

# Albatrellus syringae (Albatrellaceae) in Fennoscandia and the Baltic region: ecology and distribution

ALFRED GRANMO and GEIR MATHIASSEN

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The immigration and establishment of *Albatrellus syringae* (Parmasto) Pouzar in Estonia, Finland, Sweden and Norway since it first appeared in 1901 is explained. The species is shown to be an example of a spontaneously expanding fungus in Fennoscandia, rising from anonymity in the first half of the 1900s to be annually recorded from new localities during the last three decades. It is now distributed in a majority of the provinces in each of the treated countries. Ecologically six different types of habitats have been recognized. In general the species profits by diverse ruderal sites, but is also found in undisturbed forest habitats. Its association with different woody species, including lilac (*Syringa*), appears purely accidental, and the fungus is stated to be a saprobe, perhaps also a root necrotroph. The history of dispersal of *A. syringae* in Fennoscandia and the Baltic region the past century is illustrated by distribution maps for consecutive periods.

Key words: *Albatrellus*, Baltic region, distribution, ecology, Estonia, Europe, Fennoscandia, Finland, Norden, Norway, Sweden

Alfred Granmo & Geir Mathiassen, University of Tromsø, Tromsø Museum – University Museum, Botanical Department, N-9037 Tromsø, Norway

## Introduction

The terrestrial polypore *Albatrellus syringae* (Parmasto) Pouzar appeared to have a very restricted distribution when first described by Parmasto (1962), based on material from Tartu, Estonia, in the period 1945 – 1960. Since then, and up to the year 2000, there has been a continually increasing number of records of the species in Fennoscandia, while there are a few records from the Baltic region. It is still missing in remaining Norden, viz. Denmark, the Faeroe Islands and Iceland. The genus *Albatrellus* also includes species as *Albatrellus confluens* (Alb. & Schwein.) Kotl. & Pouzar and *A. ovinus* (Schaeff. :

Fr.) Kotl. & Pouzar, both well-known in North Europe, as well as the North American *A. peckianus* (Cooke) Niemelä.

Niemelä (1970) reported *Albatrellus syringae* in Fennoscandia, then known to him from two localities in Finland (dated 1962 and 1968), and one from the province of Norrbotten in Sweden. He also cultured it, and compared the species to *A. peckianus*. Up to 1986 the number of Finnish locations had increased to 19 (Erkkilä & Niemelä 1986). It was later reported from six localities in Medelpad and Västerbotten in Sweden by Eriksson (1979), and by Strid (1979) from Jämtland and

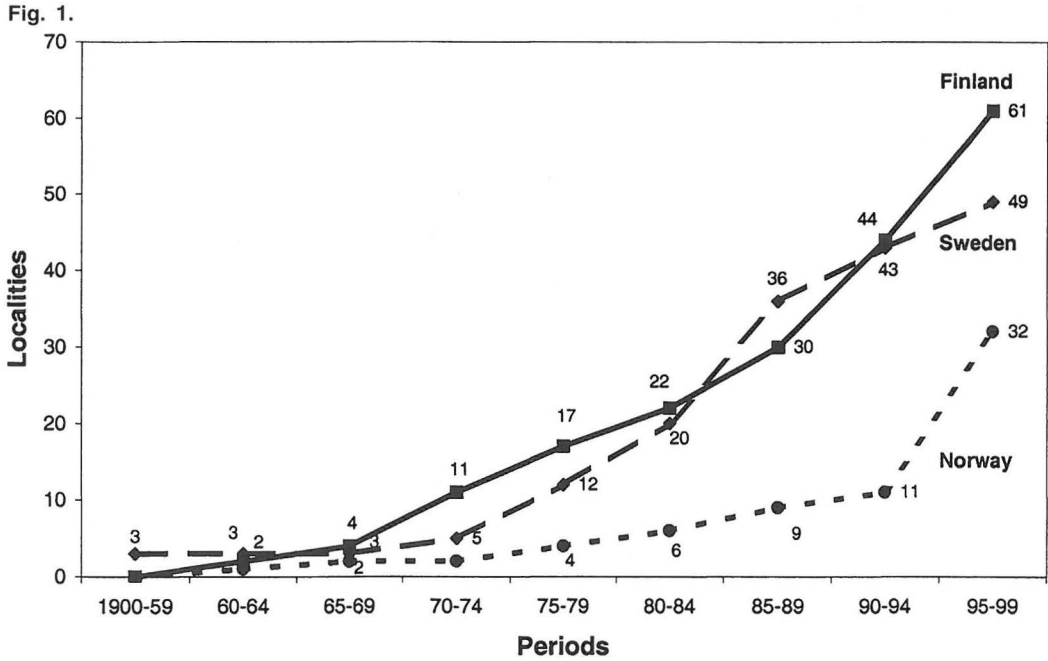


Fig. 1. Cumulative graphs for Finland, Sweden and Norway, showing number of localities of *Albatrellus syringae* during 1900–1959, and within each 5-year period during 1960–1999.

