

New insights into the natural history of the woolly devil *Ovicula biradiata* (Helenieae): chromosome number, UV reflectance, and a range extension

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ABSTRACT

The rare desert annual *Ovicula biradiata* was discovered in March of 2024 and recently described as a new genus and species. Few details about this enigmatic new composite are yet known, including its geographic distribution, reproductive biology, or chromosome number. Here we report a new record for the woolly devil and biological observations from four individual plants that were grown from seed. The cultivated plants of *O. biradiata*, from seedling to maturity, were not as densely white-woolly as plants in the field. The potted plants grew rapidly, producing solitary capitula at branch tips. The first flower parts to emerge from phyllaries were the strap-like limbs of 2–3 ray floret corollas, soon followed by the disc floret corollas already with yellow, pollen-laden anthers. A chromosome number of $2n=32$ was obtained for the species based on meiotic counts. We report preliminary evidence for reproductive self-incompatibility in the woolly devil, and the tendency for ray florets to fluoresce under ultraviolet light, suggesting they contrast with the overall cryptic appearance of the plants and aid in pollinator attraction. Finally, we report a new photographic observation recently uploaded to *iNaturalist* that, if substantiated, extends the range of the woolly devil eastward by over 130 km.

Keywords: ex-situ conservation, *iNaturalist*, pollination, self-incompatibility, Trans-Pecos Texas, UV reflectance.

INTRODUCTION

The woolly devil (*Ovicula biradiata* Manley) represents a charismatic new genus and species of Compositae in subtribe Tetraneurinae (Helenieae) that is remarkable for its small size, densely tomentose indumentum, and conspicuous 2–3 ray florets with elongated strap-like limbs, which are each white with four parallel maroon lines (Manley

et al., 2025). Everything known about this cryptic, minute, and annual Compositae has been gathered from photographs and specimens collected from two of three known localities in the backcountry of Big Bend National Park (BIBE) in the Chihuahuan Desert of Trans-Pecos Texas (Manley et al., 2025). Much remains to be learned about these plants, including their reproductive biology, chromosome number, population demographics, and ecology.



Figure 1. Senescing individuals of *Ovicula biradiata* in late spring. Photo by Dana Sloan in April 2024.

The first known individuals of the woolly devil were encountered and photographed on 2 Mar 2024 by BIBE personnel, Deb Manley and Kathy Hoyt, while hiking cross-country in search of rare plant populations (Manley et al., 2025). Taxonomists from nearby Sul Ross State University (SRSU) Michael Powell and Kelsey Wogan were invited by BIBE personnel to study the species, but by the time these investigators were granted permission to visit a population in the field on 25 Apr 2024, individual plants at all three localities had already begun to wither (Figure 1). It was not known if the delicate annual plants were fading due to drought and heat-wave conditions at the time or if this was part of a naturally accelerated annual life-history cycle. Dozens of partially desiccated individual plants were collected from two localities and the only known herbarium specimens of the woolly devil made so far were deposited at SRSU and CAS.

To discern evolutionary relationships and determine how to classify this new composite, DNA sequence data from the internal transcribed spacer (ITS) region was amplified using PCR and combined with the DNA sequence matrix for the epaleate tribes of the Heliantheae alliance originally published by Baldwin et al. (2002). Molecular phylogenetic evidence backed up by morphological observations suggested that the woolly devil is nested within

subtribe Tetraneurinae of the sneezeweed and blanket flower tribe Helenieae (Manley et al., 2025). Within Helenieae, the new species did not resolve within any of the widely-recognized helenioid genera and instead was supported as the sister lineage to the woolly paper-flowers (*Psilostrophe* DC.). The woolly devil was therefore described as a new genus and species, *Ovicula biradiata*.

Attempts to conduct further field studies in 2024 were thwarted by persistent drought conditions. Deb Manley and associates monitored the known localities and searched for any additional subpopulations of *O. biradiata* during the late winter and spring months of 2025 but did not find any individuals of the species growing (D.L. Manley, *pers. comm.*). The evidence available at the time suggested that the woolly devil is an ephemeral winter annual, initiating flowering in February or early March but only in good rain years, setting seed and withering before April.

To continue studying the woolly devil, we germinated and grew four plants from seed. The main purpose for growing plants of *O. biradiata* was to obtain a meiotic chromosome count, but this activity also provided an opportunity to learn more about the natural history of the species. Here, we report observations of the woolly devil from cotyledon to capitulum, including preliminary evidence for breeding system, mechanisms of pollinator attraction using ultraviolet light, and a significant range extension based on an observation uploaded to iNaturalist (www.inaturalist.org).

