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REISSERONIA LESARI SP. NOV., *R. GERTRUDAE* SIEDER, 1962 AND *R. TARNIERELLA* (BRUAND, 1850) IN SLOVENIA (LEPIDOPTERA: PSYCHIDAE)

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Abstract – The present study reviews the genus *Reisseronia* (Bruand, 1850) in Slovenia. Two species, *R. gertrudae* Sieder, 1962 and *R. tarnierella* (Bruand, 1850), are new to Slovenian fauna and *Reisseronia lesari* sp. nov. is described from Radensko polje in the central part of the country. The new species is parthenogenetic and is compared with several related taxa. Morphological differences are presented and shown in figures. Additional data about the habitat and biology of the discussed species are provided.

Key words: Lepidoptera, Psychidae, *Reisseronia*, new species, fauna, Slovenia.

Izvleček – *REISSERONIA LESARI* NOVA VRSTA, *R. GERTRUDAE* SIEDER, 1962 IN *R. TARNIERELLA* (BRUAND, 1850) V SLOVENIJI (LEPIDOPTERA: PSYCHIDAE)

Pričujoča študija nam daje pregled rodu *Reisseronia* (Bruand, 1850) v Sloveniji. Dve vrsti, *R. gertrudae* Sieder, 1962 in *R. tarnierella* (Bruand, 1850), sta novi za slovensko favno, *Reisseronia lesari* nova vrsta za znanost pa je opisana z Radenskega polja v osrednjem delu države. Nova vrsta je partenogenetska. Primerjamo jo z več sorodnimi vrstami in predstavljamo njihove morfološke razlike v besedi in sliki. Podajamo dodatne informacije o habitatu in biologiji obravnavanih vrst.

Ključne besede: Lepidoptera, Psychidae, *Reisseronia*, nova vrsta, favna, Slovenija.

Introduction

Members of the genus *Reisseronia* are small psychids, the wingspan of males being between 6 and 11.4 mm. The females are wingless (Arnscheid & Weidlich

2017). Larvae live a very secret life in the herbal layer and are therefore difficult to find. The genus *Reisseronia* Sieder, 1956, contains 15 species, distributed in central and south-eastern Europe and south-western Asia (Hättenschwiler 1982, 2004; Hauser 1996; Rutjan 2003; Kurz *et al*. 2006; Weidlich 2006, 2016; Malkiewicz *et al*. 2013; Larysz 2017). Some of them have been discovered in the recent decade: *R*. *satanella*, *R*. *muscaelutum* Kurz *et al*., 2006; *R*. *arnscheidi* Weidlich, 2006; *R*. *ionica* Weidlich, 2016; *R*. *imielinella* Malkiewicz *et al*., 2013 and *R*. *annae* Larysz, 2017.

In Slovenia, no species of the genus *Reisseronia* have been identified so far (Carnelutti 1992a, 1992b; Lesar & Govedič 2010; Sobczyk 2011; Arnscheid & Weidlich 2017). In 2012, the first specimen was obtained by the third author, on a dry meadow near the village of Socerb on the Karst edge. A single male was collected by net, but enough to start intensive research on this genus. A few years later, the first author found typical *Reisseronia* larval cases near the first locality and in Lokavec near Ajdovščina, on a dry extensive meadow. All these finds, after detailed morphological examination confirmed the presence of *R*. *tarnierella.* This is not a coincidence, because the familiar localities Alesso and Interneppo in northern Italy (Sieder 1972) are located not far from the state border with Slovenia.

Twelve parthenogenetic species have so far been found among the Psychidae, of which a high percentage are endemic, due to poor mobility (Malkiewicz *et al*. 2013; Arnscheid & Weidlich 2017; Larysz 2017). Among *Reisseronia*, three parthenogenetic

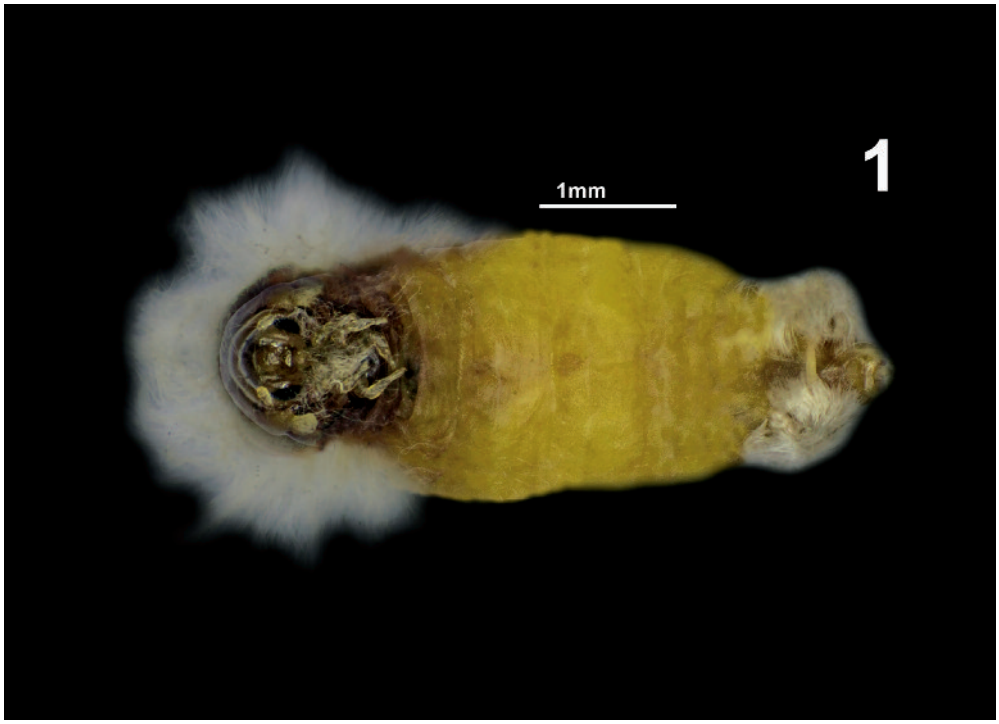


Figure 1. *Reisseronia lesari* sp. nov, female, holotype, ventral view.

species have been identified to date: *R. gertrudae* Sieder, 1962, *R. imielinella* Malkiewicz *et al*., 2013 and *R. annae* Larysz, 2017. Field research for parthenogenetic populations in Slovenia was focused at first on the northern border area, where *R. gertrudae* was expected due to the proximity of its known localities on the Austrian side. In 2015, the first author found the first *Reisseronia* population with parthenogenetic development in the vicinity of Vinica, and soon thereafter, enriched with new experience, new finds followed. In the period of 2016 to 2020, a larger number of larval cases were collected in all localities. Three populations from northern (Goričko) and south-western (Bela krajina) parts of Slovenia are clearly *R. gertrudae*: reduced legs without tarsal segments, with unpaired claws and antenna reduced to one segment. The population from moist meadows of one of the smaller flooded karst fields, Radensko polje, in the north-western part of the Dolenjska region initially showed a lot of similarity with *R. imielinella* Malkiewicz *et al*., 2013 and *R. annae* Larysz, 2017. Based on morphological differences of adults and immature stages, we describe them as a new species *Reisseronia lesari* sp. nov. Predovnik, Rekelj & Gomboc.

Materials and Methods

Collections

Specimens examined in this study were obtained by rearing adults from larvae collected in a conventional manner, with great difficulty due to the small size and unrecognizability of larval cases in the herbal layer. Collected larvae were stored in the breeding containers with some soil and herbal layer taken from the origin locality. They were kept in natural conditions, protected from direct sunlight. To avoid too high humidity, we moistened the herbal layer moderately and selectively every second or third day, occasionally only a few plants and mosses. Breeding containers were sprayed with water every morning, in sunny days also in the evening. Some adult males of *R. tarnierella* were collected on sunny days between one to three p.m., by using the method of sweeping over the vegetation with a net.