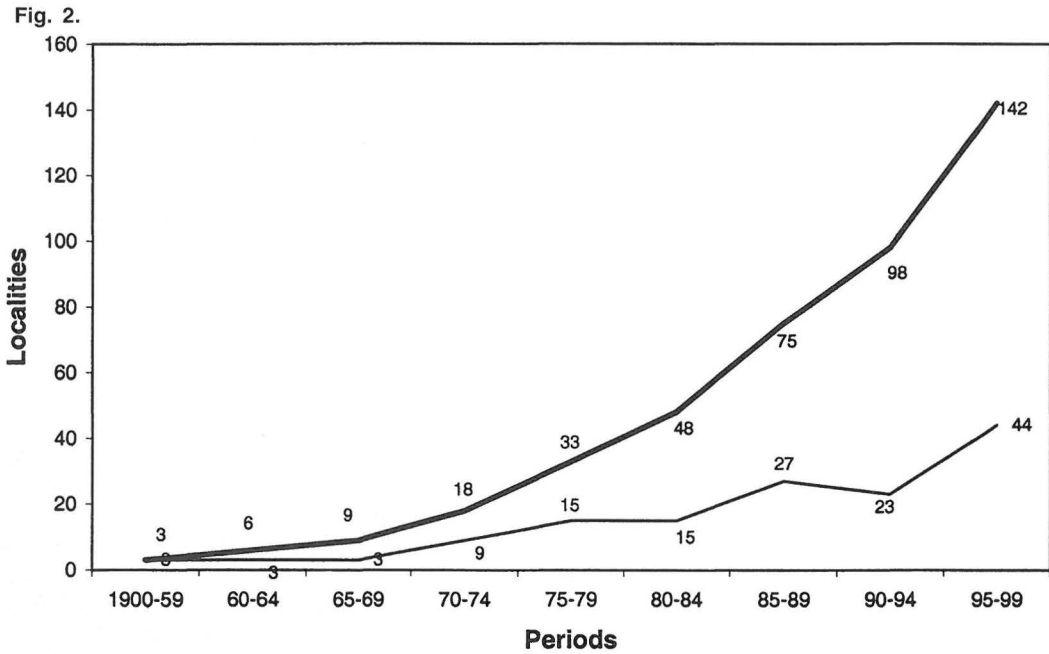


Fig. 2. Graphs showing total number of localities of *Albatrellus syringae* in Finland, Sweden and Norway in the periods 1900–1959, and in 5-year periods during 1960–1999. – Lower graph: Number of new localities in each period. Upper graph: Cumulative number of the localities in each period.

Västmanland, in addition to a second-hand record from Gotland. A small-scale map for Sweden and Finland was provided by Ryman & Holmåsén (1984). It was reported from Norway by Mørkved (1989: 137, one site in North Norway), Torkelsen (1991), and Smith (1997). The ecology and distribution in Norway was treated by Mathiasen et al. (2000).

The aim of our study was to get a picture of the dispersal and distribution of *Albatrellus syringae* in North Europe, and to sum up the ecological information we have about the species so far. Our data are from herbarium records, information from other mycologists, and from our own observations.

## Material and methods

Information about the distribution is primarily collected from the following herbaria (herbarium abbreviations according to Holmgren et al. 1990): BG, BILAS, C, GB, H, JYV, KUO, O, OULU, RIG, RIGB, S, TAA, TRH, TROM, TUR, TURA, UME, UPS, WI. In addition, colleagues and other persons in each of the Nordic countries have been consulted for supplementary informa-

tion. Material of old and critical records was examined, and a core collection of well preserved vouchers in TROM was subjected to an examination of outer and inner morphological features. The biological provinces of the Nordic countries used in "List of localities" are mapped in Hansen and Knudsen (1992).

To evaluate the history of dispersal, and for mapping purposes, we have tried to establish the number of new stations for the species within 5-year periods, rather than the number of collections (Figs. 1 and 2). Localities being more than 5 km apart have been recognized as different. We admit that it is difficult for people not having intimate knowledge of local conditions to assess which will be different sites according to this criterium. In cases of doubt we did not differ between possible sites. Consequently the number of sites may be a little underestimated.

## Results and discussion

### Ecology

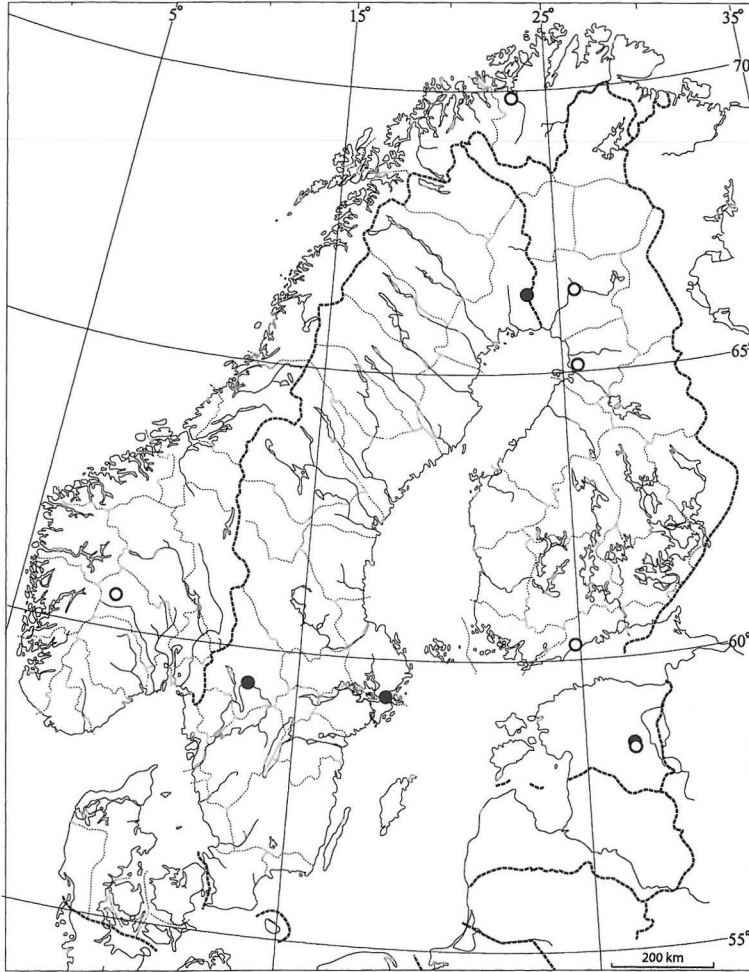
We have arranged the Norwegian, Swedish and Finnish voucher specimens according to type of habitat in which they were found (Tab. 1). The categories are thought to cover the main habitat types of the species in Fennoscandia.

