The morphology of the immature stages of *Squamapion atomarium* (Kirby, 1808) (Coleoptera, Brentidae) and notes on its life cycle

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Abstract

The immature stages (egg, mature larva and pupa) of *Squamapion atomarium* (Kirby, 1808), as well as its development cycle and the phenology of its developmental stages, are described for the first time. The larva and pupa of *S. atomarium* have typical morphological features of the subfamily Apioninae. Morphological data on the immature stages were compared with the only fully described *Squamapion* species, *S. elongatum* (Germar, 1817). The larvae of the two species differ in body size and shape, head shape, setae length, the chaetotaxy of the mouthparts, and individual types of setae on the pronotum and thorax. In the case of the pupa, there are also differences in body size and in the type of setae and chaetotaxy of the head, pronotum, metanotum and abdomen.

Keywords

Apioninae, biology, central Europe, egg, host plant, life cycle, morphology, weevil

Introduction

The genus *Squamapion* Bokor, 1923 belongs to the tribe Kalcapiini Alonso-Zaraza-ga, 1990 in the subfamily Apioninae Schönherr 1823 and family Brentidae Billberg 1820. The adult morphology, ecology, distribution and systematics of the Apionidae
Family have been presented in detail by Alonso-Zarazaga (1990, 2011), Petryszak (2004), Marvaldi and Lanteri (2005), Mokrzycki and Wanat (2005), Alonso-Zarazaga and Wanat (2014) and Alonso-Zarazaga et al. (2017). The immature stages of representatives of this family have been described by Scherf (1964), Łętowski (1991), Marvaldi (1999, 2003), Gosik et al. (2010), Wang et al. (2013), Oberprieler et al. (2014), and Łętowski et al. (2015). This genus is known from the Palearctic and Ethiopian regions and is poorly represented in the Oriental region. There are 33 known species in the Palearctic region, 19 in Europe, and only 9 in Poland (Mokrzycki and Wanat 2005; Alonso-Zarazaga 2011; Alonso-Zarazaga et al. 2017). These are herbivorous mono- or oligophagous species feeding on plants from the Lamiaceae family, with a preference for the genera Salvia L., Thymus L., Thymbra L., Origanum L., Prunella L. and Saccocalyx Coss. & Durieu. Their larvae bore tunnels inside the roots and stems, occasionally causing galls (Alonso-Zarazaga 1990). Adults have a small body size ranging from 1.10 to 2.70 mm. They are found mainly in dry and thermophilic environments – in non-forested areas and on the edges of forests and bushes (Burakowski et al. 1992).

The biology of only one species and the morphology of its immature stages are known – Squamapion elongatum (Germar, 1817) (Łętowski et al. 2015).

This study is a continuation of research on representatives of this genus found in Poland. The authors describe the morphology of the third larval instar and pupa as well as issues concerning the development and ecology of Squamapion atomarium (Kirby, 1808).

According to the literature, this species prefers warm, sandy areas and is usually found in xerothermic grasslands (Burakowski et al. 1992). Its host plants are Breckland thyme (Thymus serpyllum L.) and broad-leaved thyme (T. pulegioides L.). As regards its biology, S. atomarium feeds on the upper part of the stem of these plants, causing oval cecidia 2–4 mm long and 2 mm wide (Burakowski et al. 1992).

Material and methods

Insect collection

The research material comprised developmental stages (egg, larvae, and pupa) of S. atomarium, isolated in the laboratory from field-collected plants described in the literature as hosts. The choice of study sites was based on faunistactic data on the occurrence of S. atomarium as well as our own observations of potential habitats in the Lublin region of Poland (Cmoluch 1963, 1971, 1987, 1992; Gosik and Łętowski 2003; Łętowski et al. 2003; Łętowski 2008). The sites were as follows: 1. Okale near Kazimierz Dolny (51°18’11.0”N, 21°53’58.6”E), 2. Bochotnica (51°20’38”N, 22°00’05”E), 3. Lublin-Górki Czechowskie (51°15’47”N, 22°32’03”E), 4. Lublin (51°13’11.50”N, 22°32’04.38”E), 5. Trześniów near Lublin (51°16’20”N, 22°37’04.10”E), 6. Kolo- nia Pliszczyn (51°17’38”N, 22°37’38”E), 7. the Stawskas Góra Reserve near Chelm
The morphology of the immature stages of Squamapion atomarium

