MSC POSITION ON BOREAL FOREST ENTOMOLOGY

Title: MSc project on *Leptothorax* ants of the boreal mixedwoods

We are looking for a student for a master's project on the ecology of ants of the genus *Leptothorax* in the mixed boreal forest.

Context and problematic: The present-day population biology of any given species is an outcome of the habitats that are available to it and the intrinsic and extrinsic factors that allow it to occupy those habitats. To understand a population of a species, we must understand how its habitats are generated and maintained, and how it colonizes and retains those habitats. These complex processes motivate efforts to identify and describe model ecosystems that possess enough complexity to exhibit general principles of population biology, but not so much complexity that they cannot be understood in detail.

As trees shed wood and decay, they produce nesting sites that ants can live in. Some ant species specialize on these sites, like coarse woody debris, and do not live in any other kind of habitat. Such sites provide an extrinsic limit to the size of an ant population, and are themselves an outcome of factors including the tree species composition, age, and past history of trees in a forest. The fraction of suitable nesting sites that are occupied by a given ant species is then an outcome of factors including the ability of ants to find and colonize new sites (dispersal), interactions with other species that exploit the same habitat (competition), and extrinsic mortality (predation).

In eastern Canada, Leptothoracine ants predominantly nest in coarse woody debris that is at a specific stage of decay (Lafleur et al. 2006). Within their particular debris type, this habitat is occupied by just two ant species: the small brown Leptothorax ergatogyneous, and the large black Leptothorax canadensis, and is not occupied by other free-living ants (Heinze 1993). L. ergatogyneous has a more restricted habitat range than L. canadensis, as it is additionally only found in habitats, such as roadsides and tree fall gaps, that possess an intermediate level of direct sunlight. Perhaps as a consequence of this specialization, L. ergatogyneous possesses an intraspecific genetic polymorphism between wingless queens (low dispersal; more prevalent in isolated habitat patches) and winged queens (high dispersal; more prevalent in continuous habitat) (Heinze & Buschinger 1989).

Finally, both L. ergatogyneous and L. canadensis are killed by a specialist parasite, the slave-making ant Harpagoxenus canadensis (Heinze et al. 1991; Stuart 2009). H. canadensis queens establish colonies by invading either L. canadensis or L. ergatogyneous colonies and killing the queen, and then maintain colonies by raiding worker pupae from neighboring L. canadensis and L. ergatogyneous colonies. Slave-making ants provide a particularly tractable model for predation in ants because, unlike other predators, they live within the colony they have killed. Thus, it is possible to estimate the extent of predation within a population by identifying a) the number of colonies occupied by H. canadensis queens, and b) the number of L. canadensis and L. ergatogyneous workers in those colonies.

Studies of Leptothoracine populations in eastern Canada therefore provide a) a manageably narrow and identifiable range of suitable habitat, b) competition for nesting sites between a specialist and a generalist species, c) discrete variation in dispersal capacity, and d) extrinsic mortality due to a specialized predator at a measurable rate.

A first step toward understanding this system would be to collect Leptothoracine ants in habitats that vary in ecologically-relevant conditions. These could differ in variables that contribute to habitat generation (tree species and demography, landscape features, recency of logging and burning), as well as habitat occupancy (habitat fragmentation, competition, and predation). Within a carefully-selected range habitats, the goal would be to perform standardized sampling of colonies to determine the number of colonies per species (L. ergatogyneous, L. canadensis, and H. canadensis), and score these colonies for the presence of winged versus wingless queens and the number and species of ants in the colony. Such a study would be scientifically valuable in its own right, and would motivate future research (ie, computational approaches like GIS and ecological niche modeling, and experimental methods like transplantation experiments).

Location: The student will be based at the Institute for Forest Research (IRF; http://www.uqat.ca/programmes/irf/), at the UQAT campus in Rouyn-Noranda. However, his or her field work will take place at the Lake Duparquet Research and Teaching Forest (http://ferld.uqat.ca/), where he or she will be housed during this period. The student may also be called upon to spend some time at Harvard University for laboratory work and meetings with his or her co-supervisor. In addition, the student will be a member of the Chair in Sustainable Forest Management (http://chaireafd.uqat.ca/) and of the Centre d'étude de la forêt (http://www.cef-cfr.ca/). The IRF team is dynamic and offers a quality environment to the students, while the city of Rouyn-Noranda is culturally very active and offers a great quality of life thanks to its tourist attractions (Film Festival, Emerging Music Festival, World Guitar Festival...) and outdoor activities (hiking, camping, canoeing, skiing, snowshoeing...) (http://www.ville.rouyn-noranda.qc.ca/; http://tourismerouyn-noranda.ca/).

Financial support: $ 17,500 / year scholarship for 2 years.

Starting date: September 2021

To apply : Email your resume, cover letter, transcripts and the names of two references to the attention of Benoit Lafleur (benoit.lafleur@uqat.ca) or Buck Trible (bucktrible@g.harvard.edu).

Interested candidates must submit their documents by December 31, 2020.

Benoit Lafleur, professor
UQAT, Institut de recherche sur les forêts (http://www.cef-cfr.ca/index.php?n=Membres.BenoitLafleur)

Waring Buck Trible, researcher
Harvard University

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