Morphology

All female specimens were conserved in an alcohol-glycerol solution (75% rectified spirit-ethanol, 15% glycerol, 10% distilled water) and stored in small plastic vials. Determination and comparative work were done using an Olympus SZ51 stereomicroscope. Preparation of genitalia and individual parts of females, such as legs or antennae, followed standard techniques according to Robinson (1976).

Macro photographs were taken with a Cannon EOS 40D digital camera, through an Olympus SZ51 stereomicroscope and Reichert microscope. Images, further details and figures were later processed with Adobe photoshop CS5 master collection software. Drawings were made by using Indian ink on transparent sheets and later converted into a digital format. All drawings and micro photographs are the work of the second author. A pinned male specimen of *R. tarnierella* was photographed with a Cannon EOS 40D digital camera with macro 100mm lens. Photographs of the type localities were taken using a Canon PowerShot G5 digital camera.

All measurements were performed through a stereomicroscope, using a measuring eyepiece micrometer with appropriate magnification. One distinctive measuring method was used in this paper, called the eye index (Dierl 1969: 168; Arnscheid & Weidlich 2017: 6–7), which is calculated by measuring the minimum distance between the eyes, and dividing this value by the maximum eye diameter. The quotient resulting from this division is then converted into an index.

For nomenclature of species we referred to papers by Sobczyk (2011) and Arnscheid & Weidlich (2017). The terminology of morphological characters for imagines follows Sauter & Hättenschwiler (1999) and for the immature stages Gepp & Trattnig (1990), Patočka & Turčani (2005).

The species examined for comparative purposes were *R. imielinella*: 3 ♀, Paratype, Poland CA75, Imielin, 24.5.2007, leg. A. Larysz; *R. annae*: 4 ♀ with larval cases, Poland CA66, Katowice-Janów, 29.5.2013, leg. A. Larysz, all in coll. USMB.

Abbreviations used in description

PMSL	Prirodoslovni muzej Slovenije
USMB	Upper Silesian Museum Bytom, Poland
ŽPSL	Željko Predovnik, Slovenia
JRSL	Jurij Rekelj, Slovenia
SGSL	Stanislav Gomboc, Slovenija
coll.	collection
e.o.	ex ovo
e.l.	ex larva
leg.	legerer in Latin (collected)
n=	number of specimens examined
A1-10	abdominal segments of female, larva and pupa
№	number

Results

Reisseronia lesari sp. nov.

Diagnosis

Fifteen species have so far been identified in the genus *Reisseronia*. A total of 12 species have a bisexual reproduction strategy (with known males) and just three species *R. gertrudae* Sieder, 1962, *R. imielinella* Malkiewicz *et al*., 2013 and *R. annae* Larysz, 2017, are parthenogenetic. Observations under controlled laboratory conditions confirmed that *R. lesari* sp. nov. also has parthenogenetic development.

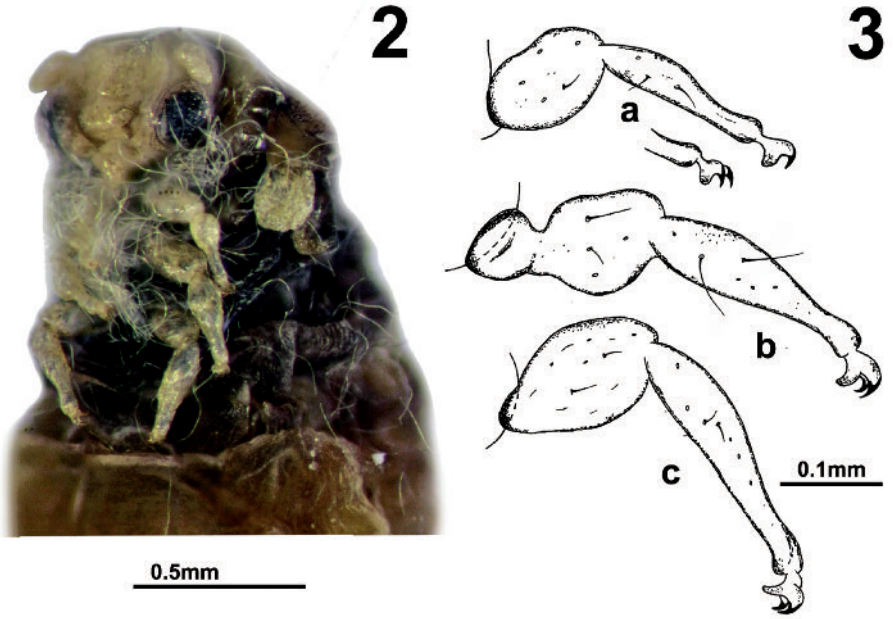
The new species can easily be distinguished from the following species: *R. tarnierella* (Bruand, 1851), *R. nigrociliella* (Rebel, 1934), *R. pusilella* (Rebel, 1940), *R.*

magna Hättenschwiler, 1982 and *R. ionica* Weidlich, 2016, by the smaller size of females and larval cases and also by the absence of tarsal segments in all legs.

Females of *R. satanella* Kurz, Kurz & Zeller-Lukashort, 2006, *R. staudingeri* (Heylaerts, 1879), and *R. arnscheidi* Wiedlich, 2006 are similar in size but *R. satanella* has six to eight fused antennal segments (*R. lesari* sp. nov. only two antennal segments) and larger larval cases (length 7.0–9.5 mm). *R. staudingeri* is distinguished by the smaller number of antennal segments (only one) and much larger larval cases (length 11.0–14.0 mm). *R. arnscheidi* differs in a higher number of antennal segments (two to three), the presence of a single tarsal segment and larger larval cases (length 8.0–10.0 mm).

The new species is distinguished from reduced females of *R. tschetverikovi* Solyanikov, 1990 and *R. muscaelutum* Kurz *et al*., 2006, by long curled hairs on the head and thorax (*R. tschetverikovi* and *R. muscaelutum* have short, erect hairs). *R. tschetverikovi* also differs in having only one antennal segment (*R. lesari* sp. nov. two antennal segments), while *R. muscaelutum* also differs in having smaller larval cases, which are six mm long (*R. lesari* sp. nov. 6.2–7.6 mm).

Females of *R. lesari* sp. nov. are most similar to the following three parthenogenetic species: *R. gertrudae*, *R. imielinella*, and *R. annae*. They can be distinguished from all three species by the presence of setae on the antennae (Fig. 4), clearly visible wings (reduced small oval lobes) (Fig. 5), and a higher number of spines (32–44) in the second row of the A5 pupal segment (*R. gertrudae* 26–33, *R. imielinella* 15 and



Figures 2-3. *Reisseronia lesari* sp. nov, female, holotype. **2.** Head and thorax, latero-ventral view. **3.** Legs of female. **a.** fore leg. **b.** middle leg. **c.** hind leg.

R. annae 20–26 spines). The new species also differs from *R. gertrudae* in having separate femur and tibia and in having paired claws (details in Table 2). The new species also differs in the colour of the hairs on the head and thorax (*R. imielinella* gray, *R. lesari* sp. nov. creamy) and the presence of spines on the vertex (Fig. 4). Females of the new species are also distinguished from *R. annae* by a smaller number of antennal segments (*R. lesari* sp. nov. two, *R. annae* three), the absence of tarsal segments and the presence of spines on the vertex. All important morphological characteristics of all four parthenogenetic species are shown in Table 1.

