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The occurrence of *Plectania melastoma* (Pezizales, Sarcosomataceae) in Japan*

Eiji NAGASAWA and Tamako NAKANISHI**

Abstract

The first documented record of *Plectania melastoma* from Japan has been presented here, based on a specimen collected from Kyoto Prefecture (Japan). *P. melastoma* was observed during spring (from end of April to early May) in a *Cryptomeria japonica* artificial forest, growing on *C. japonica* dead sticks and needle litter on the forest floor. The characteristics of the Japanese specimen agreed well with those of *P. melastoma* reported in the European and North American literature with respect to its small, shortly stipitate apothecia that were reddish orange to reddish brown on the outside, large elliptic-fusiform ascospores [19.2–25.8 × 9.6–12.6 µm, length-breadth ratio (Q) 1.8–2.4], and the wine-colored purple pigments released by the hyphae present on the outer surface of the apothecia in an aqueous solution of KOH. For comparison purposes, a full description of the specimen collected from Japan has been included along with the photographs of apothecia, taken in the natural habitat of the fungus, and of other salient microstructures. In addition, the present status of members of the genus *Plectania* in Japan has been briefly discussed.

***Key words*: ascomycetes, biogeography, *Cryptomeria japonica*, discomycetes.**

In the month of April, during a macrofungal survey, one of us (TN) encountered a small cup fungus that grew on dead sticks and needle litter of *Cryptomeria japonica* (L. f.) D. Don found on the floor of the *C. japonica* artificial forest (Figs. 1–3). The fungus was characterized by having an apothecium colored reddish-orange to reddish-brown in the outer surface which contrasts with an almost black hymenium, rather tough consistency, and a very short or rudimentary stipe attached to the substrate with a blackish tomentum. In addition to the on-field digital images of the apothecia, fresh apothecia were collected from the same location and examined in further detail. After consulting relevant literature (Dennis, 1978; Hansen and Kunudsen, 2000; Otani, 1973, 1980; Rifai, 1968; Seaver, 1928), this Japanese cup fungus was identified as the type species of the genus *Plectania, P. melastoma* (Sowerby: Fr.) Fuckel.

Plectania melastoma has been previously recorded from Japan (Katumoto, 2010), however, this record was based on a paper presented by Pfister (1997). Pfister suggested that *Peziza japonica* Berk. & M. A. Curtis [synonym, *Plectania japonica* (Berk. & M. A. Curtis) Sacc.], described from a specimen collected

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"on roots, Japan" (in the protologue of Berkeley and Curtis, 1860) and "on roots upon hillsides" [from Tokunoshima (Japan) on April 30, 1855] (Pfister, 1997), was identical to *P. melastoma* based on his study of the type specimen. He stated that "*Peziza japonica* agrees in all respects with *Plectania melastoma* (Sow. ex Fr.) Fuckel and should be considered a synonym". He did not provide any further morphological characteristics of the type specimen apart from the short descriptions provided by Berkeley and Curtis (1860) in the protologue, and by Saccardo in Sylloge Fungorum (1889) (where spore data was added as "sporidiis ellipsoideis, hyalinis, levibus, 22×11"). Therefore, a full description of the recently collected specimen from Kyoto Prefecture (Japan) has been presented here.

In the macroscopic description, the color codes given in parentheses are from Kornerup and Wanscher (1967). Microscopic examinations were based on both fresh and dried specimen using cotton blue and KOH (2.5% aqueous solution). Water mounts were prepared for observing pigmentation and all the other measurements, unless otherwise stated. The examined specimen was deposited in the herbarium of the Tottori Mycological Institute (TMI), Tottori, Japan.

Plectania melastoma (Sowerby: Fr.) Fuckel, Jahrb. Nass. Vereins Naturk. **23–24**: 324, 1870. (Figs. 1–5)

Basionym: *Peziza melastoma* Sowerby, Col. fig. Engl. fungi **2**: 64, t. 149, 1799; sanctioning: Fries, Syst. mycol. **2**: 80, 1822.

Syn.: *Peziza japonica* Berk. & M.A. Curtis, Proc. Amer. Acad. Arts & Sci. **4**: 127, 1860 [1858] [according to Pfister (1997)] ; *Plectania japonica* (Berk. & M.A. Curtis) Sacc., Syll. Fung. **8**: 163, 1889.

For other synonyms see Species Fungorum (http://www.speciesfungorum.org/)

Apothcia (Figs. 1–3) solitary or more often gregarious, up to 15 mm wide and 10 mm high, cupulate, very shortly stipitate or nearly sessile, stipes up to 4 mm long and 3 mm wide, arising from a blackish tomentum which extends to the substrate. Disc permanently concave, up to 7 mm in depth, nearly black, smooth. Margin circular, incurved, narrowly (<1 mm) sterile, denticulate when young, becoming obscurely so or nearly entire with age. Context whitish, tough-fleshy, no gelatinous layer present. Receptacle surface minutely downy, fine granular, color reddish orange (between 7B8 and 7C8) to bright brownish orange [7C8 (copper red)] at first, and remaining so until late or becoming reddish brown to brown [7D8 (burnt sienna) to 7D7 (brick red), or 7E8 (henna color)] upon aging or in the weathered specimens, often showing blackish background color through a fibrillose covering (Figs. 1 and 3).

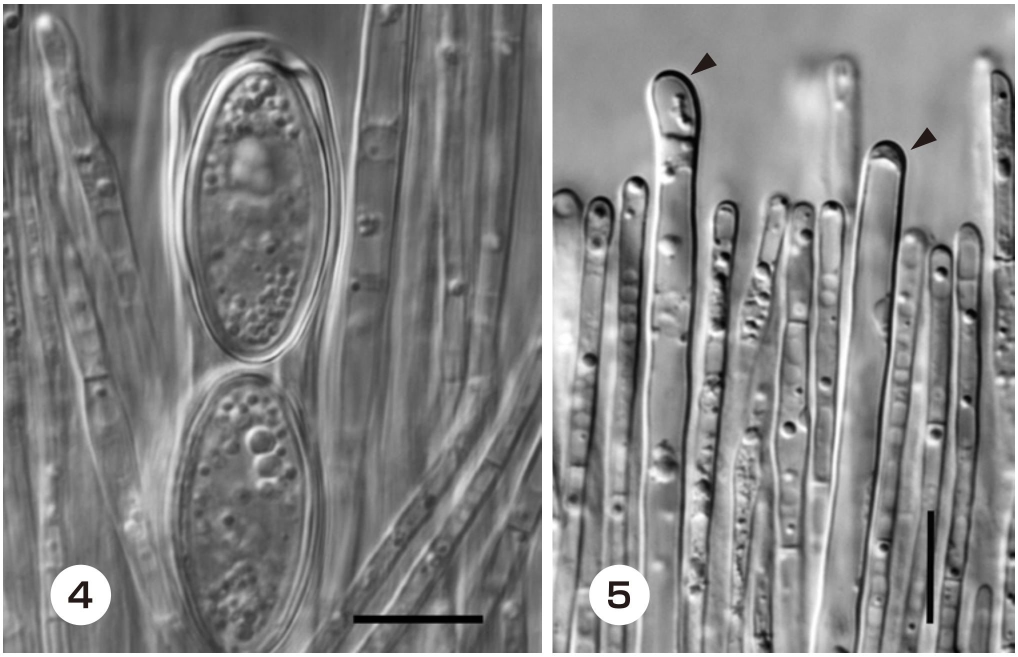
Ascospores (Fig. 4) 19.2–25.8 × 9.6–12.6 µm (n=40: mean, 22.4 ± 1.5 × 10.6 ± 0.7µm), length-breadth ratio (Q) =1.8–2.4 (n=40: mean, 2.1 ± 0.1) in water, elliptic-fusiform, smooth or fine verrucose (rarely), hyaline, thin- to moderately thick-walled, with granular content, cyanophilous in the thin outermost layer. Asci mostly around 400 µm long, up to 450 µm or somewhat longer at times, spore portion 170–200 µm long, 12–15 µm in width, 8-spored, operculate, cylindrical, tapering below into a slender flexuous base, curved near tip, thick-walled (up to 1.2 µm thick). Paraphyses of two types (Fig. 5) present: (1) ordinal (filiform, frequently septate, branched 2–3 or more times below the center, 1.8–3 µm wide), and (2) the broader, so called hymenial hairs (narrowly cylindrical, aseptate or rarely with one to two septa near the base, not (?) branched, (3–) 3.6–4.2 µm wide; both types of paraphyses have a simple, rounded tip, little or somewhat beyond the length of asci, appear as a brownish (darker brownish apically) mass in water, discolor to olivaceous brown in KOH solution, walls thin but firm. Subhymenium composed of a textura epidermoidea-like tissue, pale brown, hyphae densely interwoven, 1.8–4.8 µm wide. Medullary excipulum of textura intricata, element hyphae narrowly cylindrical, 1.8–4.8 µm wide, moderately branching; walls hyaline, somewhat thickened, and with a glassy shine (as observed in the

Figs. 1–3. Apothecia of *Plectania melastoma* in different developmental stages in its natural habitat (TMI-26361.) Figure 2 shows the granulose-powdery surface of a receptacle in a mature apothecium, while Figure 3 shows the nearly smooth, matted fibrillose surface of a receptacle in weathered apothecia. Photo courtesy, T. Nakanishi (April 23, 2017).

water mounts), slightly gelatinized at times, loosely interwoven in a hyaline gelatinous matrix, but forming a compact, brown-tinted layer (thickness, 50–65 μm) beneath the subhymenium. Ectal excipulum of textura angularis, approximately 60–80 μm thick, element cells mainly polyhedral (sometimes subglobose), 8–19.2× 6.4–17.6 μm, moderately thick-walled, walls pigmented dark brown (in water) or olivaceous black (in KOH solution). Hyphae on the receptacle surface dark brown, thick-walled [up to 1.2 (–3.2) μm], 6.4–8 μm wide, sinuous or straight, infrequently septate, mostly simple, rarely bearing a short branch, smooth, often encrusted with reddish orange to reddish brownish granules that quickly dissolve in KOH solution and release wine-colored purple pigments.

Specimen examined: on dead *Cryptomeria japonica* sticks and needle litter on the floor of the *C. japonica* artificial forest, Kyotanba-cho, Funai-gun, Kyoto Prefecuture, Japan, from April 23 to May 1, 2017, Coll. by Tamako Nakanishi, EN 17-04 (TMI-26361)

Remarks: This Japanese cup fungus can be safely identified as *P. melastoma* (Dennis, 1978; Dissing et al., 2000; Glejdura et al., 2011, Rifai, 1968; Seaver, 1928 under the name *Bulgaria melastoma*; Spooner, 2002), having small, tough-fleshy apothecia with fine granular, bright reddish orange to reddish brown outer surfaces; occurring on dead coniferous debris (habitat); possessing large elliptic-fusiform ascospores measuring 19.2–25.8× 9.6–12.6 μm and Q= 1.8-24; and



Figs. 4 and 5. Microelements of *Plectania melastoma* in a water mount. TMI-26361. Figure 4 indicates ascospores in an ascus. Note the granular contents present in the spores. Figure 5 represents the apical portion of paraphyses. Note the presence of two types of paraphyses, the broader (indicated by arrow heads) and narrower ones. (Scale bar, 10 µm)

having reddish orange to reddish brown granular encrustations (on the hyphae of the receptacle surface) that quickly solubilize in an aqueous KOH solution and release wine-colored purple pigments

In Japan, this species has been known only under the name "*P. japonica*", which was identical to *P. melastoma* as suggested by Pfister (1997) based on his study of the type specimen of *P. japonica*. However, no concrete records of the occurrence of *P. melastoma* in Japan have been presented since Pfister (1997). Apart from *P. japonica*, three species from this genus have been reported from Japan by Otani (1973, 1980) namely, *P. nannfeldtii* Korf from Hokkaido, *P. modesta* Otani (a new species) also from Hokkaido, and *P. platensis* (Speg.) Rifai from Chiba Prefecure. Of these *P. platensis* is now considered as a synonym for *P. rhytidia* (Berk.) Nannf. & Korf (Carbone et al., 2010; Carbone et al., 2015).