Tab. 1. *Albatrellus syringae*. Number of collections and percentage frequency of different types of habitats. In parentheses: number of collections in the neighbourhood of a particular woody plant. – Informations from herbarium labels of 144 vouchers in H, O, OULU, S, TROM, TUR, UPS.

Type of habitat	No. of collections	Frequency	Notes of neighbouring trees or bushes
Cemetery, lawn, garden <i>Syringa</i> (1), <i>Tilia</i> (1), <i>Thuja</i> (1)	80	55.5	<i>Pinus</i> (4), <i>Quercus</i> (2), <i>Rosa rugosa</i> (1),
Woodland road, roadside, yard	22	15.3	<i>Alnus</i> (3), <i>Salix</i> (3), <i>Picea</i> (2)
Construction area, mine, gravel pit	14	9.7	<i>Salix</i> (1), <i>Picea</i> (1)
Deciduous forest	12	8.3	<i>Alnus</i> (5), <i>Salix</i> (3), <i>Betula</i> & <i>Salix</i> (3)
Conifer forest	5	3.5	<i>Picea</i> woods (3)
Mixed coniferous-deciduous forest	4	2.8	<i>Picea</i> & <i>Populus</i> (1)
Other types/unspecified habitats	7	4.9	–

More than half of the collections were from cemeteries, lawns and gardens (Tab. 1), and occurrences of nearby woody plants were supported for only 12.5% of the collections in this group. Various woody plants were observed, and only once a connection with *Syringa* (lilac) was re-

corded. Thus no particular tree or bush – of either a hardwood or a conifer – can be inferred to be a likely symbiotic partner. In fact, the small fraction of woody plants noticed in the first group, strongly implies that the fungus cannot be mycorrhizal.



Figs. 3 – 7. *Albatrellus syringae* in Fennoscandia and the Baltic region. Maps of distribution.

Circles: New localities in the current periods during 1960–1999. Black dots: Localities recorded in previous periods. – Fig. 3. Localities recorded during 1901–1969. Black dots: Localities during 1901–1959. Circles: 1960–1969.

Even if Parmasto (1962) did not observe *Albatrellus syringae* growing on the very wood of lilac, he obviously suspected a saprobic connection with the nearby decaying stumps and trunks of this ornamental. In Italy the fungus was found in a mixed *Picea–Alnus* wood, and, according to Bernicchia (1990), causes a brown cubical rot. Niemelä (1970: 56) cultured the fungus, and stated that the positive reaction in gallic acid agar medium suggested the ability of the species to cause a white rot. The investigations of Stalpers (1992) demonstrated that cultures of *A. syringae* (and *A. peckianus*) produced laccase, “indicating the ability to degrade lignin”, and, further

(Stalpers 1992: 541): “There is no indication of mycorrhiza.”. The laboratory studies are thus consistent as to the potential type of rot. Ginns’ (1997: 262) comments on the species in North America may be added: “... *Albatrellus peckianus* and *A. syringae* are typically associated with woody debris and may be lignicolous”.

To conclude, several reports of connection with woody remains, and also rather frequently encountered close to tracks and roads, in addition to laboratory studies, point to *Albatrellus syringae* as a saprobe causing white rot. In all likelihood it may also act as a root necrotroph.

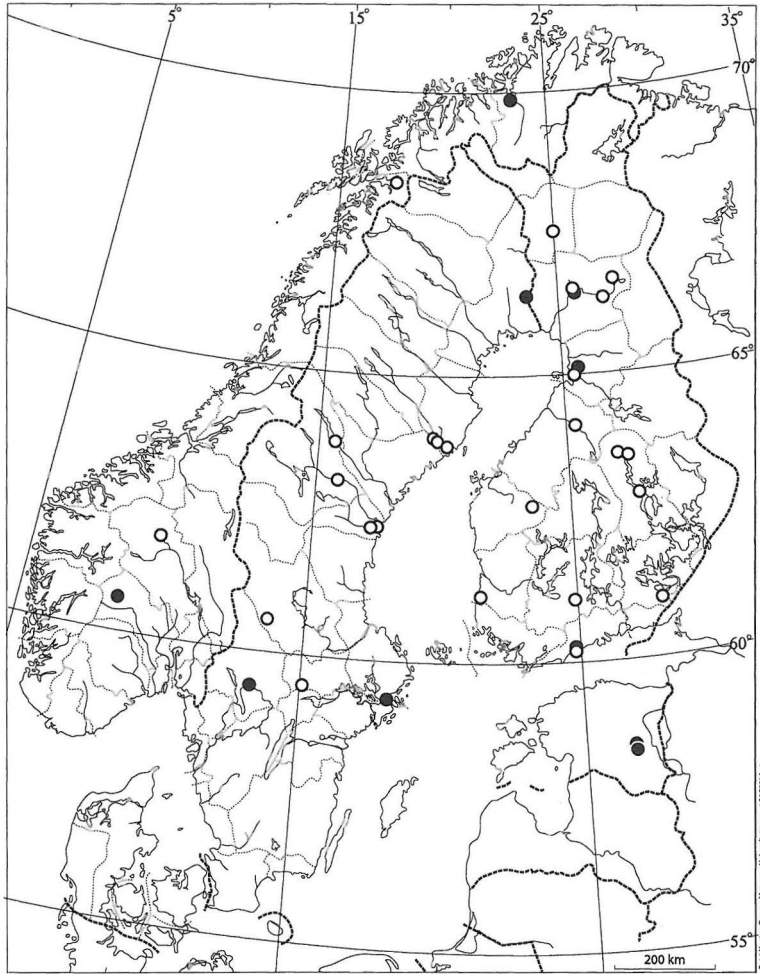


Fig. 4. *Albatrellus syringae*. Localities 1901–1979. Circles: 1970–1979 (expl.: Fig. 3).

