Recovery of the Critically Endangered bracket fungus *Amylocystis lapponica* in the Estonian network of strictly protected forests

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SUPPLEMENTARY MATERIAL 1 Description of known *Amylocystis lapponica* subpopulations and their survey history in Estonia

Note: under the Estonian Nature Conservation Act, the locations of strictly protected (Category I) species are not public information; thus the geographical co-ordinates have been here given at 1-minute accuracy. The exact location data are stored and governed by the Estonian Environmental Board. See Fig. 1 for a broad-scale map. The subpopulations are arranged by the time of their discovery.

Subpopulation 1. Tartu County, Järvselja (58˚01' 27˚19'); found in 1969

Järvselja old-growth forest (size 19 ha; south-eastern Estonia) has been protected since 1924. *A. lapponica* inhabits mixed forests of *Vaccinium myrtillus* drained peatland and *Aegopodium* types. Mycological surveys in this locality date back to the 1930s, when Elmar Leppik (the first professional mycologist in Estonia) described the local distribution of polypores and other wood rotting fungi (Parmasto 1998, and references therein). In 1952-1955, the locality was thoroughly studied by Prof. Erast Parmasto, who then continued studying the local mycota during his regular visits until 2002 (altogether 90 visits since 1950) (Parmasto et al., 2004). In 1954-1981, polypores in the locality were also annually surveyed and collected by the forester Uno Kalmeti (541 surviving herbarium collections in TAAM), who also made the first *A. lapponica* record in 1969. Despite frequent visits to the site, the species was not recorded in the period 1970-1990, but was re-discovered in 1991 (by mycologist Ilmi Parmasto; reference: TAAM126782) and again in 2001 (Erast Parmasto; TAAM180670) (Järva et al. 1999; Parmasto 2004). Between 2005 and 2018, two 2-ha plots in this locality were thoroughly inventoried for all polypores in eight years by the authors A.L. and K.R., using a standard method (Runnel and Lõhmus 2017). These surveys increased the known polypore species richness in the forest by ca 50% (Lõhmus et al., 2018), but *A. lapponica* was only detected in 2016 (1 record) and 2018 (2 records). In 2008-2015, the locality was monitored annually by the author I.S. for all *A. lapponica* fruit bodies, yielding 1–3 records each year. In 2018, the monitoring for *A. lapponica* fruitbodies was performed by the authors K.R. and A.L. (10 records).

Subpopulation 2. Ida-Viru County, NE part of the Muraka bog (59˚11' 27˚08'); found in 2011

Two localities: The main locality is a bog island (a patch of forest within a bog landscape) in Muraka nature reserve (North-East Estonia), partly covered by probably the largest intact primeval spruce forest in Estonia (>40 ha) and officially protected since 1959. The *A. lapponica* records are from spruce-dominated stands of *Vaccinium myrtillus* and *Oxalis- Myrtillus* type on this bog island and a smaller island 2.7 km away. Before the first *A. lapponica* record, the location was thoroughly surveyed by Prof. Erast Parmasto in 1965 and 1970. In 2004, this area was thoroughly surveyed for polypores by the authors I.S. and A.L., along with Prof. Erast Parmasto and Ilmi Parmasto. In the same year, the author I.S. made a thorough polypore survey in the old-growth localities in this large reserve. Since 2005, the locality has

been annually monitored for threatened spruce inhabiting polypores by the author I.S.; however, *A. lapponica* was only found for the first time in 2011, while in 2014-2016, 2-3 trunks were annually inhabited already. The first well documented survey in the other locality was first carried out in 2004, but the species only discovered in 2016.

Subpopulation 3. Ida-Viru County, SW part of the Muraka bog (59˚08' 27˚06'); found in 2016
This second subpopulation in Muraka nature reserve is located >6 km SSW from the previous one, on a small bog island (ca. 20 ha). The locality is in a spruce dominated old growth (dominant tree layer ca. 160 years olf) of *Vaccinium myrtillus* type. Before the first *A. lapponica* record (by the author I.S.; reference: TU111182), this site was surveyed for polypores in 1999 by a professional mycologist Mall Vaasma and in 2004 by the author I.S.