Recent molecular studies on Sarcosomataceae by Carbone et al. (2013), based on phylogenetic analyses using a combined data set of internal transcribed spacer (ITS) and 28S large subunit (LSU) sequences of nuclear rDNA, have indicated that the morphologically defined *Plectania* was a polyphyletic and heterogeneous assemblage and some species classified in the genus should be excluded. *P. nannfeldtii* was one such species and thus, was transferred to the genus *Donadinia* [synonymous with *D. nigrella* (Seaver) M. Carbone, Agnello & P. Alvarado] . On the other hand, *P. melastoma* and *P. rhytidia* (synonym, *P. platensis*) were retained in genus *Plectania*; however, the placement of the Japanese *P. modesta* in this genus remained unclear due to the lack of sequencing data (Carbone et al., 2015).

According to the literature, *P. melastoma* distributes in Europe (Dennis, 1978; Dissing, 2000; Glejdura et al, 2011), North America (Lincoff, 1981; Maguire, 1982; Seaver, 1928 under the name *Bulgaria melastoma*), and also in Australia (Rifai, 1968); however, its occurrence seems to be rare and localized. In Asia, It has been reported from China and India (Xu, 2000).

Macromorphologically and ecologically, *P. melastoma* is very similar to *P. zugazae* Calonge & A. Garcia (Calonge et al., 2003) known from Spain (Calonge et al., 2003), Cyperus, and Greek (Carbone et al., 2015), but not from Japan. Both species could be easily confused with each other in the field. However, *P. zugazae* differs primarily in the form and size of ascospores, which are almost ellipsoid and somewhat shorter in length but wider compared to those of *P. melastoma* [18–22 × 12–14 µm (Calonge et al., 2003); (17.5–) 19–22 (–24) × (12–) 12.5–15 (–15.5) µm (Carbone et al., 2015)]. Consequently, the *P. melastoma* ascospores display a lower Q-value (1.45-1.6, Carbone et al., 2015). *Korfiella karnika* D.C. Pant & V.P. Tewari from India (Pant and Tewari, 1970) and Japan (Nagasawa, 2004), a member of Sarcosomataceae, may also be confused with this species due to the similarly in the color of apothecia; however, the apothecia are split (almost till the base) on one side and found on mossy rotting stump (at the type locality in India) and on dead bamboo stumps (in Japan).

References

Berkeley, M. J. and Curtis, M. A. 1860. Characters of new fungi collected in the North Pacific Exploring Expedition by Charles Wright. Proc. Amer. Acad. Arts **4**: 111–130.

Calonge, F. D., Garcia, A., Sanz, M. and Bastardo, J. 2003. *Plectania zugazae* (Ascomycotina), especie neuva para la ciencia. Bol. Soc. Mycol. Madrid **27**: 17–20.

Carbone, M., Agnello, C. and Baglivo, A. 2010. Appunti su *Plectania rhytidia* e studio del typus di *Urnula platensis*. Revista di Mycologia **53**: 119–135.

Carbone, M., Agnello, C. and Alvarado, P. 2013. Phylogenetic studies in the family Sarcosomataceae. Ascomycete. Org. **5**: 1–12 .

Carbone, M., Loizides, M. and Alvarado, P. 2015. Preliminary phylogenetic and morphological studies in the *Plectania melastoma* lineage (Ascomycota, Pezizales). Ascomycete. Org. **7**: 23–29.

Dennis, R. W. G. 1978. British Ascomycetes. Vaduz, J. Cramer, 585 p.

Dissing, H., Eckblod, F.-E. and Lange, M. 2000. Sarcosomataceae Kobayasi. Pp. 125–127. In: Hansen, L and Knudsen, H. (ed.) Nordic macromycetes. Vol. 1. Ascomycetes. Nordsvamp, Copenhargen.

Glejdura S., Kunca V. and Kučera V. 2011. *Plectania melastoma* (Sarcosomataceae, Pezizales) in Slovakia. Catathelasma **13**: 19–24. + 2 colored photographs of apothcia in the habitat, on p. 1 (mature apothcium) and p. 35 (young apothecia).

Katumoto, K. 2010. List of fungi recorded in Japan. The Kanto Branch of the Mycological Society of Japan, Chiba. 1177 p.

Kornerup, A. and J. H. Wanscher, 1967. Methuen handbook of colour, 2nd Ed. Methuen & Co. Ltd.: London. 243 p.

Lincoff, G. H. 1981. The Audubon Society field guide to North American mushrooms. Alfred A. Knopf, New York. 926 p.

Maguire, R. 1982. Trial field key to the species of Sarcosomataceae in the Pacific Northwest. Reformatted with minor revision by Ian Gibson 2003 and updated by Ian Gibson 2017, Pacific Northwest Key Council. Http://www.svims.ca/council/Sarcos.htm

Nagasawa, E. 2004. *Korfiella karnika*, a discomycetes species new to Japan. p. 61. In: Mycological Society of Japan (ed.). Abstracts of papers presented at the 48th Annual Meeting of the Mycological Society of Japan, Nagasaki.

Otani, Y. 1973. On *Pseudoplectania* and *Plectania* collected in Japan. Rep. Tottori Mycol. Inst. **10**: 411–419. In Japanese.

Otani, Y. 1980. Sarcoscyphineae of Japan. Trans. Mycol. Soc. Japan **21**: 149–179.

Pfister, D. H. 1997. Type studies in the genus *Peziza*: species described by Berkeley and Curtis from the United States North Pacific Exploring Expedition（1853-1856）. Mycotaxon **6**: 337−340.

Rifai, M. A. 1968. The Australasian Pezizales in the herbarium of the Royal Botanical Gardens Kew. Verhandelingen der Koninklijke Nederlandse Akademie van Weten-schappen, afd. Natuurkunde, Tweed Sect., **57**: 1−295.

Saccardo, P. A. 1889. Sylloge fungorum VIII（Patavii）: 163.

Seaver, F. J. 1928. North American cup fungi（Operculates）. Supplemented edition. Hafner Publishing, New York. 377p.

Spooner, B. M. 2002. The larger cup fungus in Britain, part 4. Sarcoscyphaceae and Sarcosomataceae. Field mycology **3**: 9−14.

Xu, A-S. 2000. Notes on *Plectania* in Xizang. Mycosystema **19**: 200−204.

摘　　　要

京都府船井郡京丹波町のスギ林内で採集された標本（4 月～ 5 月にかけて林内の落枝および腐植上に発生）に基づいて，*Plectania melastoma*（Sowerby: Fr.）Fuckel（チャワンタケ目，クロチャワンタケ科）の日本における発生を報告した．本菌は，小型（径 1-1.5 cm 位）でお椀状の，比較的丈夫な肉質の子嚢盤を落枝および腐植上に群生するが，子実層面が黒色であるのに対して子嚢盤の外表面が鮮やかな赤橙色～赤褐色を帯び，粉状を呈するのを著しい特徴とする．また，紡錘状楕円形の比較的大きな胞子（19.2–25.8 × 9.6–12.6 µm，長さ / 幅値（Q）= 1.8–2.4）をもち，子嚢盤外表面の菌糸を KOH 水溶液で処理するとワイン色の色素を溶出する特徴をもつ．日本では外観的特徴におい類似する *Korfiella karnika* D.C. Pant & V.P. Tewari（コフキクロチャワンタケ）と混同され易いが，同菌は子嚢盤が 1 側面で基部付近まで裂けることや竹の古い切り株に発生することなどで区別される．*P. melastoma* は *Plectania* 属の基準種で，文献によれば世界，主に北半球に広く分布するが，発生はまれで局地的のようである．日本においては従来本学名における報告はないが，アメリカの北太平洋探検調査隊（1853–1856）によって日本（徳之島、1855 年 4 月 30 日，根上）で採集され，英国の M. J. Berkeley and M. A. Curtis によって 1860 年に新種記載された *Peziza japonica* Berk. & M. A. Cutis（= *Plectania japonica*（Berk. & M. A. Cutis）Sacc.）は，そのタイプを調査した Pfister（1997）によれば，*P. melastoma* と同一種であるといわれている．本種にはまだ和名が無いので新たにアカサビクロチャワンタケと命名した.

Rep. Tottori Mycol. Inst. **47** : 7－15, 2017.

安定同位体比と元素組成分析による高精度な乾シイタケの産地判別法*

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中下留美子***・鈴木彌生子****

High-precision method for determining geographic origin of dried shiitake mushrooms（*Lentinula edodes*）by analyzing stable carbon and nitrogen isotopes and the contents of elements*

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Abstract

Dried shiitake（Lentinula edodes）mushrooms, produced in Japan, China, Korea and Brazil on log cultivation or sawdust medium cultivation, were used. The analyses of stable carbon and nitrogen isotopes and the contents of elements were combined to obtain a high precision method to identify the geographic origin of shiitake, both in log and sawdust medium cultivation. The amount of each sample necessary for the test was less than 200 mg. For example, Japanese log shiitake was distinguishable from Chinese log shiitake and Chinese sawdust medium shiitake at 99.3%（136/137）and 100%（185/185）hitting ratios, respectively. In addition, Brazilian shiitake samples were assigned to a block clearly different from the Japanese, Chinese, and Korean blocks.

Key words: cultivation method, discriminant analysis, dried shiitake, geographic origin, minor element, stable carbon and nitrogen isotopes.

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緒　言

2015年度の日本の乾シイタケ生産量は2,631トンであるが，菌床栽培品は177トンにすぎず，大部分は原木栽培品が占める．一方，輸入乾シイタケは5,029トンにのぼるが，ほぼ全て香港を含む中国から入っている（林野庁 2016）．輸入乾シイタケの一部が日本産として偽装販売されることは20年来の大問題である．消費者の信頼を裏切り，乾シイタケの消費抑制の一因となるばかりか，日本産として偽装された安価な輸入品が市場で増えることで真の日本産の販売価格が不当に下落し，国内生産者にも甚大な被害を及ぼす．乾シイタケは日本の山村の貴重な換金作目であるため，その生産が脅かされれば人々の生活基盤を揺るがし，山村文化の衰退や山林の荒廃に繋がる．2000年当時には2,000～3,000トンの輸入品が国産品として販売されていたことが推定されている（高岡 2000）．

この状況を打開するため，筆者らは15年以上にわたって乾シイタケの産地判別法の開発を進めてきた．それらは柄の顕微鏡調査と傘の物性調査に元素組成分析を加えた手法（時本ら 2000，時本 2005，時本 2002，時本ら 2016），元素組成分析に注力したもの（臼井ら 2003），窒素と炭素の安定同位体比分析の有用性を認めたもの（鈴木ら 2015），ストロンチウム同位体比と元素組成分析の組み合わせで高精度化を達成したもの（時本ら 2009，時本 2011）などの多岐にわたる．また，奥崎（2001）は元素組成分析にアミノ酸分析を加味し，門倉ら（2006）は元素組成分析の高度化を図った．これらの結果，実用的な精度で乾シイタケの生産国と栽培法（原木栽培品と菌床栽培品）を判別することが可能となった．しかし，判別精度が高い重元素同位体比を用いる手法はサンプル調製に高度な技術を要するうえに分析装置の普及が進んでいないなど，判別手法にはまだ改善の余地はある．

産地判別法を広く実践し，偽装販売の抑止力をさらに強化するため，本稿では比較的広く普及している分析装置と少量のサンプルを用いて生産国および栽培法を高精度で判別する手法を提案する．

材料と方法

⑴　乾シイタケサンプルの収集

日本産の原木栽培乾シイタケは生産者から直接購入した．日本産の菌床栽培品は大部分が生シイタケとして出荷されているため，乾燥品として入手した一部を除き，購入した生シイタケを40-50℃で送風乾燥して供試した．中国産および韓国産においては，乾燥品を日本の輸入業者や当該国の知人の協力を得て収集するとともに，一部は現地に出かけて購入した．ブラジル産は現地の生産者あるいは小売店で生シイタケとして購入し，日本産と同様に送風乾燥した（Table 1）．

