Observations of a naturalized *Gazania* population & fruit morphology of a *Baccharis* species

Aleksi Baznekian

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Aleksi Baznekian

14 February 2014

Introduction

The colorful, brilliant flowers of *Gazania* Gaertn. species and hybrids are adored by gardeners across the globe. In fact, many of these species and hybrids can be purchased from local California nurseries. One of these species, *Gazania linearis* (Thunb.) Druce, has apparently escaped cultivation, and it is now naturalized in California (Mahoney *et al*., 2012). Recently, while hiking in the Verdugo Mountains, I stumbled across a seemingly naturalized Gazania population, composed of morphologically diverse individuals. I was not convinced that all of these individuals belonged to the same species, so I conducted a morphological study to unravel the population's Gazania species content. In addition, I stumbled across an isolated *Gazania* individual at a different location, and studied that individual as well.

A pistillate *Baccharis* individual, located at the foothills of the Verdugo Mountains, was observed to have fruits with variable rib numbers.

Methods

The Gazania individuals were selected using the simple random sampling technique. One hundred flowering Gazania individuals were selected from all over the population range, and numbered (California, Los Angeles County, city of Glendale, Verdugo Mountains; population area ≈ 53,000 m^2; general coordinates: 34.187° N, 118.273° W). From this group, 50 individuals were randomly (utilizing the Ran# function on my calculator) selected and identified based on their morphological characters. Magee *et al*.'s (2011) updated *Gazania* key was used to identify these individuals. The isolated *Gazania* individual inhabited and shared a roadside (along Tujunga Canyon Blvd.) with wild grasses, and California buckwheat (California, Los Angeles County, city of Los Angeles; exact coordinates: 34.236° N, 118.271° W). No other individuals were observed along this road (from Foothill Blvd, to the 210 freeway), or in the immediate vicinity of the individual. Due to time and resource constraints, I was unable to photograph all 50 individuals. The individuals, which I could not identify, were photographed. These photographs

are listed below, under "Results." The remaining identifiable individuals were grouped based on their species (and common characters), and only few individuals were photographed as representatives.

The *Baccharis* individual, situated at the foothills of the Verdugo Mountains (California, Los Angeles County, city of Glendale; along Brand Park Dr.; exact coordinates: 34.186° N, 118.275° W), was identified using Bogler's (2012) *Baccharis* key. The individual was photographed in the field, while its fruits were photographed at a later date, using a Reichert stereomicroscope.

Results

All 51 *Gazania* individuals had clumping habits (stems not trailing; caudices ± woody) and basal leaves, with densely tomentose abaxial surfaces. Forty nine of these individuals had linear leaves (Fig. 7), pinnately lobed leaves (Fig. 2) or a combination of these two (Fig. 6). Only two individual were observed to have all bipinnately lobed leaves (Fig. 17). Forty three of the individuals had glabrous to echinate adaxial leaf surfaces (Fig. 14), while the remaining eight individuals (Fig. 1-7 and 11) bore different or variable character states.

Ray floret colors ranged from yellow (Fig. 15), orange to yellow (Fig. 1), orange (Fig. 6), dark orange (Fig. 4), and yellow with orange/red stripes (Fig. 12; all such individuals were observed to have yellow ray ligules with central orange/red strips, extending from the distal parts of the adaxial spots to the tips of the ligules). Forty six individuals had yellow, orange to yellow, or orange flowers, four had yellow with orange/red strips, and the individual from Fig. 4 was the only individual observed to have dark orange flowers. Two forms of adaxial proximal spots were observed: those that formed a tight ring and were green, hazel, purple or brown in color (Fig. 2), and those that did not form a uniform ring and were black (Fig. 15). Only two out of the 51 observed individuals bore the latter phenotype. Abaxial strip colors varied, ranging from brown to orange. One specimen was observed to have blue abaxial proximal spots (Fig. 5).

Parietal bracts of 49 individuals were irregularly placed along the connate portion of the involucre (Fig. 17) or the peduncle, and they are mainly oblong. The individual in Fig. 16 has extremely long bracts relative to the other 50 individuals. It and the individual in Fig. 11 have ± regularly positioned parietal bracts. Involucres ranged from campanulate (Fig. 10) to cupuliform (Fig. 17), their widths ranging from 7.7-15 mm. Involucre hairs from one individual were observed to have dark bases (Fig. 9).

