

**DESCRIPTIONS OF PUPARIA OF AFROTROPIC SPECIES  
OF *BETASYRPHUS* MATSUMURA (DIPTERA, SYRPHIDAE)**

Libor Mazánek<sup>1</sup>, Pavel Láska<sup>1</sup>, Vítězslav Bičík<sup>1</sup>, Jindra Dušek<sup>2</sup>, Radko Novotný<sup>3</sup>

<sup>1</sup>Department of Zoology, Natural Science Faculty, Palacký University,  
Tř. Svobody 26, 771 46 Olomouc, Czech Republic  
(e-mail: Mazanek@risc.upol.cz, Flagell@risc.upol.cz)

<sup>2</sup>Institute of Applied Entomology, University of Agriculture, Zemědělská 1,  
613 00 Brno, Czech Republic

<sup>3</sup>Department of microscopic methods, Faculty of Medicine, Palacký University,  
I. P. Pavlova 35, 775 00 Olomouc Czech republic  
(e-mail: rnov@tunw.upol.cz)

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**Abstract**

A description of the puparia of Afrotropic species of genus *Betasyrphus* Matsumura, 1917 are given. Empty puparia were examined. Posterior respiratory process of species *B. claripennis* (Loew, 1858), *B. inflaticornis* (Bezzi, 1915), *B. luci* (Curran, 1938) was drafted and photographed. The puparia of three species near species *B. adligatus* (Wiedemann, 1824) are described.

**Introduction**

Schmutterer (1972) was dealing with the food ecology of immature stages of East-African Syrphidae, but did not describe the larvae and puparia. We asked Prof. Schmutterer for his material and he generously sent us all his empty puparia with reared adults. Most of his material belongs to the genus *Betasyrphus*. Unfortunately, the genus *Betasyrphus* needs revision, that is why we were not able to determine precisely the reared adults. Schmutterer's material has not been described up to now so far, even if it contains very interesting puparia. We do not want to wait for the revision of this genus, because the obtained material is sufficient for the description of

generic characters and intrageneric variability of puparia. We describe three determined species and three undetermined species similar to *B. adligatus*. The examined African species were included in genus *Betasyrphus* by Vockeroth (1969) and no immature stages have been described till now. Only the immature stages of the Asiatic species *Betasyrphus serarius* (Wiedemann, 1830) were described by Ninomyia (1959) in Japanese and included in the English key by Okuno (1967).

As for terminology we follow our previous terms in English used by Dušek & Láška (1964). We use the term orificium (Wimmer, 1925) instead of spiracles or slits, the term periorificial ornamentation is used in analogy of fundamental work of Bhatia (1939) instead of interspiracular ornamentation. Abbreviation: PRP = Posterior respiratory process. The length of PRP was measured in vertical view to the anterior side of PRP.

### **Description of puparium of genus *Betasyrphus***

Cask like puparium regularly convex above, somewhat similar to *Scaeva* – *Eupeodes* group, but posterior part more elongated with usually expressive dorsal keel (only species *B. inflaticornis* has less expressive keel). Keel gently alternating in PRP so that the base of PRP is not often distinct from above. Empty puparium light to dark brown, almost unicolorous, range of dorsomedial spots usually hardly visible. Segmental spines well developed, like in *Eupeodes*, but usually longer, about 0.11 mm to 0.24 mm according to species, more or less dark coloured. Rest of fleshy papillae absent, also on dorsal part of body. Integumental spines present as in *Scaeva* group, about 0.02–0.05 mm long (can be less developed in species B). Integumental spines more or less conical with varied shape according to species and the location, with broader basis (except of species C) than in *Scaeva* and *Eupeodes* (except for *E. corollae* with short spines on anterior part of body). Integumental spines usually more developed on the posterior part of puparium, especially in places posteriorly of the PRP, unicolorous (pale to brown) except some black spines around black segmental spines in species C and except darkened spines of dorsomedial spots, not arranged in dorsolateral pattern as in *E. corollae*.

