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INVENTORY OF THE GENUS *CRATERELLUS* PERSOON FROM KIGOMA REGION, TANZANIA

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ABSTRACT

There is scanty knowledge on macro fungi diversity in Kigoma region. Bioprospecting survey was undertaken in Miombo woodlands, Kigoma region of Tanzania that has never been explored. The survey sought to conduct an inventory of Craterellus Persoon. Conventional taxonomic techniques were used during the survey to characterize the collected materials. Both macro and micro morphological features including basidiocarp size, colour, shape, spore size and print colour were examined. High diversity of reputed macrofungi was observed. This study presents a preliminary inventory of the genus Craterellus Persoon in the country. Three species were described; two namely Craterellus cornucopioides (Linnaeus) Persoon and Craterellus odoratus (Schweinitz: Fries) Fries, being recorded for the first time in Tanzania; while the remaining one could be a new species. Further comprehensive studies need to be conducted in Kigoma miombo woodland to explore the macrofungi diversity to understand and document them.

Key words: *Craterellus*, Kigoma, Miombo woodland, Tanzania

INTRODUCTION

Miombo woodland in Tanzania is divided mainly into a Southeastern and a Northwestern zone in the country (Figure 1). As it has been reported by Campbell et al. (1996), the woodland covers an estimated area of 2.7 million km^2 on nutrient-poor soils in sub- Saharan Africa that receives less than 700 mm of precipitation per year. It is markedly distinguished from other African savannah woodland and forest formations by the high frequency of tree species with meso- and microphyllous compound leaves (Van der Meulen and Werger, 1984), the flush of new leaves before new rains and the dominance of ectomycorrhizal tree species (Högberg, 1982, 1992; Högberg and Piearce, 1986). The woodland is dominated by trees in the genera *Brachystegia* and other ectomycorrhizal trees in other genera of *Caesalpinaceae*, especially *Julbernardia* and *Isoberlinia*, as well as by host trees of the genus *Uapaca* (Phyllantaceae) (Tibuhwa et al. 2008).

Miombo woodland harbours diverse genera of basidiomycetes. Among them is the genus, *Craterellus* Persoon that is characterized by their lack of true gills but possess smooth, wrinkled, or false gills on their hymenium. These false gills are characteristically decurrent thus, running down the stem of the mushroom, rather than being attached to the cap only. The species in the genus are often tube shaped with stems that are often hollow. Members of this genus are generally edible and look closely related to the chanterelles especially their funnel shapes. *Craterellus* species superficially look similar to *Cantharellus* and generally has been confused with them (Trappe et al. 2000). They belong to the order Cantharellales, family Cantharellaceae which formally were on the same group as *Cantharellus* but through molecular phylogenic studies these

two groups were separated because the result indicated that the presence of a hollow stem is a synapomorphy (a trait corresponding to the evolutionary relationship) which reliably identifies *Craterellus* species. It is thus among the small genus of the Basidiomycetes members comprising of about 134 species so far described (Table 1). Like *Cantharellus*, *Craterellus* not only that are important for the ecology of the miombo woodland by being mycorrhizal partners to the trees (Munyanziza, 1994), but are also economically vital for the low income communities in the area. *Craterellus* and *Cantharellus* grow together, and are not easily demarcated by local gatherers. Many local mushroom gatherers consider them similar often knowing them by same vernacular names and a mixture of the two being sold in local markets and along roadsides during the rainy season.

Table 1: Described species in the genus *Craterellus* Persoon as of year 2017.