Please see the remaining figures and their captions for all other morphological characters and identification results. Figures 12-17 display a combination of characters that represent 40 of the total studied individuals; especially the individuals in Figs. 13 and 14. All of these individuals appear to be *G. krebsiana* Less. (flowers yellow, orange to yellow, orange, or yellow with orange/red strips; involucres glabrous to mealy, parietal bracts irregularly positioned on the connate portion; leaves linear to pinnately lobed [two bipinnately lobed individuals] with glabrous to echinate adaxial surfaces). The remaining 11 individuals (Fig. 1-11) were un-keyable (certain characters not matching any of the couplet; dead ends). For now, I have simply labeled these individuals as *Gazania* hybrids. The two individuals from Figs. 16 and 11 may be *G. linearis*.

The *Baccharis* species was identified as *Baccharis salicifolia* (Ruiz & Pav.) Pers. ssp. *salicifolia* (Figs. 18-19), yet instead of having fruits with 5 ribs, as stated by Bogler (2012), its fruits bear four to seven ribs (Figs. 20-23).

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Figure 1: photos by Aleksi Baznekian. Flower orange to yellow; adaxial spots hazel with distal red strips cut short. Involucre lanate and hairy, 12 mm wide; parietal bracts irregularly positioned along connate portion. Leaves linear to pinnately lobed; adaxial surface densely araneose and echinate. This individual may be a *Gazania* hybrid.

Figure 2: photos by Aleksi Baznekian. Flower yellow; adaxial spots hazel. Involucre lanate and ciliate, 12 mm wide; parietal bracts irregularly positioned. Leaves pinnately lobed; adaxial surface slightly araneose and echinate. This individual may be a *Gazania* hybrid.

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Figure 3: photos by Aleksi Baznekian. Flowers yellow; adaxial spots brown. Involucre lanate and ciliate, 10 mm wide; parietal bracts irregularly positioned. Leaves linear to pinnately lobed; adaxial surface slightly araneose and mealy. This individual may be a *Gazania* hybrid.

Figure 4: photos by Aleksi Baznekian. Flower dark orange; adaxial spots brown. Involucre glabrous to mealy, 9 mm wide; parietal bracts irregularly positioned. Leaves linear to pinnately lobed; adaxial surface glabrous/mealy, and echinate. This individual may be a *Gazania* hybrid.

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Figure 5: photos by Aleksi Baznekian. Flower orange to yellow; proximal abaxial spots blue. Involucre glabrous to mealy, 10 mm wide; parietal bracts irregularly positioned. Leaves linear to pinnately lobed; adaxial surface glabrous to barely araneose. This individual may be a *Gazania* hybrid.

Figure 6: photos by Aleksi Baznekian. Flower orange; adaxial spots purple. Involucre glabrous, 10 mm wide; parietal bracts irregularly positioned. Leaves linear to pinnately lobed; adaxial surface glabrous to slightly araneose. This individual may be a *Gazania* hybrid.

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Figure 7: photos by Aleksi Baznekian. Flower yellow; adaxial spots brown. Involucre glabrous to mealy, 10 mm wide; parietal bracts irregularly positioned. Leaves linear; adaxial surface glabrous to mealy. This individual may be a *Gazania* hybrid.

Figure 8: photos by Aleksi Baznekian. Flowers orange to yellow; adaxial spots brown. Involucre lanate, ciliate to mealy, 14 mm wide; parietal bracts irregularly positioned. Leaves simple to pinnately lobed; adaxial surface glabrous to echinate. This individual may be a *Gazania* hybrid.

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Figure 9: photos by Aleksi Baznekian. Flowers orange to yellow; adaxial spots purple. Involucre ciliate (hair bases black) and mealy, 10 mm wide; parietal bracts irregularly positioned. Leaves simple to pinnately lobed; adaxial surface glabrous to echinate. This individual may be a *Gazania* hybrid (or potentially a different species due to the black-based hairs).

