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THE CONCEPT AND CIRCUMSCRIPTION OF *GANODERMA TORNATUM*

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(With 3 Text-figures)

Ganoderma tornatum collections from nearly the whole tropical and subtropical belt could not be divided into *G. applanatum* var. *tornatum* forma *tornatum* and forma *macrosporum* as suggested by Humphrey & Leus (1931). A complete range of intermediate basidiospore sizes exists, giving a nearly normal frequency curve slightly skewed towards the lower values. This indicates that no taxa based on basidiospore sizes can be justified. Mean lengths of basidiospores were correlated with altitudes (specimens limited to those collected within lat. 10° N. and S. of the equator to limit a possible influence of latitude). Collection data and corresponding basidiospore sizes indicate also a positive influence of latitude on basidiospore size. Temperature appears to be the regulator since it varies in the same direction whether by latitude or altitude. Increase in temperature seems to depress basidiospore size.

A detailed description of *Ganoderma tornatum* (Pers.) Bres. has been published by Steyaert (1967). The aim of this was to facilitate recognition of the pathogenic species of *Ganoderma* or suspected as such for the oil palm (*Elaeis guineensis*). Specimens of *G. tornatum* were exclusively of South-East Asian origin.

Research has subsequently been extended to practically the whole world, with great variation in the number of collections from each continent, tropical Africa and Asia having been more extensively explored. It is now possible to circumscribe more effectively the various species with a trichodermic cutis (*Ganoderma* subgen. *Elfvingia*). Two species are conspicuous because they are widely distributed and their identification confused, namely *G. applanatum* (Pers. ex S. F. Gray) Pat. and *G. tornatum* (Pers.) Bres. The former is restricted to northern temperate regions and the latter is circumglobal in the tropical and subtropical belts.

Of a total of nearly 2700 *Ganoderma* specimens examined at least 222 belong to *G. tornatum*, although considering the synonymies that have been established there are about a hundred remaining binomials applicable to *Ganoderma* spp. Notwithstanding its wide distribution, *G. tornatum* has remained unrecognized elsewhere than in South-Eastern Asia.

The extension of research on a world-wide basis has shown that the concept of *G. tornatum* as a variety of *G. applanatum* is not acceptable (Steyaert, 1967, 1972).

If there is an identity of anatomical characters for the two species, then morphologically they are clearly distinct. The context of *G. applanatum* is hazel brown with lighter shades towards the cutis and the tube layer darker with a reddish shade. For *G. tornatum* the context and the tube layer are concolorous or nearly so in being dark shades of brown, sometimes fuliginous brown. However, in Pakistan and North-West India, although the two layers remain concolorous they are much paler (Steyaert, 1972). This lighter colour may be because these regions are at the extreme northern limits of the distribution of *G. tornatum*. This species can be distinguished by a character that may seem secondary but which is nevertheless significant, that is the existence in the context of more or less shiny rather thin horizontal layers of melanoid substances, frequently a little above the tube layer. *G. applanatum* never has such deposits.

A third character, equally significant, but which can only be seen in perennial basidiomata with several tube layers, is the thin layer of context tissue between each.

G. tornatum is also perennial with several layers of tubes reaching thicknesses of 5 cm and the basidiomata up to 45 cm diam (F.6, Goossens-Fontana 1069, Binga, Zaire). The tubes are then of continuous growth with no interlayering of context tissue. Stratification is nonetheless apparent but is by thin, nearly inconspicuous lines delimitating the successive strata. On breaking blocks of tube layers they shatter in slabs, as would a schistous rock.

The distinctive morphological characters of each group of basidiomata and the clearly distinct distribution, overlapping only slightly at a few points, means that there are two distinctive species.

It is in North-East India and Pakistan that the value of these morphological features can be fully appreciated in identifying the specimens (Steyaert, 1972, p. 61), where the two species' distributions overlap to some extent.

North America might be another region of overlap of the two distributions. *G. applanatum* is known from Florida whereas *G. tornatum* is known in Cuba. *G. brownii* (a synonym of *G. tornatum*) extends on the Pacific coast from California to Canada (Anon., 1961). However no specimens have been available from the Southern Mid-West of the U.S.A., so it is impossible yet to form any definite opinion as to whether the distributions overlap or not.

On the African continent the Sahara seems to be a barrier to distribution towards the north and the European continent.

SPORE AND RELATED CHARACTERS OF *G. TORNATUM*

If, on the one hand, the morphological characters of *G. tornatum* do not vary much, on the other hand the microscopic characters show a disconcerting variation in size.

An attempt to categorize the basidiomata according to the concepts of Humphrey & Leus (1931) into *G. applanatum* var. *tornatum* forma *tornatum* and var. *tornatum* forma *macrosporum* has failed entirely because a host of intermediate basidiospore sizes have appeared. Faced with this evidence of mistaken concepts the specimens were filed according to an increase in the mean lengths and for equal mean lengths by increasing mean widths. The result is given in Table 1. This shows that the mean

Table 1. Ganoderma tornatum – *specimens filed by increasing sizes of the mean basidiospore lengths and for same lengths by increasing mean diam (means in italic)*

* Specimens taken into account for Fig. 2.

	Basidiospore sizes (μm)	Mean distance between pore axes	Origin
* L.112	6·0– *6·50*– 7·0 × 4·5–*4·70*–5·0	± 180	Papua
* F.6	6·0– *6·55*– 7·0 × 4·5–*4·60*–5·0	± 215	Zaire, Binga
* B.621	6·0– *6·70*– 7·0 × 4·5–*5·15*–5·5	± 190	New Guinea
* F.7a	6·0– *6·85*– 8·0 × 4·5–*4·65*–5·0	± 205	Zaire, Binga
* D.35b	6·0– *6·85*– 8·0 × 4·5–*5·05*–5·5	± 195	Zaire, Eala
* C.155	6·0– *6·85*– 7·5 × 4·5–*5·25*–5·5	± 165	Zaire, Ipamu
* F.7f	6·5– *6·90*– 7·0 × 5·00	± 205	Zaire, Binga
K.767	6·5– *7·00*– 7·5 × 4·5–*4·95*–5·5	± 185	Malagasy
* A.3372a	6·0– *7·00*– 7·5 × 4·5–*5·15*–6·0	± 190	Zaire, Bongabo
* K.472	6·5– *7·05*– 8·0 × 4·5–*5·10*–5·5	± 165	Philippines
K.714	6·5– *7·05*– 7·5 × 4·5–*5·15*–5·5	± 185	Ghana
* A.1229	6·0– *7·05*– 7·5 × 5·0–*5·25*–6·0	± 225	Zaire, Kisantu
* C.349a	7·0– *7·10*– 7·5 × 4·5–*5·10*–5·5	± 235	Uganda, Sese Islo
* K.95a	6·0– 7·10– 8·0 × 4·0–*5·15*–5·5	± 150	Malaysia
* F.3	7·0– *7·10*– 7·5 × 5·0–*5·30*–5·5	± 160	Zaire, Sankuru
* F.7b	6·5– *7·10*– 7·5 × 5·0–*5·35*–6·0	± 185	Zaire, Binga
K.103a	7·0– *7·10*– 7·5 × 5·0–*5·35*–6·0	± 160	Sarawak
* L.65b	6·5– *7·10*– 7·5 × 4·5–*5·50*–6·5	± 160	Malaysia
* B.160	6·5– *7·15*– 7·5 × 4·5–*4·70*–5·0	± 200	Zaire, Yangambi
* C.130	7·0– *7·15*– 7·5 × 5·0–*5·15*–5·5	± 225	Zaire, Yambuya
* L.74a	6·5– *7·15*– 8·0 × 5·0–*5·35*–5·5	± 170	Malaysia
* L.69a	6·5– *7·15*– 8·0 × 5·0–*5·50*–6·5	± 190	Malaysia
* L.111	6·5– *7·20*– 7·5 × 4·5–*4·90*–5·0	± 195	Ivory Coast
* K.674	6·5– *7·20*– 8·0 × 4·0–*4·70*–5·5	± 185	Guyana
* A.1249	6·5– *7·20*– 8·0 × 4·5–*5·20*–5·5	± 245	Zaire, Yangambi
* D.119	6·5– *7·25*– 8·0 × 4·5–*5·00*–5·5	± 230	Zaire, P.N.A.
* C.179k	6·5– *7·25*– 8·0 × 4·5–*5·05*–6·0	± 230	Zaire, Yangambi
* C.349b	6·5– *7·25*– 8·0 × 4·5–*5·30*–6·5	± 230	Uganda, Mayomba
* F.7e	6·5– *7·25*– 8·0 × 5·0–*5·35*–6·0	± 160	Zaire, Binga
* A.4609	6·5– *7·25*– 8·0 × 5·0–*5·40*–6·0	± 180	Sierra Leone
K.438	6·5– *7·25*– 8·0 × 5·0–*5·60*–6·0	± 175	India
* C.242	7·0– *7·30*– 8·0 × 5·0–*5·30*–5·5	± 205	Zaire, Yangambi
* D.37f	6·0– *7·30*– 8·5 × 4·5–*5·40*–6·0	± 225	Zaire, Eala
* C.433	6·5– *7·30*– 8·0 × 4·5–*5·45*–6·0	± 175	Zaire, Yangambi
K.711	6·5– *7·35*– 8·0 × 4·5–*5·40*–6·0	± 180	China, Hainan
A.6702a	6·5– *7·35*– 8·0 × 4·5–*5·40*–6·5	± 175	Sri Lanka
* C.202	6·5– *7·40*– 8·0 × 4·5–*5·30*–6·0	± 185	Zaire, Bongabo
* C.434	7·0– *7·40*– 8·0 × 5·0–*5·35*–6·0	± 200	Zaire, Yangambi
* A.3380	7·0– *7·40*– 8·0 × 4·5–*5·35*–6·0	± 195	Zaire, Yangambi
* D.262a	7·0– *7·40*– 8·0 × 5·0–*5·35*–5·5	± 145	Malaysia
* C.326b	6·5– *7·40*– 8·0 × 5·0–*5·50*–6·0	± 165	Zaire, P.N.A.
* C.325	7·0– *7·40*– 7·5 × 5·0–*5·50*–6·0	± 160	Zaire, P.N.A.
K.106	7·0– *7·40*– 8·0 × 5·0–*5·90*–6·0	± 155	Sarawak
* A.892a	7·0– *7·45*– 8·0 × 4·5–*5·15*–5·0	± 190	Zaire, Eala
* C.189	7·0– *7·45*– 8·0 × 5·0–*5·20*–5·5	± 235	Zaire, Kisantu
* D.37b	7·0– *7·45*– 7·5 × 5·0–*5·20*–6·0	± 240	Zaire, Eala
* A.2302	7·0– *7·45*– 8·5 × 5·0–*5·25*–6·0	± 185	Zaire, Yangambi
* A.3401	7·0– *7·45*– 8·0 × 5·0–*5·45*–5·5	± 200	Zaire, Yangambi
K.716	7·50 × 5·00	± 170	Philippines
* C.533	6·5– *7·50*– 8·0 × 4·5–*5·15*–5·5	± 195	Zaire, Yangambi
K.473	7·0– *7·50*– 8·0 × 5·0–*5·40*–5·5	± 165	India
* D.257	7·0– *7·50*– 8·0 × 5·0–*5·40*–5·5	± 200	Malaysia
* C.236	7·0– *7·55*– 8·0 × 5·0–*5·40*–6·0	± 240	Zaire, P.N.A.
* A.3397	6·5– *7·55*– 8·5 × 5·0–*5·40*–6·0	± 225	Zaire, Kitotenge
* A.1253	7·0– *7·55*– 8·0 × 5·0–*5·45*–6·0	± 205	Zaire, Kisantu
* A.2435	7·5– *7·55*– 8·5 × 5·5–*5·75*–6·0	± 240	Uganda