**Dispersal and distribution in Fennoscandia and the Baltic region: past, present and future**

Several authors have suggested *Albatrellus syringae* to be a recent immigrant in the Nordic mycota that has greatly expanded its area of distribution in later years (Eriksson 1979, Ryman & Holmåsén 1984, Ryvarden & Gilbertson 1993). We agree in its accelerating expansion in modern times (cf. also Mathiassen et al. 2000), which obviously also has dissiminated to some other European countries. However, the history of *A. syringae* in Fennoscandia and the Baltic region

(Figs. 3–7) is at least a century old, dating back to its first find in Karlstad (prov. Värmland), Sweden, in 1901. The next find, also from Sweden, is from Stockholm, 1920. Another 25 years passed until it turned up in Tartu, Estonia in 1945, ultimately being described after having been observed in parks and cemeteries annually for about 10 years (Parmasto 1962). A connection between these early localities in terms of dispersal seems improbable, as does any connection to the next site, in northern Sweden (prov. Norrbotten), 1954 (Fig. 3). The period for a more continuous expanding phase in the region can be said to start shortly after 1960.

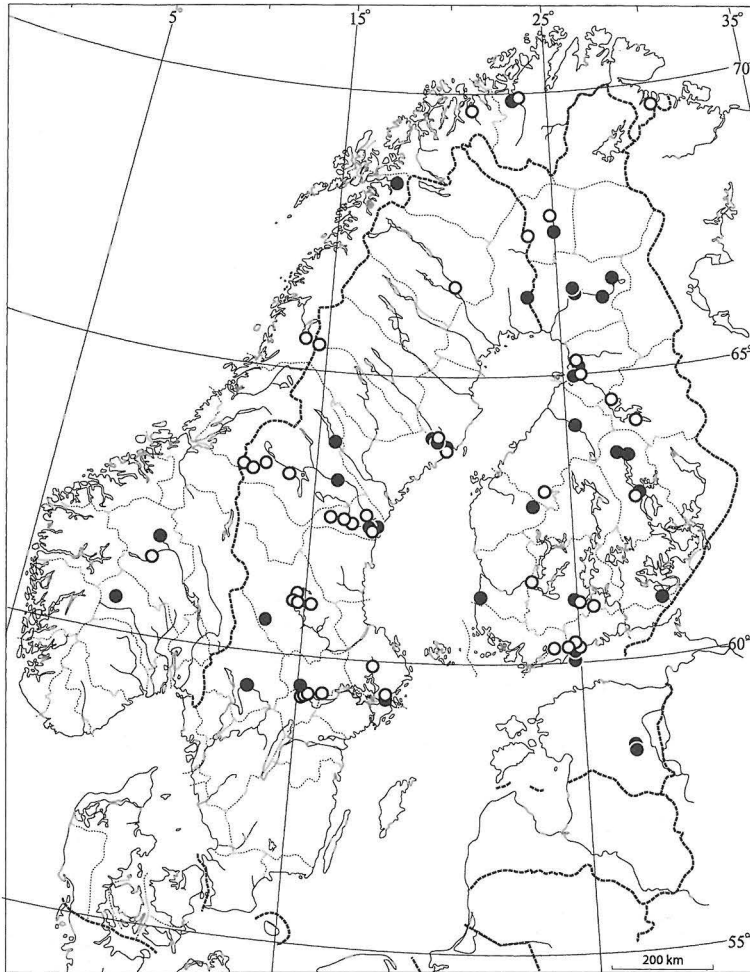


Fig. 5. *Albatrellus syringae*. Localities 1901–1989. Circles: 1980–1989 (expl.: Fig. 3).

Starting with a few isolated finds of *Albatrellus syringae* up to 1954, it is not easy to explain the sudden rise and dispersal of this polypore in Fennoscandia during the last three to four decades. According to Mathiassen et al. (2000) the expansion and establishment of *A. syringae* in Norway may have been facilitated by a growing number of appropriate sites, like lumber roads, construction areas, and lawns of different kinds, where we assume the competition with other species to be low. This may be true also for remaining Fennoscandia.

One may think of several environmental changes as possible causes for the establishment of new fungal taxa. We know for example that extensive use of fertilizers has increased the nitrogen content of the soil in large areas all over Europe, both in forested and cultivated land. Also phenoxyacids have been used to exterminate hardwood-bush in forestry and on roadsides. These treatments might have been beneficial in some way to *Albatrellus syringae*. Although speculative, one may also imagine genetic changes to have occurred in some population, making a particular