Figure 10: photos by Aleksi Baznekian. Flower orange to yellow; adaxial spots brown. Involucre ciliate and mealy, 7.7 mm wide; parietal bracts irregularly positioned. Leaves simple to pinnately lobed; adaxial surface glabrous to echinate. This individual may be a *Gazania* hybrid.

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Figure 11: photos by Aleksi Baznekian. Flower yellow; adaxial spots brown. Involucre glabrous to mealy, 12 mm wide; parietal bracts ± irregularly positioned. Leaves linear to pinnately lobed; adaxial surface glabrous to mealy. This individual may be *G. linearis*.

Figure 12: photos by Aleksi Baznekian. Flower yellow; adaxial spots hazel with distal red strips fading into orange and extending to the tip of the ligules (a cultivar). Involucre glabrous to mealy, 11 mm wide; parietal bracts irregularly positioned. Leaves linear to pinnately lobed; adaxial surface glabrous to echinate. This individual appears to be *G. krebsiana*. The top right corner photograph is of another individual studied here, which also keyed to *G. krebsiana*, yet its strips are clearly bright red, and not so fading.

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Figure 13: photos by Aleksi Baznekian. Flower yellow; adaxial spots hazel. Involucre glabrous to mealy, 10 mm wide; parietal bracts irregularly positioned. Leaves simple to pinnately lobed; adaxial surface glabrous to echinate. This individual appears to be *G. krebsiana*.

Figure 14: photos by Aleksi Baznekian. Flowers orange to yellow; adaxial spots brown. Involucre glabrous to mealy, 11 mm wide; parietal bracts irregularly positioned. Leaves simple to pinnately lobed; adaxial surface glabrous to echinate. This individual appears to be *G. krebsiana*.

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Figure 15: photos by Aleksi Baznekian. Flowers yellow; adaxial spots not forming a tight ring, black. Involucre glabrous to mealy, 11 mm wide; parietal bracts irregularly positioned. Leaves linear to pinnately lobed; adaxial surface glabrous to echinate. This individual appears to be *G. krebsiana*.

Figure 16: photos by Aleksi Baznekian. Flower orange to yellow, adaxial spots brown. Involucre glabrous to mealy, 15 mm wide; parietal bracts irregularly positioned (or ± regular?). Leaves linear to pinnately lobed; adaxial surface glabrous to echinate. This individual appears to be *G. krebsiana* (or potentially *G. linearis*).

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Figure 17: photos by Aleksi Baznekian. Flowers orange to yellow; adaxial spots purple. Involucre glabrous to mealy, 9 mm wide; parietal bracts irregularly positioned. Leaves bipinnately lobed; adaxial surface glabrous. This individual appears to be *G. krebsiana*.

Figure 18: photos by Aleksi Baznekian. A *Baccharis* individual, identified as *Baccharis salicifolia*. ssp. *salicifolia*. According to Bogler (2012), individuals of this species should have 5 fruit ribs. This individual has fruits that vary in rib numbers (fruits have been observed to have 4, 5, 6 and 7 ribs).

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Figure 19: photo by Aleksi Baznekian. A *Baccharis* individual, identified as *Baccharis salicifolia*. ssp. *salicifolia*. According to Bogler (2012), individuals of this species should have 5 fruit ribs. This individual has fruits that vary in rib numbers (fruits have been observed to have 4, 5, 6 and 7 ribs).

