

Comparing leaf and corolla shape of *Lonicera caerulea* (Caprifoliaceae) and associated species across its circumboreal range using herbarium specimens



Background

- Lonicera*, also known as honeysuckle, are shrubs or vines that include ~150 species distributed across a wide range globally.
- Across *Lonicera* there are a number of species complexes, groups of closely related organisms that are so similar in appearance that it is difficult to recognize each species
- Lonicera caerulea* is one such species complex that exists across northern Europe, North America and Asia (Fig.1.). *Lonicera caerulea* is cultivated for its edible blue fleshy fruit that is high in antioxidants
- Up to 17 species have been associated with *L. caerulea*
 - L. villosa* and *L. caerulea ssp. cauriana* are recognized from eastern and western North America respectively
 - L. caerulea subspecies kamtschatica/pallasii* recognized in Russia
 - L. caerulea ssp. edulis* is recognized across Eurasia

Here we examined the distribution of leaf and corolla shape across its widespread distribution in attempt to resolve the complicated taxonomic history.

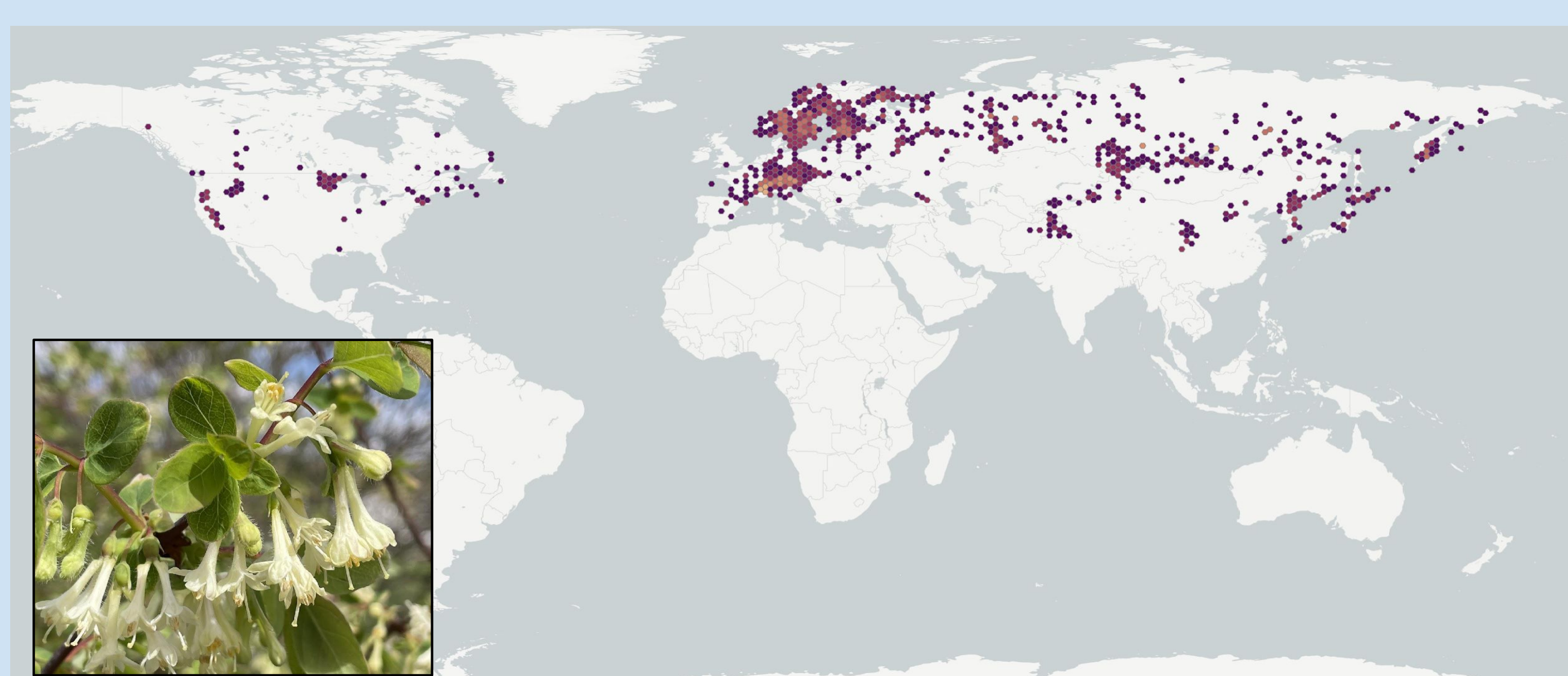


Fig. 1. The distribution of *Lonicera caerulea* on a global scale. (Data acquired from GBIF 10/26/2021)

