (5C6), or ± Ochreous to Pale Luteous toward margin with age, when old occasionally tinged with grayish yellow (4C3–5) at margin. **Stipe** attached to sclerotium directly or with pseudorhiza (up to 150 mm long), 30–80 mm long, 2–4 mm broad, equal or somewhat enlarging toward base (up to 6 mm), stuffed then narrowly hollow, with a superior,

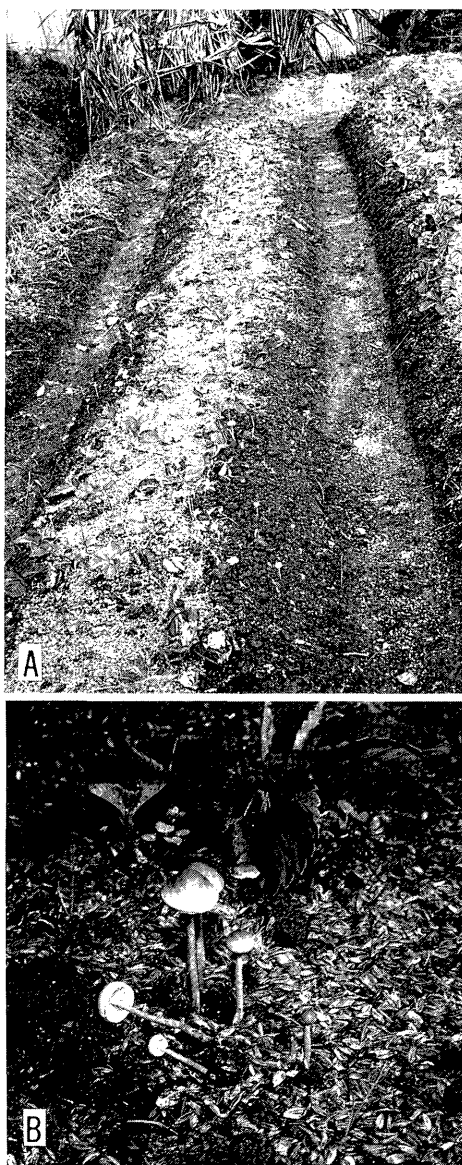


FIG. 1. *Hypholoma tuberosum* in the habitat. A. Fruiting of *H. tuberosum* in a strawberry garden (Tottori-shi, Miwa, 14 Oct. 1980. Photo by E. Nagasawa). B. Close-up of basidiocarps.

fibrillose annular zone, smooth above it, below it fibrillose to appressed squamulose, slightly viscid when wet, whitish above, paler concolorous with pileus toward base, often tinted

