

How many species are there?

James Ginns

1970 Sutherland Road, Penticton, British Columbia, V2A 8T8, Canada

Email: ginnsj@em.agr.ca

Abstract: A survey of the Corticioid fungi of North America lists 919 species. This is more than a 100% increase since the 1926 monograph by E. A. Burt. The species are distributed among 165 genera with 126 (76%) genera containing fewer than 6 species. The need for baseline data is noted and the hazards in compiling data from the literature are illustrated and discussed. The numbers of species in various regions of the World are compared.

INTRODUCTION

Some systematists are concerned with numbers of specimens, because they are necessary to evaluate, for example, habitat preferences, geographic distribution, or variation of characters within a species. Other systematists measure numbers of, if one is a mycologist, spores, cystidia or basidia to accumulate statistically significant data. And a few systematists are interested in numbers of species.

When the topics of rare species, species conservation, and biodiversity (see synopses by Hawksworth, 1991, 1992) became popular, I became more interested in the numbers of species of the Corticiaceae s.l. in North America. There were several reasons for my interest. First, a critical review of the species was needed, primarily because the past 65 years of literature was widely scattered. Second, there was no current, coherent body of baseline data for North America. And, most mycologists had a 'casual ignorance' of the size of the group and of its relevance in the functioning of the ecosystems where the species occur.

The importance of baseline data cannot be over-emphasized. Before species can be labelled 'rare' there has to be data on their distribution and occurrence in the past and at present. Such information is available for very few of the species in North America. Before fungal species can be proposed for conservation we need data on their habitats. And before the fungal biodiversity of an area, whether a country, a park, or an ecosystem, can be assessed, it is necessary to have data on the numbers of individual species in the area being studied.

Baseline data for a park or country can be ac-

cumulated in two ways. First, by collecting within the area, see, for example, Parmasto & Parmasto (1997). Second, by searching the scientific literature for reports of species from the area. The current emphasis on biodiversity studies should promote the accumulation of baseline data. Therefore, it seems appropriate to briefly review the status of the numbers of the Corticioid fungi in North America.

DEFINITIONS

The term 'North America' includes just Canada and the United States, excluding Hawaii. These countries cover 7,466,913 square miles (1,933,855,800 hectares) and include a variety of habitats from subtropical to arctic tundra. The term 'Corticioid fungi,' proposed by Parmasto (1995), is convenient because it is general, has no taxonomic status, thus can encompass species in several orders and families. It is used to refer to the Aphyllorales with effuse, sometimes reflexed, primarily nonporoid basidiomes.

NUMBERS OF SPECIES

The only monograph of the Corticioid fungi of North America is E. A. Burt's "Thelephoraceae of North America," and ancillary papers (1914-1926). He had a much broader concept of the Corticioid fungi and of North America than defined above. Thus, to accurately compare Burt's data with current data only species of Corticioid fungi are included from his broad concept of the "Thelephoraceae," and only species from Canada or the United States are included. On

this basis, Burt treated 441 species of Corticioid fungi, which were distributed in 18 genera.

In studying some species treated by Burt, I found that his detailed citation of collection data for each specimen examined to be extremely valuable, because they made it possible to confirm species concepts, geographic distributions, and morphological features. However, problems became evident. The following two examples illustrate the problem of species concepts. First, Burt (1926) proposed a new species, *Corticium ravum* Burt (now *Conferticium ravum* (Burt) Ginns & Freeman). The five collections Burt cited from the United States were studied and only one specimen was judged conspecific with the holotype. Two specimens were two different species of *Gloeocystidiellum* and one specimen was neither *Gloeocystidiellum* s.l. nor *Conferticium*. The second example is Burt's treatment of *Corticium auberianum* Mont., a species originally described from Cuba. He cited 10 specimens from the United States. Ginns (1992) studied the ten and reassigned them to eight species in six genera (Table 1). Was Burt's species concept extremely broad or did he misidentify specimens?

Recently, Ginns & Lefebvre (1993), and Ginns (1998), following a survey of over 600 references, a critical evaluation of the synonymy, and study of some poorly known species (see Ginns 1992), recognized 919 species in North America. One hundred thirty species are known only from the

Table 1. *Corticium auberianum* Mont., specimens from the United States cited by Burt (1926).