References/Acknowledgement

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¹MOMOCS : Bonhomme V, Picq S, Gauchere C, Claude J (2014). "Momocs: Outline Analysis Using R." Journal of Statistical Software, 56(13), 1–24. <https://www.istatsoft.org/v56/i13/>.

²GIMP : The GIMP Development Team. (2019). GIMP. Retrieved from <https://www.gimp.org>

³GBIF : <https://www.gbif.org/>

⁴RStudio : RStudio Team (2020). RStudio: Integrated Development for R. RStudio, PBC, Boston, MA URL <http://www.rstudio.com/>.

⁵Consortium of Northeastern Herbaria : <https://neherbaria.org/portal/>

⁶Consortium of Pacific Northwest Herbaria : <https://www.pnwherbaria.org/>

⁷Moscow Digital Herbaria : <https://plant.depo.msu.ru/open/public/en>

⁸ImageJ: Rasband, W.S., ImageJ, U. S. National Institutes of Health, Bethesda, Maryland, USA, <https://imagej.nih.gov/ij/>, 1997-2018.

Methods

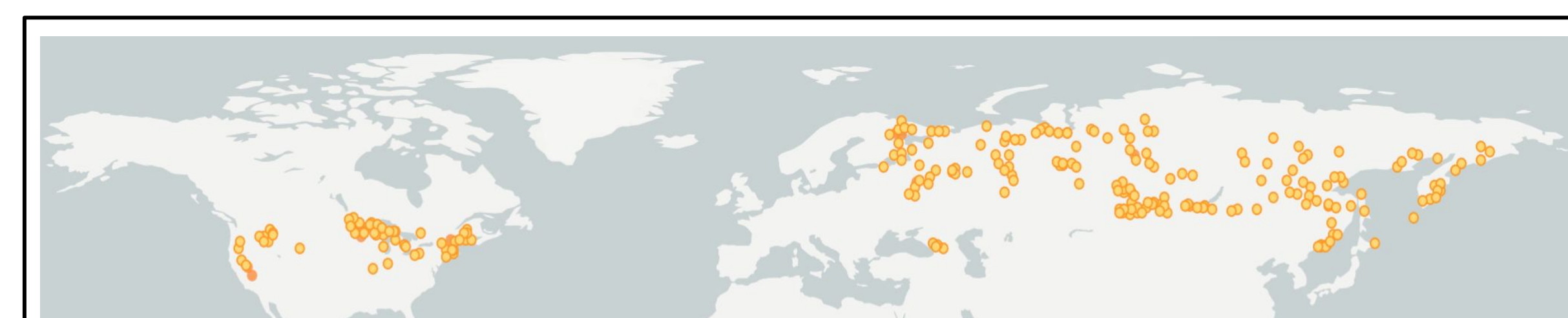
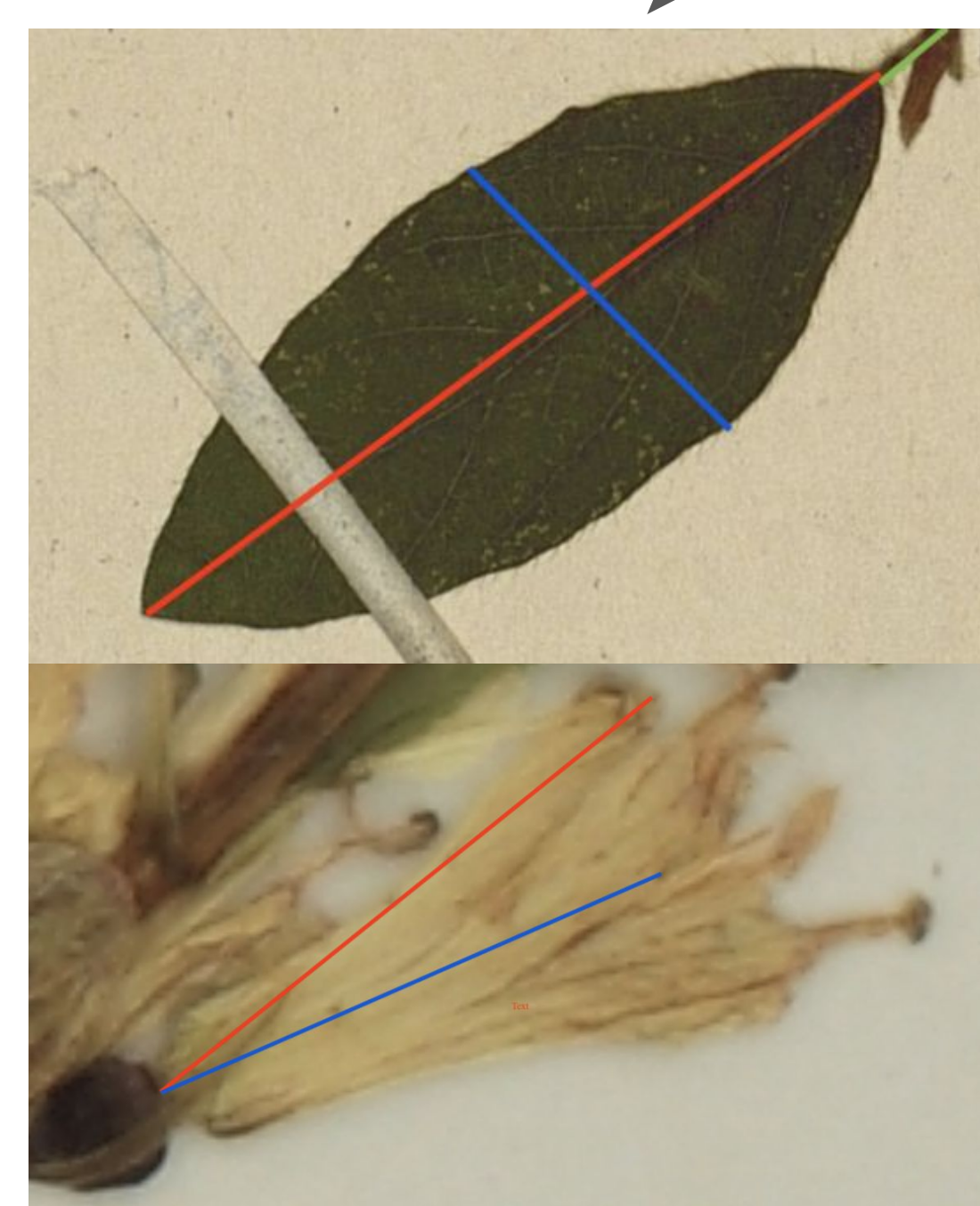


Fig. 2. Preserved specimens sample containing *L. caerulea*, *L.c. ssp. cauriana*, *L.c. ssp. kamtschatica*, *L.c. ssp. pallasii*, *L.c. edulis* and *L. villosa* from the USA and Russia (Data acquired from GBIF 10/26/2021)