145

(51°22'23"N, 23°24'11"E) and 8. the Żmudź Reserve (51°00'35"N, 23°40'14"E). Im-
mature stages of S. atomarium were found at sites 3, 5 and 8. In the remaining sites, de-
spite the presence of host plants, no specimens were found. The material was collected
from May to August 2016 and 2017. To obtain immature stages of the species, plants
were collected at the sites every 2–3 days. This frequency made it possible to study the
development cycle of the species in its natural conditions. Breeding was also conducted
in the laboratory. Squamapion atomarium adults were collected individually, directly
from the host plant and from its immediate surroundings.

Breeding

Adult specimens were placed in plastic containers covered with mesh – separately for
T. serpyllum L. and T. pulegioides L. Wet filter paper was placed on the bottom of the
containers to maintain a suitable moisture level, together with thyme. The stems were
searched for signs of oviposition and eggs about every three days. Then immature stages
were grown in Petri dishes in a growth chamber, in the following conditions: daytime
minimum 25 °C, daytime maximum 35 °C, minimum at night 15 °C, maximum at
night 20 °C, humidity (60%), light duration – day 14 h, night 10 h. Immature stages
were also grown in 125 ml plastic containers stored under room conditions (25 °C
with a 14:10 photoperiod). Filter paper soaked in water was placed on the bottom of the
container to maintain moisture, together with thyme stems with galls. The closed
containers were monitored daily for mould. This method produced better results in
terms of larvae survival than the use of the Petri dishes proposed by Scherf (1964). In
order to track development and acquire larval stages, 5 stems were randomly selected,
the galls were cut open, and developmental stages were isolated from them.

Morphological descriptions

The immature stages obtained by the methods described above were preserved in 70%
ethyl alcohol. Two methods were used to prepare microscope slides, as described by
Łętowski (1991) and Gosik et al. (2010). To prepare the drawings, we used an OLYM-
PUS SZX12 and DP72 microscope at magnifications from 200× to 400× and a TES-
CAN VEGA3LMU scanning electron microscope (SEM) at magnifications from 500×
to 2000×. The larvae for SEM images were subjected to critical point drying (CPD).
Drawings based on the slides were made using Corel Draw 18.

The terminology of Marvaldi (1999, 2003) and Oberprieler et al. (2014) was used
in the morphological descriptions of the larva and pupa for chaetotaxy, and the ter-
minality of Zacharuk (1985) and Marvaldi (1998) for antennae. The number and
distribution of setae are given for one side. Measurements of the head (following de-
capitation) were made on the head capsule, isolated from the body, with the mandibles
closed. Measurements were made of 10 L1, 4 L2, 15 L3 and 10 pupae. The larvae were
not separated by gender for the measurements. The mean and standard deviation for each parameter were calculated using Excel.

An analysis was made of the growth of the heads of individual larval instars based on Dyar’s law (1890), and the growth rate (GF) was determined based on Bednarz (1953).