Table 1 (*cont.*)

	Basidiospore sizes (μm)	Mean distance between axes	Origin
* D.258	7·0– *7·55*– 8·0 × 5·5–*5·80*–6·5	±170	Malaysia
* K.132	7·0– *7·60*– 8·0 × 5·0–*5·35*–6·0	±180	Ghana —
* C.451	7·0– *7·60*– 8·0 × 5·0–*5·35*–6·0	±180	Zaire, Yangambi
A.1973	7·0– *7·60*– 8·0 × 5·0–*5·45*–6·0	±205	South Africa
* F.7c	7·0– *7·60*– 8·5 × 5·0–*5·45*–6·0	±175	Zaire, Binga
* C.200	7·0– *7·60*– 8·5 × 4·5–*5·45*–6·5	±245	Zaire, Yangambi
* A.3372b	7·0– *7·60*– 8·0 × 5·5–*5·60*–6·0	±195	Zaire, Bongabo
* L.36	7·0– *7·60*– 8·0 × 5·0–*5·65*–6·0	±185	Zaire, Yangambi
* A.2395b	7·5– *7·65*– 8·5 × 5·0–5·10–5·5	±—	Malaysia
* D.261	7·5– *7·65*– 8·0 × 4·5–*5·20*–5·5	±180	Malaysia
A.6702b	7·0– *7·65*– 8·5 × 5·0–*5·35*–6·0	±205	Sri Lanka
* C.573a	7·0– *7·65*– 8·5 × 5·0–*5·40*–6·0	±185	Ivory Coast
* D.89	7·0– *7·70*– 8·0 × 5·0–*5·40*–6·0	±230	Zaire, Yangambi
* A.1463	7·0– *7·70*– 8·5 × 5·0–*5·50*–6·0	±250	Zaire, P.N.A.
* A.1246	7·5– *7·70*– 8·0 × 5·5–*5·70*–6·0	±235	Zaire, Boto
C.320b	7·0– *7·70*– 8·5 × 5·0–*5·70*–6·0	±185	New Caledonia
* A.2300	7·0– *7·75*– 8·0 × 5·0–*5·40*–6·0	±175	Zaire, Yangambi
* A.1979	7·5– *7·75*– 8·0 × 5·50	±285	Uganda, Kampala
A.6702c	7·5– *7·75*– 9·0 × 5·0–*5·55*–6·0	±180	Sri Lanka
* L.65a	7·0– *7·75*– 8·0 × 5·5–*5·65*–6·0	±135	Malaysia
* A.1032	7·0– *7·75*– 8·5 × 5·0–*5·25*–6·0	±240	Zaire (Kikwit?)
* L.35	7·0– *7·80*– 8·5 × 5·0–*5·15*–5·5	±195	Zaire, Yangambi
* A.6707	7·5– *7·80*– 9·0 × 4·5–*5·50*–6·0	±220	Uganda, Masindi
* A.3352	7·5– *7·90*– 8·5 × 5·5–*5·70*–6·5	±185	Zaire, Yangambi
* F.7d	7·0– *7·90*– 9·5 × 5·5–*5·80*–6·0	±180	Zaire, Binga
* C.126	7·0– *7·95*– 9·0 × 5·0–*5·45*–6·0	±205	Zaire, Sankuru
* D.256b	7·5– *7·95*– 8·5 × 5·0–*5·80*–6·0	±155	Malaysia
A.2283b	7·0– *8·00*– 8·0 × 5·0–*5·30*–6·0	±185	Philippines
* D.260	7·0– *8·00*– 9·0 × 5·5–*5·85*–6·5	±200	Malaysia
* A.1228	7·6– *8·05*–10·0 × 4·5–*5·35*–6·0	±195	Zaire, Kisantu
* K.437	7·5– *8·05*– 9·0 × 5·5–*5·70*–6·5	±185	Indonesia
* C.446	7·5– *8·05*– 9·0 × 5·5–*5·75*–6·0	±180	Zaire, Bongabo
C.320a	7·5– *8·10*– 8·5 × 5·50	±260	New Caledonia
* E.58	7·5– *8·10*– 9·0 × 5·0–*5·50*–6·5	±250	Zaire, P.N.A.
K.628	7·5– *8·10*– 8·5 × 5·5–*5·55*–6·0	±180	India
* K.48	7·5– *8·10*– 9·5 × 5·5–*5·80*–6·0	±205	Uganda
* A.6331	7·0– *8·10*– 9·0 × 5·5–*6·00*–6·5	±180	Malaysia
* C.449	7·5– *8·15*– 8·5 × 5·0–*5·30*–5·5	±205	Zaire, Yangambi
* A.3358	7·0– *8·15*– 8·5 × 5·0–*5·50*–6·0	±190	Zaire, Yangambi
A.2586b	8·0– *8·20*– 9·0 × 5·0–*5·60*–6·0	±215	Sarawak
* D.160	7·5– *8·20*– 9·0 × 5·5–*5·65*–6·0	±195	Zaire
* K.427b	8·0– *8·25*– 8·5 × 4·5–*5·65*–6·0	±205	Indonesia
* C.810	7·5– *8·25*– 9·0 × 5·0–*5·85*–6·0	±170	Malaysia
K.474	7·5– *8·25*– 9·5 × 5·0–*5·85*–6·0	±200	Philippines
K.28	7·5– *8·25*– 9·0 × 5·0–*5·85*–6·5	±170	Mozambique
* K.101	8·0– *8·25*– 9·0 × 5·5–*6·00*–6·5	±210	Uganda
* D.119b	7·5– *8·30*– 9·0 × 5·0–*5·45*–6·0	±180	Zaire, P.N.A.
A.6343	8·0– *8·30*– 9·0 × 5·5–*5·55*–6·0	±180	Cuba
* C.811b	7·0– *8·30*– 9·0 × 5·0–*5·65*–6·5	±170	Malaysia
* A.2439	8·0– *8·30*– 9·0 × 5·5–*5·95*–6·5	±175	Uganda
* A.3692	7·5– *8·30*– 9·5 × 5·5–*6·15*–7·0	±225	Tanzania, Bukoba
* C.316	7·5– *8·35*– 9·0 × 5·0–*5·55*–6·0	±250	Zaire, P.N.A.
* L.72	8·0– *8·35*– 9·0 × 5·0–*5·60*–6·5	±185	Malaysia
* A.1983	7·5– *8·35*– 9·0 × 5·0–*5·75*–7·0	±230	Indonesia
* A.3703	7·5– *8·35*– 9·0 × 5·0–*6·15*–7·0	±170	Uganda, Busoga
* C.321a	7·5– *8·40*– 9·0 × 5·0–*5·45*–6·0	±245	Zaire, P.N.A.
K.405	7·0– *8·40*– 9·0 × 5·5–*5·85*–6·5	±175	Sarawak
* C.435a	8·0– *8·45*– 9·0 × 5·0–*5·80*–6·5	±160	Zaire, Yangambi
* K.69	8·0– *8·45*– 9·0 × 5·5–*6·25*–7·0	±180	Uganda, Kampala
* K.355	8·0– *8·50*– 9·0 × 5·5–*5·85*–6·0	±160	Uganda, Rabongo forest

Table 1 (*cont.*)

