

Reassessment of type specimens of *Cordyceps* and its allies described by Dr. Yosio Kobayasi preserved in the mycological herbarium of the National Museum of Nature and Science (TNS). Part 1: the genus *Torrubiella*

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Abstract Nineteen holotype specimens of the genus *Torrubiella* described by Dr. Yosio Kobayasi and Mr. Daisuke Shimizu were relocated and accession numbers (TNS-F number) were given. A new scientific name, *Torrubiella plana* Hiroki Sato, Ban, Masuya & Hosoya nom. nov. (TNS-F-12061), was proposed for *T. minutissima* Kobayasi & Shimizu (homonym of *T. minutissima* Lagarde). The other 18 species follow: *T. alboglobosa* (TNS-F-12067), *T. aurantia* (TNS-F-12069), *T. corniformis* (TNS-F-12064), *T. ellipsoidea* (TNS-F-12055), *T. formosana* (TNS-F-12059), *T. fusiformis* (TNS-F-234548), *T. globosostipitata* (TNS-F-12057), *T. longissima* (TNS-F-12071), *T. mammillata* (TNS-F-12060), *T. miyagiana* (TNS-F-12062), *T. neofusiformis* (TNS-F-12058), *T. oblonga* (TNS-F-12070), *T. ooaniensis* (TNS-F-12063), *T. pallida* (TNS-F-12789), *T. rosea* (TNS-F-12065), *T. ryogamimontana* (TNS-F-12058), *T. ryukyuensis* (TNS-F-11932), and *T. superficialis* (TNS-F-12072).

Keywords Ascomycota · Clavicipitaceae · Cordycipitaceae · Taxonomy · Holotype

Insects are killed by various fungal pathogens. Clavicipitaceae, Cordycipitaceae, and Ophiocordycipitaceae of Hypocreales are three of the major arthropod pathogenic families (Sung et al. 2007) and include such genera as *Cordyceps* (Fr.) Link, *Torrubiella* Boud., *Isaria* Pers., and *Beauveria* Vuill. Recently, numerous molecular phylogenetic studies of *Cordyceps* and anamorphic arthropod pathogenic fungi in Hypocreales have been performed (Rehner and Buckley 2005; Stensrud et al. 2005; Sung et al. 2007). A phylogenetic classification of *Cordyceps* and related fungi has been proposed based on multigene phylogenies, resulting in major taxonomic revisions at the genus and family levels (Sung et al. 2007). Importantly, these studies revealed that *Torrubiella* is not monophyletic, but at this time proposing a phylogenetic classification of the genus is impeded by a lack of clear taxonomic concepts of *Torrubiella* species. To advance a more accurate taxonomy of *Torrubiella*, it is essential to examine morphological characters of well-vouchered type specimens.

Dr. Yosio Kobayasi and Mr. Daisuke Shimizu were two Japanese mycologists who devoted their careers to the study of arthropod pathogenic fungi. They described more than 150 taxa of arthropod pathogenic fungi (Kobayasi 1941, 1982a,b, 1983a,b; Kobayasi and Shimizu 1983a), representing approximately 30% of all known species in *Cordyceps* and *Torrubiella* (data from Index Fungorum as of 2009; <http://www.speciesfungorum.org/Names/Names.asp>). In their publications, they mentioned that the materials were to be kept in the herbarium of National Science Museum (TNS, currently National Museum of Nature and Science). Unfortunately, in spite of huge numbers of

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described species, collection numbers or accession numbers (TNS-F number), which would be the decisive information in determination of the type specimens, were not cited for many species. Furthermore, most of the types were kept in formalin, which requires periodic maintenance. However, as a consequence of insufficient human resources, funds, and space available for specimen maintenance, and the lack of an efficient system for specimen arrangement, most *Cordyceps* and *Torrubiella* specimens became untraceable in the herbarium. These unfortunate circumstances caused many researchers to assume that type specimens were lost or at the very least inaccessible.