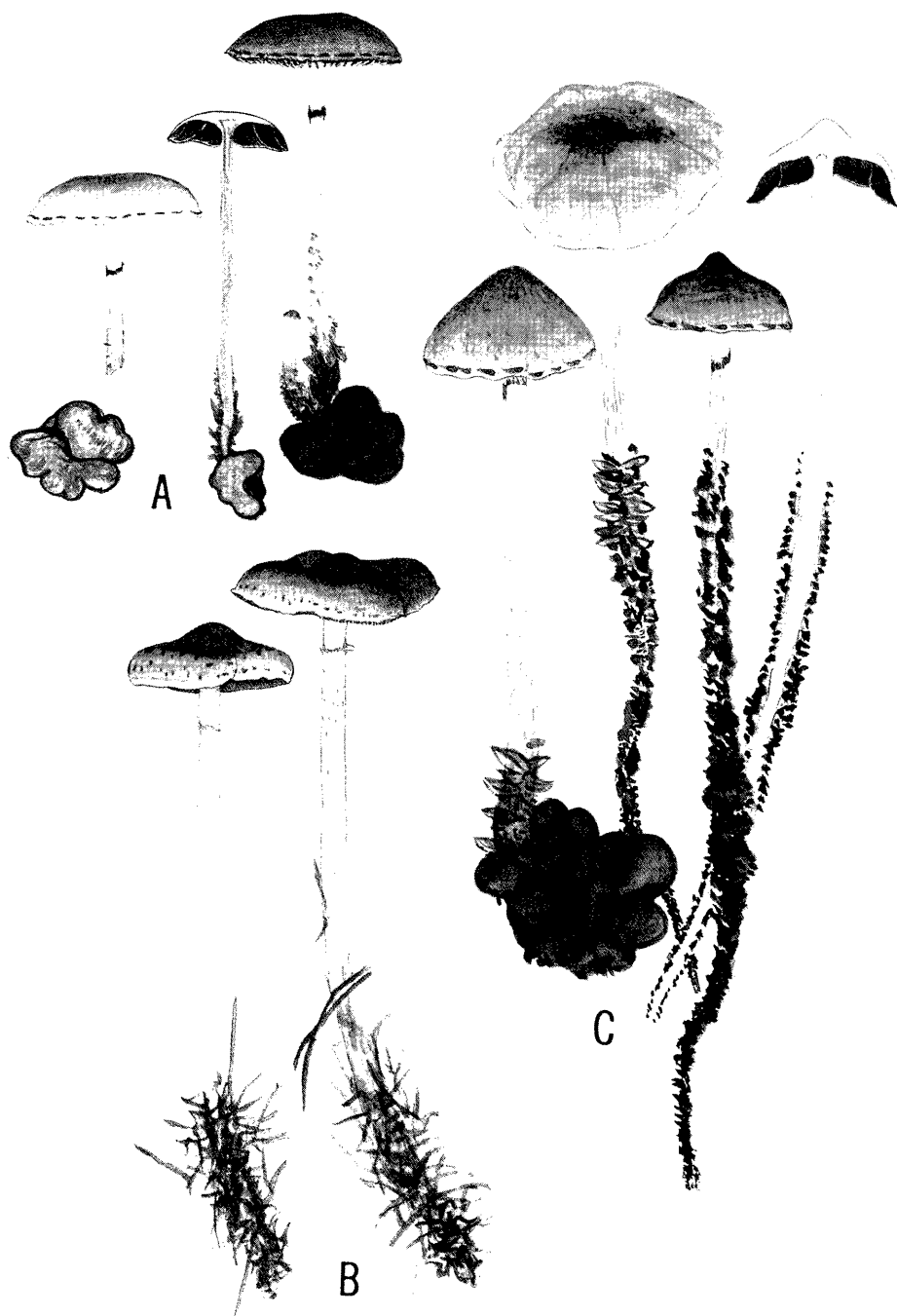


FIG. 2. Basidiocarps and sclerotia of *Hypholoma tuberosum* ($\times 0.95$), showing color and size variation among collections. A. TMI 17823; B. TMI 8288; C. TMI 17824. All del. by E. Nagasawa.

brownish orange at basal portion when old; pseudorhiza covered with whitish to brownish yellow, cottony tomentum. **Lamellae** somewhat emerginate or broadly attached, with or without a faint decurrent tooth, close to subdistant, with 1–3 tiers of lamellulae, relatively broad (up to 5 mm), whitish then becoming grey to violet grey (15D-E2), edges whitish, entire. **Flesh** whitish or tinted pale orange when mature, in stipe becoming light yellow to dull ochreous with age; taste mild or slightly bitter; odor indistinctive. **Sclerotium** nodose-irregular, subglobose to elliptical or oblong in outline, mostly 10–30 × 10–25 × 10–20 mm, solid, surface smooth (densely matted tomentose under a lens), light brown to dark brown, within dull grayish orange.

Spore deposit violet brown (10F4-3) or Brown Vinaceous.