S/	**Species in the genus Craterellus Pers.**		**Iconography***
1	*Craterellus albomarginatus* Coker	1927	*Fl. mycol. France* (Paris): 37 (1888)
2	*Craterellus amethysteus* (QuŽl.) QuŽl.	1888	*Fl. mycol. France* (Paris): 37 (1888)
3	*Craterellus amethysteus* Rea	1927	*Trans. Br. mycol. Soc.* **12**(2-3): 220 (1927)
4	*Craterellus atratoides* T.W. Henkel, Aime & A.W. Wilson	2012	*Mycologia* **104**(6): 1470 (2012)
5	*Craterellus atratus* (Corner) Yomyart, Watling, Phosri, Piap. & Sihan.	2013	*Mycotaxon* **122**: 414 (2013) [2012]
6	*Craterellus atrocinereus* Arora & J.L. Frank	2015	*Index Fungorum* **249**: 1 (2015)
7	*Craterellus auratus* QuŽl. 1888; Cantharellaceae	1860	*Mycotaxon* **122**: 414 (2013) [2012]
8	*Craterellus aureus* Berk. & M.A. Curtis	1997	*Proc. Amer. Acad. Arts & Sci.* **4**: 123 (1860) [1858]
9	*Craterellus australis* (Cleland & Cheel) Grgur.	1997	*Larger Fungi of South Australia* (Adelaide): 24 (1997)
10	*Craterellus borealis* Burt	1914	*Ann. Mo. bot. Gdn* **1**: 357 (1914)
11	*Craterellus boyacensis* Singer	1963	*Proc. Amer. Acad. Arts & Sci.* **4**: 123 (1860) [1858]
12	*Craterellus caeruleofuscus* A.H. Sm.	1968	*Michigan Bot.* **7**: 150 (1968)
13	*Craterellus caespitosus* Peck	1873	*Ann. Rep. Reg. Univ. St. N.Y.* **25**: 82 (1873) [1872]
14	*Craterellus calicornucopioides* D. Arora & J.L. Frank	2015	*Index Fungorum* **249**: 1 (2015)
15	*Craterellus calyculus* (Berk. & M.A. Curtis) Burt	1914	*Ann. Mo. bot. Gdn* **1**: 338 (1914)
16	*Craterellus canadensis* (Klotzsch ex Berk.) Sacc.	1888	in Berkeley, *Syll. fung.* (Abellini) **6**: 519 (1888)
17	*Craterellus cantharelloides* QuŽl.;		**Index Fungorum LSID:** urn:lsid:indexfungorum.org:names:322044
18	*Craterellus cantharelloides* var. cantharelloides QuŽl.;	1896	*Compt. Rend. Assoc. Franç. Avancem. Sci.* **24**(2): 619 (1896) [1895]
19	*Craterellus cantharelloides* var. *lutescens* (Pers.) QuŽl.	1896	*Compt. Rend. Assoc. Franç. Avancem. Sci.* **24**(2): 619 (1896) [1895]
20	*Craterellus cantharelloides* var. *villosus* (Pers.) QuŽl.	1896	*Compt. Rend. Assoc. Franç. Avancem. Sci.* **24**(2): 619 (1896) [1895]
21	*Craterellus cantharellus* (Fr.) Sacc.	1888	*Syll. fung.* (Abellini) **6**: 517 (1888)
22	*Craterellus cantharellus* var. albus Kawam.	1954	*Icones of Japanese fungi* **6**: 647 (1954)