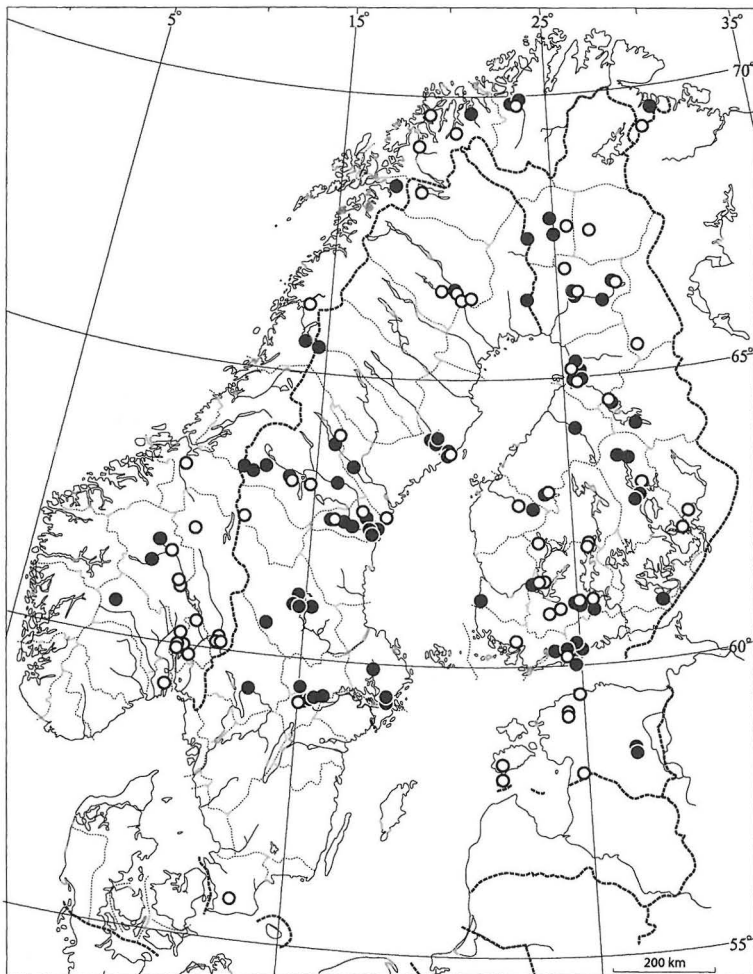


Fig. 6. *Albatrellus syringae*. Localities 1901–1999. Circles: 1990–1999 (expl.: Fig. 3).

genotype more efficient for instance in spore production, or in other ways increasing its fitness for the occupation of new habitats. A successful mutant could explain for the rapid spread and establishment of *A. syringae* in Fennoscandia. In any case, we don't believe that the Estonian sites are likely to be sources of the expanding taxon, and hardly any of the early Swedish localities, either.

According to Arnolds (1997: 125) there are few well-documented examples of spontaneously expanding fungi. Examples of recent establishment

of polypores in the Northwest European lowland are i.a. *Fomes fomentarius* (L.: Fr.) Fr., *Pycnoporus cinnabarinus* (Jacq.: Fr.) P. Karst., and *Schizopora carneolutea* (Rodway & Cleland) Kotl. & Pouzar, while the agarics *Stropharia rugosoannulata* Farlow and *Psilocybe cyanescens* Wakef. are examples of ruderal species becoming more frequent in Europe (Arnolds 1997). In Fennoscandia also the gasteromycete *Mutinus ravenelii* (Berk. & Curtis) E. Fisch. seems to expand its area (cf. Vessberg 1990), as it has done in central Europe since it first appeared there in 1943.

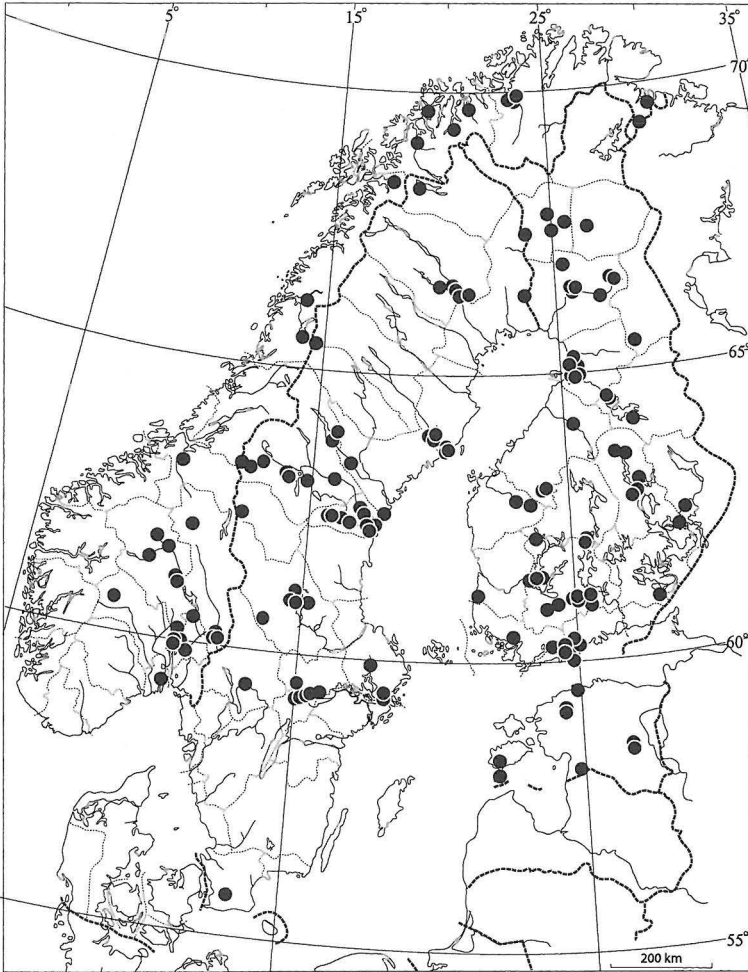


Fig. 7. *Albatrellus syringae*. Distribution at the end of 1999.

One may ask if the rise in new locations of *Albatrellus syringae* in Fennoscandia since the 1960s is real, or mainly reflects a more intense search for the fungus, or a greater awareness of it. We believe it is real, in particular because new finds have runningly been remarked in areas where the mycota was well-known prior to the record of the species. This applies for example to Skibotn, Tromsø and Rana in North Norway, and the districts near to Oslo; and to Lena in Uppland, Sweden (S. Ryman, pers. comm.). In addition, such a relatively large and remarkable polypore could hardly avoid being collected by the public as soon as emerging, if nothing else to ask some competent person about its edibility.

The active, second phase in the dispersal of the fungus in Fennoscandia, from 1960 up to and including 1999, may be seen as consisting of five periods, starting with the period 1960–1964, when the first records were made in Norway (prov. Buskerud in southern Norway in 1960) and Finland (prov. Uusimaa in 1962, and Rovaniemi in the north in 1964; Fig. 3). The next periods bear similarity to what might be called four “waves” of dispersal in terms of new sites and provinces. The first one is in Finland 1970–1974, continuing into 1975–1979 (Fig. 4), the second and third are in Sweden 1975–79, and 1985–1989 (Figs. 1, 5), and the fourth is a remarkable rise in new localities in Norway 1995–1999, which parallels a rise

in Finnish stations (Figs. 1, 6). The cumulative graph for new sites in all Fennoscandia (Fig. 2) thus is clearly exponential, although the same graph for Sweden (Fig. 1) approaches a slightly sinoid shape, reflecting a slight decrease in number of new Swedish localities the last decade or so.

