

HYGROCYBE KULA GRGUR. REVISITED

A.M. Young

Hon. Assoc., Queensland Herbarium, Brisbane Botanic Gardens Mt Coot-tha, Toowong, Qld 4066
Mail address: Bee Cottage, Blackbutt, Qld 4306. Email: tyoung@bigpond.com

Abstract

The characteristics of *Hygrocybe kula* Grgur. are reviewed and the current description shown to be a mixture collated from two separate taxa. A new description of *Hygrocybe kula* is provided based solely on the holotype collection and new information obtained from the associated watercolour. The new taxon *Hygrocybe rubronivea*, previously considered to be *Hygrocybe kula*, is here described. The species *Hygrocybe lanecovensis* A.M. Young is considered separate from *Hygrocybe kula*.

Introduction

Hygrocybe kula Grgur. (Grgurinovic 1997) is based on a collection (AD 5716) made in 1916 by J.B. Cleland from the Royal National Park (just south of Sydney), New South Wales. The exact location of the collection within the park is not known. Cleland & Cheel (1919) published a description under the name of '*Hygrophorus miniatus* Fr.' and in the list of collections believed to be this taxon they included the Royal National Park material. Grgurinovic (1997) described the species *Hygrocybe kula* and cited two other collections (AD 5717, AD 5718) that were then considered identical to the holotype, both of which were collected near Adelaide, South Australia. Grgurinovic's approach was also followed by Young & Wood (1997).

During 1998, the *Hygrocybeae* of Lane Cove Bushland Park, New South Wales were examined and the new species *Hygrocybe lanecovensis* A.M. Young was described (Young 1999). Some of its diagnostic characteristics are shared by *Hygrocybe kula* but the present definitions of each taxon permit good separation. Both species are currently defined as having red pilei, red stipes and white lamellae, but differ in that *H. kula* has a dry pileus and stipe (both of which have a simple cutis) and white lamellae that are adnate with a decurrent tooth at most; *H. lanecovensis* has a viscid pileus and stipe (an ixocutis on both) and lamellae that are deeply decurrent.

A re-evaluation of *Hygrocybe kula* data

Recently, the author had occasion to check the description of *Hygrocybe kula* in Grgurinovic (1997) and noted that a watercolour (Phyllis Clarke No. 128) had been associated with the species. Subsequently, a difference between the species text and its associated watercolour (Grgurinovic 1997, Plate 20c) became evident. The text describes the lamellae as 'adnate to slightly decurrent' whereas the watercolour made by Clarke from the holotype material shows deeply decurrent lamellae. This difference made the taxonomic separation of *Hygrocybe kula* and *H. lanecovensis* uncertain and indicated that a revision of the holotype collection of *H. kula* (and the two collections from the South Australian site) was required.

The paper by Cleland & Cheel (1919) describing '*Hygrophorus miniatus* Fr.' contains no reliable information applicable to the holotype collection of *Hygrocybe kula*. The description of '*Hygrophorus miniatus*' is a summary of characteristics based on the nine cited collections believed to be that taxon, but there is no doubt that different species were contained in those nine collections. (Cleland & Cheel *loc. cit.* do not include herbarium numbers so that it is usually impossible to be certain which Cleland collections are relevant or if they still exist.) For example, the description of '*Hygrophorus miniatus*' states that the species has pilei that are 'convex, sometimes a little dimple in the centre or umbilicate, sometimes irregular, sometimes upturned, sometimes slightly rugose and sometimes slightly squamulose...'. These characters will fit at least four currently accepted taxa occurring in the Sydney region: *Hygrocybe cantharellus* (Schwein. : Fr.) Murrill, *H. miniata* (Fr. : Fr.) P. Kumm, *H. sanguineocrenulata* A.M. Young and *H. siccitatopapillata* A.M. Young and these species will also fit the very loose collection of characters for the lamellae and stipe that are given in the Cleland & Cheel paper.