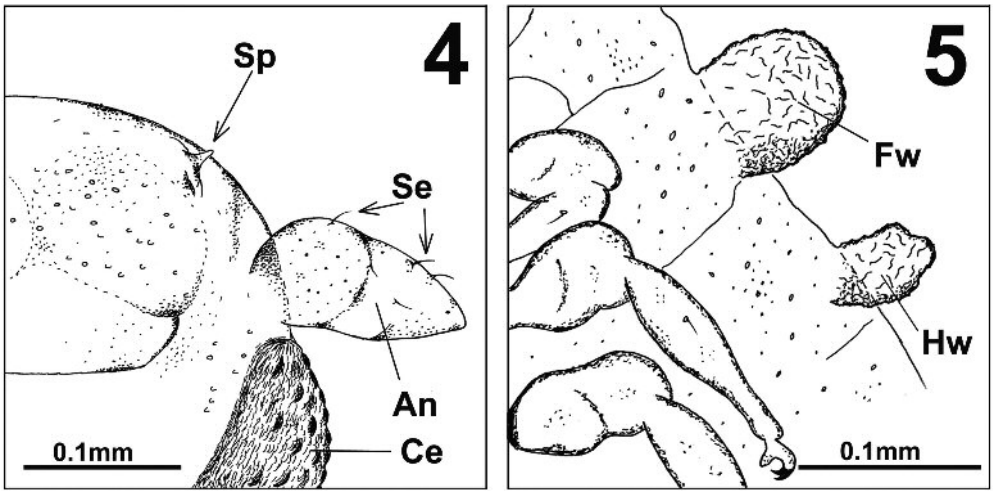
Table 1. Presentation of important distinguishing features of the imagines and immature stages of parthenogenetic species of the genus *Reisseronia* (according to Sieder 1962; Malkiewicz *et. al*. 2013; Larysz 2017; supplemented by our own investigations).

Imago - ♀	***gertrudae***	***imielinella***	***annae***	***lesari* sp.nov.**
length / width	3.0 1.0–1.5	3.3–5.2 1.0–1.8	3.0–4.2 0.9–1.3	3.4–5.1 1.0–1.9
antennal segments	1	1–2	3	2
antennal setae	absent	absent	absent	present
vertex spines	present	absent	absent	present
thorax hairs colour	creamy	gray	creamy	creamy
wings	microscop. tiny lobes	microscop. tiny lobes	not visible	strong reduced oval lobes
femur / tibia	fused	separated	separated	separated
tarsal segments	absent	variable 0–1	all legs with one	absent
leg claws	allunpaired	allpaired	allpaired	variable
Immature stages				
larval case length larval case width	6.0–7.0 2.0	5.5–7.2 1.5–2.0	6.3–8.2 1.6–2.6	6.2–7.6 2.1–2.6
pupal spines ofA5 - second row	26–33	15	20–26	32–44

Description

Adults. Parthenogenetic females with reduced wings, small length of fresh specimens 3.4 to 5.1 mm (average 4.25 mm), width 1.0 to 1.9 mm (average 1.45 mm), Fig. 1.

Head. (Fig. 4) Brown, with rippled creamy hairs. Vertex dorsal with two small excrescences, spine-like shape (these two processes have already been described in *R. gertrudae* by Sieder 1962:89), (Fig. 4). Antennae translucent, basic, reduced to only two segments, which are often fused into a whole. Segments with one to five microscopically small setae (Fig. 4). Eyes black, oval, eye index 1.9 to 2.2 (n = 10), labial and maxillary palpi absent.



Figures 4-5. *Reisseronia lesari* sp. nov. **4.** Head structures, dorsal view. **Sp.:** vertex spine; **Se:** antennal setae; **An:** antenna; **Ce:** compound eye. **5.** Thorax structures, ventral view. **Fw:** reduced forewing. **Hw:** reduced hindwing.

Thorax. Segments brown, sclerotized, with long curled creamy hairs (Fig. 1). Wings clearly visible, forewings very reduced to small oval lobes, hindwings much more reduced to tiny lobes, or barely noticeable in most specimens (Fig. 5). Legs pale brown, transparent, reduced, all with distinct separate femur and tibia, tarsal segments absent, all legs with a few microscopically tiny setae (Fig. 3). Fore leg claws paired in 30%, middle leg claws paired in 80%, hind leg claws all paired (Table 2).

Table 2. Variability of claws on legs of females from *Reisseronia lesari* sp. nov.

№	Specimen №	claws fore leg	claws middle leg	claws hind leg
1	19 387	1	1	2
2	19 388	2	2	2
3	19 389	1	2	2
4	19 390	2	2	2
5	19 392	1	2	2
6	19 397	2	2	2
7	19 403	1	2	2
8	UA 014	1	1	2
9	UA 015	1	2	2
10	UA 016	1	2	2
average		30% paired	80% paired	100% paired

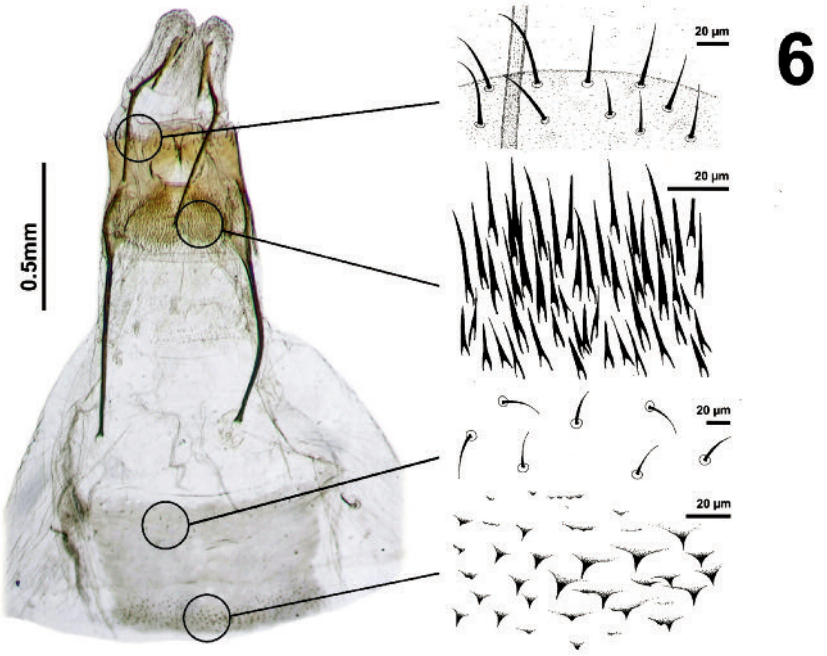


Figure 6. *Reisseronia lesari* sp. nov., female, paratype, genitalia and last abdominal segments with details, ventral view.

Abdomen. Yellowish-brown, ventrally lighter than dorsally. Sternites one to three poorly sclerotized, four to six sclerotized slightly, as a narrow strip. Seventh sternite sclerotized wider, moderately, with a narrow field of spines (Fig. 6). Segment A7 with long curled white-gray hairs prior to oviposition.

Genitalia. (Fig. 6). Ovipositor lobes rounded, membranous, slightly setose. Pseudapophyses straight, very short, less than one third the length of posterior apophyses. Posterior apophyses curved, about one third smaller than anterior apophyses. Segment A8 relatively short, cylindrical, well sclerotized in the first two thirds, with two fields of spines. Spines on postvaginal plate pointed, long and thick. Bursa copulatrix not visible.

Larva. Length of last instar larvae is between five and seven mm. The colour of abdominal segments is generally creamy to light orange, the sclerotized parts of the thoracic segments are black to dark brown, the head capsule is smooth, black and shiny (Figs. 8b, 9). The setae are translucent, long, and some are curved at the tips. Sclerotized parts of the thoracic shield are different widths, the widest part being on the prothorax and the narrowest on the metathorax. Small, sclerotized areas are also visible laterally on the mesothorax and metathorax. Dorsally on thoracic segments, a line-like, poorly sclerotized part is also visible, which is widest at the metathorax. Thoracic legs strong, moderately sclerotized, of dark brown colour, the claws long and slightly curved. Spiracles are poorly separable from the base colour of the abdo-

men, pinaculas are not visible. Crochets on abdominal prolegs are arranged in uniordinal penellipse, number of crochets 18–23 (n = 4).