⑵　炭素，窒素安定同位体比分析

既報（鈴木ら 2015）の方法によって行った．約4 mgの粉末サンプルを錫カプセルに秤量し，元素分析計（Elementar vario Pyro cube, Elementar Analysensysteme GmbH）を接続した質量分析計（IsoPrime 100，Isoprime LTD）を用いて炭素と窒素の安定同位体比を分析した．標準試料からの千分偏差（$^{\delta}$X=（R試料/R標準-1）× 1000）で安定同位体比を標記した．なお，Xは^{13}Cあるいは^{15}Nを表し，Rはそれぞれの安定同位体比^{13}C/^{12}C，^{15}N/^{14}Nである．

⑶　元素濃度分析

既報（時本ら 2016）と同様に行った．傘表面をブラッシングした乾シイタケを少量の蒸留水で洗浄し，ヒダを含まないように傘肉を粉末化した．収集単位（袋）あたり2-3個体をまとめて1サンプルとした．

容量7 mlのテフロンPFA容器に再乾した粉末サンプル0.15 g，濃硝酸3 ml，塩酸0.3 ml，過塩素酸0.3 ml，フッ化水素酸0.15 mlを入れ，電子レンジを用いる小島（1992）の方法に準じて加圧加熱分解した．ホットプレート上で酸を蒸発させたのち，残った固形物を15 gの0.1 M過塩素酸に溶解し，元素分析に供した．分析装置としては比較的広く普及しているICP-AES（JY2000-2S，堀場製作所）を用いた．

Table 1. Origin of shiitake samples used in this study

Produced on logs	Number	Produced on sawdust based media	Number
China			
Shanxi sheng 陝西省	18	Zhejiang sheng 浙江省	1
Henan sheng 河南省	11	Non-identified	110
Anhui sheng 安徽省	6		
Hubei sheng 湖北省	6		
Sichuan sheng 四川省	6		
Jiang xi shen 江西省	5		
Fujian sheng 福建省	3		
Non-identified	10		
Total	65	Total	111
Japan			
Ohita 大分	15	Akita 秋田	2
Iwate 岩手	11	Gunma 群馬	1
Shizuoka 静岡	11	Hokkaido 北海道	1
Ehime 愛媛	9	Niigata 新潟	1
Ishikawa 石川	9	Shimane 島根	1
Miyazaki 宮崎	8	Tochigi 栃木	1
Kumamoto 熊本	6	Tokushima 徳島	1
Hiroshima 広島	2	Non-identified	40
Tottori 鳥取	1		
Yamaguchi 山口	1		
Total	74	Total	48
Korea			
Jeollanam-do 全羅南道	11		
Chung cheong buk-do 忠清北道	10		
Chung cheong nam-do 忠清南道	4		
Gyeong sang nam-do 慶尚南道	4		
Jejudo 済州島	2		
Gang won-do 江原道	1		
Jeolla buk-do 全羅北道	1		
Non-identified	12		
Total	45		
Brazil			
Parana	4	Parana	4
SaoPaulo	1	Federal District	1
		SaoPaulo	1
		Non-identified	1
Total	5	Total	7

(4) 統計分析

有意差検定および判別分析にはエクセル統計2012（社会情報サービス）を用いた．

結 果 と 考 察

(1) 安定同位体比および元素濃度の生産国，栽培方法間の比較

窒素と炭素の安定同位体比（δ^{15}N，δ^{13}C）の値を Fig. 1 に示す．既報（鈴木ら 2015）の通り，δ^{15}N は日本産，中国産，韓国産の原木栽培品で低く，日本産，中国産の菌床栽培品とブラジル産（原木および菌床栽培品）で高かった．生産国間でも多くの組み合わせで有意差があり，これら安定同位体比は生産国および栽培法の判別に有効な指標であった．栽培法間で値が異なる主な理由には菌床栽培では培地に木質以外のフスマなどの添加物が含まれることがあげられる（中野ら 2004）．δ^{13}C は窒素の場合ほど栽培法間に明瞭な差異はみられなかったが，日本産原木栽培品は中国，韓国，ブ

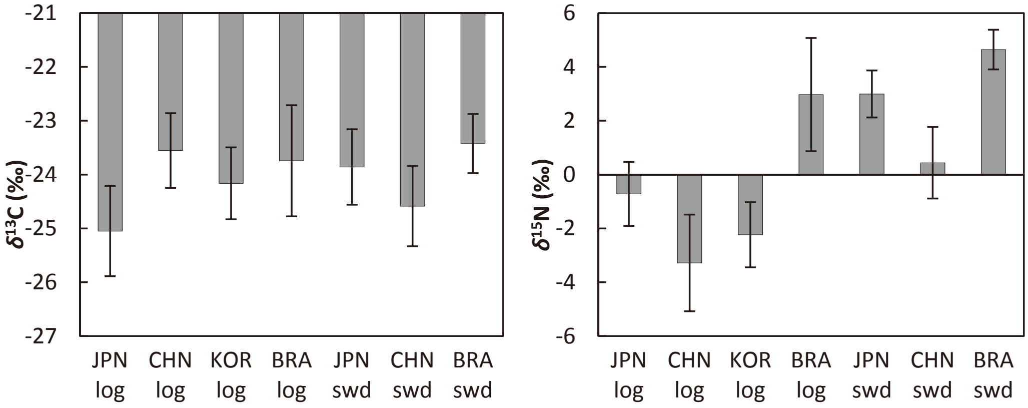

Fig. 1. Comparison of the stable carbon and nitrogen isotope ratios of the cap tissue of dried shiitake produced in various countries.
JPN: Japan, CHN: China, KOR: Korea, BRA: Brazil
Each bar shows mean ± SD
log: log cultivation, swd: sawdust medium cultivation

Statistical comparison among the mean values at 1% significance on Tukey-Kramer method
δ^{13}C JPN log < CHN log, KOR log, BRA log, JPN swd, CHN swd, BRA swd;
CHN log > KOR log, CHN swd; JPN swd > CHN swd; CHN swd < BRA swd
δ^{15}N JPN log > CHN log, KOR log, < BRA log, JPN swd, CHN swd, BRA swd;
CHN log < KOR log, BRA log, JPN swd, CHN swd, BRA swd; KOR log < BRA log, JPN swd, CHN swd, BRA swd; JPN swd > CHN swd; CHN swd < BRA swd

ラジルの原木栽培品および全ての菌床栽培品よりも有意に値が小さいなど，生産国判別に有用であった．

元素の濃度についても，既報（時本ら 2016）と同様に多くの元素で栽培法間あるいは生産国間に差異がみられた．サンプル群間で 1% 水準の有意差がみられた元素について，群毎の平均値と標準偏差を Fig. 2 に示した．たとえば P と Zn 含量は明らかに菌床栽培品が原木栽培品よりも多く，原木栽培品間では Al，Ba，Fe，Mg などが中国産で有意に多かった．ブラジルの原木栽培品は Cu，Mn，P が他国の原木栽培品よりも極めて多い特徴があった．菌床栽培品においてもブラジル産は Mg，Mn，P が多く，Al，Ba，Fe が少ない特徴があった．

⑵ 判別分析

炭素と窒素の安定同位体比と元素濃度のデータを用いて判別分析を行った．2 群の判別分析の例を Table 2 に示す．全ての原木栽培品（日本，中国，韓国，およびブラジル産）と全ての菌床栽培品（日本，中国およびブラジル産）とで分析すると，δ^{15}N と 12 種類の元素濃度値によって両群は 99.4%（341/343）の的中率で判別できた．なお，括弧内の数字は正しく判別されたサンプル数 / 供試サンプル数である（以下同じ）．日本国内の流通量が多い日本産の原木栽培品と中国産の菌床栽培品とでは判別的中率は 100%（185/185）であった．日本産と中国産の原木栽培品同士の判別分析では，9 種類の元素の濃度だけの分析では的中率 95.6%（131/137）であるのに対し，2 つの同位体比（δ^{15}N，δ^{13}C）と 7 種類の元素濃度を組み合わせると的中率は 99.3%（136/137）に向上した．日本国内の流通量が多い日本産原木栽培品，中国産菌床栽培品，および中国産原木栽培品の 3 者が高精度で判別できることから，本手法は充分な実用性を有すると言える．なお，日本産と韓国産の原木栽培品同士でも，元素濃度のみの判別的中率は 84.0%

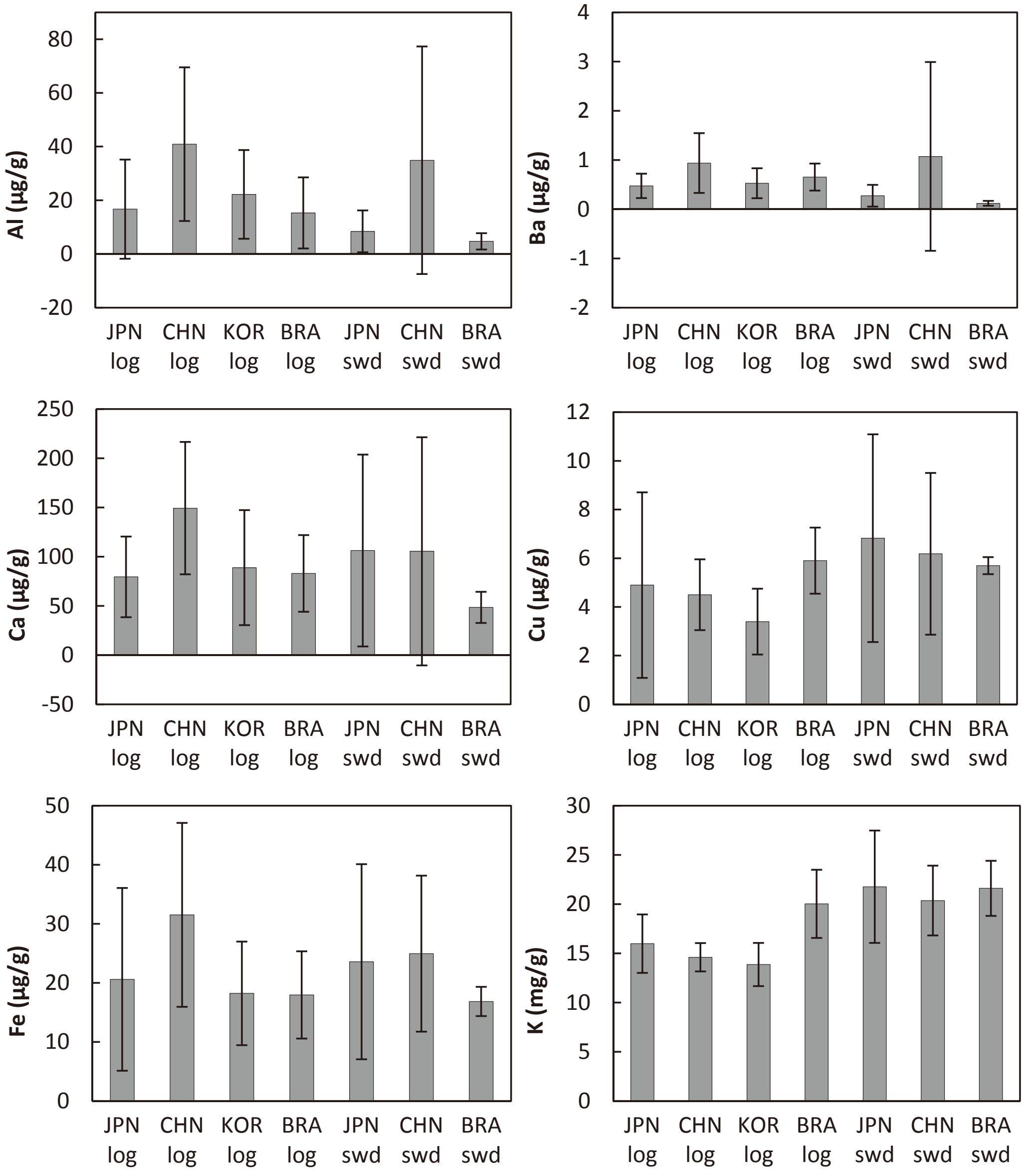

Fig. 2. Comparison of element contents among dried shiitake samples produced in various countries.
See Fig. 1. for abbreviations.
Statistical comparison among the mean values at 1% significance on Tukey-Kramer method

