Using **Comparative Morphology** to Describe a New Bush Tomato Species from the **Australian Monsoon Tropics**

Figure 1 *Solanum* sp. 'Deaf Adder' in its natural habitat. Photo by Kym G. Brennan

Based on its geography and unique morphological characteristics, the 'Deaf Adder' bush tomato is a distinct species.

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Project Goal

To describe and classify *Solanum* sp. 'Deaf Adder' as a new species by measuring morphological characteristics and using data analyses to compare its features to those of its close relatives *Solanum asymmetriphyllum* and *Solanum sejunctum*, effectively introducing it to the scientific community.

Background

Australia is a unique island continent with a wealth of endemic species, many of which are waiting to be introduced to the scientific community— as of 2009, there were 147,579 accepted described species in Australia. This seems like a lot, but there is an estimated total of 566,398 species in Australia, meaning that over 70% of species on the continent have yet to be described (Chapman, 2009). Kakadu National Park, which consists of almost twenty thousand square kilometers, is a particularly biodiverse area within northern Australia. Common terrain types include lowlands, plateaus, and floodplains, occurring in a monsoonal climate in which the wet season occurs October through March (Banfai & Bowman, 2007). The park hosts a number of endemic *Solanum* species, including *S. ultraspinosum* A.R. Bean, *S. clarkiae* Symon*, S. sejunctum* K. Brennan, C. Martine, & Symon, and *S. asymmetriphyllum* Specht (Bean, 2016; Martine et al. 2019). *Solanum* sp. 'Deaf Adder' has been suggested by regional botanists to be a localized variant of *Solanum asymmetriphyllum*, a functionally dioecious species (Symon,1981) that is widespread in the escarpment region of Kakadu. *Solanum* sp. 'Deaf Adder' appears to be limited to Deaf Adder Gorge, a remote area in the southern part of the park - and is similar in its limited distribution to *Solanum sejunctum,* another localized variant that was segregated from *S. asymmetriphyllum* in 2006 (Brennan et. al, 2006). This study seeks to measure and compare morphological differences between the three taxa to determine whether *Solanum* sp. 'Deaf Adder' should be considered a distinct species (Figure 2).

Methods

- Measurements were taken from a single female *Solanum* sp. 'Deaf Adder' plant. It is the only specimen cultivated in Bucknell's Burpee Greenhouse, and happens to be the only specimen being cultivated outside of its natural habitat.
- Measurements were taken using a dial caliper and/or tape measure.
- Measurements included but were not limited to: prickle density on calyxes, leaves, and stems; fruit diameter and height; fruit wall width; seed number and length; leaf asymmetry and length; et cetera. The expected number of analyzed traits is a minimum of 34.
- Features such as leaf area were processed via ImageJ.
- Principal components analysis (PCA), analysis of variance (ANOVA), and post-hoc testing will be performed to evaluate the significance of the characteristics of *Solanum* sp. 'Deaf Adder' compared to *Solanum sejunctum* and *Solanum asymmetriphyllum.*
- We will then designate a Latin name for the species.

Morphometric Results

- Based on the morphological measurements used in this analysis (*N* = 13 traits) there is clear separation and strong evidence to support that *Solanum* sp. 'Deaf Adder' is its own species (Figure 4).
- The first two axes of the PCA analysis explained 65.5% of the variation (Figure 4).
- The ANOVA tests confirmed that the morphological characters were different among the three species. Ten of the 13 traits were statistically significant (all $P < 0.001$).

Figure 2. Flowers, flower calyxes, and leaves of *Solanum* sp. 'Deaf Adder' (center column) next to *S. asymmetriphyllum* (left) and *S. sejunctum* (right).

Journey to Bucknell

The *Solanum* sp. 'Deaf Adder' specimen here at Bucknell is the only specimen growing outside of Deaf Adder Gorge. Ten seeds from a female specimen collected in 2006 by K. G. Brennan located at the Northern Territory Herbarium in Australia (Figure 3) were brought back to Bucknell by Dr. Chris Martine in 2018. Of those seeds, four germinated, and only one survived.

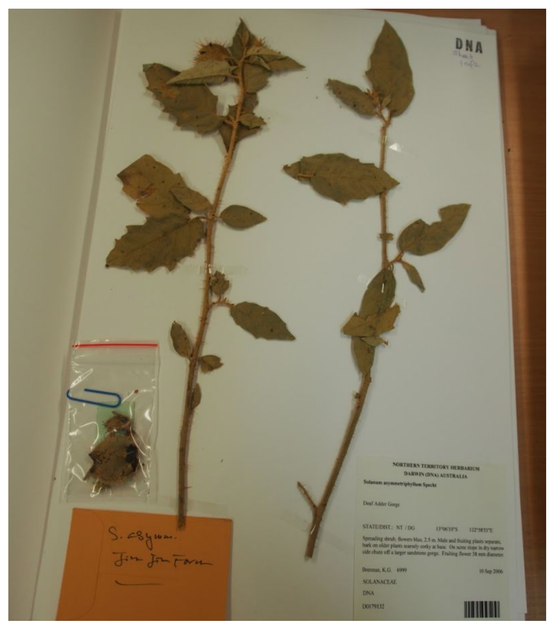

Figure 3. 2006 Female *Solanum* sp. 'Deaf Adder' specimen collected by Kym G. Brennan from the Northern Territory Herbarium.

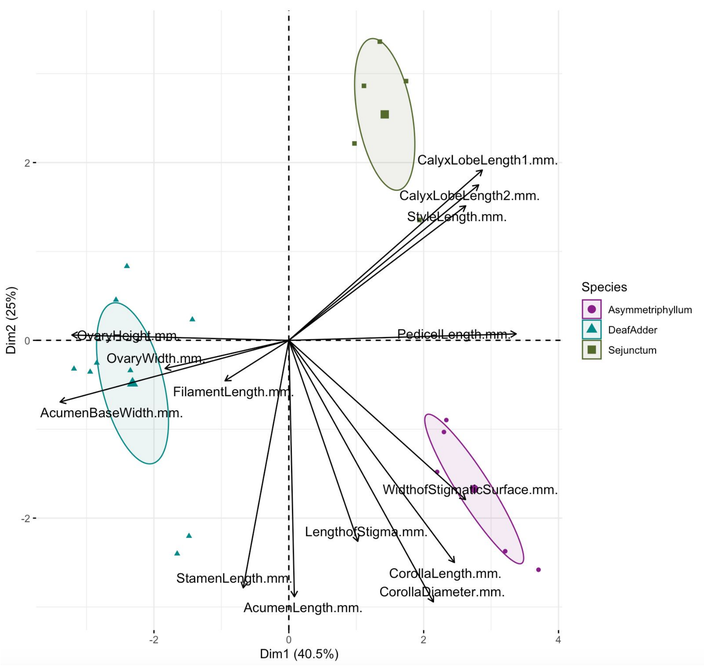

Figure 4. Principal components analysis (PCA) of the 13 morphological traits of the three *Solanum* species. Biplot shows PC1 versus PC2, which explains 65.5% of the variation.

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