Larval cases. Typical of the genus *Reisseronia*, length 6.2 to 7.6 mm (on average 6.8 mm) and width 2.1 to 2.6 mm (on average 2.3 mm), (n = 31). They are rounded in cross-section, composed of straight and narrow debris of grasses with some dark brown-black particles of soil incorporated (Figs. 8c, 9). Debris of grasses are placed longitudinally and larger pieces, typical of the genus *Reisseronia*, are almost the same length and never exceed the base of the larval case.

Pupa. (Fig. 7). Integument weakly sclerotized, pale brown. Exuvia length 4.9–5.9 mm, width 1.2–1.4 mm (n = 6). The capito-prosternal plate (Fig. 8a) is small, rounded, and mostly stays on the head of the imago. The length of antennae covers slightly exceeds the eyes. Abdominal segments with dorsal and lateral setae are a creamy white colour. Segments A4–8 dorsally with anterior bands of spines: A4 with 9–13 spines, A5 with 24–28 spines, A6–7 with 26–30 spines and A8 with 5–7 gathered spines, forming a small protuberance. Spines are small, short, triangular in shape, many times interrupted. Segment A5 has a second posterior row of 25–44 spines, which are about one-half smaller than the others and facing in the opposite direction (Fig. 7b). Cremaster reduced, simple. Details of abdominal segments A8–10 and cremaster are shown in Fig. 7c.

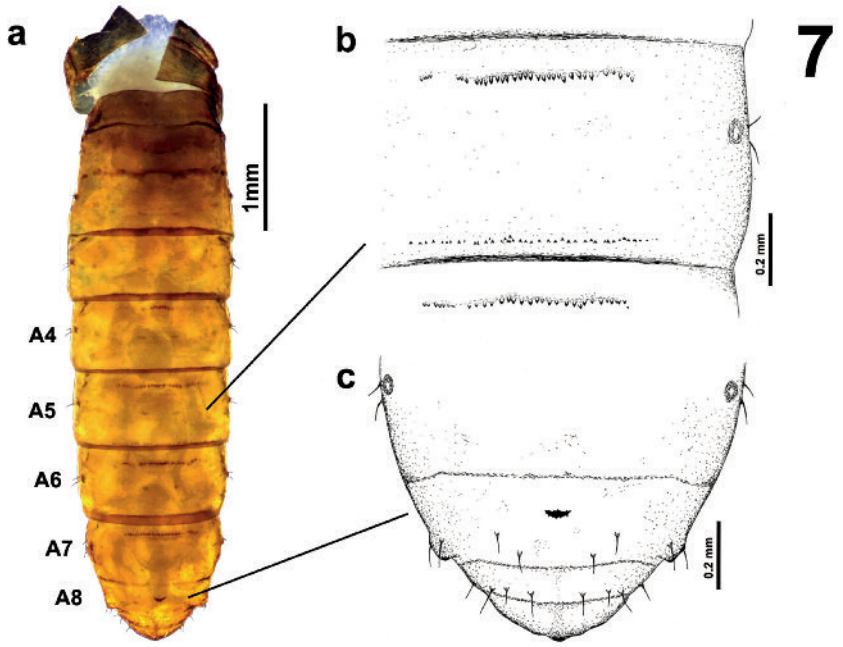


Figure 7. *Reisseronia lesari* sp. nov. **a.** exuvium, dorsal view. **b.** detail of A5 abdominal segiment with a second posterior row of spines. **c.** detail of abdominal segments A8–10 and cremaster.

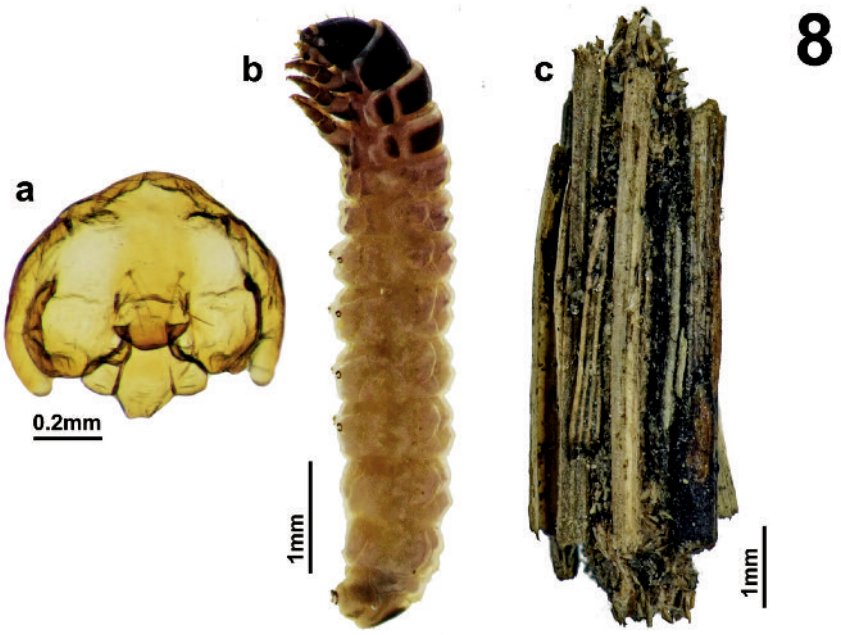


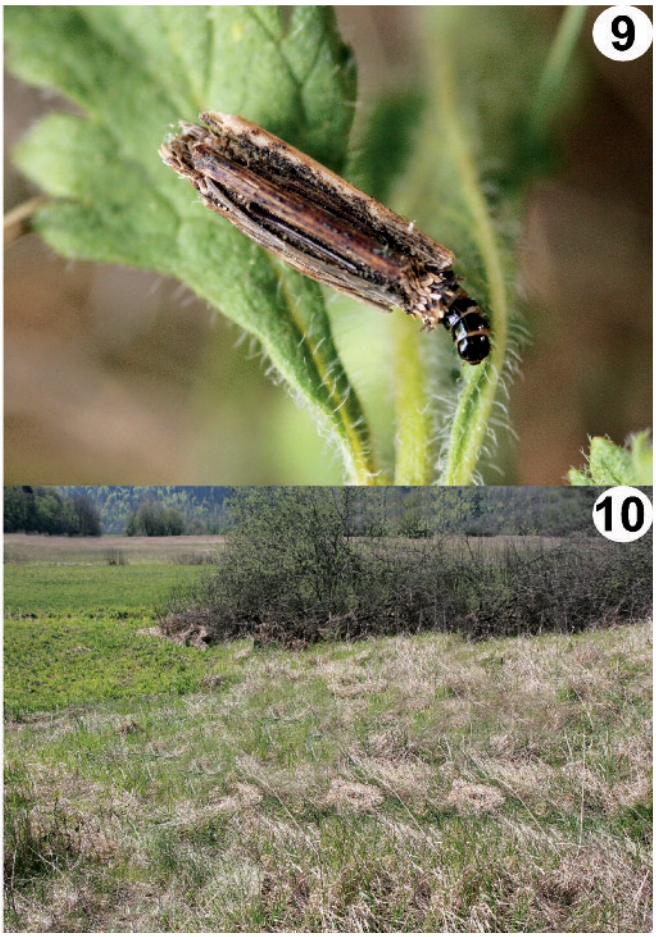
Figure 8. *Reisseronia lesari* sp. nov., female, paratype. **a.** capito-prosternal plate. **b.** mature larva, lateral view. **c.** larval case.

Type material

Holotype. ♀, stored in alcohol-glicerol solution in a small plastic vial, with larval case glued on mounting board 7x14 and pinned. Original labels: "Slovenia, Radensko polje, Mokrine, 325 m, 24.3.2019 (e.l. 27.5.2019), leg. Ž. Predovnik", "HOLOTYPE *Reisseronia lesari* Predovnik, Rekelj & Gomboc" (red label, handwriting).