Al	JPN log < CHN log, CHN swd; CHN log > JPN swd; JPN swd < CHN swd
Ba	JPN log < CHN swd; JPN swd < CHN swd
Ca	JPN log < CHN log; CHN log > KOR log
Cu	CHN log < JPN swd; KOR log < JPN swd, CHN swd
Fe	JPN log < CHN log; CHN log > KOR log
K	JPN log < JPN swd, CHN swd, BRA swd; CHN log < JPN swd, CHN swd, BRA swd; KOR log < BRA log, JPN swd, CHN swd, BRA swd

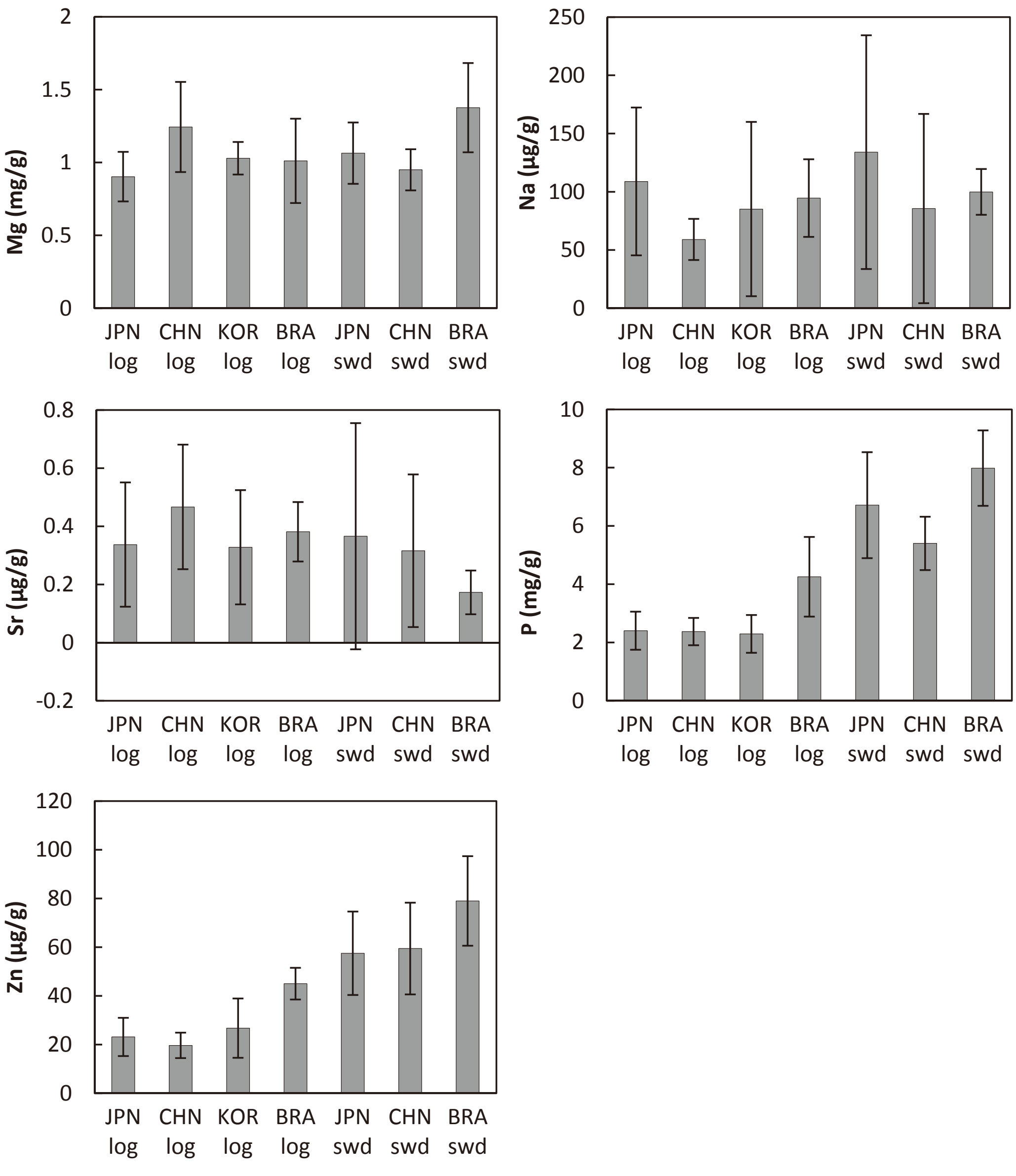

Fig. 2. Continued.

Mg	JPN log < CHN log, JPN swd, BRA swd; CHN log > KOR log, JPN swd, CHN swd; KOR log < BRA swd; JPN swd < BRA swd; CHN swd < BRA swd
Na	JPN log > CHN log; CHN log < JPN swd; JPN swd > CHN swd
P	JPN log < BRA log, JPN swd, CHN swd, BRA swd; CHN log < BRA log, JPN swd, CHN swd, BRA swd; KOR log < BRA log, JPN swd, CHN swd; BRA log < JPN swd, BRA swd; JPN swd > CHN swd; CHN swd < BRA swd
Sr	CHN log > CHN swd
Zn	JPN log < JPN swd, CHN swd, BRA swd; CHN log < BRA log, CHN swd, JPN swd, BRA swd; KOR log < JPN swd, CHN swd, BRAswd; BRA log< BRA swd; JPN swd < BRA swd; CHN swd < BRA swd

Table 2. Discriminant analyses of dried shiitake samples

Combination	Items used for analyses	Hitting ratio, %
Total log : Total sawdust (without Brazil samples)	δ^{15}N, Al, Ba, Ca, Cu, Fe, K, Mg, Mn, Na, P, Sr, Zn	99.4 (341/343)*
Japan log: China sawdust	δ^{13}C, Al, Fe, K, Mg, Na, P, Zn	100 (185/185)
Japan log : China log	Al, Ca, Cd, Cu, Mg, Mn, Na, Sr, Zn	95.6 (131/137)
	δ^{13}C, δ^{15}N, Al, Cd, Cu, Mg, Mn, Na, Sr	99.3 (136/137)
Japan log : Korea log	Al, Cu, K, Mg, Zn	84.0 (100/119)
	δ^{13}C, δ^{15}N, Al, Cu, K, Mg, Zn	85.7 (102/119)
China log : Korea log	δ^{13}C, δ^{15}N, Al, Ca, Cu, Mg, Mn, Na, Zn	96.4 (106/110)
Japan sawdust : China sawdust	δ^{13}C, δ^{15}N, Al, Ca, Fe, K, Na, Sr, Zn	100 (159/159)
Japan log: Brazil log	δ^{13}C, δ^{15}N	93.7 (74/79)
	δ^{13}C, δ^{15}N, Ca, Cd, Mn, P, Zn	100 (79/79)
China sawdust: Brazil sawdust	δ^{13}C, δ^{15}N, Cu, Fe, K, Mg, P, Zn	100 (118/118)
Korea log: Brazil log	δ^{13}C, δ^{15}N, Al, K, Mg, Na, Sr, Zn	100 (50/50)

log: log cultivation, sawdust: sawdust based medium cultivation
*In parentheses: the numbers of hitting sample /tested sample

（100/119）であるが，元素濃度と安定同位体比とを組み合わせると的中率は 85.7%（102/119）に上昇した．

ブラジル産はサンプル数が少ないので同列の比較はできないが，日本産や中国産など東アジアのシイタケと明瞭に区別された．たとえば，日本産原木栽培品とブラジル産の原木栽培品との判別的中率は 100%（79/79）であり，中国産とブラジル産の菌床栽培品同士でも 100%（118/118）の的中率であった．なお，ブラジル産と東アジア産との判別には炭素と窒素の安定同位体比が大きく貢献しており，δ^{15}N と δ^{13}C だけで日本産とブラジル産の原木栽培品同士を 93.7%（74/79）の的中率で判別できた．

日本国内の流通量の大部分を占める日本産原木栽培品，中国産菌床栽培品および中国産原木栽培品の 3 群で判別分析を行ったのが Fig. 3 である．日本産原木栽培品は中国産と明瞭に分かれ，全体の判別的中率は 98.8%（247/250）であった．一方，ブラジル産は 3 群判別分析でも日本産や中国産と明確に区分でき，たとえば日本産原木栽培品，ブラジル産の原木および菌床栽培品の 3 群分析の判

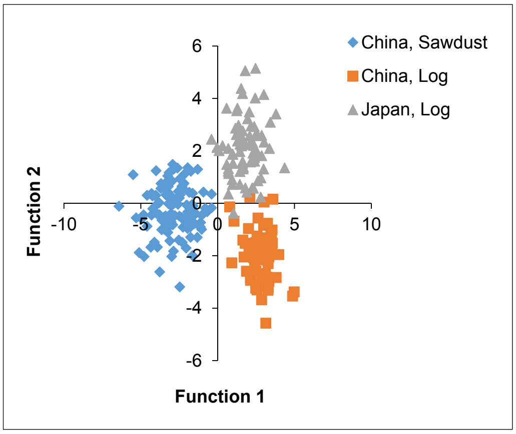

Fig. 3. Scattering graph in three shiitake groups after a discriminant analysis.
Items used for analysis: δ^{13}C, Al, Ca, Cu, Fe, K, Mg, Mn, Na, P, Sr, Zn
Hitting ratio = 98.8% (247/250). See Fig. 1 for abbreviations.

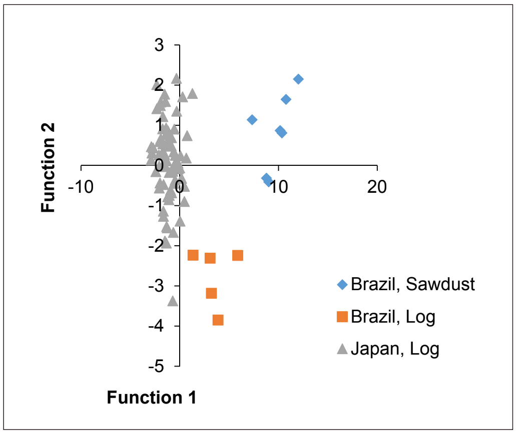

Fig. 4. Scattering graph in three shiitake groups after a discriminant analysis.
Items used for analysis: δ^{13}C, δ^{15}N, Ba, Cu, K, Mn, P, Zn
Hitting ratio = 100%（86/86）. See Fig. 1 for abbreviations.

別的中率は 100%（86/86）であった（Fig. 4）.

高精度の乾シイタケの原産国判別法としては別途報告している重元素の同位体比と微量元素による手法をあげることができる（時本ら 2009，時本 2011，2013）．しかし，本報告で提示した炭素，窒素の安定同位体比と微量元素による手法はサンプル量が僅かで済むうえ，判別精度は重元素同位体比を用いる手法に肉薄する．分析装置も比較的広く流通しており，実用性は高いと考えられる．

摘　要

日本産，中国産，韓国産およびブラジル産の原木栽培乾シイタケと菌床栽培乾シイタケを供試した．炭素と窒素の安定同位体比分析と元素濃度分析とを組み合わせることで原木栽培および菌床栽培シイタケの生産国を高精度判別する手法を提示することができ，分析に要する各サンプルの量は 200 mg 以下であった．たとえば，日本産の原木栽培品は中国産の原木栽培品とは 99.3%（136/137），中国産の菌床栽培品とは 100%（185/185）の的中率で判別できた．また，ブラジル産のシイタケは日本産，中国産および韓国産と明確に区分された．

引 用 文 献

臼井祐一・塚田政範・藤原　守・津村明宏・諸橋保・時本景亮．2003．日本産乾しいたけと中国産乾しいたけ判別法の検討．農林水産消費技術センター調査研究報告 **27**: 45–54.

奥崎政美．2001．食品の鑑別的研究―化学的成分組成の多変量解析によるキノコ類の原産地および栽培法の判別について―．女子栄養大栄養科学研報 **9**: 173–207.

門倉雅史・臼井祐一・有山　薫．2006．無機元素分析による乾シイタケの原料産地および栽培方法の判別．日食工 **53**: 489–497.

小島　功．1992．マイクロ波加熱による固体試料の酸分解．ぶんせき **1992**（1）: 14–19.

