

Study of some *Ganoderma* species

by

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Summary. — The genus *Ganoderma* is subdivided into 4 subgenera: *Ganoderma*, *Elfvigia* Imazeki, *Anamixoderma* Steyaert subgen. nov. and *Plecoderma* Steyaert subgen. nov. Subgen. *Ganoderma* is further divided into 2 sections: *Ganoderma* and *Characoderma* Steyaert sect. nov.

The following taxa are described: *G. curtisii* (Berk.) Murrill, *G. ravenelii* Steyaert sp. nov., *G. tsugae* Murrill, *G. multiplicatum* (Mont.) Pat. and var. *vitalii* Steyaert, *G. oregonense* Murrill and *G. rothwellii* Steyaert sp. nov. in subgen. *Ganoderma* sect. *Ganoderma*; *G. oerstedii* (Fries) Torrend and *G. subfornicatum* Murrill in subgen. *Ganoderma* sect. *Characoderma*; *G. amazonense* Weir in subgen. *Plecoderma*; *G. lobatum* (Schw.) Atk. and *G. lobatoideum* Steyaert sp. nov. in subgen. *Anamixoderma*.

The *Ganoderma resinaceum* and *G. parvulum* complexes are described, and the distribution of some *Ganoderma* species is discussed.

Ganoderma neglectum Pat. is excluded from the genus *Ganoderma*.

FOREWORD

One is referred to Steyaert (1972 : 56-61) for the procedures that have been followed to ensure the comparability in the data collection and on how some practical problems of herbarium storage have been solved.

Some terms used in this publication should be explained or defined :

Pedical : short stalk, less than about 5 mm long.

Stipe : stalk longer than the above.

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This paper was found nearly ready for the press among Steyaert's papers. All systematic opinions have been expressed by him; preparation for publication has been done by J. Rammeloo. Dr. R. W. G. Dennis (Kew) is acknowledged for improving the English text.

Mesopode(al) : stipe inserted in the middle of the tube layer.

Pleuropode(al) : stipe inserted laterally on the pileus.

Orthopleuropode(al) : stipe as above and vertical.

Plagiopleuropode(al) : stipe as above but horizontal or nearly so; stipe and pileus are thus on the same plane or nearly so.

Radius of pileus : (in sessile or pleuropode specimens) size taken vertically to the base.

Diameter of pileus : (in sessile or pleuropode specimens) size taken parallel to the base.

Spore shape : as the shape of the basidiospores may vary to an appreciable extent, from near spheroid to long ellipsoid, it has been found convenient to express it in figures by what one might call Spore Shape Index (S. S. I.), which is the percentage of the

$$\text{diameter (width) to the length of the spore} = \frac{\text{diam.} \times 100}{\text{length}}$$

The S. S. I. for each specimen is calculated on the mean of the measurements of ten of its basidiospores.

The number of spores measured for each specimen may appear low but measuring a greater number of spores would have entailed far too much work. In a few instances one or two supplementary sets of ten spores were measured; the gain in precision was not warranted by the increase in time and labour expended.

Since having worked on the *G. tornatum* problem (Steyaert 1975) one has become aware that basidiospores sizes cannot be fully relied upon as a distinguishing feature between varieties and even species. Conditions of growth, primarily it seems climatological ones, influence size. Nevertheless spore morphology does remain of importance in specific and varietal distinction when linked with other features.

A remark should be added here, about the basidiospores that can be observed on the cutis. When it appears that a specimen has no basidiospores in its tubes, either because it has been collected too young or at a seasonal resting stage, one is tempted to resort to the spore deposit that is often observed on the cutis of the pileus. If it is heavy one may feel some confidence that the spore deposit originated from the basidioma, but if only a few spores can be retrieved by assiduously scratching the cutis, one may as well discard the resultant spore mount, as there can be no assurances that they were produced by the specimen being examined.

As a reminder, such numbers as : A. 3407, B. 358, C. 301, K. 1042, etc. refer to the box numbers in the herbarium of the National Botanical Garden of Belgium, Meise (BR) in which the specimens are stored. Numbers such as RLS. 60. BPI. 1, RLS. 55. K. 36, etc. are also mentioned. These are given to specimens received on loan from foreign herbaria and consist of the author's initials followed by the year (55 = 1955, 60 = 1960, etc.) in which the specimen was received on loan, the code letter of the lending herbarium (K = Kew, NY = New York, etc.) and a serial number in the batch of specimens received on loan. The necessity for this numbering was realised when a single collection comprised several specimens, either kept together or distributed amongst several herbaria. In such a case all basidiomata may not belong to the same species as has happened in several instances. By this numbering a greater precision is obtained when referring to specimens.

Colors mentioned in the descriptions of the basidiomata are those of Ridgway (1912) or as translated into Latin by Dade (1943). These color names are printed in italics. Colors under the microscope are assessed without reference to a color scale and their names are in roman.

To avoid confusion months mentioned in the dates are expressed in roman figures.

SUBDIVISION OF GENUS *GANODERMA*

Because of the large number of species, the genus *Ganoderma* must inevitably be divided into taxa of lower rank. Two subgenera have long been recognized : subgen. *Ganoderma* and subgen. *Elfvigia*. Both were first published as distinct genera (Karsten 1881, 1889 a & b), but a subgenus *Ganoderma* was automatically founded when *Elfvigia* was incorporated as subgenus into *Ganoderma* (Imazeki 1939).

Subgenus *Ganoderma* is distinctive in that the species have a cutis anatomy where the hyphal ends of the terminal hyaline ramifications of the brown context hyphae are fastigate and anticlinally disposed. The hyphal ends are either inflated or keep the diameter of the hyaline ramifications. All hyphal ends, inflated or not, contain « melanoid substances » (Steyaert 1967 : 190); the array of fastigate hyphal ends is immersed in such substances to form a moderately hard crust.

An array of inflated hyphal ends has been termed a « hymeniderm » (Lohwag 1941 : 102-118) or more correctly « hymenioderm »; an array of non-inflated hyphal ends has been named a « characoderm » (Steyaert 1961 : 70, 1967 : figs. 19-20).

Subgenus *Ganoderma*, which includes at least an estimated two-thirds of the species of the genus, is further divisible into sections :

Sectio *Ganoderma*; hymenioderma elementis (fastigiatis) inflatis, plus minusve cylindraceutis, unumquodque usque ad quadruplum vel quintuplum diametri hyphae hyalinae quam coronat attingens.
— Species typica : *G. lucidum* (Curtis ex Fr.) Karst.

Section *Ganoderma*; hymenioderm elements (fastigate) swollen, more or less cylindrical, each up to 4-5 times the diameter of the hypha it terminates.

Those species that can be most closely grouped with *G. lucidum* have a white or buff colored context with a brown zone close to the tube layer with which the latter is concolorous.

In contrast to the above section is another group of species that have non-swollen hymenioderm elements with or without a terminal spheroid :

Sectio *Characoderma* Steyaert sect. nov.; hymenioderma elementis (fastigiatis) haud inflatis, unumquodque quam diametrum hyphae hyalinae quam coronat tam latum vel vix latius; interdum unum vel alius major pars eorum apice sphaeroideo coronatum. — Species typica : *G. cupreolaccatum* (Kalchbr.) Igmándy (syn. *G. pfeifferi* Bres.).

Section *Characoderma* Steyaert sect. nov.; hymenioderm elements (fastigate) non swollen, each equal to or slightly thicker than the diameter of the hyaline hypha which terminates; sometimes a few or the majority are capitate by a spheroid inflation.

The species that are the most closely grouped around the type species have a dark red brown context concolorous with the tube layer.

Subgenus *Elfvigia* (Imazeki 1939) is clearly distinctive from subgenus *Ganoderma* in having a cutis anatomy of the trichoderm type (Lohwag 1941), which is, with the layer of melanoid substances, below the ramifications of the terminal hyaline context hyphae

(Steyaert 1967). This disposition results in the latter being exposed to atmospheric hazards and becoming broken off. Type species : *G. applanatum* (Pers. ex S. F. Gray) Pat.

Besides the above two subgenera based on distinctive types of cutis anatomy, two others can be distinguished : one, where the hyaline hyphal ends intermix and mix with brown hyphae, the whole being embedded in melanoid substances, the other where hyaline hyphal ends closely entwine to form a dense layer. Neither of the cutis anatomies have external free hyphae above the deposit of melanoid substances.

The first type of cutis anatomy, has been named anamixoderm (Steyaert 1961). The subgenus, the cutis of which is characterized by such an anatomy, is named :

Subgenus *Anamixoderma* Steyaert subgen. nov. (Greek : $\mu\zeta\omicron$ = mixed); cutis hyphis hyalinis et bruneis laxè intermixtis, in substantia melanoidea toto immersis. — Species typica : *G. adpersum* (Schulz.) Donk (syn. *G. europaeum* Steyaert).

Subgenus *Anamixoderma* Steyaert subgen. nov. : cutis with hyaline and brown hyphae loosely intermixed, totally embedded in melanoid substances.

The second type of cutis anatomy had not been distinguished previously and had been considered by the author as an anamixoderm (Steyaert 1972 : pl. 6 figs 21-22) in *G. philippii* (Bres. & Henn.) Bres. The discovery that *G. amazonense* Weir had the same type of cutis anatomy, showed that this type was worthy of being distinguished from the anamixoderm type and is named :

Subgenus *Plecoderma* Steyaert subgen. nov. (Greek : $\pi\lambda\epsilon\kappa\omicron\varsigma$ = tress); cutis hyphis dense intermixtis, substantiis melanoideis impregnatis, stratum a contextu valde distinctum formantibus. — Species typica : *G. philippii* (Bres. & Henn.) Bres. [syn. *G. pseudoferreum* (Wakef.) V. Over. & Steinm.].

Subgenus *Plecoderma* Steyaert subgen. nov.; cutis of hyaline hyphae densely entwined and impregnated by melanoid substances, forming a layer sharply distinct from the context.

The basidiomata of *G. philippii* and *G. amazonense* do not differ greatly in gross morphology or in basidiospore shape and size, but they show a distinct difference in context colours. *G. philippii* has a context tawny to russet, whereas that of *G. amazonense* is buff.

The latter species is not yet reported as having rhizomorphs as a means of propagation at close range. Rhizomorphs are, on the other hand, produced by *G. philippii*, which makes it a redoubtable root parasite in tropical Asian plantations.

Within the framework of subdivisions of the genus *Ganoderma*, as set out above, further subdivision should be made, specially in subgenus *Ganoderma*; its subdivision into two sections is but a preliminary step. Though the groups of species, as they have been defined above, stand out prominently there are still species that are not clearly referable to either section.

Also, each section requires further subdivision; the next step apparently, for section *Ganoderma* at least, to be taken on the basis of basidiospore morphology. In this respect two groupings are prominent. The first where the basidiospores have crests, either irregular in size and disposition or as honeycombed ridges; the second with echinulate basidiospores. Only two species — *G. alluaudii* Pat. & Har. and *G. eminii* Henn. — are comprised in the first group, whereas a not inconsiderable amount of species are comprised in the second. This latter group can further be subdivided into species with relatively few, moderately long and thick echinules on the basidiospores, while the other has the basidiospores densely covered by short, thin echinules.

The first grouping is typified by the spores of *G. lucidum*, the second by those of *G. resinaceum*.

As regards section *Characoderma*, it must be remarked that it can include species where the cutis elements are somewhat expanded. *G. tuberculosum* is a case in point. All the hymenoderm elements in this species have a spheroid apex with the base of the element somewhat funnel-shaped. This apparently deviates from the definition of section *Characoderma*, as exemplified by *G. cupreolaccatum* (Kalchbr.) Igmándy. However, when one examines several specimens of this European species, one observes that there is some variation in the cutis anatomy. Some specimens have cutis elements as non inflated hyphal ends; in other basidiomata there is a fair proportion of cutis elements capitate by a spheroid. In yet other specimens the cutis elements are nearly exclusively capitate, so much so that the author was led into publishing a new species on the basis of such an anatomy: *G. soniense* Steyaert. However, with the accumulation of specimens it was realized that this was but a variation within the species.

As *G. cupreolaccatum* and *G. tuberculosum* are morphologically very much alike (dimidiate basidioma, context and tube layer colorous, bay, basidiospores of same sizes, shapes and brown color), they must be considered as closely related.

The variations in the cutis anatomy of *G. cupreolaccatum* recalls those in the cutis anatomy of *G. weberianum* (Bres. & Henn.) Steyaert (Steyaert 1972 : 81, 115), where the diameter of the cutis elements varies with the scarceness or abundance of gasterospores in the context. For *G. cupreolaccatum*, there being no gasterospores involved, the cause of the variations in cutis anatomy is open to conjecture.

As gasterospores have been mentioned, it is as well to remark that these peculiar propagation elements have so far only been observed among the species of subgen. *Ganoderma*. If they do afford no any worthy element for the characterization of the subdivisions of this subgenus, they afford, however, when present, means of identification of species; gasterospores differ greatly from one species to another and a specimen can be identified by them with ease and confidence. Many more species than those already recorded may be capable of producing gasterospores. Some gasterospores have been observed in a specimen of *G. lucidum*. Although this is a very rare instance, there appears to be a potential capacity to produce gasterospores in every species. The factors controlling their production remain conjectural. Steyaert (1972 : 80) suggested that it depends on advanced decay of the host plant when the nutriments for the fungus approach exhaustion.

SUBGENUS GANODERMA SECTIO GANODERMA

1. *Ganoderma curtisii* (Berk.) Murill, N. Am. Fl. 9 : 120 (1908). — Fig. 1, 2 C-D, 4.

Polyporus curtisii Berkeley, Hook. Journ. Bot. 1 : 101-102 (1849).

Basidiomata ortho- or plagiopleuropode (possibly sometimes sessile, but then on a narrow base, which may indicate stipitate specimens bereft of their stipe or pedicel). *Pileus* usually flabellate, upper surface variegated from ochraceous-buff to carob brown (the latter especially on stipe), usually slightly laccate.

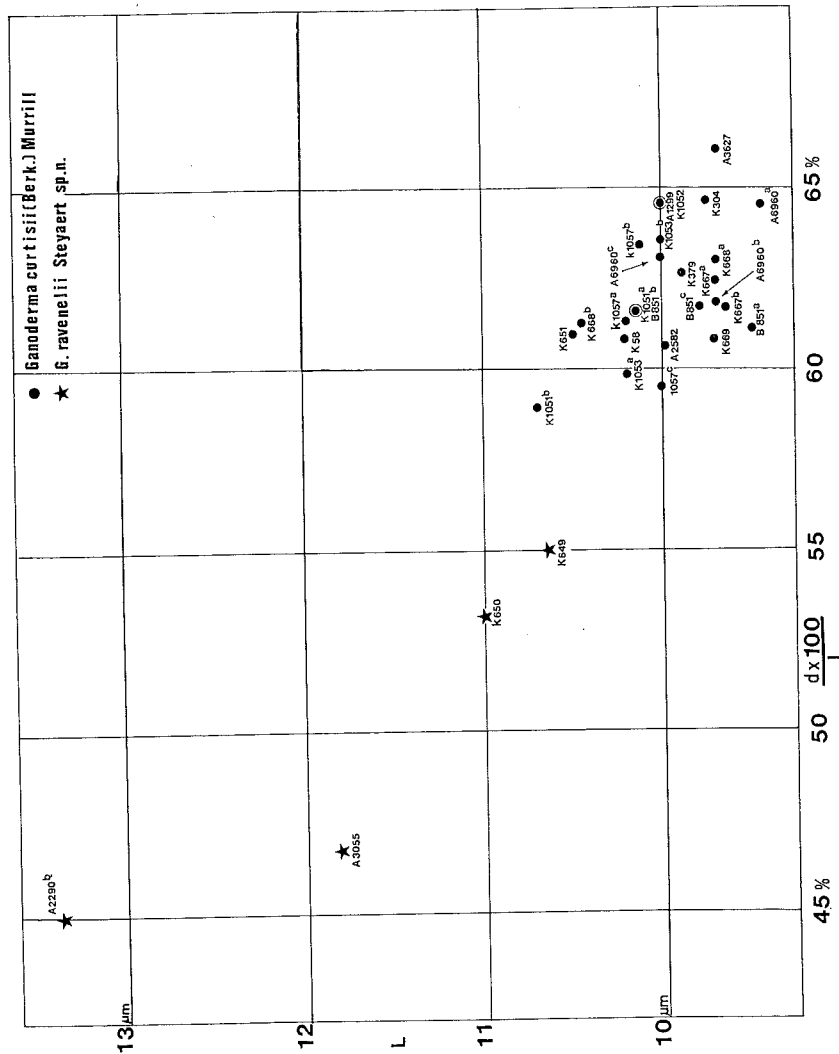


Fig. 1. — Distribution of spore shape index on spore length for *G. curtisii* (Berk.) Murrill and *G. ravenelii* Steyaert.

Section : cutis very thin to practically non existent; context about equal in thickness to tube layer, *pale ochraceous-buff* to *ochraceous-tawny* near tube layer, with one or several dark brown, thin or thick, laccate lines, originating from the stipe and running parallel to the upper surface (these lines are apparently deposits of melanoid substances); tube layer *ochraceous-tawny*, up to 10-12 mm thick.

Cutis of the hymenioderm type, elements of which are upright and closely packed in the *carob-brown* parts of the cutis, flaccid and more or less in disorderly array in light coloured parts; elements clavate $30 \times 10-12 \mu\text{m}$. *Pores* circular, 100-200 μm diam.; dissepiments 10-40 μm , distance between axes 170-230 μm . *Basidiospores* chamois-brown to brown, $8.5-10.0-12.0 \times 5.5-6.2-7.0 \mu\text{m}$, S. S. I. 59-62-66 %.

U. S. A. :

NORTH CAROLINA : Chapel Hill, common on dead wood, specially dead stumps in summer and fall, *Coker* s.n., XI-1923 (RLS.63.K.59) (K.58), plagiopleuropode, basidiosp. $9-10.2-10.5 \times 5-6.2-7 \mu\text{m}$, S.S.I. 60.8 % (neotypus, see p. 147).

FLORIDA : Altamonte springs, Seminole County, on old stump, *Schallert* (Fl. of Florida F.49), 2-VII-1958 (RLS.61.K.4) (A. 3627), orthopleuropode, basidiosp. $9.0-9.7-10.0 \times 6.0-6.4-8.0 \mu\text{m}$, S.S.I. 66 %; in lawn from oak tree roots, My Home, Seminole, *Schallert* F. 48, 21-X-1955 (RLS.67.E.22) (K. 483), basidiosp. : none; Dacle Battlefield historic site, near Bushnell, s. hosp., *Homola* 6718, 31-VIII-1977 (RLS. MAINE. 2) (K. 1057a), mesopode, basidiosp. $9.0-10.2-11.0 \times 5.5-6.2-6.5 \mu\text{m}$, S.S.I. 61.3 %; ditto (RLS.77.MAINE.3) (K. 1057b), basidiosp. $9.5-10.1-11.0 \times 6.0-6.4-7.0 \mu\text{m}$, S.S.I. 63.4 %; ditto (RLS.77.MAINE.4) (K. 1057c), plagiopleuropode, basidiosp. $9.0-10.0-10.5 \times 5.5-5.9-6 \mu\text{m}$, S.S.I. 59.5 %.

LOUISIANA : Martinsville, on rotten hardwood stump, *Humphrey* 3660, 21-VI-1914 (RLS.55.K.89) (A. 2582), plagiopleuropode, basidiosp. $9.5-9.6-10.0 \times 6 \mu\text{m}$, S.S.I. 62.5 %.

ARKANSAS : Batesville, at base of old oak stumps, *Bartholomew* (Fungi Columb. 2832), 6-X-1908 (RLS.69.NY.31) (K. 667b), apparently plagiopleuropode but stipe probably broken off, basidiosp. $9.0-9.5-10.0 \times 5.5-5.9-6.5 \mu\text{m}$, S.S.I. 62.3 %.

MISSOURI : Prope Parryville, ad terram circa *Quercus truncos vetustos*, *Demetrio*, 20-VIII-1885 (Rabenhorst-Winter, Fungi Europaei 3430) (BR) (A. 1299), plagiopleuropode, basidiosp. $8.5-10.0-11.0 \times 5.5-6.4-7.0 \mu\text{m}$, S.S.I. 64.5 %; *ibid.* (Fungi Europaei 3430) (RLS.69.NY.30) (K. 667a), plagiopleuropode (only a fragment of stipe or pedicel is still attached) (see reference to these two latter specimens in discussion), basidiosp. $8.5-9.7-11.0 \times 5.0-6.0-6.5 \mu\text{m}$, S.S.I., 62.4 %.

SOUTH CAROLINA (?) : s. loc., s. hosp., *Ravenel* (Fungi Amer. exsic. s.n.), s. dat. (RLS.69.NY.33) (K. 668b), basidiosp. $10.0-10.4-11.0 \times 6.0-6.4-7.0 \mu\text{m}$, S.S.I. 61.2 %.

NORTH CAROLINA : Onslow County, Lake Catherine, s. hosp., *House* s.n., 5-V-1911 (RLS.69.NY.5) (K. 651), plagiopleuropode, basidiosp. $9.5-10.5-12.0 \times 6.0-6.4-7.0 \mu\text{m}$, S.S.I. 61 %.

TENNESSEE : Sequoah hills, Knoxville, on base of living tree (? *Quercus*), *Donk* 13.684, 22-VII-1969 (RLS.72.L.16-17-18) (A. 6960a-b-c), basidiosp. A. 6960a : $9-9.4-10 \times 5.5-6.1-6.5 \mu\text{m}$, S.S.I. 64.55 %; A. 6960b : $9.0-9.7-11.5 \times 5.5-6.0-6.5 \mu\text{m}$, S.S.I. 61.86 %; A. 6960c : $9.0-10.0-11.0 \times 6.0-6.3-7.0 \mu\text{m}$, S.S.I. 63 %.

