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Osellaeus bonvouloirii (Ch. Brisout, 1880) – a summary of its references, distribution and new insights into biology and phenology (Coleoptera, Apionidae)

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We provide new observations on the biology and phenology of *Osellaeus bonvouloirii* (Ch. Brisout, 1880) sensu lato. Data on its distribution is summarized and discussed, and literature references are compiled.

Keywords: Coleoptera, Curculionoidea, *Osellaeus bonvouloirii*, *O. bonvouloirii baldensis*, *O. bonvouloirii occidentalis*, Alps, France, Italy, Switzerland.

INTRODUCTION

Osellaeus bonvouloirii sensu lato (s. l.) is distributed in the subalpine and alpine zones from 1400–3450 m a.s.l. in the central and western Alps from France to Switzerland and Italy. As distributional records are dispersed in the literature and original new data on distribution, taxonomy and phenology were gained, we here present a synopsis for this remarkable Alpine element.

MATERIAL & METHODS

Data for the distribution map is taken from references cited further down and from the following collections (including abbreviations): Naturhistorisches Museum Basel (NMBA); Naturhistorisches Museum der Burgergemeinde Bern (NMBE); collection Eidgenössische Technische Hochschule Zürich (ETHZ); collection Alexander Szallies, Reutlingen (cAS); collection Christoph Germann, Thun (cCG).

Specimens of *O. b. bonvouloirii* were sifted from mosses and plants (mainly *Saxifraga* spp.). The specimens were extracted from the litter following Stüben *et al.* (2000).

Breeding experiments were carried out under room temperature conditions in a glass terrarium with sandy ground, where specimens of *O. b. bonvouloirii* where kept in plastic boxes (diameter: 50 mm, height: 20 mm) with absorbent paper on the ground, together with their host plants. These were exchanged every second day. Ten specimens where placed together in each of the four boxes.

RESULTS & DISCUSSION

Taxa

***Osellaeus bonvouloirii bonvouloirii* (Ch. Brisout, 1880)**

First description: *Apion bonvouloirii* (Brisout de Barneville 1880: 232).

Locus typicus: Switzerland, Bern, Brienzer Rothorn (see remark in Germann 2010a: 3, and/or Janetschek 1956: 503–504).

References: Desbrochers 1893; Schilsky 1906; Wagner 1910; Wagner 1914; Schatzmayr 1922; Hoffmann 1929a, b, 1958; Luigioni 1929; Solari 1933; Portevin 1935; Sainte-Claire Deville 1938; Janetschek 1956; Péricart 1960, 1974; Osella 1966, 1972, 1977; Focarile 1976, 1982, 1987; Dieckmann 1977; Tempère 1978; Bellò et al. 1980; Bajtenov 1980; Lohse 1981; Tempère & Péricart 1989; Alonso-Zarazaga 1990; Ehret 1990, 1992, 1997; Abbazzi & Osella 1992; Abbazzi *et al.* 1994; Behne 1994; Scherler 1995; Alonso-Zarazaga & Lyal 1999; Pedroni 2000; Colonnelli 2003; Pelletier 2005; Abbazzi & Maggini 2009, Germann 2010a, b; Alonso-Zarazaga 2011, Goggi 2011.

Nomen dubium (mostly considered as synonym to the nominal species): *Apion bonvouloirii georgeli* Hoffmann, 1929.

Two valid subspecies are presently known:

Osellaeus bonvouloirii baldensis (Bellò, Meregalli & Osella, 1980).

First description: *Apion bonvouloiri baldensis* (Bellò *et al.* 1980: 519–525).
Locus typicus: Italy, Veneto, Monte Baldo (Telegrafo).

Osellaeus bonvouloirii occidentalis Germann, 2010

First description: *Osellaeus bonvouloiri occidentalis* (Germann 2010a: 3–10)
Locus typicus: France, Vercors, Col de la Bataille.