During the total rearrangement of the fungal specimens in TNS in the past 2 years, many specimens of arthropod pathogenic fungi, including *Cordyceps*, *Torrubiella*, *Podonectria* Petch, *Sporotrichum* Link, and *Gibellula* Cavara—mainly immersed in liquid—were relocated. We evaluated those specimens for their type status, referring to their original descriptions and their current condition under preservation.

In the present paper, we evaluated the condition of the type specimens of *Torrubiella* in TNS. *Torrubiella* attacks spiders and scale insects and is the second largest arthropod pathogenic teleomorphic genus in Hypocreales. Thirty-one taxa (Kobayasi and Shimizu 1976, 1981, 1982; Kobayasi 1982a, b) of 83 taxa (data from Index Fungorum as of 2009) have been described by Kobayasi or Kobayasi and Shimizu. Fortunately, to determine the type status of some of *Torrubiella* is less problematic than *Cordyceps* specimens because Kobayasi and Shimizu gave their collection numbers. However, it is worthwhile to denote the condition of the specimen because Kobayasi and Shimizu provided only a few photos of the specimens.

In the present article, we do not report the detailed micromorphology of each specimen. Rather, we concentrated in evaluating the type status of each potential type specimen by comparing the data on the label and publication, and assembling the information in other authentic illustrative publications (Kobayasi and Shimizu 1983b; Shimizu 1994), because illustrations cited in these publications could show the original color, which would have been lost during liquid preservation. Discrepancies between label information and descriptions in the publication were also noted, when present, and clarified.

Specimens of *Torrubiella* were located among approximately 5000 liquid-immersed specimens kept in 25 specimen lockers. Label information, including collection site, collection date, original specimen number, and collector's name, were digitized and incorporated to the database. For each examined type specimen, both specimen and label were photographed. Because collection data on the label sometimes did not precisely agree with the description, the label information was compared carefully with that in the original descriptions in each paper to assess type status.

When noted, the original collection number or specimen number was treated as the decisive information for the judgment. In cases in which the original collection number was not cited in the paper, line drawings of the external morphology of the specimens in the original paper were used to determine whether the specimen in question was the type. When the collection data on the label and those in the original paper disagreed, the discrepancies were noted, and a possible cause of the mismatch was discussed.

Most specimens were preserved in glass vials filled with formalin and overlaid with mineral oil. Because the vials were unstable for further maintenance of the specimens, attributed to their uneven bottoms and the degradation of aged cork plugs, specimens were transferred to new vials, and new labels were reproduced based on the original information. To photograph the specimen, the mineral oil layer was discarded by an oil absorbent (T-151J 3M; Mitsui, Tokyo, Japan), and the specimens were photographed in a large Petri dish flooded with distilled water, with the exceptions of *T. ellipsoidea* (see Fig. 4) and *T. fusiformis* (see Fig. 6). *Torrubiella ellipsoidea* and *T. fusiformis* were not suitable for this submergence method just described for photographing because of the dark color and small size, respectively. Hence, they were treated the same as dried specimens. Photographed specimens were transferred into new glass vials with 10% formalin liquid, and mineral oil was overlaid to avoid vaporization. Dried specimens were photographed and kept in dry conditions as they had been. Then, an accession number (TNS-F number) was given to each specimen.