At present the largest number of sites (61) lie in Finland, where *Albatrellus syringae* is known from all provinces but the two northernmost ones. The second largest number of locations is in Sweden (49, in 15 of its 29 provinces), followed by Norway (32, in 10 of its 19 provinces). In Estonia the localities have increased from one to eight since 1945. It is worth noticing that six of these sites were recorded during the last decade (1990–1999), providing further arguments to the view that the first Estonian locality is an improbable source for the expanding taxon. There are no herbarium vouchers so far from other Baltic countries. In Sweden the species is virtually lacking from the southern part, and in Norway it has not yet been found in western and southernmost Norway (Fig. 7). The recent find of *A. syringae* in Skåne, Sweden, suggests that it soon will be recorded from Denmark, too. Even if the species has been recorded in a majority of the provinces in Fennoscandia, it is still not a polypore anticipated to emerge on a casual fungus foray, mainly because of its specific habitat preference.

Taking into consideration both the periods of time, and number of localities, the dispersal seems to have been directed, from the east (Finland) to the west (Norway). Ryvarden and Gilbertson (1993) also assumed a spread westward, originating from the occurrences in Tartu, Estonia. According to our arguments above, we do not support their view as to the origin of the dispersal.

The character of a continental species has been purported by Ryvarden and Gilbertson (1993), and by Mathiassen et al. (2000) for Norway. Considering that several localities are in regions with some oceanic influence, like that in southern parts of Fennoscandia, the demand for a continental climate must be rather modest. So far, however, its distribution shows an eastern tendency in Norway, being absent in the western coast districts. Only future observations can decide if this tendency is a stable one. When considering all Fennoscandia and Europe, the distribution pattern is typical boreo-montane, with

outliers in regions outside the boreal and boreonemoral regions.

In Europe outside Fennoscandia, *Albatrellus syringae* is hitherto known from one or a few localities in Austria (Malençon 1966, as *Polyporus peckianus*; cf. Erkkilä & Niemelä 1986), Estonia (Parmasto 1999), France (Pieri & Rivoire 1999), and Italy (Bernicchia 1990). It is also known from Russia (H. Knudsen, T.Læssøe, pers. comm.), and North America (Ginns 1997).

We do not know how and where the expanding Fennoscandian taxon originated, and the fragmentary knowledge of the Russian occurrences blurs the distributional pattern. But in all probability the species will continue to gain entry in more sites the next decade, both in North Europe and elsewhere.

### Identification

The outer and inner morphology of *Albatrellus syringae* is described by Parmasto (1962), Niemelä (1970), and Ryvarden and Gilbertson (1993). The species is very similar to the North American *A. peckianus* (Cooke) Niemelä (cf. Niemelä 1970). We have started a closer study of both species, and hope to reveal further microscopic differences, to alleviate species determination (Granmo & Mathiassen 2001).

### Edibility

According to Eriksson (1979), and Mathiassen et al. (2000), *Albatrellus syringae* has been tested in for example fish dishes, where it added to a colourful appearance, and was said to taste very good. However, we do not know yet whether there may be harmful effects by prolonged consumption as food, which calls for caution in using it in dishes.

### List of localities (1901–1999)

Abbreviations of the provinces in Finland and Sweden are in accordance with Hansen & Knudsen (1992), while those of Norway are from Granmo et al. (1999).

P = information from the Norwegian Project Database (no material preserved).

SMF = information from the database of Svensk Mykologisk Förening.