**Morphological abbreviations**

AbI, AbVII, AbVIII, AbIX, AbX – abdominal segments 1, 7–10, ThI, ThII, ThIII – thoracic segments 1–3, prns pronotal setae, pada pedal s., ps pedal s., eus eusternal s., lsts laterosternal s., prs prodorsal s., pds postdorsal s., as alar s., ss spicular s., eps epipleural s., ds dorsal s., les lateral epicranial s., fs frontal s., des dorsal epicranial s., pes posterior epicranial s., at antenna, Se sensorium, sb sensillum basiconicum, ss sensillum styloconicum, oc ocellus, enc endocarina. lrms labral setae, cls clypeus s. ams anteromedial s., als anterolateral s., mes median s., lr labral rods., mds – dorsal mala e s., dms dorsal maxillary s., pfs palpiferal s., sts stipal s., mpxs maxillary palp s., mbs malar basiventral s., prms prelabium s., pms postlabium s., lgs ligular s., lbp labial palpus, as apical setae, ls lateral s., pls postero lateral s., sos suborbital s., rs rostral s., fes femoral s., ur urogomphi.

**Results**

**Description of egg**
Fig. 1

Measurements (in mm, \(N = 5\)). Length 0.28 (0.22–0.31), width 0.18 (0.15–0.20).

General. Egg elliptical, shiny, smooth. Chorion soft, delicate (Fig. 1).

Colouroperation. Pale to dark yellow.

**Description of larva**
Figs 2–6

Measurements (in mm). First larval instar (L1) – body length 0.46 (0.39–0.55), width 0.21 (0.19–0.23). Head width 0.13 (0.12–0.14).

Second larval instar (L2) – body length 0.68 (0.64–0.74). Body widest at abdominal segment III (0.34). Average pronotum width 0.27 (0.15–0.21). Head width 0.19 (0.17–0.21). Stemmata present.

Mature larva (third instar, L3) – body length 1.36 (1.09–1.72). Body widest at abdominal segment III (0.66, 0.50–0.86). Width of pronotum 0.47 (0.40–0.55). Head width 0.33 (0.30–0.38).
The morphology of the immature stages of *Squamapion atomarium*

**General L.** Cylindrical, C-shaped, pale yellow with no distinct sclerotizations (Fig. 2). Cuticle microstructure of entire body with many small, sharply pointed cuticular structures. Thoracic and abdominal segments with characteristic, short setae. Body much narrower after abdominal segment VIII.

**Head** (Fig. 3). Pale yellow, later dark yellow, slightly hidden in prothorax, longer than wide, slightly egg-shaped, widest at 2/5 of length. Epicranial suture visible. Endocarina (*enc*) distinct, long, together with epicranial suture extends 3/4 length of head (Fig. 3). End of frontal suture with distinct stemmata. Antennae (*at*) without articulations. Sensorium (*Se*) long, slightly narrowing apically. Antenna with 4 sensillae: 2 *sb* (*sensillum basiconicum*) and 2 *ss* (*sensillum styloconicum*) (Fig. 3). Epicranium with 2

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**Figure 1.** Egg of *Squamapion atomarium*. 
lateral epicranial setae (les1,2). Les1 more than 4 times longer than les2. Dorsal part of epicranium with 5 visible dorsal setae (des1–5), des1,3–5 situated more or less along frontal suture, des2 on extension of line of pes (Fig. 3). Des3 very long, des4 very short and des1,2,5 short and more or less equidistant. Epicranium with 4 thorn-shaped posterior epicranial setae posterolaterally (pes1–4) – very short and more or less equidistant. Frons with 4 frontal setae (fs1,3–5) (Fig. 3). Fs1,3 short (shortest of all fs), fs1 situated by endocarina at about 1/3 length of frons, fs3 situated outermost of all fs, close to fs4. Setae fs4 long – longest of all fs. Setae fs5 slightly above anterior margin of stemmata.