Locality	Redetermination
Arkansas	<i>Peniophora</i> sp. nov. (2 specimens)
Florida	<i>Phanerochaete</i> sp.
Georgia	<i>Scytinostroma</i> sp. 1
Louisiana	<i>Scytinostroma</i> sp. 2 (2 specimens)
North Carolina	<i>Hyphoderma</i> sp.
South Carolina	<i>Corticium</i> sp.
Vermont	<i>Hyphodontia</i> sp. 1 & sp. 2

type specimens (holotype and often paratype specimens). Some of these, as well as some other species, lack detailed descriptions and illustrations. And only 33% of the species have been described in culture (Ginns, unpubl.). Nevertheless, in the 67 years since Burt's monograph our knowledge of the Corticioid fungi has increased by more than 100%.

GENERA COMPRISING THE MYCOFLORA

The 919 species are distributed in 165 genera (Ginns 1998). Most genera are small (Table 2); 126 genera have fewer than six species. The 15 largest genera are listed in Table 3, and they account for 44% of the species.

Table 2. Size of the genera of Corticioid fungi in North America.

Number of species	Number of genera ¹
1	45
2	36
3	21
4	17
5	7
6 to 9	7
10 to 19	14
20 to 54	12

¹ Data from Ginns (1998).

COMPARISON WITH OTHER GEOGRAPHIC AREAS

The number of species of Corticioid fungi in the World and in several major regions are shown in Table 4. Unfortunately there is no readily available number for all of Europe. The figure of 1845 species in the World was calculated by adding the species numbers given by Hawksworth et al. (1995) for the families or orders of Corticioid fungi.

Table 3. The fifteen largest genera of Corticioid fungi in North America.

Name	Number of species ¹
<i>Athelia</i>	21
<i>Botryobasidium</i>	22
<i>Dendrothele</i>	17
<i>Hymenochaete</i>	22
<i>Hyphoderma</i>	40
<i>Hyphodontia</i>	30
<i>Peniophora</i>	36
<i>Phanerochaete</i>	28
<i>Phlebia</i>	29
<i>Sistotrema</i>	21
<i>Stereum</i>	22
<i>Thelephora</i>	17
<i>Tomentella</i>	54
<i>Tubulicrinis</i>	20
<i>Tulasnella</i>	23
Total	402

¹Numbers from Ginns & Lefebvre (1993), except *Botryobasidium* from G. Langer (1994) and *Hyphodontia* from E. Langer (1994).

DISCUSSION

The question 'How many species of Corticiaceae are there?' will not be answered in the near future or, perhaps not, in the next few decades. The principal reason is that there are many geographic regions and ecological niches in the World that have not been sampled. And there are problems of synonymy and species concepts to be resolved.

When collating numbers of species reported in published studies some hazards became obvious. The examples from Burt's work illustrate the need for caution when compiling data from earlier authors. The question of species con-

Table 4. Corticioid fungi - Worldwide distribution.

Area	Number	Source
Canada & United States	919	Ginns (1998)
North America	1320	Ginns unpubl.
South America	363 ¹	Hjortstam & Larsson (1994)
North Europe	463 ¹	Eriksson & Ryvarden (1973-1976), Eriksson et al. (1978-1984), Hjortstam et al. (1988a & b)
Africa	488 ¹	Hjortstam & Larsson (1994)
Asia	343 ¹	Hjortstam & Larsson (1994)
Australasia	210 ¹	Hjortstam & Larsson (1994)
World	1845	Hawksworth et al. (1995)

¹Cyphellaceae and Thelephoraceae not included.

cepts has to be resolved before early and current studies can be accurately compared. And before the number of species treated by Burt can be compared with recent counts, it is necessary to have an understanding of the synonymy to prevent one fungus from being counted several times simply because it has appeared under different names in the past. Thus, 441 species of Corticioid fungi in Burt's monograph and the 919 in Ginns (1998) must be interpreted as approximately correct.

The large number of small genera in the Corticioid fungi is primarily a result of splitting of the large Friesian genera to remove discordant elements and improve the homogeneity of the parent genus. Parmasto (1991) presented

an erudite discussion of the phenomenon/problem of the relatively new, small genera of the Corticioid fungi. His general conclusion was that many of the small genera are not justified. Although the Corticioid fungi in various regions of the World (Table 4) were compared, the data is weak. The tally of 1845 known species in the World seems conservative because over 1600 species are known in just North America and some tropical areas (Ginns, unpubl.). The relatively few species reported for Africa, Asia, Australasia, and South America are an indication of our lack of knowledge of the fungi in these areas. Although this discussion dealt with the known species, the totals have little relevance to the actual number of species, because there may be hundreds of still undescribed species in the World.

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