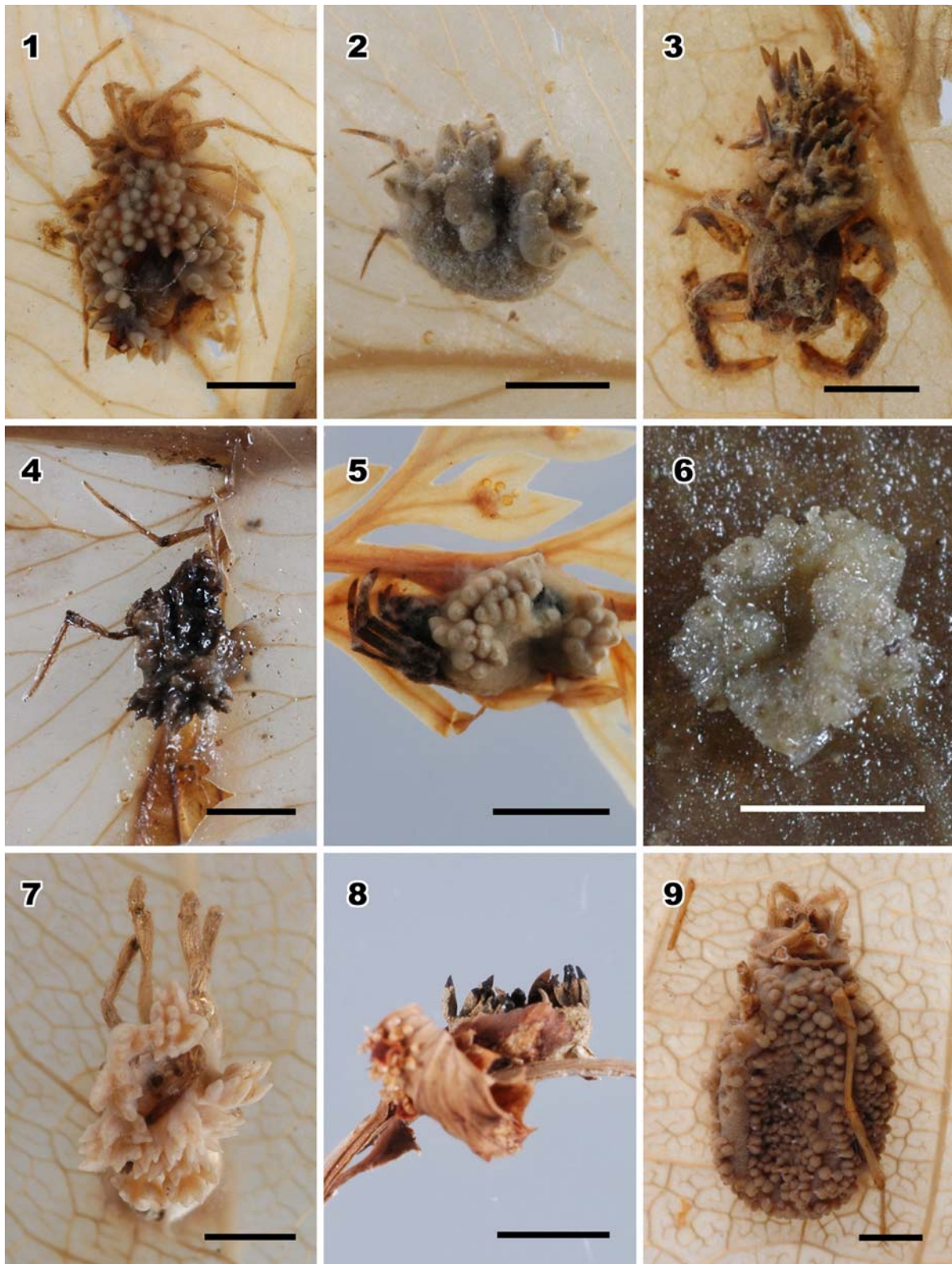
Most specimens were preserved in very good condition. In the majority of specimens, their original color was lost but the morphology was intact. For most specimens, evaporation of the preservation liquid was inhibited by mineral oil. Sixteen of 19 holotypes reported in this article turned out to be illustrated in Kobayasi and Shimizu (1983b) and Shimizu (1994).