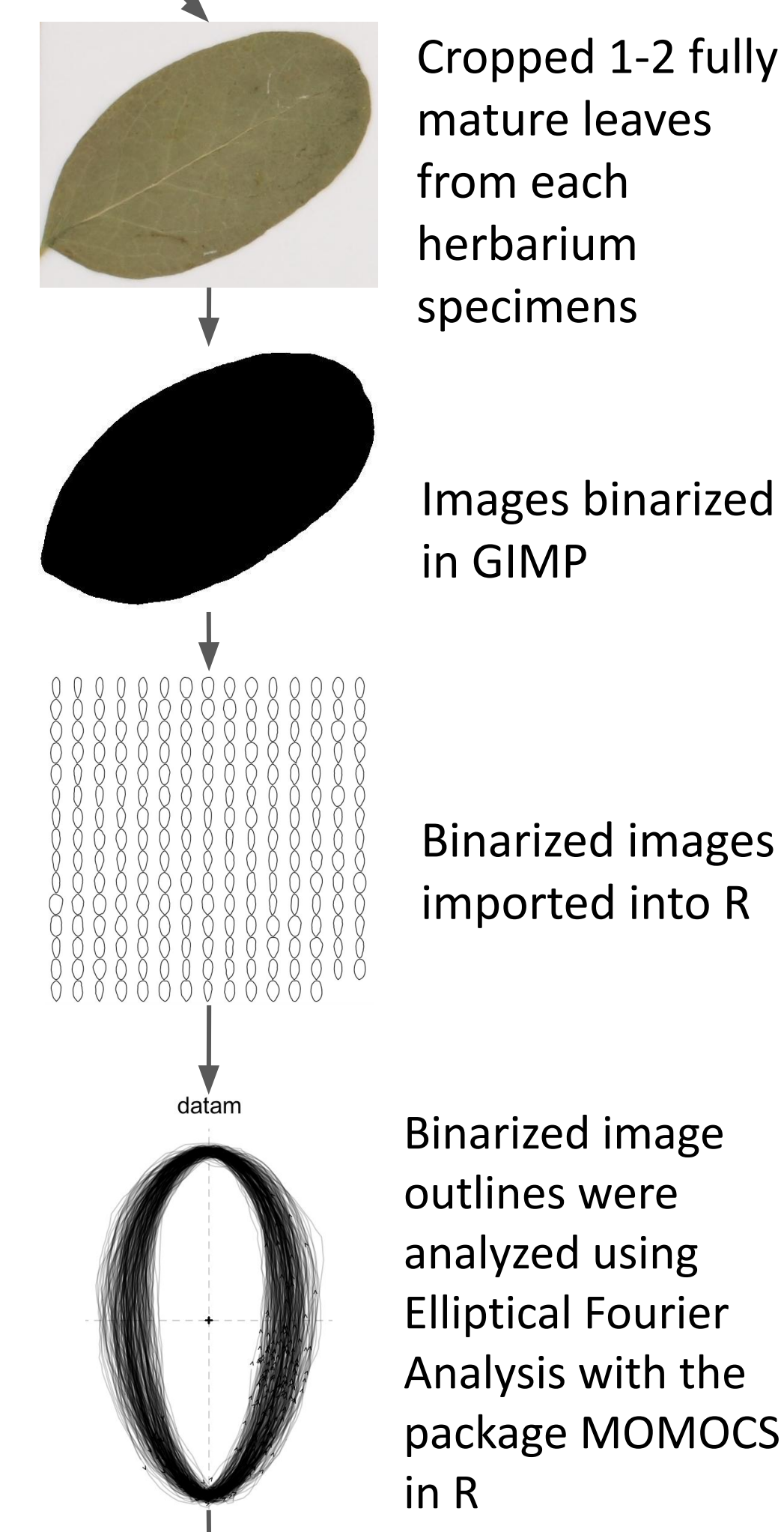
A total of 590 specimens were obtained from the Consortium of Northeastern Herbaria, the Consortium of Pacific Northwest Herbaria and the Moscow Digital Herbaria.

Leaf & Corolla Measurements



Measured **length**, **width** and **petiole length** for 5 leaves from each herbarium specimen.
Measured 2 **corollas** and **corolla tubes** from each flowering herbarium specimen.