Re-examination of the field notes that apply to the three collections listed for *Hygrocybe kula* now suggests strongly that the currently accepted description is a composite of at least two taxa because it contains pertinent information from all three collections originally believed to be *Hygrocybe kula*. Field notes with collection AD 5717 state that the pileus is convex and finely mealy while the lamellae are white and adnate but the holotype

collection is now known to have deeply decurrent lamellae and a probably viscid, striate, translucent pileus, at least in the juvenile stages. Similarly, field notes with collection AD 5718 indicate that the lamellae are adnate with a tendency to decurrency, but not deeply decurrent as occurs in the holotype; also, the material in AD 5718 has a pileipellis with a cutis, and is not the ixocutis found in *Hygrocybe kula*. For these reasons, both these collections (AD 5717, AD 5718) are no longer considered similar to the holotype collection of *Hygrocybe kula*.

Materials and Methods

A re-description of *Hygrocybe kula* based solely on the herbarium material and field notes made in 1916 from the Royal National Park holotype collection, together with the relevant Phyllis Clarke watercolour, was completed. The re-description uses the exact wording of the field notes made by Cleland with slight changes to the following aspects of the original pencilled script: dimensions in inches are converted to mm; the terms of cap, gills and stem are changed to pileus, lamellae and stipe respectively; and a single, indecipherable word just before the note on the yellowish stem base has been omitted. Where additions to the macrocharacters have been made by the author on the basis of information from either the watercolour or the microscopic examination, they are shown in square brackets []. The main difference in the microcharacters when compared with previously published data (Grgurinovic 1997, Young & Wood 1997) is that the spores in the holotype are shown to be slightly shorter than the dimensions already published ($6.2\text{--}9 \times 3.4\text{--}4.6 \mu\text{m}$); other differences are not considered significant.

Microscopic work was completed on an Olympus CX40 microscope with drawing tube attachment. Herbarium material was reconstituted in ammoniated congo-red. The microstructures of the pileus, hymenophoral trama and stipe are not depicted because they conform to standard forms (Young & Wood 1997). For the new taxon, 20 spores and 10 basidia were selected at random, drawn and measured. Scale bars are provided for all drawings: habit sketches, 10 mm; all microstructures, 10 μm . The derived parameter 'Q' is defined as the quotient of the length divided by the width of the relevant spore or basidium; the mean 'Q' is the quotient of the mean length and width respectively of a sample.

Holotype material for the new taxon has been deposited at the Queensland Herbarium, Mt. Coot-tha, Queensland (Herbarium BRI). Holotype and other material from the Cleland collection is held at the State Herbarium of South Australia, Kent Town, S.A. (Herbarium AD). Where no collector number has been assigned the convention 's.n.' is used. The author's personal herbarium number (*hb. young*) is cited for reference purposes—all material has been deposited at the relevant herbarium.

Taxonomic Information



Plate 1. *Hygrocybe kula*. Phyllis Clarke watercolour No. 128.

