

First report of early stages and ecological data of *Lycaena sichuanica* in Sichuan, China (Lepidoptera: Lycaenidae)

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KEY WORDS

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In 2010 two live females of *Lycaena sichuanica* Bozano & Weidenhoffer were collected in a small meadow at 2600 m altitude in Jiuzhaigou Nature Reserve in Northern Sichuan, China. They were kept in a rearing box with *Rumex* leaves to lay eggs. In total 20 eggs were deposited. Caterpillars accepted *Persicaria bistorta* and *Rumex* sp. as food plant. In the end three reached adulthood. Imagines hatched on 29 September, 16 and 24 October. Possibly they belonged to the second or third generation.

Introduction

In June 2009 a small population of *Lycaena sichuanica* Bozano & Weidenhoffer, was found in Jiuzhaigou Nature Reserve in Northern Sichuan. Based on specimens from this population diagnostic characters of the hitherto unknown female were presented including a description of the females genitalia (Vis & Coene 2010). On July 8, 2010, we returned to the location in Jiuzhaigou in order to study the habitat and to collect some females for egg deposition. The rearing results as well as ecological data are presented here.

Material

Two females, a fresh and a worn one, were put in a small rearing box together with some stems of *Rumex* sp. (dock), taken from the moist parts of the habitat of the butterfly on July 8, 2010. In total only 20 eggs were deposited, either on the *Rumex* leaves (figure 1) or on the plastic box itself (10×10×12 cm).

Early development

The eggs are light grey, hemispheric with relatively large dimples. The shape of the eggs is similar to that of *Lycaena phlaeas* (Linnaeus) eggs. After seven days the first larvae hatched (figure 2). The larvae are greenish, sometimes with a reddish dorsal line or a reddish line above the legs, and covered with short hairs. They were mostly found on the undersides of the leaves. Young larvae are difficult to spot, even in a rearing box. Later the larvae caused conspicuous feeding patterns in the leaves (figure 3). During our stay in Sichuan several larvae developed well initially, but died later on. After returning in Holland on July 24 only ten caterpillars were alive. Initially they accepted both *Persicaria bistorta* (common bistort) and various *Rumex* species, like *R. acetosa*, but later *P. bistorta* was no longer accepted. An apparent infection caused the death of five more caterpillars: they changed in colour and shrivelled up. The remaining

five were kept in a plastic box of 12×8×4 cm, covered with a piece of cloth. They developed very slowly and on August 26 they stopped feeding. Normally, larvae of the summer generation of the closely related *L. phlaeas* need 14-35 days to reach the pupal stage (Bink 1992). In Scandinavia *L. phlaeas* has three generations in warm summers, appearing in June until September (Henriksen & Kreutzer 1982). In the lower parts of Switzerland *L. phlaeas* is flying sometimes up to December, representing four generations (Holliger 1987).

In the polar regions of Asia there is only one brood in June until mid-August, in the northern taiga and forest steppe there are two to three broods (Gorbunov & Kosterin 2003). When they stopped eating the larvae lived already 46 days. They were about 8 mm, their colour changed from green to brown and they did not move. Larvae of *L. phlaeas* hibernate, so perhaps the larvae were in diapause.

After some trials we could solve the problem: the humidity within the box seemed to be too low. The piece of cloth that covered the box was replaced by a plastic lid, and a piece of paper tissue was added, that was injected with some drops of water daily. The larvae responded at once and started eating again. One larva did not survive the dry period so only four larvae were left.

After the fourth instar (figure 4) the first pupa was found on September 29 (figure 5). On October 4 and 6 another two pupae were found in the box, the fourth larva vanished without a trace. The pupae were greenish-brown with faintly striped wing case, similar to the pupa of *L. phlaeas*. The first imago, a male, hatched after 19 days on October 16 (figure 6), the two others, a male and a female, emerged on October 24, after 20 and 18 days, respectively. The specimens of this generation are much darker than those of the June/July generation. The black border along the margin and at the apex of the forewing is much wider and as a consequence the reddish area is more limited. The basal, discal and postdiscal area in the forewings are powdered with black scales (figure 7). Taking in mind the altitude of the