**Mouthparts.** Labrum – anterior margin slightly arched. Dorsal side with 3 thorn-shaped labral setae (lrms), of which lrms2 long and longer than others; lrms1 closer to centre, below mid-height of labrum, lrms2 and lrms3 anterolaterally (Fig. 4a). Epipharynx anteriorly with 2 anteromedial setae (ams), of which medial ams1 finger-shaped, outer setae ams2 thorn-shaped (Fig. 4b). Beside ams, 2 als on epipharynx, arranged more or less diagonally from corner to centre of labrum. Als1 slightly shorter than als2. Both wider at base and narrowing apically, Mes digitiform and placed antero-medially. Labral rods (lr) present, long, extending well beyond suture (Fig. 4a). Clypeus kidney-shaped, with slightly concave anterior margin. 1 short seta cls at lower margin, between them 1 sensillum (clss) (Fig. 4a). Mandible massive, highly sclerotization, light to dark brown in colour. Two teeth equal in size, curved. Dorsally 1 pair mandible dorsal setae (mds1,2) and 1 sensillum (Fig. 5). Setae close together, one above the other, each sensilla peripherally. Mds2 more than twice longer than mds1.

![Figure 2. Mature larva (L3) of Squamapion atomarium, lateral view.](image-url)
The morphology of the immature stages of *Squamapion atomarium*

Inner margin of inner teeth serrated. Maxillary stipes elongated, widening apically, narrowed at mid-length, with 4 distinct, hair-like setae (Fig. 6). In lower part 1 stipal seta (*stps*). In the upper part palpalferal setae *pfs*1 fairly short, placed centrally under maxillary palpus, *pfs*2 very long, placed on inner side, basioventral seta (*mbs*) short. Maxillary palpus (*mp*) 2–segmented, distal segment cylindrical, smaller than basal segment, with 10 nodular cuticular tubercles situated apically. Basal segment with rod-shaped sensorium, 1 minute maxillary palp seta (*mpxs*) and 1 pore. Malar part of maxilla with 7 dorsal maxillary setae (*dms*1–4, *vms*1–3) clearly visible, finger-shaped setae of equal length in comb-like arrangement.

Labium cup-shaped (Fig. 6). Base of prementum rounded. Postmentum with 3 pairs postmental setae (*pms*1–3), distributed evenly, one over the other, closer to outer part of postmentum, more or less parallel to its edges. First pair setae (*pms*1) situated closest to lower margin, shortest of all *pms*. Above it *pms*2, very long and longest of *pms*, thick, narrowing only at apex. Setae *pms*3 situated at 2/3 height of labium, similar in structure to *pms*2 but half their length. Labium with Y-shaped premental sclerite situated centrally. 1 pair sensilla at base of arms of this structure. At height of premental sclerite, dorsally, chitinized inverted comma-shaped labial rods with uneven edges.

**Figure 3. Squamapion atomarium** (L₃), — epicranium, dorsal view.
Figure 4. *Squamapion atomarium* (L₃) labrum and clypeus: a dorsal view b ventral view.

Figure 5. *Squamapion atomarium* (L₃) – mandibulae.

Labium with 1 pair simple palpi (*lbp*), with 7 palpillae apically, 1 inner seta at base and 1 outer sensillum. In front of palpi 1 pair long premental setae (*prms*). Behind palpi 2 pairs very short ligular setae (*lgs*) and 1 pair sensilla (Fig. 6).
Thorax. Thoracic segments with well visible pedal area. Thoracic setae longer than others. Prothorax with 7 pronotal setae varying in length (prns), 1 pleural seta (ps) and on pedal area 3 pedal setae (pda) (Fig. 2). Meso- and metathorax each with 1 relatively long prodorsal seta (prs), 2 postdorsal setae (pds), 3 alar setae (as), 3 spicular setae (ss), 3 pda on pedal area and 1 short eusternal seta (eus). Thoracic spiracle bicameral, located intersegmentally, between Th.I and Th.II (Fig. 2).

Abdomen. Tergites I–VII with 2 folds and 1 seta (prs) on prodorsum. Postdorsum with 2 pds and 2 ss of varying size; 1 epipleural seta (eps) slightly below ss. Pleurum with 1 ps. Sternum with 1 laterosternal seta (lsts). Tergit VIII with gentle folds and with 1 prs, 1 dorsal seta (ds) and 1 eps. Tergit IX without folds, with 1 ds and 1 ps. Sternum and pleurum of segments VIII–IX with 1 ps and 1 lsts. Segments I–VII with unicameral spiracles, others without spiracles (Fig. 2).