	Basidiospore sizes (μm)	Mean distance between pore axes	Origin
A.3067	8·0– *8·50*– 9·0 × 5·5–*5·75*–6·0	±245	India
* C.166	8·0– *8·50*– 9·0 × 5·5–*5·80*–6·0	±205	Zaire, Kwango
* D.259	7·5– *8·50*– 9·5 × 5·5–*5·90*–6·5	±160	Malaysia
* C.514	7·5– *8·55*– 9·0 × 5·5–*6·35*–7·0	±235	Uganda, N. Ft Portal
* D.262b	8·0– *8·60*–10·0 × 5·5–*6·35*–7·0	±175	Malaysia
* B.159	7·5– *8·60*–10·0 × 5·5–*5·90*–6·5	±250	Zaire, Bambesa
* B.155	7·5– *8·60*– 9·5 × 5·5–*6·20*–6·5	±195	Zaire, Kisantu
* A.1029	8·0– *8·65*– 9·0 × 5·5–*5·45*–6·0	±195	Zaire, Ipamu
* C.438	8·0– *8·65*– 9·0 × 5·5–*5·55*–6·0	±180	Zaire, Yangambi
K.34	8·0– *8·65*– 9·5 × 6·0–*6·20*–6·5	±190	India
* D.79b	7·5– *8·70*– 9·5 × 5·0–*5·45*–6·0	±185	Zaire, Kavumu
* C.296	8·0– *8·70*– 9·5 × 5·0–*5·70*–6·0	±200	Zaire, P.N.A.
* A.1031	8·0– *8·70*– 9·5 × 6·0–*6·35*–7·0	±235	Zaire, Panzi
* D.177b	8·5– *8·80*– 9·5 × 5·5–*5·60*–6·0	±230	Zaire, Lekwa
* C.321b	8·0– *8·80*– 9·5 × 5·5–*5·65*–6·0	±190	Zaire, P.N.A.
* K.425	8·5– *8·80*– 9·0 × 5·5–*5·90*–6·0	±225	Indonesia
A.3066	8·0– *8·80*– 9·0 × 5·5–*5·95*–6·5	±200	India
C.495b	8·0– *8·85*– 9·5 × 5·5–*6·00*–6·5	±220	Pakistan
* C.437	8·5– *8·90*– 9·5 × 5·0–*5·60*–6·5	±190	Zaire, Yangambi
* K.459	8·5– *8·90*–10·0 × 5·5–*5·70*–6·0	±180	Indonesia
C.495a	8·5– *8·90*– 9·5 × 5·5–*5·90*–6·5	±235	Pakistan
A.2289a	8·0– *8·90*–10·5 × 5·5–*6·20*–6·5	±195	S. Africa
A.1988	8·0– *8·95*– 9·5 × 4·5–*5·45*–6·5	±215	Philippines
* D.203b	8·5– *8·95*– 9·5 × 6·0–*6·50*–7·0	±195	Zaire, Rutshuru
* K.458	8·5– *9·00*– 9·5 × 5·0–*5·30*–6·0	±175	Malaysia
A.3068	8·5– *9·00*– 9·5 × 5·0–*5·75*–6·5	±205	India
* D.177a	8·0– *9·05*–10·0 × 5·5–*6·05*–6·5	±225	Zaire, Lekwa
A.1367	8·5– *9·05*–10·0 × 5·5–*6·20*–6·5	±180	Angola
* K.680	8·5– *9·10*– 9·5 × 6·0–*6·10*–6·5	±210	Cameroon
* E.65	8·5– *9·10*– 9·5 × 6·0–*6·25*–6·5	±240	Zaire, P.N.A.
* D.180a	8·0– *9·10*– 9·5 × 5·5–*6·50*–7·5	±230	Zaire, P.N.A.
* A.878	8·5– *9·15*–10·0 × 5·5–*5·85*–6·0	±253	Zaire, Mulungu
* D.176b	8·5– *9·15*–10·0 × 5·5–*6·05*–6·5	±235	Zaire, Lekwa
* E.67	8·0– *9·15*–10·0 × 6·0–*6·40*–6·5	±195	Zaire, P.N.A.
* A.2443b	8·5– *9·15*–10·0 × 6·5–*6·70*–7·0	±235	Uganda
* D.180b	8·5– *9·20*– 9·5 × 6·0–*6·50*–7·0	±245	Zaire, P.N.A.
* D.203c	9·0– *9·20*– 9·5 × 6·0–*6·65*–7·5	±190	Zaire, Rutshuru
* D.79a	8·0– *9·25*–10·5 × 5·5–*5·80*–6·5	±200	Zaire, Kavumu
K.337	9·0– *9·25*–10·0 × 6·0–*6·40*–7·0	±245	Kenya
* K.356	8·5– *9·25*– 9·5 × 5·5–*6·55*–7·0	±230	Kenya, Mt Kenya
* A.6359a	8·5– *9·25*–10·0 × 6·5–*7·25*–8·0	±265	Kenya, Nanyuki
* D.203a	8·5– *9·30*– 9·5 × 6·0–*6·05*–7·0	±205	Zaire, Rutshuru
* D.176a	9·0– *9·50*– 9·5 × 5·8–*6·25*–6·5	±160	Zaire, Lekwa
* K.351	8·5– *9·30*–10·0 × 5·5–*6·70*–7·5	±245	Kenya, Karura
* C.129	8·5– *9·35*–10·0 × 5·0–*5·25*–6·0	±210	Zaire, Nizi
* B.174a	9·0– *9·35*–10·0 × 5·5–*5·70*–6·0	±220	Zaire, P.N.A.
* K.361	9·0– *9·40*–10·0 × 5·5–*6·00*–6·5	±270	Kenya, Castle forest
* K.340	8·5– *9·45*–10·0 × 6·0–*6·45*–7·0	±240	Kenya, Lower Castle forest
* C.408	8·5– *9·45*–10·0 × 6·0–*6·65*–7·0	±255	Zaire, P.N.A.
* C.441	9·0– *9·50*–10·0 × 6·0–*6·40*–7·0	±230	Zaire, Lekwa
* D.167a	8·5– *9·50*–10·0 × 6·0–*6·65*–7·0	±235	Zaire, P.N.A.
* E.55a	9·0– *9·55*–10·0 × 5·5–*6·05*–6·5	±225	Zaire, P.N.A.
* K.343	9·0– *9·60*–11·0 × 5·5–*6·30*–7·0	±210	Kenya, Nairobi
* K.360	9·0– *9·60*–10·0 × 6·0–*6·40*–7·0	±230	Kenya, Castle forest
* K.357	9·0– *9·65*–10·5 × 5·0–*6·45*–7·0	±215	Kenya, Mt Kenya
* K.336	9·0– *9·65*–10·0 × 6·0–*6·65*–7·0	±210	Kenya, Mt Kenya
* D.167b	9·0– *9·65*–10·5 × 6·0–*6·65*–7·0	±205	Zaire, P.N.A.
* E.56b	9·0– *9·70*–10·5 × 5·5–*6·30*–7·0	±230	Zaire, P.N.A.
A.1929	9·0– *9·70*–10·5 × 6·0–*6·40*–7·0	±240	Angola (southern)
* L.108	9·5– *9·75*–10·5 × 5·5–*6·30*–6·5	±280	Kenya, Mau forest

Table 1 (*cont.*)

	Basidiospore sizes (μm)	Mean distance between pore axes	Origin
K.99	8·0– *9·75*–11·0 × 5·5–*6·35*–7·0	±215	Cameroon, bush region
* E.56a	9·0– *9·80*–11·0 × 5·5–*6·00*–6·5	±245	Zaire, P.N.A.
A.4602	9·5– *9·80*–10·0 × 6·0–*6·50*–7·0	±195	Sarawak
* L.109	9·0– *9·80*–10·0 × 6·5–*6·95*–7·5	±265	Tanzania, Lake Ngwazi
* L.87b	9·0– *9·80*–13·0 × 6·5–*6·60*–7·0	±215	Burundi, Teza
* K.354	9·0– *9·80*–10·5 × 7·00	±245	Kenya, Nanyuki
* A.6359b	9·0– *9·80*–10·5 × 7·0–*7·25*–8·0	±205	Kenya, Nanyuki
K.338	9·5– *9·85*–11·0 × 5·5–*6·10*–6·5	±255	Kenya, Nanyuki
A.2498	9·0– *9·85*–11·0 × 6·0–*6·46*–7·0	±250	South Africa
* K.31	9·0– *9·85*–11·0 × 6·0–*6·60*–8·0	±245	Cameroon mountains
* E.55b	8·5– *9·90*–11·0 × 6·0–*6·25*–6·5	±215	Zaire, P.N.A.
* B.174b	9·0– *9·95*–10·5 × 6·0–*6·65*–7·0	±220	Zaire, P.N.A.
* L.87b	9·5–*10·00*–11·0 × 6·5–*6·85*–7·0	±230	Burundi, Teza
* K.358	9·5–*10·00*–10·5 × 6·5–*7·00*–8·0	±220	Kenya, Castle forest
* E.52b	9·5–*10·05*–10·5 × 6·5–*6·80*–7·5	±255	Burundi, Teza
* C.516	9·0–*10·05*–11·5 × 6·0–*7·00*–8·0	±235	Kenya, Kinale
K.46	9·5–*10·10*–11·0 × 6·0–*6·75*–7·5	±255	Natal
* E.71a	9·5–*10·15*–11·0 × 6·5–*6·95*–7·0	±250	Rwanda
K.382	9·5–*10·25*–11·0 × 7·0–*7·35*–8·0	±265	U.S.A., Calif.
* D.200	9·0–*10·30*–11·0 × 6·0–*6·35*–7·5	±220	Kenya, S. Aberdares
* K.330	9·5–*10·30*–11·0 × 6·5–*7·00*–8·0	±220	Kenya, Castle forest
* C.237	10·0–*10·35*–11·0 × 7·0–*7·00*–7·5	±230	Zaire, P.N.A.
* E.71b	9·5–*10·40*–11·0 × 6·5–*6·80*–7·5	±245	Rwanda
* A.3664	10·0–*10·40*–11·5 × 6·5–*7·30*–8·0	±250	Kenya, Londiani
A.1990	9·5–*10·50*–11·0 × 5·5–*6·05*–6·5	±205	Philippines
K.659	10·0–*10·50*–12·0 × 6·5–*7·60*–8·0	±265	U.S.A., Calif.
* E.71c	10·0–*10·60*–11·0 × 6·5–*7·00*–7·5	±260	Rwanda
* E.52a	10·0–*10·70*–11·5 × 6·0–*6·85*–7·5	±245	Burundi, Teza
K.941	10·5–*10·85*–11·5 × 7·0–*7·15*–7·5	±250	Canada, Vict.
A.3668	10·5–*11·05*–12·0 × 7·5–*7·25*–8·0	±265	U.S.A., Calif.
* K.42	10·0–*11·40*–13·0 × 7·0–*7·50*–8·0	±180	Uganda, Kampala
	Sterile basidiomata		
C.440c		±175	Zaire
K.95b		±155	Malaysia
K.427a		±205	Indonesia
A.4603		±135	Sarawak
L.44a		±185	Sarawak
K.105		±170	Sarawak
L.44b		±175	Sarawak
A.1989		±245	Philippines
C.148		±235	Pakistan
A.3347		±255	Zaire, Yangambi
A.3362		±235	Zaire, Djugu
A.3689		±210	Uganda, Mulange
K.755		±185	Kenya, Kwale dist.
L.543		±225	U.S.A., S. Frisco
A.1987		±300	U.S.A., Calif.

lengths increase steadily from 6·5 to 11·4 μm, while the extreme sizes vary from 6 to 13 μm. This range is wide, the upper sizes being more than twice the lowest.

