Monitoring the *Lithops fulviceps* var. *lactinea* population in habitat

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We learn how *Lithops* can retract under the soil during drought and become completely invisible to the naked eye, and consequently evade detection during surveys. Photography as indicated.

Introduction

Lithops fuliceps var. *lactinea* was first collected on 2 July 1971 by Desmond and Naureen Cole and later described as a variety of *L. fulviceps* due to the pale "milky, bluish white" facial surfaces of the plants. (These plants were first collected in 1971 and not in 1972 as stated by Jainta (2017), see Cole & Cole (2005) and Cole & Cole (2008).) *L. fulviceps* var. *lactinea* is the most northern *L. fulviceps* and occurs in a few small colonies just a few hundreds of metres apart about 105km east-south-east of Keetmanshoop (Cole & Cole, 2005). The habitat of grey-white calcrete rubble that these plants grow in is well illustrated in Fig. 1.

Methods

As part of a larger study on the long-term monitoring of populations of the genus *Lithops* in Namibia, a standard area of 10×10 square metres was marked in one of the colonies on 27 April 2010 and all plants within this area were recorded. The area was revisited in 2014 and 2017 to record the plants again in the marked area and additionally record the sizes of other nearby colonies. Furthermore, during the 2017 visit to the study area, all plants found were photographed and a standard-sized 1×3cm measure was included in the photograph. These digital photographs were then downloaded and the observations on each of the characteristics studied were noted and added to the

Fig. 1 The habitat of *Lithops fulviceps* var. *lactinea* with two of the marked study square corners (metal posts) visible (Photo: Sonja Loots)

Fig. 2 A wrinkled and very cryptic *Lithops fulviceps* var. *lactinea* plant as found in 2010 (Photo: Sonja Loots)

Fig. 3 A young *Lithops fulviceps* var. *lactinea* plant (top) and an adult two-headed plant with remains of old flowers (bottom) as seen in 2017 (Photo: Roy Earlé)

database. The size of each plant was determined from the photos by measuring the breadth (at the fissure) and length of the two leaves of the plant with a pair of Mitutoyo sliding calipers and then calculating the true measurements by using the photographic size of the standard-sized measure in the photo. The density of the plants within the monitoring square as well as in each of the colonies in total was also noted as was the number of heads per plant. Plants were judged to be young when they were visibly rounded and measured approximately 2×1.5cm and if there was no evidence that they had ever flowered. The damage to the leaves of the plants was assessed on a scale of 0–5 where 0 = no damage and 5 = severe damage.

Results and discussion

During the initial visit in 2010 a total of 24 plants was recorded in the 100m² monitoring plot. All the plants were adults and none showed any predation damage to the leaves. The plants were either single or double-headed except for one plant that appeared to have nine heads. It transpired that these nine heads were three separate plants, a five-headed plant and two double-headed plants all growing very close together (Fig. 6). This was evident when the five-headed plant was again recorded in 2017 but the two double-headed plants had died off. There had been no rainfall at the study site for several weeks before the visit and the plants were all somewhat wrinkled and drawn into the soil (Fig. 2). No flowers or flower buds were present on

Fig. 4 A four-headed *Lithops fulviceps* var. *lactinea* plant in the marked study square with a 1×3cm measure in the picture to calculate the size of the heads (Photo: Roy Earlé)

any of the plants. Thirteen other plants were found in this population outside of the 100m² study site.

During the 2014 visit, no plants were found either in the monitoring square or anywhere else in the population nor was there any evidence of dead plants after two years of well below average rainfall on the farm.

The study site was again visited on 15 May 2017, six weeks after more than 50mm of rain had fallen on the farm. A total of 28 plants was found in the monitoring square on this occasion. Eight of these plants were single-headed young plants (Fig. 3, top), and 20 were adult plants (Fig. 3, bottom). Most of the plants were double-headed (11, 39.3%) but three and four-headed plants (3 of each, 10.7%) (Fig. 4), single-headed plants (2, 7.1%) (Fig. 5) and a five-headed plant (3.6%) also occurred. Every one of the 50 heads of the 28 adults recorded in the 100m² study area had flowered and developing seed capsules were present on all the heads. Outside the monitoring square, as part of the same colony, another 17 adult plants and one young plant were found. This site thus consisted of a minimum of 46 plants.

At the second site some 300m away 33 plants, including five young plants were found. The total number of *Lithops fulviceps* var. *lactinea* plants in habitat thus seems to be a minimum of 79. Of these 14 were young plants of the same age (approximately 4–5years) which corresponds with the last good rainfall and favourable conditions for germination

Fig. 5 A single-headed *Lithops fulviceps* var. *lactinea* plant showing the typical milky blueish-white face of this variety as seen in 2017 (Photo: Roy Earlé)

Fig. 6 Nine heads of three *Lithops fulviceps* var. *lactinea* plants growing close together as found in 2010 (Photo: Sonja Loots)

during the early part of 2012. In all, 17.7% of the plants in the population consisted of young plants. Since it is likely that favourable conditions for germination only occur every sixth year on average, due to the above average rainfall/drought cycle in this habitat, the 17.7% young plants over 6 years may give about a 3% annual recruitment into the population. This recruitment rate would be slightly higher than the up to 2% found in a much larger *Lithops karasmontana* subsp. *bella* population (Earlé, 2011a).

There is a third site on the farm which is very well known to the farmer and only 50m from the farmhouse. At this site plants have been removed sporadically from habitat over the past 60+ years and it now contains none.

The size of the individual heads of visibly turgid adult plants was 28–36×17–21mm while the single-headed young plants were slightly smaller at 18–22×12–17mm. These measurements are comparable with the "up to 40×31mm … mostly 25×18mm" as given for adult cultivated plants of this taxon by Cole & Cole (2005). Only seven plants showed minor damage to the leaves (scale 1) while one four-headed plant had two of the leaves severely damaged (scale 5), presumably by the armoured cricket (Earlé, 2011b).

Lithops fulviceps var. *lactinea* plants are very cryptic in their habitat of grey-white calcrete. Furthermore, the leaves are broad and flat and even when fully turgid, the surface of the face of single and double-headed adult plants is only 3–8mm above the soil surface (n=29, mean: 5.2). When not fully turgid most plants are at soil level or below the level of the soil (Fig. 2). Non-turgid plants can easily be covered by soil and grit and thus hidden from sight so as not to be detected in the population. This was well illustrated during the 2014 visit when no plants were visible.

Jainta (2017) visited the study site in December 2011 and found "about 20 plants over a 100×25 metre area". Although he did not make clear precisely which area he commented on, the photographic evidence he presented suggests that at least some of the plants were retracted below the soil surface. His findings of "about 20 plants" is less than half the number of plants found during the 2017 study in roughly the same-sized area. This illustrates that individual plants can easily retract below the soil surface and thus totally avoid detection during monitoring. The difficulty in determining accurately the population size of cryptic xerophytes such as *Lithops* plants was highlighted by Loots & Nybom (2017) and they concluded that Cluster sampling and the Belt Transect Method gave the most accurate plant density results in large populations. However, in a relatively small population where the plants are very visible when they are even slightly turgid, as was the case in 2017 due to the earlier rain, counting all the plants in the permanently marked 100m² study area is an excellent method to monitor the population size and composition of this *Lithops fulviceps* var. *lactinea* colony over many years.

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