Torrubiella alboglobosa Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 63, 1982 Fig. 1

Nom. Jpn.: Shiromaru-kumotake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12067 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

Although the original description was not accompanied with a collection number (#129 on the label), the specimen was determined as the holotype because of the following reasons. (1) This is the only specimen found for *T. alboglobosa* in TNS. (2) External morphology drawn in the original paper perfectly agreed with that of the specimen. (3) Collection data (collection date, August 12, 1966) in the original article agreed with those on the label, except for the spelling of the collection site name (“Okushinkawa” as cited in the paper should be read as “Okunikawa”). This



Figs. 1–9 *Torrubiella* specimens determined as holotypes. **1** *T. alboglobosa*: TNS-F-12067; **2** *T. aurantia*: TNS-F-12069; **3** *T. corniformis*: TNS-F-12064; **4** *T. ellipsoidea*: TNS-F-12055; **5** *T. formosana*: TNS-F-

12059; **6** *T. fusiformis*: TNS-F-234548; **7** *T. globosostipitata*: TNS-F-12057; **8** *T. longissima*: TNS-F-12071; dried specimen; **9** *T. mammillata*: TNS-F-12060. Bars **1–9** 2 mm

specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 64–2) and Shimizu (1994; pl. 352) in color.

Torrubiella aurantia Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 67, 1982 Fig. 2

Nom. Jpn.: Mikan-iro-kumotake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12069 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

The collection data in the original paper (place: along Shikamata River, Niigata Pref.; date: August 7, 1966; original specimen number: 111) matched with those on the label. External morphology of the specimen was confirmed to be identical with the drawings in the original paper (Kobayasi and Shimizu 1981; fig. 36A). This specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 59-1) and Shimizu (1994; pl. 330) in color.

Torrubiella corniformis Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 59, 1982 Fig. 3

Nom. Jpn.: Shiro-kumotake (proposed in Kobayasi and Shimizu 1982; Shiro-tsubu-kuro-kumotake in Shimizu 1994; Kuro-tsubu-shiro-kumotake in Kobayasi and Shimizu 1983b).

Specimen examined: TNS-F-12064 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

Two photographs (figs. 23A, 40) and a line drawing (fig. 24A) of the external morphology were cited in Kobayasi and Shimizu (1982). Of these, fig. 24A agreed perfectly with TNS-F-12064. TNS-F-12064 was determined as the holotype because the data in the original publication (place: Kowadani, Owase, Mie Pref.; date: July 29, 1960; original specimen number: K98; cf. Kobayasi and Shimizu 1983b) agreed with that on the label. No other specimens have been accessioned in TNS. The color illustration of *T. corniformis* later presented in Shimizu (1994; pl. 348) did not match the holotype, and Kobayasi and Shimizu (1983b) did not give a color illustration. However, both these publications cited fig. 24A of Kobayasi and Shimizu (1982). Three Japanese names have been proposed, causing confusion even by the authors because the two photographs in Kobayasi and Shimizu (1983b) were not identical with TNS-F-12064; one or two more other specimens may have existed when *T. corniformis* was described.

Torrubiella ellipsoidea Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 50, 1982 Fig. 4

Nom. Jpn.: Kumono-momogata-tsubutake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12055 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

The collection data (place: Mt. Iwamuke, Oguni city, Yamagata Pref.; date: September 6, 1970; original specimen number: TY 105) in the original paper (Kobayasi and Shimizu 1982) matched with those on the label. External morphology drawn in the original paper (Kobayasi and Shimizu 1982; fig. 7A) perfectly agreed with that of the specimen. This specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 54-2) and Shimizu (1994; pl. 345) in color.

Torrubiella formosana Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 53, 1982 Fig. 5

Nom. Jpn.: Arisan-kumotake (proposed by Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12059 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

The collection data (place: Mt. Arisan, Formosa; date: July 27, 1976) in the original paper (Kobayasi and Shimizu 1982) were identical with those on the label. External morphology shown in the photograph (fig. 10B) and line drawing (fig. 13A) in Kobayasi and Shimizu (1982) were confirmed to be identical to the specimen. The original specimen number for this specimen, described as “JA23” (Kobayasi and Shimizu 1982), may have been an orthographic error because the letter on the label on the specimen bottle could be read as “TA23.” No color illustrations were presented in either Kobayasi and Shimizu (1983b) or Shimizu (1994), but both these publications cited fig. 13A in Kobayasi and Shimizu (1982).