鈴木彌生子・中下留美子・Noemia Kazue Ishikawa・田淵諒子・作野えみ・時本景亮．2015．炭素・窒素・酸素安定同位体比分析による原木栽培及び菌床栽培乾シイタケの原産地比較．分析化学 **64**: 859–866.

高岡八郎．2000．乾シイタケ流通の問題点と改革方向．菌蕈 **46**（5）: 28–33.

時本景亮．2002．日本産シイタケと中国産シイタケとを判別する手法の開発．菌蕈 **48**（6）: 10–14.

時本景亮．2005．原産地判別「シイタケ」，食品鑑定技術ハンドブック p49–54，サイエンスフォーラム．

時本景亮．2011.「ストロンチウム同位体比を用いる乾シイタケの原産国判別法」の開発を終えて．菌蕈 **57**（5）: 16–22.

時本景亮．2013．乾シイタケの原産国判別法の開発経過と現状について．特産情報 **34**（9）: 42–44.

時本景亮・大平郁男・片田直伸．2000．乾燥椎茸判別方法．特願 2000-302260.

時本景亮・越谷　博・川﨑　晃・平田岳史．2009．重元素同位体比を用いるシイタケの原産地判別技術について．第５７回質量分析総合討論会講要集，P.432–433.

時本景亮・田淵諒子・作野えみ・越谷　博．2016．原木および菌床栽培乾シイタケの解剖学的，理的および化学的性質の比較．菌蕈研報 **46**: 12–22.

中野明正・馬場崎勝彦・上原洋一. 2004. 栽培条件の異なるコーンコブおよびフスマの添加がシイタケの δ^{15}N 値および δ^{13}C 値に与える影響とそれらの値のシイタケ栽培方法判別技術としての有効性の検討. 日本きのこ学会誌 **12**: 165−170.

林野庁 2016. 27 年特用林産基礎資料. 林野庁経営課特用林産対策室. http://www.e-stat.go.jp/SG1/estat/List.do?lid=000001172683（2017 年 2 月 20 日確認）

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日本におけるオオキイロイグチ（***Buchwaldoboletus sphaerocephalus***）の発生と分布*

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The occurrence and distribution of *Buchwaldoboletus sphaerocephalus* in Japan

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Abstract

Documented records of *Buchwaldoboletus sphaerocephalus* from Japan are presented based on collections made in 7 different localities in mainland Honshu and Shikoku. In Japan, it has been found on dead trunks, stumps, and roots of *Pinus densiflora* and *P. thunbergii,* and fruits from summer to fall（July to October）. Morphologically and ecologically distinctive features of this species are also well represented in the Japanese populations, namely: the lignicolous habit（on pine wood）; the basidiocarps entirely colored lemon yellow to yellow at least when young ; the context and tubes slightly changing to blue when injured ; and the relatively small fusiform-elliptical basidiospores measuring 5−8 × 3−4 μm. The Japanese populations appear to be more closely related to the European populations than the North American populations because the taste is mildly acidulous but not bitter, and the pileus color does not fade or become pallid over time. A Japanese description, color images of the basidiocarps, and line drawings of microstructures are provided for these Japanese collecrtions as well as a map showing known localities of the species in Japan.

Key words: biogeography, boletes, lignicolous fungi, *Pinus, Pulveroboletus*.

ザイモクイグチ属 *Buchwaldoboletus* Pilát（Pilát, 1969）は *Boletus lignicola* Kallenb. を基準種として創設された担子菌門イグチ目イグチ科の 1 属で（Kirk et al., 2008）, 1）子実体を材や木屑上に形成する腐生的な生態をもつこと，2）子実体は被膜を欠き、傘や柄は全体的に黄色あるいは褐色（帯褐橙色～明褐色あるいは赤褐色）を帯びること，3）管孔は短く，少なくとも幼時において柄に垂

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Figs. 1 and 2. Basidiocarps of *Buchwaldoboletus sphaerocephalus*. TMI-24586. Fig. 1. TMI-24586 in a young stage on *Pinus densiflora* trunk. Photo by M. Nabe, 15 July 2001. Fig. 2. TMI-24586 in a mature stage. Photo by M. Nabe, 17 July 2001.

生し，初め黄色のち緑色～オリーブ色を帯びること，5）肉および管孔は傷時通常弱い青変性をもつこと，6）柄基部の菌糸体は黄色であること，7）胞子は楕円形～卵形で，小形（通常長さは 9 μm 以下）であること，8）菌糸はクランプを欠くことなどを主要な特徴とする（Watling, 2008; Ortiz and Both, 2011）．本属は，イグチ科 (広義）の分類体系として従来世界的に広く採用されてきた Singer（1975, 1986）の体系においてキイロイグチ属 *Pulveroboletus* Murrill の異名として取り扱われたため（基準種 *B. lignicola* は *P. lignicoloa* (Kallenb.）Pilát として同属の Sulphurei 節に置か

れた)，比較的最近まで独立した属とは認められて来なかった．しかし，近年のDNA塩基配列データの解析に基づく分子系統学的研究によって，Singerの属概念に基づくキイロイグチ属は系統的に異質な菌群を含むことが次第に明らかになり，ザイモクイグチ属は分子系統学的にも独立した属として認められるようになってきている（Nuhn et al., 2013; Wu et al., 2014; Wu et al., 2016）.

著者の一人名部は2001年の7月～8月，神戸市内において，切り倒された太いアカマツの幹上に中型で全体が黄色のイグチ類の1種（Figs. 1-3）が塊状に発生しているのを認めたが，同菌はその色の他に，傘の肉が著しく厚いのに対して管孔が短い点、傷時における肉および管孔の青変性が弱い点などで特徴的であった．この時採集された標本は直ぐに新鮮な状態で長澤のもとに送られ，形態的特徴の観察および文献調査の結果，北アメリカにおいて *Boletus sphaerocephalus* Barla（Smith and Thiers, 1971；Both, 1993; Bessette et al., 2000）の学名で，また，ヨーロッパではしばしば *Pulveroboletus hemichrysus*（Berk. & M. A. Curtis）Singer（Singer, 1967）あるいは *Buchwaldob. hemichrysus*（Berk. & M. A. Curtis）Pilát（Dermek, 1979; Basezzi and Bottaro, 1999）の学名で知られていた種，即ち *Buchwaldob. sphaerocephalus*（Barla）Watling & T. H. Li と同定された．同種の発生は神戸市内の観察地では翌年の8月にも前年と同じ倒木上で観察されたが, 2003年以降は認められなかった. 筆者らはその後，同種が兵庫県をはじめ，京都府，三重県，愛知県，新潟県，および四国の愛媛県などにおいて，やはりマツ類（アカマツおよびクロマツ）の材上に発生するのを確認している．日本における *Buchbaldob. sphaerocephalus* の発生は，2010年に愛媛県で行われた日本菌学会菌類観察会の採集標本目録（細矢ら 2011）および同観察会の標本に基づく小林（2011）の報告によって既に公表されているが，日本産標本の形態的特徴，同種の国内における分布および生態については未だ十分に知られていないのでここに報告する．

記載中の色はマンセル値（GE企画センター企画編集部 1990）によった．調査標本は（一財）日本きのこセンター菌蕈研究所（TMI），国立科学博物館（TNS）および筆者の一人，名部光男の個人標本庫（HN）に保存されている．

Buchwaldoboletus sphaerocephalus（Barla）Watling & T. H. Li, Edinb. J. Bot. 61: 46. 2004.

≡ *Boletus sphaerocephalus* Barla, Champ. Prov. Nice Tab. 36. 1859.

= *Boletus sulphureus* Fr., Epicr. syst. mycol.（Upsaliae）: 413. 1838 [1836-1838], non Bull., Herb. Fr.（Paris）**9**: tab. 429. 1789.

Refer to Species Fungorum（http://www.speciesfungorum.org/）for other synonymy.

Misapplied names:. *Boletus hemichrysus*（≡ *Phlebopus hemichrysus*; *Pulveroboletus hemichrysus*）s. Singer et auct. eur. plur.（non Berk and M. A. Curtis, 1853）.

傘は径30−130 mm，最初亜球形，のち饅頭形から中高の平らに開く．縁は長く内に巻き膜状に少し突出する．表面は湿時やや粘性があり，淡黄色（6.7Y8.7/4.6, 7.3Y8.5/8.2）ないし黄色（7.6Y8.4/13.9），老成すると褐色（3.6YR4.3/8.8, 9.7R4.5/6.9）のしみを生じ，ややフエルト状ないし平滑，肉は厚くて硬くしまり，傘中央部では20 mmに達するが、縁に向かって急激に薄くなり，傘より淡色，切断しても変色しないか，局部的にあるいは管孔上部において弱い青変性（灰青色～灰緑色）を示す．虫による食害部は褐変（3.6YR4.3/8.8, 9.7R4.5/6.9）する．においは穏和でやや芳香があり，味は穏和で子実体によってはわずかに甘みあるいは酸味がある．管孔は垂生あるいは垂下歯を有してほぼ直生，ときに柄の周囲でやや陥入する．色は淡黄白色～黄色（5.2Y8.8/2.2, 6.3Y8.7/3.5），のち淡灰緑色，空気に触れると青変する．孔口は多少角形で不規則，管孔と同色あるいはときに褐色を帯びる［帯褐黄色（1.4Y6.2/9.9）ないし帯橙褐色（2.8YR5.3/11.9）]，傷つくと速やかに青変するが，ときにほとんど青変しない．青変した部分はのち退色してゆっくり帯褐色となる．柄は30−68 × 10−30 mm，しばしば下部に向かってやや太まり，中実，傘と同色で網目を欠き，ほぼ平滑，老成したものではしばしば下部において褐色（3.6YR4.3/8.8, 9.7R4.5/6.9）のしみが見られる．柄の肉は幼時表面と同色、成熟したものでは内部に向かって淡黄白色となりと

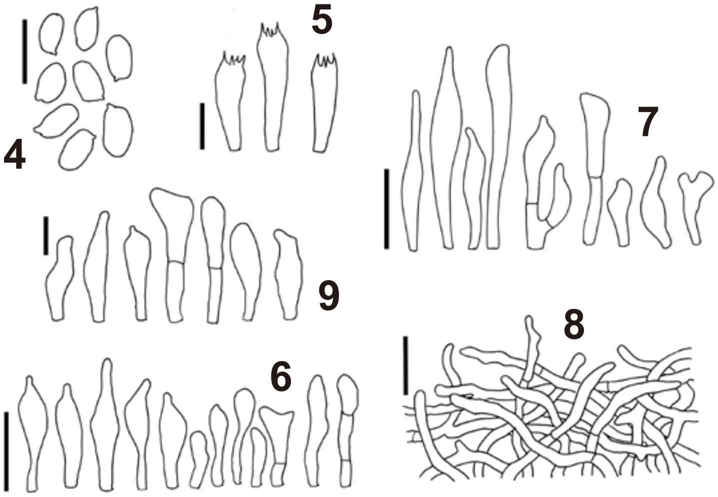

Fig. 3. Sectioned basidiocarps of *Buchwaldoboletus sphaerocephalus*. TMI-37386. Note that some sections show slight discoloration of the tubes and the context to greenish blue. Scale bar: 20 mm. Figs. 4-9. Microstructures of *Buchwaldoboletus sphaerocephalus*. Fig. 4. Basidiospores. TMI-37386. Fig. 5. Basidia. TMI-24586. Fig. 6. Cheilocystidia. Left five from TNS-F-80305 and the others from TMI-37386. Fig. 7. Pleurocystidia. Right three from TNS-F-80305 and the others from TMI-37386. Fig. 8. Part of the pileipellis. TMI-37386. Fig. 9. Caulocystidia. Left three from TMI 24586 and the others from TNS-F-80303. Scale bars: 2 cm for fig.3; 10μm for Figs. 4, 5 and, 9 ; 20μm for Figs. 6 and 7; 30μm for Fig. 8.

きにほぼ白色、傷時傘と同様に弱い青変性を示すか、変色しない（特に幼時）.