Table 1 shows that most of the basidiomata with the bigger basidiospores come from the East African Highlands (Eastern Zaire, Uganda, Kenya). In these regions the basidiospores reach sizes equal or above those for *G. brownii* and for *G. applanatum* forma *macrosporum*. As these taxa

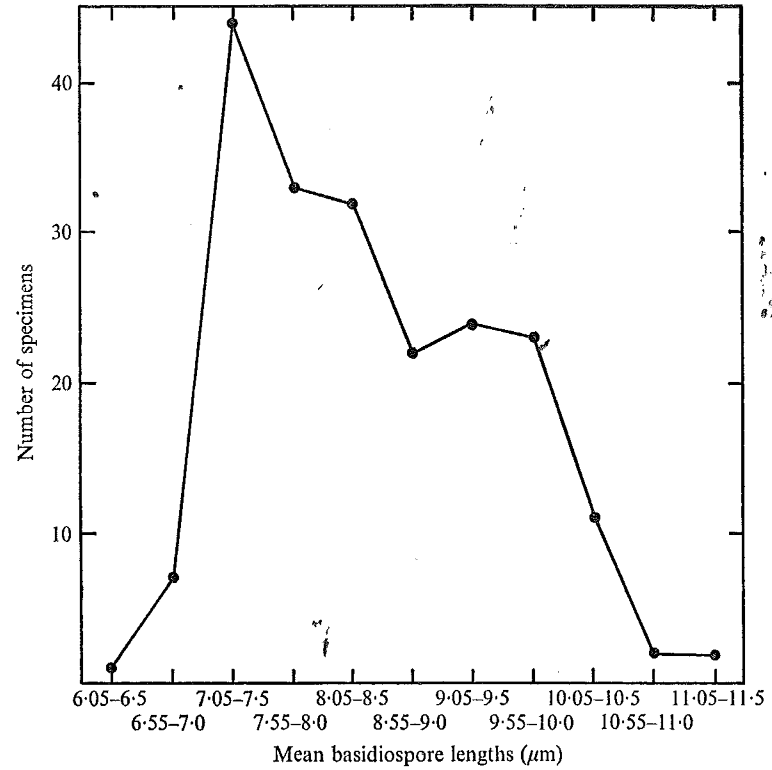

Fig. 1. Frequencies of the mean lengths of the basidiospores grouped by increments of half microns (each of the means is obtained by measuring 10 basidiospores per specimen).

can be distinguished neither morphologically nor anatomically from *G. tornatum* one must conclude that as they are based on basidiospore sizes they are but synonyms of the latter.

On grouping basidiospore mean sizes by increments of a half micron and counting the specimens for each level one obtains Fig. 1. The graph shows almost a normal distribution curve although skewed somewhat towards the lower sizes. No depression in the curve is sufficiently important to justify taxonomic segregations.

This result upsets all previous concepts of infraspecific taxa based on spore sizes in this group. The problem remains as to the cause of the wide variation in basidiospore sizes.

The grouping of the big basidiospores in specimens from the East African highlands suggests that altitude of the collecting points might be the cause and furthermore, considering the sizes of *G. brownii* basidiospores, that latitude may have the same effect.

The first hypothesis is tested by establishing a correlation curve, the parameters being basidiospore sizes against altitude. To eliminate in some measure the latitude parameter only the collections made between the

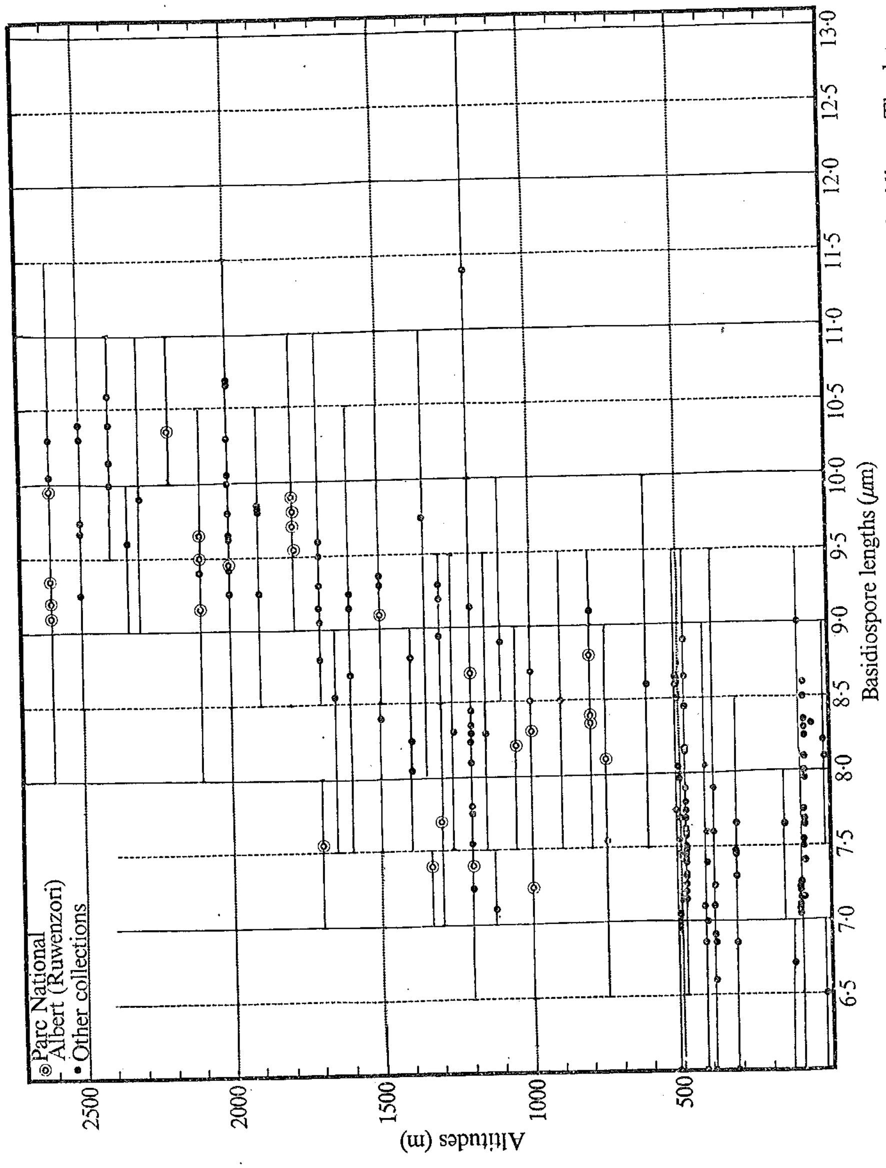

Fig. 2. Correlation between basidiospore lengths and altitude of the collection place of each basidioma. The dots and the horizontal full lines represent respectively the mean and the range of basidiospore lengths of each specimen. When several specimens have been collected at the same altitude the full line shows the range of the aggregate (note: the isolated position of K.42 with a mean basidiospore length of 11·45 µm might result from a mistake in the labelling).

Table 2. *Basidiospore length and distance between pore axes* for G. tornatum

Mean lengths of the basidiospores (µm)	Mean distances between pore axes (µm)
6·50– 7·00	192·5
7·05– 7·50	190·0
7·55– 8·00	202·4
8·05– 8·50	194·0
8·55– 9·00	205·6
9·05– 9·50	225·4
9·55–10·00	228·9
10·05–10·70	240·0
10·75–11·40	237·5

10th parallel on both sides of the Equator were considered to establish the curve in Fig. 2.

The latter shows that at the lower altitudes there exists a range in mean basidiospore size of 6·5–9 µm, and that this range shifts progressively towards bigger sizes as the elevation increases. The shift in the range of basidiospore sizes is confirmed by the collections made on Mount Ruwenzori in Parc National Albert. That is, in a very restricted geographical area. The basidiospores seem to reach their maximum sizes at an elevation of 2500 m, but collections at higher altitudes are too few to establish this uncontrovertibly.

Table 1 shows that basidiospores of specimens collected at higher latitudes than the equatorial belt defined above also increase in size. Thus the basidiospores of specimens collected in the neighbourhood of San Francisco are of the same size if not slightly smaller than those collected in the equatorial belt at elevations of 2000 m.

It is not a question of altitude or latitude that modifies the basidiospore sizes but the climatic conditions that prevail in these regions. It is well nigh impossible to establish this relationship by direct measurement, even under laboratory conditions. In principle however one can state that it is the climate which is the common denominator of altitude and latitude and which sets the sizes of the basidiospores within which they range.

On reviewing the components of climate one arrives at the conclusion that temperature varies in the same direction whether in altitude or latitude and would consequently be the ruling factor for mean basidiospore size.

Having established such differences in basidiospore sizes, the pore and dissepiment sizes which added to one another give the distance between axes of neighbouring pores, are of some interest.

By grouping the mean basidiospore sizes by increments of half microns on the one hand and corresponding distances between pore axes for each of the selected specimens on the other, and calculating the mean distance between pore axes of the specimens so grouped, one obtains the results shown in Table 2.