Torrubiella fusiformis Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 7: 117, 1981 Fig. 6

Nom. Jpn.: Taiwan hadani-tsubutake (proposed by Kobayasi and Shimizu 1981).

Specimen examined: TNS-F-234548 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

The collection data (place: Renkachi, Nankai; date: July 15, 1976; original specimen number: TA12) in Kobayasi and Shimizu (1981) were identical with those on the label. Although the original publication did not contain an illustration, this specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 53-3) and Shimizu (1994; pl. 360).

Torrubiella globosostipitata Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 49, 1982 Fig. 7

Anamorph: *Gibellula globosostipitata* Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. 8: 49, 1982.

Nom. Jpn.: Kumono-etsuki-tsubutake (proposed by Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12057 (determined as HOLOTYPUS). Specimen kept in formalin in good condition; with anamorph.

The collection data in the original paper (place: Kamabuchi, Yamagata Pref.; original specimen number: TY175; collector's name: Yahagi) were identical with those on the label. The external morphology of the specimen was confirmed to be identical with the line drawings in Kobayasi and Shimizu (1982; fig. 6, right). This specimen was cited in Kobayasi and Shimizu (1983b; pl. 53-2) and Shimizu (1994; pl. 340) in color. This specimen is the holotype of *Gibellula globosostipitata* Kobayasi and Shimizu (1982) as well as *T. globosostipitata*.

Torrubiella longissima Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 69, 1982 Fig. 8

Nom. Jpn.: Tsukidasi-nagamino-kumotake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12071 (determined as HOLOTYPUS). Dried specimen. Because there was no residual formaldehyde on the specimen, it might have been mounted in alcoholic medium, not in formalin, or the dried specimen might have been preserved in the bottle.

Although minor mismatches were noted between the label and the original description [the original collection number was noted as TY113 in Kobayasi and Shimizu (1982) whereas the number on the label was written as just “113” with printed initial “K”; collection year not written on the label], other collection data agreed (place: Mt. Aasahi, Yamagata Pref.; collected on September 6). Therefore, we determined TNS-F-12071 as the holotype. External morphology given in the line drawing in Kobayasi and Shimizu (1982; fig. 38A) was confirmed to be identical with that of the specimen on a cut leaf of vine. This specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 64-1) and Shimizu (1994; pl. 339) in color.

Torrubiella mammillata Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 54, 1982 Fig. 9

Nom. Jpn.: Usuki-marumino-kumotake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12060 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

The collection data in the original paper (place: Tsunagi, Yonezawa city, Yamagata Pref.; date: July 30, 1959; original specimen number: 54) agreed with those on the label. External morphology drawn in the original paper (Kobayasi and Shimizu 1982; fig. 12B) perfectly agreed with that of the specimen. Therefore, we identified this specimen as the holotype. This specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 55-2) in color. Shimizu (1994) cited only line drawings of microscopic morphology in Kobayasi and Shimizu (1982).

Torrubiella miyagiana Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 58, 1982 Fig. 10

Nom. Jpn.: Okunikkawa-kumotake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12062 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

The collection data (place: Okunikkawa, Miyagi Pref.; date: August 11, 1966; original specimen number: 114) in the original paper were identical with those on the label. The line drawing in the original paper (Kobayasi and Shimizu 1982; fig. 19B) was confirmed to be identical with the external morphology of the specimen. Therefore, we identified this specimen as the holotype. This specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 56–3) and Shimizu (1994; pl. 326) in color.