Distribution: Distribution maps of *O. bonvouloirii* were previously provided by Janetschek (1956), Osella (1972), Focarile (1986, 1987) and Bellò *et al.* (1980). Records used to draw the distribution map given herein were taken from the selected references listed in the following. France: Péricart (1960), Germann (2010a); Italy: Osella (1966), Bellò *et al.* (1980), Pedroni (2000), Germann (2010a), Goggi (2011); Switzerland: Germann (2010a). We here provide an up-to-date overview on the distribution of *O. bonvouloirii* s. l. (Fig. 1).

The highly doubtful record of *O. b. georgeli* from Eymoutiers, not yet verified by the examination of type material (thus categorized here as nomen dubium) was not included.

Among the material examined, further records from Switzerland were made. These are listed below:

— 1 specimen (female) TI, Gridone, 2000 m, 28.10.2010. Remarks: black, without bluish shimmer (cAS).
— 1 specimen (sex not specified) GR, Avers-Cresta, 8.1939, leg. A. Linder (vidit P. Scherler), not found in the ETHZ.

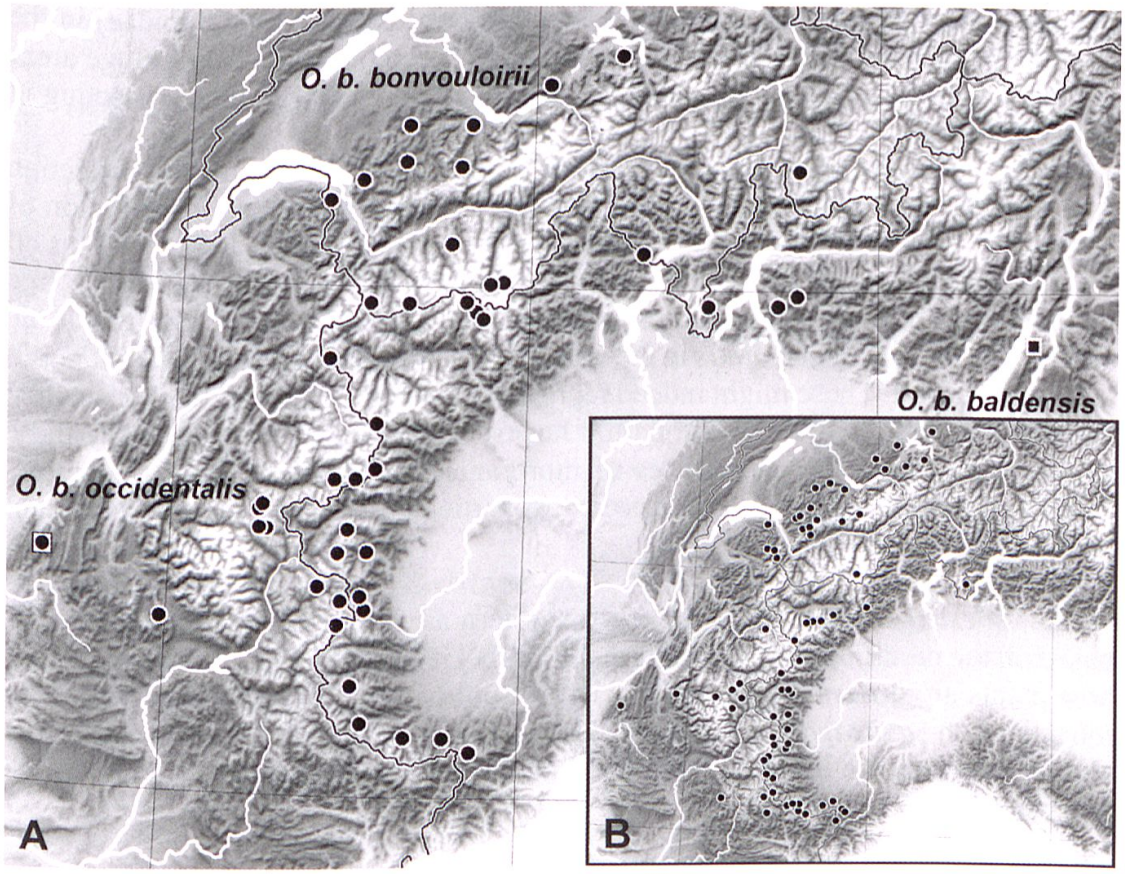

Fig. 1. A) Map showing records of *Osellaeus bonvouloirii* (Ch. Brisout, 1880) s. l. (including an overview map B) with records of *D. alpestris* Stierlin, 1878 modified after Germann (2011), which strikingly resembles the distribution pattern of *O. bonvouloirii* s. l.