ILLINOIS: Geneseo, on *Quercus coccinea* var. *tinctoria*, E. T. S. A. Harper s.n., 8-IX-1915 (RLS.65.K.42) (K. 304), sessile (?), basidiosp. $9.5-9.7-11.0 \times 6.0-6.3-7.0 \mu\text{m}$, S.S.I. 64.6 %; ditto, the other half of the preceding (RLS.66.L.21) (K. 379), basidiosp. $9.0-9.9-10.5 \times 6.0-6.2-6.5 \mu\text{m}$, S.S.I. 62.6 %.

NEW JERSEY: Fort Lee, lying on road, s. coll., 5-IV-1902 (RLS.69.K.32) (K. 668a), basidiosp. $9.0-9.7-10.5 \times 5.5-6.1-7.0 \mu\text{m}$, S.S.I. 62.9 %; woods 3 mi. S. E. of Woodbine, Cape May County, s. hosp., Rogerson & Smith s.n., 14-IX-1967 (RLS.77.NY.3) (K. 1052), basidiosp. $9.5-10.0-11.0 \times 6.0-6.4-7.0 \mu\text{m}$, S.S.I. 64.5 %; Little Falls, around oak stumps, Ashley s.n., VIII-1952 (RLS.77.NY.4) (B. 851a), basidiosp. $8.5-9.5-11.0 \times 5.0-5.8-6.5 \mu\text{m}$, S.S.I. 61 %; ditto (RLS.77.NY.5) (B. 851b), basidiosp. $9.2-10.1-11.0 \times 6.0-6.2-7.0 \mu\text{m}$, S.S.I. 61.6 %; ditto (RLS.77.NY.6) (B. 851c), basidiosp. $9.0-9.8-10.5 \times 5.5-6.0-6.5 \mu\text{m}$, S.S.I. 61.7 %; 3 mi. W. of Newfield, below Willow Grove, Salem County, s. hosp., Rogerson & Smith s.n., 14-IX-1967 (RLS.77.NY.7) (K. 1053a), basidiosp. $9.5-10.2-11.0 \times 5.5-6.1-7.0 \mu\text{m}$, S.S.I. 59.8 %; ditto (RLS.77.NY.8) (K. 1053b), basidiosp. $8.5-10.0-11.0 \times 6.0-6.3-7.0 \mu\text{m}$, S.S.I. 63.5 %.

NEW YORK: woods S. W. of Shirley, Suffolk County, on roots of oak (?), Rogerson s.n., 3-X-1967 (RLS.77.NY.1) (K. 1051a), basidiosp. $9.0-10.1-11.0 \times 5.5-6.1-7.0 \mu\text{m}$, S.S.I. 61.6 %; ditto (RLS.77.NY.2) (K. 1051b), basidiosp. $10.0-10.7-12.0 \times 5.5-6.3-7.5 \mu\text{m}$, S.S.I. 58.9 %.

Note: There have been assembled or examined at herb. BR 24 specimens which had been identified by various authors as *G. curtisii*, *G. lucidum*, or *G. lobatum*. All these specimens have in common a variegated upper surface of the pileus, partly *carob brown* and *ochraceous-buff*, sometimes nearly completely of the latter colour. Most are pedicellate, a few seem to be sessile but what is supposed to be their base of attachment on the host is narrow and more or less circular, which might indicate that they were stipitate when collected but that the stipe has been broken off. Of some, such as *Rabenhorst-Winter Fungi Europaei* 3430, only a slice has been available which precludes obtaining knowledge of the whole basidioma.

When stipitate, the basidioma is either mesopode or pleuropode and, in the latter case, either orthopleuropode or plagiopleuropode.

In the main, no distinction among these appears when the cutis structure is examined. It is a hymenioderm of which Haddow (1931) gave already a good picture. When examined in the more yellowish parts of the basidioma's upper surface it is often but a jumble of deflated or semideflated elements. They are then as Haddow has pictured them (Haddow 1931: fig. 18), massive, clublike and enrobed in a pale wax-like substance.

A surprising contrast however appears once the basidiospores are examined (fig. 2 A, B, C, D). The specimens can then be separated into two groups of distinctive basidiospores type: the one with ellipsoid spores, mostly long ellipsoid, the other with ovoid spores. This stands out clearly when spore shape indices of the

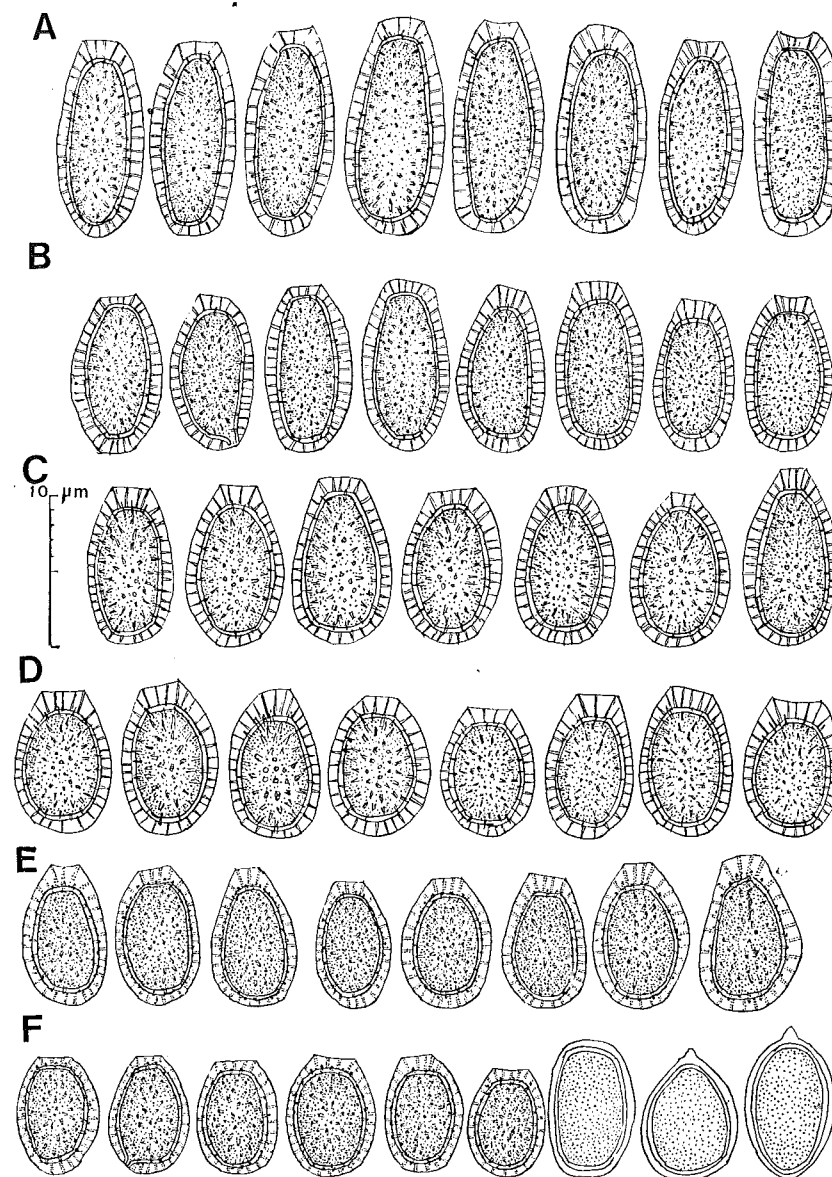


Fig. 2. — Basidiospores: A-B, *Ganoderma ravenelii* Steyaert; C-D, *G. curtisii* (Berk.) Murrill; E, *G. lobatum* (Schw.) Murrill; F, *G. lobatoideum* Steyaert (A, Ravenel 2936; B, Martin, 802 Ellis N. Am. Fungi; C, House s.n., RLS.69.NY.5; D, s. coll., RLS.61.K.4; E, Schweinitz s.n., RLS.55.NY.9; F, Martyn G O 4R).

specimens are graphed against spore lengths (fig. 1). It is noticed then that the group of specimens with ovoid spores, when the specimen is cut in half at the middle, has dark horizontal shiny lines of melanoid substances deposits, whereas the group with ellipsoid spores has no such deposits in the context. We are doubtless dealing with two different species; one of which is the true *G. curtisii*.

Reverting to Berkeley's paper (Berkeley 1849 : 102), we find the following sentence : « Substance towards the tubes cinnamon, above ochraceous, not zoned, traversed by laccate lines parallel to the surface ».

There can then be no hesitation in designating as typical the group of specimens which shows this feature : the one with ovoid spores. The other group of specimens without such laccate lines must be considered a yet unrecorded species. Murrill (1908) did not record a *Ganoderma* species with basidiospores of the sizes observed in the specimens with ellipsoid spores. This latter group of specimens is here named *G. ravenelii* Steyaert and the description of *G. curtisii* is emended.

2. *Ganoderma ravenelii* Steyaert sp. nov. — Fig. 1, 2 A-B, 7.

Basidioma flabelliforme, ortho- vel plagiopleuropodum, usque ad circa 100 mm radialiter; pagina dorsalis gibbula, haud plicata, ad marginem armeniaca surda, usque laccata badia ad stipem.

Sectio : cutis badia, sublaccata, plus minusve 60 μ m crassa ad stipem; contextus *bubalinus* ad *cinnamomeus* vel *isabellinus* ad tubulorum stratum, usque ad 10 mm crassum, *isabellinum*.

Cutis hymenodermiformis, elementis clavatis, saepe non dense agglomeratis, 20 μ m longis, 8-10 μ m crassis. *Pori* circulares vel irregulares, 80-145-360 μ m diam., dissepimentis 10-45-110 μ m crassis, axibus circa 190 μ m distantibus. *Basidiosporae* ellipsoideae, 10-11.7-14.5 \times 5-5.8-6.5 μ m, S. S. I. 44-49.3-55 %. — *Holotypus* : *Ravenel* 2936 (K).

Basidioma ortho- or plagiopleuropode (some fragments in K seem to have been taken from mesopodal specimens); upper surface of pileus from *dull rufous* at the margin to laccate *claret brown* at the stipe. *Pileus* does not seem to have a radius bigger than 110 mm.

Sectio : cutis thin, up to more or less 60 μ m thick on the stipe, reddish brown; context : *light buff* to *pinkish cinnamon* and *tawny*

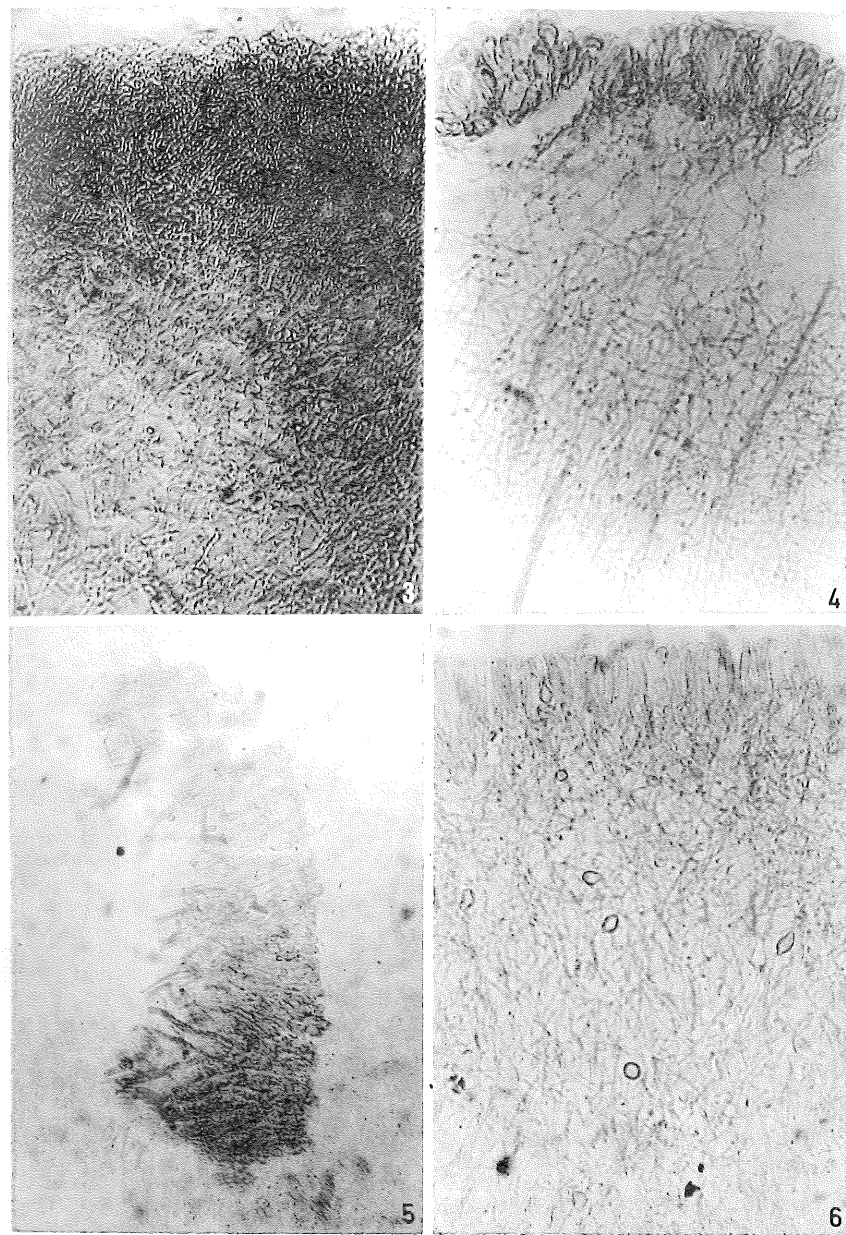


Fig. 3-6. — Section of the cutis (all $\pm \times 130$) : 3, *Ganoderma amazonense* Weir (Weir s.n., RLS.60.BPI.1); 4, *G. curtisii* (Berk.) Murrill (Coker s.n., RLS.63.K.59); 5, *G. multiplicatum* (Montagne) Pat. (Chaper s.n., A. 2499a); 6, *G. rothwellii* Steyaert (Rothwell 12 823).

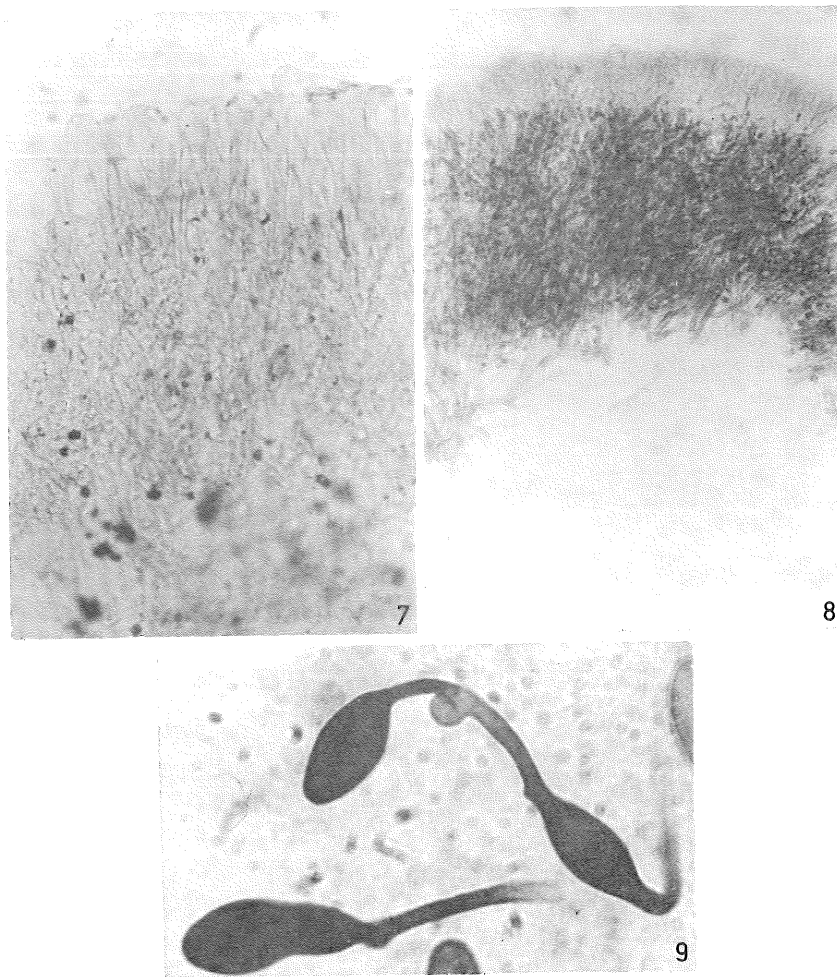


Fig. 7-9. — Section of the cutis (both $\pm \times 130$): 7, *Ganoderma ravenelii* Steyaert (Ravenel 2936); 8, *G. subfornicatum* Murrill (Peck s.n., RLS.55.NY.22); 9, *G. amazonense* Weir, hyphae from culture on potato-dextrose agar, stained with acid fuchsin ($\times 1200$); in contrast to the hyphae of normal diameter which are only faintly stained, the swelled hyphae stain a deep rhodamine purple (Fassi 395).

olive near tube layer, no laccate lines of melanoid substance; tube layer tawny-olive, up to 10 mm thick, about equal in thickness with context.

Cutis of the hymeniodermiform type, elements clavate, often not densely aggregate, 20 μm long, 8-10 μm broad. *Pores* circular to irregular, 80-145-360 μm in diam.; dissepiments 10-45-110 μm thick, distance between axes of pores 80-199-230 μm . *Basidiospores* ellipsoid, chamois brown, 10-11.7-14.5 \times 5-5.8-6.5 μm , S. S. I. 49.3 %.

U. S. A. :

SOUTH CAROLINA : Aiken, on the ground, Ravenel 2936, s. dat. (RLS.55.K.1) (A. 2290b), orthopleuropode, basidiosp. 12.0-13.3-14.5 \times 5.5-6.0-6.5 μm , S.S.I. 44.9 % (holotypus).

FLORIDA : s. loc., on the ground around oak stumps, Martin (802 Ellis, North American Fungi), I-1880 (RLS.69.NY.3) (K. 649), orthopleuropode, basidiosp. 10.0-10.6-11.0 \times 5.5-5.8-6 μm , S.S.I. 54.9 %; ditto (RLS.69.NY.4) (K. 650), plagiopleuropode, basidiosp. 10.0-11.0-12.0 \times 5.5-5.8-6.0 μm , S.S.I. 53.3 %; My Home, Seminole County, on tree in woods, Schallert s.n., 15-II-1958 (A. 3055) (BR), orthopleuropode, basidiosp. 11.0-11.8-13.0 \times 5.0-5.5-6.0 μm , S.S.I. 46.6 %.

Notes : 1. — That *G. curtisii* and *G. ravenelii* are closely related is not in doubt morphologically and in cutis anatomy they are alike as can be judged by the available specimens. Yet, they differ markedly by their basidiospore shapes and sizes and by the absence or presence of context deposits of melanoid substances. For these reasons the two taxa are separated at the specific level; perhaps is it only a varietal level. Subsequent experience may possibly reduce them to varieties of a single species but this can only be done after further study of many more specimens, accompanied by more precise knowledge of the environment in which the specimens grew.

2. — The choice of a neotype for *G. curtisii* must be commented upon. Specimens of the *G. curtisii* complex were first encountered by the writer when he began to examine the Kew *Ganoderma* collection in the late fifties. It was then realized that the specimens Berkeley cited in his 1849 paper were no longer extant and that consequently a neotype had to be chosen. The choice then fell on Ravenel's specimen 2936 which he consequently labelled as such. Only in later years, with the advent of further loans of specimens, was it realized that two groups of specimens could be distinguished, as stated above, and that the neotype selected did not correspond fully with Berkeley's description. Another neotype has therefore been selected here that corresponds better with the latter.

Ravenel's specimen 2936 (RLS. 55. K. 1), formerly proposed as neotype for *G. curtisii* is here designated as holotype for *G. ravenelii*.

It must be noticed however that on the Kew herbarium sheet two specimens are stuck under Ravenel's number 2936: one is a mesopode basidioma, the other is a middle part of an orthopleuropode specimen. This latter specimen is the holotype of *G. ravenelii* Steyaert.

3. *Ganoderma tsugae* Murrill, Bull. Torrey Bot. Club 29 : 601 (1902).
— Fig. 10 D.

G. mongolicum Pilat, Ann. Mycol. 38 : 78 (1940).

Basidioma flabellate, sessile on a narrow base, pedicellate, stipitate, or sometimes with a false plagiopleuropode stipe (what appears in Cooke 52 165 as a stipe, has a cutis indistinguishable from that of the pileus proper, is very knobby and irregular and could be considered as an elongated part of the pileus, devoid of a tube layer), shiny, *diamine brown* to *apricot orange* near the margin; margin white in actively growing specimens; pore surface white.

Section: cutis circa 120 μm thick, hard and brittle; context white slightly *light buff*, up to 35 mm thick at the base of the basidioma, tapering down to margin; tube layer up to 8 mm thick, sometimes multilayered with each layer more or less distinct, *ochraceous buff*.

Cutis hymenodermiform, elements clavate to cylindrical, $30 \times 7\text{--}10 \mu\text{m}$. Pores circular, 90-160-280 μm in diam.; dissepiments 10-44-100 μm thick. *Basidiospores* ovoid with apex remaining convex, supported by long echinules, light yellowish brown, $8.5\text{--}10.2 \times 5.5\text{--}6.4\text{--}7.5 \mu\text{m}$, S. S. I. 60-62.4-65 %.

U. S. A.:

s. loc., on decaying stump of Hemlock, s. coll., s. dat. (RLS.69.NY.28) (K. 666a), plagiopleuropode, basidiosp. $9.5\text{--}10.5\text{--}12.0 \times 6.0\text{--}6.4\text{--}7.0 \mu\text{m}$, S.S.I. 61.2 %, fig. 10.B (lectotypus); ditto (RLS.NY.29) (K. 666b), plagiopleuropode, basidiosp. $9.0\text{--}9.7\text{--}11.0 \times 6.0\text{--}6.4\text{--}7.0 \mu\text{m}$, S.S.I. 65.1 %.