Torrubiella neofusiformis Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 51, 1982 Fig. 11

Nom. Jpn.: Kumono-kouratsubutake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12058 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

The collection data (place: Ouzawa, Yamagata Pref.; date: August 23, 1959; original specimen number: 59) in the original paper were identical with those on the label. A line drawing and a photograph in the original paper (Kobayasi and Shimizu 1982; figs. 7B, 10) were confirmed to be identical with the external morphology of the specimen. Therefore, we identified this specimen as the holotype. This specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 54-3) and Shimizu (1994; pl. 323) in color.

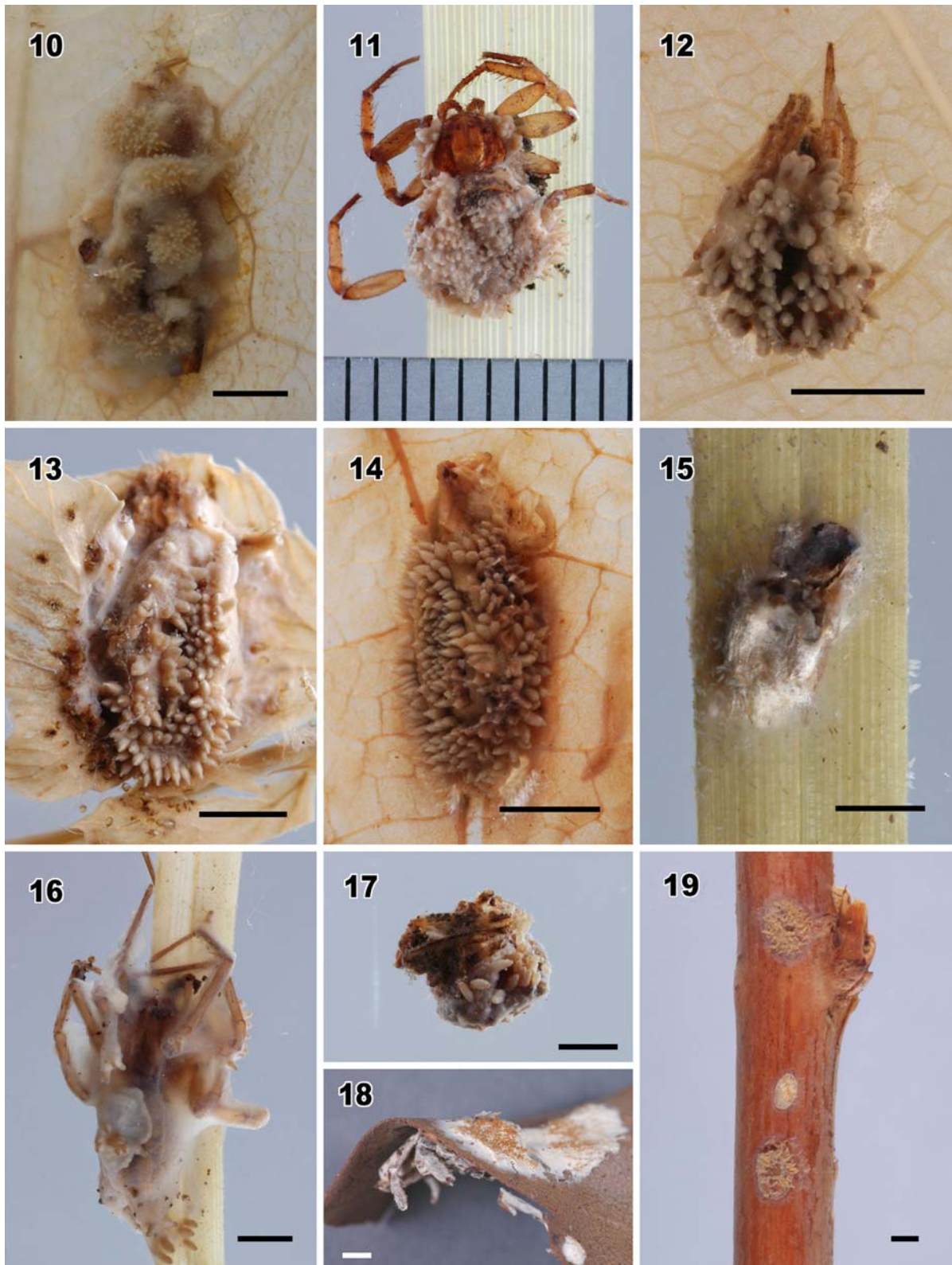
Torrubiella oblonga Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 68, 1982 Fig. 12