Paratypes. 2♀♀, with larval cases, Slovenia, Radensko polje, Mokrine, 325, 1.4.–14.5.2017 (e.l. 26.5.2017), leg. Ž. Predovnik, coll. ŽPSL; 21♀♀, with larval cases, same locality, 24.3.–11.5. 2019 (e.l. 18.5.–16.6.2019), leg. Ž. Predovnik, coll. ŽPSL; 6♀♀, with larval cases, same locality, 3.–7.4.2019 (e.l. 25.5.–10.6.2019), leg. J. Rekelj, coll. JRSL; 5♀♀, with larval cases, same locality, 30.4.2020 (e.l. 17.5.–3.6.2020), leg. Ž. Predovnik, coll. ŽPSL; 10♀♀, with larval cases, same locality, 14.3.2020 (e.l. 16.–25.5.2020), leg. J. Rekelj, coll. JRSL; 3♀♀, with larval cases, same locality, 9.–10.6.2019 (e.l. 24.3.–11.5.2019) (1a393, 1a394, 1a396), leg. Ž. Predovnik, coll. USMB.

Paratypes of larvae. 1 larva, with larval case, 6.10.2016, leg. Ž. Predovnik, coll. ŽPSL; 2 larvae, with larval cases, 8.6.2018, leg. Ž. Predovnik, coll. ŽPSL; 4 larvae, with larval cases, 20.4.2018, leg. Ž. Predovnik, coll. ŽPSL; 1 larva, with larval cases, same locality, 1.5.2018, leg. Ž. Predovnik, coll. ŽPSL; 3 larvae, with larval cases, 20.4.2019, leg. Ž. Predovnik, coll. ŽPSL; 3 larvae, with larval cases, 11.5.2019, leg. Ž. Predovnik, coll. ŽPSL; 4 larvae, with larval cases, same locality, 3.–7.4. 2019, leg.



Figures 9-10. *Reisseronia lesari* sp. nov. **9.** Mature larva in larval case, Slovenia, Radensko polje, 2.5.2018 (photo Ž. Predovnik). **10.** Natural habitat, Slovenia, Radensko polje, Mokrine, 22.4.2019 (photo J. Rekelj).

J. Rekelj, coll. JRSL; 1 larva, with larval case, same locality, 14.3.2020, leg. J. Rekelj, coll. JRSL; 2 larvae, with larval cases, same locality, 11.5.2019 (1a360, 1a363), leg. Ž. Predovnik, coll. USMB.

Paratypes of pupae. 4 pupae, with larval cases, same locality, 20.4–13.5.2018 (e.l. 8.6.2018), leg. Ž. Predovnik, coll. ŽPSL; 7 exuviae, same locality, 3.–7.4.2019, leg. J. Rekelj, coll. JRSL; 1 pupa, with larval case, same locality, 14.3.2020, leg. J. Rekelj, coll. JRSL.

Paratypes of larval cases. 6 empty larval cases, same locality, 1.4.2017, leg. Ž. Predovnik, coll. ŽPSL; 15 empty larval cases, same locality, 6.5.2017, leg. Ž. Predovnik, coll. ŽPSL; 4 empty larval cases, same locality, 1.5.2018, leg. Ž. Predovnik, coll. ŽPSL; 38 empty larval cases, same locality, 24.3.2019, leg., J. Rekelj, coll. JRSL; 26 empty larval cases, same locality, 3.–7.4.2019, leg. J. Rekelj, coll. JRSL; 33 empty larval cases, same locality, 30.4.2020, leg. Ž. Predovnik, coll. ŽPSL; 40 empty larval cases, same locality, 12.5.2020, leg. J. Rekelj, coll. JRSL.

Deposition of types

Holotype ♀ and 2♀♀ paratypes of *R. lesari* sp. nov. are preserved in coll. PMSL, 42♀♀ paratypes are deposited in coll. ŽPSL and in coll. JRSL, 3♀♀ paratypes are deposited in coll. USMB. 2 paratypes of larvae are deposited in coll. USMB, all other paratypes of larvae, pupae, exuviae and larval cases are deposited in coll. ŽPSL and in coll. JRSL.

Etymology

The new species is named after our late entomological friend Tone Lesar who dedicated his life to researching the butterfly fauna of Slovenia, focusing on the Štajerska region.

Distribution

Only known from a small area in the central part of Radensko polje in Mokrine, south to southwest and south of the village Zagradec, at an altitude 325m (Fig. 10).

Habitat

Radensko polje Landscape Park is the smallest of the nine most distinct karst fields, but includes all karst features such as karst springs, swallets, estavelles and swallow holes and is one of the larger areas of extensive meadows in central Slovenia (Perko & Orožen Adamič 1998; Lampič & Smrekar 1998; Florjanc & Jernejc-Babič 1999). The largest part of the park is covered by Central European mesotrophic to eutrophic lowland meadows, which are mixed in wet areas with wet mesotrophic and eutrophic meadows. They are intensive to extensive and are regularly or occasionally fertilized and mown several times a year (Poboljšaj *et al*. 2000).

We found larvae of *R. lesari* sp. nov. on several locations in the central part of the park on elevated sunny edges of moist or wet oligotrophic grassland - (*Molinia caerulea*) meadows and related communities. They prefer south and southwestern positions of slide slopes, which are away from the floodplain and protected from standing moisture. Their microlocalities may occasionally be flooded during medium-high floods, for a few days in spring and autumn. However, during the occurrence of maximum flooding every few years, water levels may rise all the way to surrounding villages (almost the entire Radensko polje is under water) and can remain for several days (Meze *et al*. 1981).

Localities are often in the early stages being overgrown with *Calluna vulgaris* L. and hydrophilous ligneous species such as *Alnus glutinosa* (L.), *Frangula alnus* Mill., *Salix sp*., and also: *Cornus sanguinea* L., *Prunus spinosa* L., *Quercus robur* L. and *Rosa sp*. The most populated areas are those with dominant plant taxons: *Brachypodium rupestre* (Host) Roem. & Schult., *Carex tomentosa* L. and *Festuca rupicola* Heuff.

Biology and ecology

Larvae of *R. lesari* sp. nov. live relatively hidden lives in the lower herb layer in scattered and localized colonies. The best time to find and observe active larvae is

from mid March to late May. During this time, the larval cases are large enough to be discerned in the vegetation. They are most active on sunny days in the early afternoon but, with great patience, we also found them in October and even in mid-November, when the daily temperature was above 8 degrees celsius.

Larvae were relatively easy to rear under laboratory conditions. They prefer to feed on flowers and foliage of *Plantago lanceolata* L., *Ranunculus acris* L. and *Taraxacum officinale* Web. They generally feed on dry or semi-dry foliage rather than fresh. A small number of larval cases were always found empty, or the larvae died later during breeding, because of mildew or parasitism. However, we noticed that dry winters without snow (such as winters 2018/19 and 2019/20), and consequently less moisture on Radensko polje, noticeably reduced the mildew mortality of larvae and increased parasitism.

We could not determine where mature larvae attach their larval cases in nature, but probably hidden in the lower herbal layer. In captivity, we found them fixed on the foliage or stems of food plants, on the ground and on the edges and walls of the breeding containers. They were fixed individually or, more often, in small groups. Some were hidden in the moss so that only the top of the larval case was visible from above and, lastly, some of them simply remained unfixed at the bottom. In outdoor temperature conditions, the first mature larvae began to fix larval cases in early May, with a peak in early June. A small number of larvae remain active until the second half of June or to the middle of July, but no adults emerged from these later. The pupal stage lasts 15 to 23 days.

Only females emerged, from mid-May to late June, with a peak in early June, so generally slightly later than with *R. gertrudae*. It was difficult to predict when the females would emerge and start laying eggs, because this process remains hidden inside the larval case. However, with some detailed observation, it was possible occasionally to see the activity of females before laying eggs, which was reflected by the following: the female pulled out her head from the back of the larval case for a short time and then pulled back in again. This had already been observed in *R. gertrudae* by Sieder (1962). Females do not feed, and they have a very short life. In room conditions, they mostly became active in their larval cases around midday and in the early afternoon. When they lay their 22 to 28 fairly large yellowish eggs into pupal exuvia, they leave them and quickly die. Larvae hatch from the eggs in 17 to 20 days, mostly from the second half of June until the beginning of July, eat their eggshell and immediately start to build their own larval cases, using material from their mother's case. They feed until late fall, then hibernate during the third stage of their development. In spring, they continue feeding until they mature and pupate.