Basidiospores (Fig. 3A) 8.5–12 × 5–6.5 µm, Q= 1.5–2.2 (n= 105/6/6; Mean±SD: 10.0±0.7 × 5.5±0.4 µm, Mean Q±SD: 1.8±0.1; Total range of Mean length × Mean width: 9.7–10.3 × 5.4–5.6 µm, Total range of Mean Q: 1.8–1.9), elliptical to elongate-elliptical, somewhat inequilateral in side view, with a distinct, apical pore, which is somewhat eccentrically orientated in side view, smooth, thick-walled, brown in KOH. **Basidia** (Fig. 3B) 21–31 × 7–9 µm (n=79/5/5; Mean±SD: 24.9±2 × 8.0±0.6 µm), 4-spored, rarely 2-, 3- or 5-spored, subutriform, clamped at base; sterigmata stout (3 µm at base), up to 5 µm long. **Pleurocystidia** (Chrysocystidia) (Fig. 3C) 25–52 × 10–17 µm (n=50/4/4; Mean±SD: 37.1±7.5 × 13.3±1.8 µm), scattered, occasional or infrequent at times, ventricose-fusiform to ventricose-rostrate, rarely broadly clavate, thin-walled, smooth. **Cheilocystidia** (Fig. 3D) 17–35 × 4–9.5 µm (n=80/4/4; Mean±SD: 25.0±3.4 × 6.6±1.2 µm), numerous and crowded, narrowly clavate-rostrate to narrowly ventricose-rostrate, at times subcylindric-strangulated, with an

obtuse apex, thin-walled, smooth, hyaline, forming a sterile edge to the lamella. **Caulocystidia** 22–50 × 5–8 µm, scattered or in small groups, almost absent below the annular zone, mostly irregularly cylindrical, thin-walled, smooth, hyaline. **Gill trama** regular, hyphae tubular to inflated, (3–)5–20(–30) µm wide, hyaline, with walls thin to slightly thickened. **Subhymenium** poorly differentiated, 7.5–15 µm thick, subcellular. **Pileipellis** (Fig. 3E) well differentiated into suprapellis and subpellis (hypodermium). **Suprapellis** up to 35 µm thick, an ixocutis consisting of repent, interlaced hyphae 3–5(–7.5) µm broad, filamentous, smooth or encrusted with minute, granular, brownish yellow to grayish yellow material, particularly in those near subpellis, some cells with yellow to orangish, homogeneous content. **Subpellis** (50–)65–100(–125) µm thick, pseudoparenchymatous, element cells globose to subglobose, broadly elliptical, elongate-elliptical to elongate, 15–75 × 12.5–22.5(–32.5) µm, thin-walled, often roughened with dark yellow to brownish yellow or brownish orange incrustations. **Pileitrama** of tubular to inflated, branching hyphae 5–27.5 µm broad, thin-walled, smooth, hyaline or rarely some element cells with oleiferous grayish yellow to brownish yellow, homogeneous content (in KOH). **Stipitipellis** a thin ixocutis of filamentous hyphae 3–5 µm broad, hyaline to brownish yellow, smooth or encrusted occasionally. **Stipititrama** of tubular to inflated hyphae up to 25(–47.5) µm broad, hyaline, rarely with light brown oleiferous content in KOH, thin- to thick-walled (up to 2.5 µm), not encrusted, often secondarily septate (particularly in upper stipe), with interlaced, frequently branching, filamentous hyphae 2.5–5 µm broad; appearing more or less sarcodimitic in lower stipe. **Sclerotium cortex** about 40 µm thick, appearing a melanized textura epidermoidea in section, of complicatedly interwoven