— 38 specimens (21 males, 17 females) FR, Kaiseregg, 3.11.2010, from *Saxifraga exarata* Vill. s.l. leg. A. Szallies (cAS, NMBE)
— 142 specimens (54 females and 65 males, and 23 specimens where sexes were not specified) FR, Kaiseregg, 1.4.2011, from *Saxifraga exarata* and *S. oppositifolia* L. leg. A. Szallies & C. Germann (cAS, cCG).
— 2 specimens (1 male and 1 female) NW, Brisen, 2350 m, 8.4.2011, leg. A. Szallies (cAS)

Janetschek (1956) regarded the wingless and hence quite immobile *O. bonvouloirii* as a typical glaciation relict element, supposedly having survived at least the last glaciation on mountain peaks and massifs de refuge. But another persuasive hypothesis can be put forward, complicating Janetschek´s straightforward hypothesis, and not being necessarily mutually exclusive. *O. bonvouloirii* might have gained much of its recent distribution just recently in the much warmer post-glacial period following the last glaciation. Thus the hypothesized glacial refugia on nunataks of the western Alps for instance might only be most recent refugia in the wake of climate cooling. How much of *O. bonvouloirii*´s recent distribution thus might be regarded «protocratic» (see Schmölzer 1999), after the last glaciation, certainly is worth considering. Very recently Lohse *et al.* (2011, see also Schneeweiss & Schönswetter 2011)

showed, based on the *Trechus pertyi* Heer, 1837 species group (Carabidae) in the Orobian Alps, that both, survival on nunataks and recolonisation from refuge areas might have been involved in species' biogeographical history, although acting at different times.

Our updated and summarized records available from literature and collection data (Fig. 1) provide a much more complete picture of the present distribution of *O. bonvouloirii*. Seemingly, we provide support for Janetschek's hypothesis, as all records strictly follow the arc of the Alps, and the finds are restricted to ice free mountaintops at high altitudes. Furthermore, with the subspecies *baldensis* at the eastern border, and *occidentalis* at the western one, morphologically different populations are extant. These might indeed represent the suspected «relicts» of an ancient wider distribution in pre-glaciation time Janetschek (1956) hypothesized. But these might as well be the consequences of more ancient glaciations and furthermore, much of the dispersion of any subspecies, in particular the nominate species, might be most recent and thus protocratic.

The overlap of the distribution of *O. bonvouloirii* with the one of *Dichotrachelus alpestris* Stierlin, 1878, a strictly western alpine member of Curculionidae, based on the modified map from Germann (2011) is striking (Fig. 1). Although their host plants are different (*D. alpestris* lives in moss cushions, whereas *O. bonvouloirii* lives on *Saxifraga* spp.), their ecological and/or microhabitat demands are very similar, and they are likely to share the same biogeographical history during the ice age glaciations.

Phenology

Freshly emerged specimens of *O. b. baldensis* in September (Bellò *et al.* 1980), and a fresh (immature) specimen of *O. b. bonvouloirii* from 13 August 2001 from Rochers de Naye, coll. P. Scherler (NMBE) both indicated that imagines of *O. bonvouloirii* emerge in late summer and beginning of autumn. The record of 38 specimens in November 2010 in one particular location, and the subsequently collected 142 specimens on 1st April 2011 at the same location definitely confirms that the imagines of *O. bonvouloirii* overwinter.