Other species of Psychidae

In a natural habitat, *R. lesari* sp. nov. cohabits with the following species of bagworms: *Psyche casta* (Pallas, 1767), *Psyche crassiorella* (Bruand, 1851), *Epichnopteryx* cf. *plumella kovacsi* Sieder, 1955, *Bijugis* sp., *Rebelia* cf. *plumella* (Ochsenheimer, 1810) and *Canephora hirsuta* (Poda, 1761).

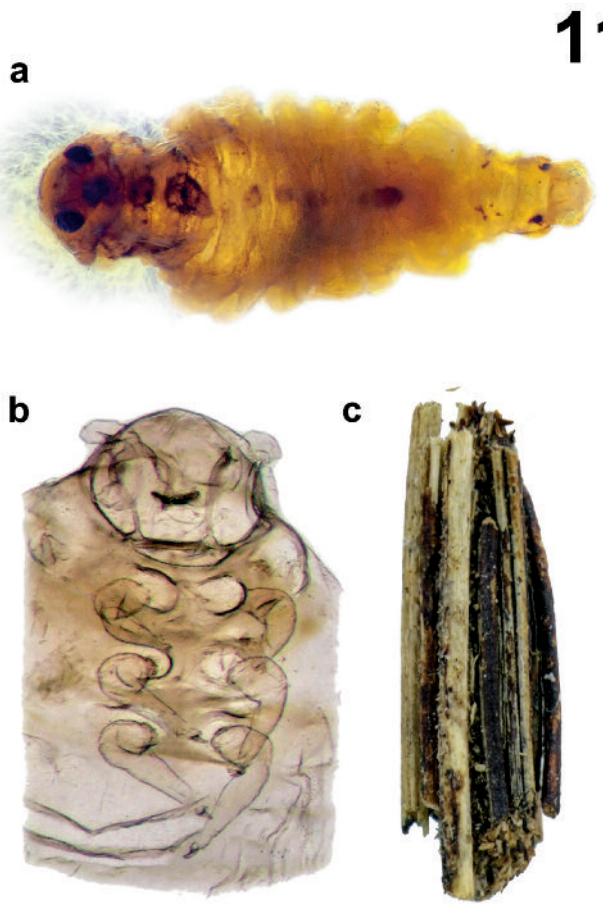


Figure 11. *Reisseronia gertrudae*, Slovenia, Vinica, Podklanec. **a.** female, ventral view. **b.** female, head and thorax details, ventral view. **c.** larval case.

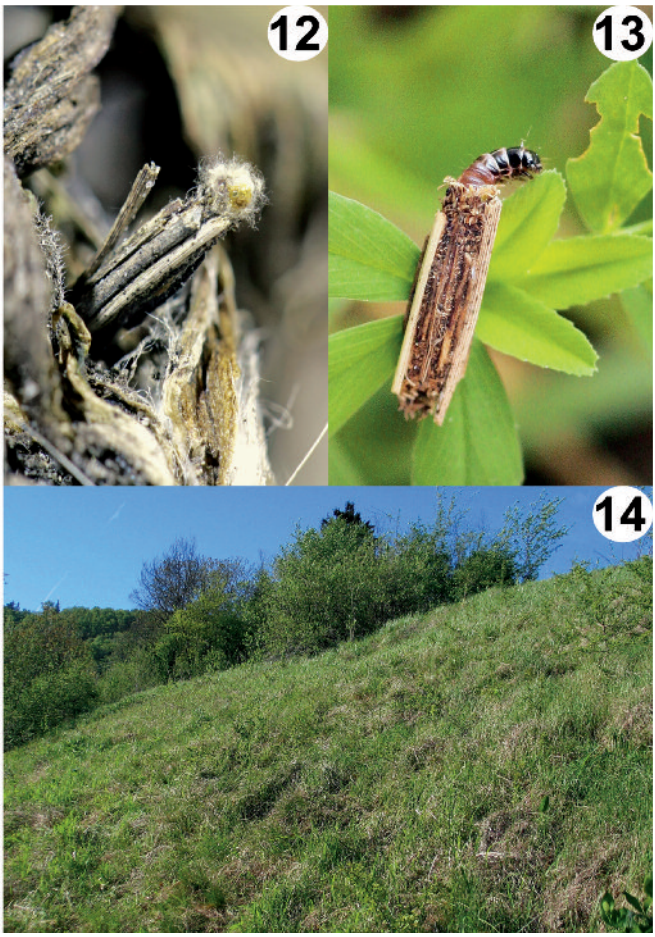
***Reisseronia gertrudae* Sieder, 1962**

Distribution

So far, the parthenogenetic species *R. gertrudae* has only been found in three localities in southern Styria in Austria. It is already extinct at the type locality and, according to recent data, is on the verge of extinction (Sieder 1962, Gepp & Tratnigg 1990; Arnscheid & Weidlich 2017). This interesting species was found for the first time in Slovenia by the first author in 2015. It has to date been confirmed in three localities: Sotinski breg near the village of Sotina in Goričko, and Vukovci and Podklanec, near Vinica in Bela krajina, close to the border with Croatia (Fig. 19).

Habitat

According to Gepp & Tratnigg (1990) in Austria *R. gertrudae* prefers xerothermal positions at an altitude of 300–670 m above sea level.



Figures 12-14. *Reisseronia gertrudae*. **12.** Female in larval case, Slovenia, Goričko, Sotina, Sotinski breg, 20.4.2020 (photo J. Rekelj). **13.** Mature larva in larval case, Slovenia, Vinica, Podklanec, 29.4. 2018 (photo Ž. Predovnik). **14.** Natural habitat, Slovenia, Vinica, Podklanec, 16.4.2017 (photo Ž. Predovnik).

In Slovenia, the habitat is semi-natural dry grasslands and scrubland facies (*Festuco-Brometalia*) on calcareous substrate. The species lives here on extensive hay meadows in old orchards (most fruit trees have already been cut down), bounded by shrub hedges and nearby forest. The most populated areas were those with an abundance of herbaceous plants such as *Thymus* sp., *Fragaria vesca* L. and mosses.

The habitat in the vicinity of Vinica in Slovenia is also semi-natural dry grasslands and scrubland facies (*Festuco-Brometalia*) on calcareous substrates, which even have a sub-Mediterranean character in some small areas (Ambrožič *et al*. 2013). Both localities are situated on south and southwest facing grassy slopes on extensively mown meadows with a xerothermal character, always above a stream or river, which gives those micro-localities slightly mesophilic microclimatic conditions.

In the village of Podklanec near Vinica, a small population lives on a dry, south-exposed slope above a small stream at an altitude of 177 m (Fig. 14). The meadow is rich in herbaceous vegetation, such as *Achillea* sp., *Euphorbia ciparissias* L., *Fragaria*

vesca L., *Plantago lanceolata* L., *Salvia pratensis* L., *Thymus* sp., and also various grasses, mosses and lichens. Abandonment of mowing and grazing already shows the early stages of overgrowing with ligneous shrubs, mainly *Prunus spinosa* L.

In the village of Vukovci near Vinica, another small population lives on an extensive hay meadow at an altitude of 229 m, not far from the river Kolpa. This meadow is partly overgrown with ligneous shrubs and bounded by vineyard and nearby forest. The composition of the herb layer is very similar to the previous one.

In Sotinski breg, Goričko, we found larvae on a south-west facing and xerothermic grassy slope with *Euphorbia cyparissias* L., *Fragaria vesca* L. *Hypericum perforatum* L, *Rumex* sp. *Salvia pratensis* L., *Thymus* sp. and with various mosses and lichens.