23	*Craterellus cantharellus* var. *cantharellus* (Fr.) Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 532 (1838) [1836-1838]
24	*Craterellus carolinensis* R.H. Petersen	1968	*Persoonia* **5**(2): 217 (1968)
25	*Craterellus cibarius* (Fr.) QuŽl.	1888	*Fl. mycol. France* (Paris): 37 (1888)
26	*Craterellus cinereofimbriatus* T.W. Henkel & A.W. Wilson	2014	*Mycologia* **106**(2): 312 (2014)
27	*Craterellus cinereus* (Pers.) Pers.	1825	*Mycol. eur.* (Erlanga) **2**: 6 (1825)
28	*Craterellus cinereus* var. *cinereus* (Pers.) Pers.	1825	*Mycol. eur.* (Erlanga) **2**: 6 (1825)
29	*Craterellus cinereus* var. *multiplex* (A.H. Sm.) A.H. Sm.	1968	*Michigan Bot.* **7**: 151 (1968)
30	*Craterellus clavatus* (Pers.) Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 533 (1838) [1836-1838]
31	*Craterellus cochleatus* Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 534 (1838) [1836-1838]
32	*Craterellus comperi* LŽv.	1842	in Demidov, *Voyage dans la Russie Meridionale et la Crimeé, par la Hongrie, la Valachie et la Moldavie* **2**: 87 (1842)
33	*Craterellus confluens* Berk. & M.A. Curtis	1867	*J. Linn. Soc.*, Bot. **9**: 423 (1867)
34	*Craterellus convolvulatus* (A.H. Sm.) Eyssart. & Buyck	2010	in Buyck, Lewis, Eyssartier & Hofstetter, *Cryptog. Mycol.* **31**(1): 31 (2010)
35	*Craterellus cornucopioides* (L.) Pers.	1825	*Mycol. eur.* (Erlanga) **2**: 5 (1825)
36	*Craterellus cornucopioides* var. cornucopioides (L.) Pers.	1825	*Mycol. eur.* (Erlanga) **2**: 5 (1825)
37	*Craterellus cornucopioides* var. crispus Sacc.	1888	*Syll. fung.* (Abellini) **6**: 516 (1888)
38	*Craterellus cornucopioides* var. flavicans Sacc.	1877	*Michelia* **1**(no. 1): 5 (1877)
39	*Craterellus cornucopioides* var. mediosporus Corner	1966	*Monogr. Cantharelloid Fungi*: 95 (1966)
40	*Craterellus cornucopioides* var. multiplex (A.H. Sm.) Romagn.	1996	*Bull. trimest. Soc. mycol. Fr.* **112**(2): 135 (1996)
41	*Craterellus cornucopioides* var. parvisporus Heinem.	1958	*Bull. Jard. bot. État Brux.* **28**: 431 (1958)
42	*Craterellus cornucopioides* var. roseus R. Heim	1960	*Revue Mycol.*, Paris **25**: 225 (1960)
43	*Craterellus corrugis* Peck	1899	*Bull. Torrey bot. Club* **26**: 69 (1899)
44	*Craterellus costaricensis* Qiu X. Wu	1995	in Wu & Mueller, *Docums Mycol.* **25**(nos 98-100): 490 (1995)
45	*Craterellus crispus* (Bull.) Berk.	1860	*Outl. Brit. Fung.* (London): 266 (1860)
46	*Craterellus cristatus* Kauffman	1930	*Pap. Mich. Acad. Sci.* **11**: 172 (1930) [1929]
47	*Craterellus cyathiformis* Pers.	1825	*Mycol. eur.* (Erlanga) **2**: 6 (1825)
48	*Craterellus cymatodermoides* D.A. Reid, K.S. Thind & Adlakha	1958	*Trans. Br. mycol. Soc.* **41**(1): 131 (1958)
49	*Craterellus delitescens* Burt	1914	*Ann. Mo. bot. Gdn* **1**: 339 (1914)
50	*Craterellus dilatus* Burt	1914	*Ann. Mo. bot. Gdn* **1**: 343 (1914)
51	*Craterellus dongolensis* Sacc.	1917	*Riv. Accad. di Padova* **33**: 185 (1917)
52	*Craterellus dubius* Peck	1878	*Ann. Rep. N.Y. St. Mus. nat. Hist.* **31**: 38 (1878)
53	*Craterellus elegans* Rick	1931	*Egatea* **16**: 41 (1931)
54	*Craterellus excelsus* T.W. Henkel & Aime	2009	*Mycotaxon* **107**: 202 (2009)
55	*Craterellus fallax* A.H. Sm.	1968	*Michigan Bot.* **7**: 153 (1968)
56	*Craterellus flavobrunneus* (R.H. Petersen) Eyssart. & Buyck	2010	*Cryptog. Mycol.* **31**(1): 31 (2010)
57	*Craterellus floccosus* Boud.	1878	*Bull. Soc. bot. Fr.* **24**: 308 (1878) [1877]
58	*Craterellus floccosus* QuŽl.	1878	*Bull. Soc. bot. Fr.* **24**: 308 (1878) [1877]

