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Modelling agaricoid fungi distribution in Andean forests of Patagonia

Gonzalo M. Romano*[1], Alina G. Greslebin[1] and Bernardo E. Lechner[2]

[1] Departamento de Biología, Facultad de Ciencias Naturales, Universidad Nacional de la Patagonia San Juan Bosco, Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Route 259 Km 16, U9200EYM, Esquel, Chubut, Argentina

[2] DBBE, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, PROPLAME-PRHIDEB (CONICET), Intendente Güiraldes 2160, C1428EGA, Ciudad Autónoma de Buenos Aires, Argentina

With 2 figures and 2 tables and 1 appendix

Abstract: Agaricoid fungi of Subantartic forests have been vastly studied at a taxonomical and, to less extent, ecological level. These historical approaches have left large amounts of presence-only occurrences of several endemic species of the Andean region. Since sampling season in Patagonia is reduced to a minimum because of its large extension and climate conditions that govern the region, it is essential to focus on locations where subjects of study are present. Knowledge of patterns of fungal distributions can help lead future forest management investments as well as to guide efforts to delimit fungal hot-spots areas of conservation. The aim of the present work was to assess the potential distribution of a selection of 9 saprophytic and 9 ectomycorrhyzic gilled fungi based on their abundance, seasonality, occurrences in bibliography and detectability. Eighty localities were georreferenced for 260 occurrences of the species modelled. The ectomycorrhyzic *Rhodophyllus patagonicus* presents the most restricted distribution among all species studied while *Psathyrella falklandica*, saprophytic, has the most widespread distribution. Despite having different nutritional requirements, all species studied exhibit a very similar dependence with mean precipitation of the driest month and similar potential distributions. Distribution maps are provided for each species. Discussion on the dynamics and extent of fungal species distribution in Patagonia is also provided.

Key words: Agaricales, species distribution models, MaxEnt, *Nothofagus*, Subantarctic forests.

Introduction

Agaricoid fungi include most species forming gilled and fleshy basidiomes ("mushrooms"). They include, among others, saprophytic and ectomycorrhyzic genera (Rinaldi et al. 2008). Among the latter, the most diverse group present in the Andean forests of Patagonia

*Corresponding author e-mail: gonza.romano@gmail.com

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(AP forests) is associated with different species of endemic *Nothofagus* (Fagales), which has diversified from Gondwanaland (Manos 1997). It includes native species of some interest to local industry, like *N. pumilio* or "lenga". This species covers the biggest area of the southern Andean mountains in Patagonia, from Neuquén province (Argentina) to Tierra del Fuego (Cabrera 1976, López Bernal et al. 2012).

Agaricoid fungi have been vastly studied in Patagonia since 1887 (Spegazzini 1887a, b), with special focus in Tierra del Fuego (Singer 1969, Horak 1979). Gamundí & Amos (2007) recorded numerous mycological expeditions to Tierra del Fuego from 1817 to 2006. Several research has been done with agaricoid nomenclature and taxonomy at a global (e.g. Matheny et al. 2006), regional (e.g. Singer 1969, Moser & Horak 1975, Valenzuela 1993, Valenzuela et al. 1998) and national level (e.g. Horak 1979, Pildain et al. 2009, Romano & Lechner 2014); and even with their ecological role (e.g. Horak 1982, Godeas et al. 1993, Valenzuela 1993, Valenzuela et al. 1998). However, only scant observations focusing on their macroecological distribution have been made (e.g. Horak 1981, Horak 1983, Zervakis et al. 2004, Wollan et al. 2008, Matheny et al. 2009). This approach is crucial not only to comprehend agaricoid species spatial coverage, but also to understand the importance of its association with native forests. Additionally, it has the potential for directing conservational actions to prevent the fragmentation of fungal native niches.

The southern forests of Patagonia are comprised in Maule, Valdivian Forest and Magellanic Forest provinces in the Subantarctic sub-region of the Andean region of South America (Morrone 2015).

Species distribution modelling (SDM) is a recent approach to studying patterns of diversity and macroecology. Despite biogeographical research has been done with different groups in Patagonia (e.g. Morrone 2011, Schiaffini et al. 2013), fungi have received little attention from this insight. Moreover, to our knowledge only a few have applied such method to study agaricoid distributional patterns in the world (Wollan et al. 2008, Wolfe et al. 2009, Yuan et al. 2015).

The aim of the present work was to provide potential distribution of representative agaricoid species that can help to understand the extent of their distribution in Patagonia, lead future forest management investments as well as to guide efforts to delimit fungal hot-spots areas of conservation.

Material and methods

Study area: The research was conducted at a South American scale, involving all countries boundaries into the Subantarctic sub-region of Andean region as in Morrone (2015). Study area is between 24–56° S, 57–76° W.

Species selected: We created an index based on Godeas et al. (1993), in which scores were assigned for number of occurrences on bibliography, relative abundance and seasonality (Romano et al. unpublished), and detectability (Lõhmus 2009). Eighteen endemic species were selected based on their score at a regional scale, 9 saprophytic (SAP) and 9 ectomycorrhyzic (ECM). Their occurrence was obtained from bibliography and herbaria as well as from material collected by the authors in *N. pumilio* forests. Universidad de Buenos Aires (BAFC), Universidad Nacional de La Plata (LPS) and Centro de Investigación y Extensión Forestal Andino Patagónico (CIEFAP) herbaria were consulted. Herbaria acronyms follow Holmgren (1990) when applicable. All herbarium exsiccates checked and basidiomes collected have been georeferenced following Chapman et al. (2006) recommendations. All nomenclature names follow Kirk et al. (2008). Nutrition information was obtained from Rinaldi et al. (2008).

Distribution modelling: MaxEnt 3.3.3k (Phillips et al. 2004) was used to assess agaricoid fungi potential distribution in Patagonian forests. Environmental variables from 1950 to 2000 and 30 arc seconds of spatial resolution (0.86 km^2) were obtained. The data set contained altitudinal elevation and 19 bioclimatic variables (Hijmans et al. 2005 http://www.worldclim.org/).

We also used a categorical layer with biogeographic provinces of the Andean region following Morrone (2015) criteria (Romano unpublished).

Ten replicates were performed for each species with random seed, a regularization multiplier of 1, sample radius of -3, prevalence of 0.625, 10000 background points, 1000 iterations and logistic output. Variable contributions were analyzed through MaxEnt's Jackknife test. We evaluated predicted models with area under the curve (AUC) and the receiver operating characteristics (ROC) (Phillips et al. 2004, 2006). Merow et al. (2013) and Radosavljevic & Anderson (2014) recommendations were followed to adjust MaxEnt settings according to the objectives of the study. In particular, prevalence value was tested between 0.5 – 0.7 range, with considerable differences in the extension of species geographical distribution. Finally, models were plotted in a GIS map using DIVA-GIS 7.5 (Hijmans et al. 2001 http://www.diva-gis.org/).

Results

Potential distribution models were obtained for the 9 ECM species (Fig. 1) and the 9 SAP species (Fig. 2). Tables 1 and 2 summarize information about the contribution and permutation importance of each variable to the potential distribution of each species studied. Occurrences of the 18 species selected can be seen in Supplementary Table 1.

Distribution models allowed categorization of the species studied based on their distributions: Two patterns were observed: *A. statuum* (Fig. 1A), *C. austroduracinus* (Fig. 1B), *C. permagnificus* (Fig. 1D), *D. antarctica* (Fig. 1E), *I. geophyllomorpha* (Fig. 1F), *Ru. nothofaginea* (Fig. 1H), *S. stropharioides* (Fig. 1I), *Cl. patagonica* (Fig. 2A), *G. gamundiae* (Fig. 2B), *Gy. fuegianus* (Fig. 2C) and *P. baeosperma* (Fig. 2G) followed a continuous distribution along Subantarctic forests, while *C. magellanicus* (Fig. 1C), *R. patagonicus* (Fig. 1G), *H. dusenii* (Fig. 2D), *Hy. frowardii* (Fig. 2E), *M. dendrocystis* (Fig. 2F), *Pl. spegazzinianus* (Fig. 2H) and *Ps. falklandica* (Fig. 2I) presented a disjunct distribution.

Rhodophyllus patagonicus (ECM) presents the most restricted distribution among all species studied (Fig. 1G). It is modulated by ecoregions and precipitation of the driest month (BIO14). On the other hand, *Psathyrella falklandica* (SAP) has the most widespread distribution, with occurrences not only in the continental portion of South America but also in Malvinas islands (Fig. 2I).

Models adjustment (AUC) was high for all species studied except for *R. patagonicus* and *M. dendrocystis*, which models yielded a value of 0.741 ± 0.352 (Table 1) and 0.759 ± 0.359 (Table 2). Occurrences in the continent are less common despite the majority of models studied showed an unrestricted distribution along Valdivian and Magellanic Forests.

The ecoregional layer was important for every ECM and SAP Fungi species studied. All species but *S. stropharioides* (Fig. 1I) are modulated in some degree by precipitation of driest month (BIO14), as shown in Tables 1 and 2.