Biology and ecology

Similar to citations of Sieder (1962) and Gepp & Trattnig (1990) larvae of *R. gertrudae* live fairly hidden lives in the herb layer. In Slovenia, we found them very locally and in relatively small numbers. We achieved the best results for observation of active larvae in the second half of March to the end of April, during sunny weather between 14–17 h. Some active, half-grown larvae were also found on sunny days in October.

Larvae apparently feed on various plants. In the natural habitat, we observed feeding on leaves of *Fragaria vesca* L., but in captivity they quickly accepted *Taraxacum officinale* Web. (fresh flowers and leaves) and *Plantago lanceolata* L., when, despite there being fresh leaves, they fed more often on dry or semi-dry foliage. In captivity, the first larvae fixed their larval cases on April 23, continuing until early June. Only females hatched from middle May to late June, with a peak from the end of May to early June.

Many larvae were infested with an unindentified species of small parasitoid wasp (Hymenoptera). The level of parasitism was noticeably higher than with populations of *R. lesari* sp. nov. from Radensko polje.

Breeding of the F1 generation

In the first stages of their development, young larvae feed on fresh leaves of *P. lanceolata*, *T. officinale* and *Trifolium pratense* L.: later mostly on *P. lanceolata*. In the fall, breeding containers with third instar larvae were placed outside, to provide natural conditions for their hibernation. During the winter they became partially active on warmer days, but it was only the spring thawing that really reactivated their feeding. They resumed feeding from the end of March, until they completed their development and pupated in May. Completion of development (the emergence of females and the laying of eggs), was completed approximately 15 days earlier than in nature. Specimens cultivated ex. ovo were noticeably larger than in nature.

Remarks

Specimens from southern localities Podklanec and Vukovci, deviate slightly morphologically from the classical form from the north of the country. The difference is

Figures 15-17. *Reisseronia tarnierella*. **15.** Male resting on grass, Slovenia, Socerb, 5.4.2020, 12:20 pm, (photo J. Rekelj). **16.** Female in larval case transmitting pheromones, Slovenia, Socerb, 7.4.2020 (studio photo J. Rekelj). **17.** Mature larva in larval case, Slovenia, Lokavec, 5.4.2020 (photo Ž. Predovnik).

noticeable in a reduction of the legs, meaning that specimens have some legs with separated femur and tibia. This is usually only noticeable in one or two legs in a single specimen and can be seen on any leg and not necessarily in pairs. No other morphological differences were observed.

Material

Slovenia, Bela krajina, Vinica, Podklanec, 177 m, all leg. Ž. Predovnik, coll. ŽPSL: 4 larvae, with larval cases, 24.10.2015; 3 larvae, with larval cases, 2 empty larval cases, 2.4.2016; 2 larvae, with larval cases, 8 empty larval cases, 12.4.2016; 4 larvae, with larval cases, 8 empty larval cases, 16.4.2016; 7 larvae, with larval cases, 7 empty larval cases, 30.4.2016; 4 larvae, with larval cases, 2 empty larval cases, 18.5.2016; 9 ♀♀, with larval cases, 7 pupae with eggs, with larval cases, 13.6.2016 (e.o. 7.–27.5.2017); 5 larvae, with larval cases, 2 empty larval cases, 20.4.2018; 2 mature larvae, with larval cases, 1 pupa, with larval case, 22.4.2018 (e.l. 8.6.2018); 2

larvae, with larval cases, 7 empty larval cases, 2 pupae, with larval cases, 28.4.2018 (e.l. 11.6.2018); 1♀, with larval case, 16.3.2019 (e.l. 10.5.2019).

Slovenia, Bela krajina, Vinica, Vukovci, 229 m, all leg. Ž. Predovnik, coll. ŽPSL: 2 ♀♀, with larval cases, 31.3.2019 (e.l. 23.5.2019); 2 ♀♀, with larval cases, 6.4.2019 (e.l. 25.5 and 29.5.2019); 4 ♀♀, with larval cases, 20.4.2019 (e.l. 23.5–3.6.2019).

Slovenia, Goričko, Sotina, Sotinski breg, 404 m: 1 larva, with larval case, 1.2.2020, leg. Ž. Predovnik, coll. ŽPSL; 1 larva, 2 empty cases, 8.2.2020, leg. Ž. Predovnik, coll. ŽPSL; 15 larvae, 28 empty larval cases, 28.3.2020, leg. Ž. Predovnik, coll. ŽPSL; 4♀♀, with larval cases, 28.3.2020 (e.l. 20.–28.4.2020), leg. J. Rekelj, coll. JRSL; 4 larvae, with larval cases, 28.3.2020, leg. J. Rekelj, coll. JRSL; 7 larvae, 9 empty larval cases, 2.5.2020, leg. Ž. Predovnik, coll. ŽPSL; 3 larval cases with exuviae, 29 empty larval cases, 2.5.2020, leg. J. Rekelj, coll. JRSL.

Other species of Psychidae

In the Podklanec locality, *R. gertrudae* cohabits with the following species of bagworms: *Rebelia* sp., *Acanthopsyche atra* (Linnaeus, 1767) and in the Vukovci locality with: *Epichnopteryx* cf. *plumella kovacsi*, Sieder, 1955, *Bijugis bombycella* (Denis & Schiffermüller, 1775), *Rebelia* cf. *plumella* (Ochsenheimer, 1810) and *Rebelia* sp.

In locality Sotinski breg *R. gertrudae* cohabits with *Psyche casta* (Pallas, 1767), *Psyche crassiorella* (Bruand, 1851), *Bijugis bombycella* (Denis & Schiffermüller, 1775) and *Rebelia plumella* (Ochsenheimer, 1810).

***Reisseronia tarnierella* (Bruand, 1851)**

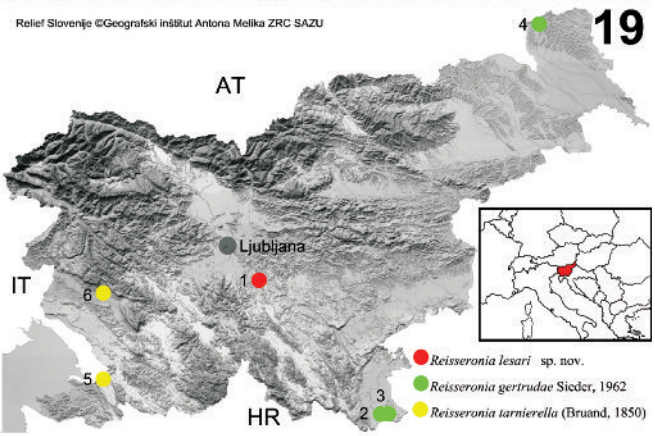
Distribution

R. tarnierella is a generally widespread species in Europe but highly local. It has been found in small, scattered colonies in central France, the Netherlands, Belgium, western Germany, Slovakia and northern Italy (Weidlich 2011; Arnscheid & Weidlich 2017). This species was found in Slovenia for the first time in a sub-Mediterranean region on the Karst edge in the vicinity of the village of Socerb and in Lokavec near Ajdovščina (Fig. 19).

Habitat

The habitat is semi-natural, eastern sub-Mediterranean (submediterranean-illyrian) dry and semi-dry grasslands: extensively used medows and pastures. The first male specimen was collected by net, during routine investigation of dry rocky karst meadow with *Euphorbia nicaeensis* All., *Euphorbia fragifera* Jan., *Eryngium amethystinum* L., *Festuca* sp., *Satureja montana* L, *Thymus* sp., etc.