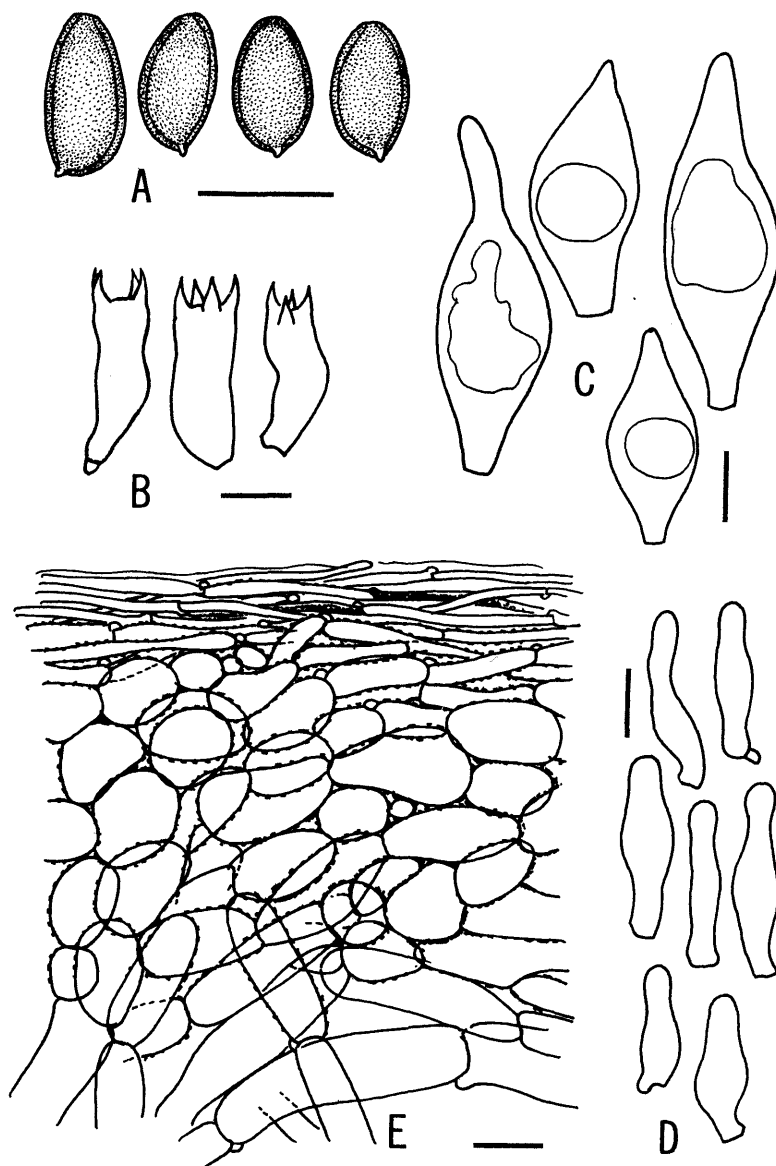


FIG. 3. Microstructures of *Hypholoma tuberosum*. A. Basidiospores. B. Basidia. C. Pleurochrysozystidia. D. Cheilocystidia. E. Section of pileipellis. All from TMI 17824. Bars in A–D = 10 μ m; in E = 20 μ m.

hyphae 2–2.5 μ m broad, with dark brown, united walls; cortical surface covered with brown, filamentous hyphae 2–3 μ m broad, with smooth walls. **Sclerotium trama** appearing intermediate between textura epidermoidea and

textura intricata in section (closer to the former toward the cortex), of densely interwoven hyphae 2–10 μ m broad, with hyaline to brownish (beneath the cortex), thickened (up to 2 μ m) walls. **Hyphae** from pseudorhiza surface fila-