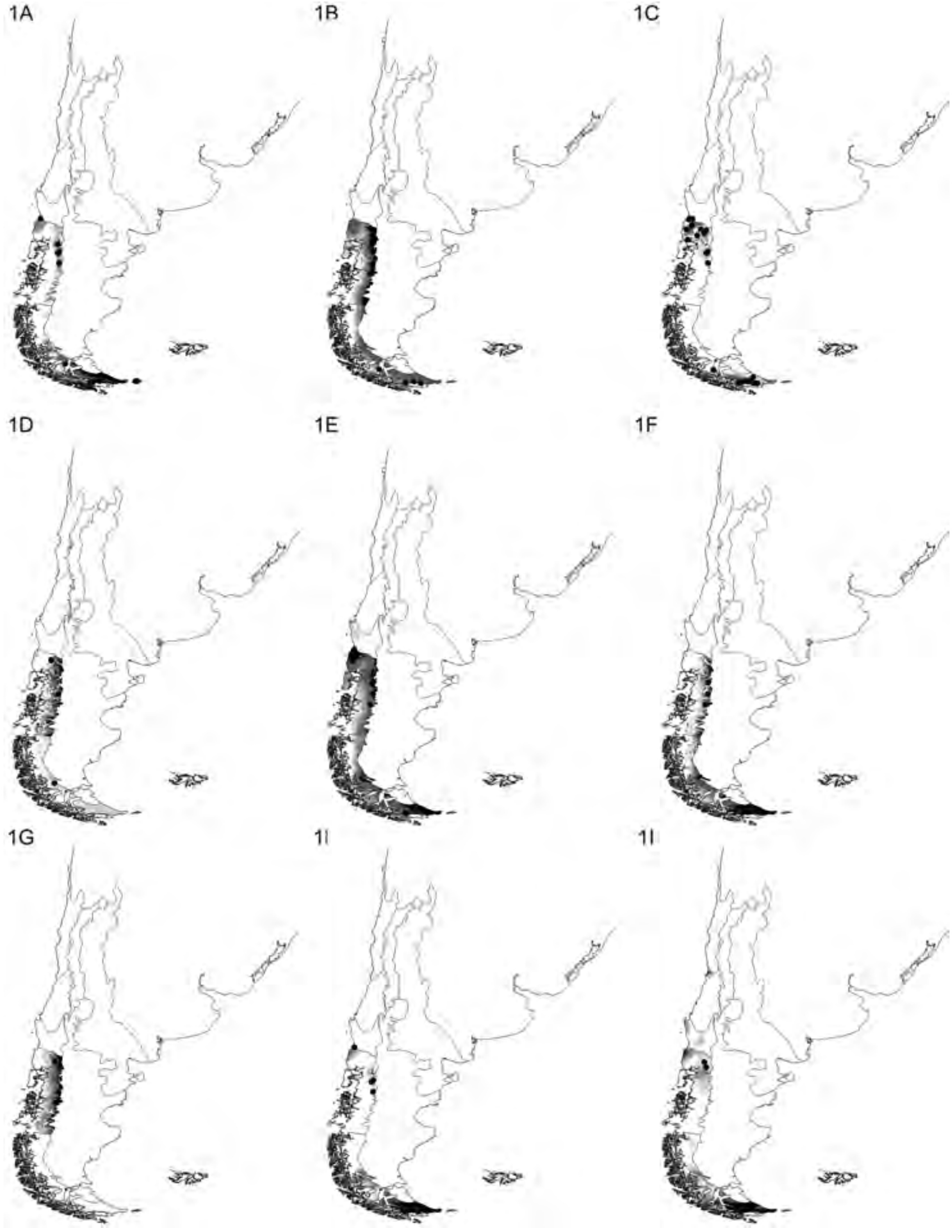

Fig. 1. Potential distribution models for ECM species studied. A. Austropaxillus statuum, B. Cortinarius austroduracinus, C. Cortinarius magellanicus, D. Cortinarius permagnificus, E. Descolea antarctica., F. Inocybe geophyllomorpha, G. Rhodophyllus patagonicus, H. Russula nothofaginea, I. Stephanopus strophariоides. Probabilities: 0–0.5 (white), 0.5–0.6 (light gray), 0.6–0.7 (gray), 0.7–0.8 (dark gray), 0.8–1 (black).

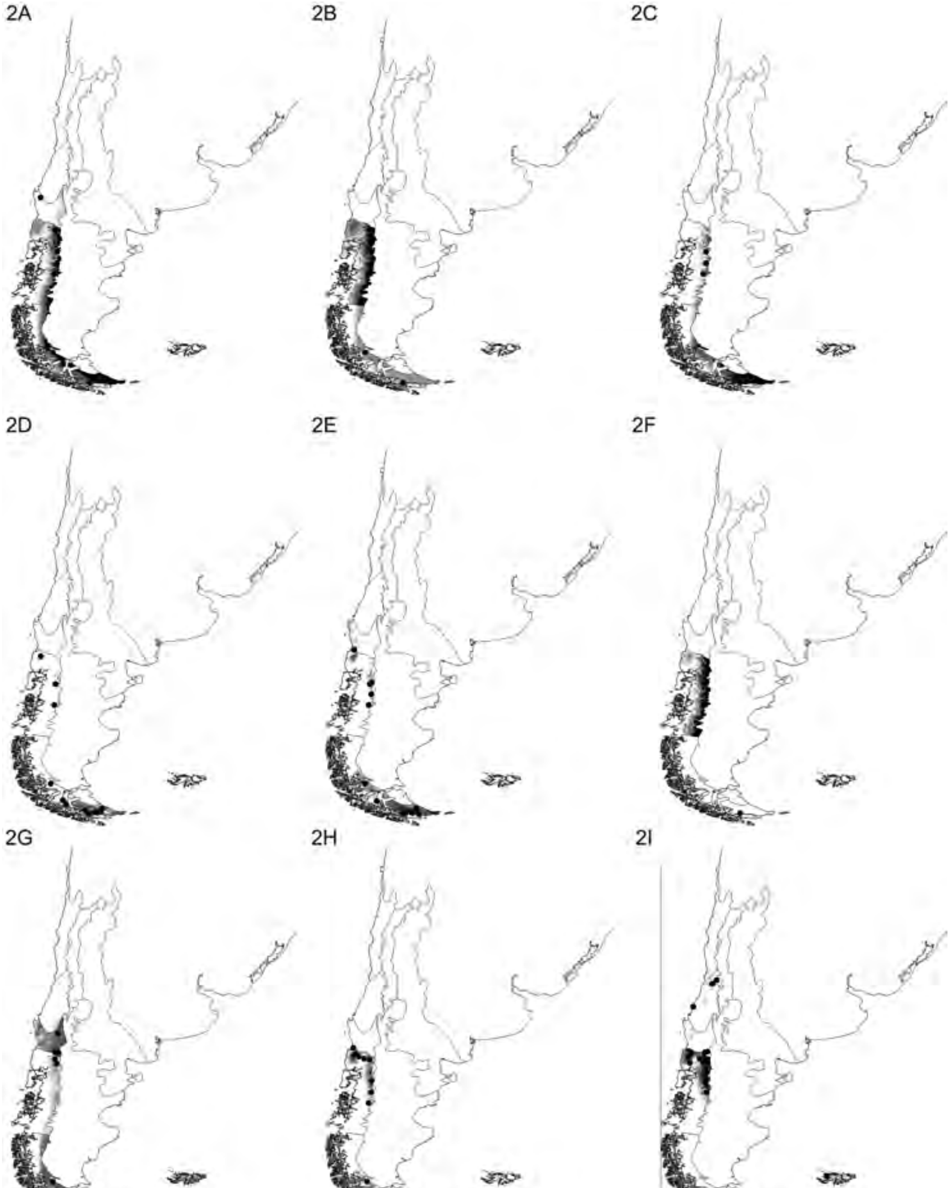

Fig. 2. Potential distribution models for SAP species studied. A. Clitocybe patagónica, B. Galerina gamundiae, C. Gymnopus fuegianus, D. Hydropus dusenii, E. Hypholoma frowardii, F. Mycena dendrocystis, G. Pholiota baeosperma, H. Pluteus spegazzinianus, I. Psathyrella falklandica. Probabilities: 0–0.5 (white), 0.5–0.6 (light gray), 0.6–0.7 (gray), 0.7–0.8 (dark gray), 0.8–1 (black).

Table 1. Contribution and permutation of variables to potential distribution of each ECM species.

Species	*Austropaxillus statuum*		*Cortinarius austroduracinus*		*Cortinarius magellanicus*		*Cortinarius permagnificus*	
AUC	0.844 ± 0.255		0.924 ± 0.040		0.957 ± 0.021		0.881 ± 0.117	
Percentage	Contribution	Permutation	Contribution	Permutation	Contribution	Permutation	Contribution	Permutation
Elevation	4.624	5.210	–	–	6.928	12.662	0.002	0.022
Ecoregion	53.591	34.979	83.859	94.601	19.262	15.883	75.673	82.865
BIO1	0.001	–	–	–	–	–	9.152	4.722
BIO2	–	–	–	–	–	–	–	–
BIO3	1.024	2.707	0.267	–	27.663	34.488	0.632	–
BIO4	4.732	3.206	–	–	0.020	–	0.137	0.716
BIO5	0.081	0.040	–	–	0.309	–	–	–
BIO6	1.593	6.138	–	–	1.761	0.857	–	–
BIO7	–	–	–	–	–	–	–	–
BIO8	0.462	3.793	–	–	0.828	9.719	–	–
BIO9	–	–	–	–	–	–	–	–
BIO10	1.370	–	–	–	–	–	–	–
BIO11	4.888	3.663	–	–	0.049	–	–	–
BIO12	0.004	1.218	–	–	–	–	–	–
BIO13	0.035	0.031	–	–	0.501	3.554	–	–
BIO14	26.753	28.656	15.874	5.399	8.159	9.098	14.405	11.675
BIO15	–	–	–	–	0.481	1.153	–	–
BIO16	–	–	–	–	–	–	–	–
BIO17	0.024	3.423	–	–	0.374	4.162	–	–
BIO18	0.083	6.935	–	–	33.577	8.208	–	–
BIO19	0.737	–	–	–	0.088	0.217	–	–

BIO1: Annual mean temperature, BIO2: Mean diurnal range (mean of monthly (max temp – min temp)), BIO3: Isothermality (BIO2/BIO7) (* 100), BIO4: Temperature seasonality (standard deviation *100), BIO5: Maximum temperature of warmest month, BIO6: Minimum temperature of coldest month, BIO7: Temperature annual range (BIO5-BIO6), BIO8: Mean temperature of wettest quarter, BIO9: Mean temperature of driest quarter, BIO10: Mean temperature of warmest quarter, BIO11: Mean temperature of coldest quarter, BIO12: Annual precipitation, BIO13: Precipitation of wettest month, BIO14: Precipitation of driest month, BIO15: Precipitation seasonality (coefficient of variation), BIO16: Precipitation of wettest quarter, BIO17: Precipitation of driest quarter, BIO18: Precipitation of warmest quarter, BIO19: Precipitation of coldest quarter.