After a few years, this meadow was turned into pasture on which, despite researching, no specimen at any development stage has been confirmed. This led us to find a similar, more preserved biotope in the surrounding area. The new locality shows a slightly different picture. The species lives here on a dry, southerly



Figures 18-19. Natural habitat, Slovenia, Socerb, 21.3.2020 (photo J. Rekelj). **19.** Distribution map of *Reisseronia* species in Slovenia: **1**–Radensko polje, Mokrine; **2**–Vinica, Podklanec; **3**–Vinica, Vukovci; **4**–Sotinski breg; **5**–Socerb; **6**–Lokavec.

exposed, extensively mown meadow with deeper soil. Among the plant species we found there, *Anthyllis vulneraria* L., *Dianthus sanguineus* Vis., *Helianthemum ovatum* (Viv.), *Onobrychis* sp., *Plantago holosteum* Scop., *Salvia pratensis* L., *Sanguisorba minor* Scop., *Scorzonera villosa* Scop. and various grasses dominate (Fig. 18). The habitat is limited by a typical karst hedge, composed mainly of trees and shrubs, such us *Crataegus monogyna* Jacq., *Cornus sanguinea* L., *Cotinus coggygria* Scop., *Fraxinus ornus* L., *Ligustrum vulgare* L., *Ostrya carpinifolia* Scop., *Prunus mahaleb* L. *Prunus spinosa* L. and *Quercus pubescens* Willd. In the Lokavec locality near Ajdovščina, the habitat is a dry, south-exposed slope with exstensively mown meadow with a rich herbaceous layer. The composition of the plant species is similar to that in Socerb: *Fragaria* sp., *Galium* sp., *Helianthemum ovatum* (Viv.), *Salvia pratensis* L., *Sanguisorba minor* Scop., *Thymus* sp. etc. There are also *Euphorbia cyparissias* L., *Hypericum perforatum L.* and various mosses and grasses.

Biology and ecology

R. tarnierella is one of the smallest species in the genus *Reisseronia*, with a wingspan of males between 6–7 mm (Arnscheid & Weidlich 2017). It is very difficult to observe the species in nature, not only because of the hidden life of larvae and, consequently, difficulties in finding the right habitat, but also because of the extremely short life span of specimens (Weidlich 2011). Near Gemone in Italy, adults emerge in the first half of June, and males are active between 12:30 –14:30 h (Sieder 1956, 1972).

In Slovenia, we collected larvae at the end of March and in April. In captivity, larvae accepted mainly *Taraxacum officinale* Web., as well as *Plantago lanceolata* L. and *Trifolium pratense* L. According to modest data from the field and the results of breeding, adults of *R. tarnierella* in the Socerb and Lokavec locality appear at the end of April to the begining of May. Three males were collected in Socerb with the method of sweeping over the vegetation with a net in sunny and dry weather between 13:00–14:00 h. Their flight was surprisingly fast and barely noticeable between the vegetation. Females were only observed in laboratory conditions (e.p.), and transmitted pheromones for several days up to 16:00 h.

Remarks

Larval cases in the Socerb locality were composed from closely attached fine particles of dry grass, placed longitudinally. The length of larger females was 8.0 to 9.0 mm and width 2.0 to 2.3 mm. Larval cases of males were smaller, length 6.0 to 7.0 mm and width 1.9 to 2.0 mm.

Material

Slovenia, Primorska, Socerb, 400 m: 1 ♂, 27.5.2001, leg. S. Gomboc, coll. SGSL.

Slovenia, Primorska, Socerb, 370 m: 2 empty larval cases, 10.4.2016, leg. Ž. Predovnik, coll. ŽPSL; 3 larvae, with larval cases, 7 empty larval cases, 22.4. 2016, leg. Ž. Predovnik, coll. ŽPSL; 2 ♂♂, 13.38 h and 13.46 h, 22.5.2016, leg. Ž. Predovnik, coll. ŽPSL; 1 ♀, with larval case, 20.5.2016 (e.l. 4.6.2016), leg. J. Rekelj, coll. JRSL; 4 ♂♂, 3 ♀♀, with larval cases, 1 empty larval case, 8.3.2020 (e.l. 1.–5.4.2020), leg. J. Rekelj, coll. JRSL.

Slovenia, Primorska, Lokavec near Ajdovščina, Slokarji, 301 m, all leg. Ž. Predovnik, coll. ŽPSL: 2 ♂♂, with larval cases, 21.3.2020 (e.l. 20.4. and 25.4.2020); 7 ♀♀, with larval cases, 21.3. and 23.3.2020 (e.l. 15.–27.4.2020); 20 empty larval cases, 21.3. and 23.3.2020.

Other species of Psychidae

In Socerb locality, *R. tarnierella* cohabits with the following species of bagworms: *Epichnopterix* cf., *Rebelia* sp., *Megalophanes viciella* (Denis & Schiffermüller, 1775), *Acanthopsyche zelleri* (Mann, 1855), *Pachythelia villosella* (Ochsenheimer, 1810), *Phalacropterix praecellens* (Staudinger, 1870).

In the Lokavec locality, the species cohabits with *Taleporia politella* (Ochsenheimer, 1816), *Rebelia* sp., *Acanthopsyche zelleri* (Mann, 1855), *Pachythelia villosella* (Ochsenheimer, 1810) and *Phalacropterix praecellens* (Staudinger, 1870).

Discussion

Parthenogenesis in the genus *Reisseronia* is well known, although no more detailed genetic studies have been conducted in this field to reveal details of the type of parthenogenesis and relatedness of the populations found. The evolution of parthenogenetic populations was already investigated by Soumalainen (1961). He published a morphometric study of polyploid and parthenogenetic weevil populations, whereby he assumed that the characters that he had chosen to study were little affected by environmental variability. In this first experimental demonstration he stressed that "*evolution has not come to a complete standstill in polyploid parthenogenetic populations. Polyploid parthenogenetic weevils and other similar forms still possess some mechanism which allows genotypic differentiation of populations and thus secures continued evolution*" (Soumalainen 1961:330). This study suggested that parthenogenetic populations of the genus *Reisseronia* have a common ancestor and that they are capable of evolution, despite the asexual reproduction. *R. lesari* sp. nov. is well distinguished from the other three parthenogenetic species by serial morphological features. In doing so, the primary structures (setae on the antennae and legs) suggest that this population might be (the oldest and perhaps) the origin of the parthenogenetic mode of reproduction (A. Larysz 2020, pers. comm., 25 March). The new species is also interesting because of the habitat choice, which differs slightly from classical "*Reisseronia* habitats". It inhabits floodplain areas, where water can occasionally remain for several days during major floods in spring and autumn (Meze *et al*., 1981). Further studies are needed to clarify how *R. lesari* sp. nov. manage to survive this period. Likewise, the distribution of the species is not yet definitive and is presently limited only to the type locality. In the coming years, we will be carrying out additional fauna studies in several similar habitats in central Slovenia. In the last year, we have already found another new locality with a parthenogenetic population of *Reisseronia* near the capital Ljubljana, and another on wet meadows of Prekmurje in the vicinity of Lendava. Collection of specimens and comparative studies are already in progress.

R. gertrudae is seriously endangered in Austria (Arnscheid & Weidlich 2017), so the Slovenian populations are a very important contribution to the survival of this species in general. The recently discovered locality in Sotina in northeast Slovenia is not a surprise, being actually only 8 kilometers away from a familiar locality at St. Anna am Aigen in Austria. A real surprise was the discovery of populations in the vicinity of Vinica in the far southeast of the country. This currently known, unusual pattern of distribution in Slovenia, indicates the possibility of the existence of intermediate populations and also populations on the Croatian side.

These findings lead us to the conclusion that Austrian localities belong to the northwestern areal, which is the extreme for distribution of this species.

According to the current investigation, *R. tarnierella* is very choosy about habitat and present very locally on the floristically richest dry meadows in the sub-Mediterranean part of Slovenia. The new findings are due to a good knowledge of biotopes and hard work. For example, in the vicinity of the village of Lokavec near Ajdovščina, only two of the six selected meadows gave a few results and only one gave a few more. As with the previous two parthenogenetic species, there are still plenty of suitable habitats to continue investigations, so we can expect a larger distribution in the future.

Acknowledgements

We would like to thank Adam Larysz (Poland), for the opportunity to study the comparative material of *R. imielinella* and *R. annae* under his care, and for his help with valuable information about the new species, as well as for his comments on the manuscript.

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