PENNSYLVANIA: s. loc., s. hosp., Barbour s.n., s. dat. (PC) (A. 2287b), basidiosp. $10.0\text{--}10.9\text{--}12.0 \times 6.0\text{--}6.6\text{--}7.5 \mu\text{m}$, S.S.I. 60.1 %; propre Sayre, on *Tsuga canadensis*, Barbour (1308 Kryptogamae exsic.) (A. 2587a) (BR), basidiosp. $9.5\text{--}10.0\text{--}11.0 \times 6.0\text{--}6.4\text{--}7.0 \mu\text{m}$, S.S.I. 64.5 %.

KENTUCKY: Cumberland Gap, National Historic Park, Sugar run area, Bell County, on stump of *Tsuga canadensis*, Cooke 52 165, 14-VI-76 (RLS.76.Cooke.1) (B. 849), plagiopleuropode, basidiosp. $10.0\text{--}10.3\text{--}11.0 \times 6.0\text{--}6.2\text{--}7.0 \mu\text{m}$, S.S.I. 60.7 %.

OHIO: Conkle's Hollow State Park, on *Tsuga canadensis*, Cooke 32 022, 16-VII-1960 (RLS.76.Cooke.2) (C. 936), plagiopleuropode, basidiosp. $9.0\text{--}10.1\text{--}11.0 \times 5.5\text{--}6.4\text{--}7.5 \mu\text{m}$, S.S.I. 62.9 %.

MICHIGAN: Takquemaran, Luce County, in huge troops on fallen trunk of *Tsuga canadensis*, Watling 619/A.692, 6-VII-1965 (RLS.67.4.3) (K. 464), plagiopleuropode, basidiosp. $8.5\text{--}9.6\text{--}10.5 \times 6.0\text{--}6.2\text{--}7.0 \mu\text{m}$, S.S.I. 64.6 %; Reesbog,

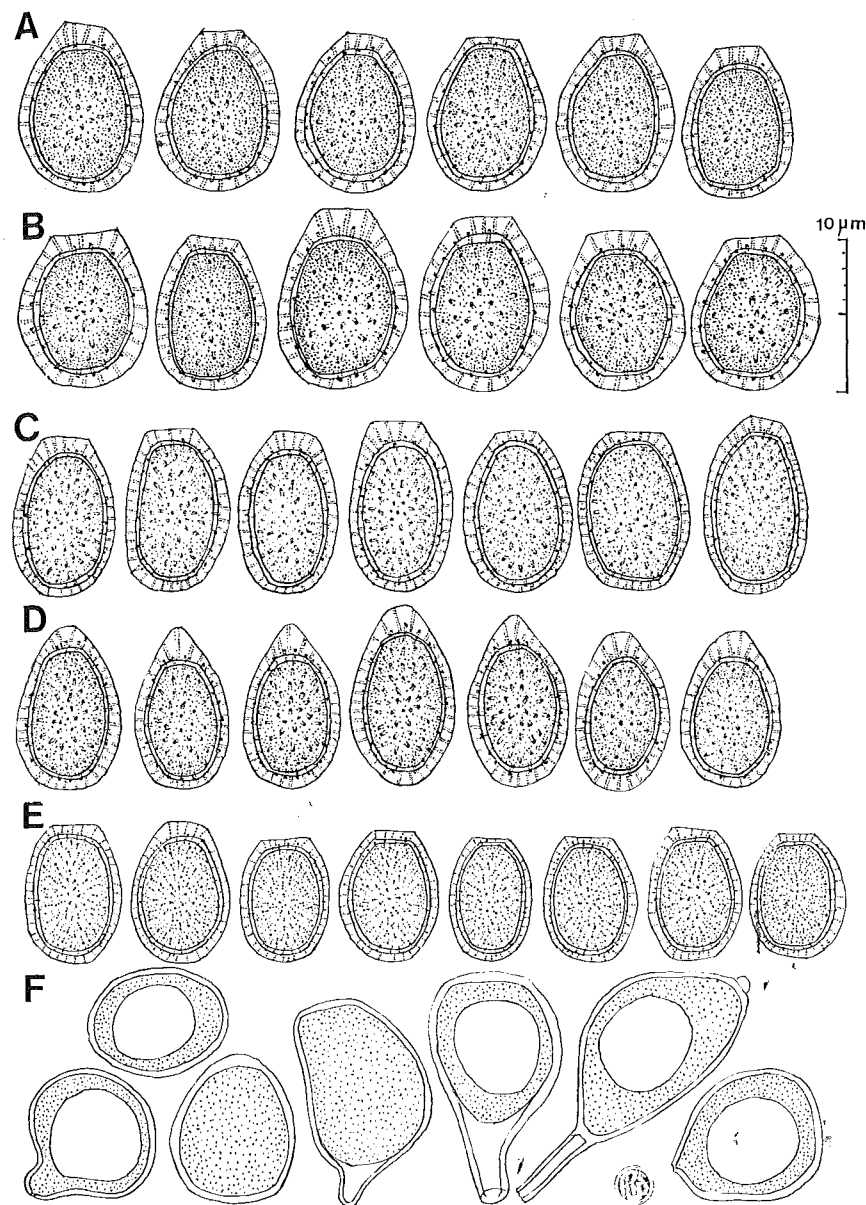


Fig. 10. — A-B, *Ganoderma oerstedii* (Fries) Torrend, basidiospores (A, Oersted s.n., RLS.68.UP.1; B, Peck s.n., RLS.55.NY.4); C, *G. oregonense* Murrill, basidiospores (Kirkwood s.n., RLS.69NY.18); D, *G. tsugae* Murrill, basidiospores (s. coll., RLS.69.NY.28); E-F, *G. rothwelii* Steyaert, basidiospores (E) and gasterospores (F) (Rothwell 12 833).

Cheboygan County, s. hosp., *Smith* 22 120, 10-VIII-1946 (RLS.65.K.26) (K. 289), plagiopleuropode, basidiosp. $10.5-10.9-12.0 \times 6.5-6.9-7.0 \mu\text{m}$, S.S.I. 60.2 %.

CANADA :

QUEBEC : Mt Burnet, on *Tsuga canadensis*, *Macrae* F. 3498, 2-VIII-1933 (RLS.69.K.69) (K. 676), plagiopleuropode, basidiosp. $10.0-10.8-11.5 \times 6.0-7.0 \mu\text{m}$, S.S.I. 60.2 %.

MONGOLIA : Wei Tch'ang, s. hosp., *Licent* s.n., 14-VI-1927 (A. 1984) (BR), (fragm. holotypus *G. mongolicum* Pilat), basidiosp. $9.0-9.9-10.5 \times 5.5-6.25-7.0 \mu\text{m}$, S.S.I. 63.1 %.

Notes : 1. — According to the specimens examined or cited by Murrill (1902, 1908), the distribution of the species extends from Kentucky in the south to Quebec in Canada in the north and to Minnesota to the west, which is practically the area covered by *Tsuga canadensis*.

There seems to be an anomaly in including in synonymy the type specimen of *G. mongolicum* Pilat, which was collected in Mongolia. This means that the area of distribution of *G. tsugae* in Asia is separated from its American range by the expanse of the North Pacific ocean and by half of the continent of North America.

In spite of this, the author is unable to find any distinguishing feature and, especially in view of the uniform basidiospore morphology, he asserts the synonymy. Further research, especially into the N. E. Asian species of *Ganoderma*, may modify this conclusion.

2. — It should be noticed that Murrill (1902) states that the fungus is annual and quickly decays or is easily prey to insects. This does not seem to be confirmed by *Cooke* 32 022 (C. 936) that has been examined and has two tubes layers, which apparently means that it is two years old. Murrill's statement appears therefore to be incorrect.

4. *Ganoderma multiplicatum* (Montagne) Pat., Bull. Soc. Mycol. Fr. 5 : 74 (1889). — Fig. 5, 11, 12.

Polyporus multiplicatus Montagne, Ann. Sci. Nat., Bot., ser. 4, 1 : 128 (1854).

Ganoderma luteum Steyaert, Bull. Jard. Bot. Etat Brux. 31 : 62 (1961).

G. lusambilaense Steyaert, Bull. Jard. Bot. Etat Brux. 32 : 92 (1962).

G. wynaadense Steyaert, Bull. Jard. Bot. Etat Brux. 32 : 98 (1962).

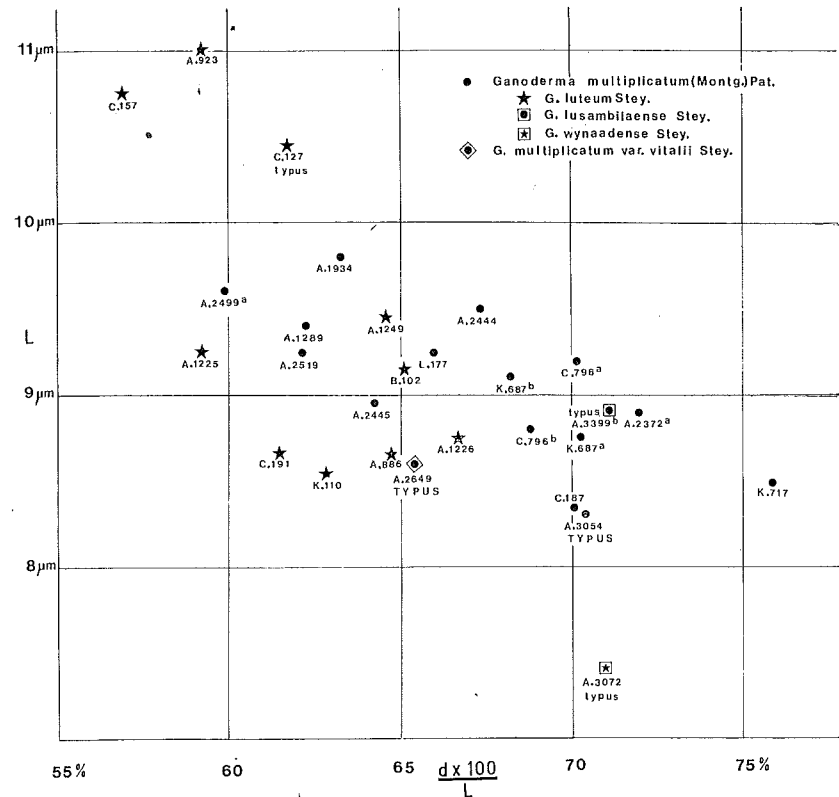


Fig. 11. — *Ganoderma multiplicatum* (Montg.) Pat., distribution of basidiospore shape index on spore length.

Basidioma sessile, three-quarters circular or dimidiate, often plagiopleuropode; upper surface normally laccate, with numerous, thin (circa 2 mm) concentric folds, *light seal brown* with margin of growing specimens *apricot orange* and *apricot buff*; under certain conditions of growth (apparently dense woodland), upper surface dull with *yellowish buff* areas, remaining however multiplicate but with broader folds, in others the upper surface is only partially laccate and multiplicate, in still others, the whole upper surface may be dull with no concentric folds, or may also be *tawny olive* in concentric stripes and folds alternating with *cinnamon buff*.

Section : from broad to narrow triangular with up to 40 mm at the base; cutis circa 40 µm thick, hard; context from half to the same thickness as the tube layer, either *cinnamon buff* with *verona*

brown near the tube layer and concolorous with it or entirely cinnamon buff with the tube layer a shade darker, often with streaks of thin deposits of melanoid substances.

Cutis hymeniodermiform, elements mostly irregular, $70 \times 6-10 \mu\text{m}$, with the melanoid substances appearing as if curdled. Pores circular, $70-185-310 \mu\text{m}$; dissepiments $10-75-170 \mu\text{m}$ thick, distance between axes circa $260 \mu\text{m}$. Basidiospores ovoid to ellipsoid, $7-8.7-12 \times 5-5.9-7.5 \mu\text{m}$, S. S. I. 56.7-72 %.

FRENCH GUIANA : s. loc., s. hosp., Leprieur 867, s. dat. (RLS.58.PC.1) (A. 3054) (holotypus, basidiosp. $7.5-8.3-9.0 \times 5.5-5.8-6.0 \mu\text{m}$, S.S.I. 70.4 %; s. loc., s. hosp., Leprieur 854, s. dat. (RLS.51.PC.10) (A. 1353), basidiospores : none.

BRAZIL : Santa Laura, Madeira river, Amazonas, s. hosp., Weir (U.S. dept. Agric. Path. Myc. coll. 66 859), s. d. (RLS.55.K.25) (A. 2372a), basidiosp. $8.0-8.7-9.5 \times 6.0-6.4-7.5 \mu\text{m}$, S.S.I. 73.9 %.

SIERRA LEONE : Njala, dead trunk of *Albizia nigra*, Deighton M. 3650, 8-XI-1950, (RLS.55.K.23) (A. 2444), basidiosp. $9.0-9.5-11.0 \times 6.0-6.4-7.0 \mu\text{m}$, S.S.I. 67.4 %; Njala, on *Adenanthera pavonina*, Deighton M. 2589b, 27-VII-1948 (RLS.55.K.10) (A. 2445), basidiosp. $8.5-8.9-10.0 \times 5.5-5.7-6.5 \mu\text{m}$, S.S.I. 64.2 %; on dead part of live trunk of *Ochtocosmus africanus*, Deighton M. 4910, 27-X-1952 (RLS.55.K.86) (A. 2519), basidiosp. $9.0-9.5 \times 5.5-6.0 \mu\text{m}$, S.S.I. 62.2 %; Njala, on dead trunk of *Albizia zygia*, Deighton M. 3650, 8-XI-1950 (RLS.69.K.82) (K. 687a-b), basidiosp. $8.0-8.7-9.0 \times 6.0-6.1-7.0 \mu\text{m}$, S.S.I. 70.3 %.

IVORY COAST : Assinie, s. hosp., Charper s.n., s. dat. (PC), (A. 2499a), basidiosp. $8.0-9.6-10.5 \times 5.5-5.7-6.0 \mu\text{m}$, S.S.I. 59.9 %.

ZAIRE : Boto, on *Chrysophyllum lacourtianum*, Steyaert 44 326, 2-XII-1944, (A. 1244) (BR), basidiosp. $9.0-9.4-10.0 \times 5.5-6.1-7.0 \mu\text{m}$, S.S.I. 64.5 %; Binga, s. hosp., Steyaert 44 402, 18-XII-1944, (C. 191) (BR), basidiosp. $8.5-8.7-9.0 \times 5.0-5.3-5.5 \mu\text{m}$, S.S.I. 60.9 %; Yangambi, on *Antrocaryon nanannii*, Fassi 1446b, s. dat. (holotypus *G. lusambilaense*) (BR) (A. 3399b), basidiosp. $7.0-8.3-9.5 \times 5.5-6.0-7.0 \mu\text{m}$, S.S.I. 72.8 %; Yangambi, on dead tree, Ghesquière 329, 28-XII-1925, (BR) (C. 127), basidiosp. $9.5-10.4-11.5 \times 5.5-6.4-7.5 \mu\text{m}$ (holotypus *G. luteum*); Yangambi, on *Cynometra hankei*, Fassi s.n., VIII-1953 (BR) (A. 1934), basidiosp. $9.0-9.8-11.0 \times 5.5-6.2-7.0 \mu\text{m}$, S.S.I. 63.3 %; Bukuma-Bokatola, Stener 632, on dead wood in jungle, IX-1930 (BR) (A. 886), basidiosp. $7.5-8.6-9.5 \times 5.0-5.6-6.5 \mu\text{m}$, S.S.I. 64.7 %; Eala-Kolikoli, on dead wood, Stener 236b, VII-1930 (BR) (A. 923), basidiosp. $10.0-11.0-12.0 \times 6.0-6.5-7.5 \mu\text{m}$, S.S.I. 59.3 %; Eala, on dead wood in jungle, Stener 470, VIII-1930 (BR) (B. 102b), basidiosp. $8.5-9.1-10.0 \times 5.5-5.9-6.5 \mu\text{m}$, S.S.I. 64.8 %; s. loc., s. hosp., Lootens 2B, s.d. (BR) (A. 1945), basidiosp. none; Kisantu, s. hosp., Vanderyst s.n., 5-XII-1909 (BR) (A. 1225), basidiosp. $8.0-9.4-10.0 \times 5.0-5.6-6.5 \mu\text{m}$, S.S.I. 59.3 %; Kisantu, s. hosp., Vanderyst s.n., 1907 (BR) (A. 1226), basidiosp. $8.5-9.7-12.0 \times 6.0-6.5-7.0 \mu\text{m}$, S.S.I. 66.3 %; Kisantu, s. hosp., Vanderyst 15 616, 1925 (BR) (C. 157), basidiosp. $10.0-10.7-11.5 \times 5.5-6.1-7.0 \mu\text{m}$, S.S.I. 56.7 %; Kikosi, s. hosp., Vanderyst s.n., 1907 (BR) (A. 1289), basidiosp. $9.0-9.4-10.0 \times 5.5-5.8-6.5 \mu\text{m}$, S.S.I. 62.2 %; Madibi, s. hosp.,

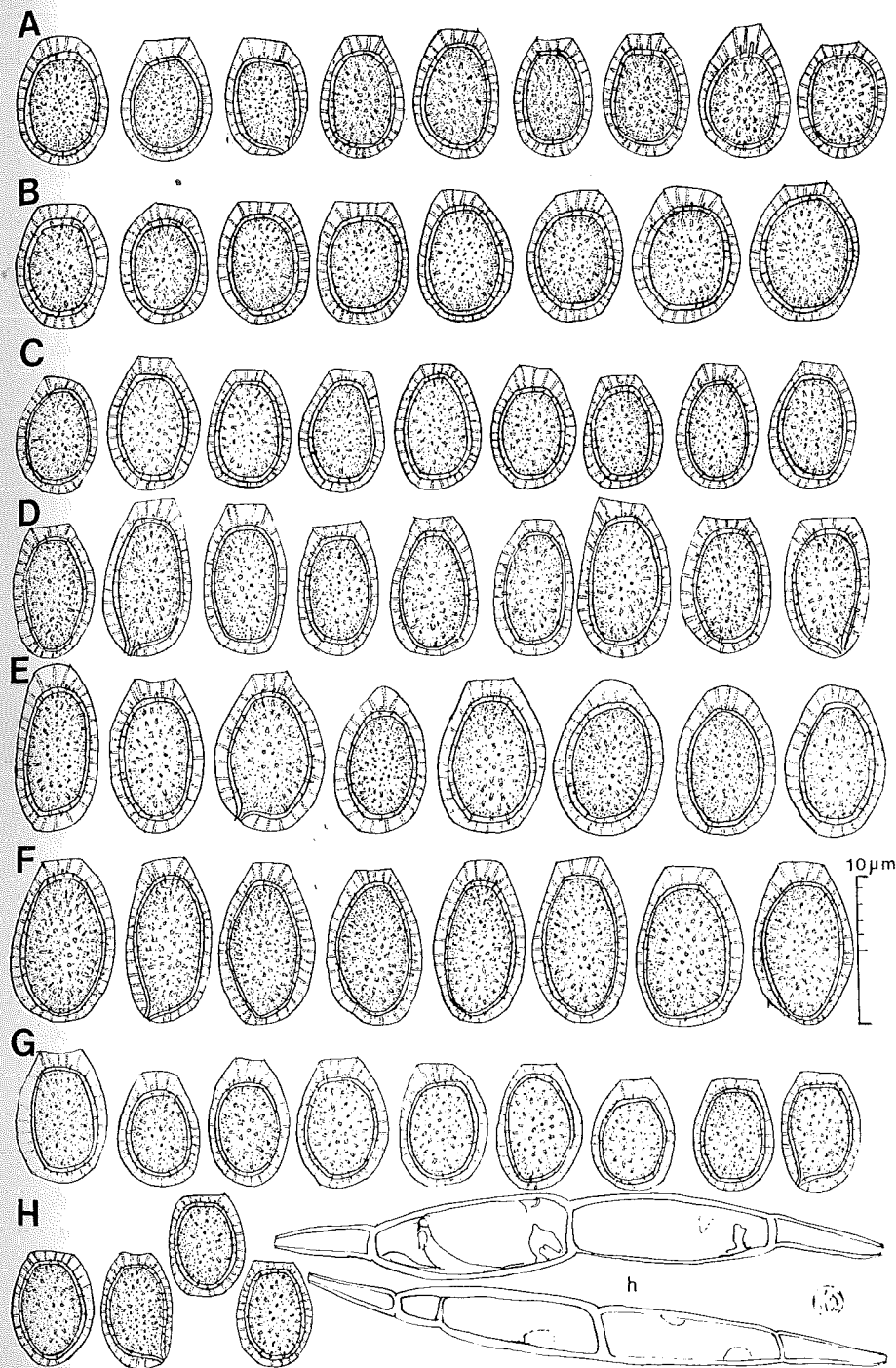


Fig. 12. — A-H, *Ganoderma multiplicatum* (Montg.) Pat., basidiospores (A, Leprieur 867; B, Weir, Path. Mycol. coll. 66 859; C, Sapin 748; D, Charper s.n.; E, Ghesquière 329; F, Stener 236 bis; G, Fassi 1446; H, *Debra Dum* 4246); h, spores of contaminating fungus (?) observed connected with hyaline hyphae (*Debra Dum* 4246).

Sapin 748, 28-VI-1906 (BR) (C. 187), basidiosp. $7.5-8.3-9.0 \times 5.5-5.8-6.0 \mu\text{m}$, S.S.I. 70.1 %.

ZAMBIA: Kitwe, on *Marquesia macroura*, Fanshawe 70, 10-X-1963 (RLS.64.K.157) (K. 110), basidiosp. $9.0-9.5-10.5 \times 5.5-6.0-7.0 \mu\text{m}$, S.S.I. 62.8 %.

ANGOLA: Isla de Luanda, on trunk of *Casuarina equisetifolia*, Pinto-Lopès s.n., 11-IX-1973 (BR) (L. 177), basidiosp. $9.0-9.2-9.5 \times 6.0-6.1-6.5 \mu\text{m}$, S.S.I. 65.9 %.