担子胞子は（4.5−）5−8 × 3−4 μm（測定数 100, 長さ / 幅平均値 1.85）, 紡錘状楕円形, 平滑, 淡黄色, やや厚壁, 水酸化カリウム水溶液中で黄変する. 担子器は 16−24 × 5−6.5 μm, こん棒形, 4胞子をつける, クランプはない. 縁シスチジアは多生し 11−44 × 4−10 μm, 類棍棒形, 紡錘形〜便腹形, 頂部が伸長した類紡錘形, 薄壁. 側シスチジアは散生し, 11−53 × 3.5−9 μm, 類棍棒形, 紡錘形〜頂部が細長く伸長した類紡錘形, 薄壁. 傘の表皮は錯綜してしばしば立ち上がる菌糸からなる. 菌糸は径 2.5−6 μm, しばしば分岐し, 黄色の色素を含み, また菌糸の表面には黄色の色素が沈着する. 柄シスチジアは群生し, 15−37 × 4.5−11μm, 類棍棒形, 類円柱形, 紡錘形で先端が突起状のものをまじえる, 表面には黄色の色素が凝着し細胞内部に黄色い色素をもつものもある.

Specimens examined: HYOGO Pref., Kobe-shi, Futatabi Park, cespitose on thick logs of *Pinus densiflora* Siebold et Zucc., 17 July 2001, Mitsuo Nabe（TMI-24586; EN01-80）; ditto, 1 Aug. 2001, M. Nabe（TMI-24593; EN01-84）; ditto, 30 Aug. 2001（TMI-24600; EN01-90）; ditto, 18 Aug. 2002, M. Nabe（TNS-F-80306）; Minamiawaji-shi, Matsuhokeino, solitary at the foot of stump of *P. thunbergii* Parl., 14 July 2009, M. Nabe（TNS-F-80303）. KYOTO pref., Jyoyo-shi, Terada, cespitose on stump of *P. densiflora*, 10 July 2009, Yoji Tanaka（TNS-F-80302）. AICHI Pref., Toyota-shi, Nishiyamanaka-cho, on *P. densiflora*, 3 Oct. 2010, at the Toyota-tomono-kai foray（TNS-F-80304）. EHIME pref., Niihama-shi, Funaki（Shimin-no-mori）, on *Pinus densiflora*, 10 Oct. 2010, collector unknown（TMI-37384）; Imabari-shi, Sakurai（Tsunashiki-Tenmangu）scattered on stump of *P. thunbergii*, 10 Oct. 2010, Kentaro Hosaka（TMI-37385, 37386）; ditto, on roots of *P. thunbergii* stump, 29 Oct. 2010, Hisashi Ogawa（TNS-F-80305）. NIIGATA Pref., Shibata-shi, Ijimino, solitary on stump of *P. densiflora*, 8 Oct. 2012, Noriyuki Matsumoto（HN-NS-121008 in private herbarium of M. Nabe）. MIE Pref., Tsu-shi, Karasu-cho, scattered on stump of *P. thunbergii*, 10 Sept. 2016, Masahito Taniguchi（HN-MT-160910）.

ザイモクイグチ属は世界的に広く分布するが, 種類数は少なく, 現在までに 13 種が知られているに過ぎない（Ortiz and Both, 2011; Index Fungorum, http://www.indexfungorum.org/ accessed May 31, 2017）. 日本からは今までにザイモクイグチ *Buchwaldob. pseudolignicola*（Neda）Both & B. Ortiz（Neda et al., 1987：*P. pseudolignicola* Nerda として）, コツブノイロガワリ *Buchwaldob. xylophilous*（Petch）Both & B. Ortiz（青木, 1990：*P. xylophilous*（Petch）Singer として）および *Buchwaldob. sphaerocephalus*（Barla）Watling & T. H. Li（小林 , 2011; 細矢ら , 2011；名部・長澤, 本報告）の 3 種が知られているが, 著者の一人長澤は北海道で採集された標本に基づいて本属の基準種である *Buchwaldob. lignicola*（Kallenb.）Pilát が同地に発生することを確認している (長澤・村上未発表). 青木実氏は日本きのこ図版 No.2031 において（青木, 1995）, 同氏が 1942 年 9 月 10 日に滋賀県彦根市の自宅庭において杉の切り株の根元に塊状に発生しているのを観察したイグチ類の 1 種を, オオキイロイグチ（仮称）*Pulveroboletus* sp. として記録している. 標本は残されていないが, 記録された子実体の肉眼的特徴および塊状に発生する特異な発生形態から同菌は *Buchwaldob. sphaerocephalus* であると考えられる. 従って, 青木氏の命名によるオオキイロイグチを本種の和名として用いることを提唱したい.

オオキイロイグチに類似した日本産の既知種としてはキイロイグチ *Pulveroboletus ravenelii*（Berk. & M. A. Curtis）Murrill., ザイモクイグチ *Buchwaldob. pseudolignicola*, およびコツブノイロガワリ *Buchbaldob. xylophilus* があるが, キイロイグチ（今関・本郷, 1989）は子実体が地上生で粉質な被膜を有し胞子がより大形な点で, ザイモクイグチ（Neda et al. 1987）およびコツブノイロガワリ（Corner, 1970; Ortiz and Both, 2011）はマツの材上に発生する点で共通性があるが, 共に傘の色が幼時から一様に橙黄色あるいは褐色を呈する点, また胞子が卵形〜短楕円形でより小さい縦横比をもつ点でそれぞれ本種と区別できる.

本種はヨーロッパおよび北アメリカに分布し,

Fig. 10. Known distribution of *Buchwaldoboletus sphaerocephalus* in Japan. 1 Kobe-shi, Hyogo. 2 Joyo-shi, Kyoto. 3 Minamiawaji-shi, Hyogo. 4 Toyota-shi, Aichi. 5 Imabari-shi and Niihama-shi, Ehime. 6 Shibata-shi, Niigata. 7 Tsu-shi, Mie.

針葉樹の切り株や樹幹および鋸屑に発生することが知られている（Barla, 1859; Both, 1993; Bessette et al., 2000; Watling, 2004; Watling and Hills, 2005; Knudsen and Vesterholt, 2008, 2012; Ortiz and Both, 2011）．本種と同じくヨーロッパおよび北アメリカに分布するザイモクイグチ属の種では *Buchbaldob. lignicola*（ヨーロッパおよび北アメリカ）と *Buchwaldob. hemichrysus*（Berk. & M. A. Curtis）Pilát（≡ *Boletus hemichrysus* Berk. & M. A. Curtis; *Pulveroboletus hemichrysus*（Berk. & M. A. Curtis）Singer）（北アメリカ）が知られているが，前者は傘および柄が全体的に黄褐色～赤褐色を帯び，また，傘表面が軟らかい綿毛状でしばしば細鱗片状にひび割れること，また，しばしばカイメンタケ［*Phaeolus schweinitzii*（Fr.）Pat.］と相伴って発生することなどの点で本種と異なり（Bessette et al. 2000; Muñoz 2005; Watling and Hills 2005; Knudsen and Vesterholt 2008），後者は傘が鮮やかな黄金色～橙黄色を呈し黄色い粉質物におおわれる点と孔口および柄が赤味を帯びる点で本種と異なる（Berkeley and Curtis, 1853; Weber and Smith, 1985; Both, 1993; Bessette et al., 2000）．本種を *Buchbaldob. hemichrysus* と同一種とみなす考えもあるが（Singer, 1967, 1986; Muñoz 2005），筆者らは両者を別種として取り扱う Both（1993），Bessette et al.（2000），Watling（2004），Watling and Hills（2005）および Ortiz and Both（2011）を支持する．

本種は夏から秋にマツ属の切り株や根，切り倒された樹幹に発生し，ときに基質の表皮下に黄色い菌糸塊を形成して多数の子実体が叢生する．筆者らが観察した子実体では基部が一体化したり，柄の途中から別の子実体が枝のように成長するなど特異な形状のものも見られた．Smith and Thiers

（1975）および Bessette et al.（2000）によれば，北アメリカ産の *Buchbaldob. sphaerocephalus* には特徴的な味はなくいくぶん苦いとされ，Watling and Hills（2005）は英国産のものについてわずかに酸味があると記述しているが，筆者らの観察によると日本産の標本では苦味はなく味は穏和で，ときにわずかな酸味のほか甘味が感じられた．またヨーロッパ産の *Buchbaldob. sphaerocephalus* は，手で触れたり老成するとさび色を帯びるあるいはさび色のしみを生じるのみで退色することはないが（Watling and Hills, 2005; Knudsen and Vesterholt, 2008），北アメリカ産の菌では老成すると子実体の傘表面の色が退色して淡黄色ないし類白色になるという（Both 1993; Bessette et al. 2000; Smith and Thiers, 1975）．日本産の *Buchbaldob. sphaerocephalus* は北アメリカ産の菌と異なり老成しても子実体の傘表面の色が退色することはなく，ヨーロッパ産の菌と同様に老成すると徐々に赤褐色を帯びる．

本種の日本産標本が得られた発生地を白地図に示した（Fig. 8）．四国および本州の広い範囲に分布しており，クロマツとアカマツが分布する九州地方やアカマツが分布する北海道西南部（林，1985）でも本種の発生の可能性が考えられる．

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摘　要

北アメリカおよびヨーロッパに分布することが知られている *Buchwaldoboletus sphaerocephalus* の兵庫県を含む 1 府 5 県（京都府，三重県，愛知県，新潟県，および愛媛県）における発生を形態的特徴の記載、子実体の写真および顕微鏡的特徴の線画、日本における分布図を伴って報告し，和名としてオオキイロイグチを提案した．

引 用 文 献

青木　実 . 1995. 日本きのこ図版 No.2031. オオキイロイグチ．In: 名部みち代（編），日本きのこ図版　第 **5** 巻, p. 119. 日本きのこ同好会 2, 神戸 .

Basezzi, B. and Bottaro, R. 1999. Un fungo raro presente sul carso triesno *Buchwaldoboletus hemichrysus*（Berk. & Curt.）Pilát. Revista di Mycol. **42**（2）: 155–161.

Barla, J. B. 1859. Les Champignons de la Province de Nice et principalement les espécies comestibles, suspectes ou vénéneuses. XXX, Nice, Tab 36.

Berkeley, M. J. and Curtis, M. A. 1853. Centuries of North American Fungi. Ann.Mag.nat.Hist., Ser. 2, 429.

Bessette, A. E., Roody, W. C, Bessette, A. R. 2000. North American boletes, A color guide to the fleshy pored mushrooms. Syracuse University Press, Syracuse. 396 p.

Both, E. E. 1993. The boletes of North America. A compendium. Buffalo Museum of Science, Buffalo. 436 p.

Corner, E. J. H. 1972. The Boletus in Malaysia. Government Printing Office, Singapore. 263 p.

Dermek. A. 1979. Fungorum rariorum icons coloratae. Pars IX. Cramer, Vaduz. 34 p.

GE 企画センター企画編集部 . 1990. New Century Colors 1440 新色彩辞典. GE 企画センター, 東京 . 154 p.

林　弥栄 . 1985. 日本の樹木．山と溪谷社，東京．751 p.

細矢　剛・保坂健太郎・藤岡佳代子・前川二太郎・長澤栄史 . 2011. 2010 年度日本菌学会菌類観察会目録．日本菌学会ニュースレター **2011-2**: 8–10.

今関六也・本郷次雄 . 1989. 原色日本新菌類図鑑（Ⅱ）．保育社，大阪．315 p.

Kirk, P. M., Cannon, P. F., Minter, D. W. and Stalpers, J. A. 2008. Ainsworth and Bisby's Dictionary of the Fungi, 10th ed. CAB International, Wallingford. 771 p.

Knudsen, H. and Vesterholt, J. 2012. Funga Nordica: Agaricoid, boletoid cyphelloid, and gastroid genera, Nordsvamp, Copenhagen. 965 p.

小林真吾 . 2011. 愛媛県における *Buchwaldboletus sphaerocephalus*（Barla）Watling & T. H. Li の分布記録. 愛媛県総合科学博物館研究報告 **16**: 121–123.

Muñoz, J.A. 2005. *Boletus* s.l. Fungi Europaei 2. Edizioni Candusso, Allasio. 952 p.