PRP short (0.2–0.38), often with much longer anterior sclerotized side than short posterior sclerotized side, where the spiracular plate is somewhat sessile on nodular portion, so that the spiracular plate is oblique to the surface of puparium. Carinae of orificia I and II well developed, high similarly as in *Scaeva* and *Eupeodes*. Dorsal spur in most species (not of *E. claripennis* and species C) much more developed than in *Scaeva* or *Eupeodes*. Orificia I and III almost opposite or in angle about 130°. Angle between orificia II and III about 90°. Distance between median ends of orificia I and III variable according to species. Periorificial ornamentation hardly visible.

Cephalopharyngeal skeleton similar as in other aphidophagous species with somewhat bent, strong and pointed labium. Mandibulae weak especially in smaller specimens.

***Betasyrphus claripennis* (Loew, 1858)**

(Figs. 1, 2, 13, 14, 15, 16. Photos. 1, 2)

Puparium regularly convex above except small part just before PRP. Posterior end of puparium narrow with expressive dorsal keel. Whole puparium about 5.5–7 mm long, 2.5–3 mm broad, 2.4–3 mm high. Empty puparium unicolorous light brown, with hardly visible dorsomedial spots. Segmental spines distinct, light brown, about 0.16–0.22 mm long (including 0.03–0.05 mm of broadened basal part). Integument covered by unicolorous small, blunt triangular thorns from about 0.02 mm, on anterior part, to 0.04 mm on posterior end of puparium.

Posterior part of puparium keel-like above, just at the end keel gently altering in PRP, so that the base of PRP is not clear. The length from base of nodular portion to apex of dorsal spur about 0.3 mm. Nodular portion about 0.08 mm broad. The width of spiracular plate about 0.4 mm apically, the height 0.23–0.28 mm. The posterior margin of spiracular plate almost sessile, so that spiracular plate is oblique. Orificia I and II on distinct dark carinae. Dorsal spur large about 0.06 mm high, much higher than carina I, rounded in lateral view. Orificia I and III almost opposite. Distance between median ends of orificia I and III about 0.06–0.085 mm, shorter than length of orificium I.

**Examined material.** Africa, Kenya, Nairobi: 1♂ 24. 9. 1970 on *Macrosiphum rosae*; 1♂ 1♀ 27. 9. 1970 on *Brachycaudus aegyptica*; Chiromo 1♀ 25. 9. 1970 on *Aphis fabae*. All leg. and reared by Schmutterer.

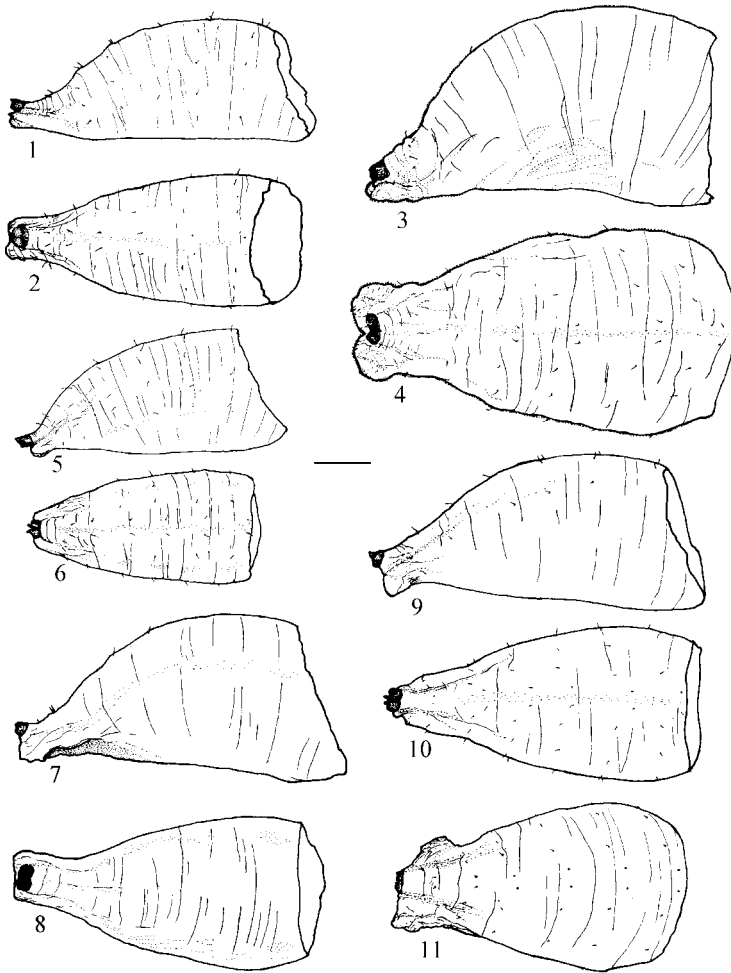
***Betasyrphus inflaticornis* (Bezzi, 1915)**