Description of pupa
Figs 7–10

Measurements (in mm). Body length 1.51 (1.24–1.63), width 0.84 (0.72–0.93) (Figs 7–10).
Figures 7–9. Pupa of *Squamapion atomarium* 7 ventral view 8 dorsal view 9 lateral view.
The morphology of the immature stages of *Squamapion atomarium*

**Colouration.** Colour creamy-white.

**Head.** Eyes large, with 1 supraorbital seta (*sos*) between them. Rostrum long, extending to end of tarsi of mesolegs, not very wide, with 1 rostral seta (*rs*) below base of antennae, shorter than *sos*. Antennae relatively long, club with conical papillae. Antennae sub-parallel to protibia (Figs 7, 9).

**Thorax.** Pronotum wider than long; sides with 2 lateral setae – long *ls1* and shorter *ls2*; 1 apical seta on apex (*as*), half length of *ls1* (Figs 7, 8); lower margin with 2 postero-lateral setae (*pls1,2*), similar in length to *as1*. Mesonotum without setae. Metanotum with 2 setae, slightly shorter than *ls1* (Figs 8, 9). Each femur with 1 femoral seta (*fes*) on convex base (Figs 8, 9).

**Abdomen.** Chaetotaxy very sparse. Each segment with 1 short dorsal seta located close to lateral margin. Each of lateral parts of abdominal segments I–VII with 1 pair

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*Figures 10–15.* *Squamapion atomarium* 10 pupa 11 occurrence environment 12 a gall 13 the most common place to lay eggs at the root collar 14 place for laying eggs 15 larva in prepupal stage for pupation.
minute lateral setae. Spiracles located between tergites and pleurites, clearly visible on segments I–VI, on others absent (Fig. 9). Segment IX terminally with 1 pair urogomphi (ur) with characteristic ends in form of flattened bifurcation (Fig. 7).

**Notes on biology and life cycle**

Figs 11–17

**Host plant.** The life cycle of *S. atomarium* was described based on field data and laboratory observations. *Thymus serpyllum* and *T. pulegioides* were confirmed as host plants (Fig. 11).

**Life cycle.** Adults, following overwintering and maturation feeding, begin copulation and egg laying in the first half of May. Increased egg laying was observed at the end of May, and single eggs were still noted in early June. Adults usually feed in the evening, by gnawing round holes in the leaf that do not exceed 1 mm in diameter. The fertilized female gnaws a cavity in the stem and lays one egg in it (Fig. 12). Oviposition takes place primarily at the root collar, but it was also observed up to the fourth or fifth node, in both nodes and internodes (Fig. 13). After laying the egg the female does not seal the site with any secretion. The first instar larva (*L*₁) hatches on average 4 days

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**Figure 16.** Life cycle of *Squamapion atomarium.*
The morphology of the immature stages of *Squamapion atomarium*

The egg is laid and moults after 10–12 days. The L₁ instar was observed as early as mid-May, but these were isolated specimens. Maximum emergence was observed from the second third of May. L₁ larvae were found until mid-June. The second larval instar (L₂) appeared at the end of May. The activity of L₂ larvae causes distinct galls about 1.32 mm long and about 0.75 mm wide. Furthermore, L₂ gnaws out an opening for oviposition on the opposite side of the groove, but does not gnaw through the skin. The second larval instar lasts on average 10 days, and then the larva moults again. L₃ larvae appeared as early as the last third of June and were noted until mid-July. The average duration of this stage is about 11 days. This stage continues feeding and the gall grows, reaching on average about ca 2.31 in length and ca 1.70 mm in width (Fig. 14). The third larval instar enlarges the opening in the stem. Then pupation takes place (Fig. 15). The pupal stage lasts 2–3 days on average. The first pupae appeared at the end of June. Finally, at a maximum 40 days after the egg is laid, adult individuals appear. An increase in the emergence of adults took place from mid-July. The entire life cycle of *S. atomarium* is presented in the diagram in Figure 16.