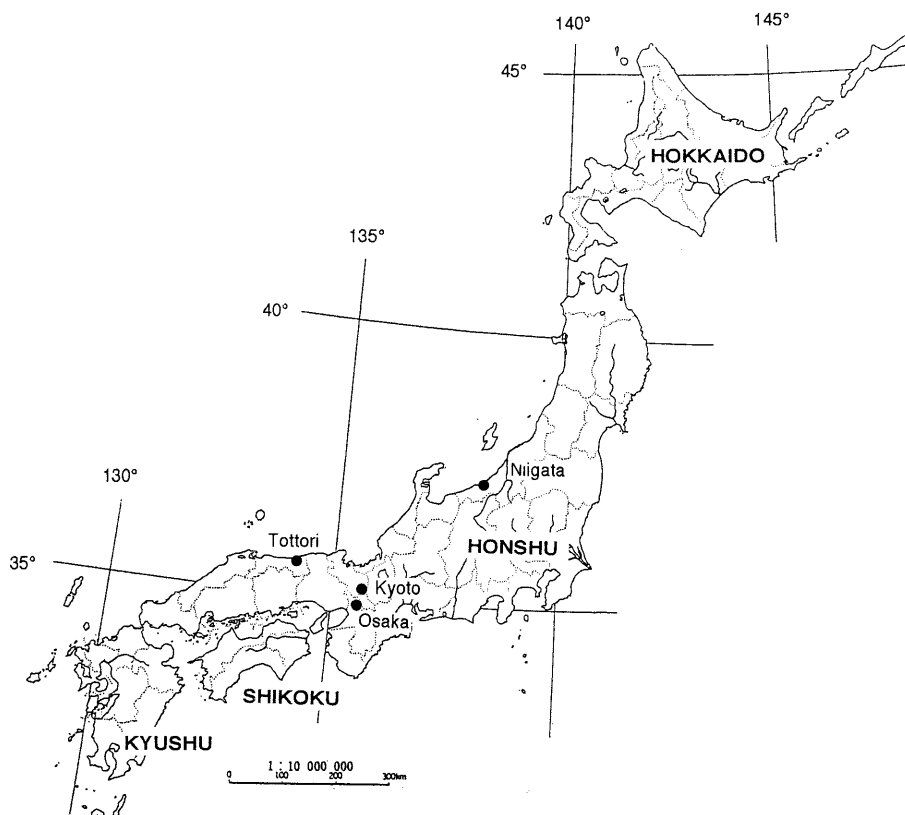


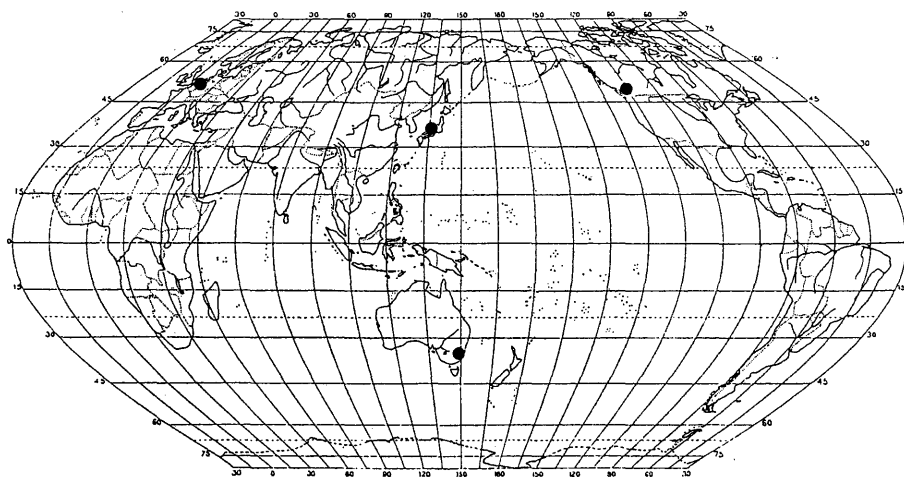
FIG. 4. Distribution of *Hypholoma tuberosum* in Japan.

mentous, 2.5–4(–7) μm broad, walls hyaline to pale yellow or brownish, smooth, thin to slightly thickened. **Clamp connections** frequent in all tissues.

Ecology and Distribution in Japan: Solitary or more often gregarious, 1 to 5 basidiocarps per sclerotium; on soil fertilized with compost or leafmold in a cultivated field (Fig. 1A), on a lawn, and also in parks under newly planted trees or on flower beds; late September to October. Known in Honshu, from Tottori, Osaka, Kyoto and Niigata (Fig. 4).

World distribution: Canada (Redhead and Kroeger, 1987), Australia (Priest and Simpson, 1992), Belgium (Noordeloos, 1999) and Japan (this paper). Refer to Fig. 5.

Material examined: HONSHU: TOTTORI: Tottori City, Kokoge, 6 Oct. 1975, E. Nagasawa 75-142 (TMI 8288; sclerotia lost); Tottori City, Miwa, 14 Oct. 1980, T. Hongo, E. Nagasawa 80-178 & N. Maekawa (TMI 17823); the same site, 22 Oct. 1980, E. Nagasawa (TMI 17824); Tottori City, Koyama, 17 Oct. 1986, K. Saito (TMI 13323; sclerotia lost); OSAKA: Takatsuki City, Hagitani Athletic Park, 19 Oct. 1988, T. Kakee (TMI 23179). KYOTO: Kyoto City, Umekouji Park (Inochino-mori), 29 Sept. 1997, Y. Shimono (TMI 24418); the same site, 26 Sept. 1998 and 16 Oct. 1999, Y. Shimono. NIIGATA: Joetsu City, Takada Park, 23 Oct. 1987, N. Kosakai (Hongo 6831).

