

Urbanization Effects on Beetle Diversity

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Abstract

Urbanization has been a problem, regarding extinction of many species, for over 2,000 years, dating back to the earliest man made cities. The habitats of many species, specifically beetles, have been destroyed, resulting in severe limitations of biodiversity. This trend can be seen within most species of insects, who often experience the same situations as the beetles studied within the experiment³.

Introduction

Beetles are significant parts of the ecosystem due to the fact that they decompose organisms and return their nutrients to the soil⁷. They thrive in habitats which contain lots of vegetation, as well as sources of freshwater. Using barcode technology, the sequences, and therefore names of the beetles will be able to be determined¹.

Materials & Methods

The specimens were collected using simple pitfall traps in both urbanized and rural areas during a rainstorm which may have affected the results in order to gain accurate results of how the beetles were affected. The specimens were also collected by hand due to a lack of specimens acquired. Then until extraction took place the specimens were preserved using both a refrigerated environment and ethanol. A silica DNA isolation was used in order for the standard PCR procedure to occur using COI Primers. The sequences found were then sent using Sanger Sequencing to Barcode LI.

Results

Based on the few samples collected and analyzed, it is evident that the major beetle species in both urban and forested areas is *Harpalus pennsylvanicus*, making up 60% of our result composition (see figure 1.1). It proved to be difficult to gather beetles from forested areas, so our data is not entirely indicative of diversity in the wild. Multiple implications within the methods, such as the poorly made traps, as well as the time of year, likely resulted in the lack of diversity within the data (figure 1.1). Upon DNA analysis, the DNA of a spider (figure 3.3) was found within the data; the reason for this is still unknown. This abnormality became an outlier in the data, affecting both the pie chart and the phylogenetic tree (figures 1.1, and 2.1, respectively). Overall, based on the fact that the traps, located in urbanized areas, failed to collect any beetles, the locations that contained the most diverse amount of beetles were forested areas which had both vegetation and a source of water.

