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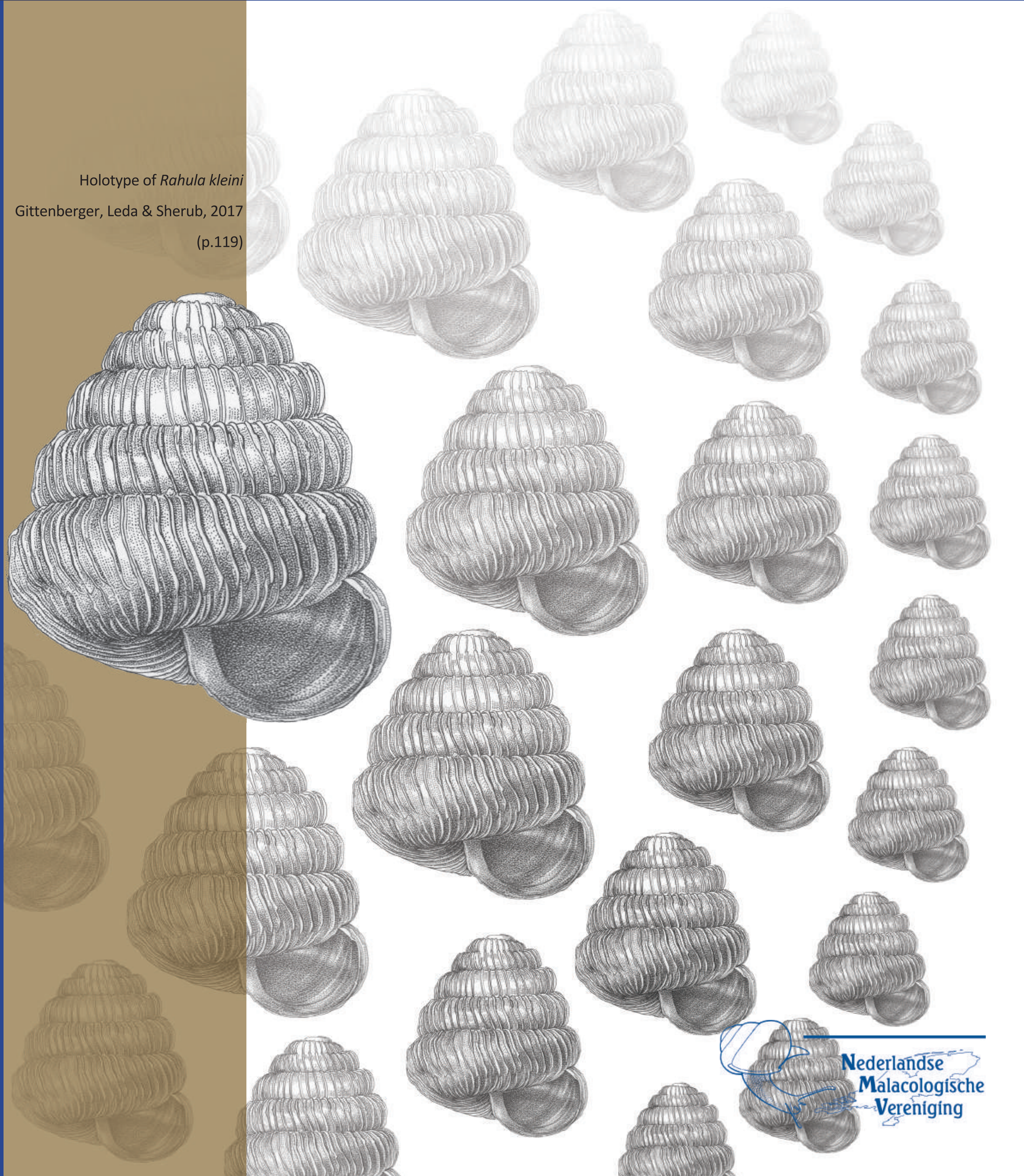