MATERIALS & METHODS

Fertile cypselae were obtained from Deb Manley's 25 Apr 2024 holotypic dried plant collection of *O. biradiata* from one of the three known BIBE localities of the species. Cypselae were placed in a paper envelope inside an unsealed plastic bag and stored at ordinary refrigerator temperatures for approximately four months. Attempts to germinate *O. biradiata* from seed were initiated in mid-May 2024. Approximately 10 cypselae were planted in a plastic 7 × 10 cm pot filled to ~1.5 cm from the top with fine commercial potting medium. The potting medium was soaked from below by placing the pot



Figure 2. **A.** Cultivated *Ovicula biradiata* individual with emerging capitula. **B.** Close up of capitula. **C.** Overview of individual with pendent sprawling stems overtopping the pot. **D.** Sparse woolly indumentum silhouetted by light. **E.** Detail of pendent stems.



Figure 3. **A.** Proximal view of *Ovicula biradiata* individual photographed at the type locality. **B.** Lateral view of dense indumentum on leaves and stems. Photos by Deb Manley (A) and James Bailey (B).

in a tray filled with water. Moisture at the medium surface was maintained by occasional spraying with a fine mist, and the pot was covered by a stiff, clear plastic sheet. These initial attempts to germinate seeds failed.

Following a second failed attempt to germinate woolly devil seeds using the same technique, in mid-June 2024, we decided to apply cold stratification to overcome dormancy (Baskin & Baskin, 2000). The third attempt to propagate *O. biradiata* from seed was initiated on 31 Aug 2024. Seeds were stratified over the course of three days in a home refrigerator at approximately 4° C. This time approximately 10 fertile (filled) cypselae were planted in non-compressed, fine potting medium. Moisture in the seed environment was maintained as in earlier trials. After 7–10 days, seven seeds had germinated.

Early-stage capitular buds picked for analyses of meiotic chromosome number counts were fixed in modified Carnoy's solution (4 parts chloroform; 3 parts absolute ethanol; 1 part glacial acetic acid). Standard meiotic squash techniques as outlined in Turner and Johnston (1961) were employed in preparing slides with acetocarmine stain (carmine

powder dissolved in 45% acetic acid) and in microsporocyte observations.

Once cultivated plants were flowering, we illuminated them with ultraviolet (UV) light using a 12W portable UV light. Plants were viewed under UV light for two nights, two days apart on 20 and 22 Feb 2025, three times each night, at ca. 7:00 pm, ca. 9:30 pm, and 11:00 pm. Herbarium specimens were viewed with UV light once during the day, in a dark room. Herbarium acronyms follow Thiers (2025).

RESULTS & DISCUSSION

Observations of development

Four seedlings survived and developed into mature plants. Upon germination, each individual plant presented two ovate cotyledons approximately 0.5 cm wide with only sparse silky trichomes. One of four seedlings, "Woolly Devil One" (hereafter WDI) grew vigorously [Figure 2A–E](#), surpassing the other plants. This dominant individual produced several prostrate stems that mingled with the other plants and overtopped the pot, partially shading other

The devil appears again

In February of 2025 an observation uploaded to iNaturalist by Heather Gully revealed the first known photographs of the woolly devil (*Ovicula biradiata*) taken in April 2019 in Sanderson, Texas, a range extension of over 130 km from the type collection.

Close up shot of *Ovicula biradiata* in Sanderson, Texas
Photo by Heather Gully



Figure 4. Small capitulum of *Ovicula biradiata* revealing itself with emergence of the first ray lamina. Photo by A.M. Powell.

plants and possibly hindering their development. Within a few days, leaves and stems of the seedlings produced a partial silky indumentum of woolly trichomes, but not the dense, whitish tomentum characteristic of plants observed in the field (Figure 3A–B). The pale greenish aspect of immature foliage and lack of dense trichomes persisted throughout the life span of the cultivated plants (Figures 2–3).

On 3 Dec 2024, a tiny capitulum approximately 3 mm across appeared at the tip of one stem of WDI. Additional heads were produced rapidly, all partially obscured among woolly trichomes and by tiny leaves, towards the distal branches of WDI. The small capitula were inconspicuous until the tiny strap-like distal portion of one ray floret corolla developed (Figure 4) and extended beyond the phyllaries. Second ray florets appeared and, in some cases, a third ray floret developed. After the ray florets, a single disc corolla extended from an opening head (Figure 5A–B) exhibiting

exserted style branches covered in yellow pollen (Figure 6A–E). Both ray and disc corollas were all white in some plants, while others were white with conspicuous, maroon, parallel veins (Figure 5, 6), as in plants observed in the field by Manley et al. (2025).

Woolly devil development from seed-to-flowering took three months. WDI was most vigorous in growth (Figure 2A–B) and prolific in producing approximately 200 heads. All the heads of WDI were triradiate (Figure 5), until later stages of growth, when a few biradiate heads (Figure 2E) appeared near branch tips (the latter noted on 3 Feb 2025). Two other individual plants that reached maturity also exhibited vitality in growth, and their numerous capitula were all biradiate. One individual plant, which was outcompeted by the other three plants, remained stunted and did not produce prostrate stems.