Péricart (1974) reported on a very short appearance time of *O. bonvouloirii* in the French Alps (Briançonnais und Queyras) with a peak in the middle of July and disappearance of the imagines already at the beginning of August «...la durée d'apparition de l'imago est très brève.» and «...l'abondance maximale a lieu vers la mi-juillet, et l'insecte disparaît après les premiers jours d'août.» Unfortunately Péricart (1974) did not indicate how many specimens his observations were based on. However, regarding the presented data here, his generalized conclusion cannot be valid.

We compiled 417 records of specimens available from literature and collection data and plotted them against the year's months (Fig. 2). Records peak in April, September and November, not being common during usual sampling times of most entomologists in the Alpine zone (which is June to August). All three peaks are mainly based on single collection events, and therefore show that previous assumptions on the rarity of *O. bonvouloirii* are mostly due to the rarefaction of specimens in summer time, when the overwintered specimens have propagated and died off and the new generation has not yet emerged.

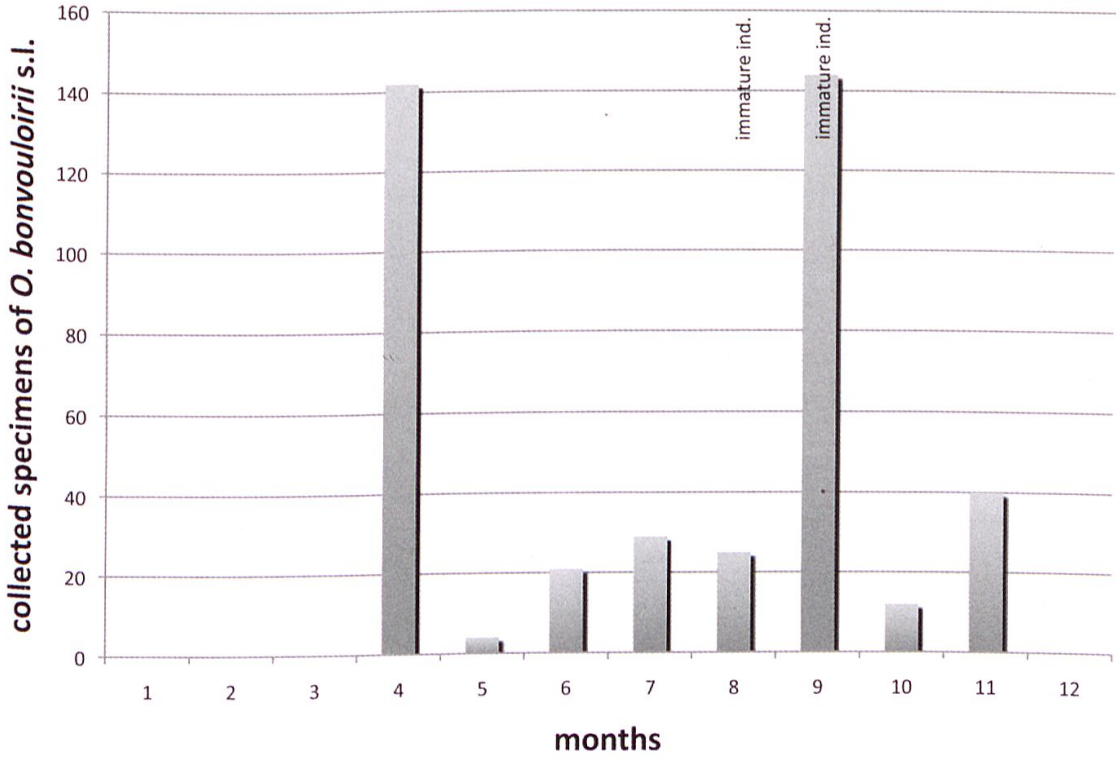

Fig. 2. Plot of the collection dates (months 1–12) of the 417 specimens of *Osellaeus bonvouloirii* (Ch. Brisout, 1880) s. l. included here (data was taken from collections and listed references).