SEYCHELLES ISLANDS: s. loc., on *Parkia roxburghii*, Dupont 64 (Herb. IMI 40 816), s. dat. (RLS.65.K.77) (C. 796a), basidiosp. $9.0-9.2-9.5 \times 6.0-6.4-7.0 \mu\text{m}$, S.S.I. 70.1 %; *ibid.* (RLS.65.K.78) (C. 796b), basidiosp. $8.0-8.8-9.5 \times 5.5-6.0-6.5 \mu\text{m}$, S.S.I. 68.8 %.

INDIA: Wynaad division, on stump of *Mesua ferrea*, (Herb. Debra Dun H. 4246), 24-I-1946 (RLS.58.DD.8) (A. 3072), (holotypus *G. wynaadense*), basidiosp. $7.0-7.4-8.0 \times 5.0-5.2-6.0 \mu\text{m}$, S.S.I. 70.9 %.

INDONESIA:

JAVA: Bogor, s. hosp., Massart 607, s. dat. (BR) (A. 1292), basidiosp. none.

Notes: 1. — In 1854, Jean F. C. Montagne reporting on Leprieur's collections in French Guiana published *Polyporus (Fomes) multiplicatus*. In the comments that follow the description he states « Je ne connais aucune espèce de ce groupe qui présente une quantité aussi considérable de plis concentriques d'où j'ai tiré le nom spécifique... ». This is indeed true for typical specimens from whichever continent they originate. Their determination offers no difficulties when cutis anatomy, colours of context and tube layer and basidiospore morphology have been taken into account. One is led then to consider as distinct taxa those that lack the laccate multiply upper surface of the pileus which the type specimen shows admirably; hence the species *G. luteum*, *G. lusambilaense* and *G. wynaadense* which the author has described as new (Steyaert 1961, 1962).

However when one has gathered an important number of specimens, difficulties arise in distributing them among the respective « species ». If *G. luteum* is multiply, the folds of the cutis are broader, the upper surface is dull brown with yellowish patches and the basidiospores have a tendency of being more ellipsoid, whereas in specimens true to type they are ovoid. Others, although they comply in cutis anatomy, context colours and so forth, have a non plicate dull or a partially laccate multiply upper surface. However when the basidiospores are graphed taking in consideration the spore shape index one obtains figure 11 which shows that the basidiospore sizes and shapes merge into those of *G. multiplicatum*.

G. lusambilaense is a small pulvinate basidioma with an irregular cinnamon upper surface. No other specimen examined matches it morphologically.

G. wynaadense on the other hand is morphologically identical with *G. multiplicatum*, but the basidiospores are distinctly smaller (fig. 12 H). The fungus is host however to a hyaline fungus with hyaline triseptate fusiform spores that blocks the tubes of part of the tube layer (fig. 12 h). It is possible that this parasitism is responsible for the reduction in size of the basidiospores.

2. — *G. multiplicatum* var. *vitalii* Steyaert (Steyaert 1962) is morphologically undistinguishable from the type variety, but it has gasterospores of a markedly distinct morphology compared to those of other species. It might be questionable to consider this as a variety. The production of gasterospores might be only a response to certain environmental conditions. This case could be in some way analogous to that of *G. weberianum* (Bres. & Henn.) Steyaert and *G. lauterbachii* P. Henn. (Steyaert 1972: 81, 115), where gasterospores can be either sparsely or abundantly distributed in the context modifying thereby the cutis anatomy. In the case of var. *vitalii*, as the gasterospores are far less abundant than in *G. weberianum*, it appears that they have not modified cutis anatomy, at least to any appreciable degree.

3. — Steyaert (1961: 82) compared *G. luteum* Steyaert with *G. corrugatum* Steyaert. The latter is however sharply distinguishable from *G. multiplicatum* (Montagne) Pat., although it has a multiply upper surface, in having a dark brown context with thick striae of melanoid substances deposits.

— var. *vitalii* Steyaert, Bull. Jard. Bot. Etat Brux. 32: 104' (1962)

— Fig. 13.

Although the opinion has been expressed above that this variety may be but an ecological variant it is kept separate from the type variety until that suggestion is confirmed by further research.

It can only be distinguished from the type variety by the presence of gasterospores, the dimensions and description of which have been given by Steyaert (1962: 104) as being $11.5-17-29 \times 10-12.4-14 \mu\text{m}$. A spheroid 8.5 to $10.5 \mu\text{m}$ in diam. is visible in the center of the gasterospore. It has some sort of wall, dark brown, some $2 \mu\text{m}$ thick, enclosing a protoplasm that is probably hyaline, as by trans-

mitted light it appears of lighter yellowish than the protoplasm in which it is suspended (fig. 13).

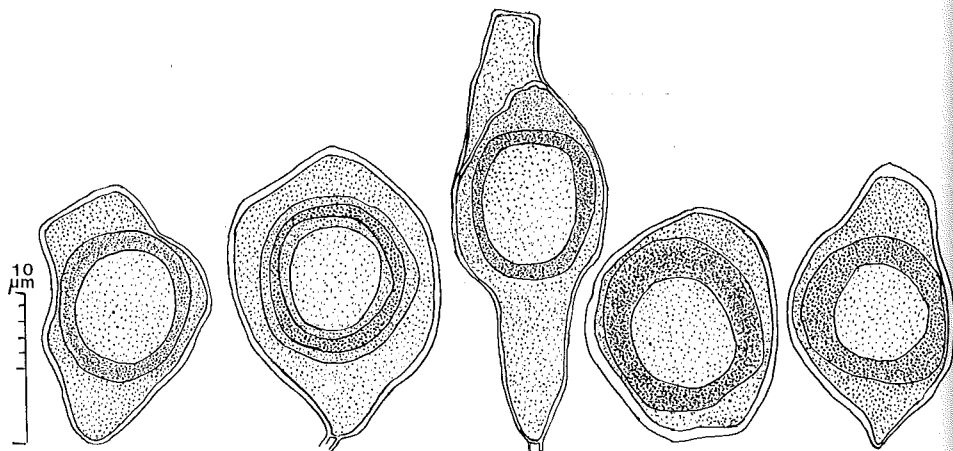


Fig. 13. — *Ganoderma multiplicatum* (Montagne)
Pat. var. *vitalii* Steyaert, gasterospores (Vital, Fungos do Brasil 1311).

5. *Ganoderma oregonense* Murrill, N. Am. Fl. 9 : 119 (1908). —
Fig. 10 C.

G. sequoiae Murrill, N. Am. Fl. 9 : 119 (1908).

G. nevadense Murrill, N. Am. Fl. 9 : 119 (1908).

Basidioma usually with thick stipe, plagiopleuropode, sometimes sessile, reniform or flabellate, pulvinate; upper surface usually laccate, sometimes dull, bay to blackish brown, sometimes with wide concentric folds near the margin; pore surface white in actively growing specimens, browning with age; up to circa 20 cm in radius but exceptionally bigger.

Section: cutis circa 120 μ m thick, blackish brown, usually soft; context punky, uniformly cartridge buff with only a slightly darker zone near tube layer, up to 60 mm thick; tube layer pinkish buff to buckthorn brown, up to 35 mm thick.

Cutis elements clavulate to cylindrical, apex somewhat inflated, circa 30 μ m long, 5-10 μ m wide at apex. *Pores* circular to somewhat irregular, big, 150-260-850 μ m in diam.; dissepiments 20-70-200 μ m thick, distance between axes circa 330 μ m, but with wide variations 245-475 μ m. *Basidiospores* ovoid to near ellipsoid, 8.5-11.8-14.5 \times 6-7.1-8.5 μ m, S. S. I. 66.8 %, light yellowish brown.

U. S. A. :

OREGON : Tillamook coast, on old log, near seaside, *Kirkwood* s.n., VII-VIII-1901 (RLS.69.NY.18) (K. 660a), plagiopleuropode, basidiosp. 10.5-10.8-11.5 \times 6.5-6.8-7.0 μ m, S.S.I. 62.9 % (holotypus); ibid. (RLS.69.NY.19) (A. 660b), basidiosp. 8.5-10.1-12.0 \times 6.0-6.7-7.5 μ m, S.S.I. 66.8 %; s. loc., on old log of *Picea sitchensis*, s. coll., summer 1905 (RLS.62.K.25) (A. 3891), basidiosp. 10.5-11.4-12.5 \times 6.5-7.1-8.0 μ m, S.S.I. 62 %; Crater Lake, on *Tsuga mertensiana*, Weir 11 469, IX-1919 (RLS.55.K.74) (A. 2511), sessile, basidiosp. 12.0-13.1-14.0 \times 7.0-7.4-8.0 μ m, S.S.I. 56.9 %.

CALIFORNIA : Sequoia Canyon, on *Sequoia* sp., *Eastwood* 40, 28-XII-1902 (RLS.62.K.41) (A. 3906) (holotypus *G. sequoiae* Murrill), plagiopleuropode, basidiosp. 11.5-12.4-13.5 \times 6.5-7.6-8.5 μ m, S.S.I. 61.3 %; Sands flats, Mt Shasta, Siskoyou County, on *Abies magnifica* var. *shastensis*, W. B. & V. G. Cooke 5482, 21-IX-1977 (RLS.78.Cooke.1) (H. 25), sessile, basidiosp. 10.0-11.8-13.5 \times 7.0-7.4-8.5 μ m, S.S.I. 63.1 %.

NEVADA : Marlette Lake, on dead spruce trunk, *Baker* 1489, 15-VIII-1902 (RLS.62.K.20) (A. 3888) (holotypus *G. nevadense* Murrill), basidiosp. 10.5-12.1-13.0 \times 7.0-7.7-8.5 μ m, S.S.I. 64 %.

WASHINGTON : S. W. corner of Mt Rainier Nat. Park, s. hosp., *Dodd* s.n., 14-X-1969 (RLS.72.L.36) (B. 620), plagiopleuropode, basidiosp. 10.5-11.5-14.6 \times 6.0-8.0 μ m, S.S.I. 57.4 %.

CANADA :

BRITISH COLUMBIA : on ? *Tsuga*, Vancouver (sea level), *Redhead* s.n., 14-IV-1969 (RLS.73.K.UBC.1) (A. 6972), plagiopleuropode, basidiosp. 11.0-12.1-14.0 \times 6.0-6.5-8.0 μ m, S.S.I. 54.1 %; Mt Seymour (near Vancouver), alt. 3330', on coniferous stump, *Redhead* s.n., 27-VII-1973 (RLS.74.UBC.2) (B. 833), ? plagiopleuropode, basidiosp. 11.0-12.5-13.0 \times 6.5-7.2-7.5 μ m, S.S.I. 59.7 %; Univ. Brit. Col. campus, circa 100' alt., from ground among sawdust, *Redhead* s.n., 19-X-1973 (R.L.S.74.UBC.1) (L. 179), plagiopleuropode, basidiosp. 11.0-11.5-12.0 \times 6.5-7.0-7.5 μ m, S.S.I. 61 %; Guesme Island (S. of Vancouver), on dead trunk of conifer, *Kautt*, summer 1973 (RLS.77.Jahn.1) (L. 186), basidiosp. 11.5-12.5-13.0 \times 6.5-7.0-7.5 μ m, S.S.I. 57.6 %.

Notes : In its punky consistency, anatomy and thickness of its context, *G. oregonense* is closely related to *G. colossus* (Fr.) Baker (Steyaert 1972 : 97, figs. 6 f-g, pl. 11 fig. 42). The latter species shows however in its worldwide tropical distribution some important variations. In the majority of cases, it has a greyish yellow cutis of hymeniodermiform anatomy, but the elements of which are badly developed and scarcely impregnated with melanoid substances. A specimen from the coast of Angola (*Pinto-Lopès* 5, L. 174) has an orange brown cutis with a normal hymeniodermiform anatomy. All these specimens have basidiospores as pictured in Steyaert (1972). On the other hand, the type specimen of *G. molli-carnosum* (Lloyd) Sacc. & Trott., which was collected in South Africa, is morphologically indistinguishable from *G. colossus*, but has basidiospores very much the same, in size and shape, as those of *G. oregonense*.

It should be remembered that the type specimen of *G. colossus* was collected in Costa-Rica; that is, considered on the global scale, very

close to the distribution area of *G. oregonense*. Could it be then that *G. oregonense* is but a temperate climatic variant of *G. colossus*? This idea should be seriously considered as it has been shown that *G. tornatum*, another practically exclusively tropical species, also extends along the Pacific coast of North America, up to Vancouver, Canada, and has basidiospores influenced in size by climatic conditions.

6. *Ganoderma rothwellii* Steyaert sp. nov. — Fig. 6, 10 E-F.

Basidioma sessile, late adnatum, semi-resupinatum, semi-dimidiatum; pagina dorsalis irregulariter convoluta, surda, umbrina, margine albo.

Sectio: cutis tenuis, circa 50 μm crassa, brunnea; contextus circa 30 mm crassus, fulvus; tubuli breves, circa 3 mm longi, contextu concolores.

Cutis hymenodermiformis elementis leviter claviformibus, 25-30 \times 5-7 μm ; contextus hyphis tenuibus, sinuosis, circa 2 μm diam. *Pori* circulares, 160-195-220 μm diam., dissepimentis 10-40-70 μm crassis, axibus circa 235 μm distantibus. *Basidiosporae* ovoideae, 8-8.5-9 \times 5.5-6.2-7 μm , S. S. I. 72.9 %, echinulis brevissimis proxima inconspicuis. *Gasterosporae* luteae, subhyalinae, rotundae vel formis diversis, 9.5-11.5-14 \times 7-8.4-9 μm , saepissime globulum singulum circa 6 μm refringentem continentes. — *Holotypus*: Rothwell 12 823 (I. M. I. 59 536).

Basidioma sessile, widely adnate, subresupinate-dimidiata; upper surface irregularly convolute, dull, mummy brown, margin white.

Section: cutis thin, circa 50 μm thick, brown; context circa 30 mm thick, tawny; tube layer thin, tubes 3 mm long, concolorous with context.

Cutis hymenodermiform, elements slightly claviform, 25-30 \times 5-7 μm ; context hyphae thin, about 2 μm thick. *Pores* circular, 160-195-220 μm in diam.; dissepiments 10-40-70 μm thick; distance between axes 235 μm . *Basidiospores* ovoid, 8-8.5-9 \times 5.5-6.2-7 μm , S. S. I. 72.9 %. *Gasterosporae* subhyaline yellow, spherical or variously shaped, 9.5-11.5-14 \times 7-8.4-8 μm , usually with a single 6 μm diam. refringent globule.

RHODESIA: s. loc., on *Cassia* sp., Rothwell 12 823 (Herb. I.M.I. 59 536) (holotypus) (RLS.68.K.38) (A. 6603).

Note: Considering the features of the gasterosporae the specimen is considered a hitherto unrecorded species.

SUBGENUS GANODERMA SECTIO CHARACODERMA

7. *Ganoderma oerstedii* (Fries) Torrend, Brot. 17: 37 (1920). — Fig. 10 A-B.

Fomes oerstedii Fries, Nov. Symb. Myc.: 63 (1855).

Ganoderma tuberculosum Murrill, N. Am. Fl. 9: 123 (1908).

Basidioma dimidiate, semicircular, with indistinct concentric folds becoming more conspicuous near margin, narrowly concentrically plicate, with radiating fragmentary folds, sublucid blackish brown in seasoned parts, orange rufus in recently grown parts.

Section: cutis circa 50 μm thick, shiny blackish brown, with a subcuticular zone about 450 μm wide, cadmium yellow; context hard, bay with concentric lighter zones, sometimes with irregular sanford brown zones; very variable in thickness, sometimes only a fraction of that of the tube layer (Kotlaba & Ramon Cuevas s.n., A. 6345); tube layer amber brown to tawny, tubes of continuous growth without perceptible layering, up to 35 mm thick.

Cutis characodermiform with elements capitate by a spheroid, about 20 μm long and 5 μm wide at the spheroid. *Pores* circular, 120-165-280 μm ; dissepiments 20-65-120 μm , distance between axes about 230 μm . *Basidiospores* ovoideo-spherical, 9-10.5-12.5 \times 6-7.7-9 μm , S. S. I. 69.4-73.5-80.4 %.

U. S. A.:

FLORIDA: Lake Alfred Citrus Experiment Station, on *Citrus*, Knorr s.n., XII-1958 (C. 419), basidiosp. 10.0-10.7-12.0 \times 7.5-7.9-9.0 μm , S.S.I. 74 %; same as preceding, basidiosp. 10.5-11.0-12.0 \times 7.5-7.9-8.0 μm , S.S.I. 71.5 %.

COSTA RICA: s. l., s. dat., Oersted. (RLS.68.UP.1) (K. 523) (holotypus), basidiosp. 9.0-10.2-11.0 \times 7.0-7.8-8.0 μm , S.S.I. 76.5 %.

BELIZE: s. loc., on dead wood, Peck (Fungi of Brit. Honduras s.n.), 1906 (RLS.55.NY.4) (A. 2296a), (holotypus *G. tuberculosum*), basidiosp. 9.5-10.2-11.5 \times 7.5-8.2-9.0 μm , S.S.I. 80.4 %.

CUBA: Jaguey Grande, ad basim trunci semivivi *Citri aurantium*, Paulech s.n. (comm. Kotlaba), 1967 (RLS.68.PR.1) (L. 83), basidiosp. 9.0-9.8-10.5 \times 6.5-7.2-8.0 μm , S.S.I. 73.5 %; Camaguëy, in horto publico, ad basim trunci emortui *Fici religiosa*, Kotlaba & Ramon Cuevas s.n., 10-IV-1967 (RLS.68.PR.9) (A. 6345), basidiosp. 9.5-10.0-10.5 \times 7.0-7.5-8.0 μm , S.S.I. 75 %.

JAMAICA: Amity property, Bushy Park, St Catherine, on post, Lewis (Fl. of Jamaica F. 88), 9-II-1947 (RLS. 61.K.29) (A. 3650), basidiosp. 9.5-11.0-12.5 \times 7.5-7.9-9.0 μm , S.S.I. 72.3 %.

DOMINICA : s. loc., on dead *Citrus medica* var. *acida*, Ashby (IMI 34 438), s. dat. (RLS.68.K.3) (K. 484), basidiosp. $10.5-11.4-12.5 \times 7.5-7.9-8.5 \mu\text{m}$, S.S.I. 69.4 %.

TRINIDAD : St Augustine, on dead tree (?) *Gliricidia sepium*, Baker (Fungi of Trinidad 1858), 12-VIII-1947 (RLS.61.K.30) (A. 3651), basidiosp. $10.0-10.5-11.0 \times 7.0-7.7-8.0 \mu\text{m}$, S.S.I. 73.5 %.

GUYANA : Lamaha Dam, Botanic Gardens, Georgetown, on decayed tree stump, s. coll., s. dat. (RLS.69.K.139) (K. 730), basidiosp. $9.0-9.3-10.0 \times 6.0-6.8-7.5 \mu\text{m}$, S.S.I. 72.7 %.

Note : *G. oerstedii* appears to be a species restricted to South and Central America and the Caribbean and impinges but slightly into North America. Although the cutis anatomy is distinct from that of *G. cupreolaccatum* (*G. pfeifferi*), it is nonetheless very close to this European species.

8. *Ganoderma subfornicatum* Murrill, N. Am. Fl. 9 : 121 (1908). — Fig. 8, 14, 15.

G. triviale Bres., Ann. Mycol. 10 : 501 (1912).

G. maitlandii Steyaert, Bull. Jard. Bot. Etat Brux. 31 : 77 (1961).

G. staneri Steyaert, Bull. Jard. Bot. Etat Brux. 31 : 79 (1961).

Basidioma pedicellate to stipitate, plagiopleuropode. *Pileus* flabelliform to reniform, up to 7 cm in radius and 9 cm diam.; upper surface usually with double set of concentric folds, primary folds deeply grooved, spaced about 5 cm, secondary folds spaced 1-1.5 mm, imbricate at first; blackish brown, usually laccate, ferruginous when covered by spore deposits.

Section : cutis very thin, about $40 \mu\text{m}$, brownish black; context about equal in thickness to tube layer, bay, often with an ochre yellow central zone also with slightly darker vertical concentric zones, spaced 1-1.5 mm (they correspond to the secondary folds of the upper surface); tube layer concolorous with context or slightly darker.

Cutis characodermiform, the elements of which are only slightly thicker than the hyaline context hyphae, about $40 \mu\text{m}$ long, usually capitate by a spheroid $8-9 \mu\text{m}$ diam. Pores circular, $50-130-250 \mu\text{m}$ diam.; dissepiments $30-90-210 \mu\text{m}$, distance between axes of pores $170-220-270 \mu\text{m}$. Basidiospores ovoid to ellipsoid, brown echinules moderately thick, $8-9.8-12 \times 5.5-6.3-7.5 \mu\text{m}$, S. S. I. 53.4-65-76.6 %.

BELIZE : s. loc., s. hosp., Peck s.n., 1906 (RLS.55.NY.22) (A. 2363b), (holotypus), basidiosp. $9.5-9.7-10.0 \times 5.5-6.0-6.5 \mu\text{m}$, S.S.I. 62 %.