This shows that if there is an increase in pore size in conjunction with an increase in basidiospore size it is very moderate and acquires only a measurable importance when the mean basidiospore sizes reach more or

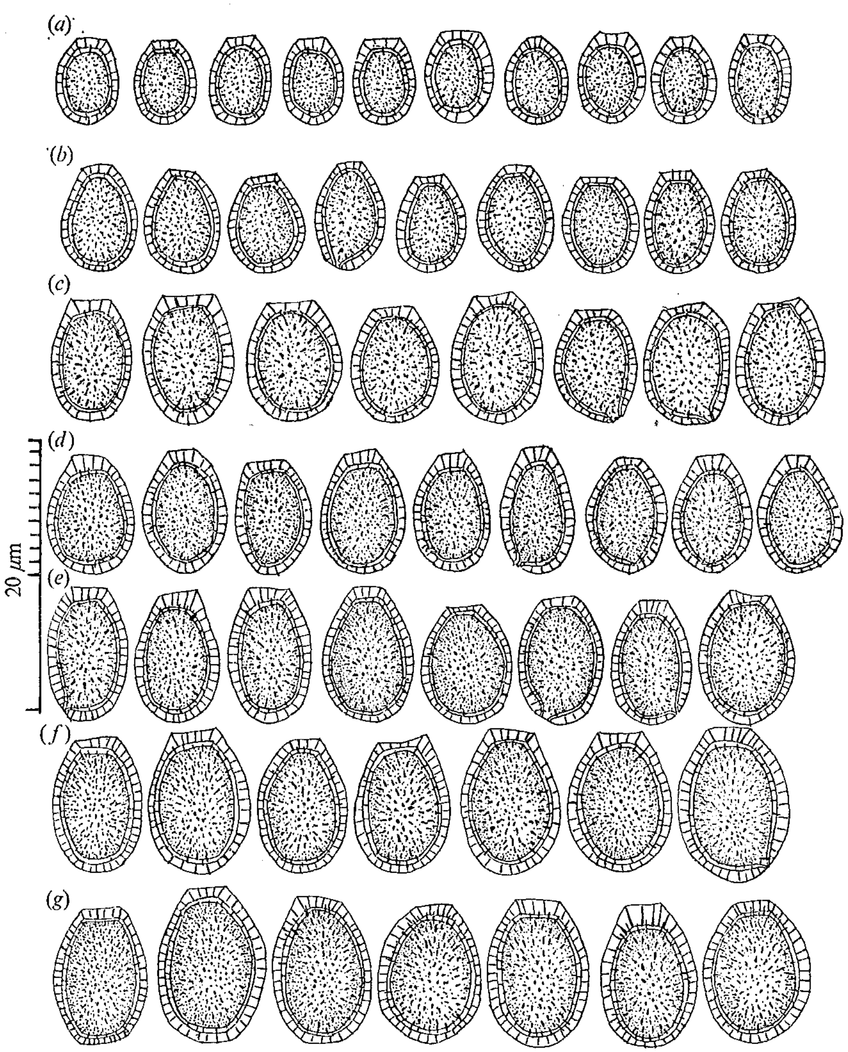

Fig. 3. Influence of altitude and latitude on basidiospore size of *Ganoderma tornatum*. (*a*) L.112, alt. ± 100 m; (*b*) L.36, alt. 470 m; (*c*) A.1031, alt. 1000 m; (*d*) E.65, alt. 1500 m; (*e*) L.87b, alt. 2100 m; (*f*) A.3664, alt. 2500 m; (*g*) K.659, *G. brownii*, lat. N. 37° 53′.

less 9 µm, but the increase in the mean distance between pore axes is at the most 50 µm. That is, somewhat less than 25 %, whereas the basidiospores double at least in lengths.

Nevertheless one must admit that the one or several factors that influence basidiospore sizes also affect the pores and dissepiments.

These findings disclose a strange conclusion, that for a fungus widely distributed in tropical regions, temperature depresses some expressions of growth. However one might perhaps consider bigger spores as a bigger

reserve for germination, thus ensuring an accrued life potential in less favourable environments.

On the taxonomic level the description of *G. tornatum* must be emended to remain in keeping with this new concept of the species.

GANODERMA TORNATUM (Pers.) Bres. *Hedwigia* **53**: 55 (1912) (Fig. 3).

Polyporus tornatus Pers. in Freyc., *Voy. aut. Monde, Bot.*: 173 (1827).
Elfvingia tornata (Pers.) Murrill, *Bull. Torrey bot. Cl.* **30**: 301 (1903).
Polyporus australis Fr., *Elench. Fung.*: 108 (1828).
Ganoderma australe (Fr.) Pat., *Bull. trimestr. Soc. mycol. Fr.* **5**: 71 (1889).
Fomes oroflavus Lloyd, *Letter* **48**: 8 (1913).
Ganoderma oroflavum (Lloyd) Humph., *Philipp. J. Sci.* **45**: 503 (1931).
Elfvingia brownii Murrill, *Western Polypores*: 29 (1915).
Ganoderma brownii (Murrill) Gilbertson, *Mycologia* **53**: 505 (1961).
Ganoderma applanatum (Pers.) Pat. var. *philippinense* Humph. & Leus, *Philipp. J. Sci.* **45**: 535 (1931).
Ganoderma applanatum (Pers.) Pat. var. *laevisporum* Humph. & Leus, *Philipp. J. Sci.* **45**: 533 (1931).
Ganoderma applanatum (Pers.) Pat. var. *tornatum* (Pers.) Humph. & Leus forma *macrosporum* Humph. & Leus, *Philipp. J. Sci.* **45**: 551 (1931).

Basidioma sessile, dimidiate, up to 45 cm diam and up to 10 cm thick at the base; upper surface concentrically furrowed, cracking by dessication, 'melleus' (Ridgway: cinnamon buff) to 'olivaceus' (Ridgway: clove brown); margin incurved often with horizontal folds (for perennial basidiomata), the youngest white (in actively growing stage); pore surface white, sometimes yellow (might be a host influence?), browning, sometimes periphically by irregular bands 1–3 cm wide.

Section: Cutis hard, brittle, up to 600–700 µm, 'olivaceus'. Context usually less than 10 mm thick, up to 40 mm in big specimens, with thin horny, slightly shiny horizontal streaks, often a little above the tube layer, 'badius' (Ridgway: bay) to 'umbrinus' (Ridgway: blackish brown). Tube layer up to 60 mm thick in big specimens, concolorous with context.

Cutis of trichoderm type, similar to that of *G. applanatum* of free hyaline or brown hyphae in continuation of the context hyphae, held together at the base by a deposit of melanoid substances. Pores circular, 90–*150*–200 µm diam, dissepiments 30–*65*–130 µm thick, distance between axes of pores 135–*210*–285 µm, pore and dissepiment sizes somewhat influenced by the altitude of collection point of the basidiomata between more or less 1500 m and 2500 m. Basidiospores ovoid, brownish yellow to brown 6–13 µm long by 4·5–8 µm thick. At an altitude of 0–600 m, 6–9 µm long, at the altitudes of 2000–2500, 8·5–11·5 µm, exceptionally 13 µm, apparently decreasing in size for altitudes above 2500 m. Smooth, non-echinulate, abnormal basidiospores generally but not always larger than the echinulate ones from the same basidiomata (Spec. D.262a). Other abnormal basidiospores have small warts instead of echinulations.

COMMENTS UPON MATERIAL

Specimen D.262a has normal echinulate basidiospores 7·0–7·4–8·0 × 5·0–5·35–5·5 μm whereas the nonechinulate ones measure 7·5–9·9–13·0 × 5·5–6·35–10·0 μm. In this specimen the nonechinulate basidiospores are about equal in number to normal basidiospores.

The nonechinulate basidiospores set a problem as mentioned previously (Steyaert, 1972, pp. 64–65). They are specially frequent for *G. tornatum* and are always mixed with the normal ones. They cannot therefore be the basis for distinguishing an infra-specific taxon, even when very much predominant as in var. *laevisporum* Humph. & Leus where echinulate basidiospores can nevertheless be found.

It should be noted that *G. tornatum* is to be observed for cultivated plants mainly on *Cocos nucifera*. According to the number of examined specimens it is much less frequent on *Elaeis guineensis*.

The present paper is a perfect demonstration of the opinion published previously (Steyaert, 1972, p. 57) that it is imperative to undertake world-wide monographic studies of the major genera or groups of genera that have been left in abeyance.

Although readily admitting the need for establishing local floras and their usefulness it should also be admitted that their value would be greatly enhanced should the species concerned be known with greater precision. *G. tornatum* is precisely a case in point which fully bears out the contention. Whereas formally *Ganoderma brownii* was considered as an aboriginal plant to the Pacific coast of North America, now it appears as belonging to a widely distributed species in the tropics and subtropics but which under the influence of local physical conditions is modified in some of its microscopic features.

One cannot but emphasize that the need for world-wide monographs is specially urgent in the Polyporaceae where disagreement on the generic concepts is notably rife.