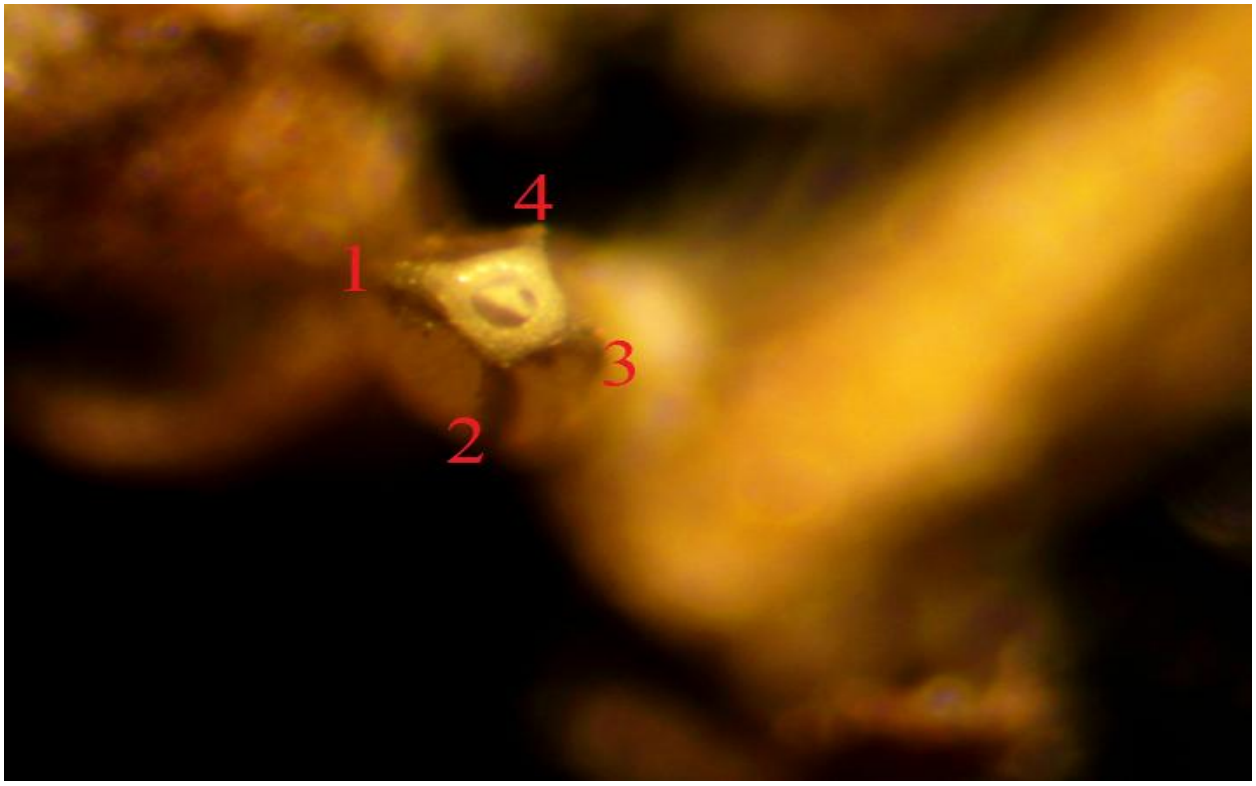

Figure 20: photo by Aleksi Baznekian. A fruit, from the individual (*Baccharis salicifolia*. ssp. *salicifolia*) portrayed in Figs. 18 and 19, having 4 ribs.

