Spring emergence & abundance of *Nebria brevicollis* in Burnaby, British Columbia

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Introduction

Nebria brevicollis is a ground beetle species native to Europe. Only in the last 15 years has *N. brevicollis* been observed in North America. The first appearance of *N. brevicollis* in British Columbia was only seven years ago, in 2015 (McGregor et al., 2020).

Preliminary findings have observed *N. brevicollis* to be a able to feed on a variety of foods, and that it is active for longer periods in the year compared to other ground beetles (LaBonte, 2011). *N. brevicollis* also appears to have the ability to colonize a wider range of environments compared to any other introduced ground beetle species thus far. This presents *N. brevicollis* as a potential invasive species despite there not yet being conclusive evidence that it has deleterious effects on humans or native species (LaBonte, 2011).

In this project, I will examine *N. brevicollis'* abundance and emergence during the spring season. Pitfall traps will be installed to track where *N. brevicollis* is found and when it is active. I expect that *N. brevicollis* will be found across the widest range of sites, in greater numbers as well as earlier in the season. This would reflect its characteristic nature of thriving near human activity and tolerance to a wide range of environments. I also seek to determine whether *N. brevicollis* is active throughout the winter. It should be noted that this project is currently ongoing.

Methods & Materials

Ten pitfall traps were set across three different sites in the city of Burnaby: two at a home address on 01/29/22, three at Wesburn Park, and five at Central Park in a 50m transect (10m apart) on 02/05/22. The transect was designed to examine differences based on proximity to human activity.

To assess whether sites were disturbed versus undisturbed (relative to each other), field site assessments of the areas surrounding each trap in a 20m radius were made. Horizontal forest structure was assessed by measuring trees' diameter at breast height (Dbh). Seedlings were classified as <2.5cm Dbh, saplings as 2.5-10cm Dbh, pole logs as 10-28cm Dbh and saw logs as >28cm Dbh. Vertical forest structure was assessed visually by estimating percentage cover of each type of vegetation.

Pitfall traps were made of two plastic cups: the outer cup having a hole for drainage and the inner cup having a similar hole but lined with wire to prevent escape. Traps were set such that their rims were flush with the ground. Styrofoam plates supported by wooden skewers were used to protect the traps from rain. Traps were checked once a week, with catches being bagged then recorded according to their respective trap, date, species, and life cycle stage.

Results & Discussion

Trap Sites

Each trap site had a field assessment performed that detailed environmental characteristics including land usage, forest structure (if applicable), and local biota. A site series assessment of the Central Park site was performed and determined to be 05 Cw – Sword fern (Greene & Klinka, 1994).

Trap	UTM Coordinates	Elevation & Slope	Forest Structure	Land Use
Home 1	10U 498480m E, 5454547m N	88m 5° slope eastern aspect	N/A	Residential single-family detached home.
Home 2	10U 498469m E, 5454550m N			
Wesburn Park 1	10U 499161m E, 5454442m N	69m 20° slope western aspect	**Vertical:** Canopy cover: 50% Sapling cover: 5% Shrub cover: 5% Ground cover: 10% **Horizontal:** Saw logs: 10% Pole logs: 50% Saplings: 40% Seedlings: 0%	Recreational use park including sports fields, playground, community centre, forested area with ravine.
Wesburn Park 2	10U 499189m E, 5454436m N			
Wesburn Park 3	10U 499157m E, 5454420m N			
Central Park 1 (10m)	10U 498934m E, 5453009m N	127m 5° slope northwestern aspect	**Vertical:** Canopy cover: 70% Sapling cover: 20% Shrub cover: 80% Ground cover: 60% **Horizontal:** Saw logs: 10% Pole logs: 30% Saplings: 60% Seedlings: 0%	Recreational use park including walking trails, picnic area, pond, outdoor swimming pool, golf course, stadium. Largely forested.
Central Park 2 (20m)	10U 498927m E, 5453002m N			
Central Park 3 (30m)	10U 498920m E, 5452995m N			
Central Park 4 (40m)	10U 498913m E, 5452988m N			
Central Park 5 (50m)	10U 498906m E, 5452981m N			