Chromosome counts support hypothesized phylogenetic relationships

On 11 Dec 2024, several heads in an early stage of development were picked and fixed in modified Carnoy's solution in preparation for a meiotic chromosome count. The first attempt, on 12 Dec, was unsuccessful because the bud material was in advanced stages of meiosis and pollen production. Nine additional attempts to obtain a chromosome number were made using a total of 42 buds. Capitular buds with microsporocytes in diakinesis and late anaphase I of meiosis were still very small and barely recognizable as heads.

We report a chromosome number of $2n = 32$ for *O. biradiata*, based on progeny derived from seeds of the type collection (Figure 7). The $x = 16$ base chromosome number for *Ovicula* Manley is consistent with molecular phylogenetic and morphological data that supports a closer relationship between *Ovicula* and *Psilostrophe* ($x = 16$; Rice et al., 2015; Strother, 2006) than to *Tetraneuris* Greene ($x = 15$; Rice et al., 2015) or other well recognized *Tetraneurinae* genera. We have also observed that the meiotic chromosomes of *Ovicula* and *Psilostrophe* are similar in size and show a tendency for deep staining with acetocarmine.

Reproductive biology of *O. biradiata*

The cultivation of *O. biradiata* was accomplished inside southeast-facing windows of a residence where no insects could be observed visiting the plants. On



Figure 5. *Ovicula biradiata* close up of capitulum. **A.** Lateral view. **B.** Frontal view. Photos by K. Wogan on December 2024.

8 Feb 2025, mature florets were examined under a dissecting microscope. No fertile cypselae were found. Again, in March and April 2025, numerous heads were harvested and examined for fertile cypselae, but none was found. Based on the lack of observed fertile cypselae, we preliminarily conclude that *O. biradiata* is most likely a self-incompatible annual.

To investigate the function of the densely white-woolly trichomes covering *O. biradiata*, UV light was directed at mature flowering plants. Plant tissues covered in trichomes appeared to absorb UV light, while the ray florets of both bi- and triradiate heads fluoresced (see full page insert on [page 8](#)). Some of the small, strap-like corollas, with limbs measuring $3\text{--}6 \times 0.6\text{--}1$ mm, were fluorescent from the proximal to the distal ends, while some only fluoresced in the distal half or less. Fluorescence in herbarium specimens of *O. biradiata* was essentially the same as in living plants, with trichomes appearing to absorb UV light while the ray florets fluoresced.

In April 2025, the vigorous, carefully nurtured cultivated plants of *O. biradiata* began to show signs of senescence.

Material was harvested from WDI, pressed, dried, and mounted as a chromosome-number voucher specimen. By mid-April senescence was evident in all four of the cultivated plants. At this time a considerable amount of the plant material was harvested and placed in RNAlater (Thermo Fisher Scientific) for use in whole-genome sequencing. We observed that the timing of senescence in our cultivated plants closely matched the life history of the species in the field, which we view as support for the conclusion that *O. biradiata* is an ephemeral winter annual.

A range extension for *O. biradiata*

An observation uploaded in February of 2025 to iNaturalist (Gully, 2025) includes photos of *O. biradiata* from April of 2019 growing with other common spring annual plants in the low Chihuahuan Desert, such as *Astragalus nuttallianus* DC., *Plantago ovata* Forssk., and *Scutellaria drummondii* Benth. The photographed plants were low annuals with numerous, spreading prostrate stems, resembling the same growth form as that observed in cultivated *O. biradiata*. The substrate on which the plants were growing appears to be calcareous gravel, the same substrate in which plants

Beyond visible, the woolly devil's spectral signature

Under UV light the dense woolly trichomes of this plant's leaves and stems absorb light while the ray florets reflect it, giving the capitula a conspicuous, spooky appearance.

Ovicula biradiata under UV light in the basement of the Sul Ross State University Herbarium
Photo by Kelsey Wogan



Figure 6. Developmental stages in *Ovicula biradiata* capitula. **A.** Prior to emergence of the style. **B.** Style emergence. **C.** Lateral view of secondary pollen presentation on unopened styles. **D.** Frontal view showing a mixture of receptive and pre-receptive disk florets with exposed stigmatic surfaces. Photos by A.M. Powell.