Table 1 continued.

Descolea antarctica		*Inocybe geophyllomorpha*		*Rhodophyllus patagonicus*		*Russula nothofaginea*		*Stephanopus stropharioides*	
0.836 ± 0.264		0.946 ± 0.024		0.741 ± 0.352		0.906 ± 0.148		0.904 ± 0.123	
Contribution	Permutation	Contribution	Permutation	Contribution	Permutation	Contribution	Permutation	Contribution	Permutation
2.551	6.074	0.748	1.643	–	–	7.747	22.759	9.878	26.700
83.209	87.810	67.355	66.566	83.194	76.661	61.404	39.173	63.989	29.443
–	–	6.908	2.071	7.513	0.128	0.106	0.291	–	–
–	–	–	–	–	–	–	–	–	–
2.758	1.494	1.899	2.803	0.964	0.603	9.683	22.311	15.926	18.044
–	–	–	–	2.071	–	0.327	–	–	–
–	–	0.621	–	–	–	0.025	0.205	–	–
–	–	–	–	–	–	0.230	0.111	–	–
–	–	–	–	–	–	–	–	–	–
–	–	0.005	0.045	0.042	0.109	2.426	5.092	9.741	25.590
–	–	–	–	–	–	0.010	–	–	–
–	–	1.119	–	–	–	0.175	0.025	–	–
–	–	0.479	2.033	–	–	2.103	4.804	–	–
–	–	4.786	–	0.211	11.726	0.002	0.228	–	–
–	–	0.319	0.062	–	–	0.098	0.352	–	–
10.781	3.328	13.073	1.688	3.903	10.774	15.277	4.650	0.347	0.211
–	–	–	–	–	–	0.172	–	0.090	–
–	–	–	–	–	–	–	–	–	–
0.694	1.295	2.690	23.090	0.693	–	–	–	–	–
0.006	–	–	–	–	–	–	–	0.031	0.012
–	–	–	–	1.409	–	0.217	–	–	–

Table 2. Contribution and permutation of variables to potential distribution of each SAP species.

Species	*Clitocybe patagonica*		*Galerina gamundiae*		*Gymnopus fuegianus*		*Hydropus dusenii*	
AUC	0.837 ± 0.257		0.920 ± 0.065		0.964 ± 0.030		0.941 ± 0.117	
Percentage	Contribution	Permutation	Contribution	Permutation	Contribution	Permutation	Contribution	Permutation
Elevation	–	–	–	–	0.913	1.345	10.852	20.927
Ecoregion	77.808	84.555	80.073	92.947	74.977	63.287	57.368	26.155
BIO1	0.162	0.219	1.416	0.375	1.472	18.627	–	–
BIO2	–	–	–	–	–	–	–	–
BIO3	–	–	–	–	2.206	0.533	7.266	8.977
BIO4	0.006	–	–	–	–	–	0.893	1.126
BIO5	–	–	–	–	0.709	0.085	–	–
BIO6	–	–	0.668	–	–	–	1.979	3.787
BIO7	–	–	0.003	0.112	–	–	1.097	–
BIO8	–	–	–	–	0.214	0.526	1.501	5.369
BIO9	–	–	–	–	0.352	–	–	–
BIO10	1.515	–	–	–	0.184	–	–	–
BIO11	–	–	0.051	0.005	–	–	0.265	0.348
BIO12	–	–	1.644	–	–	–	0.416	6.166
BIO13	–	–	0.303	–	0.177	0.677	0.568	0.577
BIO14	20.509	15.225	15.789	6.348	17.402	14.527	10.483	25.839
BIO15	–	–	–	–	–	–	1.488	0.578
BIO16	–	–	–	–	–	–	–	–
BIO17	–	–	0.053	0.214	1.395	0.394	0.326	–
BIO18	–	–	–	–	–	–	4.072	0.152
BIO19	–	–	–	–	–	–	1.427	–

BIO1: Annual mean temperature, BIO2: Mean diurnal range (mean of monthly (max temp – min temp)), BIO3: Isothermality (BIO2/BIO7) (* 100), BIO4: Temperature seasonality (standard deviation *100), BIO5: Maximum temperature of warmest month, BIO6: Minimum temperature of coldest month, BIO7: Temperature annual range (BIO5-BIO6), BIO8: Mean temperature of wettest quarter, BIO9: Mean temperature of driest quarter, BIO10: Mean temperature of warmest quarter, BIO11: Mean temperature of coldest quarter, BIO12: Annual precipitation, BIO13: Precipitation of wettest month, BIO14: Precipitation of driest month, BIO15: Precipitation seasonality (coefficient of variation), BIO16: Precipitation of wettest quarter, BIO17: Precipitation of driest quarter, BIO18: Precipitation of warmest quarter, BIO19: Precipitation of coldest quarter

Table 2 continued.

Hypholoma frowardii		*Mycena dendrocystis*		*Pholiota baeosperma*		*Pluteus spegazzinianus*		*Psathyrella falklandica*	
0.928 ± 0.052		0.759 ± 0.359		0.875 ± 0.105		0.937 ± 0.051		0.898 ± 0.070	
Contribution	Permutation	Contribution	Permutation	Contribution	Permutation	Contribution	Permutation	Contribution	Permutation
9.016	8.974	–	–	1.846	1.912	6.195	8.542	1.420	1.612
53.138	25.871	72.515	71.893	49.889	32.817	24.650	17.963	29.228	18.499
0.057	–	7.671	1.500	–	–	–	–	–	–
–	–	–	–	–	–	0.837	0.659	0.689	0.087
6.732	4.419	1.219	–	0.081	0.043	16.470	12.647	32.890	12.985
0.681	0.747	1.495	–	0.032	–	0.080	0.200	0.514	0.089
0.029	–	–	–	–	–	–	–	0.371	0.166
0.044	0.145	0.534	0.003	–	–	0.396	0.192	1.044	0.307
–	–	–	–	–	–	–	–	–	–
0.508	1.522	0.062	0.078	0.169	4.358	0.557	3.565	–	–
0.019	–	–	–	–	–	–	–	–	–
0.024	0.004	–	–	–	–	–	–	–	–
0.045	–	3.016	–	16.132	0.198	–	–	0.008	–
–	–	0.429	2.010	–	–	0.427	–	23.288	30.882
0.134	0.165	–	–	–	–	0.290	–	–	–
19.954	12.835	5.230	10.102	29.723	38.144	10.401	45.894	7.514	32.654
0.612	0.737	–	–	1.337	7.540	0.857	1.508	0.188	0.722
–	–	–	–	–	–	–	–	0.103	0.821
3.568	30.235	6.849	4.277	–	–	0.209	0.184	0.711	0.023
5.440	14.347	0.339	10.137	0.792	14.988	38.633	8.647	0.102	0.145
–	–	0.642	–	–	–	–	–	1.929	1.009

Discussion

We used the MaxEnt approach to predict distributions of the 9 saprophytic and 9 ectomycorrhyzic gilled fungi selected based on their abundance, seasonality, occurrences in bibliography and detectability.

Psathyrella falklandica (SAP), which had the most widespread distribution, was found not only in the continental portion of South America but also in Malvinas islands, where there is no Subantarctic forest (Broughton & McAdam 2005). Its distribution is conducted not only by ecoregions, but also by isothermality (BIO3) and annual precipitation (BIO12), rather than the more restrictive layer precipitation of the driest month.

The model adjustment (AUC) was low for *R. patagonicus* and *M. dendrocystis* (0.741 ± 0.352 and 0.759 ± 0.359, respectively). These species are not as easily detectable as others (Lõhmus 2009), and probably this is the reason why they have only been cited for four localities. However, MaxEnt has been found to be robust for predicting distribution models, even if there are only scant occurrences records (Wisz et al. 2008, Shcheglovitova & Anderson 2013, Yuan et al. 2015).

Despite having different nutritional requirements, models of ECM and SAP species exhibit a very similar dependence with precipitation of the driest month (BIO14) and similar potential distributions. This finding could be suggesting that nutritional requirements are not important to agarics distribution modelling.