Nom. Jpn.: Tsutsunaga-kumotake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12070 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

The collection data (place: Okushinkawa; date: August 12, 1966; original specimen number: 127) in the original article were identical with the information on the label. The line drawing in the original paper (Kobayasi and Shimizu 1982; fig. 38A) was confirmed to be identical with the external morphology of the specimen. Therefore, we identified this specimen as the holotype. As in the case of *T. alboglobosa*, the collection site “Okushinkawa” cited in the original paper should be read as “Okunikkawa.” This specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 60-2) and Shimizu (1994; pl. 322) in color.

Torrubiella ooniansis Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 58, 1982 Fig. 13



Figs. 10–19 *Torrubiella* specimens determined as holotypes (continued). **10** *T. miyagiana*: TNS-F-12062; **11** *T. neofusiformis*: TNS-F-12058; **12** *T. oblonga*: TNS-F-12070; **13** *T. ooaniensis*: TNS-F-12063; **14** *T. pallida*: TNS-F-12789; **15** *T. plana*: TNS-F-12061, holotype of

T. minutissima Kobayasi & Shimizu, non *T. minutissima* Lagarde; **16** *T. rosea*: TNS-F-12065; **17** *T. ryogamimontana*: TNS-F-12058; **18** *T. ryukuensis*: TNS-F-11932, dried specimen; **19** *T. superficialis*: TNS-F-12072. Bars **10**, **12–19** 2 mm; scale **11** 1 mm (minimum)

Nom. Jpn.: Ooani-shiro-kumotake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12063 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

The collection data (place: Ooani, Akita Pref.; date: August 9, 1970; original specimen number: TA94) in the original paper were identical with those on the label. The line drawing in the original paper (Kobayasi and Shimizu 1982; fig. 19C) was confirmed to be identical with the external morphology of the specimen. Therefore, we identified this specimen as the holotype. This specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 57-1) and Shimizu (1994; pl. 353) in color.

Torrubiella pallida Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 65, 1982 Fig. 14

Nom. Jpn.: Usuki-ooani-kumotake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12789 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

The collection data (place: Ooani, Akita Pref.; date: August 8, 1970; original specimen number: TA108) in the original paper were identical with those on the label. The line drawing in the original paper (Kobayasi and Shimizu 1982; fig. 32A) was confirmed to be identical with the external morphology of the specimen. Therefore, we identified this specimen as the holotype. This specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 58-2) and Shimizu (1994; pl. 328) in color.

Torrubiella plana Hirok. Sato, S. Ban, Masuya & Hosoya, nom. nov. MycoBank no.: MB 515071.

≡ *Torrubiella minutissima* Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 57, 1982. nom. illeg. (Art. 53.1); non *T. minutissima* Lagarde, in Archs. Zool. Exp. Gén. 56: 281, 1917 Fig. 15

Etymology: planus = flat, plane. Flat extending appearances of hyphal mat with scattered minute perithecia from the host cadaver.

Nom. Jpn.: Kogome-kumotake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12061 (determined as HOLOTYPUS of *T. minutissima* Kobayasi & Shimizu 1982; non *T. minutissima* Lagarde 1917). Specimen kept in formalin in good condition.