(Figs. 3, 4. Photos. 3, 4)

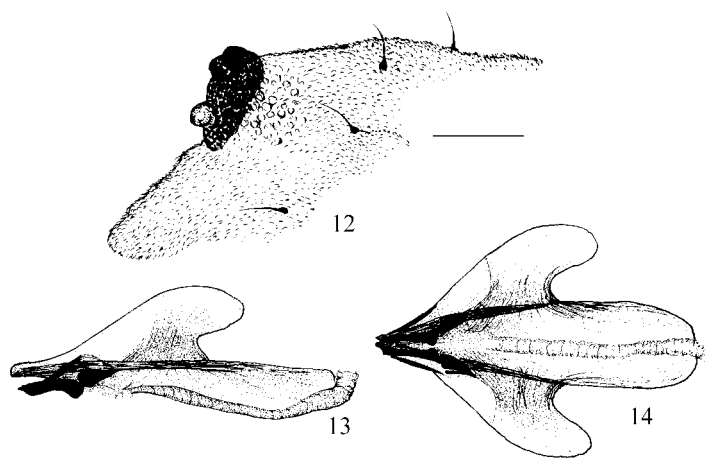
Puparium regularly convex above except small part just before PRP. Posterior end of puparium broad, with inexpressive dorsal keel. Whole puparium about 7.5–8 mm long, 3.7–3.9 mm broad, 3.5–3.8 mm high. Empty puparium dark brown, with hardly visible range of dorsomedial spots. Segmental spines distinct, often darkened, particularly on the posterior part of puparium, about 0.14 mm long (including 0.04–0.05 mm of broadened basal part). Integument covered by sharp unicolorous brown thorns with broadened basal part. The length of thorns is about 0.03 mm, on posterior end of the puparium 0.05 mm.

PRP somewhat submerged on the posterior end of inexpressive keel. PRP short, from base to the apex of dorsal spur about 0.2–0.23 mm long. Nodular portion absent. The width of spiracular plate 0.45–0.5 mm apically, the height 0.26–0.28 mm. Spiracular plate sessile on the posterior margin, so that spiracular plate is very oblique to the surface of puparium. Orificia I and II on distinct black carinae. Dorsal spur small, about 0.03 mm, not higher than carina I. Angle of orificia I and III about 130°. Distance between median ends of orificia I and III great, about 0.15 mm, longer than length of orificium I.