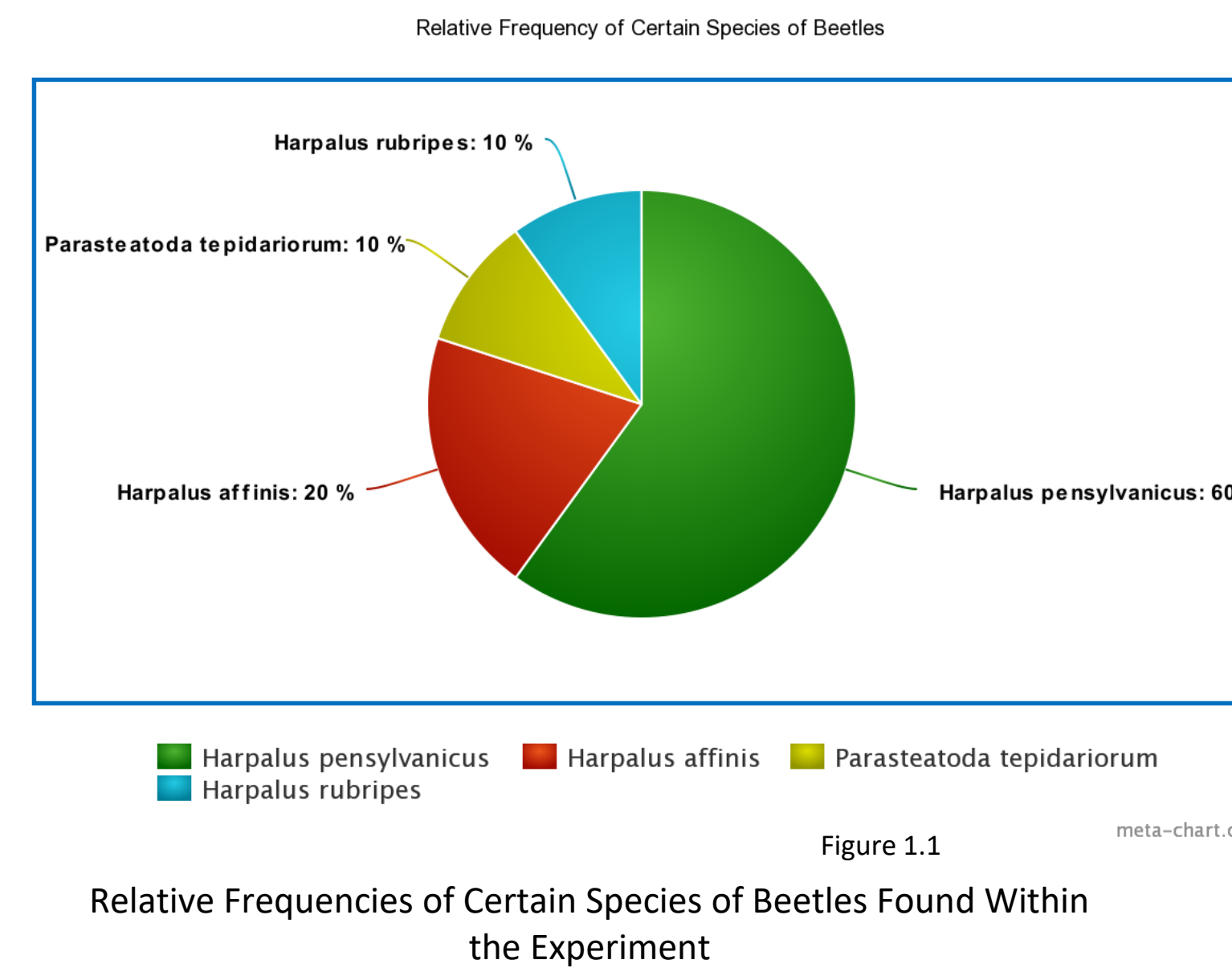


Figure 1.1

Phylogenetic Tree of Species and Their Respective BLAST Results

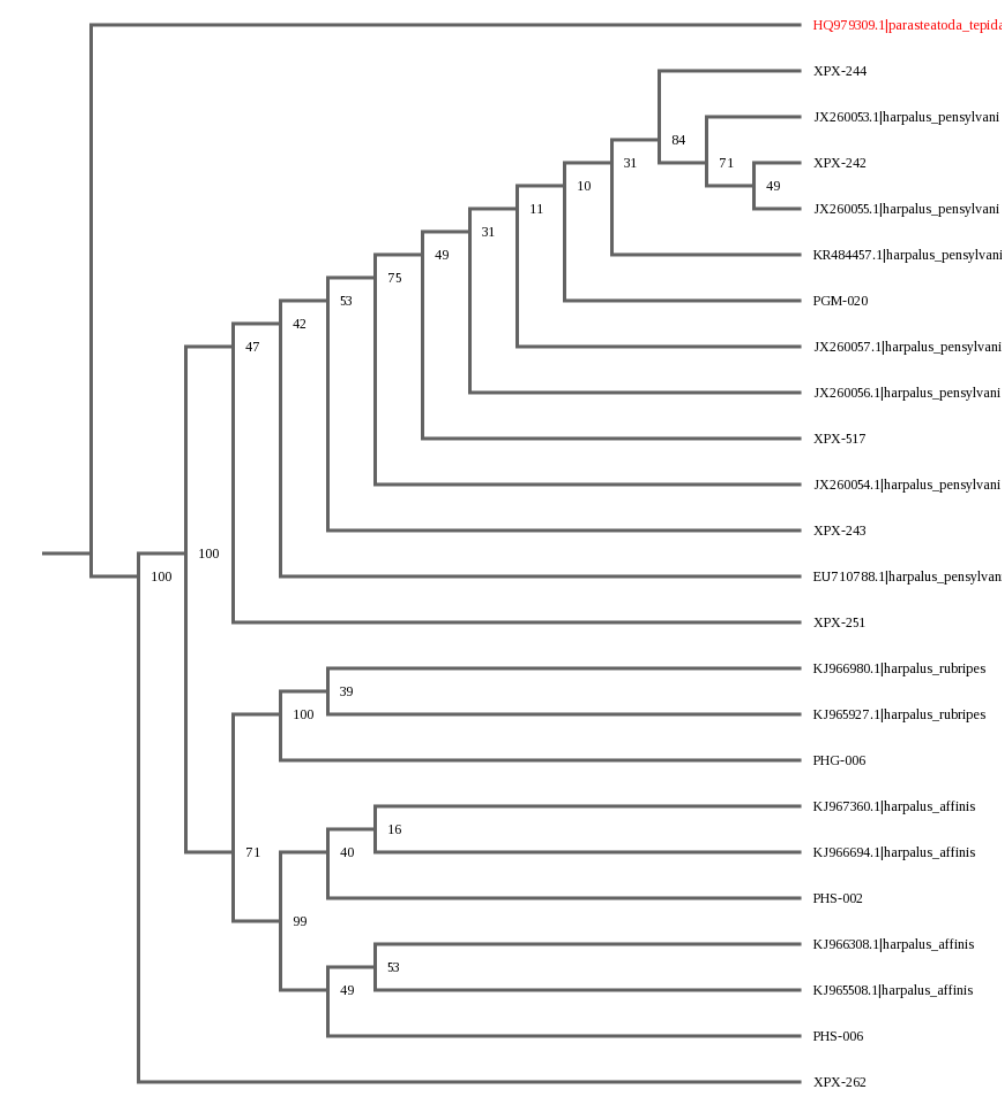


Figure 2.1



XPX-251

Figure 3.1



XPX-262 (Photo)

Figure 3.2



XPX-262 (Data)

Figure 3.3

Discussion

The results of our experiment weren't unexpected, we knew that urbanization has major effects on biodiversity based on previous research and general knowledge. Our goal was to figure out the extent that urbanization had on the biodiversity of beetle species. Despite the small number of samples, the evidence is still there that point towards a major lack of diversification among beetles on Long Island, at least in the areas that we collected from. There were a few mistakes made on our behalf regarding the DNA analysis process which led to a majority of the samples being incorrect, one of these mistakes is what occurred with sample XPX-262 (see figure 3.2) this is clearly a beetle, but after we received the DNA from the lab for identification it came back as a spider, specifically *Parasteatoda tepidariorum* (figure 3.3). It's not exactly known what caused the major discrepancy between the two results but it's believed to be from misplaced DNA samples during extraction.

References