Subpopulation 4. Tartu County, Tõllassaare (58˚28' 26˚12'); found in 2017
Tõllassaare is a strict old-growth zone in the centre of the large wetland-dominated Alam-Pedja nature reserve in central Estonia; it has *de facto* been protected since 1948 due to establishment of a Soviet military area nearby. The records are from two spruce dominated forests of *Vaccinium myrtillus* type (110-120 years old trees in the dominant layer) 0.9 km apart: one situated on a large (ca. 1 km in diameter) remote mineral land patch between bogs and the other on a small bog island (ca. 6 ha). Before the first *A. lapponica* record in 2017 (by the author I.S., references: TU111692, TU111694-95, TU111698-99), this locality was thoroughly surveyed for fungi 1996–1997 by a group of 16 professional Estonian mycologists, including Erast and Ilmi Parmasto.

Subpopulation 5. Valga and Võru Counties, Karula (57˚44' 26˚29'); found in 2017
This subpopulation in South-Estonia comprises three dispersed localities 5–6 km from each other, all in strict zones of Karula National Park. Two localities are in mixed pine-dominated old growth of *Oxalis* and *Oxalis-Vaccinium vitis-idaea* types (10-30% spruce); in the third locality several records are from >120 years-old drained peatland conifer forests. Before the first *A. lapponica* records in 2017 (by the author I.S., references: TU114583, TU114585, TU114586), the localities were thoroughly surveyed for fungi in 2003 in frames of spring and autumn forays of professional and amateur Estonian mycologists; and in 2016, the localities were visited by a prominent international group of mycologists in the frame of the 22th Nordic Mycological Congress.

Subpopulation 6. Tartu County, Padakõrve (58˚36' 27˚00'); found in 2018
The Padakõrve subpopulation in Eastern Estonia inhabits a *Polytrichum - Vaccinium myrtillus* type old growth that has been protected since 1964. The forest is pine dominated with 182 years old overstorey (30% spruce). Before the first *A. lapponica* record in 2018 (by the author I.S.), this locality was thoroughly surveyed for fungi in 1998 by Prof Erast Parmasto and Ilmi Parmasto, and in 2005 by the author A.L.

Subpopulation 7. Ida-Viru County, Lüganuse (59˚17' 26˚53'); found in 2018
The locality for is officially protected since 2006, but it has been in a natural state long before. It is an *Aegopodium* type nemoral forest dominated by 103 year old aspens, and only 13% spruce content. The first *A. lapponica* record from this location was made in 2018 by amateur mycologist Urmas Ojango. We

have no information of the earlier study history from this location, but it has been apparently visited by biologists repeatedly as a habitat for flying squirrel.

Subpopulation 8. Harju County, Kuusalu (59˚24' 25˚37'); found in 2018
The locality is situated north of Koitjärve bog in Põhja-Kõrvemaa nature reserve, officially protected since 1991; however, the landscape was *de facto* largely protected due to a Soviet military area for decades. The locality is a riverine old growth of *Oxalis-Vaccinium myrtillum* type, dominated by 134 years old spruces. The first *A. lapponica* record was made in 2018 by amateur mycologist Urmas Ojango who had surveyed the same stand regularly for polypores also 2010-2014 (no findings). In addition, the wider neighborhood was thoroughly studied for fungi in 2001 in the frame of spring and autumn forays of professional and amateur Estonian mycologists.

Subpopulation 9. Pärnu County, Kikepera (58˚21' 25˚00'); found in 2018
The locality is situated south of Kikepera bog, in Soomaa National Park, in a large wind-throw area in mixed deciduous dominated forest where the overstorey still contains 5% of 122 year old spruces. The site is at a remote edge of Kikepera bog, officially protected since 1981, but it has no visible signs of human impact. Before the first *A. lapponica* record in 2018 (by a visiting professional mycologist Otto Miettinen, reference: TU128011), the exact locality has been studied for polypores by Prof Erast Parmasto in 1993, and by the author K.R. 2015-2017. Although we lack explicit information, it is highly probable that the locality has been repeatedly visited by professional mycologists also before 1993 and in period 1994-2005 since it is close to a university field station that hosts yearly mycological field-courses. The generally good historical knowledge of the Soomaa National Park is illustrated by the fact that in 1999 Prof. E. Parmasto published a survey on the mycota of Soomaa National Park, comprising records of 360 fungal species in the area (Keskkonnaamet, 2011).

References

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