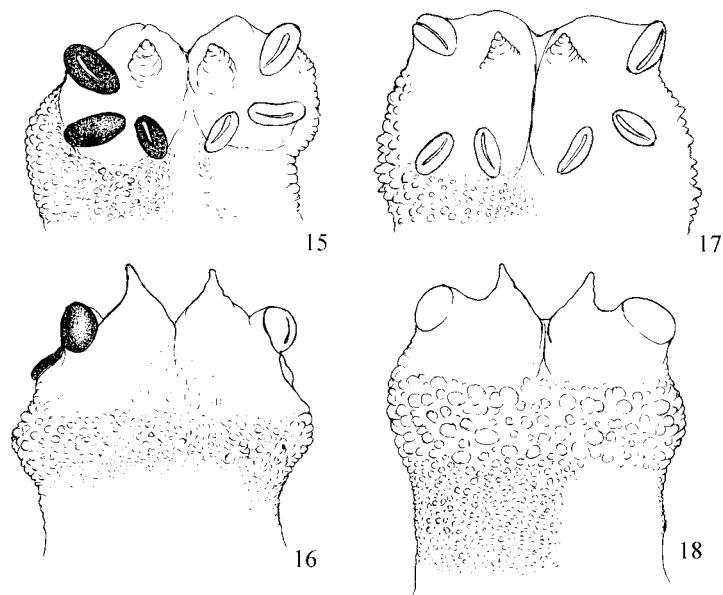
**Examined material.** Africa, Hunter's lodge, 3♀ 22. 10. 1970 on *Toxoptera citridis*, leg. and reared by Schmutterer.



**Figs. 1–11:** Puparia of *Betasyrphus* species (1, 3, 5, 7, 9 – lateral view, 2, 4, 6, 8, 10, 11 – dorsal view): 1, 2 – *claripennis* (Chiromo). 3, 4 – *inflaticornis* (Hunter's lodge). 5, 6 – *luci* (Nairobi, 14. 2. 1971). 7, 8 – sp. A (Nairobi, 23. 9. 1970). 9, 10 – sp. B (Nairobi, 24. 9. 1970). 11 – sp. C (Nairobi, 10. 9. 1970). Scale bar: 1 mm.



**Figs. 12–14:** 12 – *Betasyrphus* sp. C (Nairobi, 15. 1. 1971) posterior part of puparium in lateral view. 13, 14 – cephalopharyngeal skeleton of the third instar larva of *B. claripennis* (Nairobi, 24. 9. 1970): 13 – lateral view, 14 – dorsal view. Scale bars: 0.2 mm.



**Figs. 15–18:** Posterior respiratory process: 15, 16. *B. claripennis* (Chiromo): 15 – spiracular plate, 16 – from above. 17, 18 *B. sp. A* (Nairobi, 3. 2. 1970): 17 – spiracular plate, 18 – from above. Scale bar: 0.25 mm.

***Betasyrphus luci* (Curran, 1938)**

(Figs. 5, 6. Photo. 5)

Puparium regularly convex above except small part just before PRP. Posterior end of puparium narrow with expressive dorsal keel. Whole puparium about 4.5–6 mm long, 2.2–2.7 mm broad, 2–2.5 mm high. Empty puparium brown, with visible range of dorsomedial spots in posterior part of puparium. Segmental spines well developed, darkened, about 0.16–0.19 mm long (including 0.03–0.05 mm of broadened basal part). Integument covered by pale brown (on dark dorsomedial spots seems to be dark brown), pointed, triangular thorns shorter than 0.02 mm (on posterior end of the puparium its length = 0.025 mm).

Posterior part of puparium keel-like above, just at the end keel gently altering in PRP. The length from base of nodular portion to apex of dorsal spur about 0.3 mm. Nodular portion about 0.08 mm broad. The width of the spiracular plate 0.32–0.4 mm apically, the height 0.19–0.25 mm. Posterior sclerotized side of PRP shorter, so that spiracular plate is oblique. Orificia I and II on distinct blackened carinae. Dorsal spur large, about 0.06 mm high, much higher than carina I, rounded in lateral view. Orificia I and III opposite. Distance between median ends of orificia I and III great, about 0.1 mm, longer than length of orificium I.