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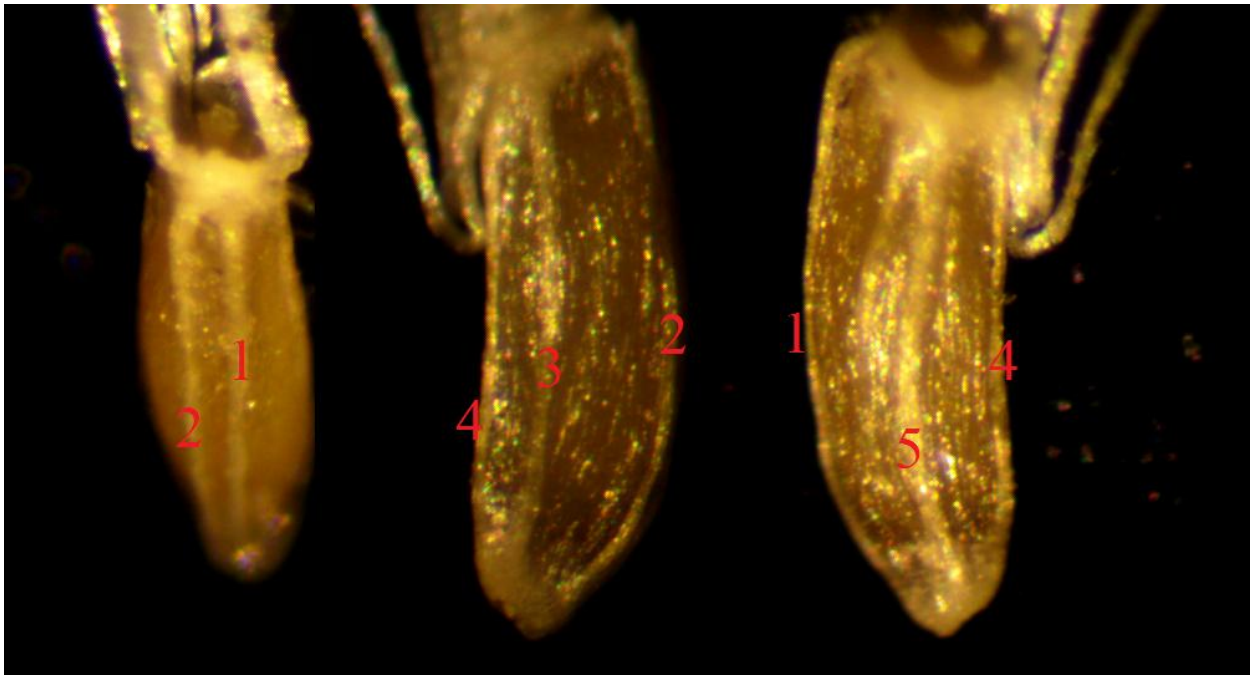

Figure 21: photos by Aleksi Baznekian. A fruit, from the individual (*Baccharis salicifolia*. ssp. *salicifolia*) portrayed in Figs. 18 and 19, having 5 ribs.