1. Eggs of *Lycaena sichuanica*, deposited on *Rumex*, 8.vii.2010, Sichuan, Jiuzhaigou. Photo: Ruud Vis

1. Eieren van *Lycaena sichuanica*, afgezet op *Rumex* op 8.vii.2010, Sichuan, Jiuzhaigou



2. Larvae of *Lycaena sichuanica*, Sichuan, Jiuzhaigou, 19.vii.2010. Photo: Ruud Vis

2. Uitgekomen rupsen van *Lycaena sichuanica*, 19.vii.2010



3. Glutton pattern larvae of *Lycaena sichuanica*, Sichuan, Jiuzhaigou. Photo: Ruud Vis

3. Vraatpatroon rupsen van *Lycaena sichuanica*, Sichuan, Jiuzhaigou.



4. Larva, last instar, of *Lycaena sichuanica*, Sichuan, Jiuzhaigou, 24.ix.2010. Photo: Ruud Vis

4. Rups, in laatste vervelling, van *Lycaena sichuanica*, Sichuan, Jiuzhaigou, 24.ix.2010



5. Pupa of *Lycaena sichuanica*, Sichuan, Jiuzhaigou, 29.ix.2010. Photo: Ruud Vis

5. Pop van *Lycaena sichuanica*, Sichuan, Jiuzhaigou, 29.ix.2010.



6. *Lycaena sichuanica*, ♂, Sichuan, Jiuzhaigou, hatched in Holland, 16.x.2010. Photo: Ruud Vis

6. *Lycaena sichuanica*, ♂, Sichuan, Jiuzhaigou, uitgekomen in Holland, 16.x.2010



7. Upper specimen *Lycaena sichuanica*, ♂, Sichuan, Jiuzhaigou, 8.vii.2010, recto. Lower specimen *Lycaena sichuanica*, ♂, Sichuan, Jiuzhaigou, hatched in Holland, 24.x.2010, recto. Photo: Ruud Vis
7. Bovenste exemplaar *Lycaena sichuanica*, ♂, Sichuan, Jiuzhaigou, 8.vii.2010, bovenzijde. Onderste exemplaar *Lycaena sichuanica*, ♂, Sichuan, Jiuzhaigou, uitgekomen in Holland, 24.x.2010, bovenzijde

habitat on 2600 m and the rather moderate climatological conditions of the Jiuzhaigou region, several broods of *L. sichuanica* should be possible here, supposing the first generation is on the wing in May.

Habitat

In Jiuzhaigou Nature Reserve *L. sichuanica* inhabits a 15-20° sloping damp meadow of ca. 300×400 m, surrounded by broad-leaved and pine forests (figure 8). In the meadow percolating water runs into small streams which flow into a brook bordering the meadow at its lowest parts (figure 9). The water drains into surrounding wetlands and lakes with crystal-clear water. *Rumex* plants were observed in numbers dispersed over the meadow. We found large *Rumex* plants near the brook, but also smaller ones higher up on the meadow. *Berberis* bushes as well as *Geranium* and *Ranunculus* were found scattered throughout the meadow. The diversity of the vegetation was striking.

Field observations

On July 8, 2010, the population of *L. sichuanica* in the investigated area could be estimated at about 40 specimens. Weather conditions were variable, with infrequent sunshine. The butterflies



8. Habitat of *Lycaena sichuanica*, Sichuan, Jiuzhaigou, 2600 m, 8.vii.2010. Photo: Ruud Vis

8. Habitat van *Lycaena sichuanica*, Sichuan, Jiuzhaigou, 2600 m, 8.vii.2010.



9. Lowest side in the habitat of *Lycaena sichuanica*, Sichuan, Jiuzhaigou, 2600 m, 8.vii.2010. Photo: Ruud Vis

9. Laagste kant in de habitat van *Lycaena sichuanica*, Sichuan, Jiuzhaigou, 2600 m, 8.vii.2010.

were active during sunny periods. They frequently visited flowers of various plants. On June 17, 2009, during our first visit, we found nearly all imagines to be in fresh condition, but early July 2010 many specimens showed wing damages. The accompanying butterfly species at this time of the year were: *Ochlodes ochracea* (Bremer), *Aporia delavayi minshani* Bang-Haas, *Pieris rapae yunnana* Mell, *Pieris erutae* Poujade, *Pieris napi* (Linnaeus), *Neptis rivularis* (Scopoli), *Neope agrestis* (Oberthür), *Lethe yunnana* d'Abrera and *Polyommatus amorata* Alpheraky. See Vis & Coene (2010) for a list of accompanying species in June 2009; only *P. erutae* and *L. yunnana* were also observed in 2009.