Specimens examined: (1) Each collection preceded by Herb. BR box no. (2) * denotes data included in Fig. 3. (3) P.N.A. = Parc National Albert. * A.878, Zaire, Mulungu, Mar. 1939, F. Hendrickx 518, alt. 1600 m; * A.892a, Zaire, Eala, Aug. 1930, P. Staner 473, alt. 320 m; * A.1029, Zaire, Ipamu, Sept. 1921, H. Vanderyst 10861, alt. 450 m; * A.1031, Zaire, Panzi, 1925, H. Vanderyst 16826, alt. 1000 m; * A.1032, Zaire (Kikwit?), Apr. 1921, H. Vanderyst 9183, alt. 487 m; * A.1228, Zaire, Kisantu, Mar. 1907, H. Vanderyst, alt. 540 m; * A.1229, Zaire, Kisantu, May 1907, H. Vanderyst, alt. 540 m; * A.1246, Zaire, Boto, on *Klainedoxa ovalifolia*, 29 Nov. 1944, R. L. Steyaert 44.310, alt. 500 m; * A.1249, Zaire, Yangambi, on *Combretum* sp., 22 Apr. 1944, R. L. Steyaert 44.131, alt. 470 m; * A.1253, Zaire, Kisantu, Mar. 1907, H. Vanderyst s.n., alt. 540 m; A.1367, Angola, J. Gossweiler 022, Herb. Lloyd 37494; * A.1463, Zaire, Riv. Biangolo, track Mwenda-Katuka, P.N.A., 28 Apr. 1953, H. Frédéricq 8950, alt. 1300 m; A.1929, Angola (southern), 1891, Peshuel-Lörsche, RLS.54.K.4; A. 1973, Republic S. Africa, Cramond & Harden Heights, on *Acacia decurrens* var. *mollisima*, 11 Apr. 1911, Pole-Evans 1326, lat. S. ± 29°, RLS.54.K.23; * A.1979, Uganda, Kampala, 1915, W. Small 318, alt. 1200 m, RLS.54.K.29; * A.1983, *Polyporus tornatus* Pers., Indonesia, Isl. Rawak, 1826, Gaudichaud, RLS.53.PC.33; A.1987, *G. applanatum* (Pers.) Pat var. *brownii* Humph., holotype, U.S.A., Calif., Berkeley, 5 Nov. 1905, on *Umbellularia californica*, C. J. Humphrey, lat. N. 37° 45′, RLS.53.PC.35; A.1988, *G. applanatum* (Pers.) Pat. var. *philippinense* Humph. & Leus, holotype, Philippines, Isl. Luzon, Prov. Laguna, Mt Maquiling, on large white Lauan, 24 Sept. 1928, C. J.

Humphrey 50047, lat. N. 14°, RLS.53.PC.36; A.1989, *G. applanatum* (Pers.) Pat. var. *laevisporum* Humph. & Leus, holotype, Philippines, Isl. Luzon, Mountain Prov., Bontoc sub-Prov., Mt Data, Feb. 1928, M. S. Clemens (Bur. Sci. 50084), lat. N. ± 17°, RLS.53. PC.37; A.1990, *G. applanatum* (Pat.) Pars. var. *tornatum* (Pers.) Humph & Leus f. *macrosporum*, holotype, Philippines, Isl. Luzon, Prov. Laguha, Majayjay, May 1928, McGregor, Bur Sci. 50087, lat. N. ± 15°, RLS.53.PC.38; A.2283b, Philippines, Isl. Luzon, Prov Bataan, Dec. 1909, H. P. Curran, For. Bur. 19234, lat. N. ± 15°, RLS.53.PC.22; A.2289a, Rep. S. Africa, Somerset East, 1878, McOwan, de Thüm. *Myc. Univ.* 2204, lat. S. 32° 44′; * A.2300, Zaire, Yangambi, on *Macaranga* sp., 20 Apr. 1954, B. Fassi 100, alt. 470 m; * A.2302, Zaire, Yangambi, on *Coloncoba welwitschii*, Nov. 1954, B. Fassi 201, alt. 470 m; * A.2395b, Malaysia, 1 Nov. 1954, Herb. Div. Pl. Path. 1363, lat. N. ± 4°, RLS.55.K.16; * A.2435, Uganda, Uganda forest, T. D. Maitland 377, alt. 1200 m, RLS.55.K.44; * A.2439, Uganda, T. D. Maitland, alt. 1200 m, RLS.K.48; * A.2443b, Uganda, T. D. Maitland 2, alt. 1200 m, RLS.K.51; A.2498, Rep. S. Africa, Cape Prov., Knysna, on *Olea laurifolia*, Dec. 1923, J. Phillips, Un. Dep. Agr., Myc. Herb. 18043, lat. S. 34° 03′, RLS.55.K.17; * A.2586b, Indonesia, Amboina, July–Nov. 1913, C. B. Robinson 2050, lat. 3° 41′, RLS.53.PC.46; A.3066, India (southern), on living *Cedrala toona*, 25 Jan. 1946, Herb. Dehra Dun 4242, RLS.58.DD.2; A.3067, India (southern), on stump of *Shorea robusta*, 25 Sept. 1958, Herb. Dehra Dun Lacch 87/58, RLS.58.DD.3; A.3068, India, Dehra Dun, on main stem of *Tectona grandis*, 25 Sept. 1958, Herb. Dehra Dun Lacch 30/58, lat. N. 30° 19′, alt. 680 m, RLS.58.DD.3; A.3347, Zaire, Yangambi, on *Guarea ?laurentii*, 31 Jan. 1956, B. Fassi 284, alt. 470 m; * A.3352, Zaire, Yangambi, on *Trichilea prieureana*, 5 Mar. 1956, B. Fassi 413, alt. 470; * A.3358, Zaire, Yangambi, on *Combretodendron africanum*, 17 Mar. 1954, B. Fassi 635, alt., 470 m; * A.3362, Zaire, Lekwa-Djugu, on *Olea hochstetteri*, 8 June 1956, B. Fassi 726, alt. 1500 m; * A.3372a–b, Zaire, Bongabo (Ineac), on *Gilbertiodendron dewevrei*, 10 Nov. 1956, B. Fassi 836, alt. 435 m; * A.3380, Zaire, Yangambi, on *Paramacrolobium coeruleum*, June 1956, B. Fassi 976, alt. 470 m; * A.3397, Zaire, Kitotenge (road Masisi–Walikale), 28 Apr. 1958, B. Fassi 1280, alt. 750 m; * A.3401, Zaire, Yangambi, on *Polyalthia suaveolens*, 22 July 1958, B. Fassi 1467, alt. 470 m; * A.3664, Kenya, Sotiten (Londiani), on *Acacia melanoxylon*, 5 Dec. 1955, I. A. S. Gibson, alt. 2500 m, RLS.61.K.47; A.3668, *Elfvingia brownii* Murrill, holotype ?, U.S.A., Calif., Brown, lat. N. ± 37°, RLS.61.K.50; A.3689, Uganda, Mulange ?, on logs, July 1919, R. A. Dummer 908, RLS.PC; * A.3692, Tanzania, Bukoba, Maruku Coffee Station, 23 Apr. 1955, G. A. Semit 70, alt. 1260 m, RLS.61.EA. 1; * A.3703, Uganda, Busoga forest (near Masindi), 24 Oct. 1961, I. A. S. Gibson 784c, alt. 1200 m, RLS.62.K.4; A.4602, Sarawak, 1936, Oxford Univ. Exp. Sarawak, S.184, RLS.64.K.137; A.4603, Sarawak, Oxford Univ. Exp. Sarawak, RLS.64.K.139; * A.4609, Sierra Leone, 26 Nov. 1926, F. C. Deighton M 89, lat. N. ± 8°, RLS.65.K.75; * A.6331, Malaysia, Banting, on *Cocos nucifera*, Mar. 1965, P. D. Turner, coconut stump. 1, alt. less than 100 m, lat N. 2° 48′, RLS.65.Bant.63; A.6343, Cuba, Prov. Oriente, in valle fluminis Jaguani inter La Melba et Los Lirios in Mont Cuchillas de Toa pr. Baracoa, ad troncos emortuis, 16 Mar. 1967, Fr. Kotlaba, alt. near sea level, lat. N. 20° 23′, RLS.68.PR.7; * A.6359a–b, Kenya, Nanyuki, 3 Nov. 1963, H. E. Brown 27, alt. 1800 m, RLS.68.K.27–28; A.6702a–b–c, Sri Lanka, Naramwala, dead wood and roots of *Cocos nucifera*, July 1967, R. L. Bull, lat. N. 7° 25′, RLS.69.K.26–27–28; * A.6707, Uganda, Budongo forest (near Masindi), on fallen *Cynometra* sp. branch, 16 June 1968, D. N. Pegler U.1506, alt. 1150 m, RLS.69.K.50; * B.155, Zaire, Kisantu, 1907, H. Vanderyst, alt. 540 m; * B.159, Zaire, Bambesa, on fallen trunk in forest, 27 July 1944, R. L. Steyaert 44.281, alt. 620 m; * B.160, Zaire, Yangambi, on *Parinari glabra*, 20 Apr. 1944, R. L. Steyaert 44.120, alt. 470 m; * B.174a–b, Zaire, Kalonge (P.N.A.), on tree trunk, 31 Sept. 1952, H. Fredericq 8161, alt. 2600 m; * B.621, New Guinea, Sepik dist., Along Yapa (riv. Hunstein), on dead tree on river flat, 20 July 1966, R. D. Hoogland & L. A. Craven 10594, alt. 120 m; * C.126, Zaire, Sankuru, Apr. 1925, J. Ghesquière 206, alt. 500 m; * C.129, Zaire, Shari valley, near bridge on Nizi–Bungu road, Ed. Milliau, Jan. 1928, alt. 1500 m; * C.130, Zaire, Yambuya, J. Ghesquière 498, alt. 500 m; * C.155, Zaire, Ipamu, H. Vanderyst 25281, alt. 450 m; * C.166, Zaire, Kwango, 1925 ?, H. Vanderyst 16680, alt. 1000 m; * C.179k, Zaire, Yangambi, J. Louis 1485, alt. 470 m; * C.189, Zaire, Kisantu, Mar. 1907, H. Vanderyst, alt. 540 m; * C.200, Zaire, Yangambi, on stump of *Milletia congolana*, 12 Apr. 1944, R. L. Steyaert 44.082, alt. 470 m; * C.202, Zaire, Bongabo, on stump of *Macrolobium coeruleum*, 15 Dec. 1944, R. L.