59	*Craterellus floriformis* (Schaeff.) QuŽl.	1892	*Compt. Rend. Assoc. Franç. Avancem. Sci.* **20**(2): 466 (1892) [1891]
60	*Craterellus foetidus* A.H. Sm.	1968	*Michigan Bot.* **7**: 152 (1968)
61	*Craterellus hesleri* R.H. Petersen	1975	*Česká Mykol.* **29**: 200 (1975)
62	*Craterellus humphreyi* Burt	1914	*Ann. Mo. bot. Gdn* **1**: 344 (1914)
63	*Craterellus hypolyssoides* Ces.	1879	*Atti Accad. Sci. fis. mat. Napoli* **8**(no. 3): 10 (1879)
64	*Craterellus ianthinoxanthus* (Maire) PŽrez-De-Greg.	2000	in Carbó, et al. *Bolets de Catalunya* (Barcelona) **19**(901-950): làm. 908 (2000)
65	*Craterellus ignicolour* (R.H. Petersen) Dahlman, Danell & *Spatafora*	2000	*Mycol. Res.* **104**(4): 392 (2000)
66	*Craterellus incarnatus* QuŽl.	1890	*Compt. Rend. Assoc. Franç. Avancem. Sci.* **18**(2): 511 (1890) [1889]
67	Craterellus indicus Deepika, Ram. Upadhyay & Mod.S. Reddy	2012	*Mycol. Progr.* **11**(3): 769-774 (2012)
68	*Craterellus infundibuliformis* QuŽl.	1888	*Fl. mycol. France* (Paris): 36 (1888)
69	*Craterellus insignis* Cooke	1890	*Grevillea* **19**(no. 89): 2 (1890)
70	*Craterellus konradii* Bourdot & Maire	1930	*Bull. trimest. Soc. mycol. Fr.* **46**: 227 (1930)
71	*Craterellus laetus* Pat. & Har.	1912	*Bull. Soc. mycol. Fr.* **28**: 282 (1912)
72	*Craterellus lateritius* Berk.	1873	*Grevillea* **1**(no. 10): 147 (1873)
73	*Craterellus lutescens* (Fr.) Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 532 (1838) [1836-1838]
74	*Craterellus lutescens* f. *citrinosulphureus* Blanco-Dios & TomŽ-Ortega	2011	*Tarrelos*, Revista da Federation Galera de Micoloxia **13**: 13 (2011)
75	*Craterellus lutescens* f. *luteocomus* (H.E. Bigelow) Eyssart.	2011	in Eyssartier & Roux, *Le Guide des Champignons*, France et Europe (Paris): 1083 (2011)
76	*Craterellus lutescens* f. *lutescens* (Fr.) Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 532 (1838) [1836-1838]
77	Craterellus lutescens f. *niveipes* (Schild & WŠfler) Blanco-Dios	2011	*Tarrelos*, Revista da Federation Galera de Micoloxia **13**: 14 (2011)
78	*Craterellus lutescens* var. *albidus* (Bon & Pacaud) Blanco-Dios	2011	*Tarrelos*, Revista da Federation Galera de Micoloxia **13**: 14 (2011)
79	*Craterellus lutescens* var. *bisporus* (Bertault) Blanco-Dios	2011	*Tarrelos*, Revista da Federation Galera de Micoloxia **13**: 14 (2011)
80	*Craterellus lutescens* var. *crocatus* Sacc.	1888	*Syll. fung.* (Abellini) **6**: 515 (1888)
81	*Craterellus lutescens* var. *lutescens* (Fr.) Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 532 (1838) [1836-1838]
82	*Craterellus marasmioides* Berk. & M.A. Curtis	2000	*J. Linn. Soc.*, Bot. **10**(no. 46): 328 (1868) [1869]
83	*Craterellus melanoxeros* (Desm.) PŽrez-De-Greg.	1868	*Bolets de Catalunya* (Barcelona) **19**(901-950): làm. 908 (2000)
84	*Craterellus minimus* Saut.	1876	*Hedwigia* **15**: 152 (1876)
85	*Craterellus montanus* Velen.	1939	*Novitates Mycologicae*: 167 (1939)
86	*Craterellus multiplex* Cooke & Massee	1889	*Grevillea* **18**(no. 86): 25 (1889)
87	*Craterellus multiplex* (Underw.) Shope	1938	*Mycologia* **30**(4): 373 (1938)
88	*Craterellus multiplex* (A.H. Sm.) Pomerl.	1980	*Fl. Champ. Québec* (Ottawa): 274 (1980)
89	*Craterellus multiplex* var. multiplex Cooke & Massee	1889	*Grevillea* **18**(no. 86): 25 (1889)
90	*Craterellus multiplex* var. niveus Massee	1900	*Pap. Proc. R. Soc. Tasm.*: 98 (1900) [1898-1899]