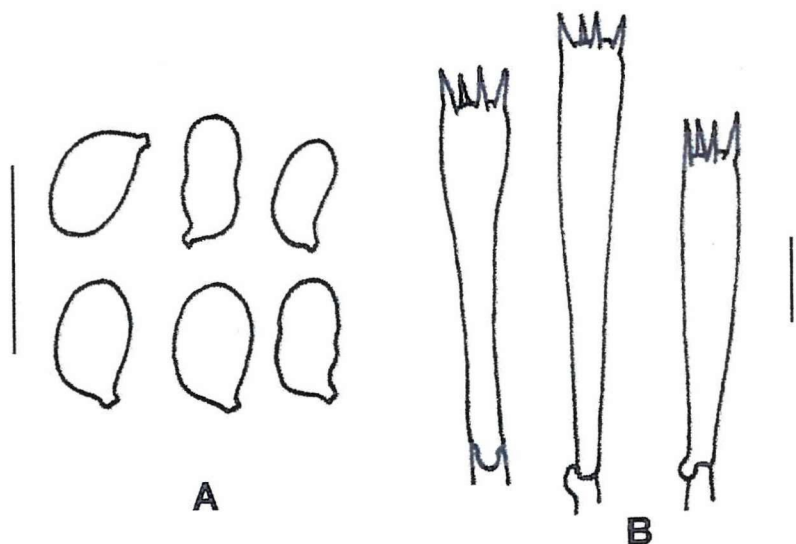


Figure 1. *Hygrocybe kula* (holotype AD 5716). A. spores; B. basidia. (Scale bars = 10 μm .)

A redescription of *Hygrocybe kula*

Hygrocybe kula Grgur., *Larger Fungi of South Australia*, 336 (1997). Plate 1.

Pileus 19 mm, blood-red, convex, then slightly depressed, [viscid at least when young], edge a little striate [distinctly striate and even]. *Lamellae* cream, slightly decurrent [deeply decurrent], rather distant. *Stipe* 38 mm, blood-red, base yellowish, slightly hollow, [viscid at least when young]. On ground. Under trees. Nat. Park. 15/7/16. Plate 1, Figure 1.

Spores 5–7 × 2.7–4.7 µm, mean 6.2 × 3.8 µm, Q: 1.3–2.0, mean Q: 1.61, ellipsoidal to cylindrical and a few slightly constricted, hyaline, smooth. *Basidia* 33–55 × 6–9 µm, mean 41.5 × 6.8 µm, Q: 4.3–8.0 (–10.0), mean Q: 6.09, (2-) 4-spored, clamped. *Cystidia* absent. *Hymenophoral trama* regular and consisting of parallel chains of cylindrical to ellipsoidal, hyaline, thin-walled, rather inflated elements 14–67 (–100) × 4–10 µm, clamps present; lactifers present as tortuous, thin-walled, highly refractive hyphae 4–8 µm diam. *Pileipellis* an ixocutis (which may be weak and possibly resembles a cutis if dry) consisting of repent, cylindrical, hyaline, thin-walled hyphae 3–5 µm diam., clamps abundant. *Stipitipellis* an ixocutis (which may be weak and possibly resembles a cutis if dry) consisting of repent, cylindrical, hyaline, thin-walled hyphae 2.5–3 µm diam., clamps abundant.

Habitat: On ground under trees; [probably gregarious to caespitose].

Material examined: N.S.W.: Royal National Park, 15.vii.1916, *J.B. Cleland s.n.* (AD 5716, holotype). S.A.: Greenhill Rd nr Adelaide, 1.vii.1922, *J.B. Cleland s.n.* (AD 5718); 27.vi.1921 (AD 5717).

Remarks: It is unfortunate that, in this particular instance, Cleland did not place a reference to the Phyllis Clarke watercolour number on the field notes with the holotype collection. Although Cleland usually did this when a watercolour existed, there is very good reason to believe that Clarke's watercolour 128 is of the holotype material because no other Cleland collections of that date, location and name exist and the watercolour does conform very well with both the material and Cleland's field notes.

The holotype of *Hygrocybe kula* is in very poor condition, but sufficient material still remains of a single basidiome (almost certainly the larger one illustrated in the Clarke watercolour) and it shows very clearly that the lamellae are deeply decurrent and run down the stem for quite some distance. Cleland's field notes state that the lamellae are 'slightly decurrent', however Phyllis Clarke's watercolour displays a basidiome with deeply decurrent lamellae which conforms with the basidiome fragment in the holotype collection. Cleland's note of 'slightly decurrent' lamellae therefore becomes his personal interpretation. Both the Clarke watercolour and Cleland's notes agree that the stipe has a yellow base and that the pileus margin is striate; the watercolour also shows the pileus margin is even.