- Norway.** (Without loc.) 1974 *Stordal* (O). **Ak:** Eidsvoll: Øverbygda Sep 1997 *Hombles & Morud* (O). – Lørenskog: Fjellhammer Jul 1996 *Holst-Jensen* (O). **Oslo:** Oslo: Maridalen Frysja Sep 1996 *Olavsen* (O). Brekke at Maridalsvt. Jul 1998 *Sinding-Larsen* (P). Sørkedalen Nov 1997 *Normann* (O). Bjerkebakken Oct 1999 *Johannessen* (O). **He:** Alvdal: Sølve Aug 1992 *Rørhus* (O). – Kongsvinger: Stømner Sep 1995 *Rindal* (O). Bøgeråsen 1997 & Jul 1998 *Amundsen* (O). Vestliveien Jul 1998 *Tangen* (O). **Op:** Gausdal: Gausdal Aug 1997 *Braate*, and Svingvoll - Skeikampen Sep 1997 *Braate & Smith* (O). – Lunner: Grua Aug 1993 *Raddum* (O). – Nord-Fron: Øyangen Aug 1985 *Marstad* (O; culture in CBS, cf. Stalpers 1992: 538; Marstad, pers. comm.). Rondeplassen N of Kvam Aug 1997 *Hagnes* (priv. coll.). – Sel: 10 km W of Otta Aug 1977 *Besi* (O). **Bu:** Hol: Ustaoset 1960 *Sivertsen* (material lost). **Ve:** Tønsberg: Kjellelia Jul 1998 *Marstad 18B-98* (O). **ST:** Skaun: Bårdalen Sep 1999 *Gjestland & Sivertsen* (TRH). **No:** Hattfjelldal: Hattfjelldal Aug 1988 *Dunfjeld* (TROM). – Narvik: Narvik war cemetery (German part) Sep & Aug 1975, 1979, 1985, 1986, 1987, 1991, 1999, all coll. by *Skifte*; Aug 1981 *Skifte & Granmo*, Sep 1987 *Skifte & Bendiksen* (all: TROM). – Rana: Hauknes Aug 1998 *Dahlberg* (TROM). **Tr:** Målselv: Olsborg Aug 1999 *Sætra* (TROM). – Nordreisa: Hysingjord Jun 1983 *Sætra* (TROM). – Storfjord: Skibotn field st. Aug 1995 *Moser* (IB). – Tromsø: Kroken Sep 1996 *Aasen* (TROM). **Fi:** Alta: Aronnes Aug 1968 *Skifte & Gulden* (material lost). Sandfallet Aug 1989 *Møller* (TROM). Kaiskuru & Elvebakken Jul 1995 *Mølmen & Johansen* (TROM), Kaiskuru *Balandin* (TROM). – Sør-Varanger: Kirkenes Aug 1980 *Dahlmeyer* (TROM). Skogfoss 1995 & 1997 *Gunnermann* (no vouchers). **Sweden. Sk:** Lund: Silvåkra Aug 1999 *Invert* (S). **Vrm:** Karlstad: Trossnäs Jul 1901 *Fries* (S). **Nrk:** Glanshammar: Nytinge Sep 1986 & Aug 1988 *Carlsson & Nilsson* (UPS). Skomakartorp Aug 1989 *Ryman* (UPS). – Nikolai: Brunnsgårdet Sep 1994 *Lindström* (S). – Rinkaby: Nasta Jun 1983 *Carlsson & Nilsson* (O). **Upl:** Lena: Hummeltorpet c. 1988 *Ryman* (no voucher). – Sollentuna: Helenelunds st. Jun 1987 *Åström* (S). – Stockholm: Norra Kyrkogården Jul 1920, Jul 1922, Jul 1924 *Romell* (S; as *Polyporus cristatus*, rev. Strid 1978). **Vsm:** Arboga: Älholmen Sep 1986 *Kaufmann* (S). – Nora: Vikar Sep 1977 *Hakelien* (S). **Dlr:** Malung: Malung Oct 1977 *Runquist* (UPS). – Mora: Färnäs Sep 1985 *Jons* (S). Moranoret Sep 1985 *Fredriksson* (S). – Orsa: Orsa Sep 1986 *Broström* (UPS). – Rättvik: Boda Sep 1983 *Kytövuori* (H). **Mpd:** Borgsjö: Näset Gammelbodarna Jul 1984 *Wimo* (UPS). Granbodåsen Aug 1989 *Eriksson* (L; cf. Stalpers 1992: 538). Borgsjö Aug 1986 *Læssøe* (C), 1990 (Tedebrand 1990: 22), Sep 1995 *Rydberg* (SMF), *Carlson & Muskos* (SMF). – Lidens: Sundsjöåsen Aug 1999 *Wedin* (UPS). – Seleånger: Silje Sep 1979 *Tedebrand* (herb. Sundsvall). – Stöde: Stöde Aug 1986 *Hagmann* (S). – Sundsvall: Kubikenborg Sep 1978 *Thörngren* (herb. Sundsvall). Indal Jul 1981 *Jansson* (S). – Torp: Hussborg Aug 1989 *Muskos* (S). – Tuna: Ängomåsen Jul 1985 & Aug 1988 (S). Stöde Aug 1986 *Hagman* (S). Tuna Aug 1987 *Andersson* (S). **Ang:** Härnösand: Härnösand Aug 1992 *Strid* (S). – Sollefteå: Ramsele Aug 1979 *Muskos* (S). **Vb:** Umeå: Umeå Sep 1975 *Grelsson* (UME). Umeå Sep 1980 *Eriksson & Nitare* (UME). Umeå 4 Oct 1980 *Nitare & Eriksson* (S). Umeå Sep 1997 *Olofsson* (UME). – Vännäs: Fällforsen Aug 1973 & Jul 1974 *Eriksson* (UME). Harrsele Sep 1974 *Strid* (S). Vännäs Aug & Sep 1978, coll. by *Eriksson* (UME), *Palm & Hjalmarsson* (UME), *Palm* (S), Aug 1986 *Eriksson & Nogrased* (UME). **Nb:** Övertorneå: Matarengi Aug 1954 *Lönnqvist* (UPS; as *Polyporus confluens*). Matarengi Sep 1957 *Lönnqvist* (UPS; as *Polyporus arcularius*). **Hrj:** Tännäs: Funäsdalen Aug 1992 *Severin*, Röstberget Aug 1992 *Sandström & Severin* (S). (S). **Jmt:** Alanäs: Lövberga Aug 1995 (UPS). – Berg: Østersund Aug 1993 *Marstad* (O). – Duved: Mullfjället Jul 1985 *Jeppson & Jeppson* (S). – Mattmar: Storbodarna Aug 1984 *Ryman* (UPS), Aug 1993 *Lundberg* (SMF). – Ragunda: Stugun Sep 1980 *Lindström* (S), Aug 1981 *Ryman* (UPS; Fungi Exs. Suecici ined. Picture in Ryman & Holmåsén 1984). – Ström: Strömsund Aug 1978 *Strid* (S). – Åre: Enafors Aug 1981 *Nitare* (S). Storlien Aug 1981 *Nitare* (S). **LyL:** Storuman: Skalmödan Sep 1985 *Kytövuori* (H). **LL:** Jokkmokk: Kanibäcken Aug 1989 *Karström* (S). Lower Kuouka Kvarnbäcken Aug 1990 *Moberg 9215* (S). Jokkmokk Aug 1992 *Karström* (observation). Vuollerim Karkberget c. 1996 *Karström* (observation), Porsidammen Aug 1999 *Karström* (observation). **TL:** Kiruna: Abisko Aug 1995 *Marstad* (TROM, O). **Finland. V:** Lohja: Lohja Aug 1986 *Pykälä* (H). – Marttila: Hirvas Aug 1990 *Yli-Mattila* (TUR). **U:** Espoo: Pohjois-Tapiola Sep 1985 *Pusa* (H). Otaniemi