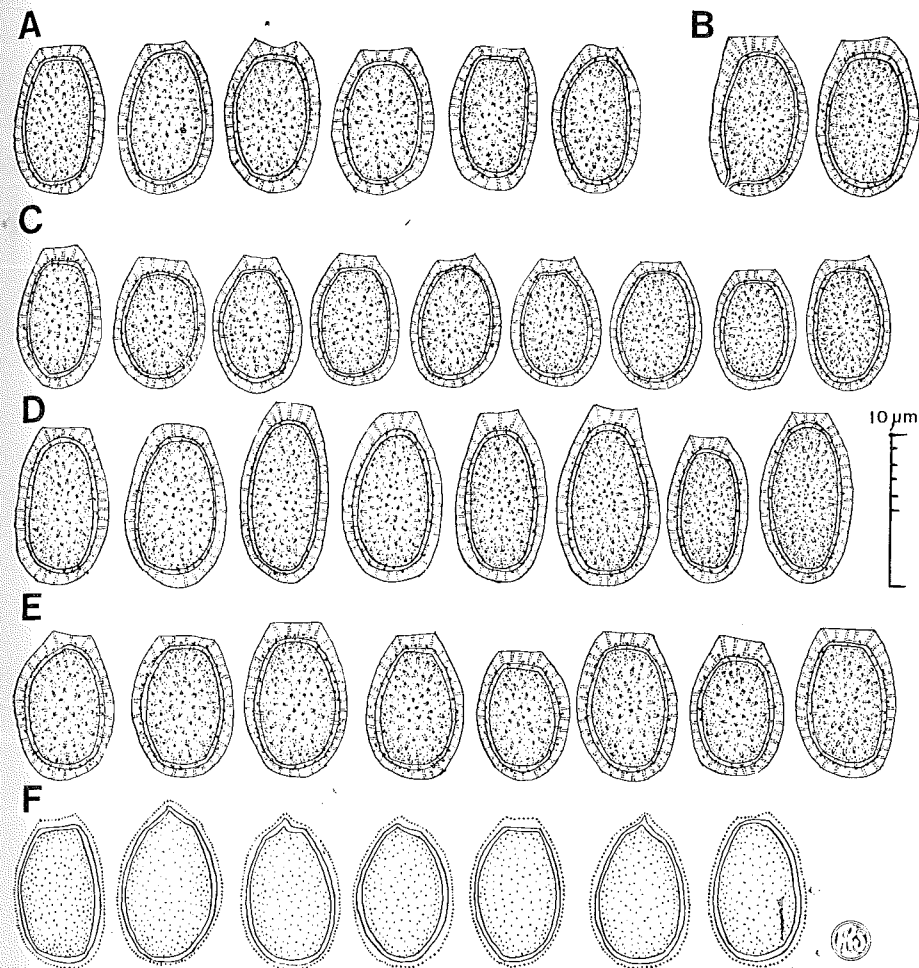


Fig. 14. — A-F, *Ganoderma subfornicatum* Murrill : A-E, basidiospores; F, abnormal smooth basidiospores (A, Peck s.n., RLS.55.NY.22; B, Von Höhnel 127, RLS.56.S.3; C, Von Höhnel 127, RLS.55.K.46; D, Staner 229; E, Maitland s.n., RLS.55.K.36).

NIGERIA : Benin, riv. Okhuo, on rotten log, Waterston (Fungi Nigeria 1052), 8-VII-1948 (RLS.62.K.1), basidiosp. $8.5-9.4-10.0 \times 5.5-5.9-6.5 \mu\text{m}$.

ZAIRE : Eala, sur arbre mort en forêt inondée, Goossens 64, IX-1923 (D. 37a-c-e-) (BR), basidiosp. $8.0-8.7-9.5 \times 5.5-5.9-6.5 \mu\text{m}$, S.S.I. 68.2 %; Eala, sur bois mort, Staner 229, VII-1930 (A. 919a) (BR) (holotypus *G. staneri*), basidiosp. $9.5-11.0-12.0 \times 5.5-6.3-7.0 \mu\text{m}$, S.S.I. 57.3 %; Yangambi, sur souche de *Vitex mombasae*, Steyaert 44 169, 27-IV-1944 (A. 2588) (BR), basidiosp. $8.0-9.4-11.0 \times 5.5-6.4-7.5 \mu\text{m}$, S.S.I. 67.6 %; Yangambi, sur *Garcinia punctata*, Fassi 726, 20-III-1956 (A. 3360) (BR), basidiosp. $10.0-10.6-11.5 \times 5.5-6.2-7 \mu\text{m}$, S.S.I. 57.8 %; Yangambi, sur *Erythrophleum guineense*, Fassi 905, 11-II-1957 (A. 3378) (BR),

basidiosp. 10.0-10.9-12.0 × 6.0-6.6-7.0 μm, S.S.I. 60.4 %; Yangambi, sur *Allophylus africanus*, Fassi 1096, 1956 (A. 3388) (BR), basidiosp. 10.0-10.9-12.0 × 6.0-6.4-7.0 μm, S.S.I. 58.3 %; Yangambi, sur *Paramacrolobium coeruleum*, Fassi 1122, 14-IX-1957 (A. 3393a-b) (BR), basidiosp. 9.5-9.9-11.0 × 6.0-6.1-7.0 μm, S.S.I. 62.1 %; Yangambi, s. hosp., *Louis* 1485, 17-III-1936 (C. 179f) (BR), basidiosp. 9.0-9.3-10.0 × 6.0-6.3-7.0 μm, S.S.I. 67.4 %; Ipamu (?), s. hosp., *Vanderyst* 12 073, IX-1922 (C. 155) (BR), basidiosp. 9.0-9.5-10.0 × 6.5-6.7-7.5 μm, S.S.I. 70.5 %; Parc National Albert, Muntule (Mt Hoyo), sur bois mort *Van Schuytbroek* (Expl. P.N.A. 12 547), 16-VII-1955 (C. 395) (BR), basidiosp. 9.0-10.0-10.5 × 6.0-6.6-7.5 μm, S.S.I. 65.8 %.

UGANDA: Sese Islands, s. hosp., *Maitland* s.n., I-1920 (RLS.55.K.36) (C. 334) (holotypus *G. maitlandii*) basidiosp. 8.0-9.8-11.0 × 5.5-6.6-7.0 μm, S.S.I. 67.6 %; Sese Islands, s. hosp., *Maitland* s.n., s. dat. (RLS.55.K.32) (A. 2426a), basidiosp. 9.5 × 6.0-6.6-7.0 μm, S.S.I. 69.5 %; s. loc., s. hosp., *Maitland* 62, s. dat. (RLS.55.K.56) (A. 2497), basidiosp. 8.5-8.9-10.0 × 6.0-6.1-6.5 μm, S.S.I. 68.7 %; Entebbe, s. hosp., *Maitland* s.n., 1922 (RLS.55.K.43) (C. 336), basidiosp. 8.5-9.6-10.5 × 6.0-6.6-7.0 μm, S.S.I. 68.4 %; Entebbe, Kiawaga Forest, s. hosp., *Maitland* s.n., s. dat. (RLS.55.K.42) (A. 2433), basidiosp. 9.5-9.9-10.5 × 6.5-6.9-7.5 μm, S.S.I. 69.7 %; s. loc., s. hosp., *Maitland* s.n., 1916 (RLS.55.K.46) (A. 2437), basidiosp. 9.5-9.6-10.0 × 5.5-6.2-6.5 μm, S.S.I. 64.6 %.

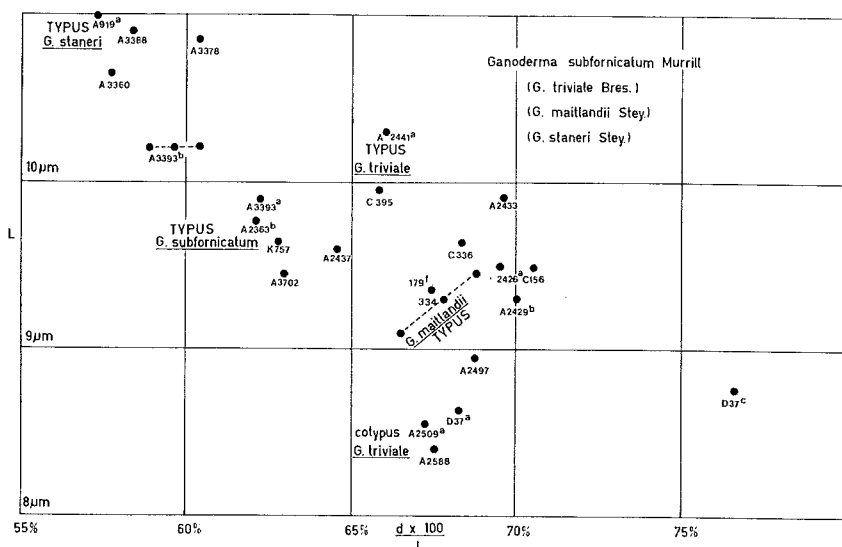


Fig. 15. — *Ganoderma subformicatum* Murrill, distribution of spore shape index on spore length.

KENYA: Mazeran Forest, s. hosp., *Maitland* 588, 1921 (RLS.55.K.37) (A. 2429b), basidiosp. 8.5-9.3-9.5 × 6.5-6.6-7.0 μm, S.S.I. 70 %; Shimba hills, s. hosp., *Cain et al.* 661 490, 24-VIII-1966 (RLS.71.K.27) (K. 757), basidiosp. 9.0-9.6-10.0 × 5.5-6.0-6.5 μm, S.S.I. 62.7 %.

INDONESIA:

JAVA: Buitenzorg, s. hosp., *Van Höhnel* 127, s. dat. (RLS.56.S.3) (holotypus *G. triviale*), basidiosp. 10.0-10.3-11.0 × 6.0-6.8-7.5 μm, S.S.I. 66 %; s. loc., s. hosp., *Von Höhnel* 127, s. dat. (cotypus *G. triviale*) (RLS.55.K.46) (A. 2509a), basidiosp. 8.0-8.5-9.0 × 5.5-5.7-6.0 μm, S.S.I. 67.3 %.

Notes: 1. — All the specimens grouped under this binomial are morphologically alike. All are plagiopleuropode, either with a stipe or a pedicel, with the same cutis anatomy of the characoderm type, the elements of which are inflated at the tip into a spheroid, sometimes somewhat elongated. Context and tube layers are concolorous, sometimes with paler horizontal zones in the context.

There is however a marked variation in the size and shape of the basidiospores that goes from the ovoid (*Goossens* 64, D. 37c) to the ellipsoid (*Staner* 229, A. 919a, holotypus *G. staneri*). This variation stands out in fig. 12 where the specimens are distributed according to the coordinates: spore lengths (1) and spore shape index (S. S. I.). Some specimens are represented by three dots linked by dashed lines. These are specimens where two sets of ten spores have been measured; the middle dot representing the mean.

2. — It must be noted that the holotype of *G. triviale* and the cotype have more or less widely spaced dots. It happens that no basidiospores could be retrieved from the tubes of the holotype. Those that have been measured were collected on the upper surface (see foreword). In this case it would be preferable to rely for basidiospore characters on the cotype rather than on the holotype.

SUBGENUS PLECODERMA

9. *Ganoderma amazonense* Weir, Bull. U. S. Dept. Agric. 1380: 84 (1926). — Fig. 3, 9, 16, 17, 18.

Basidioma sessile to subplagiopleuropode, often irregular, most flabelliform three-quarters circular to semi-circular with usually a narrow base; upper surface often irregular, knobbly, or smooth with radiating folds near the base, natal brown; pore surface white.

Section: cutis medium, about 100 μm thick, natal brown; context contrasting sharply with cutis, light buff, sometimes very light brown towards tube layer, approximately equal in thickness to latter; tube layer yellow ochre, total thickness at base about 20 mm, thinning out towards the margin.

Cutis anatomy: hyphal ends closely entwined, forming with impregnating melanoid substances a solid layer. Pores irregularly circular, 90-180-320 μm diam.; dissepiments 10-45-120 μm thick, distance between axes of tubes 185-230-270 μm. Basidiospores ovoid, with short echinules, light yellowish brown, 6-7.6-9 × 5-5.6-6.5 μm.

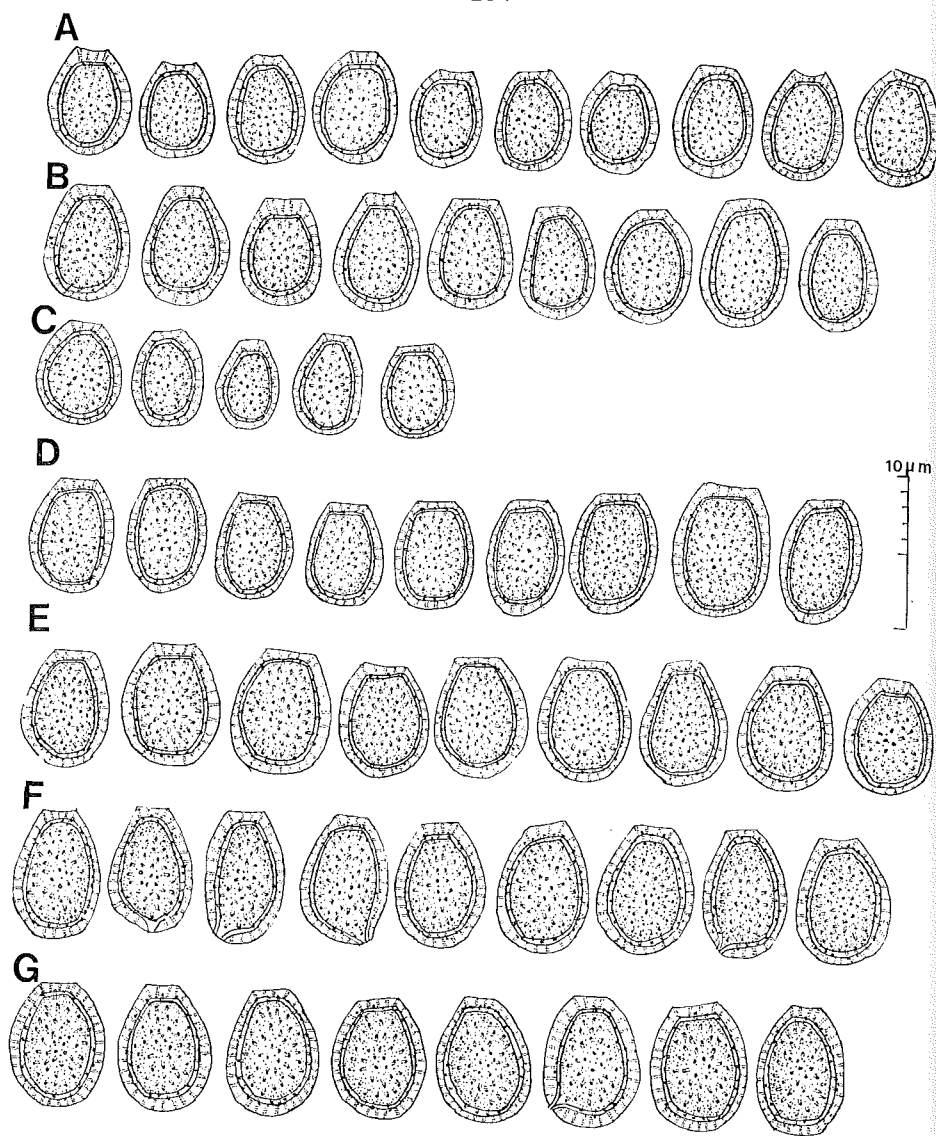


Fig. 16. — *Ganoderma amazonense* Weir, basidiospores (A, Weir s.n., BPI 62 043; B, Weir s.n., BPI 30 539; C, Grant 2122; D, Fassi 395; E, Lebrun 6578; F, Rammeloo Z 167; G, Deighton M 2293).

BRAZIL: Cocal Grande, Para, Amazonas, on *Hevea brasiliensis*, Weir (BPI 62 043), 20-VIII-1923 (RLS.60.BPI.1) (A. 3407) (holotypus), basidiosp. $6.0-6.9-7.5 \times 5.0-5.1-5.5 \mu\text{m}$, S.S.I. 74.6 %; Cocal Grande, Para, Amazonas, on *Hevea brasiliensis*, Weir (BPI 30 539), 20-VIII-1923 (RLS.76.BPI.1) (K. 1041), basidiosp. $6.5-7.2-8.0 \times 5.0-5.4-6.0 \mu\text{m}$, S.S.I. 75.2 %; Urucuritaba, Rio Madeira, on *Hevea* sp., Weir (BPI 30 537), 28-VIII-1923 (RLS.76.BPI.2) (K. 1042), basidiosp. $6.5-7.1-$

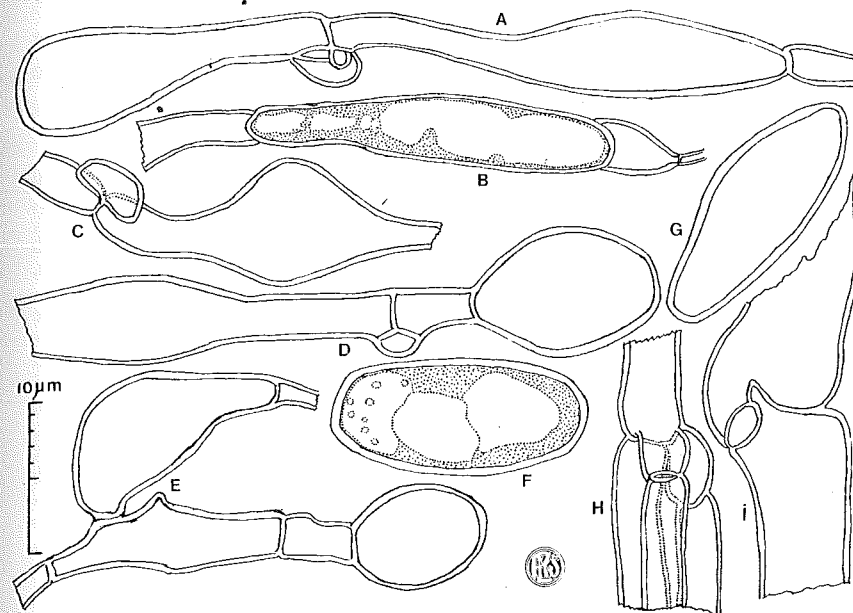


Fig. 17. — *Ganoderma amazonense* Weir, culture on potato dextrose agar: A, C, D: various types of clamp connections; E, H, I: various types of septa and ramifications; B, F: cells with highly refringent content in grayish protoplasm; G: detached hyaline cell (Fassi 395).

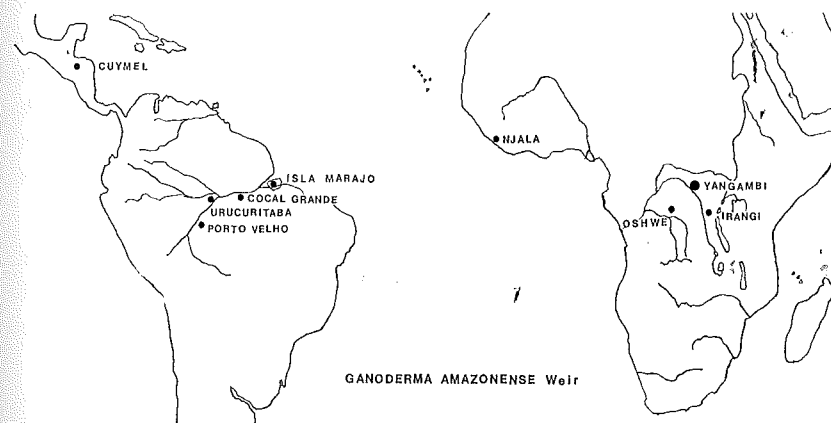


Fig. 18. — *Ganoderma amazonense* Weir, Afro-American distribution of the species.

7.5 × 5.0-5.4-5.5 μm, S.S.I. 75.5 %; Isla Marajo, on *Hevea brasiliensis*, Weir (BPI 30 531), 23-XI-1923 (RLS.76.BPI.3) (K. 1043), basidiosp. 7.0-7.4-8.0 × 5.0-5.4-6.0 μm, S.S.I. 72.5 %; Porto Velhos, on *Spondias* dead roots, Weir (BPI 30 532), 8-IX-1923 (RLS.76.BPI.4) (K. 1044), basidiosp. 6.0-6.7-8.5 × 4.5-5.1-5.5 μm, S.S.I. 70.8 %.

HONDURAS: Cuymel, on *Ficus* sp., Grant 2122, 27-VIII-1940 (RLS.76.BPI.5), basidiosp. 6.0-6.2-6.5 × 4.0-4.7-5.5 μm, S.S.I. 75.8 %.

ZAIRE: Yangambi, on *Hevea brasiliensis* (sodium arsenite poisoned), Fassi 395, 2-III-1956 (B. 358a-b) (BR), basidiosp. 6.5-7.0-9 × 5.5-3-6 μm, S.S.I. 69.3 %; Yangambi, on *Synsepalum* sp. (stump of tree sodium arsenite poisoned in 1954), Fassi 267, I-1956 (A. 3346) (BR), basidiosp. 7.0-7.6-8.0 × 5.5-5.6-6.0 μm, S.S.I. 74.3 %; Yangambi, on *Celtis mildbraedii* (stump of tree sodium arsenite poisoned), Fassi 1128, 10-X-1957 (A. 3394) (BR), basidiosp. 7.5-8.0-8.5 × 6.0-6.3-6.5 μm, S.S.I. 78.3 %; Yangambi, on *Isoloma bruneelii* (stump of tree sodium arsenite poisoned), Fassi 1125, 10-X-1957 (A. 3395) (BR), basidiosp. 7.0-8.0-8.5 × 5.5-5.9-6.5 μm, S.S.I. 74.4 %; Yangambi, on *Cola griseiflora* (stump of tree sodium arsenite poisoned), Fassi 1126, 12-X-1957 (A. 3396) (BR), basidiosp. 7.5-8.1-8.5 × 5.5-5.8-6.5 μm, S.S.I. 72.2 %; Yangambi, on *Hevea brasiliensis*, Fassi 184, 2-XI-1954 (C. 301a-b-c-d) (BR), basidiosp. 7.0-7.7-9.0 × 5.0-5.5-6.5 μm, S.S.I. 71.4 %; Yangambi, on *Cola griseiflora* (stump of tree sodium arsenite poisoned), Fassi 184, 2-XI-1954 (C.453) (BR), basidiosp. 7.0-7.5-8.0 × 5.5-5.7-6.5 μm, S.S.I. 75.5 %; Oshwe, on dead wood, *Lebrum* 6578, XI-1932 (A. 983) (BR), basidiosp. 7.5-8.0-8.5 × 5.5-6.1-6.6 μm, S.S.I. 76.4 %; Irangi (Kivu), s. hosp., *Rammeloo* Z. 167, 24-III-1972 (L. 182c) (BR), basidiosp. 8.0-8.4-9.0 × 5.0-5.5-6.0 μm, S.S.I. 66.1 %.