Discussion

So far we found *L. sichuanica* in one location only. During our trips in the reserve we saw other open areas but we could not really explore them (it is not allowed to enter the fields). The habitat is possibly created by human activities as we found remains of a small building in the centre of the meadow. Although the meadow is situated within the nature reserve and paths traverse the whole reserve, the butterfly's habitat is not yet endangered by human activity: it is outside the region where the thousands of tourists come to visit the waterfalls, coloured

lakes and Tibetan villages. However, abundance and population density of *L. sichuanica* are not very high, possibly as a consequence of the small size of the meadow. This alone makes the population vulnerable.

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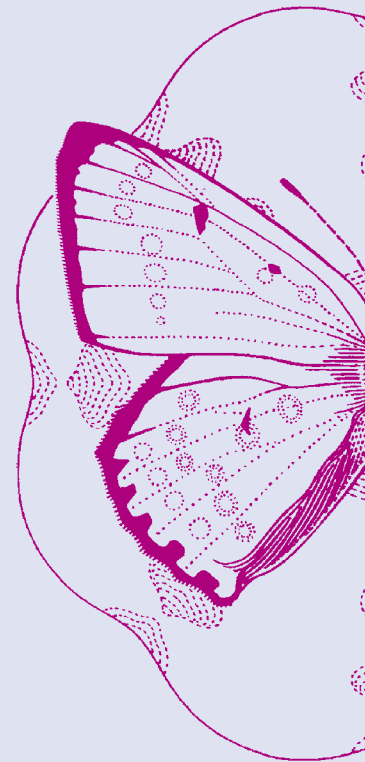
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Samenvatting

Eerste melding van de ontwikkelingsstadia en ecologische gegevens van *Lycaena sichuanica* in Sichuan, China (Lepidoptera: Lycaenidae)

In juni 2009 werd een kleine populatie van *Lycaena sichuanica* Bozano & Weidenhoffer gevonden in Jiuzhaigou Nature Reserve in Noord Sichuan. Op 8 juli 2010 werd de locatie in Jiuzhaigou opnieuw bezocht, teneinde de habitat verder te onderzoeken en enkele vrouwtjes te verzamelen voor kweekdoeleinden. Door twee vrouwtjes werden in totaal 20 eieren afgezet. Na zeven dagen kwamen de eerste eieren uit. Gedurende ons verblijf in Sichuan ontwikkelden enkele rupsen zich eerst voorspoedig maar na een paar dagen trad sterfte op. Bij terugkeer in Nederland waren nog tien rupsen in leven. Ze accepteerden zowel adderwortel (*Persicaria bistorta*) als diverse zuringsoorten (*Rumex* spp.). Later werd adderwortel geweigerd. Ten gevolge van een infectieziekte gingen nogmaals vijf rupsen dood. De overgebleven vijf rupsen werden gehouden in een plastic doos, afgedekt met fijnmazig doek. De rupsen ontwikkelden zich bijzonder traag en op 26 augustus stopten zij met eten. Het bleek dat de luchtvochtigheid in de doos te laag was. Na extra bevochtiging begonnen de rupsen onmiddellijk weer te eten. Eén rups heeft de droge periode niet overleefd. De eerste pop werd op 29 september gevonden en op 4 en 6 oktober werden nog twee poppen in de doos ontdekt. De eerste vlinder, een mannetje, kwam na 19 dagen uit op 16 oktober en op 24 oktober verschenen de twee andere vlinders, een mannetje en een vrouwtje, na respectievelijk 20 en 18 dagen. Rekening houdend met de hoogte van 2600 m van de habitat en de gematigde klimatologische omstandigheden in de Jiuzhaigou regio, zijn meerdere generaties van *L. sichuanica* mogelijk. De eerste generatie zal daar al in mei kunnen vliegen. De uitgekomen vlinders behoren mogelijk tot de 3^e generatie. *Lycaena sichuanica* is door ons tot nu toe op slechts één locatie gevonden, waar de biotoop niet wordt bedreigd. De populatie is klein en bestaat uit ongeveer 40 exemplaren. De habitat is een kleinschalige weide en is waarschijnlijk ontstaan door menselijke activiteiten.



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