Gamundí & Amos (2007) reported numerous expeditions to Tierra del Fuego (both Argentinean and Chilean). The large number of occurrences reported in that island for each species is reflected in all models constructed. Although most of the models studied show an unrestricted distribution along Valdivian and Magellanic Forests (Morrone 2015), occurrences in the continent are less common. This indicates that future mycological expeditions in the Andean region ought to be aimed for the continental portion of Magellanic Forests province (49–50°S, Santa Cruz in Argentina, Región XII in Chile) rather than Tierra del Fuego. Such territory represents an intrigue because forests mix with glaciers, and some models predict occurrences of species there. Although less frequent, occurrences in Valdivian Forests tend to support a distributional expansion from the southernmost localities in 55°S (corresponding to Tierra del Fuego) to drier and more template weather conditions in latitudes as north as 40°S (Chubut in Argentina and Región XI in Chile). Maule province also exhibits some potential to new occurrences, as it can be seen for *D. antarctica*, *S. stropharioides*, *Cl. patagonica*, *Hy. frowardii*, *P. baeosperma* and *Ps. falklandica*.

The degree of importance of the ecoregional layer for all species studied makes evident the suitability of Morrone (2015) understanding of the Subantarctic sub-region of the Andean region for Fungi species. Moreover, the shapefile we created following Morrone (2015) was made available for ecologists working in this vast territory across South America.

The significance of precipitation of driest month (BIO14) for most species is congruent with large observations of its importance along with humidity for basidiome production (Stamets 1993). In this way, Yuan et al. (2015) found similar relevance of precipitation for modelling distributions of three *Phellinus* species in China. However, they become critic in the warmest quarter of the year rather than in the driest month. On the contrary, Wollan et al. (2008) found that Norwegian Fungi distribution models are related with temperature and irradiation variables because precipitation are not a limiting factor in Norway like they are in Patagonia Argentina. In such a manner, *S. stropharioides* (ECM) is the only species of the present study which shows a distribution dependent exclusively on temperature conditions. In spite of its independence from precipitation variables (BIO12-19), the effect of humidity could be implied in the altitudinal layer, which makes a significant contribution to *S. stropharioides* model. On the other hand *C. austroduracinus*, *D. antarctica*, *Cl. patagonica*, *G. gamundiae* and *Gy. fuegianus* exhibit dependence only on precipitation conditions.

Subantarctic Forests Province (ecoregional layer) and precipitation of driest month (BIO14), followed by isothermality (BIO3), are the most important bioclimatic variables modulating the distribution of most agaricoid species studied. Schiaffini et al. (2013) used a similar ecoregional-dependent layer following Olson et al. (2001) criteria to model distribution of the Patagonian weasel (*Lyncodon patagonicus*). However, to our knowledge, an ecosystemical layer has never been used for studying Fungi species potential distributions.

Despite some species models exhibit a disjunct distribution, it is possible they are an artefact of the lack of sampling records in 49–50°S (Santa Cruz in Argentina, Región XII in Chile).

The benefits of using presence-only data rather than presence/absence data have been discussed (e.g. Phillips & Dudík 2008, Renner & Warton 2013). This discussion could be enlarged in assessing Fungi species if the paradigm of basidiomes production is added: by finding basidiomes we can assure that a species is present in a location. However, its absence does not necessarily mean that the species is absent. Moreover, before metagenomics techniques were developed, the only way of studying agaricoid species occurrences was by finding basidiomes. In such a manner, by ignoring the importance of presence-only data, we would be ignoring most, if not all, mycological literature. In such a way, we can also think of potential distribution models of fungal species as maps of species basidiomes producing locations.

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References

BROUGHTON, D.A. & J.J. MCADAM 2005: A checklist of the native vascular flora of the Falkland Islands (Islas Malvinas): New information on the species present, their ecology, status and distribution. – J. Torrey Bot. Soc. **132**: 115–148.

CABRERA, A. 1976: Regiones Fitogeográficas Argentinas. – In: ACME (ed.): Enciclopedia Argentina de Agricultura y Jardinería.

CHAPMAN, A.D. & J. WIECZOREK 2006: Guide to Best Practices for Georeferencing. – Global Biodiversity Information Facility.

COTTON, A.D. 1915: Cryptogams from the Falkland Islands collected by Mrs Vallentin and described by A. D. Cotton. – Bot. J. Linn. Soc. **43**: 137–231.

GAMUNDÍ, I. & V. AMOS 2007: Exploraciones micológicas en Tierra del Fuego. – Bol. Soc. Argent. Bot. **42**: 131–148.

GARNICA, S., M. WEISS & F. OBERWINKLER 2003: Morphological and molecular phylogenetic studies in South American *Cortinarius* species. – Mycol. Res. **107**: 1143–1156.

GODEAS, A.M., A.M. ARAMBARRI & I.J. GAMUNDÍ 1993: Micosociología en los bosques de Nothofagus de Tierra del Fuego I. Diversidad, abundancia y fenología. – Acad. Nac. Cs . Ex. Fís. Nat. Buenos Aires. **45**: 291–302.

HIJMANS, R.J., L. GUARINO, M. CRUZ & E. ROJAS 2001: Computer tools for spatial analysis of plant genetic resources data: 1. DIVA-GIS. – Plant. Genet. Resour. Newsl. **127**: 15–19.

HIJMANS, R.J., S.E. CAMERON, J.L. PARRA, P.G. JONES & A. JARVIS 2005: Very high resolution interpolated climate surfaces for global land areas. – Int. J. Climatol. **25**: 1965–1978.

HOLMGREN, P., N. HOLMGREN & L. BARNETT 1990: Part I: The herbaria of the world. – In: HOLMGREN, P.K., N.H. HOLMGREN & L.C. BARNETT (eds.): Index herbariorum, New York Botanical Garden.

HORAK, E. 1979: Fungi, Basidiomycetes Agaricales y Gasteromycetes secotioides. – In: GUARRERA, S.A., I. GAMUNDÍ DE AMOS & D. RABINOVICH DE HALPERIN (eds.): Fl. Criptog. Tierra del Fuego **11**: 1–528.

HORAK, E. 1981: Notes on taxonomy and biogeography of *Rozites* Karsten. – Sydowia **34**: 94–108.

HORAK, E. 1982: Agaricales in Antarctica and Subantarctica: Distribution, ecology and taxonomy. – In: LAURSEN G.A. & J.F. AMMIRATI (eds.): Arctic and Alpine Mycology: The First International Symposium on Arcto-Alpine Mycology. University of Washington Press, pp. 82–121.

HORAK, E. 1983: Mycogeography in the South Pacific Region: Agaricales, Boletales. – Aust. J. Bot. Suppl. Ser. **10**: 1–41.

KIRK, P., P. CANNON, D. MINTER & J. STALPERS 2008: Dictionary of the Fungi. – CABI Publishing.

LÕHMUS, A. 2009: Factors of species-specific detectability in conservation assessments of poorly studied taxa: The case of polypore fungi. – Biol. Conserv. **142**: 2792–2796.

LÓPEZ BERNAL, P., G. DEFOSSÉ, P. QUINTEROS & J. BAVA 2012: Sustainable Management of Lenga (*Nothofagus pumilio)* Forests Through Group Selection System. – In: GARCIA, J.M. & J.J. DIEZ CASERO (eds.): Sustainable Forest Management – Current Research **3**: 45–66.

MANOS, P. 1997: Systematics of *Nothofagus* (Nothofagaceae) based on rDNA Spacer Sequences (ITS): Taxonomic congruence with morphology and plastid sequences. – Am. J. Bot. **84**: 1137–1155.

MATHENY, P.B., J.M. CURTIS, V. HOFSTETTER, M.C. AIME, J.M. MONCALVO et al. 2006: Major clades of Agaricales: a multilocus phylogenetic overview. – Mycologia **98**: 982–995.

MATHENY, P.B., M.C. AIME, N.L. BOUGHER, B. BUYCK, D.E. DESJARDIN et al. 2009: Out of the Palaeotropics? Historical biogeography and diversification of the cosmopolitan ectomycorrhizal mushroom family Inocybaceae. – J. Biogeogr. **36**: 577–592.

MEROW, C., M.J. SMITH & J.A. SILANDER Jr 2013: A practical guide to MaxEnt for modeling species distributions: what it does, and why inputs and settings matter. – Ecography **36**: 1058–1069.

MORRONE, J.J. 2011: Island evolutionary biogeography: analysis of the weevils (Coleoptera: Curculionidae) of the Falkland Islands (Islas Malvinas). – J. Biogeogr. **38**: 2078–2090.

MORRONE, J.J. 2015: Biogeographical regionalisation of the Andean region. – Zootaxa **3936** (2): 207–236.

MOSER, M. & E. HORAK 1975: *Cortinarius* Fr. und nahe verwandte Gattungen in Südamerika. – Beih. Nov. Hedwig. **52**: 1–628.

OLSON, D.M., E. DINERSTEIN, E.D. WIKRAMANAYAKE, N.D. BURGESS, G.V.N. POWELL et al. 2001: Terrestrial ecoregions of the world: a new map of life on Earth. – Bioscience **51**: 933–938.

PHILLIPS, S.J., M. DUDÍK & R.E. SCHAPIRE 2004: A Maximum Entropy Approach to Species Distribution Modeling. – In: Proceedings of the Twenty-First International Conference on Machine Learning, p. 655–662.

PHILLIPS, S.J., R.P. ANDERSON & R.E. SCHAPIRE 2006: Maximum entropy modeling of species geographic distributions. – Ecol. Model. **190**: 231–259.

PHILLIPS, S.J. & M. DUDÍK 2008: Modeling of species distributions with Maxent: new extensions and a comprehensive evaluation. – Ecography **31**: 161–175.