Both the pileus and stipe of the remaining intact basidiome in the herbarium material have a 'varnished' surface which indicates either dried, gelatinised hyphae or a gluten layer, and there are quantities of sand grains adherent to the surfaces of both. Microscopic confirmation of a possible ixocutis is often very difficult (as is also agreed by Boertmann pers. comm.), but large numbers of spores were found to be firmly adherent to the cuticular hyphae of the pileus which also supports the supposition that an ixocutis was present on the pileus. There was almost certainly an ixocutis on the stipe as well. Cleland's field notes give no indications as to the viscosity of the pileus and stipe but this is not considered critical because many taxa within the Hygrophoraceae are at first viscid in the juvenile stage but will be described as 'quite dry or tacky at most' if they are collected at maturity, especially during dry weather.

The microdrawings of spores and basidia of *Hygrocybe kula* in Grgurinovic (1997) were taken from the holotype and are still relevant. The microdrawings of spores of *Hygrocybe kula* in Young & Wood (1997) were also done from the holotype and remain relevant. The habit sketch of *Hygrocybe kula* in Young & Wood (1997) is now replaced by the Phyllis Clarke watercolour No. 128 as depicted in Plate 1.

It is extremely desirable that this species be recollected as soon as possible from the holotype locality. This may prove very difficult as there are no records which indicate precisely where Cleland made his collection in the Royal National Park. The Park is very large, has a considerable number of locations which will fit the holotype habitat of 'under trees' and some previously suitable areas are now covered by buildings associated with park management.

No species designation is suggested for collections AD 5717 and AD 5718 although both definitely belong to the genus *Hygrocybe*. In both cases, the material is very fragmented and extremely difficult to examine microscopically. It is possible that either or both collections may represent a new taxon, but it would be very

inadvisable to describe a new species on the basis of the fragments and incomplete descriptions that comprise both collections. Re-collection of similar material from Cleland's original locality will provide the most satisfactory solution to this problem.

Separation of *Hygrocybe kula* and *Hygrocybe lanecovens*

Hygrocybe kula and *Hygrocybe lanecovens* may be assumed to have red, convex pilei that are viscid at least in juvenile stages. The pileus of *H. kula* has an even, striate margin, while *H. lanecovens* has no striations and very strongly crenulate margins. It is presumed impossible that such crenulate margins would not have been observed and neither noted by Cleland nor depicted by Clarke. The striate margin also suggests that *H. kula* has a basidiome with at least a partially translucent pileus; such a pileus does not exist for *H. lanecovens* which remains opaque at all stages.

The lamellae of *H. kula* are stated to be 'cream'; those of *H. lanecovens* are pure white until very late maturity when they may have a faint cream tint. The Cleland collection clearly shows that several basidiomes were collected and at least one of these was juvenile. If white lamellae were present in the early stages, it is reasonable to assume this fact would have been recorded because Cleland's field notes are usually very reliable as to colour. The stipe base of *H. kula* is described in the text and depicted in the watercolour as distinctly yellow; yellow is never found on the stipe of *H. lanecovens* which remains consistently red throughout its length, even in old specimens.

Spore dimensions of the two taxa are very similar [(6.0–) 6.7–8.0 × 3.7–5.0 (–5.3) μm in *H. lanecovens*] although those of *H. lanecovens* are slightly wider. The shapes and dimensions of other microcharacters of the two taxa are also very similar and are not considered further here.

Although the two species are obviously close, there are sufficient macrocharacters to permit their separation and for the moment the two taxa are retained. It is conceded that future collections of *Hygrocybe kula* may possibly reduce *H. lanecovens* to a variant of *H. kula*; however, the currently known information about the two taxa make this possibility unlikely.

A new species based on the original misinterpretation

The description of *Hygrocybe kula* presented in Grgurinovic (1997), Young & Wood (1997) and Young (1999) is a collation of characters for at least two taxa. However, the mixed description was applied consistently by Young & Wood (1997) and Young (1999) to a widely occurring species which was interpreted as *H. kula* in all relevant collections but is now known to be separate. It has a convex pileus which is smooth, red and dry; adnate, white lamellae with at most a decurrent tooth; and a red, dry stipe which is often sinuous. A formal description of this taxon now follows.