Steyaert 44.383, alt. 500 m; * C.326, Zaire, Kyandolili (P.N.A.), on wood, 16 Oct. 1952, H. Frédéricq 8301, alt. 1700 m; * C.237, Zaire, Kikyo (P.N.A.), on wood, 23 Feb. 1953, H. Frédéricq 10358, alt. 2200 m; * C.242, Zaire, Yangambi, on *Albizia gummifera*, Aug. 1953, B. Fassi, Labo Phyto 12, alt. 470 m; * C.296, Zaire, Mutsora (P.N.A.), on dead tree, in bush savannah, 24 Dec. 1955, G. de Witte 9874, alt. 1200 m; * C.316, Zaire, Banyingi pr. Maginda (P.N.A.), 21 July 1954, G. de. Witte 10922, alt. ± 800 m; C.320a–b, New Caledonia, Nouméa, Sept. 1955, F. Bugnicourt, lat. S. 22° 16′; * C.321 a–b, Zaire, Banyingi pr. Maginda (P.N.A.), 22 July 1954, G. de Witte 10924, alt. ± 800 m; * C.325, Zaire, Riv. Kakole, trib. Byangolo (P.N.A.), on dead tree, 8 Nov. 1954, G. de Witte 11245, alt. 1330 m; * C.326b, Zaire, riv. Byangolo trib. of Djilube, on dead tree, 7 Sept. 54, G. de Witte 11239, alt. ± 1200 m; * C.349a, Uganda, Sese Isl., Jan. 1920, T. D. Maitland, alt. 1140 m, RLS.55.K.49; C.349b, Uganda, Entebbe Mayomba, Jan. 1919, T. D. Maitland 377, alt. 1200 m, RLS.55.K.53; * C.408, Zaire, Ngesho (P.N.A.), on dead wood, 6 Apr. 1934, G. de Witte A.15, alt. 2000 m; * C.433, Zaire, Yangambi, on *Bosquiea angolensis*, 7 Mar. 1956, B. Fassi 493, alt. 470 m; * C.434, Zaire, Yangambi, on *Fagara macrophylla*, 16 Mar. 1952, B. Fassi 530, alt. 470 m; * C.435a, Zaire, Yangambi, on *Trichila prieureana*, 16 Mar. 1956, B. Fassi 535, alt. 470 m; * C.437, Zaire, Yangambi, on *Synsepalum* sp., 26 Mar. 1956, B. Fassi 680, alt. 470 m; * C.438, Zaire, Yangambi, on *Trichilia gilgiana*, 14 Mar. 1956, B. Fassi 682, alt. 470 m; C.440c, Zaire, Djugu-Lekwa, on *Olea hochstetteri*, on branches, 8 June 1956, B. Fassi 786, alt. 1800 m; * C.441, Zaire, Djugu-Lekwa, on *Olea hochstetteri*, 8 June 1956, B. Fassi 788, alt. 1700 m; * C.448, Zaire, Bongabo, on *Gilbertiodendron dewevrei* dead stump, 9 May 1956, B. Fassi 851, alt. 430 m; * C.449, Zaire, Yangambi, on *Cynometra hankei*, 1957, B. Fassi 1056, alt. 470 m; * C.451, Zaire, Yangambi, on *Trichilia* sp., 1956, B. Fassi 1094, alt. 470 m; C.458, Pakistan, Changa-Manga, on *Dalbergia sissoo*, 29 Oct. 1950, S. Ahmad, RLS.58.LAH.12; C.495a–b, Pakistan, Sharhan, on logs, 20 Aug. 1959, S. Ahmad, alt. 2400 m, lat. 30–35°, RLS.59.LAH.14–15; * C.514, Uganda, New Fort Portal, on *Grevillea robusta*, 21 Oct. 1961, I. A. S. Gibson 785d, alt. 1650 m, RLS.62.K.2; * C.516, Kenya, Kinale forest stat., on *Ocotea usambarensis*, Aug. 1961, I. A. S. Gibson, alt. 2600 m, RLS.62.K.5; * C.533, Zaire, Yangambi, on dead tree, 10 Feb. 1956, B. Fassi 306, alt. 470 m; * C.573a, Ivory coast, Bamoro, on *Gmelina arborea*, 12 Nov. 1963, F. Brunck C.I.103F, lat. N. 7° 50′, alt. ± 300, RLS.64.CIFT.1; * C.810a, Malaysia, Banting, on *Cocos nucifera*, Mar. 1965, P. D. Turner, coconut stump 10, alt. ± 100 m, lat. 2° 48′. RLS.65.BANT.73; * C.811b, Malaysia, Banting, on *Cocos nucifera*, Mar. 1965, P. D. Turner, coconut stump 16, alt. ± 100 m, lat. 2° 48′, RLS.65.BANT.81; * D.35b, Zaire, Eala, at base of *Carica papaya*, Sept. 1923, Goossens-Fontana 49, alt. 320 m; * D.37b–f, Zaire, Eala, Sept. 1921, Goossens-Fontana 64, alt. 320 m; * D.79a–b, Zaire, Kavumu, Sept. 1938, F. Hendrickx 345, alt. 1600 m; * D.89, Zaire, Yangambi, 21 Apr. 1944, R. L. Steyaert 44,223, alt. 470 m; * D.119a–b, Zaire, Mulaba, pr. Ngite (P.N.A.), on tree, 23 Jan. 1954, G. de Witte 9787, alt. ± 1000 m; * D.160, Zaire, Mukoka (P.N.A.), on dead tree, 15 Nov. 1956, G. de Witte 13865, alt. 995 m; * D.167a–b, Zaire, Kamatembe, south of Ngesho (P.N.A.), 21 Apr. 1934, G. de Witte A.16b, alt. 2100 m; * D.176a–b, Zaire, Djugu-Lekwa, on dead *Olea hochstetteri*, 8 June 1956, B. Fassi 787, alt. 1800 m; * D.177a–b, Zaire, Djugu Lekwa, on *Chrysophyllum fulvum*, 8 June 1956, B. Fassi 789, alt. 1800 m; * D.180a–b, Zaire, Kalonge (P.N.A.), on *Rapanea pulchra*, 20 May 1958, B. Fassi 1341, alt. 2600 m; D.200, Kenya, Kinale (South Aberdares), from rotten *Ocotea usambarensis*, Aug. 1961, I. A. S. Gibson 748, alt. 2600 m, RLS.62.K.6; * D.203a–b–c, Zaire, Rutshuru, on dead tree, Nov. 1937, J. Lebrun 8420, alt. 1300 m; * D.256b, Malaysia, Banting, on *Cocos nucifera*, Mar. 1965, P. D. Turner, Coconut trunk 16b, alt. ± 100 m, lat. N. 2° 48′, RLS.65.BANT.58; * D.257, Malaysia, Banting, on *Cocos nucifera*, Mar. 1965, P. D. Turner, Coconut trunk 17, alt. ± 100 m, lat. N. 2° 48′, RLS.65.BANT.69; * D.258, Malaysia, Banting, on *Cocos nucifera*, Mar. 1965, P. D. Turner, Coconut trunk 18, alt. ± 100 m, lat. N. 2° 48′, RLS.65.BANT.60; * D.259, Malaysia, Banting, on *Cocos nucifera*, Mar. 1965, P. D. Turner, Coconut trunk 19, alt. ± 100 m, lat. N. 2° 48′, RLS.65.BANT.61; * D.260, Malaysia, Banting, on *Cocos nucifera*, Mar. 1965, P. D. Turner, Coconut stump 11, alt. ± 100 m, lat. N. 2° 48′, RLS.65.BANT. 74; * D.261, Malaysia, Banting, on *Cocos nucifera*, Mar. 1965, P. D. Turner, Coconut stump 12, alt. ± 100 m, lat. N. 2° 48′, RLS.65.BANT.75; * D.262a–b, Malaysia, Banting, on *Cocos nucifera*, Mar. 1965, P. D. Turner, Coconut stump 13, alt. ± 100 m, lat. N. 2° 48′, RLS.65.BANT.76–77; * E.52a–b, Burundi, Teza, on dead trunk, 20 Dec.

