

The larval host-plant of *Satyrium ledereri* (Boisduval, 1848) on the Greek island of Sámos (Lepidoptera : Lycaenidae)

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Abstract. The larval host-plant of *Satyrium ledereri christianae* Olivier, 1989, from the Greek island of Sámos, has been determined as *Atraphaxis billardieri* var. *billardieri* (Jaub & Spach, 1844) (Polygonaceae). Superficial descriptions of the larva and pupa are provided. The species hibernates as a larva, presumed to be of the 2nd instar. Whilst evidence relating to the circumstances of discovery of larvae argues for hibernation occurring in bark crevices on the stem of its host-plant, these same observations, in company with other considerations, serve to promote the notion that better hibernating strategies may not only be available but actually exploited. The taxonomic implications of pre-imaginal life-history and host-plant phytochemistry are discussed.

Samenvatting. De voedselplant van *Satyrium ledereri* (Boisduval, 1848) op het Griekse eiland Sámos (Lepidoptera : Lycaenidae) Op het Griekse eiland Sámos werd *Atraphaxis billardieri* var. *billardieri* (Jaub & Spach, 1844) (Polygonaceae) vastgesteld als de voedselplant van *Satyrium ledereri christianae* Olivier, 1989. De rups en de pop worden beschreven. De soort overwintert als rups, waarschijnlijk in het tweede stadium. Gegevens over de omstandigheden van de ontdekking van de rupsen pleiten voor overwintering in schorsspleten van de voedselplant, hoewel de mogelijkheid open blijft dat betere overwinteringsstrategieën worden gebruikt. De taxonomische implicaties van de biologie van de jeugdstadia en van de chemische eigenschappen van de voedselplant worden besproken.

Résumé. La plante nourricière de *Satyrium ledereri* (Boisduval, 1848) dans l'île grecque de Sámos (Lepidoptera : Lycaenidae) *Atraphaxis billardieri* var. *billardieri* (Jaub & Spach, 1844) (Polygonaceae) a été déterminée comme étant la plante nourricière de *Satyrium ledereri christianae* Olivier, 1989 en l'île grecque de Sámos. Une description de la chenille et de la chrysalide est présentée. L'espèce hiverne dans le stade larvaire, probablement après la première mue. Des données concernant les circonstances de la découverte des chenilles plaident pour une hibernation dans les crevices de l'écorce de la plante nourricière, bien que la possibilité reste ouverte que de meilleures stratégies d'hibernation soient non seulement possibles, mais aussi réellement exploitées. Les implications taxinomiques de la biologie des états pré-imaginaux et de la phytochimie de la plante nourricière sont traitées.

Key words : *Satyrium ledereri christianae* - Lycaenidae - larva - pupa - *Atraphaxis billardieri* - Polygonaceae - larval host-plant - phytochemistry - taxonomy - hibernation - Sámos - Greece.

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The Larval Host-plant of *Satyrium ledereri* (Boisduval, 1848)

In 1988, Mr. Alain Olivier discovered *Satyrium ledereri* Boisduval on the eastern Aegean island of Sámos, Greece (Olivier, 1989). Various

considerations caused Mr. Olivier to differentiate this population from Asiatic counterparts by erecting the subspecific taxon *christianae*.

For the express purpose of acquiring knowledge of the pre-imaginal stadia of this species, my wife and I arranged to visit Sámos in March 1993. To facilitate my endeavours, Mr. Olivier and several other friends in Belgium kindly collated and communicated to me all relevant information in their possession. One item of data of particular value was a photograph, provided by Mr. T. Garrevoet, of a plant, for which, according to the collective observations of Mr. Dirk van der Poorten, Mr. Olivier and Mr. Garrevoet, adults of *S. ledereri* appeared to have particular interest. It is worthy of mention that Mr. van der Poorten's observations relate to experience of the species in Turkey. Although the photograph was taken for the purpose of showing plant habit, rather than detailed structure, it certainly appeared that the plant was not a member of the Leguminosae as had been reported (Olivier loc. cit.). Despite this uncertainty, the total information provided proved of definitive value in locating the biotope, thanks largely to an excellent map drawn by Mr. Olivier. Confirming the larval host-plant, requiring, of course, the discovery of a larva, proved much more of a problem. The main difficulty here was the unseasonally low temperatures which, on the summit of the Karvoúni mountain, rarely climbed more than 1 or 2 degrees above freezing in the early days of our visit, a physical inconvenience much aggravated by the constant, very strong and chilling wind. Local people told me that snow had settled as low as 800m on the mountain just one week before my arrival on 24th March. In consequence, most vegetation was dormant and it was not until 10th April that the tiny leaf buds of the suspected larval host-plant showed signs of swelling. On this day, the search commenced, but it was 11 days before the first *S. ledereri* larva was found. The discovery was quite fortuitous. The larva was 1.5mm long and still in hibernation under a flake of bark on the thin stem of the host-plant; in fact, it was the white hairs emanating from the dorsum of the larva which were seen first, and then only because of the angle of the sun which caused these uniformly-spaced, silken filaments to glisten. An exact representation of this improbable circumstance was recorded in the original photograph used to prepare Figure 1 of the plate: the photograph shows two larva in close proximity, one of which is in an almost totally concealed hibernating position with just a few of the dorsal hairs betraying its presence. Regrettably, this particular larva has been inadvertently excluded from the frame of Figure 1 in consequence of it having gone unnoticed by the printer in the preparation of the plate! However, Figure 1 shows the somewhat larger, more conspicuous larva newly aroused from hibernation. The average size of the 12 larvae found was about 4mm - the first caterpillar found proved to be by far the smallest. Several colonies of the host-plant were located, distributed more or less uniformly above the tree-line of the Karvoúni mountain, and in most of these at least one larva was found, indicating a far

