

In search of *Lithops halenbergensis*: exploring the contact zone between *L. karasmontana* subsp. *eberlanzii* and *L. francisci*

Abstract: We have found a string of colonies of *L. francisci* (Dinter & Schwantes) N. E. Brown that appear to abruptly change into a string of colonies of *L. karasmontana* subsp. *eberlanzii* (Dinter & Schwantes) D.T. Cole. The separation between each colony is between 50 and 300 m, and the separation between the last *L. francisci* colony and the first *L. karasmontana* ssp. *eberlanzii* colony is 240 m. We expect that neighboring colonies interact with each other, including the closest *L. francisci* and *L. karasmontana* subsp. *eberlanzii* colonies. However, no obvious hybrids were noted in this area, possibly because the on-going drought has severely desiccated the plants, killing typically over half of the plants in these and several other colonies.

Introduction

The species *Lithops halenbergensis* Tisch. was first described by Arthur Tischer in 1932. Despite numerous searches (e.g., Cole 2004) *L. halenbergensis* (originally published as *L. halenbergense* but corrected to *L. halenbergensis* by D.T. Cole, 1988) has not again been seen in habitat since the original publication.

The plant was said to grow near “Halenberg,” Namibia. The location name may refer to the train stop about 50 km east of the coastal town of Lüderitz,

though it is spelled Haalenberg on the station sign (Fig. 1) and on the official maps issued by the South African Government Printer (e.g., South West Africa 1:250 000 Topographical Sheet 2615 Lüderitz; second edition; revised 1977). It may also refer to one of the mountains near the train station. The highest mountain peak (696 m) lies just north of the train station and is listed as Höhlenberg on the map; none of the other peaks are named. Most likely the location name “Halenberg” refers to the general terrain surrounding the Haalenberg train stop, including mountains and associated flat areas. In the following, “Halenberg” in quotation marks refers to Tischer’s original use of the word.

L. halenbergensis Tisch. has characteristics of both *L. francisci* (Dinter & Schwantes) N. E. Br.

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1. View of Haalenberg station

and *L. karasmontana* subsp. *eberlanzii* (Dinter & Schwantes) D.T.Cole. Tischer explicitly states that *L. halenbergensis* foremost resembles forms of *L. karasmontana* ssp. *eberlanzii*. In particular, he states that the face of *L. halenbergensis* is mostly opaque and colored brown, ochre, or ruby (hematite-red) with a slightly sunken pattern of irregular lines and or dots that may be translucent, darker colored than the body, or reddish-brown. However, unlike *L. karasmontana* subsp. *eberlanzii*, which flowers white, *L. halenbergensis* flowers yellow. In addition, the face of the plant was said to have a number of small, dark green dots that are mostly indistinct and inconspicuous. These dots together with the yellow flower color put *L. halenbergensis* in relation to *L. francisci* and other yellow flowering dotted Lithops.

Tischer's original publication (1932) delineates his struggle to accept that *L. halenbergensis* is worthy of species status. In fact, he took the first plant sent to him by F. G. Eberlanz in 1924 as a form of *L. karasmontana* subsp. *eberlanzii*. This conclusion was straightforward, because the plant sent to him by Eberlanz resembled known *L. karasmontana* subsp. *eberlanzii* and because he did not know the flower color (Table 1), as the plant never bloomed for him. Six years later in 1930, F. Erni sent him a second batch of plants. He found these plants to be identical to the plant he received in 1924 from Eberlanz and which he apparently still had in his possession. This time the plants came with the clear statement that the flower color is yellow. Because *L. karasmontana* subsp. *eberlanzii* flowers white, he doubted this assertion and presumed this to be a mixup. It is possible for a given Lithops species with yellow flowers to include very rare individuals with white flowers, but the reverse, i.e., that a white-flowering species has a yellow-flowering morph, has not been yet seen. So Tischer wrote to Erni to question the accuracy of the information given. Erni replied by sending plants from all three species growing near "Halenberg" and reaffirming their unequivocal flower color: The shipment, sent in the same year as Erni's first shipment, comprised plants of the known *L. karasmontana* subsp. *eberlanzii* (white flower), of the known *L. francisci* (yellow flower), and of the unknown *L. halenbergensis* (yellow flower). (Table 1). This quenched Tischer's doubts: Having all three species in his hand, he states that "the *halenbergensis* plants proved to be totally different from the *francisci* plants". Moreover, he states that *L. halenbergensis* is decisively distinguished from *L. karasmontana* subsp. *eberlanzii* by the presence of dark-green