Hygrocybe rubronivea A.M. Young, *sp. nov.*

Hygrocybe kula auct. non p.p. Grgur.: Grgurinovic, *Larger Fungi of South Australia* 336 (1997).

Pileus 7–30 mm, ruber, convexus dein planatus, siccus, glaber vel farinosus, ad marginem crenulatus. Lamellae adnatae cum dentes decurrentes, niveae dein sub-cremae, ad marginem concolorae. Stipes 11–35 × 2–3 mm, ruber, siccus, glaber, sinuatus vel sub-sinuatus. Sporae 6.5–10.0 × (3.5–) 4.0–7.0 μm, Q: 1.3–1.9, oblongae vel ellipsoideae, aliquot sub-constrictae, hyalinae. Basidia 27–40 × 6–9 μm, Q: 4.5–7.6, (2-) 4-spora, fibulata. Cystidia nulla. Trama hymenophoralis regularis, fibulata. Epicutis pilei cutem eformans. Gregaria in humo sylvestri.

Holotypus: New South Wales. Lane Cove Bushland Park, 7.vi.1998, R. & E. Kearney (*hb. young* 2078) (*holotypus* BRI) hic designatus.

Pileus 7–30 mm, convex then becoming rather flattened and occasionally centrally depressed, dry, smooth or sometimes mealy, brilliant crimson (near 8A8–10A8), margins crenulate (especially when young) to even, not cracking, may be yellow tinted. *Lamellae* broadly adnate with a slight decurrent tooth, thick, widely spaced, pure white becoming cream coloured (3A2–4A2) with age, margins concolorous; veins often present on the upper lamellae surfaces and on the pileus undersurface. *Stipe* 11–35 × 2–3 mm, more or less cylindrical although occasionally with a tendency to become flattened, often sinuous, firm, smooth, dry, at first brilliant crimson, but paling with age and may become pinkish cream, the base has a tendency to become yellow-tinted and this may spread upwards. Odour none; taste mild. Figure 2.

Spores 6.5–10 × (3.5) 4–7 μm, mean 8.4 × 5.4 μm, Q: 1.3–1.9, mean Q: 1.6, oblong to ellipsoidal and occasionally slightly constricted medially, apiculus prominent 1–2 μm. *Basidia* 27–40 × 6–9 μm, mean 36 × 6

μm , Q: 4.5–7.6, mean Q: 5.6, narrowly clavate, 2- or 4- spored, clamped. *Cystidia* absent. *Hymenophoral trama* regular, consisting of cylindrical, clamped, and occasionally inflated elements $25\text{--}60 (100) \times 2\text{--}10 \mu\text{m}$, lactifers present as highly refractive, tortuous and sometimes branching, clamped hyphae $2\text{--}4 \mu\text{m}$. *Pileipellis* a cutis of clamped hyphae, $3\text{--}5 \mu\text{m}$ diam., lactifers occasionally present and similar to those in the hymenophoral trama. *Stipitipellis* a cutis of hyaline, thin-walled, clamped hyphae $3\text{--}5 \mu\text{m}$ diam.

Habitat and distribution: On soil in rainforest or at least in very sheltered locations; gregarious to caespitose. Recorded from New South Wales and Queensland.

Material examined: N.S.W.: Mt Wilson, 2.vii.1980, A.E. Wood (UNSW 80/301); Watagan State Forest, 22.vi.1988, A.E. Wood & F. Taeker (UNSW 88/273); Cumberland State Forest, 31.iii.1990, A.E. Wood (UNSW 90/100). Qld: Bunya Mountains National Park, 6.v.1989, A.M. Young 1369 (BRI).