Leaf Shape Morphometrics



Data subjected to Principal Component Analysis

Results

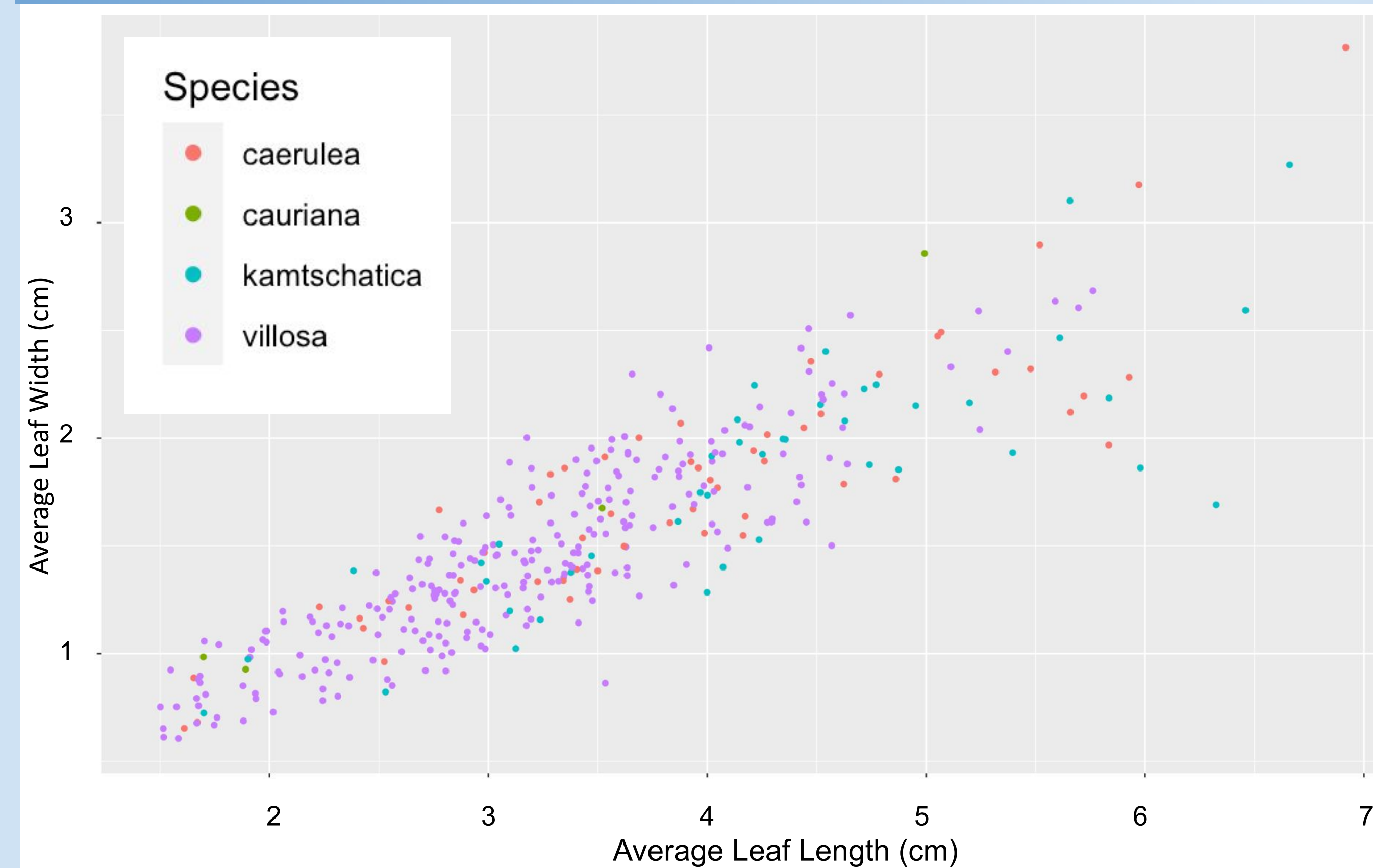


Fig 3. Examining the relationship between average leaf length and leaf width resulted in no differences detected between these subspecies. N = 367. Here we examine differences based on taxonomy, however this is correlated to region for this sample. *L. caerulea* subspecies obtained from western USA, *L.c. ssp. cauriana* obtained from California, *L.c. ssp. kamtschatica* obtained from Russia, *L. villosa* obtained from eastern USA