dots, albeit indistinct or inconspicuous, and additionally by its peculiar hematite-red body and red markings, to which the Coles (Cole and Cole 2005) refer as rubrications.

The fact that *L. halenbergensis* has not again been seen in habitat since the original publication has led many to dismiss its existence. *L. halenbergensis* is not mentioned at all, for example, in the most recent Lithops monograph (Earlé and Round 2021). Others consider *L. halenbergensis* as a synonym for *L. francisci*, which is a categorization published by Nel in his monograph on *Lithops* (1946). To us this choice of synonymy is highly surprising given the statements of resemblance to *L. karasmontana* subsp. *eberlanzii* in Tischer's original description (1932). Jainta (2017) even goes one step further and considers *L. halenbergensis* not only a synonym of *L. francisci*, but he also sets it on par with *L. gesinae* var. *gesinae* deBoer, *L. gesinae* var. *annae* (DeBoer) D.T. Cole, and *L. hermetica* D.T. Cole, all of which he lumps into one species: *L. francisci*!

Finally, there is a set of authors, notably S. Hammer and D. and N. Cole, who do not dismiss the existence of *L. halenbergensis* so lightly. Hammer has suggested that *L. halenbergensis* is a hybrid between *L. francisci* and *L. karasmontana* subsp. *eberlanzii* (1991, 1994). Hammer (1999) refers to a statement by Wilhelm Triebner published by Schwantes (1957) that *L. francisci* and *L. karasmontana* subsp. *eberlanzii* grow together in the Kowisberge (a mountain range almost halfway between Haalenberg and Lüderitz) and Haalenberg mountains, but Hammer goes on to say that none of the colonies he knows are closer than a few kilometers and that he is not aware of mingling among the two taxa. Desmond and Naureen Cole, who searched extensively for *L. halenbergensis* (Cole and Cole 2014), also state that they have not found the two taxa growing in the same colony, though at one location they found them "less than a kilometer apart" (Cole 2004, Cole and Cole 2005). The Coles find it unlikely that *L. halenbergensis* is a simple hybrid and consider the problem of *L. halenbergensis* unresolved. They advocate that the search for this elusive taxon should continue (Cole and Cole 2005).

We note that hybridization, especially over an extended period, is considered one of the mechanisms that may lead to speciation. Thus, hybridization and speciation are not mutually exclusive. Thus, neither the suggestions by the Coles nor by Hammer necessarily exclude each other. For hybridization to occur, however, it is necessary to show that the two taxa can interact geographically.

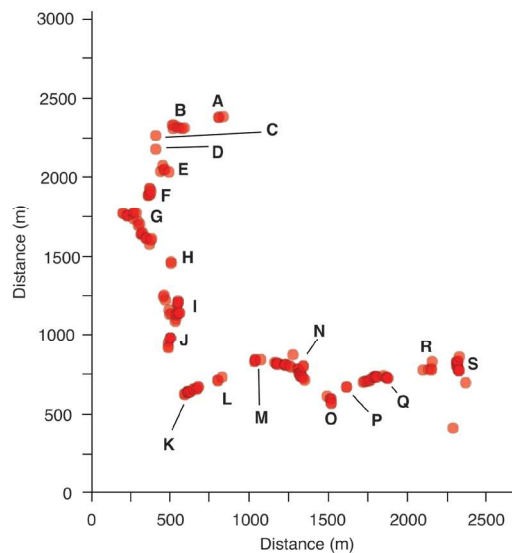
Table 1. Plants and information received by Tischer upon which he based the description of the new taxon *halenbergensis*.