1967, E. Petit 2154, alt. 2000 m; * E.55a–b, Zaire, riv. Buisonge (P.N.A.), on dead wood, 21 Oct. 1952, H. Fredericq 8336, alt. 1780 m; * E.56a–b, Zaire, p. Kyandolire (P.N.A.), 22 Oct. 1952, H. Fredericq 8350, alt. 1780 m; * E.58, Zaire, Ilemba, trib. of Semliki (P.N.A.), on dead tree, 14 July 1954, G. de Witte 10914, alt. 750 m; * E.65, Zaire, lake Mugunga (P.N.A.), 31 Jan. 1934, G. de Witte A.11, alt. 1500 m; * E.67, Zaire, Kamatembe (P.N.A.), on dead wood, 21 Apr. 1934, G. de Witte A.16a, alt. 2100 m; * E.71a–b–c, Rwanda, km 70 Astrida–Shangugu road, on dead stump, Mar. 1958, Reynders 31, alt. 2400 m; * F.3, Zaire, Munungu, 20 Apr. 1910, Sapin, alt. 450 m; * F.6, Zaire, Binga, Goossens-Fontana 1069, alt. 380 m; * F.7a–b–c–d–e–f, Zaire, Binga, Goossens-Fontana 1068, alt. 380 m; K.28, Mozambique, on *Androstachys johnsonii*, Aug. 1921, G. Coombes, RLS.63.K.29; * K.31, Cameroon, Nyanga camp (Cameroon Mountains), Dec. 1930, T. D. Maitland 119, alt. 2250 m, RLS.63.K.32; K.34, India, Dehra Dun, Soharарpur road, Aug. 1953, K. S. Thind, lat. N. 30° 19′, RLS.63.K.35; * K.42, Uganda, Kampala, 1915, W. Small 317, alt. 1200 m, RLS.63.K.43; K.46, Rep. S. Africa, Natal, Cramond & Harden heights, on *Acacia mollissima*, 11 Apr. 1911, J. B. Pole-Evans, Dept. Agr. Myc. Herb. 1365, RLS.63.K.47; K.48, Uganda, Mayomba forest, Jan. 1919, T. D. M.(aitland?) 377, alt. 1200 m, RLS.63.K.49; * K.69, Uganda, Kampala, 1915, W. Small 317, alt. 1200 m, RLS.63.K.70; * K.95a, Malaysia, Johore, Labis Estate, on *Elaeis guineensis*, Feb. 1954, E. R. Rosenquist, alt. ± 100 m, lat. N. 2° 10′, RLS.63.K.127–136; K.99, British Cameroons, savannah, 1930, T. D. Maitland 97, alt. 1350 m, lat. N. ± 6°, RLS.63.K.132; K.101, Uganda, Mayomba forest, Jan. 1919, T. D. M.(aitland?) 377, alt. 1200 m, RLS.63.K.133; K.103a, Sarawak, 1936, Oxford Univ. Exp. 1936, S.392, lat. 2°–4°, RLS.64.K.138; K.105, Sarawak, 1936, Oxford Univ. Exp. 1936, lat. N. 2°–4°, RLS.64.K.141; K.106, Sarawak, 1936, Oxford Univ. Exp. 1936, lat. N. 2°–4°, RLS.64.K.142; * K.132, Ghana, Aburi, 5 May 1949, S. J. Hughes 418, alt. 200 m, lat. N. 5° 53′; * K.330, Kenya, Castle forest, south slope of Mt Kenya, Polo 16, alt. ± 2000 m, RLS.65.K.83; * K.336, Kenya, Mt Kenya, Nov. 1964, Otieno & Students, Polo 40, alt. 2000 m, RLS.65.K.89; K.337, Kenya, Polo 44a, RLS.65.K.90; K.338, Kenya, Polo 44b, RLS.65.K.91; * K.340, Kenya, Lower Castle Forest, on dry rotten log, 14 Nov. 1964, Polo 46, alt. 2000 m, RLS.65.K.93; * K.343, Kenya, Nairobi City Park, on woody plant, 24 Feb. 1964, Agnew, alt. 1700 m, RLS.65. K.96; * K.351, Kenya, Karura forest, on forest floor, 27 Dec. 1963, H. E. Brown Pol 2, alt. 1500 m, RLS.65.K.104; * K.354, Kenya, Nanyuki, tree stump in forest, 3 Nov. 1963, H. E. Brown 27, alt. 1900 m, RLS.65.K.107; * K.355, Uganda, Rabongo forest, Murchison Falls Nat. Park, on *Treculia africana*, 26 May 1964, H. E. Brown Pol 101, alt. 900 m, RLS.65.K.108; * K.356, Kenya, Mt Kenya, 14 Nov. 1964, (Students) Pol. 174, alt. 2000 m, RLS.65.K.109; * K.357, Kenya, Mt Kenya, 14 Nov. 1964, (Students) Pol. 180, alt. 2000 m, RLS.65.K.100; * K.358, Kenya, Castle forest, 14 Nov. 1964, Castellino Pol. 182, alt. 2400 m, RLS.65.K.111; * K.360, Kenya, Castle forest Station, 14 Nov. 1964, A. Joomaye Pol. 191, alt. 2340 m, RLS.65.K.113; * K.361, Kenya, Castle forest, 14 Nov. 1964, W. P. Rodgers Pol. 194. alt. 2100 m, RLS.65.K.44; K.382, U.S.A., Calif., Martin County, Alpine lake, on *Umbellularia californica*, 30 Jan. 1960, J. E. Lawrence 522, lat. N. ± 38°, RLS.66.L.24; * K.405, Borneo, Mt Raja, (im Urwald), Dec. 1924, H. Winkler 1047, alt. ± 1500 m, lat. S. 0° 31′, RLS.66.L.55; * K.425, Indonesia, Java, Tjibodas (Mt Gedeh), Sept. 1924, Bruggeman (Herb. Bogor 8760), alt. 1400 m, RLS.66.K.89; * K.427a–b, Indonesia, Java, Tjibodas, decayed stems and stumps, C. & D. V. Overeem – de Haas – Dakkus – Bruggeman – W. D. Van Leeuwen, Herb. Bogor 705, alt. 1400 m, RLS.66.L.91–92; * K.437, Indonesia, Java, Tjibodas, 23 Sept. 1924, Bruggeman, Herb. Bogor 8760, alt. 1400 m, RLS.66.L.106; K.438, India, Bengal Agarpara, Nov. 1931, D. N. Chakravorti 1249, alt. 0–100 m, Herb. Donk 8740, lat. N. 22°–23°, RLS.66.L.107; K.453, U.S.A., Calif., San Francisco (Muir woods), on *Umbellularia californica*, Nov. 1915, Mrs J. Humphrey, Herb. Donk 8738, lat. N. ± 38°, RLS.66.L.128; K.453, U.S.A., Calif., San Francisco, Muir woods, on *Umbellularia californica*, Nov. 1915, Mrs J. Humphrey, Herb. Donk 8738, lat. N. ± 38°, RLS.66.L.128; * K.458, Malaysia, Johore, Pontian road, Dec. 1929, E. J. H. Corner, Sing. Field 23225, Herb. Donk 2736, alt. ± 100 m, lat. N. 2°, RLS.66.L.134; * K.459, Indonesia, Java, Poedjon, July 1937, van Heurn?, Herb. Donk 8782, alt. 1100 m, RLS.66.L.141; * K.472, Philippines, Negros, Prov. Orient. Dumaguete, Apr. 1908, A. D. E. Elmer, Philipp. Isl. Pl. 10017, alt. ± 100 m, lat. N. 9° 20′, RLS.67.E.11; K.473, India, Calcutta, on trunk of *Mangifera indica*, 28 Aug. 1946, lat. N. 22° 35′, RLS.67.E.12; K.474, Philippines, Mindanao, Dist. Davao, Todaya (Mt Apo), May 1909, A. D. E. Elmer, Philipp, Isl. Pl. 10756, lat. N. 6° 58′, RLS.67.E.13; K.628, Indian Ocean, Christmas Isl., Dales (West coast), 13 Aug. 1968, D. A. Powell 121b, alt. 42 m, lat. S. 10° 30′, RLS.69.K.4; K.659, *Elfvingia brownii* Murrill, holotype, U.S.A., Calif., Berkeley, U. C. Campus, Strawberry Canyon, on dead and decaying *Umbellularia*, 27 Sept. 1913, V. S. Brown 307, lat. 37° 53′, RLS.59.NY.17; * K.674, Guyana, pr. Bartica, Riv. Essequibo, str. Moraballi, on dead log, 21 Oct. 1929, E. B. Martyn 659R, alt. 0–100 m, lat. 6° 24′, RLS.69.K.67; * K.680, Cameroon, above Nuea, 1929, T. D. Maitland 2, alt. ± 800 m, lat. N. 4° 09′, RLS.69.K.74; K.711, China, Hainan, Dist. Ling Shui, Po Teng Shi, on partly decaying living tree, 26/29 Apr. 1932, H. Fung 20047, lat. N. ± 19°, RLS.69.K.116; K.714, Ghana, 1949, comm. Fook 119, lat. N. 6°–10°, RLS.69.K.120; K.716, Philippines, Palawan, Mt Kabinbin, 22 Mar. 1929, B. Reyes, Bur. Sci. 50021, lat. N. 9°–10°, RLS.69.K.123; K.755, Kenya, Coast Prov. Dist Kwale, Shimba hills, zone wireless Station, on dead log, 13 Apr. 1968, F. Magogo & P. Glover 837, alt. 330 m, RLS.71.K.2; K.767, *Fomes oroflavus* Lloyd, holotype, Malagasy, H. Perrier de la Bathie, Herb. Lloyd 34373, RLS.71.BPI.1; K.941, Canada, B. C., Victoria, on *Prunus cerasifera* var. *pissardii*, 28 Nov. 1958, A. T. Foster & H. M. Craig, DAOM 69990, lat. N. 48° 26′; * L.35, Zaire, Yangambi, on *Cola griseiflora*, 10 Oct. 1957, B. Fassi 1128, alt. 470 m; * L.36, Zaire, Yangambi, on *Diospyros* sp., 10 Oct. 1957, B. Fassi 1129, alt. 470 m; L.44a–b, Malaysia, Sarawak, 1936, Oxf. Univ. Exp. 1936, S.320, lat. N. 1°–4°, RLS.64.K.147–148; * L.65a–b, Malaysia, on *Cocos nucifera*, Mar. 1965, P. D. Turner, coconut trunk 6a, 0–100 m, lat. N. 2° 48′, RLS.65.BANT.37–38; * L.69a, Malaysia, Banting, on *Cocos nucifera*, Mar. 1965, P. D. Turner, coconut trunk 12a, alt. 0–100, lat. N. 2° 48′, RLS.65.BANT.48; * L.72, Malaysia, Banting, on *Cocos nucifera*, Mar. 1965, P. D. Turner, coconut stump 8, alt. 0–100 m, lat. N. 2° 48′, RLS. 65.BANT.71; * L.74a, Malaysia, Banting, on *Cocos nucifera*, Mar. 1965, P. D. Turner, coconut stump 17a, alt. 0–100 m, lat. N. 2° 48′; * L.87a–b, Burundi, Nyabigondo (Teza), 14 Nov. 1967, alt. 2100 m; * L.108, Kenya, Kericho dist., West Mau Forest, Sambret tea Est., on fallen *Podocarpus*, 27 Mar. 1968, D. N. Pegler K.298, alt. ± 2000 m, RLS.64.K.48; * L.109, Tanzania, Iringa distr., Lake Ngwazi, Mufindi, 7 May 1968, D. N. Pegler T.826, alt. 1900 m, RLS.69.K.51; * L.111, Ivory coast, Grand Bassam, Aboisso, Forêt de la Toumanguié, on wood, P. Bamps 2291, lat. N. 5° 14′; * L.122, Papua, Brown river, on *Tectona grandis*, 20 Aug. 1969, K. J. White, Dept. Agr. & Livest. 6647, alt. 0–100 m, lat. S. 9° 04′.

'Parc National Albert' is currently renamed 'Parc National des Virungas'. The former name is here retained because the collections of *G. tornatum* result from various explorations the 'Institut des Parcs Nationaux du Congo Belge' organized before and after the last war. Indeed these explorations brought back among its many natural history collections no less than 26 specimens of this species alone. In this respect the author extends his deep appreciation to Mr G. de Witte and his collaborators who are responsible for these collections. Had the elevation of their collection sites not been mentioned the conclusions of this paper would not have been as forceful. Also included in this cordial extension of thanks are all the other collectors who did likewise.

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