Remarks: This species resembles *Hygrocybe miniata* which differs by having yellow-pink to orange lamellae and a pileipellis that is a trichoderm. Two other bright red taxa with white lamellae are *Hygrocybe lanecovensensis* and *H. kula*, both of which can be separated by their deeply decurrent lamellae and the distinctly viscid pilei which remain viscid until the basidiome is at least half expanded.

Etymology: Latin, *ruber*, red; Latin, *niveus*, snow-white; referring to the combination of the brilliant red pileus and white lamellae.

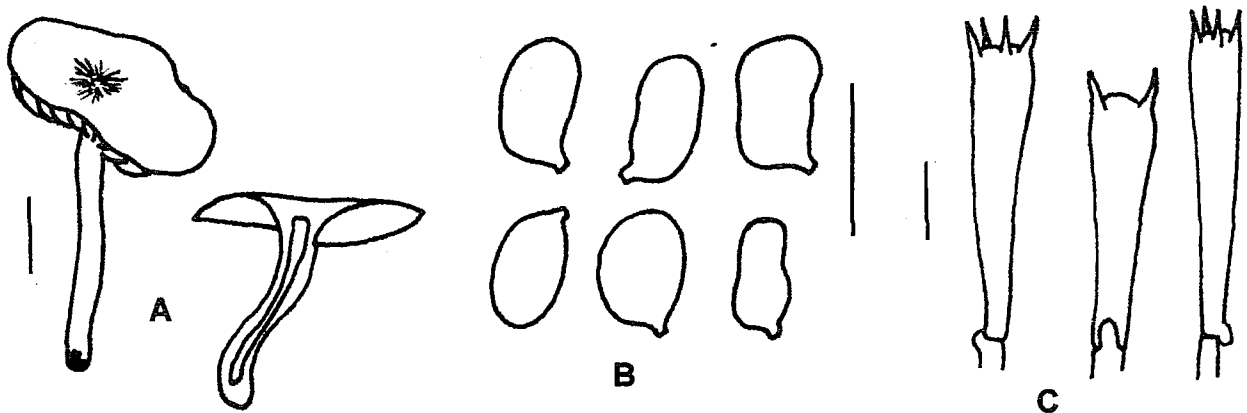


Figure 2. *Hygrocybe rubronivea* (holotype BRI) A. habit sketch; B. spores; C. basidia. (Scale bars: habit sketch = 10 mm; spores and basidia = 10 μm .)

Acknowledgements

The author wishes to express his thanks to: Dr David Boertmann of the Department of Arctic Environment, Denmark for comments on the reconstitution of pileus cuticles in the Hygrophoraceae; Dr Cheryl Grgurinovic of ABRS for information on the Cleland material; Dr Laurie Haegi and Mr Graham Bell of the State Herbarium of South Australia for their generous assistance with the Cleland material relevant to this investigation; Associate Professor Ray Kearney and Mrs Elma Kearney of Sydney for their continuing and unstinting assistance with the Hygrophoraceae of Lane Cove Bushland Park. This investigation was undertaken under a research grant provided by the Australian Biological Resources Study.

References

- Cleland, J.B. & Cheel, E. (1919). Australian Fungi: Notes and Descriptions. No. 3. *Transactions and Proceedings of the Royal Society of South Australia* **43**, 262–315.
- Grgurinovic, C.A. (1997). *Larger Fungi of South Australia*. Botanic Gardens of Adelaide and State Herbarium and the Flora and Fauna of South Australia Handbooks Committee, Adelaide, S.A.
- Young, A.M. (1999). The Hygrocybeae (Fungi, Basidiomycota, Agaricales, Hygrophoraceae) of the Lane Cove Bushland Park, New South Wales. *Austrobaileya* **5**, 535–564.
- Young, A.M. & Wood, A.E. (1997). Studies on the Hygrophoraceae (Fungi, Homobasidiomycetes, Agaricales) of Australia. *Australian Systematic Botany* **10**(6), 911–1030.