SIERA LEONE: Njala, on living *Cassia siamea*, Deighton M. 2293 (IMI 40 945), 12-VIII-1940 (RLS.65.K.71) (A. 4606), basidiosp. 7.0-8.0-8.5 × 6.0-6.1-7.0 μm, S.S.I. 76.4 %.

Notes: 1. — If one can obtain a sufficiently representative idea of the morphology of the species by the twenty specimens examined, of which six are American, one might state that the African specimens are larger than the Americans and of more regular growth. The American specimens are all of more or less irregular growth of which plate 6 of Weir's 1926 publication is a good representation.

2. — As this more or less restricted set of specimens seems to suggest, the distribution of *G. amazonense* not only covers the Amazon river valley but also Central America up to Honduras and, on the other side of the Atlantic, also West and Central Africa in the primary equatorial forest (fig. 18).

No specimen has been available from East of the Central African Graben, although a specimen (*Rammeloo* Z 167) has been collected in the lower reaches of the latter, on its western side.

Culture of *G. amazonense*: on collecting his specimen 395, Fassi cultured it on potato dextrose agar to which 0.5 % yeast extract had been added. This medium gave growth to a peculiar mycelium of hyphae about 3 μm diam. with inflated clubshaped cells (fig. 17

A-B) or free ellipsoid ones (fig. 17 F-G). The inflated cells are deep rhodamine red with acid fuchsin, whereas the normal mycelium is only faintly stained (fig. 9). It is septate with various types of clamp connections (fig. 17 A, C, D).

Besides the mycelium with hyphae about 3 μm in diam., other hyphae, also hyaline, about double the latter diameter are produced (fig. 17 I). Spherical cells about 12-18 μm in diam. have also been observed.

SUBGENUS ANAMIXODERMA

Subgenus *Anamixoderma* comprises currently not more than six or seven species and the incidence of collections seems to indicate that they are more widespread in Europe and the Americas than elsewhere.

G. adpersum (Schulz.) Donk, *G. kosteri* Steyaert, *G. lobatum* (Schw.) Atk. and the new South American species *G. lobatoideum* Steyaert have all a dark red brown context concolorous with the tube layer. Two species from Indonesia, *G. donkii* Steyaert and *G. vanheurnii* Steyaert (Steyaert 1972: 75, 69), have their contexts respectively *Brussels brown* and *auburn*. *G. vanheurnii* is distinctive in its ellipsoid spores, otherwise all spore shapes in the subgenus are ovoid.

10. *Ganoderma lobatum* (Schw.) Atkinson, Ann. Mycol. 6: 190 (1908). — Fig. 2 E, 19.

Polyporus lobatus Schweinitz, Trans. Am. Phil. Soc., ser. nov. 4: 157 (1834).

Elfvigia lobata (Schw.) Murrill, N. Am. Fl. 9: 114 (1908).

Fomes lobatus (Schw.) Sacc., Syll. Fung. 21: 304 (1912).

Polyporus reniformis Morgan, Journ. Cincinn. Soc. Nat. Hist. 8: 103 (1885).

Elfvigia reniformis (Morgan) Murrill, Bull. Torrey Bot. Club. 30: 299 (1903).

Basidioma sessile, flabelliform to dimidiate, up to 12 cm in radius, concentrically sulcate, ferruginous to tawny, to *mummy brown* with age; margin thin to thickly rounded.

Section: cutis blackish brown, shiny, approximately 50 μm thick underlaid of a brownish yellow zone some 300 μm thick with a dark brown layer some 200 μm thick, parallel to the cutis some 70-80 μm below the latter; context about same thickness as tube layer, *chestnut* to *bay*, with shining streaks of deposits of melanoid substances, tube layer some 10 mm thick, concolorous with context.

Cutis of anamixoderm type. *Pores* round, 100-145-180 μm ; dissepiments 10-65-110 μm thick, distance between axes 200-210-225 μm . *Basidiospores* ovoid, brown, truncate at maturity, 7.5-9.3-11.0 \times 5.0-6.3-7.0 μm , S. S. I. 60-66.1-73.6 %.

U. S. A.:

NORTH CAROLINA: Salem, s. hosp., *Schweinitz* s.n., s. dat. (RLS.55.NY.9) (A. 2303b) (holotypus), basidiosp. 9.0-9.3-10.5 \times 5.0-5.9-7.0 μm , S.S.I. 63.98 %; s. loc. (U. S. A.), s. hosp., s. col., s. dat. (RLS.53.PC) (A. 2281a).

GEORGIA: Sandersville, on bark of decayin log. *Harper* 1329a, 1902 (RLS.55.NY.10) (A. 2304a), basidiosp. 7.5-8.1-9.0 \times 5.5-6.0-6.5 μm , S.S.I. 73.6 %.

NEW JERSEY: Newfield, s. hosp., *Ellis* 3999, s. dat. (RLS.67.E.9) (K. 470), probably flabelliform (only a slice being available), basidiosp. 8.5-9.1-10.0 \times 5.5-5.9-6.5 μm , S.S.I. 65.4 %.

ILLINOIS: Metropolis, on rotten stumps of *Quercus* sp., *Humphrey* 9670, 26-X-1919 (RLS.61.K.1) (A. 3624), dimidiate, basidiosp. 9.0-9.3-10.0 \times 6.0-6.4-7.0 μm , S.S.I. 69 %.

Note: When *Ganoderma* specimens with an anamixoderm type of cutis are examined from North, Central and South America, one notices that they can be separated into two groups on the basis of their spore shapes and sizes and their geographical distribution. One group can be identified under the binomial *G. lobatum* (Schw.) Atk. described above, the other group has distinctly different basidiospores as is evidenced by fig. 19.

The grouping of the dots is such that the South and Central American specimens indicate a separate species which is described as new.

11. *Ganoderma lobatoideum* Steyaert sp. nov. — Fig. 2 F, 9, 19.

Basidioma flabelliforme ad pseudotipitatum, ad 20 cm rad. et 20 cm diam., saepe irregulare; pagina dorsalis gibbula ad concentric sulcata, *isabellina* ad *sepiacea*, margine alba ad ochracea.

Section: cutis sepiacea, nitens, circa 120 μm crassa; contextus umbrinus, horizontaliter deposita sclerosis nitentibus materiaram melanoidearum striatus, ad 20 mm crassus; tubulorum striatum contextu concolor, usque ad 13-15 mm crassus.

Cutis anatomice anamixodermiformis. *Pori* circulares 90-130-210 μm diam., dissepimentes 10-55-100 μm crassis, axibus circa 185 μm distantibus. *Basidiosporae* maturae apice truncatae, 6.5-7.8-9.0 \times 4.0-5.3-6.5 μm , S. S. I. 63-67-70 %, brunneae basidiosporae haud echinulatae obovoideae vel obpyriformes, pallidobrunneae, 6.5-7.8-10 \times 4.5-5.3-6.5 μm . — *Holotypus*: *Martyn* 604 (K).

Basidioma flabelliform to pseudostipate, up to 20 cm in radius and 20 cm diam., often irregular; upper surface knobly to concentrically sulcate, *buckthorn brown* to *Dresden brown* or *mummy brown*; margin white in growing specimen with *yellow ochre* rim.

Section: cutis sepia, shiny, about 120 μm thick; context *mars brown*, with horizontal shiny sepia striae of deposits of melanoid

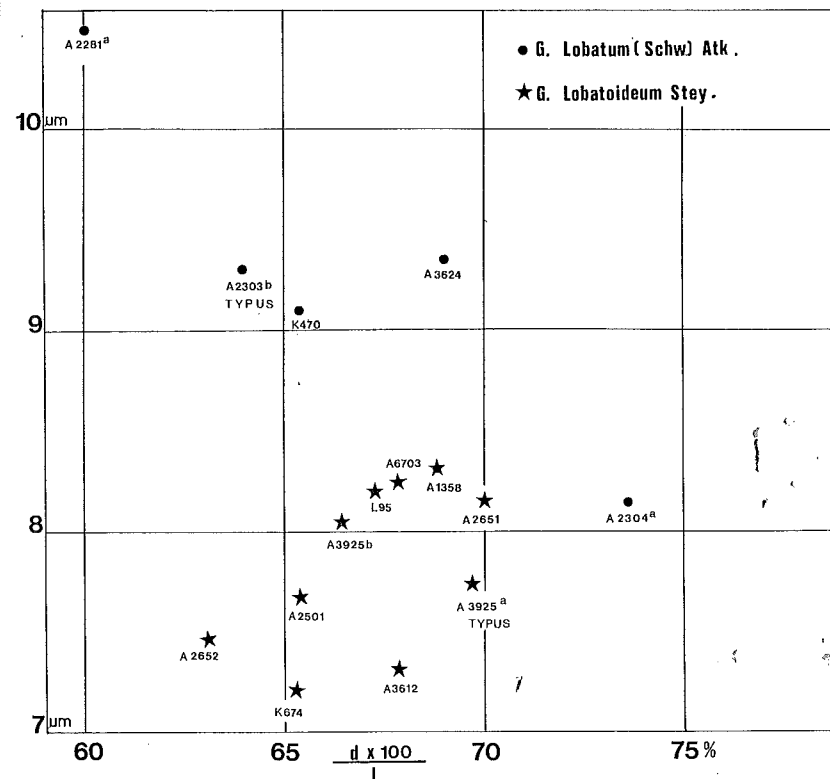


Fig. 19. — *Ganoderma lobatum* (Schw.) Atk. and *G. lobatoideum* Steyaert, distribution of spore shape index (S.S.I.) on spore length.

substances, up to 20 mm thick; tube layer concolorous with context, up to 13-15 mm thick.

Cutis anamixodermiform. Pores circular 90-130-210 μm diam., dissepiments 10-55-100 μm , distance between axes about 180 μm . Basidiospores truncate at maturity, 6.5-7.8-9.0 \times 4.0-5.3-6.5 μm , brown, S. S. I. 63.1-67.3-69.9 %; non echinulate basidiospores obovoid or obpyriform, pale-brown, 7-8-9 \times 4.5-5 μm .

GUYANA : Essequibo river, Moraballi creek, near Bartica, on top of fallen log, *Martyn* 604, (Oxford Univ. Exp. Brit. Guiana, 1929), 17-X-1929 (RLS.63.K.67) (A. 3925a) (holotypus), basidiosp. 7.0-7.7-8.0 \times 4.5-5.4-6.0 μm , S.S.I. 69.7 %; *ibid.* (RLS.62.K.68) (A. 3925b) (isotypus), basidiosp. 8.0-8.05-8.5 \times 5-5.3-5.5 μm , S.S.I. 66.5 %; Essequibo river, Moraballi creek, near Bartica, on dead log, *Martyn* 659, (Oxford Univ. Exp. Brit. Guiana, 1929), 25-X-1929 (RLS.69.K. 674), basidiosp. 6.5-7.2-8.0 \times 4-4.7-5.5 μm , S.S.I. 65.3 %.

BRAZIL. Jardim Bot. Rio de Janeiro, s. hosp., *Fidalgo & Kauffmann Fidalgo* OKF 00 647, XII-1955 (A. 2656) (BR), s. basidiosp.; Remote dos Males, Rio Javary, s. hosp., *Occhioni* 00 339, 20-X-1927 (A. 2651) (BR), basidiosp. 7.0-8.1-9.0 \times 4.5-5.7-6.5 μm , S.S.I. 69.9 %; Tocantim, s. hosp., *Occhioni* 00 343, 9-XI-1927 (A. 2652) (BR), basidiosp. 7.0-7.4-8.0 \times 4.5-4.7-5.0 μm , S.S.I. 63.1 %.

BOLIVIA : Guayaramerin, on dead trunk of dicot. tree, *Singer* B.2037, 16-III-1956 (RLS.61.K.88) (A. 3612), basidiosp. 7.0-7.3-8.0 \times 4.5-4.9-5.5 μm , S.S.I. 67.8 %.

COLUMBIA : Mitu Vaupès, on fallen log, *Holliday* 87 (Anglo-Columbian Cacao coll. exp.), 3-XI-1952 (RLS.55.K.61) (A. 2501), basidiosp. 7.0-7.6-8.5 \times 4.5-5.0-5.5 μm , S.S.I. 65.4 %.

CUBA : s. loc., s. hosp., *Fungi Wigthiani* 2157, s. dat. (RLS.53.PC) (A. 1358), basidiosp. 8.0-8.3-9.0 \times 5.0-5.8-6.0 μm , S.S.I. 69.9 %.

U. S. A. :

NEW ORLEANS : Jeffers County, s. hosp., *Reid* s.n., 17-VIII-1968 (RLS.69.K.39) (L. 95), basidiosp. 7.5-8.2-9.0 \times 4.5-5.5-6.5 μm , S.S.I. 67.1 %.

MISSISSIPPI : Logtown, Hancock County, *Reid*, s.n., 20-VIII-1968 (RLS.69.K.36) (A. 6703), basidiosp. 7.5-8.2-9.0 \times 5.0-5.6-6.0 μm , S.S.I. 67.9 %.

THE GANODERMA RESINACEUM COMPLEX

Ganoderma resinaceum Boud. is a species that can easily be confused in its external and internal morphology with *G. lucidum* (Curtis ex Fr) Karst., but there is a distinct difference however between the two species when their basidiospores are considered.

Some notes about the problem have already been published by Steyaert (1972). *G. lucidum* has ovoid spores with relatively few, relatively long and thick echinules, whereas for *G. resinaceum* the basidiospores are ovoid with a tendency to being ellipsoid and densely covered with relatively short and thick echinules.

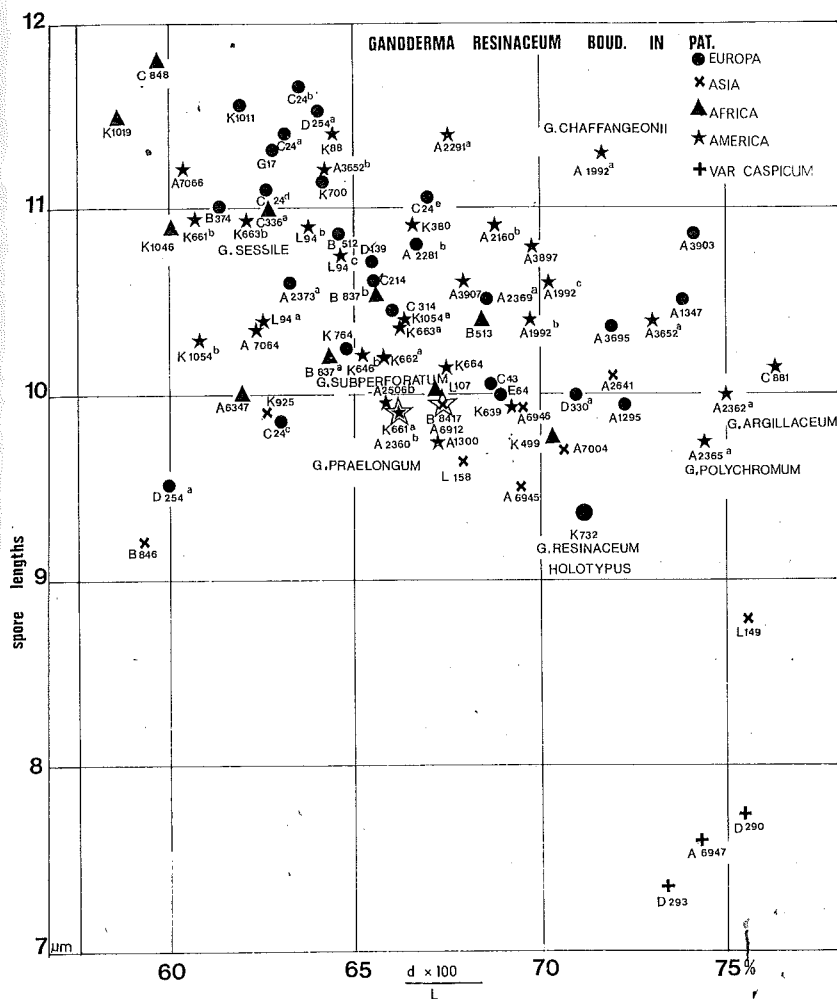


Fig. 20. — *Ganoderma resinaceum* Boud. in Pat., distribution of spore shape index (S.S.I.) on spore length.

This latter feature of the basidiospores is the only safe guide for distinguishing the two species. With practice one can often guess the identity of a specimen correctly on superficial characters, but one can never attain unerringness on that basis. It is most difficult to convey in words the morphological differences between the two species. When one has assembled a considerable number of specimens, one notices that *G. resinaceum* can be much larger than *G. lucidum*.

Both species can be stipitate, but this happens much more frequently in *G. lucidum* than in *G. resinaceum*, where it seems to be rather exceptional. Presence or absence of a stipe depends largely on the host on which it grows. Stipitate specimens usually appear on buried wood or roots, whereas sessile specimens appear on trunks or stumps. This might mean that *G. resinaceum* is more a trunk invader in contrast to *G. lucidum* which appears rather to be a root invader. Trunk invasions by *G. resinaceum* can no doubt be massive (Steyaert 1977), producing at least half a dozen big basidiomata. But the volume of such fruiting is of no doubt related to the importance of the thallus permeating the host trunk. No such development of *G. lucidum* has ever, to the author's knowledge, been observed.

When all the specimens with *G. resinaceum* type of basidiospores are set apart and systematically examined, one finds that these specimens have all a buff or light chamois context, with the lowest part adjacent to the tube layer concolorous with the latter which is chestnut or auburn brown colour. However Iranian and Central American specimens, that have been described by Murrill under various binomials as *G. argillaceum* and *G. praelongum*, have the tube layer with the adjacent context a very pale brown almost buff. *G. chaffangeonii*, described by Patouillard for a specimen from Venezuela, reverts to the typical distinction of colour between context and tube layer.

From Tunisia and Sudan two specimens are available with *G. resinaceum* type of basidiospores, but with atypical context characters. The Tunisian specimen has been described by Patouillard under the binomial *G. fici*; its context is very narrow and seems a shade of brown. The Sudanese specimen on the other hand has distinctly a chestnut colored context and is apparently to be excluded from the *G. resinaceum* complex. On the other hand, there are Moroccan, Rwandan and Transvaal specimens of typical *G. resinaceum*. The external morphology of the basidiomata of *G. resinaceum* may be the cause of some confusion as the upper surface may vary in the topotype regions of France from a shiny brownish red to the

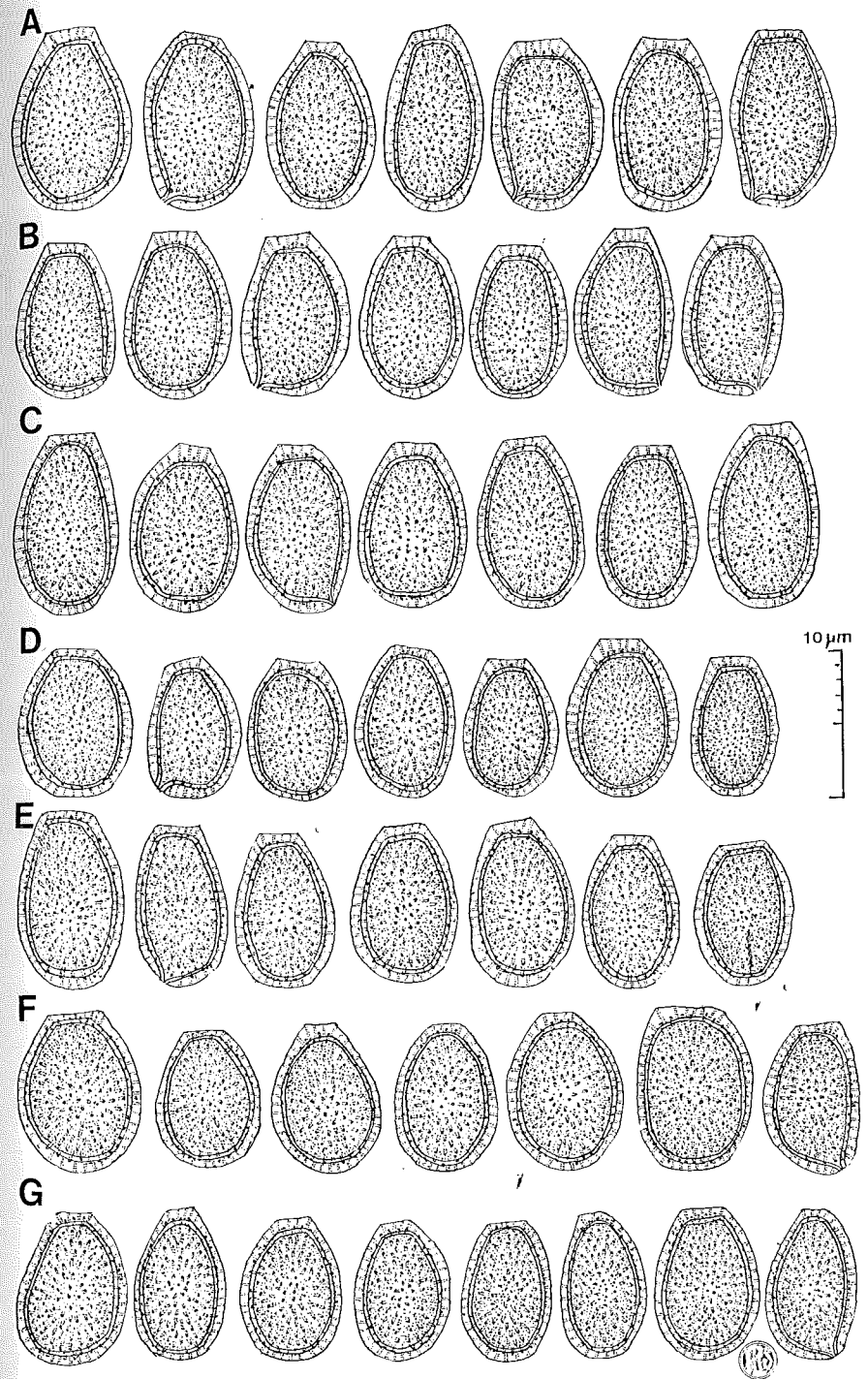


Fig. 21. — *Ganoderma resinaceum* Boud. in Pat., basidiospores (A, Van Bambeke s.n., C. 24b; B, Semaille s.n., D. 139; C, s. coll., RLS.74.PRE-PPI.39; D, Malinvern, Rabenhorst Fungi Europ. 1003; E, Pinto-Lopès s.n., C 214; F, Kreisel s.n., A. 3695; G, Ershad & Izadyar s.n., Iran 33, RLS.71 Iran 27).

typical shiny *blackish brown*. The upper surface also appears different when it is heavily coated by a spore deposit that then becomes *tawny*.