91	*Craterellus mussooriensis* D.A. Reid, K.S. Thind & Adlakha	1958	*Trans. Br. mycol. Soc.* **41**(1): 132 (1958)
92	*Craterellus niger* S‡, Pinheiro & Wartchow	2014	n Sá, Pinheiro, Silva, Maia & Wartchow, *Nova Hedwigia* **99**(3-4): 526 (2014)
93	*Craterellus nucleatus* Schršd.	1908	*Centralbl. Gesammte Forstwesen* **34**: 396 (1908)
94	*Craterellus ochrosporus* Burt	1914	*Ann. Mo. bot. Gdn* **1**: 334 (1914)
95	*Craterellus ocreatus* Pers.	1825	*Mycol. eur.* (Erlanga) **2**: 5 (1825)
96	*Craterellus odoratus* (Schwein.) Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 532 (1838) [1836-1838]
97	*Craterellus odoratus* var. *odoratus* (Schwein.) Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 532 (1838) [1836-1838]
98	*Craterellus odoratus* var. *solidostipite* K.S. Thind & Adlakha	1958	*Indian J. mycol. Res.*: 57 (1958) [1956]
99	*Craterellus olivaceoluteus* T.W. Henkel, Aime & A.W. Wilson	2014	Yves Lamoureux, mycoquebec.org.
100	*Craterellus orinocensis* Pat. & Gaillard	1888	*Bull. Soc. mycol. Fr.* **4**(1): 19 (1888)
101	*Craterellus pallidipes* (R.H. Petersen) Eyssart. & Buyck	2010	*Cryptog. Mycol.* **31**(1): 31 (2010)
102	*Craterellus pallidus* (Pers.) Ricken	1918	*Vadem. Pilzfr.*: 248 (1918)
103	*Craterellus palmatus* Burt & Overh.	1914	*Annual Report of the Missouri Botanical Garden, St. Louis* **1**: 342 (1914)
104	*Craterellus papyraceus* Berk. & M.A. Curtis	1857	*Trans. Linn. Soc. London* **22**: 129 (1857)
105	*Craterellus partitus* (Berk.) Sacc.	1888	*Syll. fung.* (Abellini) **6**: 518 (1888)
106	*Craterellus peckii* R.H. Petersen	1976	*Mycologia* **68**(2): 325 (1976)
107	*Craterellus philippinensis* Bres.	1913	*Hedwigia* **53**: 47 (1913) [1912]
108	*Craterellus pistillaris* Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 534 (1838) [1836-1838]
109	*Craterellus pleurotoides* (T.W. Henkel, Aime & S.L. Mill.) A.W. Wilson	2012	*Mycologia* **104**(6): 1475 (2012)
110	*Craterellus plicatulus* Heinem.	1958	*Bull. Jard. bot. État Brux.* **28**: 433 (1958)
111	*Craterellus pogonati* Peck	1906	*Bull. Torrey bot. Club* **33**(4): 218 (1906)
112	*Craterellus pontevedrensis* Blanco-Dios	2014	*Micol. Veg. Medit.* **29**(1): 102 (2014)
113	*Craterellus pulverulentus* Berk. & M.A. Curtis	1868	*J. Linn. Soc.*, Bot. **10**(no. 46): 328 (1868) [1869]
114	*Craterellus pusillus* (Fr.) Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 533 (1838) [1836-1838]
115	*Craterellus pusio* Berk.	1859	*Bot. Antarct. Voy.*, III, Fl. Tasman. **2**: 258 (1859) [1860]
116	*Craterellus queletii* Ferry	1892	*Revue mycol.*, Toulouse **14**(no. 55): 96 (1892)
117	*Craterellus roseus* (Schwein.) Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 533 (1838) [1836-1838]
118	*Craterellus rugiceps* Berk. & Cooke	1876	*J. Linn. Soc.*, Bot. **15**: 387 (1876) [1877]
119	*Craterellus rugulosus* (LŽv.) Pat.	1894	*Bull. Soc. mycol. Fr.* **10**(2): 56 (1894)
120	*Craterellus sinuosus* (Fr.) Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 533 (1838) [1836-1838]
121	*Craterellus sinuosus* * crispus (Bull.) Fr.	1838	*Fl. mycol. France (Paris): 35 (1888)*
122	*Craterellus sinuosus* var. crispus (Bull.) QuŽl.	1888	*Epicr. syst. mycol.* (Upsaliae): 533 (1838) [1836-1838]
123	*Craterellus sinuosus* var. sinuosus (Fr.) Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 533 (1838) [1836-1838]

124	*Craterellus sparassoides* Speg.	1884	*Anal. Soc. cient. argent.* **17**(2): 76 (1884)
125	*Craterellus spathularius* Berk. & M.A. Curtis	1868	*J. Linn. Soc.*, Bot. **10**(no. 46): 328 (1868) [1869]
126	*Craterellus spathuliformis* Gillet	1884	*Tabl. analyt. Hyménomyc. France* (Alençon): 173 (1884)
127	*Craterellus strigosus* T.W. Henkel, Aime & A.W. Wilson	2012	*Mycologia* **104**(6): 1472 (2012)
128	*Craterellus subperforatus* (A.H. Sm.) Eyssart. & Buyck	2010	Bull. of the Torrey Botanical Club 25 (6): 323 (1898)
129	*Craterellus subundulatus* (Peck) Peck	1904	*Ann. Rep. N.Y. St. Mus.* **67**: 27 (1904) [1903]
130	*Craterellus taxophilus* Thom	1904	*Bot. Gaz.* **37**(3) (1904)
131	*Craterellus tubaeformis* (Fr.) QuŽl.	1888,	*Fl. mycol. France* (Paris): 36 (188
132	*Craterellus turbinatus* Burt	1926	*Ann. Mo. bot. Gdn* **13**(3): 313 (1926)
133	*Craterellus unicolor* Berk. & Ravenel	1873	*Grevillea* **1**(no. 10): 148 (1873)
134	*Craterellus variabilis* (Riess) QuŽl.,	1950	*Monograph of Clavaria and Allied Genera* (London): 687 (1850)
135	*Craterellus venosus* R.H. Petersen	1975	*Česká Mykol.* **29**: 201 (1975)
136	*Craterellus verrucosus* Massee	1906	*Bull. Misc. Inf.*, Kew: 256 (1906)
137	*Craterellus violaceus* (Fr.) Fr.	1838	*Epicr. syst. mycol.* (Upsaliae): 533 (1838) [1836-1838]
138	*Craterellus zelleri* Burt	1926	*Ann. Mo. bot. Gdn* **13**(3): 314 (1926)