Neda, H., Yokoyama, T., Furukawa, H. 1987. A new lignicolous *Pulveroboletus* from Japan. Trans. Mycol. Soc. Japan **28**: 319–324.

Nuhn, M.E., Binder, M., Taylor, A.F.S., Halling, R.E., Hibbett, D.S. 2013. Phylogenetic overview of the Boletineae. Fungal Biol. **117**: 479–511.

Ortiz, B. and Both, E. E. 2011. A Preliminary survey of the genus *Buchwaldoboletus*, Bull. Buffalo Soc. Nat. Sci. **40**: 1–14

Pilát, A. 1969. *Buchwaldoboletus* genus novum Boletacearum, Friesia **9**: 217–218.

Singer, R. 1967. Die Röhrlinge. Teil II. Die Boletoideae und Strobilomycetaceae. Verlag Julius KLinkhardt, Bad Heilbrunn Obb. 151 p.

Singer, R. 1975. The Agaricales in modern taxonomy, 3rd ed. J. Cramer, Vaduz. 912 p.

Singer, R. 1986. The Agaricales in modern taxonomy, 4th ed. Koeltz Scientific Books, Koenigstein. 981 p.

Smith, A. H. and Thiers, H. D. 1971. The boletes of Michigan. The University of Michigan Press, Ann Abor. 428 p.

Watling, R. 2004. New combination in Boletaceae and Gomphidiaceae（Boletales）. Edinb. J. Bot. **61**（1): 41–47

Watling, R. 2008. A manual and source book on the boletes and their allies. Synopsis Fungorum 24. Fungiflora, Oslo. 248 p.

Watling, R. and Hills, A. E. 2005. British Fungus Flora Part 1. Boletes and their allies, Revised and enlarged edition. Royal Botanic Gardens Edinburgh, Edinburgh. 172 p.

Weber, N. S. and Smith, A. H. 1985. A field guide to southern mushrooms, The University of Michigan Press, Michigan. 280 p.

Wu, G., Feng, B., Xu, J., Zhu, X.T., Li, Y.C., Zeng, N.K., Hosen, M.I., Yang, Z.L. 2014. Molecular phylogenetic analyses redefine seven major clades and reveal 22 new generic clades in the fungal family Boletaceae. Fungal Diversity **69**: 93–115.

Wu, G., Li, Y.C., Zhu, X.T., Zhao, K., Han, L.H., Cui, Y.Y., Li, F., Xu, J.P., and Yang, Z.L. 2016. One hundred noteworthy boletes from China. Fungal Diversity **81**: 25–188. Doi: 10.1007/s13225-016-0375-8.

A list of papers published in the issues No. 1（1961）to No. 10（1973）of the Reports of the Tottori Mycological Institute.

（Back issues and reprints may be available on request.）

No. 1（Nov. 1961）

Hashioka, Y., Komatsu, M. and Arita, I.: *Trichoderma viride*, as an antagonist of the wood-inhabiting Hymenomycetes. I. Ecology and physiology of *Trichoderma* occurring on the log-wood of *Lentinus edodes*. Pp. 1−8.

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Takemaru, T.: Genetical studies on fungi, IX. The mating system in *Lentinus edodes*（Berk.）Sing. Pp. 61−68. In Japanese with English abstract.

Hashioka, Y., Komatsu, M. and Arita, I.: Morphological and physiologica1 characters of hybrid fruit-bodies in *Lentinus edodes*. Pp. 69−84. In Japanese.

Matsumoto, Y. and Watanabe, A.: On the variation of temperature of inner part of bed-log of *Lentinus edodes* by direct sunlight. Pp. 85−91. In Japanese.

Matsumoto, Y. and Nishio, Y.: On the variation of temperature and humidity at different height above the ground in bed-log nursery of *Lentinus edodes* under artificial shade. Pp. 92−94. In Japanese.

No.2（Dec. 1962）

Arita, I. and Takemaru, T.: Some problems on the mating system of *Pholiota nameko*（T. Ito）S. Ito et Imai. Pp.1−10. In Japanese with English abstract.

Kimura, K. and Kadoya, K.: Studies on abnormal fruit-bodies of the hymenomycetous fungi. II. Trikaryotic fruit-bodies of *Coprinus macrorhizus* f. *microsporus*. Pp.11−22. In Japanese with English abstract.

Matsumoto, Y. and Takita, H.: On the autumnal artificial multiplication of Shiitake in the heavy snow-fall regions. Pp.23−26. In Japanese.

Kawai, A.: On the relation between the drying speed and the shrinkage during the drying of fruit-bodies of *Lentinus edodes*（Berk.）Sing. Pp.27−30. In Japanese.

Hashioka, Y.: Cultures of *Volvaria*-mushroom in Thailand. Pp.31−37. In Japanese.

Takemaru, T.: The genetics of mating system in the mushroom-a review. Pp.39−52. In Japanese.

No.3（Dec. 1963）

Kimura, K.: Studies on the BULLER phenomenon by making use of a gene marker. I. Incompatible di-mon matings. Pp.1−5. In Japanese with English abstract.

Komatsu, M.: Morphogenesis of gill and sporulation in *Lentinus edodes*（Berk.）Sing., with special reference to those influenced by light and temperature

conditions. Pp.6−17. In Japanese with English abstract.

Arita, I.: A preliminary assay for the residual effect of the different organic fungicidal substances against *Trichoderma viride*, the major enemy in Shiitake-mushroom cultivation. Pp.19−24. In Japanese.

Matsumoto, Y. and Takita, H.: Field trials on the fungicidal protection of bed-logs from the invading fungi injurious to Shiitake-mushroom. Pp.25−42. In Japanese.

No.4（Dec. 1964）

Hashioka, Y. and Komatsu, M.: *Trichoderma viride*, as an antagonist of the wood-inhabiting Hymenomycetes. III. Species of *Hypocrea* occurring on log-woods of *Lentinus edodes*. Pp.1−5.

Komatsu, M. and Hashioka, Y.: *Trichoderma viride*, as an antagonist of the wood- inhabiting Hymenomycetes. IV. Physiological properties of the different forms of *Trichoderma* derived from the different *Hypocrea* species and soil. Pp.6−10.

Komatsu, M. and Hashioka, Y.: *Trichoderma viride*, as an antagonist of the wood-inhabiting Hymenomycetes. V. Lethal effect of the different *Trichoderma* forms on *Lentinus edodes* inside log-woods. Pp.11−20.

Komatsu, M. and Kimura, K.: Studies on abnormal fruit-bodies of the hymenomycetous fungi. III. Fruit-bodies with brownish gills of *Lentinus edodes*（Berk.）Sing. Pp.21−28. In Japanese with English abstract.

Komatsu, M. and Kimura, K.: Studies on abnormal fruit-bodies of the hymenomycetous fungi. IV. Sterile fruit-bodies of *Lentinus edodes*（Berk.）Sing. Pp.29−36. In Japanese with English abstract.

Takemaru, T.: Monokaryotization studies in the Basidiomycetes. I. Chemical induction. Pp.37−40. In Japanese with English abstract.

Takemaru, T.: Monokaryotization studies in the Basidiomycetes. II. Neohaplonts induced by oxgall treatment. Pp.41−43. In Japanese with English abstract.

Arita, I.: Dedikaryotization of dikaryotic mycelia in *Pholiota nameko*. I. Pp.44−51. In Japanese with English abstract.

Takita, H.: Propogation of the injurious fungi of *Lentinus edodes*-bedlogs on soil. I. Growth of the injurious fungi on the agar media and steamed soil. Pp.53−57. In Japanese with English abstract.

No.5（Dec. 1966）

Komatsu, M. and Hashioka, Y.: *Trichoderma viride*, as an antagonist of the wood- inhabiting Hymenomycetes. VI. *Pachybasium* strains and their antibiosis to *Lentinus edodes*. Pp.1−11.

Komatsu, M. and Hashioka, Y.: Mycogenous decays of the arboricolous mushrooms. I. Pp.12−17.

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Kimura, K. and Mitsuishi, T.: Studies on the BULLRE phenomenon by making use of a gene marker. II. Doubly compatible di-mon matings. Pp.25−36. In Japanese with English abstract.

Arita, I. and Sakamoto, M.: The mating system in some Hymenomycetes. I. The mating system in *Tyromyces albellus* and *Panus rudis*. Pp.37−41. In Japanese with English abstract.

Aoshima, K. and Kobayashi, T.: Notes on *Tyromyces albellus*（Peck）Bond. et Sing. and *Spongiporus lacteus*（Fr.）Aoshima, comb. nov. Pp.42−50. In Japanese.

Kawai, A.: Ventilation and air temperature in relation to desiccation of mushrooms of shiitake, *Lentinus edodes*（Berk.）Sing. Pp.51−55. In Japanese.

Kawai, A.: Lustre, flavour, and deformation of gills of shiitake-mushrooms in relation to artificial desiccation. Pp.56−60. In Japanese.

Matsumoto, Y.: Effects of moisture of bed-logs on mushroom production in shiitake（*Lentinus edodes*）culture. Pp.61−64. In Japanese.

Hiratsuka, N.: Bibliography on the rust fungi of the Japanese Archipelago（1955~1966）. Pp.65−78. In Japanese.

No.6（Jul. 1968）

Komatsu, M. and Kimura, K.: Sexuality of *Lentinus edodes*（Berk.）Sing. collected in Borneo. Pp.1−8. In Japanese with English abstract.

Komatsu, M. and Kimura, K.: Studies on abnormal fruit-bodies of hymenomycetous fungi. V. Fruit-bodies with white pilei of *Lentinus edodes*（Berk.）Sing. Pp.9−17. In Japanese with English abstract.

Komatsu, M.: *Trichoderma viride*, as an antagonist of the wood-inhabiting Hymenomycetes. VII. On the distribution of *Trichoderma*, *Pachybasium* and *Gliocladium* in the fields of Shiitake-mushroom［*Lentinus edodes*（Berk.）Sing.］. Pp.18−28. In Japanese with English abstract.

Komatsu, M.: *Trichoderma viride*, as an antagonist of the wood-inhabiting Hymenomycetes. VIII. The antibiotic activity against the mycelial growth of *Lentinus edodes*（Berk.）Sing. of three genera, *Trichoderma*, *Pachybasium*, *Gliocladium* and other sterile forms.Pp.29−42. In Japanese with English abstract.

Kawai, A. and Kashiwagi, J.: Relation of temperature to yield of fruit-bodies of Shiitake, *Lentinus edodes*（Berk.）Sing. Pp.43−48. In Japanese with English abstract.

Arita, I.: Studies on the life cycle of *Pholiota nameko*（T. Ito）S. Ito et Imai. Pp.49−57. In Japanese with English abstract.

Arita, I.: Studies on cultivation of *Pholiota nameko*（T. Ito）S. Ito et Imai. I. On the growth rate of mycelia in relation to temperature. Pp.58−73. In Japanese with English abstract.

Hiratsuka, N. and Kaneko, S.: A taxonomic revision of species of *Puccinia* on the Umbelliferae in the Japanese Archipelago. Pp.74−110.

Ishikawa, H.: On the degradation of wood by wood-rot fungi. Pp.111−118. In Japanese.

No.7（Dec. 1969）

Hiratsuka, N. and Kaneko, S.: Three species of *Puccinia* on the Polygonaceae in Japan. Pp.1−7.

Hashioka, Y. and Fukita, T.: Ultrastructural observations on mycoparasitism of *Trichoderma*, *Gliocladium* and *Acremonium* to phytopathogenic fungi. Pp.8−18.

Komatsu, M. and Inada, S.: *Trichoderma viride*, as an antagonist of the wood-inhabiting Hymenomycetes. IX. Antifungal action of *Trichoderma*, *Gliocladium* and other species of *Hypocrea* to *Lentinus edodes*（Berk.）Sing. Pp.19−26. In Japanese with English abstract.

Komatsu, M.: *Trichoderma viride*, as an antagonist of the wood-inhabiting Hymenomycetes. X. Temperature and humidity in relation to *Trichoderma*, *Gliocladium* and other species of *Hypocrea* attacking *Lentinus edodes*（Berk.）Sing. inside bed-logs. Pp.27−50. In Japanese with English abstract.