FIG. 5. Distribution of *Hypholoma tuberosum* in the world.

The Japanese material described above agrees well with the protologue of *H. tuberosum* (Redhead and Kroeger, 1987) and a redescription based on Belgium material (Noordeloos, 1999) in its essential characters including the habitat. As pointed out by the original authors, *H. tuberosum* is unique in this genus in forming subterranean sclerotia which are irregular in shape; no other *Hypholoma* species hitherto known (Smith, 1951 as *Naematoloma*; Singer, 1986 as *Naematoloma*; Watling and Gregory, 1987; Rald, 1992; Noordeloos, 1999 as *Psilocybe* subg. *Hypholoma*) have this character. In addition, the habitat in nutrient-rich soil, the small to relatively small basidiocarps with a slender stature, the subviscid (when wet) brownish orange to light brown pileus often with scattered veil remnants at the margin, the broadly attached gills tinted grey to violet grey and the often radiating stipe with an obscure annular zone near the apex are diagnostic for this species. Microscopically, the medium-sized basidiospores with a distinct apical pore, the presence of an ixocutis of narrow hyphae in the pileilellis, the relatively large, ventricose to ventricose-rostrate chrysocystidia and the small,

narrowly ventricose-rostrate to subcylindrical cheilocystidia are characteristic. *Agrocybe semiorbicularis* (Bull.) Fayod and *A. arvalis* (Fr.) Singer may be confused with *H. tuberosum* in the field, both growing in similar habitats and producing basidiocarps similar in some respects. However, *A. semiorbicularis* lacks sclerotia at the base of the stipe and in *A. arvalis*, although it produces sclerotia, their shape is not irregular but globose to subglobose. Further, these species produce dark brown spore prints lacking a violet tint and have different microscopical characters of the pileipellis, cystidia and so on.

Our knowledge of the distribution of *H. tuberosum* in Japan is still very limited, but its occurrence in four widely separated localities (Fig. 4) suggests that it is more widely distributed in this country than the present records indicate. From biogeographical and ecological viewpoints, it seems to be interesting that *H. tuberosum* has a disjunct distribution in the world (Fig. 5), known from Canada, Australia, Belgium and Japan, and except for Australia, where the fungus is assumed to occur naturally in peat bogs, *H. tuberosum* has been found in artificial habitats such as gardens, parks and

cultivated fields as well as compost piles, mulch beds or fertilized soil. We have not enough data to discuss whether *H. tuberosum* is an indigenous species or an introduced one to Japan, but its ecology in Japan so far known seems to support the latter hypothesis.

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摘 要

キンカクイチメガサ（新称）の日本における発生について

長沢栄史・下野義人・本郷次雄

従来日本から未記録であったモエギタケ科のきのこ、*Hypholoma tuberosum* Redhead & Kroeger（キンカクイチメガサ／菌核市女傘：新称）の日本における発生について報告した。本種は1987年にカナダ、バンクーバー産の標本に基づいて新種記載された比較的新しい種類であるが、*Hypholoma* (= *Naematoloma*) クリタケ属において菌核を形成する点を著しい特徴とする。カナダからの報告以後は、オーストラリアおよびベルギーから報告されているのみであった。菌核は地中に形成され、褐色で不規則に歪み、大きさは通常10–30 × 10–25 × 10–20 mm。子実体は一つの菌核から1–5個生じ、比較的小形。かさは径2–4 cm位、黄土色～帯褐橙色で湿時やや粘性を帯びる。柄はつばを欠き、傘より淡色で細長く、菌核が土に深く埋っているときは基部が根状に長く伸びる。胞子紋は暗紫褐色。胞子は楕円形で発芽孔を有し、大きさ8.5–12 × 5–6.5 μm（平均10 × 5.5 μm）。日本では秋、芝生、畑、公園内の植木の下、あるいは花壇などに発生し、鳥取県（鳥取市）、京都府（京都市）、大阪府（高槻市）および新潟県（上越市）で発見されている。国内における生態および分布の状況から推察して、本菌は恐らく国外からの移入種であり、また、国内に広く分布しているのではないかと考えられる。