Figure 1. Location and site assessments of pitfall trapping areas

Figure 2. Home address (top), Wesburn Park (middle), Central Park (bottom)

Site Name	Vegetation
Home Address	Creeping buttercup (*Ranuculus repens*)* Dandelion (*Taraxacum officinale*)* English holly (*Ilex aquifolium*)* Lanky moss (*Rhytidiadelphus loreus*) White clover (*Trifolium repens*)* Family Poaceae
Wesburn Park	Bigleaf maple (*Acer macrophyllum*) English holly (*Ilex aquifolium*)* English ivy (*Hedera helix*)* Lanky moss (*Rhytidiadelphus loreus*) Sitka spruce (*Picea sitchensis*) Sword fern (*Polystichum munitum*)
Central Park	Douglas fir (*Pseudotsuga menziesii*) Salal (*Gaultheria shallon*) Spiny wood fern (*Dryopteris expansa*) Sword fern (*Polystichum munitum*) Trailing blackberry (*Rubus ursinus*) Western hemlock (*Tsuga heterophylla*) Western red cedar (*Thuja plicata*)

Figure 3. Vegetation found at each trap site. * = introduced/non-native species

Trap Catches

For the first two weeks, there we no ground beetle catches. The first *N. brevicollis* was caught on 2/17/22. In each subsequent week, *N. brevicollis* was seen but only at the home address and Wesburn park. Based on the types of native & non-native vegetation present, it is evident that the home address site and Wesburn Park are the most disturbed and Central Park is the least disturbed. Out of a total 24 *N. brevicollis*, 11 were found at the home address, and 12 were found at Wesburn Park. Only a single *N. brevicollis* was found at Central Park over 8 weeks of pitfall trapping. *N. brevicollis* seems to follow the trend of other introduced European ground beetles preferring disturbed/anthropogenic habitats (McGregor & Wahl, 2021).

N. brevicollis is a ground beetle that breeds in the autumn months and adults can be seen active throughout the winter (Jaskula & Soszyńska-Maj, 2011). 15 of the total catches were observed to be larvae, suggesting that *N. brevicollis* may be active in the winter at the larval stage as well.

Only two other ground beetle species were found and solely at the Wesburn Park site: *Notiophilus sp.*(one on 3/10/22, two on 3/17/22) and *Pterostichus patruelis* (one on 3/17/22). Notably, these species were not seen until three weeks after the first *N. brevicollis* catch. This coincides with previous findings (LaBonte, 2011) that *N. brevicollis* is active during periods when other ground beetles are still dormant.

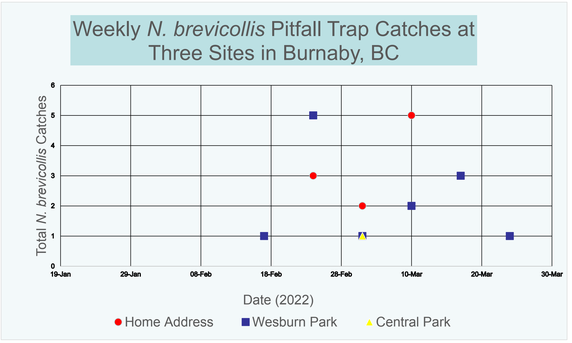

Figure 4. Total trap catches sorted by site (data collection ongoing)

Conclusion

Conclusions are preliminary and based off currently available data (Data collection in this research project is ongoing). *N. brevicollis* is a species rapidly expanding in British Columbia and is active earlier in the spring compared to other ground beetles. Additionally, it appears *N. brevicollis* is the most abundant species in disturbed/anthropogenic environments. As the season continues however, it is expected that other ground beetle species will account for a greater proportion of trap catches.

Given its earlier spring emergence, *N. brevicollis* may hold a competitive advantage over other ground beetles. This may be in part what grants *N. brevicollis* its effectiveness in colonizing new environments. If *N. brevicollis* turns out to be outpacing and displacing native species, it will pose a risk to local biodiversity, which in turn would have a dentrimental downstream effect on human populations.

References

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