PILDAIN, M.B., M.P.A. COETZEE, M. RAJCHENBERG, R.H. PETERSEN, M.J. WINGFIELD et al. 2009: Molecular phylogeny of *Armillaria* from the Patagonian Andes. – Mycol. Prog. **8**: 181–194.

RADOSAVLJEVIC, A. & R.P. ANDERSON 2014: Making better MAXENT models of species distributions: complexity, overfitting and evaluation. – J. Biogeogr. **41**: 629–643.

RENNER, I.W. & D.I. WARTON 2013: Equivalence of MAXENT and Poisson Point Process Models for Species Distribution Modeling in Ecology. – Biometrics **69**: 274–281.

RINALDI, A.C., O. COMANDINI & T.W. KUYPER 2008: Ectomycorrhizal fungal diversity: separating the wheat from the chaff. – Fungal Divers. **33**: 1–45.

ROMANO, G.M. & B.E. LECHNER 2014: The Cortinariaceae of Argentina's Nothofagus forests. – Mycotaxon **126**: 247. http://mycotaxon.com/resources/checklists/romanov-126-checklist.pdf

SHCHEGLOVITOVA, M. & R.P. ANDERSON 2013: Estimating optimal complexity for ecological niche models: a jackknife approach for species with small sample sizes. – Ecol. Model. **269**: 9–17.

SCHIAFFINI, M.I., G.M. MARTIN, A.L. GIMÉNEZ & P.J. PREVOSTI 2013: Distribution of *Lyncodon patagonicus* (Carnivora, Mustelidae): changes from the Last Glacial Maximum to the present. – J. Mammal. **94**: 339–350.

SINGER, R. 1952: The Agarics of the Argentine sector of Tierra del Fuego and limitrophous regions of the Magallanes area I: White and pink spored groups. – Sydowia **6**: 165–226.

SINGER, R. 1953: The Agarics of the Argentine sector of Tierra del Fuego and limitrophous regions of the Magallanes area II: Brown spored groups (except *Cortinarius*). – Sydowia **7**: 206–265.

SINGER, R. 1958: Monographs of South American Basidiomycetes, especially those of the east slope of the Andes and Brazil 1: The genus *Pluteus* in South America. – Lloydia **21**: 195–302.

SINGER, R. 1969: Mycoflora australis. – Beihefte Nova Hedwigia **29**: 1–405.

SPEGAZZINI, C. 1887a: Fungi patagonici. – Bol. Acad. Nac. Cienc. **11**: 5–59.

SPEGAZZINI, C. 1887b: Fungi fuegiani. – Bol. Acad. Nac. Cienc. **11**: 135–311.

STAMETS, P. 1993: Growing Gourmet and Medicinal Mushrooms. – Ten Speed Press.

VALENZUELA, E. 1993: Estudio sistemático, corológico y ecológico de los Agaricales sensu lato de los bisques autóctonos de la Región de Los Lagos en Chile. – PhD Thesis. Universidad de Alcalá de Henares.

VALENZUELA, E., G. MORENO, S. GARNICA & C. RAMIREZ 1998: Micosociología en bosques nativos de *Nothofagus* y plantaciones de *Pinus radiata* en la X Región de Chile: diversidad y rol ecológico. – Rev. Chil. Hist. Nat. **71**: 133–146.

WOLFE, B.E., F. RICHARD, H.B. CROSS & A. PRINGLE 2009: Distribution and abundance of the introduced ectomycorrhizal fungus *Amanita phalloides* in North America. – New Phytol. **185**: 803–816.

WISZ, M.S., R.J. HIJMANS, J. LI, A.T. PETERSON, C.H. GRAHAM et al. 2008: Effects of sample size on the performance of species distribution models. – Divers. Distrib. **14**: 763–773.

WOLLAN, A.K., V. BAKKESTUEN, H. KAUSERUD, G. GULDEN & R. HALVORSEN 2008: Modelling and predicting fungal distribution patterns using herbarium data. – J. Biogeogr. **35**: 2298–2310.

YUAN, H.S., Y.L. WEI & X.G. WANG 2015: Maxent modeling for predicting the potential distribution of Sanghuang, an important group of medicinal fungi in China. – Fungal Ecology **17**: 140–145.

ZERVAKIS, G.I., J.M. MONCALVO & R. VILGALYS 2004: Molecular phylogeny, biogeography and speciation of the mushroom species *Pleurotus cystidiosus* and allied taxa. – Microbiology **150**: 715–726.

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Appendix

Species	Nutrition	Country	Province	Locality – Observations	Latitude	Longitude	Herbarium number	References
Austropaxillus statuum (Speg.) Bresinsky and Jarosch 1999	ECM	Argen-tina	Chubut	Futaleufú, Huemules	42°46'48.20"S	71°28'1.28"O		This paper
				Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				Futaleufú, Lago La Plata	44°50'0.15"S	71°43'35.57"O		This paper
				PN Los Alerces, Cerro Dedal	42°54'26.88"S	71°37'28.36"O		This paper
			Tierra del Fuego	Isla de los Estados	54°45'20.34"S	64°15'21.01"O	LPS 16811	Horak (1979)
				Isla de los Estados, Puerto Hoppner	54°45'5.15"S	64°24'36.90"O		Spegazzini (1887b)
				Lapataia, Lago Roca	54°49'56.03"S	68°33'42.49"O	ZT 74/21	Horak (1979)
				Rio Grande, Estancia María Cristina	54°22'0.00"S	67°20'0.00"O		Godeas et al. (1993)
				Río Lapataia	54°50'37.52"S	68°33'53.72"O	LPS 35386	Horak (1979)
				Río Lapataia	54°50'37.52"S	68°33'53.72"O	LPS 35422	Horak (1979)
				Ushuaia, Al este de Ushuaia	54°49'27.36"S	68°20'44.31"O	ZT 62/40	Horak (1979)
				Ushuaia, Al norte de Ushuaia	54°49'27.36"S	68°20'44.31"O	ZT 66/281	Horak (1979)
				Ushuaia, Al norte de Ushuaia	54°49'27.36"S	68°20'44.31"O	ZT 74/41	Horak (1979)
				Ushuaia, Laguna Victoria	54°45'0.00"S	67°45'0.00"O		Godeas et al. (1993)
				Valle Carbajal	54°42'15.86"S	68°13'25.96"O	LPS 35413	Horak (1979)
		Chile	Los Ríos	Valdivia, Rebellín	39°44'00"S	73°11'00"O	AH 15495	Valenzuela (1993)
				Valdivia, Rebellín	39°44'00"S	73°11'00"O		Valenzuela et al. (1998)
			Magal-lanes y Antártica Chilena	Punta Arenas	53°9'2.21"S	70°54'56.06"	LPS 38594	Horak (1979)
Clitocybe patagonica (Speg.) Speg. 1891	SAP	Argentina	Chubut	Futaleufú, Huemules	42°46'48.20"S	71°28'1.28"O		This paper
				Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				Futaleufú, Lago La Plata	44°50'0.15"S	71°43'35.57"O		This paper

			Neuquén	Quetrihué	40°49'16.78"S	71°37'59.02"O	BAFC M-5118	Singer (1969)
			Tierra del Fuego	Rio Grande, Estancia Nueva Argentina	54°22'59.88"S	67°17'60.00"O	LIL M-192	Singer (1952); Singer (1969)
				Rio Grande, Estancia Nueva Argentina	54°22'59.88"S	67°17'60.00"O	LIL M-19 Fig. 2A	Singer (1952); Singer (1969)
				Ushuaia, Ensenada	54°50'47.58"S	68°28'51.92"O	ZT 75/193	Horak (1979)
		Chile	de la Araucanía	Malleco, Cordillera de Nahuel Buta, San Carlos	37°47'46.52"S	72°58'44.64"O	SGO M-6928	Singer (1969)
				Puerto Natales, Los Robles, Monte Alto	52°04'10.29"S	71°50'50.28"O	ZT 62/60	Horak (1979)
			Magallanes y Antártica Chilena	Punta Arenas	53° 9'2.21"S	70°54'56.06"O	LPS 2911	Horak (1979)
Cortinarius austroduracinus M.M.Moser 1975	ECM	Argentina	Chubut	Futaleufú, Huemules	42°46'48.20"S	71°28'1.28"O		This paper
				Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				Futaleufú, Lago La Plata	44°50'0.15"S	71°43'35.57"O		This paper
			Neuquén	Lago Espejo	40°37'24.57"S	71°45'20.28"O	LPS 40039	
				Lago Nahuel Huapi, Puerto Manzano	40°47'52.89"S	71°36'35.91"O	IB 63/384	Moser & Horak (1975)
				Nahuel Huapi, Península Quetrihué, Lago "Patagua"	40°50'35.38"S	71°37'17.82"O	IB 63/352	Moser & Horak (1975)
				Nahuel Huapi, Puerto Manzano	40°47'52.89"S	71°36'35.91"O	IB 63/381	Horak (1979)
			Tierra del Fuego	Ushuaia, Ensenada	54°50'47.58"S	68°28'51.92"O	ZT 74/28	Horak (1979)
				Ushuaia, Ensenada	54°50'47.58"S	68°28'51.92"O	LPS 38040	
				Ushuaia, Estancia Moat	54°53'49.00"S	67° 4'36.10"O		Godeas et al. (1993)
				Ushuaia, Laguna Victoria	54°45'0.00"S	67°45'0.00"O		Godeas et al. (1993)
		Chile	Magallanes y Antártica Chilena	Península Brunswick, Puerto Hambre	53°36'27.54"S	70°55'59.20"O	ZT 75/8	Horak (1979)
Cortinarius magellanicus Speg. 1887	ECM	Argentina	Chubut	Futaleufú, Huemules	42°46'48.20"S	71°28'1.28"O		This paper
				Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				PN Los Alerces,	42°53'51.15"S	71°37'48.33"O		This paper