less parochial occurrence than noted by Mr. Olivier in respect of the adult insect. It seems almost certain that *ledereri* is associated with all colonies of its host-plant on the summit of this mountain. That only 12 larvae were found in 8 days of intensive searching, and not in all host-plant colonies, is probably attributable mostly to the weather conditions, as it was only towards the end of the search period that larvae started to show a willingness to feed and, even then, only in captivity. This activity coincided with the bursting of the host-plant leaf buds: very soon after, the principal problem of the investigation became manifest. The host-plant resembled nothing in my experience, and the need to leave the island raised the difficulty of finding a substitute. Like all high-altitude shrubs, the plant was deeply-rooted and very unlikely to have survived rough removal. In the event, sufficient plant material was kept in adequate condition, by refrigeration, for sufficient time so as to require only one return trip to Sámos for replenishment. By the time the larvae achieved full size, some flowers and a single seed had become available and it was an enormous surprise to learn that the *ledereri* host-plant was a kind of "Dock" - a member of the Polygonaceae. By July, I had received a letter, whilst still in Greece, from Mr. De Prins informing me that plant samples taken from Sámos by Mr. Garvoet in 1991 had been identified as *Atraphaxis billardieri* Jaub & Spach, 1844, variety *billardieri* (Polygonaceae). It is possible, therefore, that *ledereri* could be reared on other members of the Polygonaceae, perhaps a *Rumex* species. Aided by Flora Europaea (1964), I was able, subsequently, to confirm that my own plant samples, comprising leaves, flowers and a single seed, collected from Mt. Karvoúni at 1140m, belonged to the aforementioned species. Amongst the photographs taken to record the various characters of the host-plant, perhaps the most useful in aiding its field identification, at least, during the flight period of *ledereri*, will be that showing the detail of the flower (Figure 4). It is also worth indicating that the general habit of the plant can be appreciated from the specimen which appears in the biotope picture, Figure 6: this is the pinkish-beige, wiry shrub just below centre-right of the photograph.

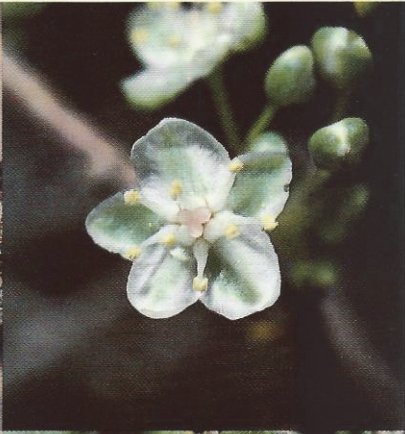
The hibernation quarters of *S. ledereri*

Despite the fact that all larvae were found on the stem of the host-plant, the speculation that the aerial parts of the plant comprise the hibernating quarters of the species is supported only by the discovery of a few, non-feeding specimens *under* the bark of the stems. The manner in which many, if not all, hibernated Lycaenid larvae behave after winter diapause is possibly of especial relevance in this context. In general, the *beginning* of the end of diapause proper is characterised by brief periods of sluggish activity punctuated by intervals of rest of diminishing duration as the end of this transitional phase approaches. In short, most larvae appear to take an appreciable time to "wake up". After remaining completely motionless for months, a larva may change its position very slightly, or it may spend several

Plate 1



1



2



3



4



5



6

hours moving slowly and randomly only to take up a new position where it remains for an hour, a day or, indeed, several days. Not infrequently, these apparently aimless meanderings will be attended by some attempt to feed, although, more often, a larva gives the impression of contemplating feeding without executing the act itself. The relevance of such behaviour to the situation of *ledereri* will be clear, for it is not certain that the larvae were, at the time of their discovery, at the end of their diapause having spent the winter under the bark of the stems, or, that they were in a transitional phase, sunning themselves, resting, or preparing to feed, having hibernated in some other site amongst moss or litter at the base of the plant or under nearby stones. The latter is the more usual strategy for European Lycaenids adapted to low-growing plants and one which would appear to offer greater security during the winter months.