Aug 1992 *Jakobsson* (H). – Helsinki: Metsälä Aug 1978 *Järvi* (H). Herttoniemi Jul 1984 *Kytövuori* (H). Maunula Jun 1999 *Laitakari* (H). – Tuusula Oct 1962 *Saarnijoki* (H, UPS), Aug 1968 *Niemelä* (H). Rajamäki Sep 1983 *Toivonen & Askola* (H). **St:** Rauma: Äyhö Aug 1979 *Jokinen* (TUR). **EH:** Asikkala: Väaksky Aug 1993 *Haikonen* (H). Aurinkovuori Sep 1997 *Haikonen* (H). – Hämeenlinna: Myllymäki Jul 1996 *Lahti* (H). Ahvenisto Aug 1996 *Lahti & Vauras* (TURA, H). – Lahti: Ursan Aug 1987 *Haikonen* (H). – Lammi: Lammi Sep 1971 *Laine* (H). Pappilankylä Aug 1982 *Piirainen* (H), Sep 1985 *Harmaja* (H), Aug 1992 *Niemelä* (H), Sep 1996 *Niemelä & Dai* (H), Sep 1997 *Niemelä* (photo in H). – Jokioinen Jul 1998 *Syrjänen* (TUR). – Pirkkala: Rajaniemi Sep 1987 *Oikkonen* (H). – Tampere: Kaukajärvi Jul 1993 *Kosonen* (TUR). Pispala Sep 1990 *Kosonen* (TUR), Oct 1992 *Söderholm* (H). Hervanta Oct 1995 (TUR). **ES:** Lappeenranta: Mäntylä Aug 1979 *Vuokko* (H). **EP:** Alavus: Alavus Aug 1972 *Alanko* (H). – Nurmo: Hyllykallio 1998 *Jokinen* (OULU). **PH:** Jyväskylä: Myllyjärvi Sep 1997 *Tynkkynen* (JYV). Tourula Sep 1997 *Häkkinen* (JYV). Seppälänkangas Sep 1998 *Saari* (JYV). – Virrat: Kaleton Aug 1993 *Kytövuori* (H). **PS:** Iisalmi: Runni Jul 1976 *Takala* (KUO). – Kiuruvesi: Niskakoski Jul 1974 *Takala* (KUO). – Kuopio: Kuopio Aug & Sep 1970, 1971, 1972, 1973, 1977, 1978, all coll. by *Hakala* (H, KUO, O, OULU, TUR), Aug 1981 *Vauras* (H), 1981 *Kotiranta* (OULU), Aug 1988 *Heikkilä* (KUO). – Savonranta: Raatelammisalo Sep 1995 *Haikonen* (H). – Siilinjärvi: Ahmo Aug 1998 *Savolainen* (KUO). **PK:** Liperi Aug 1994 *Ulvinen et al.* (H). **KP:** Haapavesi: Mieluskylä Aug 1971 *Koskela* (OULU). – Soini: Soini Aug 1987 *Herttua* (TUR), 1992 *Herttua* (H). Herttua Sept 1995 *Herttua* (TUR). **Kn:** Vaala: Jylhämä Sep 1982 *Myllyoja* (OULU), Aug 1997 *Askonen* (OULU). – Kajaani: Kajaani Aug 1987 *Vauras* (H). **OP:** Haukipudas: N of Kalimenoja Sep 1991 *Salo* (OULU). Tuiranhovi Sep 1992 *Kaukonen* (OULU). – Kiiminki: Isohalmeenmaa Sep 1968 *Ulvinen* (H, OULU), Sep 1989 *Väre* (OULU). – Oulu: Oulu Aug 1970 *Knuuttila* (OULU), Sep 1984 *Blomberg* (OULU), Sep 1996 *Portti* (OULU). Kaukovainio Jul 1983 *Hakulinen* (DAOM, H, L, OULU). Vallinkorva Sep 1996 *Portti* (OULU). **PeP:** Kemijärvi: Kemijärvi Aug 1974 & Aug 1999 *Uino* (OULU). – Rovaniemi: Rovaniemi Sep 1964 *Ahti* (H), 1977 *Remes* (OULU), Aug 1978 *Laurinen* (OULU). Pekkala

Aug 1977 *Kaihua* (OULU). Meltaus Aug 1990 *Ruotsalainen & Vauras* (H, JYV, TURA). Pahtaja Aug 1990 *Sergejeff* (H, TURA). Koskenkylä Aug 1998 *Saira* (OULU). **Ks:** Taivalkoski: Taivalkoski Aug 1990 *Kytövuori* (H). **Kil:** Kittilä: Kaukonen Aug & Sep 1978 *Veki* (OULU). Mustavaara Aug 1992 *Kytövuori* (H). Sirkka Sep 1986 *Hakala* (KUO). – Kolari: Äkäsjokisuu Aug 1986 *Ruotsalainen & Vauras* (H). **SoL:** Sodankylä: Pultinpuoti Aug 1992 *Kytövuori* (H). **Estonia.** Tartu 1945 *Witkowski* (TAA); 1951 (TAA), Sep 1957, Jul 1960 (H, TAA), all coll. by *Parmasto*. Tallinn Sep 1998 *Roosimaa* (TAA). – Harjumaa: Mõnuste near Haiba Sep 1994 *Parmasto* (TAA). – Pärnumaa: Veelikse Jul 1996 *Niemelä, Dai, Parmasto & Kõljalg* (H, TAA). – Raplamaa: Vardi Alvar Forest Reserve Oct 1998 *Parmasto* (TAA). – Saaremaa: Viidumäe Sep 1990 (Jeppson 1993); W of Viieristi Aug 1998 *Parmasto* (TAA) (cf. *Parmasto* 1999).

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