Evaluating Showy Milkweed (*Asclepias speciosa*) ecotypic variation in adaptive traits using a genecological approach

Worksheet- Testing associations among climate variables and plant characteristics.

Instructions: save a copy of this worksheet and fill out the text sections electronically. You will also be creating data analysis products in excel and R that will need to be saved separately and submitted with your lab notebook submission.

1. Identify two plant traits that you'd like to assess (define which variables are dependent and independent) with respect to climate and develop hypotheses that predict how each plant trait should be associated **with at least** three climate variables (3 pts)

    a. List plant trait 1 + ≥3 climate variables you wish to test associations with

Independent:

Dependent:

<u>Plant trait 1 hypothesis:</u>

    b. List plant trait 2 + ≥3 climate variables you wish to test associations with

Independent:

Dependent:

<u>Plant trait 2 hypothesis:</u>

For each variable, calculate descriptive statistics (3 pts)

2. Produce Descriptive statistics (in excel) for each dependent and independent variable you plant to test

3. Evaluate the descriptive statistics of the dependent and independent variable you analyzed

    a. Which dependent variables display the greatest variability? The least? How do you know?
    b. Which independent variables do you think will be the most informative in predicting outcomes of dependent variables? Support your argument with data from the descriptive statistics.

4. produce frequency histograms (in R) for each dependent and independent variable you plant to test (lines 56-66 in the R code) (3 pts)
    a. Export these histograms as .pdfs (you'll need to give them file names) then copy paste images into the space below, or attach images as .pdfs to the final exercise.
    b. Assess the normality of the data. What issues or strengths do you see?

5. In R, produce a correlation matrix and p-value matrix among the dependent variables and independent variables you are testing.
    a. Highlight all significant p-values among all variables (second table R produces)
    b. Highlight all corresponding R-values (correlations) among all variables (first table R produces)

6. Answer the following prompts:

    a. What type of model of inquiry do you think this work best exemplifies? (Field Study, Field Experiment, or laboratory study)? Why?
    b. What (if any) relationships among independent variables are the strongest (R) and most significant (p)?
    c. Attempt to explain why it is that these relationships may exist (try to provide the simplest (most likely) explanation for the relationship you observed.

    d. What (if any) relationships among the dependent variables are the strongest (R) and most significant (p)?
    e. Attempt to explain why it is that these relationships may exist (try to provide the simplest (most likely) explanation for the relationship you observed.

    f. What (if any) relationships among the independent and dependent variables are the strongest (R) and most significant (p)?
    g. Attempt to explain why it is that these relationships may exist (try to provide the simplest (most likely) explanation for the relationship you observed.

7. In Excel, conduct regression tests that evaluate the strength of the **two most significant relationships** you identified among the **each of the sets of independent and dependent variables** that you used to test your hypotheses.
    a. Put each set of tests on a separate tab in the excel worksheet.
    b. Produce a complete figure that shows the relationship
        i. A trend line, r^2 value and equation of the relationship.

8. Assess the quality of the relationships that you modeled.
    a. Are relationships strong or weak?
    b. If weak, what aspects of the data seem to be causing issues?
    c. What do you think it is possible to have gotten significant correlations among variables using Pearson's correlation coefficients, but not regressions?
        i. For help with this, please check out this link

9. Assess each set of original hypotheses you constructed **based on the Pearson significance (p) of relationships among the dependent and independent variables**.
    a. In your assessment, be certain to:
        i. Assess the validity of your null and alternative hypothesis
            1. Let the significance be the primary determinant of your assessment and use the correlation to suggest the strength of the relationship/correlation.
        ii. Support your statements with evidence
    b. For each set of results, use critical thinking to:
            1. Offer potential explanations as to why you got the results that you did (whether results were expected or unexpected).
            2. Consider biological/ecological phenomena that might explain the results.
        ii. Provide potential suggestions to improve the analyses or methods to make stronger inferences.