The larva and pupa of *Satyrium ledereri*

Regrettably, time did not permit study of the larval stage in the detail which was to have been preferred. Nonetheless, it is hoped that the following information will be of some value.

From the size of post-hibernation larvae (3-4 mm), it is inferred that *ledereri* over-winters in the 2nd instar. In this same instar, the larva feeds for about 6 days on developing leaf buds. The livery of the 3rd instar larva is dramatically different and, indeed, very attractive. The ground colour is a slightly deeper green than for the final instar (Figure 3), and shows subtle variation within each segment. Two yellow lines straddling the dorsum are prominent. An equally conspicuous sub-spiracular line is variegated yellow and red. A rusty-red suffusion is strongly apparent on the posterior segments. This stage lasted 6-8 days. The last and final instar, presumed to be the 4th, lasted about 15 days. Throughout this period, the larva maintained the appearance recorded in Figure 3. Prior to pupation, the larva did not feed for 2-3 days and, indeed, remained motionless during this time.

Pupation occurred without attachment. The pupal stage lasted about 14 days. The pupa is shown in Figure 2. A freshly emerged female butterfly is shown in Figure 5.

Legend of plate 1:

Figure 1 : Hibernated larva of *Satyrium ledereri* (Boisduval, 1848).

Figure 2 : Pupa of *Satyrium ledereri* (Boisduval, 1848).

Figure 3 : Full-grown larva of *Satyrium ledereri* (Boisduval, 1848).

Figure 4 : Single flower of *Atraphaxis billardieri* var. *billardieri* (Jaub & Spach, 1844), the larval host-plant of *Satyrium ledereri* (Boisduval, 1848).

Figure 5 : *Satyrium ledereri* (Boisduval, 1848) ♀ underside.

Figure 6 : Biotope of *Satyrium ledereri* (Boisduval, 1848), Mt. Karvoúni, 1140 m, Sámos, Greece, March 1993, showing habitat of host-plant, centre-right.

Of the 5 male specimens obtained from pupa, none displayed any trace of the lilac reflections mentioned by Mr. Olivier in his original description of ssp. *christiana* (Olivier, loc. cit.). This is curious, since optical phenomena of this kind, arising from diffraction, are usually more noticeable in fresher insects and, indeed occasionally may only be apparent, by reason of positional consolidation of scales, in insects which have not flown.

Distribution of *S. ledereri* on Sámos

The *ledereri* host-plant on the Kerketevs mountain in western Sámos was noted at 1000m and above. This is coincident with the altitudinal range of the adults as recorded by Mr. Olivier (personal communication).

Taxonomic implications of pre-imaginal life-history

Bearing in mind that taxonomy is the study of *biological* relationships between organisms, it would appear to be a matter of some concern that the early life-history of an insect is, more often than not, omitted entirely from its taxonomic evaluation. Considering that adaptation of both larva and pupa is every bit as consequential as that of the adult insect to the survival of the organism, the detraction from the value of any taxonomic analysis which disregards no less than two of the three forms - morphs - in which an insect lives its life, would seem to be minimally substantial. In close parallel to any taxonomic relevance of the biological character or ecological requirements of the adult insect, the phytochemistry of the larval host-plant is no less important, if only for the reason that a caterpillar is, almost literally, what it eats. Through the mediation of metamorphosis, there is in consequence a direct link between plant chemistry and that of the imago, despite the very profound chemical changes which accompany the equally dramatic physical transformations. Host-plant taxonomy *per se* may provide, in principle at least, important indicators of host status. Whilst it would be simplistic to seek an extraction of "ready-made" answers to problems of insect taxonomy from host-plant taxonomic/phytochemical classifications alone, the correlations thus obtainable can only enhance the level of understanding.

Whilst even the most constructively oriented speculation cannot supplant experimental evidence, it is instructive in this instance to reflect upon the disparities which are now known to exist between *Satyrium ledereri* and some of its cogeners in respect of over-wintering strategy and host-plant phytochemistry. The question of suitability of generic classification emanating from considerations of host-plant phytochemistry has been exemplified in the case of *Lycæna thetis* Klug (Tolman 1993).

Whether or not it is prudent or profitable to proceed with a taxonomic evaluation in the absence of information which *may* be of critical importance, such as pre-imaginal life-history, can, of course, only be determined

unequivocally once such information has been acquired and assessed. Moreover, this leads inexorably to the somewhat paradoxical conclusion that, in the longer term, taxonomic progress may be facilitated by giving less concern to taxonomy and more effort to acquiring the biological data upon which, ultimately, taxonomic evaluations need to be based.

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