Shipment number	Year	Sender	Taxon	Number	Location Information	Flower color information
#1	1924	Eberlanz	<i>halenbergensis</i>	one double-headed plant	near “Halenberg”	not stated
#2	1930	Erni	<i>halenbergensis</i>	several plants	“Halenberg”	yellow
#3	1930	Erni	<i>halenbergensis</i>	several plants	“Halenberg”	yellow
#3	1930	Erni	<i>francisci</i>	several plants	“Halenberg”	yellow
#3	1930	Erni	<i>eberlanzii</i>	several plants	“Halenberg”	white

The above discussion shows that investigations into the nature of *L. halenbergensis* should focus not only on the identification of *L. halenbergensis* in the field but also whether the range of *L. francisci* and *L. karasmontana* subsp. *eberlanzii* overlap. The latter was thought to be true for one brief moment, when Cole (2005) announced that based on a conversation with T. Schoeman a patch of *L. karasmontana* subsp. *eberlanzii* occurs within a large colony of *L. francisci*. He quickly retracted that statement (Cole 2006), as it was based on a confusion of localities, and he reaffirmed that the closest colonies of the taxa are over a half a mile apart.

Like Hammer and the Coles, we take Tischer’s description of a new species seriously. Both Eberlanz and Erni were experienced collectors and they most likely sent plants to Tischer because they believed that their new find warranted a scientific description as a new taxon. Surely, Eberlanz must have seen that his plant was not a form of *L. francisci* and yet also distinct from the taxon that bears his name. Erni, who sent multiple plants, must have reached the same conclusion.

We were struck by the apparent ease with which Erni seemed to be able to send more plants. Both *L. karasmontana* subsp. *eberlanzii* and *L. francisci* are abundant in the Haalenberg area. But sending multiple *L. halenbergensis* indicates that there must have also been a reasonably large colony from which to pick those plants. We assume that Tischer would have stated in his chronology, if either Eberlanz or Erni had indicated to him that the plants were rare. From this we gather that there is either a large overlap region from which to pick hybrids, or there must be at least one distinct colony of the true species *L. halenbergensis*. Moreover, either location must be near or at “Halenberg” (Table 1).



2: Locality data obtained during 6 days of field work in a given area near the Haalenberg train station. The data show a continuous string of plants interrupted by areas of substrates that are not amenable for lithops to thrive, such as pure rock, deep sand, stream beds, or shifting substrates. These areas are between 50 m and 350 m wide and split the *Lithops* populations into “colonies” labeled A through S. Representative photographs of plants in each colony are provided in Fig. 3. *L. francisci* populates the colonies starting from A and higher; *L. karasmontana* ssp. *eberlanzii* populates the colonies starting from S and lower. Species abruptly change between colonies L and M, which are separated by a section of stark rock, and no mixing was found. The separation between the outer edges of the two colonies L and M is 240 m.

Proximity Measurements of *L. francisci* and *L. karasmontana* subsp. *eberlanzii*

Based on the thoughts above we started a systematic search for *L. halenbergensis* after we located the two well-known colonies of *L. francisci* and *L. karasmontana* subsp. *eberlanzii* in the Haalenberg area. So far, we have spent 15 full days searching promising



3A.



3B.



3C.



3D.



3E.



3F.

habitat for plants in March and December 2020, February and November 2021, and January, February, and March 2022. In an unexpected way two of us (PB and JKL) were enabled in this search by the Covid-19 pandemic because air traffic to essentially all countries

other than Namibia was closed to Americans during much of this time frame.

During our search we found many colonies of plants, which do not belong to the well-known locations. Here, we define plants to belong to a



3G.