Holotype of *Rahula kleini* Gittenberger, Leda & Sherub, 2017 (p.119)

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Record of *Fruticicola lantzi* (Lindholm, 1927) and *Fruticicola sinistrorsa* Tsvetkov, 1938 (Gastropoda, Pulmonata, Bradybaenidae) from Kyrgyzstan

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The record of both a dextral *Fruticicola lantzi* and a sinistral *F. sinistrorsa* on one leaf of a plant is discussed in relation to their taxonomic level. In former times these reciprocal chiral forms were considered subspecies of *F. lantzi*. Now, because of their premating isolation and their syntopic occurrence, in accordance with Schileyko, these taxa have to be considered different species. The populations of both species provided the opportunity to study covariance in relation to their reciprocal morphs.

Key words: Pulmonata, *Fruticicola*, chirality, covariance, Kyrgyzstan.

Introduction

On 10.vii.2015, a live dextral *Fruticicola lantzi* (Lindholm, 1927) and a live sinistral *Fruticicola sinistrorsa* Tsvetkov, 1938 (Figs 1-6) were collected by T. and F. van den Berg on the Chyrchyk Pass in the East Alai Mountains in the region of Gulcha, in de southwestern part of Kyrgyzstan (40˚14'39 N – 73˚18'22 E, about 2370 m a.s.l.). The snails were both found on a single leave of a plant. When the snails were received by the author, they were already dehydrated.

At first sight, except for the coiling direction, both snails look rather similar. The protoconch is about 1½ body whorl, the total of body whorls is 5¼ and only a small portion of the narrow umbilicus is covered by the reflected columellar margin. Both snails only have one coloured band instead of three. This dark brown, sharply defined middle band passes just above the suture and continues just above the periphery of the last whorl. It does not extend over the thickened apical margin of the aperture. Only some parts of the whorls of the sinistral shell show a faint upper band just below the suture. The third lower band is missing on both shells. The dextral shell is 11.3 mm high and 16.8 mm wide. The sinistral shell is 11.3 mm high and 17.5 mm wide. Both shells have broken parts that are restored. Only in the sinistral specimen a little part of de apertural lip is missing. Because of the widened aperture, the shells are fully grown but smaller than indicated in the description by Lindholm (1927) and Sysoev & Schileyko (2009). The sinistral shell is more flattened. The shells are kept in the collection of the author.

For identification of the snails Lindholm (1927), Sysoev & Schileyko (2009) and Kantor et al. (2010) were used. *Fruticicola lantzi* is known from Kyrgyzstan and has a distribution in the Tian Shan, Pamiro-Alai and Alai ridges (Schileyko, 1978; Sysoev & Schileyko,

Figs 1-6. *Fruticicola* specimens from Gulcha, Kyrgyzstan. **1-3**, *F. lantzi*, the dextral species; **4-6**, *F. sinistrorsa*, the sinistral species; **1**, **4**, dorsal side; **2**, **5**, ventral side; **3**, **6**, side view. Photographs by Ingrid Margry-Moonen.

2009; Kantor et al., 2010).

Tsvetkov (1938) described sinistral specimens of *Fruticicola lantzi* as the subspecies *F. l. sinistrorsa* Tsvetkov, 1938. For the sinistral specimens, the status of subspecies is accepted by several authors, most of the time in *Fruticicola* Held, 1837 (Gause & Smaragdova, 1940; Klabunovskiĭ & Patrikeev, 1959; Sysoev & Schileyko, 2009; Kantor et al., 2010), sometimes in *Bradybaena* Beck, 1837 (Schileyko, 1978; Okumura et al., 2008). Sysoev & Schileyko (2009: fig. 97) show syntypes and lectotypes from several subspecies of *Fruticicola lantzi*, including the lectotype of ssp. *sinistrorsa*.