	PN Los Alerces, Cerro Dedal	42°54'26.88"S	71°37'28.36"O		This paper
Neuquén	Nahuel Huapi, Laguna de los Cántaros	41°00'37.55"S	71°49'25.18"O	IB 63/274	Moser & Horak (1975)
	Nahuel Huapi, Laguna de los Cántaros	41°00'37.55"S	71°49'25.18"O	IB 63/297	Moser & Horak (1975)
	Nahuel Huapi, Laguna de los Cántaros	41°00'37.55"S	71°49'25.18"O	IB 63/311	Moser & Horak (1975)
	Nahuel Huapi, Laguna de los Cántaros	41°00'37.55"S	71°49'25.18"O	M 1801	Moser & Horak (1975)
	Nahuel Huapi, Puerto Manzano, meseta por encima de la casa de DIEM	40°47'52.89"S	71°36'35.91"O	Neotipo 63/347 (MM)	Moser & Horak (1975)
Rio Negro	Puerto Blest, camino a Los Cántaros	41°00'50.92"S	71°49'25.40"O	BAFC 33651	
	Valle Frías (entre el Lago Frías y Paso de las Nubes)	41°06'5.19"S	71°48'40.00"O		Moser & Horak (1975)
Tierra del Fuego	Gertrude Cove, Onniuáia ó Gertrudis Cove: en la costa fuegina, al pie de Monte Darwin	54°52'44.57"S	68°33'35.27"O		Spegazzini (1887a)
Tierra del Fuego	Lago Fagnano	54°37'1.30"S	67°27'35.19"O		Valenzuela (1993)
	Puerto Harberton	54°52'41.61"S	67°19'54.74"O	BAFC 23258	Horak (1979); Valenzuela (1993)
	Puerto Harberton	54°52'41.61"S	67°19'54.74"O	BAFC 2326	Valenzuela (1993)
	Puerto Harberton	54°52'41.61"S	67°19'54.74"O	BAFC 23317	Horak (1979); Valenzuela (1993)
	Puerto Harberton	54°52'41.61"S	67°19'54.74"O	LPS 35384	Horak (1979); Valenzuela (1993)
	Rio Grande, Estancia María Cristina	54°22'0.00"S	67°20'0.00"O		Godeas et al. (1993)
	Tierra Mayor	54°43'42.04"S	68°00'6.25"O	LPS 37999	
	Tierra Mayor	54°43'42.04"S	68°00'6.25"O	ZT 74/91	Horak (1979); Valenzuela (1993)
	Tierra Mayor, Valle del Rio Triste	54°44'1.21"S	67°54'3.53"O	ZT 74/191	Horak (1979); Valenzuela (1993)
	Ushuaia, Al norte de Ushuaia	54°49'27.36"S	68°20'44.31"O	ZT 75/60	Horak (1979)
	Ushuaia, Estancia Moat	54°53'49.00"S	67°4'36.10"O		Godeas et al. (1993)

				Ushuaia, Lago Fagnano	54°37'1.30"S	67°27'35.19"O	IB M-359	Horak (1979); Moser & Horak (1975)
				Ushuaia, Lago Fagnano	54°37'1.30"S	67°27'35.19"O	M 3354	Moser & Horak (1975)
				Ushuaia, Laguna Victoria	54°45'0.00"S	67°45'0.00"O		Godeas et al. (1993)
				Ushuaia, Lapataia	54°51'0.30"S	68°34'38.86"O	ZT 74/38	Horak (1979)
				Ushuaia, Tierra Mayor	54°43'42.04"S	68°00'6.25"O	BAFC31547	
				Ushuaia, Valle del Glaciar Martial	54°47'49.53"S	68°21'12.94"O	ZT TF50	Valenzuela (1993); Moser & Horak (1975)
		Chile	Los Lagos	Osorno, Antillanca	40°45'00"S	72°08'00"O		Valenzuela et al. (1998)
				Osorno, Entre Ensenada y Ralún, Provo Yanquihueen Puerto Fao	41°17'31.88"S	72°27'56.57"O	M 7610	Moser & Horak (1975)
				Osorno, San Juan de la Costa, Popoén	40°43'00"S	73°29'00"O		Valenzuela et al. (1998)
				Provo Llanquihue, A unos 15 km al nordeste de Puerto Pargua	41°41'35.35"S	73°20'39.58"O	M 6795	Moser & Horak (1975)
			Los Ríos	Valdivia, Cordillera Pelada	40°21'00"S	72°57'00"O		Valenzuela et al. (1998)
				Valdivia, Cordillera Pelada	40°21'00"S	72°57'00"O	AH 15459	Valenzuela (1993)
				Valdivia, Los Troncos	39°46'37.25"S	72°54'6.08"O		Valenzuela et al. (1998)
				Valdivia, Rebellín	39°44'00"S	73°11'00"O		Valenzuela et al. (1998)
				Valdivia, Universidad Austral de Chile, Casa de Extención	39°48'00"S	73°15'00"O	AH 15458	Valenzuela (1993)
				Valdivia, Universidad Austral de Chile, Jardin Botánico	39°48'00"S	73°15'00"O	TUB 011480	Garnica et al. (2003)
			Magal-lanes y Antártica Chilena	Bahía Yendegaia, Iandagáia: profundo canal, que corre en el límite de las posesiones argentinas y chilenas, en la Tierra del Fuego	54°51'58.29"S	68°40'56.27"O		Spegazzini (1887b); Moser & Horak (1975)
				Picton Island	54°55'0.00"S	66°54'58.95"O		Spegazzini (1887b)
				Voces Bay	53°40'20.76"S	70°58'22.26"O		Spegazzini (1887a)
Cortinarius permagnificus E.Horak 1975	ECM	Argentina	Chubut	Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
			Tierra del Fuego	Rio Grande, Estancia María Cristina	54°22'0.00"S	67°20'0.00"O		Godeas et al. (1993)
				Ushuaia, Laguna Victoria	54°45'0.00"S	67°45'0.00"O		Godeas et al. (1993)

		Chile	Los Lagos	Osorno, Antillanca	40°45'00"S	72°08'00"O	AH 19524	Garnica et al. (2003)
			Magal-lanes y Antártica Chilena	Puerto Natales, Los Robles, Monte Alto	52°04'10.29"S	71°50'50.28"O	ZT PN 49	Moser & Horak (1975); Horak (1979)
Descolea antarctica Singer 1952	ECM	Argentina	Chubut	Futaleufú, Huemules	42°46'48.20"S	71°28'1.28"O		This paper
				Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				Futaleufú, Lago La Plata	44°50'0.15"S	71°43'35.57"O		This paper
				PN Los Alerces, Cerro Dedal	42°54'26.88"S	71°37'28.36"O		This paper
			Tierra del Fuego	Rio Grande, Estancia María Cristina	54°22'0.00"S	67°20'0.00"O		Godeas et al. (1993)
				Rio Grande, Estancia Nueva Argentina	54°22'59.88"S	67°17'60.00"O	LIL M-144a	Horak (1979)
				Ushuaia, Al norte de Ushuaia	54°49'27.36"S	68°20'44.31"O	ZT 64/98	Horak (1979)
				Ushuaia, Al norte de Ushuaia	54°49'27.36"S	68°20'44.31"O	ZT 75/425	Horak (1979)
				Ushuaia, Al norte de Ushuaia	54°49'27.36"S	68°20'44.31"O	ZT 74/146	Horak (1979)
				Ushuaia, Al norte de Ushuaia	54°49'27.36"S	68°20'44.31"O	BAFC 23928	Horak (1979)
				Ushuaia, Ensenada	54°50'47.58"S	68°28'51.92"O	ZT 74/7	Horak (1979)
				Ushuaia, Ensenada	54°50'47.58"S	68°28'51.92"O	ZT 74/10	Horak (1979)
		Chile	Los Ríos	Valdivia, Rebellín	39°44'00"S	73°11'00"O	AH 13139	Valenzuela (1993)
				Valdivia, Rebellín	39°44'00"S	73°11'00"O	AH 13907	Valenzuela (1993)
				Valdivia, Rebellín	39°44'00"S	73°11'00"O		Valenzuela et al. (1998)
				Valdivia, Universidad Austral de Chile, Jardin Botánico	39°48'00"S	73°15'00"O	AH 15297	Valenzuela (1993)
				Valdivia, Universidad Austral de Chile, Jardin Botánico	39°48'00"S	73°15'00"O	AH 15298	Valenzuela (1993)
				Valdivia, Universidad Austral de Chile, Jardin Botánico	39°48'00"S	73°15'00"O	AH 13908	Valenzuela (1993)
Galerina gamundiae Singer 1964	SAP	Argentina	Chubut	Futaleufú, Huemules	42°46'48.20"S	71°28'1.28"O		This paper
				Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				Futaleufú, Lago La Plata	44°50'0.15"S	71°43'35.57"O		This paper
			Neuquén	Villa La Angostura	40°45'28.82"S	71°39'4.31"O	BAFC20423	Horak (1979)
			Tierra del Fuego	Ushuaia, Lapataia	54°51'0.30"S	68°34'38.86"O	ZT 74/208	Horak (1979)