Breeding experiments

40 specimens of *O. b. bonvouloirii* collected on 1st April 2011 were fed in captivity kept in a terrarium. Because indigenous *Saxifraga* spp. were not available ad libitum, we used instead a *Saxifraga* x *arendsii* -hybrid (cult.) (a crossbreeding from *S. hypnoides* L., *S. exarata* s. l., and *S. rosacea* Moench.), which is commonly sold in garden centres. All plant organs were offered, and controlled daily regarding feeding traces and possible oviposition. On 3rd of April, the first egg was observed in a fruit capsule. Its colour was bright yellow when freshly deposited. Its size (measured from totally 10 eggs) was about 0.3 mm, its form varied from circular to oval. Until April 12th, 12 deposited eggs could be observed: 3 in fruit capsules, 1 in crown leaf, 1 in flower bud, 1 in flower stem, 5 in leaves, 1 in a leaf basis (Fig. 3). The eggs were deposited in the following manner: first a hole was bored into the substrate, and then a cavity was hollowed out wherein the egg was deposited. Afterwards the cavity was sealed with faeces. About ten days after oviposition, the colour of the eggs changed to greyish-blackish. On April 14th the first two larvae (from the two first eggs laid in fruit capsules), of about the same length as the egg, emerged, which fed immediately on plant tissue, and immature corns provided (Fig. 3E). One of the larvae was kept alive and resetted every two days in fresh fruit capsules of *Saxifraga* x *arendsii* and also *S. oppositifolia* (that was now available during a certain time). The larva mostly fed in a mining manner, and grew (Fig. 4), and till beginning of Mai, its length was about 1 mm. On 10th of Mai the larva unfortunately died, because its substrate desiccated, due to absence of the first author.