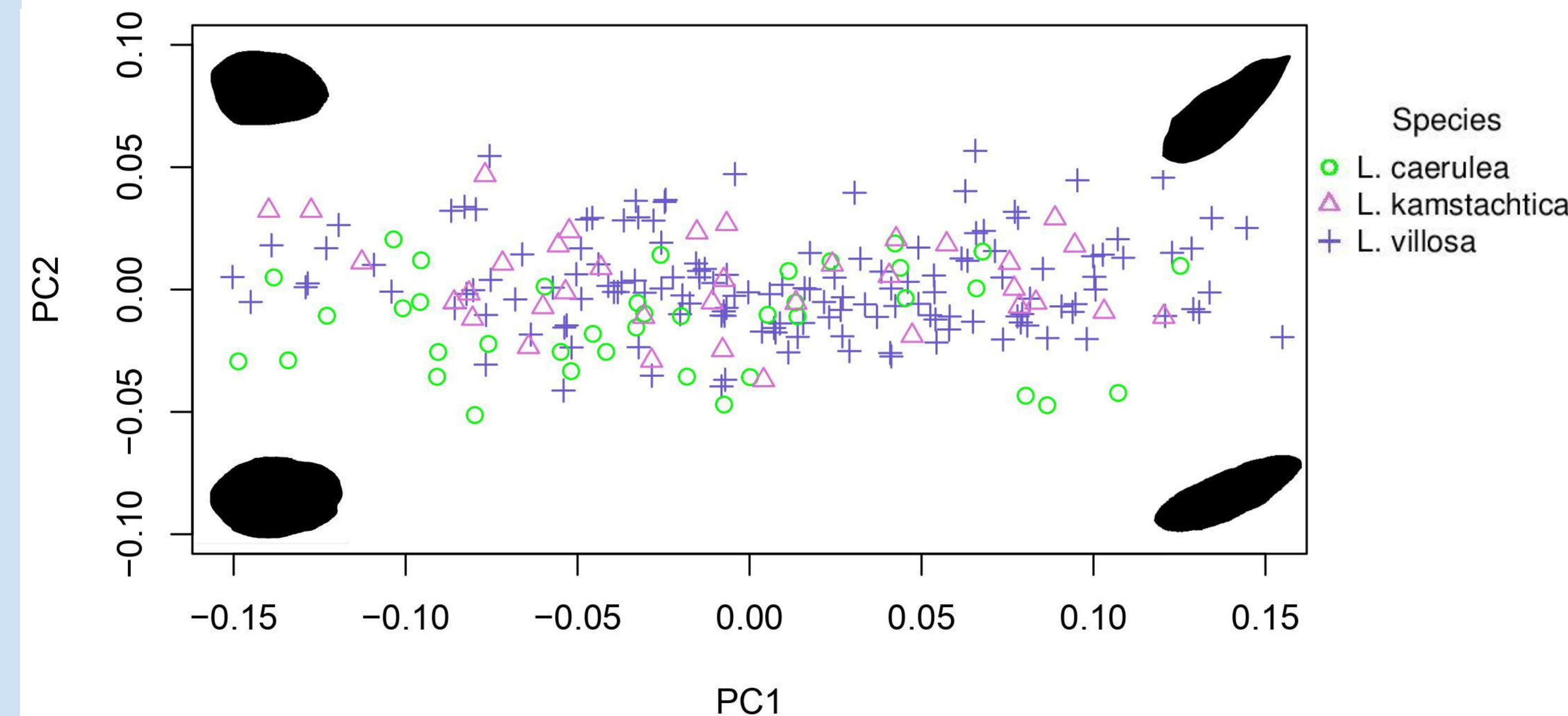


Fig.4. A morphospace illustrating the distribution of leaf shape of *L. caerulea* in Idaho, *L. villosa* in Maine and *L. caerulea ssp. kamtschatica* in Russia. Species are denoted by symbol and color. N=223 and the average number of specimens per species is 28. For each specimen there is an overlap with each other suggesting no morphological difference in leaf shape from *L. caerulea*, *L. villosa* and *L. caerulea ssp. kamtschatica*.