		Chile	Magallanes y Antártica Chilena	Puerto Natales, Valle del Río Rubens	52°04'57.70"S	72°02'46.45"O	ZT 62/50	Horak (1979)
Gymnopus fuegianus (Singer) Halling and J.L.Mata 2004	SAP	Argentina	Chubut	Futaleufú, Huemules	42°46'48.20"S	71°28'1.28"O		This paper
				Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				Futaleufú, Lago La Plata	44°50'0.15"S	71°43'35.57"O		This paper
			Tierra del Fuego	Estancia Nueva Argentina	54°22'59.88"S	67°17'60.00"O	M 157 LIL	Singer (1952)
				Lago Fagnano	54°37'1.30"S	67°27'35.19"O		Singer (1952)
				Rio Grande, Estancia María Cristina	54°22'0.00"S	67°20'0.00"O		Godeas et al. (1993)
				Tierra Mayor	54°43'42.04"S	68°00'6.25"O	ZT 74/65	Horak (1979)
				Ushuaia	54°49'27.36"S	68°20'44.31"O	ZT 62/108	Horak (1979)
				Ushuaia, Laguna Victoria	54°45'0.00"S	67°45'0.00"O		Godeas et al. (1993)
Hydropus dusenii (Bres.) Singer (1969)	SAP	Argentina	Chubut	Futaleufú, Lago La Plata	44°50'0.15"S	71°43'35.57"O		This paper
				PN Los Alerces, Cerro Dedal	42°54'26.88"S	71°37'28.36"O		This paper
			Tierra del Fuego	Río Pipo	54°48'17.51"S	68°29'32.10"O	BAFC 23935	Horak (1979)
				Estancia Nueva Argentina	54°22'59.88"S	67°17'60.00"O	M 616 LIL	Singer (1952)
				Estancia Nueva Argentina	54°22'59.88"S	67°17'60.00"O	M 162 LIL	Singer (1952)
				Lago Fagnano	54°37'1.30"S	67°27'35.19"O		Singer (1952)
				Lapataia, Lago Roca	54°49'56.03"S	68°33'42.49"O	ZT 71/17	Horak (1979)
				Rio Grande, Estancia María Cristina	54°22'0.00"S	67°20'0.00"O		Godeas et al. (1993)
				Tierra Mayor	54°43'42.04"S	68°00'6.25"O	ZT 74/14	Horak (1979)
				Ushuaia, Laguna Victoria	54°45'0.00"S	67°45'0.00"O		Godeas et al. (1993)
				Ushuaia, Lapataia	54°51'0.30"S	68°34'38.86"O	ZT 62/114	Horak (1979)
		Chile	Los Ríos	Valdivia, Cordillera Pelada	40°21'00"S	72°57'00"O		Valenzuela et al. (1998)
				Valdivia, Cordillera Pelada	40°21'00"S	72°57'00"O	AH 15307	Valenzuela (1993)
			Magallanes y Antártica Chilena	Rio Azopardo	54°29'39.66"S	68°53'13.34"O		Singer (1952)

				Isla Dawson	53°59'30.00"S	70°39'30.00"O		Singer (1952)
				Lago Fagnano	54°30'20.53"S	68°48'39.96"O		Singer (1952)
				Península Brunswick, Puerto Hambre	53°36'27.54"S	70°55'59.20"O	ZT 75/13	Horak (1979)
				Puerto Natales, Valle del Rio Rubens	52°04'57.70"S	72°02'46.45"O	ZT 62/116	Horak (1979)
Hypholoma frowardii (Speg.) Garrido 1985	SAP	Argentina	Chubut	Futaleufú, Huemules	42°46'48.20"S	71°28'1.28"O		This paper
				Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				Futaleufú, Lago La Plata	44°50'0.15"S	71°43'35.57"O		This paper
				PN Los Alerces, Cerro Dedal	42°54'26.88"S	71°37'28.36"O		This paper
			Tierra del Fuego	Laguna del Indio	54°33'54.37"S	67°16'24.57"O	BAFC 23918	Horak (1979)
				Laguna del Indio	54°33'54.37"S	67°16'24.57"O	BAFC 23921	Horak (1979)
				Laguna del Indio	54°33'54.37"S	67°16'24.57"O	BAFC 23922	Horak (1979)
				Ruta Cero	54°47'28.54"S	67°38'10.46"O	BAFC 23936	Horak (1979)
				Rio Grande, Estancia María Cristina	54°22'0.00"S	67°20'0.00"O		Godeas et al. (1993)
				Ushuaia	54°49'27.36"S	68°20'44.31"O	LPS 38956	Horak (1979)
				Ushuaia	54°49'27.36"S	68°20'44.31"O	LPS 38957	Horak (1979)
				Ushuaia	54°49'27.36"S	68°20'44.31"O	BAFC 23932	Horak (1979)
				Ushuaia, Ensenada	54°50'47.58"S	68°28'51.92"O	BAFC 23934	Horak (1979)
				Ushuaia, Estancia Moat	54°53'49.00"S	67°4'36.10"O		Godeas et al. (1993)
				Ushuaia, Laguna Victoria	54°45'0.00"S	67°45'0.00"O		Godeas et al. (1993)
				Ushuaia, Lapataia	54°51'0.30"S	68°34'38.86"O	ZT 74/54	Horak (1979)
				Ushuaia, Lapataia	54°51'0.30"S	68°34'38.86"O	ZT 66/219	Horak (1979)
		Chile	Los Ríos	Valdivia, Cayumapu	39°43'4.44"S	73°02'3.90"O	M 7761 (SGO)	Singer (1969)
				Valdivia, Fundo Forestal Pedro de Valdivia	39°44'58.83'S	73°3'6.29"O	AH 15786	Valenzuela (1993)
			Magallanes y Antártica Chilena	Puerto Natales, Valle del Rio Rubens	52°04'57.70"S	72°02'46.45"O	ZT 62/47	Horak (1979)

				Voces Bay	53°40'20.76"S	70°58'22.26"O	LPS "Fragments only"	Singer (1969)
				Voces Bay	53°40'20.76"S	70°58'22.26"O		Spegazzini (1887a)
Inocybe geophyllomorpha Singer 1953	ECM	Argentina	Chubut	Futaleufú, Huemules	42°46'48.20"S	71°28'1.28"O		This paper
				Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				Futaleufú, Lago La Plata	44°50'0.15"S	71°43'35.57"O		This paper
			Tierra del Fuego	Rio Grande, Estancia Nueva Argentina	54°22'59.88"S	67°17'60.00"O	LIL M-272	Singer (1953); Horak (1979)
				Ushuaia, Laguna Victoria	54°45'0.00"S	67°45'0.00"O		Godeas et al. (1993)
				Ushuaia, Valle del Glaciar Martial	54°47'49.53"S	68°21'12.94"O	ZT 66/554	Horak (1979)
				Ushuaia, Valle entre el Monte Olivia y Cinco Hermanos	54°44'14.90"S	68°11'45.61"O	ZT 74/112	Horak (1979)
Mycena dendrocystis E.Horak 1980	SAP	Argentina	Chubut	Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				Futaleufú, Lago La Plata	44°50'0.15"S	71°43'35.57"O		This paper
				PN Los Alerces, Cerro Dedal	42°54'26.88"S	71°37'28.36"O		This paper
			Tierra del Fuego	Ushuaia, Valle del Glaciar Martial	54°47'49.53"S	68°21'12.94"O	ZT 66/220	Horak (1979)
Pholiota baeosperma Singer 1953	SAP	Argentina	Chubut	Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				Futaleufú, Lago La Plata	44°50'0.15'S	71°43'35.57"O		This paper
			Neuquén	Lago Lacar, Puerto Pucará	40°09'55.49"S	71°37'34.57"O	BAFC M-6017	Singer (1969)
				San Martín de los Andes	40°9'10.85"S	71°19'58.51"O	LIL M-471	Singer (1953)
				Villa La Angostura, Selva Triste	40°46'31.73"S	71°39'39.19"O	BAFC M-3053	Singer (1969)
			Rio Negro	Cerro Catedral	41°13'2.37"S	71°29'44.40"O	BAFC M-5172	Singer (1969)
				Cerro Catedral	41°13'2.37"S	71°29'44.40"O	BAFC M-5170	Singer (1969)
			Tierra del Fuego	Lago Fagnano	54°37'1.30"S	67°27'35.19"O	LIL M-368	Singer (1953); Singer (1969); Horak (1979)
				Puerto Harberton	54°52'41.61"S	67°19'54.74"O	BAFC 23418	Horak (1979)
				Puerto Harberton	54°52'41.61"S	67°19'54.74"O	BAFC 23925	Horak (1979)
				Puerto Harberton	54°52'41.61"S	67°19'54.74"O	BAFC 23274	Horak (1979)