In middle North America there is equally disconcerting variation; as in Europe the specimens vary from a red to blackish brown color and from subshiny to shiny. Besides that, there is the disconcerting fragrant misnomer of *G. sessile* Murrill; a name which belies the description where a stipe up to 4 cm long is described at some length.

G. polychromum (Copel.) Murrill must be mentioned as there are some peculiarities that need be examined. When he described *G. polychromum* from a South Californian specimen (A. 2365a). Copeland (1904) referred to the context as « ... obscure concentric zonato... ». It should be noted that Murrill (1908) gave in English a description of *G. polychromum* that omitted this peculiarity which in fact is the only character that might distinguish it from typical specimens of *G. resinaceum*. Such context zonations can however be noticed in some European specimens.

A Portuguese specimen (C. 214) has a very thick context with well marked concentric zones and so has also a Belgian specimen (K. 761). Such features can only be ascribed special conditions of growth either of climatic or host influences.

It is well to mention that only Angiosperms have been recorded as host plants of *G. resinaceum*; no specimens are mentioned as collected on Gymnosperms. Among the Angiosperms the *Fagaceae* (*Quercus*, *Fagus*), the *Salicaceae* (*Salix*) and the *Leguminosae* (*Acacia*, *Robinia*, *Cercis*, *Gleditsia*, etc...) seem the most prone to be attacked.

This discussion results in a delimitation of the species and its distribution which leads to the following emended description.

12. *Ganoderma resinaceum* Boud. in Pat., Bull. Soc. Mycol. Fr. 5 : 72 (1889). — Fig. 20-23.

G. chaffangeonii Pat., Bull. Soc. Mycol. Fr. 5 : 74 (1889).

G. sessile Murrill, Bull. Torrey Bot. Club 29 : 604 (1902).

Polyporus polychromus Copel., Ann. Mycol. 2 : 507 (1904).

Ganoderma polychromum (Copel.) Murrill, N. Am. Fl. 9 : 119 (1908).

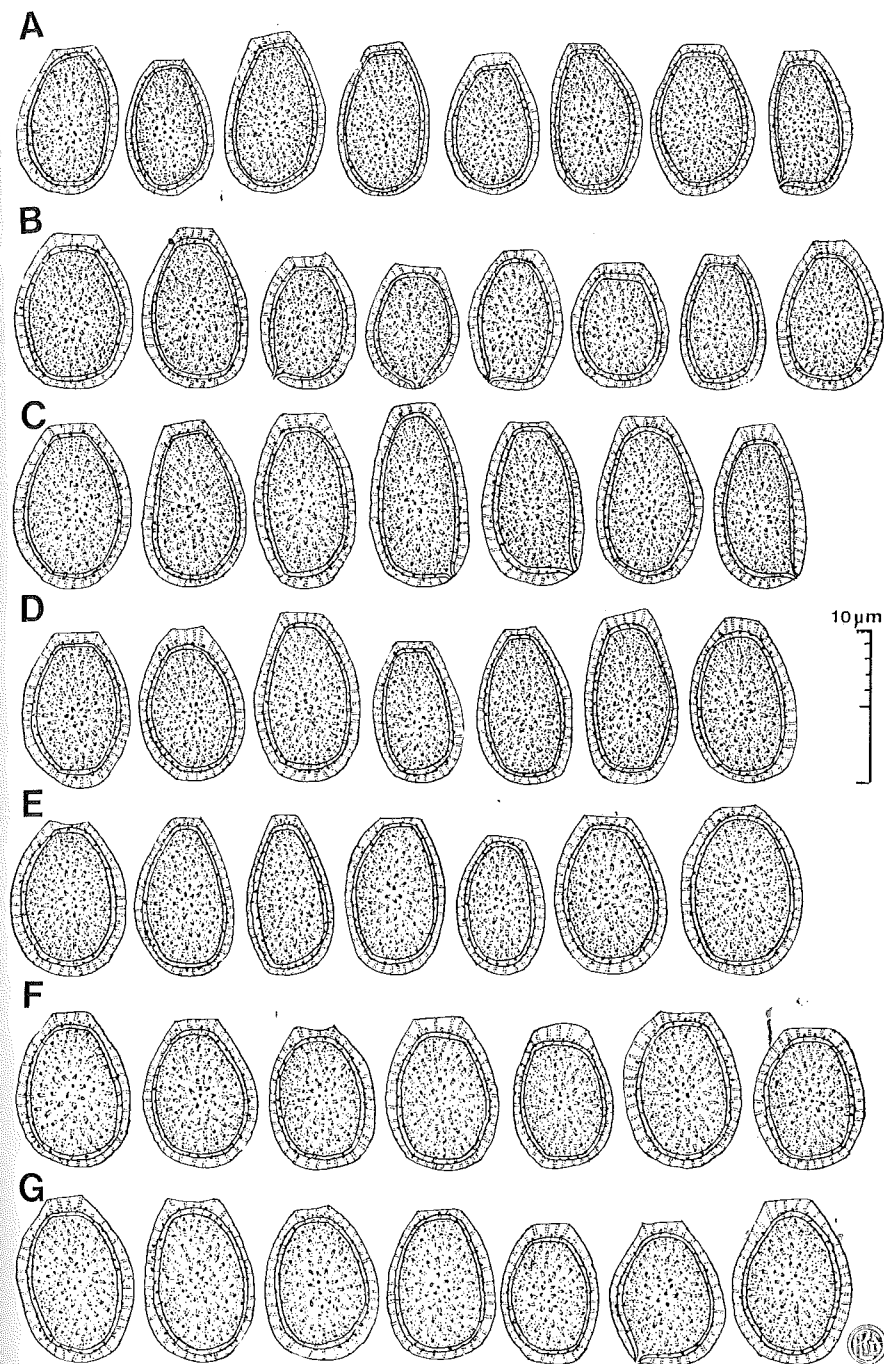


Fig. 22. — *Ganoderma resinaceum* Boud. in Pat., basidiospores (A, Ahmad s.n., Fungi W. Pakistan 15 289; B, Bose s.n., K; C, de Witte 11 770; D, Sellschop s.n., PPI 30 526; E, Haid & Atkinson s.n., CUP 19 560; F, Copeland s.n., RLS.55.NY.23; G, Earle 658).

G. praelongum Murrill, N. Am. Fl. 9 : 121 (1908).

G. argillaceum Murrill, N. Am. Fl. 9 : 122 (1908).

G. subperforatum Atk., Bot. Gaz. 46 : 337 (1908).

Basidioma usually sessile, dimidiate, sometimes orthopleuropode when produced on buried wood, up to 20 cm rad., 30 cm diam. and 10 cm thick at basis (as can be produced in one season's growth between March and September), solitary, superimposed or scattered depending on thallus development within the host plant; upper surface mostly irregular, sometimes smooth or with concentric folds, from *brazil red* to *blackish brown*, usually shiny, sometimes subshiny due to atmospheric hazards, or dull brown *tauwny* when densely covered by basidiospores; cutis of same colour as upper surface, 50-60 μm thick; context from *light buff* to *ochraceous-buff*, sometimes with darker concentric growth lines, base adjacent to tube-layer concolorous with the latter, up to 80 mm thick (one season's growth); tube layer up to 1.5 mm thick (one season's growth).

Cutis of the typical hymenioderm type; elements cylindrical, clavate, 40-58 \times 5-9 μm , densely impregnated with melanoid substances, exceptionally in disarray. *Pores* round to irregular, big, 90-210-420 μm diam.; dissepiments 10-55-320 μm , distance between axes about 260 μm . *Basidiospores* ellipsoidal to long ovoid, 8-10.5-14 \times 5.5-6.9-9.5 μm , S. S. I. 59.7-66.7-76.3 %, chamois-brown, endospore densely covered by short, thin echinules, seldom with non echinulate basidiospores, 9.5-13 \times 6.5-8 μm , light brown.

FRANCE: Blesiacum (Blois) reperi, ad caudices *Quercus* quot annis satis frequenter, *Boudier*, s. dat. (RLS.69.PC.1) (K. 732), basidiosp. 8.5-9.3-10.5 \times 6-6.6-7.5 μm , S.S.I. 71.1 %; s. loc. (Touraine), s. hosp., *Semaille* s.n., IX-1955 (D. 139) (BR), basidiosp. 10.0-10.7-11.5 \times 6.5-7.0-7.5 μm , S.S.I. 65.4 %; Condom (Gers), s. hosp., *Ribers* s.n., s. dat. (PC) (A. 2281b), basidiosp. 10.0-10.8-11.5 \times 6.5-7.2-8.0 μm , S.S.I. 66.7 %; s. loc. (Pyrénées), s. hosp., *Rullier* 273, 2-VIII-1964 (BR) (D. 254a), basidiosp. 9.5-11.5-12.0 \times 6.0-6.9-7.0 μm , S.S.I. 60 %; ditto (D. 254b), basidiosp. 10.0-11.4-12.5 \times 7.0-7.3-8.0 μm , S.S.I. 64 %.

BELGIUM: Gent, *Salix* sp., *Van der Veken* s.n., 2-X-1968 (D. 330a) (BR), basidiosp. 9.0-10.0-11.0 \times 6.5-7.1-8.0 μm , S.S.I. 71 %; Vinderhaute, s. hosp., *Van Bambeke* 3049, 11-VII-1912 (BR) (C. 24c), basidiosp. 10.0-11.4-12.0 \times 6.5-7.2-8.0 μm , S.S.I. 63.2 %; ditto (C. 24b), basidiosp. 10.5-11.6-12.0 \times 6.5-7.4-8.5 μm ; ditto (C. 24c), basidiosp. 9.0-9.8-11.0 \times 6.0-6.2-7.0 μm , S.S.I. 62.9 %; ditto (C. 24e) basidiosp. 11.0-11.5-12.0 \times 7.0-7.4-8.0 μm ; S.S.I. 67 %; Peteghem bij Oudenaerde, bois enfouis, *D. Froment* s.n., 25-VIII-1964 (F. 43) (BR), basidiosp. 9.5-10.0-10.5 \times 6.5-6.9-7.5 μm , S.S.I. 68.7 %; Antwerpen, s. hosp., *Veremans* s.n., 1963 (B. 572) (BR), basidiosp. 8.5-10.8-12.0 \times 6.0-7.0-7.5 μm , S.S.I. 64.5 %; Meise, on *Quercus*, *Wilczek* s.n., 7-VIII-1969 (D. 325) (BR), basidiosp. 9.0-10.0-11.0 \times 6.5-6.8-7.5 μm , S.S.I. 68.5 %; Meise, on *Quercus rubra*, *Steyaert* 75 000, 15-IX-1975 (G. 17) (BR), basidiosp. 10.0-11.3-12.0 \times 6.5-7.1-7.5 μm , S.S.I. 62.5 %;

Forêt de Soignes, s. hosp., s. coll., IV-1927 (E. 64) (BR), basidiosp. 9.5-10.0-11.0 \times 6.0-6.9-8.0 μm , S.S.I. 69 %; Overijse, Notre-Dame de Bonne Odeur, s. hosp., *Girard* s.n. 26-VIII-1955, (C. 314) (BR), basidiosp. 9.5-10.4-11.5 \times 6.5-6.9-7.0 μm , S.S.I. 66 %; Xhoris, souche de feuillu, *Lauwers* s.n., 13-IX-1971 (K. 761) (BR), basidiosp. 9.5-10.2-11.0 \times 6.0-6.6-7.5 μm , S.S.I. 64.9 %.

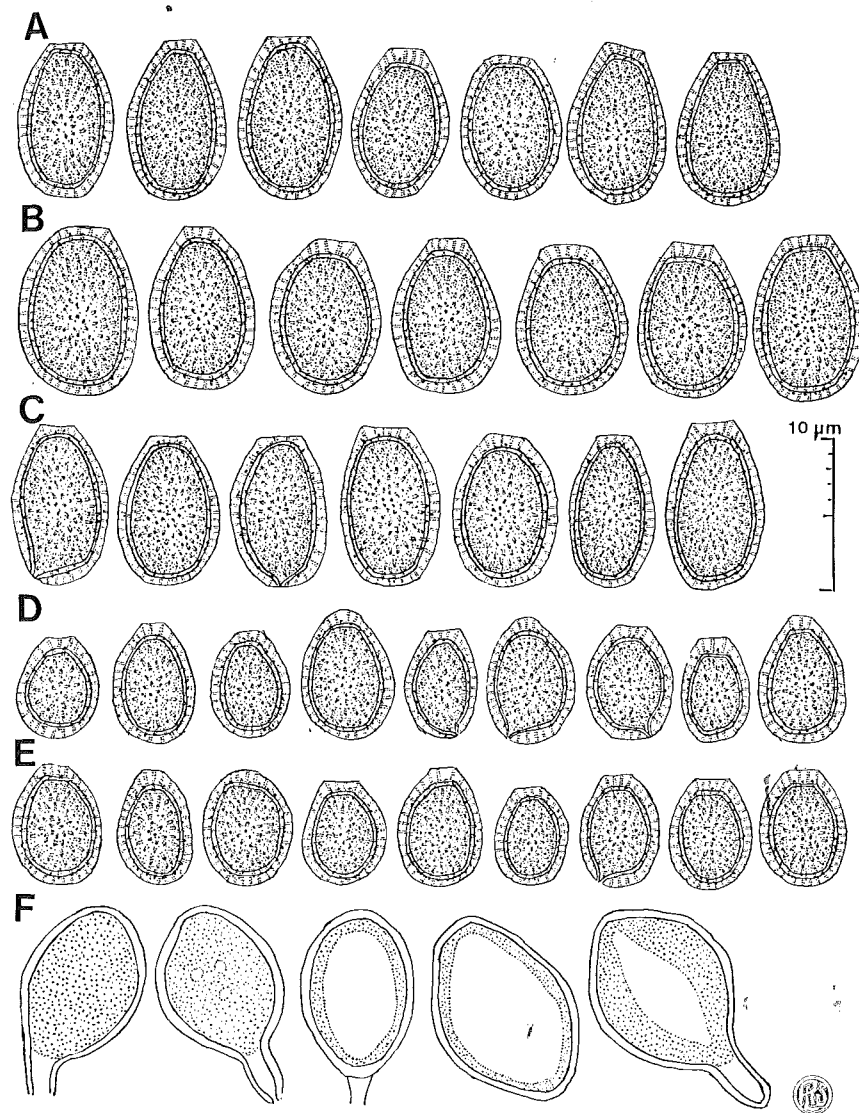


Fig. 23. — A-C, F, *Ganoderma resinaceum* Boud. in Pat.: A-C, basidiospores; F, gasterospores (A, Earle & Murrill 536; B, Chaffangeon s.n., RLS.53.PC.40; C, Morton s.n., RLS.76.Cooke. 2; F, Berthault in Malençon, Champignons du Maroc 6917); D-E, id., undescribed variety with smaller basidiospores (D, Ershad & Izadyar s.n., RLS.75.Iran.5; E, Ghazi-off s.n., RLS.75.Iran.7).

GREAT BRITAIN: Ruislip (Middlesex), on dead oak tree, *Reid* s.n., autumn 1959 (RLS.69.K.99) (K. 700), basidiosp. 10.0-11.1-12.0 × 7.0-7.1-8.0 μm, S.S.I. 64.1 %; Petersham (Surrey), on *Quercus pedunculata*, s. coll., s. dat. (RLS.74.PRE-PPI.39) (K. 1011), basidiosp. 11.0-11.5-12.5 × 7.0-7.1-7.5 μm, S.S.I. 61.9 %; Oxford, s. hosp., *J. S. Hughes* s.n., s. dat. (RLS.55.K.19) (A. 2369a), basidiosp. 9.5-10.5-11.5 × 6.5-7.2-8.0 μm, S.S.I. 68.6 %.

CHEKOSLOVAKIA: Carpatorossia, Teresva, Tiacevo, ad truncum quercinum, *Pilat* (Fungi carpatici lignicoli n° 16), VII-1932 (B. 374) (BR), basidiosp. 10.0-11.0-12.5 × 6.0-6.7-7.5 μm, S.S.I. 61.4 %.

PORTUGAL: s. loc., ad trunca, *Torrend* s.n., 1905 (RLS.52.K.38) (A.3903), basidiosp. 10.5-10.8-12.0 × 7.0-8.0-8.5 μm, S.S.I. 74.2 %; s. loc., sur *Acacia* sp., *Pinto-Lopès*, s.n., VIII-1951 (C. 214) (BR), basidiosp. 10.0-10.6-11.5 × 6.5-6.9-7.5 μm, S.S.I. 65.6 %; s. loc., sur *Populus alba*, *Pinto-Lopès* 595, 17-XII-1946 (A. 1347) (BR), basidiosp. 10.0-10.5-11.0 × 6.5-7.7-8.0 μm, S.S.I. 73.8 %.

ITALY: Prope Oldenico, on *Salix alba*, *Malinverni* (1003, Rabenhorst, Fungi europaei), autumn 1863 (A. 1295) (BR), basidiosp. 9.0-9.5-11.0 × 6.0-6.9-7.5 μm, S.S.I. 72.25 %; Torino (Parc d'Arignano), on *Araucaria* sp., *Fassi* 1723, 12-XI-1964 (C. 795) (BR), basidiosp. 8.0-9.4-10.0 × 5.5-6.2-7.0 μm, S.S.I. 66 %; Lake Como, s. hosp., *Ferranti* s.n., 18-XI-1938 (RLS.155.K.27) (A. 237a), basidiosp. 10.0-10.6-11.0 × 6.0-6.7-7.0 μm, S.S.I. 63.2 %.

BULGARIA: Varna, ad ripam lacus « Varnsks ezero » prope vicum Belslav, ad caudicem *Juglandis regiae*, *Kreisel* s.n., 8-IX-1958 (BR) (A. 3695), basidiosp. 9.0-10.3-11.5 × 6.0-7.4-8.5 μm, S.S.I. 72 %.

ISRAËL: Baniyas springs, am öfer selber des Jordans, *Salix* noch aufstehend aber sheinbar tot, *Jaquenoud* il. 4, 15-VII-1971 (A. 6912) (BR), basidiosp. 9.0-9.9-10.5 × 6.0-6.7-7.0 μm, S.S.I. 67.3 %.

IRAN: Khoskdaran-Shaksavar (Mazanderan), s. hosp., *Ershad & Izadyar* (Iran 21), 19-VIII-1971 (L. 158) (BR), basidiosp. 9.0-9.6-11.0 × 6.0-6.5-7.0 μm, S.S.I. 67.9 %; Kharabad (Mazanderan), *Gleditsia caspica*, *Ershad & Izadyar* (Iran 6), 24-VIII-1971 (L. 149) (BR), basidiosp. 8.5-8.8-9.5-11 × 6-6-6-7 μm, S.S.I. 75.6 %; Khoskdaran (Mazanderan) s. hosp., *Ershad & Izadyar* (Iran 22), 16-VIII-1971 (BR) (A. 6945), basidiosp. 8.5-9.5-11.0 × 6.0-6.6-7.0 μm, S.S.I. 69.5 %; Khoskdaran (Mazanderan), s. hosp., *Ershad & Izadyar* (Iran 23), 16-VIII-1971 (A. 6946) (BR), basidiosp. 9.5-9.9-10.5 × 6.0-6.6-7.5 μm, S.S.I. 69.5 %; N. of Iran, s. loc., *Ershad & Izadyar* s.n., 22-VIII-1971 (A. 7004) (BR), basidiosp. 9.0-9.7-11.0 × 6.5-6.8-7.0 μm, S.S.I. 70.6 %; Gol Cheshmeh, Shah-Pasand (Gorgan), on *Malus communis*, *Ticho* s.n., 6-XII-1974 (B. 846) (BR), basidiosp. 8.5-9.2-12.5 × 4.5-5.4-7.0 μm, S.S.I. 59.2 %; N. of Iran, s. loc., on wood, *Ershad & Riedl* s.n., 24-IV-1974 (B. 847) (BR), basidiosp. 9.5-9.9-10.5 × 6.5-6.7-7 μm, S.S.I. 67.3 %; Gav-Sar, on *Carpinus betulus*, *Ershad & Izadyar* (Iran 5), 19-VIII-1971 (D. 290) (BR), basidiosp. 6.5-7.5-8.5 × 4.5-5.4-6.0 μm, S.S.I. 71.5 %; Shaksavar, s. hosp., *Ghazi-off* s.n. (Iran.7), 1971 (D. 293) (BR), basidiosp. 6.5-7.5-8.0 × 4.5-5.4-6.0 μm, S.S.I. 72 %.

PAKISTAN: Lahore, on stump of *Dalbergia sisoo*, *Ahmad* (Fungi of Pakistan 15 289), 27-XI-1961 (K. 925) (RLS.72.L.3), basidiosp. 9.5-9.9-10.5 × 5.5-6.2-7.0 μm, S.S.I. 62.6 %.

INDIA: Assam hills, s. loc., s. hosp., *Bose* s.n., V-1934 (fragm. BR), basidiosp. 8-10.1-10.5 × 5.5-7.2-8 μm, S.S.I. 72 %.