**Parasitoids.** In the second half of July, endoparasitic hymenopterans of the superfamily Chalcidoidea were very active, which is manifested by the high level of parasitism of L₃ larvae. On average 7 of 10 third-instar larvae exhibited symptoms of parasite infection: dark red discolouration on the thoracic tergites and pleurites and swelling of the ab-

![Figure 17. Larva of a chalcidoid endoparasitoid found inside the mature larva (L₃) of Squamapion atomarium.](image)
dominal segments caused by the growth of the intruder larvae (Fig. 17). The mature larva of the parasitoid usually occupied the space from the second or third thoracic segment to the eighth abdominal segment. The adult larva of the parasite is ca 0.75 mm long and ca 0.56 mm wide. The body of the pupa of the parasitoid is black with a metallic sheen and well chitinized. The parasites brought about the death of L₃ of *S. atomarium*.

**Head growth of larval instars and growth factor (GF)**

Figs 18, 19

Deviations of the mean dimensions of the heads of individual larval stages from the theoretical dimensions are shown in Figures 18, 19. Analysis of the ratios of the head sizes of larval instars does not clearly result in a single growth factor. GF between L₁ and L₂ is 1.43 and between L₂ and L₃ it is 1.75.

![Figure 18. Mean real and average theoretical head lengths of *Squamapion atomarium* larval stages.](image1)

![Figure 19. Mean real and average theoretical head widths of *Squamapion atomarium* larval stages.](image2)
The morphology of the immature stages of *Squamapion atomarium*

**Discussion**

Among species of the genus *Squamapion*, only *S. elongatum* (Germar, 1817) has previously been described, and the existing data on *S. atomarium* concern only its habitat and host plants, with an equal role ascribed to *T. serpyllum* and *T. pulegioides* (Burakowski et al. 1992; Łętowski et al. 2015). The present study has shown that the preferred plant species is broad-leaved thyme (*T. pulegioides*), on which more galls were observed. This is most likely linked to the environment inhabited by *S. atomarium*, where this species of thyme is more common. Another new observation is the site of oviposition and galls. According to Burakowski et al. (1992), the larva feeds on the upper part of the stem. In the present study, the eggs were usually laid in the lower part of the stem.

The morphology of the L₃ larva and pupa of *S. atomarium* does not differ from the typical characters of the subfamily Apioninae (Alonso-Zarazaga and Wanat 2014). These features are the strongly convex and C-shaped body, colour, subglobose head, coronal suture and endocarinal line, clearly visible stemmata close to the frontal suture; numbers of *des*, *les* and *fs*; transverse and trapeziform clypeus with one pair of *cls* and one pair of *clss*; chaetotaxy of the labrum and epipharynx; mandible chaetotaxy; morphology and chaetotaxy of the maxilla and labium; thoracic segments with a prodorsum and postdorsum; very small prodorsum of the pronotum; morphology and chaetotaxy of the pro-, meso- and metanotum, except the number of *as*, with three pairs in *S. atomarium*; mesothoracic spiracles on the membrane between the pro- and mesothorax; and the abdominal morphology and chaetotaxy, except for the presence of *lsts* on the 8th abdominal segment in *S. atomarium*.

Thus the immature stages of the species are generally very similar in their morphology to those described by Łętowski (1991) for *Synapion ebeninum* (Kirby, 1808), *Stenopterapion intermedium* (Eppelsheim, 1875) and *Metatrichapion reflexum* (Gyllenhal, 1833), by Gosik et al. (2010) for *Diplapion confluens* (Kirby, 1808), or by Wang et al. (2013) for *Pseudaspidapion botanicum* Alonso-Zarazaga & Wang, 2011. *Squamapion atomarium* was also confirmed to possess an apomorphic trait of Apioninae emphasized by Marvaldi (2003), namely a lack of spiracles beginning in the eighth abdominal segment. There are differences in body size and in the number and distribution of setae (see Łętowski et al. 2015).