				Ushuaia, Aserradero Preto	54°47'28.54"S	67°38'10.46"O	BAFC 23397	Horak (1979)
				Ushuaia, Estancia Moat	54°53'49.00"S	67°4'36.10"O	ZT 75/175	Horak (1979)
				Ushuaia, Valle del Rio Grande	53°49'45.14"S	67°50'48.77"O	ZT 75/199	Horak (1979)
		Chile	de la Araucanía	Malleco, Lonquimay	38°27'9.36"S	71°22'24.54"O	BAFC	Singer (1969)
			Magal-lanes y Antártica Chilena	Puerto Natales, Los Robles, Monte Alto	52°04'10.29"S	71°50'50.28"O	ZT 62/58	Horak (1979)
Pluteus spegazzinianus Singer 1952	SAP	Argentina	Chubut	Futaleufú, Huemules	42°46'48.20"S	71°28'1.28"O		This paper
				Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				Futaleufú, Lago La Plata	44°50'0.15"S	71°43'35.57"O		This paper
			Neuquén	Quetrihué	40°49'16.78"S	71°37'59.02"O	M 675a LIL	Singer (1958)
			Tierra del Fuego	Los Cántaros, entre Lapataia y Ushuaia	54°49'48.00"S	68°26'14.67"O	ZT 74/6	Horak (1979)
				Río Fuego	53°59'45.39"S	67°24'58.80"O	ZT 74/249	Horak (1979)
				Estancia Nueva Argentina	54°22'59.88"S	67°17'60.00"O	M 153 LIL	Singer (1952); Singer (1958)
				Estancia Nueva Argentina	54°22'59.88"S	67°17'60.00"O	M 303 LIL	Singer (1952); Singer (1958)
				Estancia Nueva Argentina	54°22'59.88"S	67°17'60.00"O	M 303a LIL	Singer (1952); Singer (1958)
				Puerto Harberton, Shanly	54°52'41.61"S	67°19'54.74"O	BAFC 23307	Horak (1979)
				Rio Grande, Estancia María Cristina	54°22'0.00"S	67°20'0.00"O		Godeas et al. (1993)
				Río Grande, Estancia Nueva Argentina	54°22'59.88"S	67°17'60.00"O	LIL M-303	Horak (1979)
				Ushuaia	54°49'27.36"S	68°20'44.31"O	BAFC23927	Horak (1979)
				Ushuaia, al norte de Ushuaia	54°49'27.36"S	68°20'44.31"O	ZT 63/369	Horak (1979); Valenzuela (1993)
				Ushuaia, al norte de Ushuaia	54°49'27.36"S	68°20'44.31"O	ZT 75/75	Horak (1979)
				Ushuaia, Glaciar Martial	54°47'49.53"S	68°21'12.94"O	ZT 63/370	Horak (1979)
				Ushuaia, Laguna Victoria	54°45'0.00"S	67°45'0.00"O		Godeas et al. (1993)
				Ushuaia, Tierra Mayor	54°43'42.04"S	68°00'6.25"O	ZT 74/216	Horak (1979) Valenzuela (1993)

		Chile	Los Lagos	Osorno, Antillanca	40°45'00"S	72°08'00"O		Valenzuela et al. (1998)
				Osorno, Rucatayo	40°33'00"S	72°38'00"O	AH 15343	Valenzuela (1993)
			Los Ríos	Valdivia, Camino Fundo las Palmas	39°44'00"S	73°08'00"O	AH 15344	Valenzuela (1993)
				Valdivia, Cordillera Pelada	40°21'00"S	72°57'00"O		Valenzuela et al. (1998)
			Magal-lanes y Antártica Chilena	Puerto Natales, Los Robles, Monte Alto	52°04'10.29"S	71°50'50.28"O	ZT 63/368	Horak (1979); Valenzuela (1993)
Psathyrella falklandica Cotton 1915	SAP	Argentina	Chubut	Futaleufú, Huemules	42°46'48.20"S	71°28'1.28"O		This paper
				Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				Futaleufú, Lago La Plata	44°50'0.15"S	71°43'35.57"O		This paper
				PN Los Alerces, Cerro Dedal	42°54'26.88"S	71°37'28.36"O		This paper
			Islas Malvinas (Falkland Islands)	Isla Gran Malvina, Ensenada Roy	51°32'56.16"S	60°23'10.01"O		Cotton (1915)
			Neuquén	Cerro Colorado	40°05'35.12"S	71°24'4.83"O	BAFC M 1731	Singer (1969)
				Lago Lacar, Puerto Pucará	40°09'55.49"S	71°37'34.57"O		Singer (1969)
				Nahuel Huapi, Puerto Manzano	40°47'52.89"S	71°36'35.91"O	BAFC M-3278	Horak (1979)
				Nahuel Huapi, Puerto Manzano	40°47'52.89"S	71°36'35.91"O	BAFC M 3429	Singer (1969)
				Nahuel Huapi, Puerto Manzano	40°47'52.89"S	71°36'35.91"O	BAFC M 3436	Singer (1969)
				Nahuel Huapi, Puerto Manzano	40°47'52.89"S	71°36'35.91"O	BAFC M 3282 A	Singer (1969)
				Nahuel Huapi, Puerto Manzano	40°47'52.89"S	71°36'35.91"O	BAFC M 3278	Singer (1969)
				Villa La Angostura, Selva Triste	40°46'31.73"S	71°39'39.19"O	BAFC M 6036	Singer (1969)
			Rio Negro	Cerro Catedral	41°13'2.37"S	71°29'44.40"O	BAFC M 5350	Singer (1969)

				Cerro Otto	41°08'50.03"S	71°22'48.21"O	BAFC M-4012	Singer (1969); Horak (1979)
				Laguna Frias	41°03'47.92"S	71°47'59.36"O	BAFC M-6052	Singer (1969)
			Tierra del Fuego	Valle del Río Olivia	54°42'56.61"S	68°12'40.68"O	ZT 66/235	Horak (1979)
				Ushuaia, Al este de Lapataia	54°51'0.30"S	68°34'38.86"O	ZT 74/97	Horak (1979)
				Ushuaia, Estancia Moat	54°53'49.00"S	67°4'36.10"O		Godeas et al. (1993)
				Ushuaia, Península Ushuaia	54°50'07.30"S	68°18'30.49"O	ZT 66/229	Horak (1979)
		Chile	Los Lagos	Llanquihue, Frutillar	41°8'0.02"S	73°1'39.50"O	SGO M 7544	Singer (1969)
				Osorno, Antillanca	40°45'00"S	72°08'00"O		Valenzuela et al. (1998)
			Los Ríos	Valdivia, 5 km N of Conales	40°08'16.70"S	72°57'59.11"O	SGO M 6902	Singer (1969)
				Valdivia, Cordillera Pelada	40°21'00"S	72°57'00"O		Valenzuela et al. (1998)
			Maule	Entre Chovellén y Tregualemu	35°57'12.23"S	72°43'43.94"O	SGO M 7202	Singer (1969)
				Entre Chovellén y Tregualemu	35°57'12.23"S	72°43'43.94"O	SGO M 7217	Singer (1969)
			Metropolitana de Santiago	Macul	33°30'0.00"S	70°33'60.00"O	SGO M 7340	Singer (1969)
				Rangue	33°50'1.11"S	70°58'1.64"O	SGO M 7141	Singer (1969)
Rhodophyllus patagonicus Singer (1969)	ECM	Argentina	Chubut	Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				Futaleufú, Lago La Plata	44°50'0.15"S	71°43'35.57"O		This paper
			Rio Negro	Laguna Frías	41°03'47.92"S	71°47'59.36"O	BAFC M-3099	Singer (1969)
			Tierra del Fuego	Lapataia	54°51'0.30"S	68°34'38.86"O	ZT 74/27	Horak (1979)
Russula nothofaginea Singer 1950	ECM	Argentina	Chubut	Futaleufú, Huemules	42°46'48.20"S	71°28'1.28"O		This paper
				Futaleufú, Lago Guacho	43°49'53.91"S	71°28'31.39"O		This paper
				PN Los Alerces, Cerro Dedal	42°54'26.88"S	71°37'28.36"O		This paper
			Tierra del Fuego	Laguna del Indio	54°33'54.37"S	67°16'24.57"O	BAFC 23920	Horak (1979)
				Lapataia	54°51'0.30"S	68°34'38.86"O	ZT 74/27	Horak (1979)

				Tierra Mayor	54°43'42.04"S	68°00'6.25"O	ZT 74/72	Horak (1979)
				Lago Fagnano	54°37'1.30"S	67°27'35.19"O	LIL M-276	Horak (1979)
				Puerto Harberton	54°52'41.61"S	67°19'54.74"O	BAFC 23255	Horak (1979)
				Rio Grande, Estancia Nueva Argentina	54°22'59.88"S	67°17'60.00"O	LIL M-297	Horak (1979)
				Ushuaia, Al norte de Ushuaia	54°49'27.36"S	68°20'44.31"O	ZT 66/210	Horak (1979)
				Ushuaia, Al norte de Ushuaia	54°49'27.36"S	68°20'44.31"O	ZT 75/69	Horak (1979)
				Ushuaia, Laguna Victoria	54°45'0.00"S	67°45'0.00"O		Godeas et al. (1993)
		Chile	Los Ríos	Valdivia, Rebellín	39°44'00"S	73°11'00"O		Valenzuela (1993); Valenzuela et al. (1998)
Stephanopus stropharioides E.Horak 1975	ECM	Argentina	Rio Negro	Bariloche, El Manso, pasando última pasarela, bosque de coihue	41°35'0.36"S	71°38'23.11"O	CIEFAP 53	
				Valle Frias	41°06'5.19"S	71°48'40.00"O		Moser & Horak (1975)
			Tierra del Fuego	Ushuaia, Al este de Lapataia	54°51'0.30"S	68°34'38.86"O	ZT 74/32	Moser & Horak (1975); Horak (1979)
				Ushuaia, Tierra Mayor	54°43'42.04"S	68°00'6.25"O	ZT 74/128	Horak (1979)
				Ushuaia, Valle del Glaciar Martial	54°47'49.53"S	68°21'12.94"O	ZT 75/36	Horak (1979)