U. S. A.:

s. loc.: s. hosp., *J. B. Ellis* 363, s. dat. (Herb. M. C. Cooke 1885) (RLS.63.K.117) (K88), basidiosp. 11.0-11.4-12.5 × 6.5-7.3-8.0 μm, S.S.I. 64.5 %.

NEW-YORK: Fort Lee, on Sycamore log, *Underwood* s.n., X-1894 (RLS.69.NY.25) (K. 664), basidiosp. 9.5-10.1-11.0 × 6.5-6.8-7.0 μm, S.S.I. 67.5 %; White plains, on deciduous wood, *Underwood* s.n., V-1897 (RLS.69.NY.20.21) (K. 661a-b), basidiosp. a: 9.0-9.9-11.0 × 5.5-6.5-7.5 μm, S.S.I. 66.2 %, b: 11.0-11.9-13.0 × 6.0-7.2-8.0 μm, S.S.I. 60.7 %.

NEW JERSEY: Pennsville, on decaying log of *Acer rubrum*, *Commons* s.n., 17-IX-1894 (RLS.77.NY.9) (K. 1054a-b), basidiosp. a: 10.0-10.4-11.0 × 6.0-6.9-7.5 μm, S.S.I. 66.4 %, b: 9.5-10.3-11.0 × 5.5-6.3-7.0 μm, S.S.I. 60.9 %.

OHIO: Anderson Twp., Hamilton County, on *Cercis canadensis*, *W. B. Cooke & V. G. Cooke* 55 238, 29-X-1977 (A. 7066) (BR), basidiosp. 10.5-11.1-12.0 × 6.0-6.6-7.0 μm, S.S.I. 60.4 %; J. Bryan State Park, Green County, on rotten hardwood wood, *Morton* s.n., IV-1972 (A. 7064) (BR); Chillicote, among *Datura stramonium*, *Haid & Atkinson* 19 560 (RLS.69.CUP.5) (K. 646b) (type of *G. subperforatum* Atk.), basidiosp. 9.0-10.2-11.0 × 5.5-6.6-8.0 μm.

ILLINOIS: Cypress, on *Fraxinus nigra*, *Humphrey* 1342, 24-XI-1913 (RLS.55.K.72) (A. 2506b), basidiosp. 9.5-9.9-11.0 × 6.0-6.5-7.0 μm, S.S.I. 65.8 %.

MISSOURI: Perryville, circa *Quercus truncos vetustos*, *Demetrio* (Rabenh.-Wint. Fungi Eur. 3430), 20-VIII-1885 (A. 1300) (BR), basidiosp. 8.5-9.7-10.5 × 6.0-6.5-7.0 μm, S.S.I. 67.2 %.

SOUTH CAROLINA: Aiken, s. hosp., *Ravenel* s.n., s. dat. (RLS.55.K.2), basidiosp. 11.0-11.4-11.5 × 6.5-7.7-8.5 μm, S.S.I. 67.5 %.

LOUISIANA: St Tammany Parish, s. hosp., *Welden* 257, 19-I-1956 (RLS.66.L.22) (K. 380), basidiosp. 10.0-10.9-11.5 × 7.0-7.2-8.0 μm, S.S.I. 66.6 %; Batture (New Orleans, Jefferson Parish), s. hosp., *Reid* s.n., 17-VIII-1968 (RLS.69.K.33-34-35) (L. 94a-b-c), basidiosp. a: 8.5-9.0-10.0 × 6.0-6.3-6.5 μm, S.S.I. 62.5 %, b: 10.0-10.9-12.0 × 6.5-6.9-7.5 μm, S.S.I. 63.8 %, c: 10.5-10.7-11.5 × 6.5-6.9-7.5 μm, S.S.I. 64.7 %; Audubon Park (New Orleans), s. hosp., *Reid* s.n., 21-VIII-1968 (RLS.69.K.20) (K. 639), basidiosp. 9-9.9-11 × 6.5-6.9-7.5 μm, S.S.I. 69.3 %.

TEXAS: s. loc., s. hosp., *Long* 191, s. dat. (RLS.62.K.42) (A. 3907), basidiosp. 9.5-10.6-12.5 × 7-7.2-8 μm, S.S.I. 67.9 %; on *Liquidambar styraciflora* (dead fallen trees), s. coll., Timber and forest disease survey 12 123, 21-XI-1911 (RLS.69.NY.23) (K. 663a), basidiosp. 9.5-10.3-11.0 × 6.0-6.8-8.0 μm, S.S.I. 66.2 %; as preceding (RLS.69.NY.24) (K. 663b) (type of *G. sessile* Murrill), basidiosp. 10.0-10.9-12.0 × 5.5-6.8-8.0 μm, S.S.I. 62.1 %; Bedford Park, on old stumps of oak, s. coll. (RLS.69.NY.22) (K. 662a), basidiosp. 9.5-10.2-11.5 × 6.0-6.7-7.0 μm, S.S.I. 65.7 %.

CALIFORNIA: Searsville, on *Quercus lobata*, *Copeland* s.n., X-1902 (RLS.55.NY.23) (A. 2365a) (typus of *G. polychromum* (Copel.) Murrill), basidiosp. 9.5-9.7-10.5 × 6.5-7.2-8.0 μm, S.S.I. 74.4 %; s. loc. (South California), on dead *Quercus agrifolia*, *Johnston* s.n., s. dat. (RLS.62.K.32) (A. 3897), basidiosp. 10.0-10.8-12.0 × 6.5-7.0-7.5 μm, S.S.I. 64.8 %.

CUBA: Alto Cedro, on dead wood in low dense virgin forest, *Earle & Murrill* 536, 19-III-1905 (RLS.55.NY.15) (type *G. praelongum* Murrill), basidiosp. 11.0-11.7-12.5 × 6.5-7.5-8.5 μm, S.S.I. 64.1 %; Santiago de las Vegas, s. hosp., *Earle* 658, 5-VII-1904 (A. 2362a) (BR), basidiosp. 9.0-10.0-10.5 × 7.0-7.6-8.0 μm, S.S.I. 76 %.

MARTINIQUE: Fort de France, *Jacquenoud* s.n., 17-IV-1971 (C. 881) (BR), basidiosp. 9.5-10.1-10.5 × 7.0-7.7-8.5 μm, S.S.I. 76.4 %.

GUADELOUPE: s. loc., s. hosp., *Palmer*, s.n. (in herb. Berk. 1879), s. dat. (RLS.61.K.31) (A.3652a), basidiosp. 9.5-10.4-12.5 × 7.0-7.6-8.0 μm, S.S.I. 73.1 %; s. loc., s. hosp., s. coll. (herb. Berk. 1879) (RLS.61.K.32) (A. 3652b), basidiosp. 10.0-11.2-12.5 × 6.5-7.2-8.0 μm, S.S.I. 64.3 %.

VENEZUELA: s. loc., s. hosp., *Chaffangeon* s.n., 1885 (RLS.53.PC.40) (A. 1992a) (typus *G. chaffangeonii* Pat.), basidiosp. 10.0-11.3-12.5 × 7.5-8.1-9.5 μm, S.S.I. 71.7 %; same as preceding (A. 1992b), basidiosp. 9.5-10.4-11.0 × 7.0-7.2-7.5 μm, S.S.I. 70.3 %.

BRAZIL: Sao Leopoldo, in truncis, *Rick* (Fungi austro-americi 135), 1905 (PC) (A. 2160b), basidiosp. 9.5-10.9-12.0 × 6.5-7.5-8.0 μm, S.S.I. 68.8 %.

MOROCCO: Rabat, à la base de *Schinus terebenthifolius*, *Boutin* s.n., (herb. Malençon, Champ. du Maroc 4.629), summer 1962 (B. 513) (BR), basidiosp.

9.5-10.4-11.0 × 6.5-7.1-8.0 μm, S.S.I. 68.8 %; quelques km au delà de El Hajeb vers Meknès, sur *Quercus*, Rammeloo 2430, VII-1971 (RLS.76.Gent.1), (K. 1040), basidiosp. 10.5-10.9-12.0 × 6.0-6.5-7.0 μm, S.S.I. 60.1 %.

ZAÏRE: Parc Nat. Albert, riv. Sinamboro, sur arbre mort, de Witte 11770, 25-I-1965 (C. 326a) (BR), basidiosp. 10.5-11.0-12.0 × 6.5-6.9-7.5 μm, S.S.I. 62.7 %.

RWANDA: Butare, on old stump of *Acacia*, Rammeloo 3915, 21-VII-1974 (RLS.75.Gent.12) (K. 1019), basidiosp. 10.0-11.4-14.0 × 6.5-6.7-7.0 μm, S.S.I. 58.5 %.

KENYA: Lake Naivasha (hippo point), on dead *Acacia xanthophloea* stump, Pegler K. 160, 21-III-1968 (RLS.69.K.47) (L.107), basidiosp. 9.0-10.0-10.5 × 6.5-6.7-7.5 μm, S.S.I. 67.2 %; Subukia valley (alt. 2013 m), on *Acacia* sp. (*A. abyssiniva* or *A. labai*), Griffin s.n., 15-VI-1967 (RLS.69.K.30) (K. 499), basidiosp. 8.5-9.7-10.5 × 6.0-6.8-8.5 μm, S.S.I. 70.3 %.

SOUTH AFRICA: Transvaal, on stems of live *Salix* sp., *Sellschop* s.n. (Pretoria-Pl. Protect. Inst. 30 526), III-1939 (RLS.74.PRE-PPI 16-17) (B. 837a-b), basidiosp. a : 9.0-10.2-11.0 × 5.5-6.5-7.0 μm, S.S.I. 64.2 %, b : 9.5-10.5-12.0 × 6.0-6.9-8.0 μm, S.S.I. 65.4 %.

GANODERMA PARVULUM COMPLEX

Ganoderma bibadiostriatum Steyaert was published (Steyaert 1962) for a species that has in the context deposits of melanoid substances in two distinct lines; since then quite a number of supplementary specimens exhibiting the same feature have been examined and studied.

It now appeared that a least two species, if not three are involved : *G. parvulum* Murrill, *G. stipitatum* Murrill and *G. bibadiostriatum* Steyaert.

The type specimen of *G. parvulum* Murrill, unfortunately reduced to a half basidioma, has been described as sessile, whereas the two other species are definitely stipitate, but otherwise morphologically distinct from one another. *G. stipitatum* has pilei up to 80 mm in diam. (according to available specimens), whereas those of *G. bibadiostriatum* in their full spore bearing stage have a diameter less than 30 mm. The first species has a short and rather thick stipe, much shorter than the pileus radius, whereas the second has a relatively thin stipe, somewhat equal in length to the pileus radius. *G. stipitatum* has a context much thicker than its tube layer, sometimes with ramifications of the upper layer of melanoid substances which considerably harden the context.

In many respects the type specimen of *G. parvulum* resembles *G. stipitatum*, but its small size (22 mm in radius in the spore bearing stage) seems to preclude any identification with it. On the other hand, the absence of a stipe (unless it has been broken off

in the cutting up of the specimen) or the relatively thick context, that is noticeably thicker than the tube layer likewise precludes identification of *G. parvulum* with *G. bibadiostriatum*, which is less than 20 mm thick with context and tube layer of equal thickness. It appears therefore that three species are involved, although the type specimen of *G. parvulum* remains unmatched.

The three species have basidiospores that are of the same type with relatively numerous but very short echinules. However, there seems to be a difference in their spore shapes.

13. *Ganoderma parvulum* Murrill, N. Am. Fl. 9 : 123 (1908).

Basidioma nearly circular in outline, attached at a point, cutis glabrous, laccate, azonate, slightly tubercular, very lightly marked by a few concentric furrows; margin acute.

Section : cutis very thin, between 60 and 100 μm thick, dark reddish brown; context about two-thirds of pileus thickness, entirely light ochraceous buff with two horizontal layers of carob brown melanoid substances; up to two-thirds of the context from the base; tube layer about one third of pileus thickness, slightly russet.

Cutis of the hymenoderm type, with elements cylindrical to slightly clavate, 20 × 5-6 μm; context hyphae pale, subantiline, much ramified. Pores circular 120-140-160 μm; dissepiments 30-55-90 μm diam., distance between axes 195 μm. *Basidiospores* buff, 7.5-8.1-8.5 × 5.5-5.9-6.5 μm, S. S. I. 72.8 %.

NICARAGUA : s. los., decayed wood. Smith. s.n., 1891-1892 (RLS.55.NY.13) (A. 2358a) (holotypus), basidiosp. vide supra.

Note : In describing this fungus one must rely mostly on Murrill's description (Murrill 1908), certainly based on examination of the specimen in a fresher state than it is now and probably when it was entire.

14. *Ganoderma stipitatum* Murrill, Bull. Torrey Bot. Club. 30 : 229 (1903).

Basidioma small to median sized, mostly flabellate, sometimes of irregular shape, up to 65 mm diam., with short stumpy stipe, plagiopleurupode, sometimes up to 30 mm long and 5 mm diam.; upper surface carob brown, semilaccate; margin rounded, white when actively growing.

Section: cutis very thin, less than 50 μm thick, laccate, *carob brown*; context at least two-thirds of pileus thickness, *warm buff*, with lines of *carob brown* melanoid substances deposits and other non linear inclusions conferring extreme hardness to the pileus; tube layer about one third of pileus thickness, *cinnamon brown*.

Cutis hymenodermiform, cutis elements cylindrical to subclavate, $35 \times 4.5 \mu\text{m}$. Pores circular, 130-160 μm diam.; dissepiments 50-75 μm thick, distances between axes 180-235 μm . *Basidiospores*: $7.0-7.8-10.5 \times 4.5-5.7-6.5 \mu\text{m}$, S. S. I. 72.9 %.

NICARAGUA: s. loc., s. hosp., *Smith* s.n., s. dat., (RLS.55.NY.12) (A.2355b) (holotypus), plagiopleuropode, basidiosp. $7.0-7.8-10.5 \times 4.5-5.5-6.5 \mu\text{m}$, S.S.I. 70.4 %.

COSTA-RICA: Finca Navarra, on rotten log, *Maxon* 615, 21/23-V-1906, (RLS. 55.NY.24) (A. 2365b), basidiosp. $7.0-7.8-10.5 \times 4.5-5.4-6.0 \mu\text{m}$, S.S.I. 69.2 %.

SURINAME: Brokobaka, op hout, *Oort* 20, 2-III-1962, (RLS.72.L.21-22) (A. 6962a-b), basidiosp. a: $7.0-7.8-9.0 \times 5.0-5.3-5.5 \mu\text{m}$, S.S.I. 68.1 %; b: $7.0-7.7-8.1 \times 5.0-5.2-6.0 \mu\text{m}$, S.S.I. 68.2 %.

BOLIVIA: Prov. Nor-Yungas, Dept. La Paz, river Charobamba, on dicot. trunk, *Singer* B 1155, 13-II-1956 (RLS.61.K.88) (A. 3617), plagiopleuropode, basidiosp. $7.0-7.6-8.0 \times 5.5-5.8-6.5 \mu\text{m}$, S.S.I. 76.3 %.

15. *Ganoderma bibadiostriatum* Steyaert, Bull. Jard. Bot. Etat Brux. 31: 99 (1962).

Basidioma spatulate to flabellate, pileus 2-3 cm diam., stipe 1-3 cm long, up to 5 mm thick; upper surface *warm blackish brown*, dull to sublaccate, with concentric folds spaced at 1-2 mm; margin incurved, pore surface *verona brown* in dry specimens (probably white when fresh).

Section: cutis about 40 μm thick, *warm blackish brown*, context thin, up to 3 mm thick, cinnamon, enveloping extremity of pore layer, with double horizontal dark brown streaks of melanoid substances; tube layer up to 5 mm thick, darker cinnamon than context.

Cutis hymenodermiform, elements cylindrical to subclavate, $20-35 \times 4-5 \mu\text{m}$; context hyphae subanticline to anticline, about 3 μm diam., with intermixed hyaline-hyphae 1-2 μm diam. Pores circular, 100-124-170 μm diam.; dissepiments 20-48-80 μm , distance between axes 170 μm . *Basidiospores* ovoid to subellipsoid, pale yellow to pale yellowish brown, $7.0-9.3-11.0 \times 5.5-6.5-7.5 \mu\text{m}$, S. S. I. 67.4-70.0 %.

BRAZIL: Rio de Janeiro, Mesa do Imperador, alt. 450 m, s. hosp., *Fidalgo* & *Kauffmann Fidalgo* (F. 44), 3-III-1955 (A. 2654b) (BR) (holotypus), basidiosp.

$9.0-9.4-10.0 \times 6.0-6.8-7.5 \mu\text{m}$, S.S.I. 72 %; Rio Jurua, s. hosp., *Prail* 107, 20-X-74, (RLS.61.K.39) (A. 3658a-b), basidiosp. a: $9.0-9.4-10.0 \times 6.0-6.7-7.5 \mu\text{m}$, S.S.I. 71.4 %; b: no spores.

PERU: Iquitos, Rio Navair, Aguas blancas, sobre tronco podre, *Occhioni* 16 RB. 4.5.03, 27-X-1927, (A. 2645a-b) (BR), basidiosp. $8.0-8.6-10.0 \times 5.5-5.8-6.5 \mu\text{m}$, S.S.I. 67.4 %; ditto, *Occhioni* RB. 4.5.03, 27-X-1927, (BR) (A. 2654a), basidiosp. none.

VENEZUELA: Guatopo, between Ocomare del Tuy et Altragracia, Estado Miranda, *Dennis* 1457, 25-VI-1958, (BR) (A. 3061a), basidiosp. $7.0-8.0-8.5 \times 5.5-5.9-6.0 \mu\text{m}$, S.S.I. 73.3 %.

DISCUSSION ON THE DISTRIBUTION OF SOME GANODERMA SPECIES

What has been revealed above on the discussion of *G. amazone* Weir brings to the fore the question of the intercontinental distribution of some of the *Ganoderma* species.

Of the four subgenera, into which the genus is now divided, subgenus *Ganoderma* is undeniably the most prolific in species. When some species such as *G. eminii* Henn. and *G. alluaudei* Pat. & Har., that have outstanding characteristics, are considered, their area of distribution is easily established. For most of the other species with more obscure characters the establishment of their area of distribution demands much closer investigations.

A case in point is the distribution of *G. multiplicatum* (Mont.) Pat., a species which appears to modify its morphology, probably as a result of environmental conditions. Anyway, it is now established without doubt that *G. multiplicatum* is an Americano-African species extending from Honduras and the Amazon valley to at least the Seychelles Islands. The Indian and Indonesian specimens available for study have been unfortunately too few for the importance of this species in the Asiatic tropics to be assessed or to show whether its distribution closes the periglobal circle by way of islands as stepping-stones across the Pacific Ocean.

Within the group of species with a *G. lucidum* (Curtis ex Fr.) Karst. type of basidiospore, that is those with relatively long and few echinules of medium thickness, one has: *G. curtisii* (Berk.) Murrill, *G. ravenelii* Steyaert and *G. tsugae* Murrill. Each of these species differs from *G. lucidum* by at least one character. Whereas *G. lucidum* has long and cylindrical (Steyaert 1967: fig. 14) cutis hymenoderm elements, *G. curtisii* has obovate or pyriform elements. *G. lucidum* has ovoid basidiospores with a collapsed apex, whereas

G. ravenelii has ellipsoidal ones and *G. tsugae* basidiospores have a permanent apex supported by one or two long echinules. No American specimen has these three distinctive characters of *G. lucidum* combined. There is thus no effective evidence that the distribution of *G. lucidum* extends to North America which confirms W. Murrill's opinion on the matter.

With regards to *G. tsugae* it should be recalled here what has been stated above of the identity of its characters with those of *G. mongolicum* Pillat. *G. tsugae* seems however to be associated exclusively with *Tsuga canadensis* on the American continent which is a plant distributed only across the latter's eastern half. Does this indicate that there exists in Mongolia a *Tsuga* indistinguishable from *Tsuga canadensis*?

EXCLUDED SPECIES

Ganoderma neglectum Pat., Journ. Bot. 1 : 169 (1887).

There is in the Herbarium in Paris (PC) a specimen determined by Patouillard as *Ganoderma neglectum* Pat. with the inscription « specimen authenticum ». As Patouillard (1887) in his publication neither fixed the type specimen nor mentioned the collector, the so-called authentic specimen might be considered as the closest approximation to a type.

The description of *G. neglectum* (Patouillard 1887) cites however « ... spores globuleuses (in italics) (11-12.6 μm) portant de grosses verrues arrondies ... » This description of the basidiospores is not borne out when the « authentic specimen » is examined; the basidiospores one finds in the tubes in relative abundance are totally at variance with it. They are ovoid, with very fine short echinules, only perceptible under an immersion objective. They measure 7.5-8.2-9.0 \times 5.0-5.7-6.5 μm .

Considering the description of the basidiospores one may doubt that the species described by Patouillard was in fact a *Ganoderma*. The spore dimensions given would rather suggest an *Amauroderma*, but among the latter, where in the majority of the species the basidiospore echinules are short and thin, two species, *Amauroderma fasciculatum* (Pat.) Torrend and *A. renidens* (Bres.) Torrend have basidiospores with relatively sizable warts or at least thick echinules.

The sizes of the basidiospores in these species however do not agree with those given by Patouillard for *G. neglectum*. Those of *A. fasciculatum* measure 13-14.5 \times 9-11 μm and those of *A. renidens* 6.5 \times 8.5 μm ; the sizes are either too big or too small. Moreover *A. fasciculatum* and *A. renidens* are stipitate species, whereas *G. neglectum* was described by Patouillard as resupinate on the underside of branches. Of the two species, only *A. renidens* is known from South America, whereas *A. fasciculatum* is known only from Africa.

It seems unlikely that a *Ganoderma* would develop on branches. None of the other specimens examined by the author is reported in such a position.

The conclusion is that *G. neglectum* should be considered a nomen dubium and excluded from *Ganoderma*.

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