Source: * http://www.indexfungorum.org/names/Names.asp; in January 2017

Mushrooms from Miombo woodland of Tanzania have been studied before by Härkönen et al. (1995, 2003) who reported several common species in different genera of *Cantharellus, Russula, Lactarius, Amanita* and *Boletus* and (Tibuhwa 2008, 2009, Tibuhwa et al 2012) who studied species in the genus *Cantharellus* describing new species and proposing a new genus *Afrocantharellus*. However, some parts of the Miombo woodlands are yet to be surveyed and hence its mycoflora generally understudied. The Kigoma region in northwestern Tanzania, situated at the border of Burundi and Lake Tanganyika, is the best example of such. This region has been unreached due political instability in the neighboring countries- Burundi and Democratic Republic of Congo (DRC). The so far studies on edible fungi in Miombo forest in Kigoma province is the short description of a new species *Lactifluus kigomaensis* De Crop and Verbeken (De Crop et al. 2012) in the recently described genera *Lactifluus* and a recent study by Tibuhwa (2017) which report on the cytotoxicity, antimicrobial and antioxidant activities of a macrofungi *Boletus bicolor* from the area. Miombo forest in Kigoma province remains a hotspot of biodiversity where many taxa are yet to be explored. This work presents three species from the genus *Craterellus*, collected for the first time in the country and one of which might be new to science.

MATERIALS AND METHODS

Study area

The study was carried out in the miombo woodland of Kigoma for 2 two weeks during the rain season of March-May year 2011 (Figure 1). The miombo woodland in Kigoma is dominated by tree species of *Brachystegia* and other ectomycorrhiza trees of the family Caesalpinaceae, especially members of the genera *Isoberlinia* and *Julbernardia* plus other members of the family Phyllantaceae (Uapaca) De Crop et al. (2012).

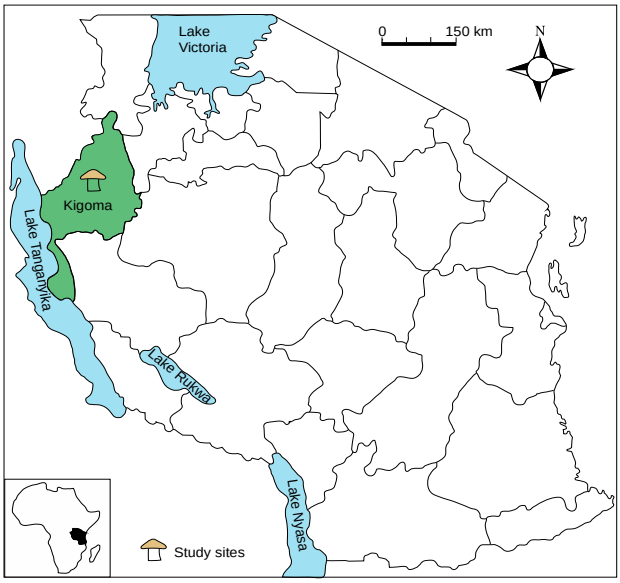

Figure 1: Map of Tanzania showing the sampling sites miombo woodland in the northwestern Tanzania in Kigoma region. (Source: Google map, modified by the researcher by inserting the study sites)

Collection of mushroom and morphological analysis

The mushroom fruitbodies were photographed in situ, prior to picking from its substrate (Figures 2-4). Picking was done with the aid of the scalpel. Picked mushrooms were then packed into collecting plastic bags which were correctly labeled with collection number, collecting date, name of the collector as well as few field identification tips such as sporocarp shape, colour, smell, colour changing on bruising, and tentative name before it was brought to the Department of Molecular Biology and Biotechnology laboratory at the University of Dar es Salaam for further research work. Identification was done using available colored field guide books/ monographs such as Arora (1986); Härkönen et al. (1995, 2003), Kirk et al. (2001); Lodge et al. (2004) and Internet facilities (The fungi nomenclature was based on Kirk and Ansell (1992) as well as the web site of CABI bioscience databases (http://www.speciesfungorum.org/Names/Names.asp). Voucher specimens (DDT 1042/2011, DDT 1043/2011), *Craterellus* sp 2 (DDT 1057/2011) and *Craterellus* sp 3 (DDT 1056/2011), were kept in the mycological herbarium of the University of Dar es Salaam (DSM).

Macroscopic observation

Sampling methods complies with that of Tibuhwa (2010, 2011) and consists of collecting the basidiomata randomly throughout the woodland and each specified habitat recording each collection point using the Global Positioning System (GARMIN 12 XL, USA). These materials were dried on

locally made mushroom drier using kerosine lamps. Each observed mushroom was photographed *insitu*, prior to picking from its substrate.