Discussion

The biology of left-right asymmetry with the maternal effect is discussed in Okumura et al. (2008). Most of the time, a chiral reciprocal snail is considered to be an aberrant form. Such mutants are found in many gastropod species but they are rare in number and will vanish from the population (Gould & Young, 1985).

In some tree-snail species, both dextral and sinistral specimens may copulate successfully. Schilthuizen et al. (2007) even showed a positive sexual selection for this dimorphism in *Amphidromus inversus* (O.F.

Müller, 1774), probably caused by a greater fecundity in such interchiral matings by both the chirality of the spermatophore and the femal reproductive tract.

In most other gastropod taxa, opposite coiling populations are found incidentally. In his research on *Leucostigma candidescens* (Rossmässler, 1835), Nordsieck (2011) describes three dextral subspecies for this normally sinistral clausiliid species. He considers these populations subspecies because of their differences in both the shells and their generally parapatric dispersal. Two of the dextral subspecies live close to their ancestral subspecies, one subspecies (*L. c. dextromira* Nordsieck, 2011) even has a modest syntopical overlap. Because of their elongated shells, these snails are still able to mate with the opposite coiled subspecies, which is a third reason for keeping them at a subspecific level.

Sysoev & Schileyko (2009) mention that from *F. lantzi* both dextral and sinistral populations are known. *Fruticicola* snails have globular shells. Gittenberger (1973, first unpaged p., in Dutch; 1988) already supposed, that snails with opposite coiled shells with a globular form are reproductivily isolated. Later on, van Batenburg & Gittenberger (1996) showed with a computer experiment that this may enable single-gene speciation, whereas Gittenberger et al. (2012) speculated about the frequency that this mechanism might have been effective during gastropod evolution. Janssen (1966), Margry (2009) and Margry & Gittenberger (2011) described failed attempts of mating by dextral and sinistral specimens of *Arianta arbustorum* (Linnaeus, 1758). Okumura et al (2008: fig 9B) showed the genital mismatch between a sinistral and a dextral *Bradybaena similaris* (Férussac, 1821). These findings support the supposition of reproductivily isolated individuals. In 2012, Schileyko states, that de sinistral *sinistrorsa* taxon, described by Tsvetkov, without any doubt evoluated from the dextral *Fruticicola lantzi.* He deservedly raised de sinistral *F. sinistrorsa* to the species level because these sinistral snails can copulate only with each other and they are found at close distances (e.g. few meters) of dextral snails (Schileyko, in mail).

Okumura et al. (2008) describe dextrality as genetically dominant in the mostly dextral families of the Bradybaenidae. For this reason, the populations of *Fruticicola sinistrorsa* will have to be homozygous recessive for their sinistrality. Only new sinistral mutants of *F. lantzi* will be able to break through this sympatric reproductive isolation. Because of the maternal effect, such new sinistral mutants from dextral populations can be heterozygous and can disturb the homozygosity of the sinistral populations. That is above all, if both chiral taxa have an entirely equivalent shape except for the reversed symmetry itself.

Because *F. sinistrorsa* is known for at least 80 years, it would be of interest to look for more differences. Gould & Young (1985) compared 28 characters in five sinistral and 50 randomly chosen dextral specimens of *Cerion*. They found significant differences in form and size between those chiral reciprocals. Especially the twisting of the sinistral shells towards the apertural side is of interest. Such a consistent pattern of covariance would be an additional reason to consider *Fruticicola sinistrorsa* a separate species. Despite many similarities, both opposite coiling shells of this paper show minor differences, e.g. the shape of the umbilicus, which is more open in the sinistral snail (Fig. 2,5). Moreover, the shell of *F. sinistrorsa* is flatter compared to the lectotype depicted in Schileyko & Soesev (2009: fig 97G). In order to investigate the systematic sinistral uniqueness of *F. sinistrorsa*, it would be of interest to study both sinistral and dextral *Fruticicola* species morphologically, as performed by Gould & Young (1985).

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