Arita, I. and Mimura, K.: The mating system in some Hymenomycetes. II. The mating system in *Favolus arcularius*（Batsch ex Fr.）Ames, *F. mikawai*（Lloyd）Imaz., *Pholiota adiposa*（Fr.）Quél. and *Pleurotus cornucopiae*（Paul ex Pers.）Roll. Pp.51−58. In Japanese with English abstract.

Takemaru, T. and Fujioka, N.: The mating system of *Hirschioporus fusco-violaceus*（Fr.）Donk. Pp.59−63. In Japanese with English abstract.

Kimura, K.: Fruiting competition between paired dikaryons of *Coprinus macrorhizus*（Pers. ex Fr.）Rea f. *microsporus* Hongo. Pp.64−70. In Japanese with English abstract.

Takemaru T.and Kamada, T.: The induction of morphogenetic variations in *Coprinus* basidiocarps by UV irradiation. Pp.71−77. In Japanese with English abstract.

Komatsu, M.: Notes on the hyphomycetous fungi isolated from sawdust-ricebran media of *Pholiota nameko*（T. Ito）S. Ito et Imai. Pp.78−89. In Japanese with English abstract.

Arita, I., Mimura, K. and Teratani, A.: Studies on the cultivation of *Pholiota nameko*（T. Ito）S. Ito et Imai. II. The mycelial growth and the formation of fruit-bodies of *Pholiota nameko* on different kinds of the sawdust media. Pp.90−104. In Japanese.

Hiratsuka, N. and Hiratsuka, T.: A check list of

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Takemaru, T. and Kamada, T.: A bibliography on the basidiocarp mor-phogenesis in the Hymenomycetes and Gasteromycetes. Pp.127−140.

No.8（Dec. 1970）

Komatsu, M.: Mycoantagonists to Shiitake-mushroom, *Lentinus edodes*（Berk.）Sing. inside bed-logs. I. Morphological characters of *Cephalosporium* spp. and *Phialophora lignicola*（Nannf.）Gold., and antagonistic effects against the mycelial *growth* of *L. edodes*. Pp.1−10. In Japanese with English abstract.

Takemaru, T. and Kamada, T.: Genetic analysis of UV-induced, developmental variations in *Coprinus* basidiocarp: the elongationless and expansionless. Pp.11−16. In Japanese with English abstract.

Takemaru, T. and Sano, A.: Multiple-allelomorph heterothallism in the tetrapolar basidiomycete *Coriolus versicolor*（Fr.）Quél. Pp.17−21. In Japanese with English abstract.

Takemaru, T. and Ide, S.: Tetrapolar mating system in the basidiomycete *Microporus flabelliformis*（Fr.）Kuntze. Pp.22−26. In Japanese with English abstract.

Takemaru, T. and Fujioka, N.: Tetrapolar heterothallism in the basidiomycete *Steccherinum ochraceum*（Fr.）S.F. Gray. Pp.27−32. In Japanese with English abstract.

Takemaru, T. and Ohhara, K.: Incompatibility factors in the natural population of *Panus rudis* Fr. growing on a fallen trunk. Pp.33−38. In Japanese with English abstract.

Hiratsuka, N. and Sato, S.: Notes on *Puccinia mitriformis* S. Ito. Pp.39−44.

Hiratsuka, N.: Additions and corrections to “A provisional list of Uredinales of Japan proper and the Ryukyu Islands.”（1960）- Ⅱ . Pp.45−51.

Hiratsuka, N. and Kaneko, S.: A list of Uredinales found in the Tanzawa Mountain range, Pref. Kanagawa, Japan. Pp.52−65.

Ishikawa, H.: The fungal anthraquinone pigments and the biosynthesis of the pigments. Pp.66−84. In Japanese.

No. 9（Dec. 1971）

Hashioka, Y.: Scanning and transmission electronmicrographs of shiitake, *Lentinus edodes*（Berk.）Sing. Pp.1−10.

Hiratsuka, N. and Kaneko, S.: Notes on two species of *Puccinia* on the Polygonaceae. Pp.11−15.

Takemaru, T. and Ide, S.: Tetrapolar heterothallism in the basidiomycete, *Tyromyces pubescens*（Fr.）Imaz. Pp.16−20. In Japanese with English abstract.

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Hiratsuka, N.: Revision of taxonomy of the genus *Uromyces* in the Japanese Archipelago. Pp.1−98.

Hiratsuka, N. and Kaneko, S.: A taxonomic revision of the species of *Puccinia parasitic* on the Polygonaceae in the Japanese Archipelago. Pp.99−140.

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Akai, S. and Oguchi, T.: On the withering of lower leaves and ear rot of rice plants and their causal fungi 1. *Helminthosporium* leaf spot of leaves of rice plants collected in Thailand and Malaysia and fungi isolated from their spots. Pp.687–692. In Japanese with English abstract.
Tokunaga, Y. and Ohara, I.: Latent infection of anthracnose on *Citrus* in Japan. Pp.693–702.
Saho, H. and Takahashi, I.: A check list and host index of fungi on forest trees collected at the Tokyo University forest in Hokkaido, Japan.（1960~1972）. Pp.703–714.
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Hirai, T.: Studies on the barley mosaic disease II, Induced resistance caused by some chemicals. Pp.749–760. In Japanese with English abstract.
Miyamoto, S. and Miyamoto, Y.: The movement of tobacco mosaic virus within the plant of *Nicotiana rustica* L. Pp.761–770. In Japanese with English abstract.

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Ushiyama, R. and Hashioka, Y.: Viruses associated with Hymenomycètes 1. Filamentous virus-like particles in the cells of a fruit body of shiitake, *Lentinus edodes* (Berk.) Sing. Pp.797–805. In Japanese with English abstract.

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Papers with TMI contribution numbers

No. 403

Availability of downgraded wheat for conversion to domestic raw materials in *Pleurotus eryngii* cultivation (In Japanese)

Yasuhito Okuda, Koichi Hase, Yoshitake Satokawa, Yuuki Kobayashi, Isao Ohuchi and Shigeyuki Murakami

Mushroom Science and Biotechnology **25** (1): 23–26. 2017.

Clarification of risk in imported foods has led to raised awareness of consumers about food safety. Consequently, the retail and food-service industries treating mushrooms tend to focus on production information, including composition of the mushroom beds with value in domestic production. *Pleurotus eryngii* (DC.) Quél. is well known as a good edible mushroom in Japan. However, composition of the mushroom beds depends on imported raw materials. We considered domestic raw materials that can substitute for the bran from imported wheat frequently used in *P. eryngii* cultivation. Thus, meal from domestic and downgraded wheat as a potential material on the cost and supply side was identified from the refinement process and domestic distribution. Practical *P. eryngii* cultivation with this wheat meal indicated that the yield per bottle increased significantly, with an increase in available fruiting bodies.

Key words: Domestic raw material, Food safety, *Pleurotus eryngii*, Sawdust-based cultivation, Wheat meal.

エリンギ栽培における国内産原材料への転換に向けた規格外小麦全粒粉の有用性

奥田康仁・長谷幸一・里川佳武・小林勇貴・大内功男・村上重幸.

日本きのこ学会誌 **25**(1): 23–26. 2017.

近年の輸入食品のリスクの顕在化は食の安全に対する消費者の意識向上につながった.その結果,きのこを取り扱う小売業や外食産業では国内産志向の進展だけでなく,菌床の原材料の産地を含めた生産情報についても開示する傾向にある.エリンギは優秀な食用きのこであるが,栽培に用いる菌床は国外で栽培された原材料に依存している.そこで栄養材として頻繁に用いられる外国産小麦由来フスマの代替となりうる国内産小麦由来栄養材について小麦の精製工程および国内の流通状況を調査した.結果として価格面・供給面で有用な国内産規格外小麦全粒粉をフスマの代替として見出した.エリンギ栽培にこれを用いたところ,フスマを用いた場合と比較して主に有効茎数の増加に伴う増収効果が認められた.

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Papers without TMI contribution numbers

Fungal wood decomposer activity induces niche separation between two dominant tree species seedlings regenerating on coarse woody material

Yu Fukasawa, Yasuyuki Komagata and Shuji Ushijima

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Decomposition subsystems have an essential role in forest dynamics but few studies demonstrate the effect of microbial decay traits on seedling regeneration. In the present study, we focused on seedling regeneration on coarse woody material (CWM), which is an important regeneration site for forest tree species, and

the effects of wood decay type according to fungal decay preference for wood structural components on seedling colonization. Effects of log properties including wood decay type and other environmental variables on seedling density were evaluated by ordination methods and generalized linear models. In total, 22 woody species were recorded as seedlings on *Pinus densiflora* logs. By ordination analysis, white rot in heartwood and brown rot in sapwood, as well as canopy openness and log diameter, showed significant association with seedling communities. The factors selected for a generalized linear model for explaining seedling densities of the two dominant seedling species *Cryptomeria japonica* and *P. densiflora* included brown rot in sapwood and white rot in heartwood, but the effects were different: a positive effect of brown rot on *C. japonica* and a negative effect of white rot on *P. densiflora*. These results suggested that wood decay type could induce niche separation between dominant tree species regenerating on CWM.

Key words: forest regeneration, log, rot type, seedling colonization, wood decay fungi.

Discovery or Extinction of New *Scleroderma* Species in Amazonia?

Iuri G. Baseia, Bianca D. B. Silva, Noemia K. Ishikawa, João V. C. Soares, Isadora F. FrancËa, Shuji Ushijima, Nitaro Maekawa and MarõÂa P. MartõÂn
PLoS ONE **11**(12): e0167879. 2016. DOI: 10.1371/journal.pone.0167879.

The Amazon Forest is a hotspot of biodiversity harboring an unknown number of undescribed taxa. Inventory studies are urgent, mainly in the areas most endangered by human activities such as extensive dam construction, where species could be in risk of extinction before being described and named. In 2015, intensive studies performed in a few locations in the Brazilian Amazon rainforest revealed three new species of the genus *Scleroderma*: *S. anomalosporum, S. camassuense* and *S. duckei*. The two first species were located in one of the many areas flooded by construction of hydroelectric dams throughout the Amazon; and the third in the Reserva Florestal Adolpho Ducke, a protected reverse by the INPA. The species were identified through morphology and molecular analyses of barcoding sequences (Internal Transcribed Spacer nrDNA). *Scleroderma anomalosporum* is characterized mainly by the smooth spores under LM in mature basidiomata (under SEM with small, unevenly distributed granules, a characteristic not observed in other species of the genus), the large size of the basidiomata, up to 120 mm diameter, and the stelliform dehiscence; *S. camassuense* mainly by the irregular to stellate dehiscence, the subreticulated spores and the bright sulfur-yellow colour, and *Scleroderma duckei* mainly by the verrucose exoperidium, stelliform dehiscence, and verrucose spores. Description, illustration and affinities with other species of the genus are provided.

Population genetics and fine-scale genetic structure of *Rhizopogon roseolus* in Tottori sand dune

Hiroshi Abe, Akiko Tabuchi, Yasuhito Okuda, Teruyuki Matsumoto, Kazuhide Nara.
Mycoscience **58**(1): 14–22. 2017. Doi: 10.1016/j.myc.2016.07.009

We investigated the population genetics and fine-scale genetic structure of *Rhizopogon roseolus*. A total of 173 *R. roseolus* sporocarps were collected from two stands in the Tottori sand dune. We developed and applied five novel polymorphic microsatellite (SSR; simple sequence repeat) markers for sporocarp genotyping. In total, we identified 110 genets, most of which were small in size. Spatial autocorrelation analyses revealed a significantly positive genetic structure in short-distance classes. The inbreeding coefficient value was significant in both stands (F_{IS} = 0.18), while the F_{ST} value (F_{ST} = 0.020) indicated little genetic differentiation between the two populations. The majority of alleles were distributed in

both stands with similar frequencies. These results suggest that short-distance spore dispersal plays a dominant role in generating new genets, and eventually increases the frequency of inbreeding in the Tottori sand dune, whereas rare gene flow between the two stands, possibly associated with spore dispersal by mycophagous animals, could reduce genetic differentiation.

Key words: Ectomycorrhizal fungi, Genet, Shouro, Spatial autocorrelation, SSR.