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3I.

given colony if plants at the edge are separated at least 50 m from plants in the next location. We searched linearly, i.e., in a search pattern roughly defined by a line about 10–50 m wide until we no longer could locate plants; then we searched in a wider radius in areas that appeared to provide

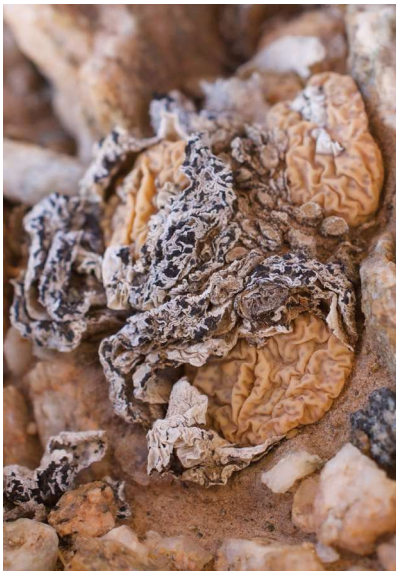
suitable habitat until we found the next colony. In various cases, a given colony was sufficiently isolated (> 500 m) so that we could not locate any neighboring colonies. These colonies appeared to consist of plants of the same taxon, none of which appeared to be *L. halenbergensis*.



3J.



3K.



3L.



3M.



As we found a plant, we photographed it, inspected it up close, and recorded its position with our GPS device. Many years of drought in the area have left many plants dead. We also inspected and photographed apparently dead plants and recorded their position.

In one area, which two of us (PB and JKL) explored for 6 individual days, we located a nearly continuous string of lithops colonies, which spans most of the suitable habitat along the path we took. The colonies are marked A through S in Fig. 2. Representative photographs of plants in these colonies are given in Fig. 3. Each colony is typically separated from another by patches of substrate that is not amenable for lithops

growth, such as naked rock, loose sand, stream beds, or shifting gravel, although there were also areas which appeared suitable for lithops but were devoid of plants. The separations have widths between 50 m and 350 m. We would like to point out that there may be more plants to the left or right of our line of search. We have left these areas for future exploration.

Results and Discussion

The plant colony A comprises *L. francisci*, as do the neighboring colonies. By contrast, colony S and neighboring colonies are populated by *L. karasmontana*



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subsp. *eberlanzii*. From Fig. 2 it is not obvious where the colonies of one taxon end and the colonies of the other start. In fact, one would assume from Fig. 2 that colonies may even mix at some point. We found, however, that taxa abruptly change between colonies L (*L. francisci*) and M (*L. karasmontana* subsp. *eberlanzii*). These two colonies are separated by a section of stark rock with essentially no obvious good habitat (though lithops have the cunning feature to grow in places where one least suspects them). No mixing was found on either side, although many plants in either border colony appeared to be or were dead. In fact, the first live *L. karasmontana* subsp. *eberlanzii* we ascertained in colony M was found by uncovering what appeared to be a mostly dead plant (see Fig. 3 M).

The separation between the outer edges of the two colonies L and M is 240 m. This distance is smaller than the separation between other colonies of the

same taxon, and it is at least 3 times closer than the closest distance reported before by Cole (2004, 2006). The distance surely is short enough for winged pollinators to explore either colony, possibly also for ants and other crawling insects. Furthermore, populations are not static, and historically they may have at times expanded and overlapped under better conditions.

The Haalenberg area is prone to high winds, as already noted by Cole & Cole (2014). At one point, while exploring the top of Höhlenberg, we saw a dust storm approaching from the west, and even before it hit the mountain the gusts were strong enough to nearly blow us off our feet while we were quickly descending. Undoubtedly, these winds pick up not only dust and sand but also lithops seeds and disperse them over the area. This ensures that suitable habitat will be populated by plants possibly during a time scale measured as short as centuries. If so, mixed populations should readily exist given the close proximity



3R.

of the two taxa uncovered by our exploration.

The data presented in Fig. 2 strengthen the possibility of the existence of *L. halenbergensis*. We think that a more exhaustive exploration, especially of areas to either side of the colonies we documented, has a good chance of finding this elusive taxon.

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3S.