Microscopic observations

Microscopic characters were recorded from dry specimens and observed in an ammonia-Congo red solution, after a short pre-treatment in a 10% Potassium hydroxide solution. Measurement of spores (length, width and Q ="quotient length/ width") were taken for 40 spores and are presented in arithmetic averages. Forty measurements of basidiospores were used for obtaining statistical estimates indicated as: (min) min – SD – AV – max – SD (max) Q, in which min = lowest value recorded for the measured specimen, max = highest value, AV = arithmetic mean and SD standard deviation; Q= the ratio length/width. Spore shapes were described according to Bas (1969). The original collections are conserved in the Mycological herbarium of Ghent University (GENT), and duplicates stored at the University of Dar es Salaam herbarium (UDSM). Colour codes were adopted from Kornerup (1962).

RESULTS AND DISCUSSION

Two weeks field trip yielded enormous macrofungi collections of which corresponded to species identified as*: Craterellus cornucopioides* (Linnaeus) Persoon (DDT 1042/2011, DDT 1043/2011) Figure 2, *Craterellus odoratus* (Schweinitz: Fries) Fries (DDT 1057/2011) Figure 3 and *Craterellus* sp (DDT 1056/2011) Figure 4. They belong to: Kingdom-Fungi, division-Basidiomycota, Class-Basidiomycetes, Order-Cantharellales, Family-Cantharellaceae and Genus *Craterellus*

3.1 Taxonomic description

3.1.1 *Craterellus cornucopioides* (Linnaeus) Persoon [MB#: 153130]

Common Name: Black trumpet or Trumpet of Death or the Horn of Plenty

Synonym:

Merulius cornucopioides (L.) Pers., [MB#473318]

Cantharellus cornucopioides (L.) Fr., [MB#294066]

Cantharellus cornucopiae Wallr., [MB#562463]

Dendrosarcus cornucopioides (Pers.) [MB#524930]

Dendrosarcus cornucopiodes (L.) Kuntze [MB#527942]

Basidiocarp cone- to trumpet-shaped, thin leathery fruit body**, Cap**: small, 1.2 -2.8 cm, hairy when young which differentiates into arboriform tiny outgrowth like other tiny pileus on top of the cap. Black (23FI) **Hymenium** smooth without gills, paler (23D1) decurrent. **Margin** wavy and paler like hymenium contrasting the black cap. **Stipe** smooth and stuffed, 0.3x3.5 cm. **Basidia** are clavate (club shaped),slender and with two sterigmata. **Basidiospores** 9-11 x 6-7.5 µ elliptical; hyaline and smooth. **Clamp connections** absent. **Spore print** white-cream.

Habitat: growing gregariously, scattered or in tightly packed clusters of 3-4 mushrooms in the floor of mixed miombo woodland species in Kigoma region. Grew abundantly on the forest floor. Their black colour and small size make them difficult to be seen as they resemble dead decaying leaves.

Figure 2: Fruiting bodies of *Craterellus cornucopioides* (Linnaeus) Persoon growing on soil in in miombo woodland Kigoma. (All photos taken by the author).

Distribution: This species is known from North America, Europe, Asian continent (Japan and Korea) and Australia (National Biodiversity Network- 2017). In Africa it is only known from South Africa by Talbot (1958) in his description of the Genera *Craterellus, Cymatoderma* (Cladoderris) and *Thelephora* in South Africa although the species was reported to posses 4 sterigmata as opposed to the known two.

Identification marks: This is a black *Craterellus* probably conspecific to *Craterellus cornucopioides* (Linnaeus) Pers. However, this looks relatively much smaller 1.2 -2.8 cm compared to 5-15 cm of the *C. cornucopioides*. It also posses unique numerous small fibrils on the main cap a typical reminiscent of the genus *Craterellus* Pers., rendering it a very unsmooth surfaces. The species is easily recognized in the field by its small size and black colour which make it closely resemble two other black trumpet *Craterellus* species; *Craterellus foetidus* and *Craterellus cenerius* but differ markedly from them by lacking shallow gray gill ridges.

Edibility: Although they are too small and too rare to represent some culinary interest thus never collected for food, but local community recommend them for being deliciously edible.