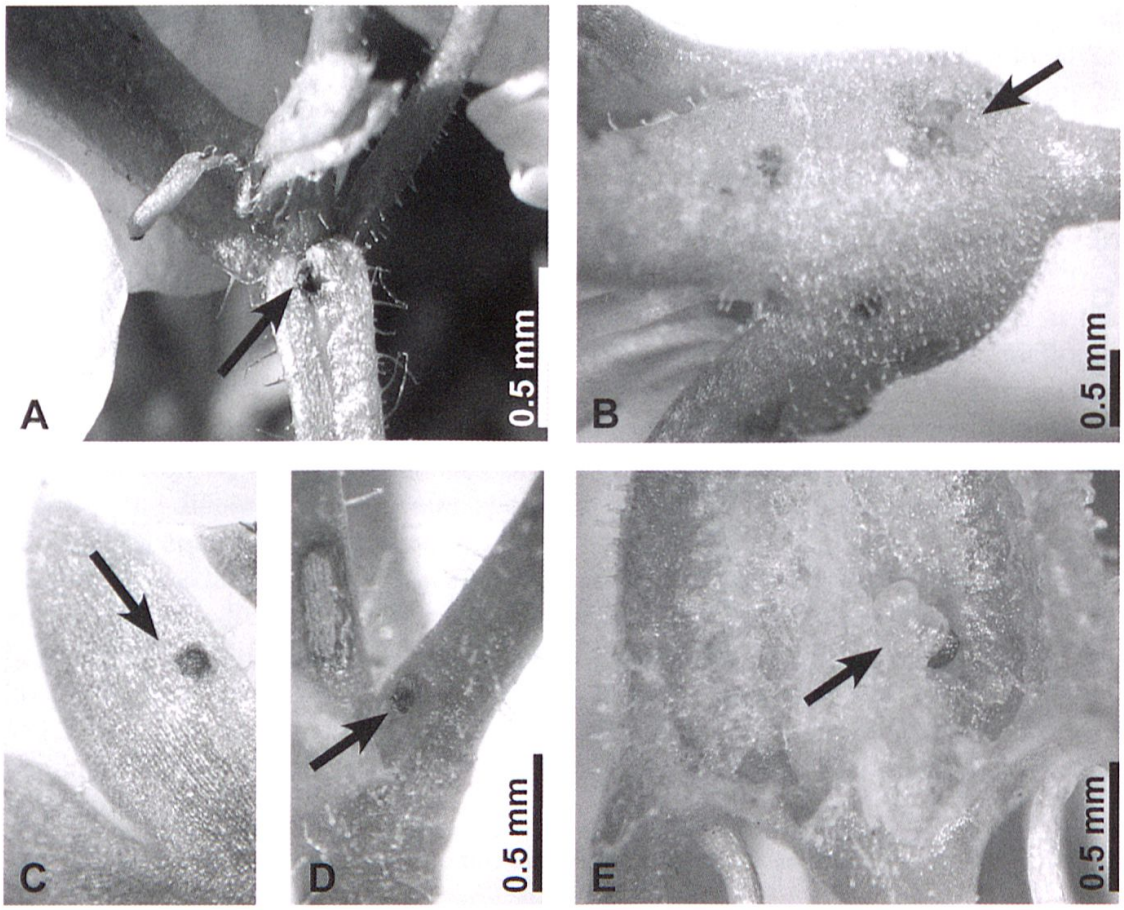

Fig. 3. Oviposition sites of *Osellaeus b. bonvouloirii* (Ch. Brisout, 1880) with eggs deposited in different plant organs of *Saxifraga* x *arendsii* –hybrid. The arrows indicate the oviposition sites: A) in leaf basis; B) in fruit capsule (freshly deposited egg at the arrow's point); C) in leaves (the freshly deposited egg is visible through the plant tissue, and the hole is sealed with dark faeces); D) in flower stem; E) feeding first larval instar in fruit capsule (Photos: C. Germann).

A hypothesis of the generalized life cycle of *O. bonvouloirii* s. l. is proposed:

— Oviposition occurs in spring (April to May) after overwintering. Another (egg-) maturation feeding of the adults and copulating follow (directly observed). Substrates for oviposition are leaves, nodes, stems, fruits and crown leaves of *Saxifraga* spp. (presented laboratory data).
— Larval substrates are the same where eggs were deposited, the larvae feed/mine within the respective plant tissue (presented laboratory data).
— Larvae develop in late spring and during summer. Probably – depending on potential harsh climatic conditions – the mean developmental time of 40 days within Apionidae (Dieckmann 1977) might be exceeded. Overwintered adults die off (rarefaction of the species; likely the reason for low specimen numbers of *O. bonvouloirii* in collections).
— Pupal development (most probably within the feeding substrate, and not in the ground) is completed in August and September, adults emerge, feed – observations by Bellò *et al.* (1980) – and overwinter (as stated here).