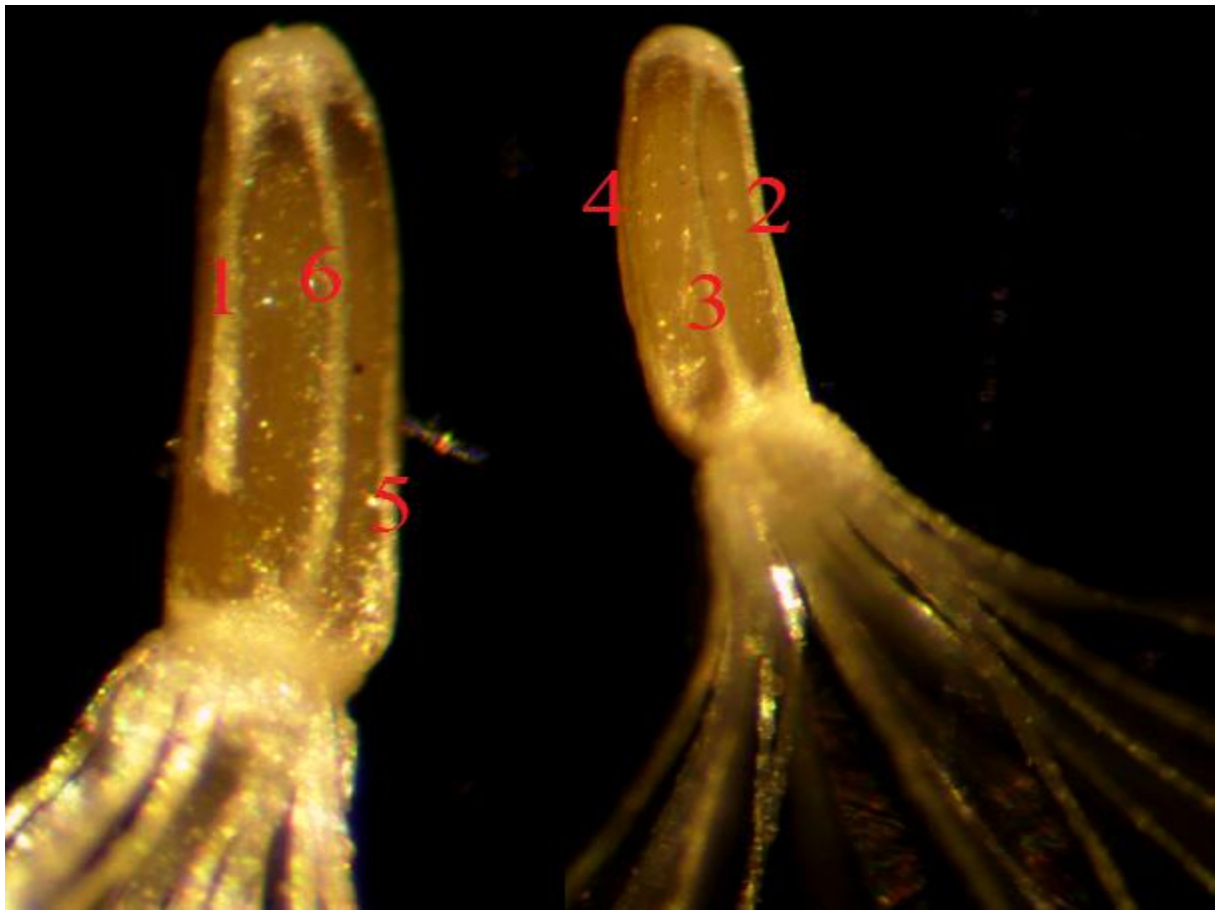

Figure 22: photos by Aleksi Baznekian. A fruit, from the individual (*Baccharis salicifolia*. ssp. *salicifolia*) portrayed in Figs. 18 and 19, having 6 ribs.

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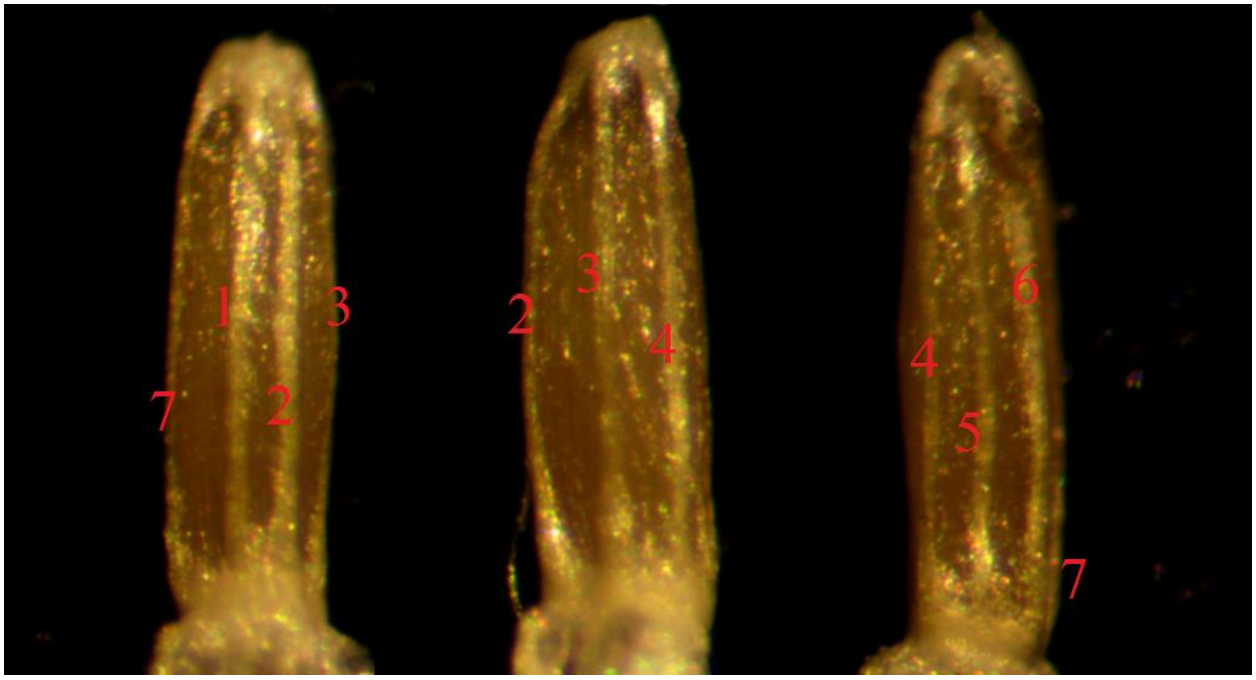

Figure 23: photos by Aleksi Baznekian. A fruit, from the individual (*Baccharis salicifolia*. ssp. *salicifolia*) portrayed in Figs. 18 and 19, having 7 ribs.