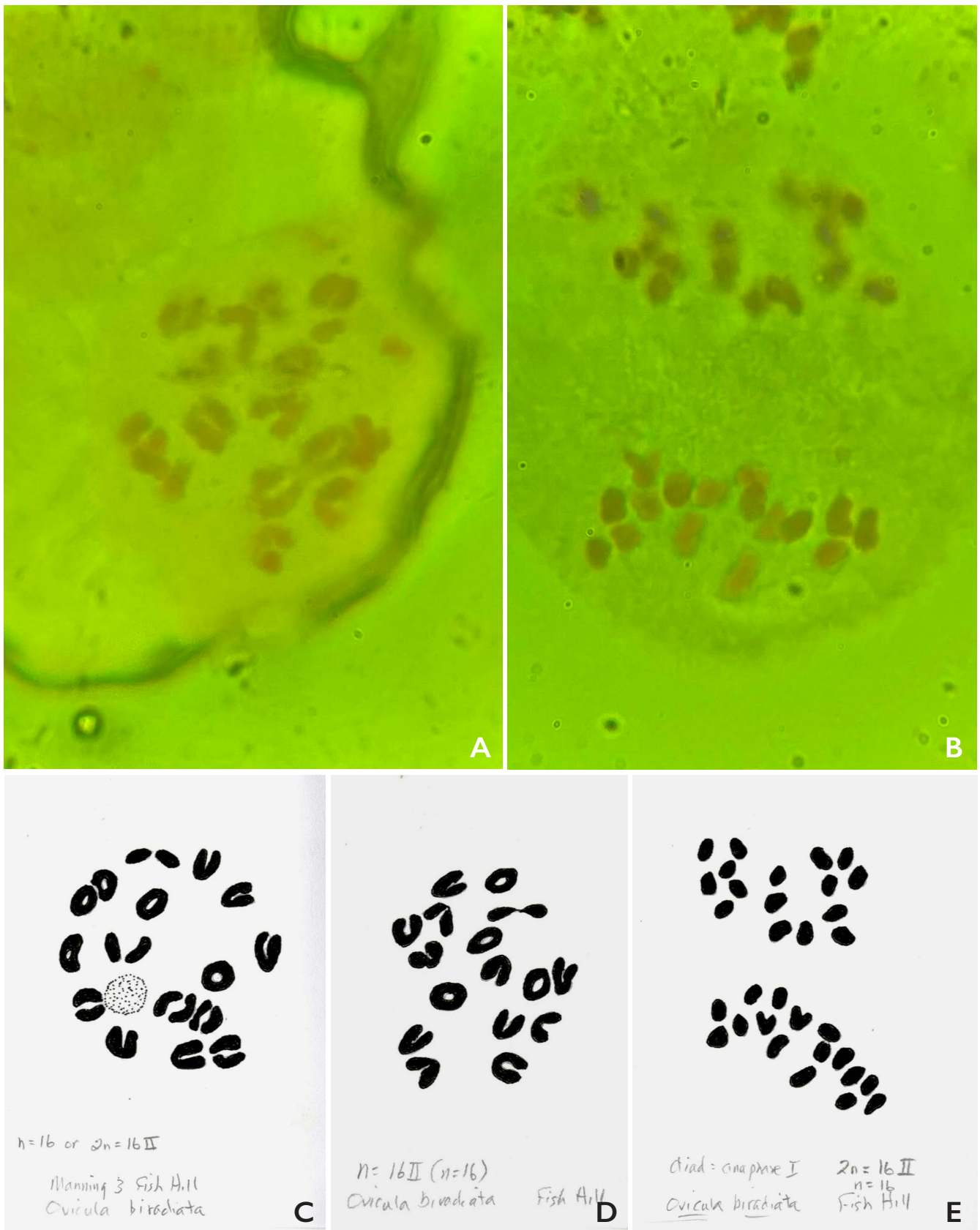


Figure 7. Meiotic chromosomes of *Ovicula biradiata*. **A.** Diakinesis. **B.** Anaphase. **C-E.** Free-hand drawings of chromosomal configurations. Photos and illustrations by A.M. Powell.

Ephemeral green

In a good year, the view from "the Window", a lookout in the Chisos Mountains of West Texas, stretches over the Chihuahuan Desert in a lush, inviting sweep of green. In a dry year, the same landscape turns harsh and unforgiving, the vegetation brown and brittle beneath the sun.

*Chisos Mountains, Texas
Photo by Isaac Lichter Marck*

had been observed growing at the type locality. In one photo a small fly (Diptera) is visible perched on the apex of one of the long ray florets. A fourth photo (Gully, 2025) was added in March 2025 to show an ant (Formicidae) crawling on top of the prostrate stems.

After speaking with Heather Gully by phone, it was confirmed that the observations were made on a private ranch near the town of Sanderson, in western Texas. By measuring the distance between the type locality and the town of Sanderson using Google Earth, it was determined that these new observations extend the range of the woolly devil by ca. 130 kilometers. Given extraordinary drought conditions that persisted through spring of 2025, it has so far been impossible to visit Sanderson to make herbarium specimens and study plants in detail at this new locality.

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