3.1.2 *Craterellus odoratus* (Schweinitz: Fries) Fries [MB#190345]

Common Name: Fragrant Chanterelle

Synonym:

Merulius odoratus Schwein., [MB#440167]

Cantharellus odoratus (Schwein.) Fr., [MB#294079]

Trombetta odorata (Schwein.) [MB#471983]

Thelephora cantharella Schwein., [MB#183553]

Craterellus confluens Berk. & M.A. Curtis, [MB#152626]

Craterellus lateritius Berk., [MB#156308]

Fruit body large sized mushroom up to 17 cm wide composed of several curved, orange funnel shaped fruit bodies growing in tufts, with several **stipe** originating from the same base, which is slightly tacked in the soil like pseudorrhiza, with the below ground portion being dark while the above ground paler and thicker. **Cap** smooth orange at the center paling toward the margin (5A8) slightly sticky or waxy when fresh and all surface slowly bruises to rust

colour. **Hymenium** smooth or slightly wrinkled, pale yellow contrasting the bright cap (5A4). **Stipe** thick, smooth, dry, hollow, up to 5 cm wide, but not clearly demarcated from the cap. **Basidiospore** 3.5-7 x 7.5-12, narrow oval to elliptical shape. **Spore print** light yellowish. **Clamp connections** not observed. **Smell** the mushroom has distinctive fruity smell.

Figure 3: Fruiting bodies of *Craterellus odoratus* (Schweinitz: Fries) Fries growing on soils in miombo woodland in Kigoma region. (All photos taken by the author).

Identification marks: This is a bright orange *Craterellus* growing in tufts with distinguishing fruit smell in the field. In the field the species closely resemble other orange funnel-shaped Chantharelles but the hollow stipe, and smooth or slightly wrinkled hymenium demarcate it from them.

Habitat: Found growing abundantly in tightly packed clusters of 2-6 mushrooms in the forest floor of mixed miombo woodland species in Kigoma region.

Distribution: This species is known from South America, Southeastern United State of America and Australia reference. This study is its first report in Tanzania and Africa.

Edibility: Choice; highly liked and sold in mixture with *Cantharellus*.

***Craterellus* species 3**

Fruit body large sized mushroom which is vase shaped. **Cap** 12-17 cm, lobed irregularly, multipileate where by several pileus emanate from a single stipe, bright yellow (6A7) and dry. **Hymenium** grooved, light pink to purple (7B3). **Stipe** fibrous and hollow, colour concurring to the hymenium. The hymenium and stipe are also more brightly coloured than *Craterellus tubaeformis*. The hymenium is almost smooth or slightly veined and is pink. **Basidiospore** 4.5-7 x 7.5-13 narrow oval to elliptical shape. **Spore print** light yellowish. **Clamp connections** not observed. **Spore print** pale pink.

Figure 4: *Craterellus* species 3 growing in miombo woodland Kigoma and sold in mixture with other chanterelle mushrooms in the open market in the region. (All photos taken by the author).

Identification marks: The species looks superficially similar to *Craterellus lutescens* and *Craterellus tubaeformis* because of the possession hollow stipe and pink hymenium, however it differs from the two by the possession of multipileate attribute/characteristic and by having large sized basidiocarp of 12-17 cm as opposed to small to medium sized basidiocarp of 2-4 (7) cm and 2-7 cm of the two respectively. It further differs from *Craterellus lutescens* by having no brown lilacs while unveined false gills, the bright colors of the cap, hymenium and stipe demarcate it further from *Craterellus tubaeformis*. The species also looks like other yellow *Cantharellus* species (*Cantharellus confluens* and *Cantharellus lateritius*) with pink hymenium however the possession of hollow stipe places it well with *Craterellus* rather than *Cantharellus* species. This could be probably a new species and molecular studies are underway to confirm its identity.

Distribution: Based on its unique characteristics, it is probably a new species

Edibility: Choice; highly liked and sold in mixture with *Cantharellus* species.

***Craterellus* general ecology and distribution**

The genus *Craterellus* was originally described by Persoon in year 1825 with *Craterellus cornucopioides* as type species from *Cantharellus* group defined by Fries in 1821. Species in this genus have been described from different parts of the world including America, Europe, Asia, and Australia found growing mainly under beech, oak or other broad-leaved trees, especially in moss in moist spots on heavy calcareous soil. Despite of the intensive study on mushroom in other African forests and woodlands (Heinemann 1966, Högberg, 1982, Morris 1984, Munyanziza 1994, Härkönen et al. 1995, 2003, Buyck et al. 2000, Tibuhwa et al. 2008, 2012, Tibuhwa, 2011) species in this genus are known from Africa by a single record of *Craterellus cornucopiodes* by Talbot (1958). This could indicate that *Craterellus* species endemic to the virgin forest environment with high quantity of dead wood; where human activities are limited. Kigoma miombo woodland, the less explored miombo wood land is least disturbed (De Crop 2012).

CONCLUSION

Miombo woodlands of Kigoma region is a hotspot of fungi diversity. Three species under the genus *Craterellus* were recorded for the first time during the study in March 2011. One of the three species could be new to science. Further studies need to be undertaken in this region to unravel more macro fungi while molecular

characterization should be done to ascertain the identity of the unknown species.

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