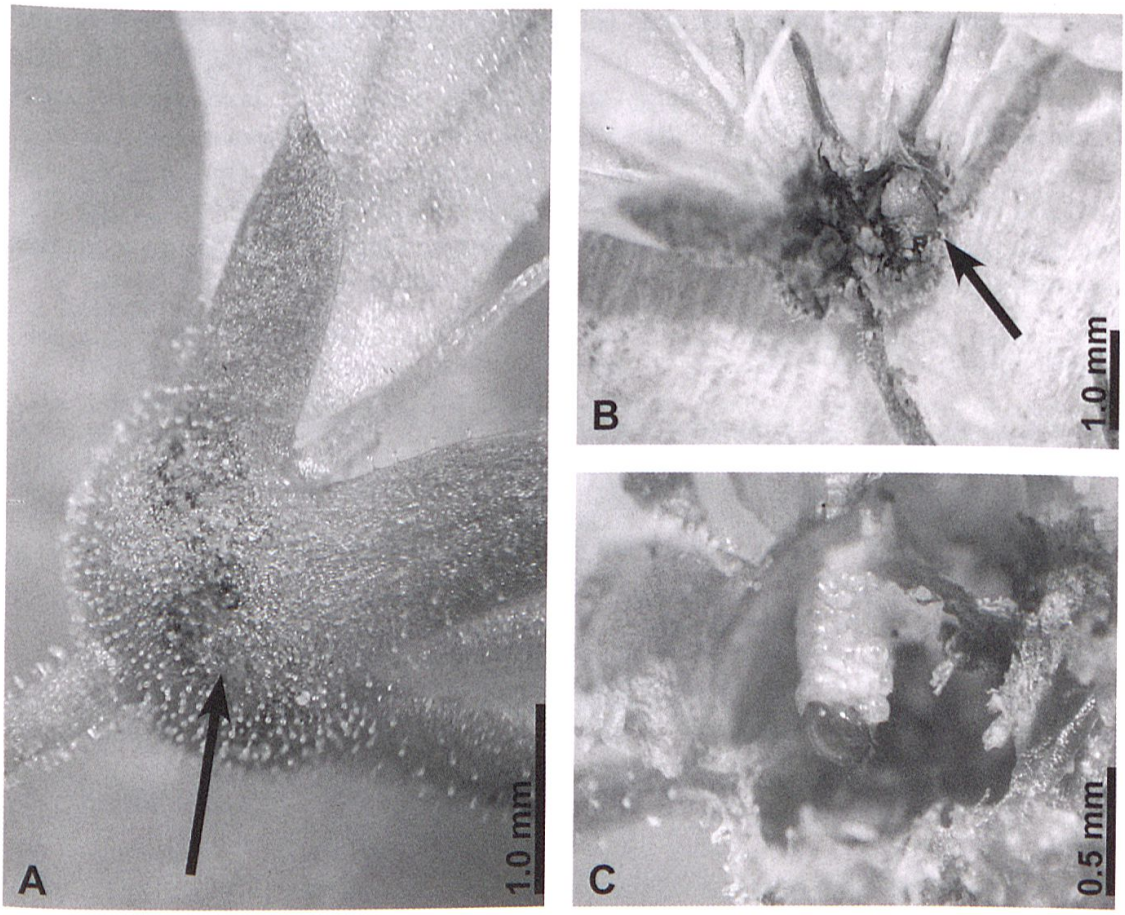

Fig. 4. A) Traces of a mining larva of *Osellaeus b. bonvouloirii* (Ch. Brisout, 1880) in a flower bottom of a *Saxifraga arendsii* –hybrid (view from the outside, see arrow); B and C) older (probably second) larval instar at 6th of Mai (Photos: C. Germann).

Host-plants

As possible host-plant of *O. bonvouloirii*, *Saxifraga oppositifolia* is predominantly reported. Also *O. b. occidentalis* was found on this plant (Germann 2010b). Osella (1972) reported *Saxifraga biflora* All. as a potential host plant, since specimens were found nearby under stones. Péricart (1974) was the first who reported *S. caesia* as another possible host-plant for *O. bonvouloirii* in the Briançonnais «... aussi sur une espèce du groupe de *caesia* L.». Scherler (1995, and unpublished records in NMBE) reported finds from both plants. *O. b. baldensis* was found on *S. caesia*; freshly emerged adults were feeding on the leaves and stems, and also emerged from collected plant cushions (Bellò *et al.* 1980).

Solari (1933) reported on adults sifted under *Saxifraga oppositifolia* showing deformations on the elytra. He concluded these deformations to be due to movements of the ground, wherein he supposed the embedded pupal stage. According to Dieckmann (1977), nymphosis to take place in the ground would be rather exceptional within Apionidae. Because he did not find feeding traces or larval stages of *O. bonvouloirii*, Solari (1933) assumed that larvae might feed ectophagously on the plant roots, something we would dismiss regarding our here presented results.

We found about 50 specimens (of totally 142) of *O. b. bonvouloirii* on the Kaiseregg in a scree slope where exclusively *Saxifraga exarata* grew. Feeding tests showed that *S. exarata* is very likely another host plant for *O. bonvouloirii*, apart from another finding location at the same mountain (just 100 m away) where *O. b. bonvouloirii* was collected near *S. oppositifolia*. Furthermore, as *O. b. bonvouloirii* also fed (and layed eggs) on a *Saxifraga* x *arendsii* -hybrid, other *Saxifraga* spp. can also be expected as host plants. However, further study is needed to clear this unambiguously.

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