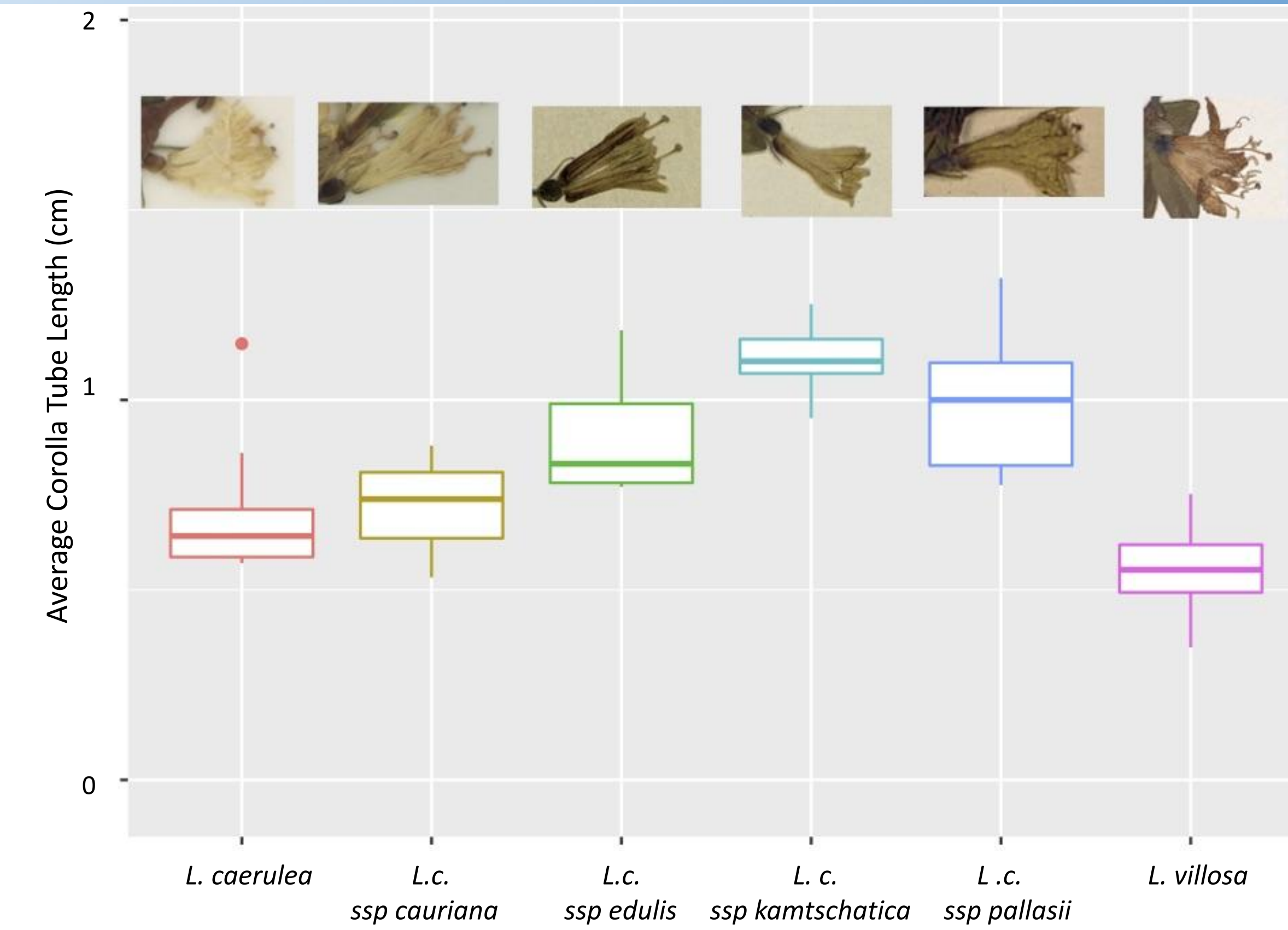


Fig 5. Boxplot depicting the relationship between average corolla tube length for 6 different subspecies of caerulea. N = 54. *L. caerulea* subspecies obtained from western USA, *L.c. ssp. cauriana* obtained from California, *L.c. ssp. kamtschatica/pallasii/edulis* obtained from Russia, *L. villosa* obtained from eastern USA.

Discussion & Future Work

- Examination of leaf measurements were unable to differentiate *L. caerulea* and related taxa.
- Examination of leaf shape did not show clustering of *L. caerulea*, *L. villosa* or *L. caerulea ssp. kamtschatica*
- These data suggest that leaf shape cannot be used to differentiate *L. caerulea*, *L. villosa*, *L. cauriana* and *L. kamtschatica*
- Examination of corolla measurements were unable to differentiate *L. caerulea* and related taxa.
- Corolla data, leaf pubescence and other traits should be investigated further to determine if there is variation between subspecies.
- Future work to expand our study is to include environmental and climate data to detect potential differences among subspecies and varieties of *L. caerulea* and *L. villosa* across their range