1. dnabarcoding101.org W. Using DNA barcodes to identify and Classify living things. Dnabarcoding101.org. [accessed 2021 May 13]. <https://dnabarcoding101.org/files/using-dna-barcodes.pdf>
2. Insectidentification.org. [accessed 2021 May 13]. <https://www.insectidentification.org/insects-by-type-and-region.php?thisState=New%20York&thisType=Beetle>
3. Shuisong Y, Yan F, Kai L. Impacts of urbanization process on insect diversity: Impacts of urbanization process on insect diversity. Sheng wu duo yang xing [Chinese biodiversity]. 2013 [accessed 2021 May 13];21(3):260–268.
4. Magura T, Lövei GL, Tóthmérész B. Does urbanization decrease diversity in ground beetle (Carabidae) assemblages?: Urbanization and carabid diversity. Global ecology and biogeography: a journal of macroecology. 2010;19(1):16–26.
5. Beetles. Www.si.edu. [accessed 2021 May 13]. <https://www.si.edu/spotlight/buginfo/beetle>
6. Species *Harpalus pennsylvanicus* - Pennsylvania Dingy Ground Beetle. Bugguide.net. [accessed 2021 May 13]. <https://bugguide.net/node/view/18851>
7. Beetle information for kids: Beetle facts for students. Pestworldforkids.org. [accessed 2021 May 13]. <https://www.pestworldforkids.org/pest-guide/beetles/>

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