The collection data (place: Tsunagi, Yonezawa city, Yamagata Pref.; date: July 30, 1959; original specimen number: 57) in the original paper were identical with those on the label. The line drawing in the original paper (Kobayasi and Shimizu 1982; fig. 19A) was confirmed to

be identical with the external morphology of the specimen. Therefore, we identified this specimen as the holotype for *T. minutissima* sensu Kobayasi and Shimizu (1982). Color illustrations in Kobayasi and Shimizu (1983b; pl. 56-1) and Shimizu (1994; pl. 347) matched with the specimen: TNS-F-12061. A new scientific name, *Torrubiella plana*, is proposed here to accommodate this specimen, because *T. minutissima* Kobayasi and Shimizu (1982) is a later homonym of that in Lagarde (1917).

Torrubiella rosea Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 61, 1982 Fig. 16

Nom. Jpn.: Sango-kumotake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12065 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

The collection data (place: Tsunagi, Yonezawa city, Yamagata Pref.; date: July 1, 1959; original specimen number: 47) in the original paper were identical with those on the label. The line drawing in the original paper (Kobayasi and Shimizu 1982; fig. 26A) was confirmed to be identical with the external morphology of the specimen. Therefore, we identified this specimen as the holotype. This specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 57-2) and Shimizu (1994; pl. 317) in color. However, the illustration as printed in Shimizu (1994) is a mirror image of that in Kobayasi and Shimizu (1982, 1983b).

Torrubiella ryogamimontana Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 66, 1982 Fig. 17

Nom. Jpn.: Nagamino-kumotake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12058 (determined as HOLOTYPUS). Specimen kept in formalin in good condition.

The collection data (place: Mt. Ryogami, Chichibu; date: September 10, 1951; original specimen number: 338) in the original paper were identical with those on the label. The line drawing in the original paper (Kobayasi and Shimizu 1982; fig. 32B) was confirmed to be identical with the external morphology of the specimen. Therefore, we identified this specimen as the holotype. This specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 58-3) and Shimizu (1994; pl. 341) in color.

Torrubiella ryukyuensis Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 55, 1982 Fig. 18

Nom. Jpn.: Iriomote-koromo-kumotake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-11932 (determined as HOLOTYPUS). Dried specimen in good condition.

Because there was no residual formaldehyde on the specimen, it might have been mounted in alcoholic medium, not in formalin, or the dried specimen may have been preserved in the bottle.

The collection data (place: Goza, Isl. Iriomote, Ryukyu (Okinawa); date: July 27, 1971) in the original paper were identical with those on the label. However, there was a small confusion about the original number of this specimen. Kobayasi and Shimizu (1982) noted the number of the collection number as “O. L. 4,” but wrote “O. I. 4” on the label, with printed “O. I.” and hand-written “4”. Because “O. I.” could be assumed to be the acronym of “Okinawa, Iriomote,” the correct collection number should be O. I. 4. The line drawing in the original paper (Kobayasi and Shimizu 1982; fig. 16A) was confirmed to be identical with the external morphology of the specimen. Therefore, we identified this specimen as the holotype. This specimen was illustrated in Kobayasi and Shimizu (1983b; pl. 55-3) and Shimizu (1994; pl. 336) in color.

Torrubiella superficialis Kobayasi & Shimizu, Bull. Natn. Sci. Mus. Ser. B. 8: 74, 1982 Fig. 19

Nom. Jpn.: Kaigaramushi-kiiro-tsubutake (proposed in Kobayasi and Shimizu 1982).

Specimen examined: TNS-F-12072 (determined as HOLOTYPE). Specimen preserved in formalin in good condition.

The collection data (place: Kamabuchi, Yamagata Pref.; original specimen number: TY202) in the original paper were identical with those on the label. The collection date (July 24, 1978) on the label was not cited in the original paper. The photograph in the original paper (Kobayasi and Shimizu 1982; fig. 47) was confirmed to be identical with the external morphology of the specimen. Therefore, we identified this specimen as the holotype. It was difficult to determine whether the color illustrations in Kobayasi and Shimizu (1983b; pl. 63-2) and in Shimizu (1994; pl. 57) matched with the holotype specimen.

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