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Short communication

Intensive local surveys can complement rapid survey techniques to provide insights into the population size and ecology of lichenised fungi

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ABSTRACT

We propose that insights to population ecology of lichenised fungi can be efficiently obtained by combining rapid biodiversity surveys, which representatively sample large areas, with intensive studies in selected populations discovered. To illustrate this approach, we compared results from an Estonian rapid survey scheme with an intensive local population survey of the poorly known epiphytic crustose lichen, *Lecanora thysanophora*. In contrast to what the data from rapid surveys suggested, the intensive survey revealed that this typically sterile species can occur in remarkably dense populations obviously limited by host tree availability; we also recorded emerging sexual reproduction in the population centre. Our results imply that the detection of even poorly identifiable species may mostly depend on total field effort.

Lichenised fungi that form easily detectable thalli on substratum surfaces provide distinct opportunities for fungal ecological studies. Still, the knowledge of lichen population ecology is largely based on a few conspicuous macrolichens (Scheidegger & Werth 2009). For most lichens, notably 'sorediate crusts' – a large morphologically delineated group of microlichens, which often dominates lichen assemblages (Dietrich & Scheidegger 1996) – there are not even any examples of basic population parameters measured in the field. Such crusts have granular or powdery vegetative diaspores (soredia) on the upper surface of the thallus (sorediose lichens) or their whole thallus is granular ('leprose crusts'). Often their reproduction is entirely vegetative, different species co-occur at the microhabitat scale (e.g., John & Dale 1995) and look similar, so

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that their reliable determination requires laborious screening of lichen substances. The recommendation for biodiversity assessments has been to collect multiple standard samples of such crusts to assess at least species' relative abundances and habitat use (Lõhmus *et al.* 2003; Cáceres *et al.* 2008), but population approaches are lacking.

Here, we propose that insights to lichen population ecology can be obtained by combining rapid biodiversity surveys over large areas with intensive surveys where selected populations are discovered. Such two-stage sampling approaches generally optimise field effort when studying rare or elusive species (Thompson 2004) but, in the case of rapid lichen surveys, the second stage can also overcome bias resulting from poor detectability. We have previously developed the 'first stage' – a rapid survey procedure based on random sampling, stratified by vegetation type and management intensity, to survey the abundance and habitats of most species at a regional scale (Lõhmus & Lõhmus 2009). In this paper we explore the merits of intensive ('second stage') sampling for lichen ecology and conservation biology. We use the example of a poorly known sorediate crust, *Lecanora thysanophora* (Lecanoraceae) – a mainly epiphytic leprose lichen, which resembles several others and was validly described only recently from North America (Harris *et al.* 2000). It was then reported also from Europe where, in the light of accumulating records, it now appears regionally common, but always sterile (Supplementary material).

The current study was based on the Estonian rapid survey scheme where standard 2 ha forest plots are searched for all lichen species during 4 hr (Lõhmus & Lõhmus 2009). These data indicate that *L. thysanophora* inhabits forests frequently but sparsely – it has been found in approximately one-third of old forest stands, on average four records per plot (P. Lõhmus, unpublished data). To add a population perspective, we selected in eastern Estonia (58°15′N; 27°24′E) two such closely situated plots, which represented typologically different subcompartments in an 8 ha patch of 100-yr-old forest surrounded by younger stands (Fig 1). The northern subcompartment had an overstory dominated by *Alnus glutinosa* (50 %) and *Tilia cordata* (20 %), with a subcanopy of mostly late-successional deciduous trees. The tree layer in the central subcompartment was dominated by *Populus tremula* (55 %), *Betula* spp. (20 %) and *Picea abies* (25 %) and a dense subcanopy of *P. abies*. The southern subcompartment was dominated by *P. abies* with a few *Betula* spp. The rapid survey method had yielded four records of *L. thysanophora* in the 2 ha plot in the northern subcompartment and one record in the central

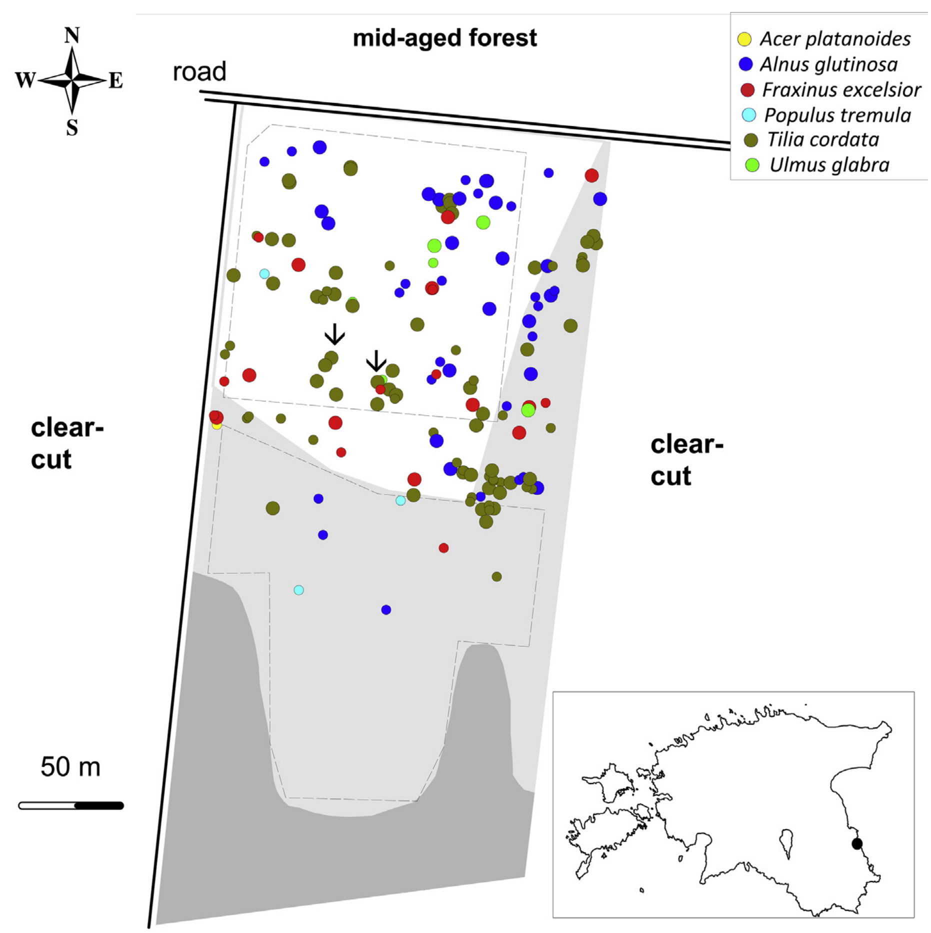

Fig 1 – Distribution of trees occupied by *Lecanora thysanophora* in the study area. The colours refer to tree species, larger spots denote >100 cm² cover on the trunk and the arrows indicate the presence of apothecia. Shades of grey distinguish forest subcompartments on a gradient from deciduous forest on the seasonally wet *Dryopteris* site in the north to spruce-dominated forest on the meso-eutrophic *Oxalis* site in the south; borders of the rapid survey plots are indicated with the dashed line.