In the comparative analysis of the egg and L₃ larva of *S. atomarium* and *S. elongatum*, the two species are distinguished by differences in the size of both the egg and the L₃ larvae – in *S. atomarium* they are about half the size as in *S. elongatum* (Łętowski et al. 2015). Similar differences are found in the width of the epicranium of the two species, the shape of the head, and some features of their chaetotaxy. The differences are presented in Table 1.

The case of the pupa is similar. There are clearly visible differences between species in body size and chaetotaxy. The body of the pupa of *S. atomarium* is shorter than that of *S. elongatum* (1.5–2.0 times) and has far fewer abdominal setae (Table 2). There are also minor differences in body colour. Similar proportions of body length are found in adults.

The study and descriptions of additional species of the genus *Squamapion* will make it possible to distinguish and describe its generic characters.
Table 1. Character comparison between L₃ *Squamapion atomarium* and *Squamapion elongatum*.

| Trait                                | Species                      |                  |
|---------------------------------------|------------------------------|-----------------|
|                                       | *Squamapion atomarium*       | *Squamapion elongatum* |
| Body mm (length/width)                | ca 1.36/ca 0.66              | ca 2.78/ca 1.24 |
| Setae                                | shorter, with pointed ends   | longer          |
| Head                                 | slightly egg-shaped          | oval            |
| Antennae                             | 4 sensilla                   | 2 sensilla      |
| Number of setae on maxillary palpus  |                              |                 |
| basal segment                        | 1 seta, 1 sensillum          | 1 seta, 2 sensilla |
| distal segment                       | none                         | 1 short sensillum |
| Labrum/epipharynx                    |                              |                 |
| *ams*                                | 2 pairs (*ams1–2*)           | 3 pairs(*ams1–3*) |
| *als*                                | 2 pairs                       | 3 pairs         |
| *lr*                                 | large, widening towards outer margin of epipharynx | narrow |
| Labium with *pms*                    | 3 pairs(*pms1–3*)            | 2 pairs(*pms1 and pms3*) |
| Number of conical papillae *dms*     | 4                            | 5               |
| Number of setae *prns* on pronotum   | 7                            | 5               |
| Number of setae *pda*                | 3                            | 2               |
| Number of setae *si*                 | 2                            | 3               |

Table 2. Character comparison between the pupa of *Squamapion atomarium* and *Squamapion elongatum*.

| Trait                                | Species                      |                  |
|---------------------------------------|------------------------------|-----------------|
|                                       | *Squamapion atomarium*       | *Squamapion elongatum* |
| Body mm (length/width)                | ca 1.51/ca 0.84              | ca 2.67/ca 0.94 |
| Colour                               | creamy-white                 | whitish-grey    |
| Head setae                           | 1 pair *sos*, 1 pair *rs*    | 1 pair *vs*, 1 seta *rs* |
| Pronotum                             | 1 pair *as* (*as1*), 2 pairs *ls* (*ls1,2*) | 2 pairs *as* (*as1,2*), 1 pair *ls* |
| Metanotum                            | 2 pairs of setae             | 3 pairs of setae |
| Abdomen                              | only 1 pair of setae of I–VII abdominal segments | absent |
| Abdomen                              |                               |                 |
| lateral part                         | AbI-III: 7 pairs,            |                 |
| dorsal part                          | AbIV-VI: 5 pairs,            |                 |
|                                       | AbVII: 3 pairs,              |                 |
|                                       | AbVIII: 1 pair               |                 |
| Urogomphi                            | flattened bifurcation, straight | crescent-shaped, narrow |

Analysis of the growth rate and the ratio of actual and theoretical average head sizes produced some discrepancies that may have been influenced by the fact that the individuals were not divided by sex or collection site, and thus may have represented different populations.

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The morphology of the immature stages of Squamapion atomarium

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