Discussion

I believe this morphological study sufficiently (of course, not comparable to nDNA and cpDNA sequence data comparisons) demonstrates that *G. linearis* is not the only (or predominant) naturalized *Gazania* species in this apparently naturalized population, and perhaps all such populations across Los Angeles County and California. Apparently, only the individuals in Figs. 11 and 16 appear to lack irregularly situated parietal involucre bracts, and may be *G. linearis*. According to Anthony Magee, *G. linearis* has no irregularly situated parietal bracts on the connate portion of its involucres or peduncles (personal communication via email). All the other 49 individuals, including the isolated individual observed along the roadside (Fig. 9), bear parietal involucre bracts that were either situated along the connate portion of their involucres or peduncles. The individual in Fig. 9 may be a different species due to having hairs that have black bases. Individuals bearing flowers with orange/red strips are cultivars, whereas individuals with solid flower colors (yellow, orange or red) are more likely to be of wild-type, unaltered stocks (Howis *et al*., 2009). The cultivars may be artificially selected forms of *G. krebsiana*, or they may be hybrids involving this species (they do key to *G. krebsiana*). Moreover, the orange/red strips of these flowers appear to vary in color intensity and length, and there is a possibility that in the absence of artificial selection and propagation (in nature), this phenotype is being masked by the presence of solid color-coding alleles, obtained from cross pollination of such cultivated individuals and individuals with solid flower colors (Fig. 24). In any case, it appears that this population is dominated by *G. krebsiana*.

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Figure 24: photos by Aleksi Baznekian. Clockwise from top left: keys to *G. krebsiana*, bearing full red strips; keys to *G. krebsiana*, bearing red strips extending 1/2 of ligules; keys to *G. krebsiana*, bearing faded/full orange strips (individual from Fig. 12); may be a *Gazania* hybrid, bearing only the dark red proximal portions of the red strips (individual from Fig. 1); and may be *Gazania* hybrid, dark red spots or strips absent from the distal ends of its adaxial ring forming spots (individual from Fig. 2). The individual from Fig. 1 may actually be a cross between a cultivated individual with full red strips and an individual with solid flower color, as in Fig. 2.

Based on these results, it is possible that I have observed a localized, and not a naturalized, population, which consists of *G. krebsiana*, hybrids involving this species, and other *Gazania* species (Mahoney *et al*., 2012). I believe that the observed population is naturalized based on its size and distribution (individuals are randomly distributed, and occupy disturbed roadsides and other such areas within the population's range). Even if this population is localized, the isolated roadside individual is not, and it, too, does not key to *G. linearis*. At any rate, the population's label cannot change certain facts. It is well known that the commonly cultivated species of *Gazania* hybridize readily (Howis *et al*., 2009), and gene flow from such diverse localized populations to naturalized populations will increase the variability of their gene pools (bees were observed to visit the flowers of individuals studied here), which in turn, may increase the reproductive success (Sexton *et al*., 2011) of the already moderately invasive *G. linearis* (Brusati, 2011). Consequently, if landscape managers understand the biological diversity (with regards to *Gazania* spp.) of both kinds of populations, and their effects on one another, they may be able to formulate different or more efficient control measures.

The fruits from the *B. s.* ssp. *salicifolia* individual show great deal of variety in rib numbers, yet it is possible that I have erroneously identified the species. Or, I have correctly indentified the species, and it actually has individuals, whose fruits vary in rib numbers. I will leave it up to the Asteraceae (and *Gazania* and *Baccharis* taxon) authorities to review and confirm my findings. I will add any and all results, originating from such reviews, to an addendum, credit the author, and attached it to this article.

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Acknowledgments

I would like to thank Anthony R. Magee for emailing me a personal copy of his article, containing the updated *Gazania* key. I fully financed this project, providing all the necessary funds and materials. I would like to dedicate this project to my mother, Aydek Babakhani.

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