**Examined material.** Africa, Kenya, Nairobi: 1 ♀ 14. 2. 1971 on *Myzus ornatus*, leg. Mr. Kenga, reared by Schmutterer (angle of orificia I and III about 140°, integument covered by small blunt almost nodular thorns shorter than 0.02 mm); 3 ♀ ♀ 5. 9. 1970 on *Neophyllaphis grobleri*, leg. and reared by Schmutterer.

***Betasyrphus* sp. A cf. *adligatus* (Wiedemann, 1824)**

(Figs. 7, 8, 17, 18. Photos. 6, 7)

Puparium regularly convex above except small part just before PRP. Posterior end of puparium narrow with expressive dorsal keel. Whole puparium about 6.5–8 mm long, 3.1–3.8 mm broad, 3–3.7 mm high. Empty puparium light brown, without dorsomedial spots. Segmental spines distinct, often darkened apically, about 0.16–0.24 mm long (including 0.05–0.06 mm of broadened basal part). Integument covered by pale brown, pointed slender thorns from about 0.03 mm on anterior part to 0.06 mm on posterior end of puparium.

Posterior part of puparium keel-like above, just at the end keel gently altering in PRP, so that the base of PRP is not clear. The length from base of nodular portion to apex of dorsal spur about 0.3 mm. Nodular portion about 0.06 mm broad. The width of spiracular plate about 0.47 mm apically, the height about 0.25 mm. The posterior margin of spiracular plate sessile, so that spiracular plate is oblique. Orificia I and II with distinct darkened carinae. Dorsal spur about 0.05 mm high, higher than carina I, rounded in lateral view. Orificia I and III almost opposite. Distance between median ends of orificia I and III great, about 0.1, longer than length of orificium I.

**Examined material.** Africa, Kenya, Nairobi: 1 ♂ 3. 2. 1970 on *Aphis fabae solanella*; 1 ♂ 23. 9. 1970 on *Brevicoryne brassicae*. All leg. and reared by Schmutterer.

***Betasyrphus* sp. B cf. *adligatus* (Wiedemann, 1824)**

(Figs. 9, 10. Photo. 8)

Puparium regularly convex above except small part just before PRP. Posterior end of puparium narrow with expressive dorsal keel. Whole puparium about 6–7 mm long, 2.8–3.3 mm broad, 2.8–3.3 mm high. Empty puparium light brown, with hardly visible range of dorsomedial spots. Segmental spines distinct, often somewhat darkened, about 0.14–0.20 mm long (including 0.03–0.05 mm of broadened basal part). Integument covered by small blunt almost nodular thorns shorter than 0.02 mm.

Posterior part of puparium keel-like above, just at the end keel gently altering in PRP, so that the base of PRP is not clear. The length from base of nodular portion to apex of dorsal spur 0.34–0.38 mm. Nodular portion 0.08–0.11 mm broad. The width of spiracular plate about 0.42 mm apically, the height about 0.25 mm. Posterior side of PRP short, so that spiracular plate is oblique. Orificia on distinct apically blackened carinae. Dorsal spur large about 0.06 mm high, much higher than carina I, with somewhat rounded apex in lateral view. Orificia I and III opposite. Distance between median ends of orificia I and III very short, about 0.05–0.07 mm, distinctly shorter than length of orificium I.

**Examined material.** Africa, Kenya, Nairobi: 1 ♀ 29. 7. 1970 on *Hyperomyzus lactucae*; Taila Hills, 1 ♂ 1 ♀ 23. 10. 1970 on *Sorenicorgae brassicae*; 2 ♀ ♀ 24. 9. 1970 on *Hyperomyzus lactucae*; Chiromo, 1 ♀ 1 ♂ 14. 9. 1970 on *Aphis fabae* (?). All leg. and reared by Schmutterer.

***Betasyrphus* sp. C cf. *adligatus* (Wiedemann, 1824)**

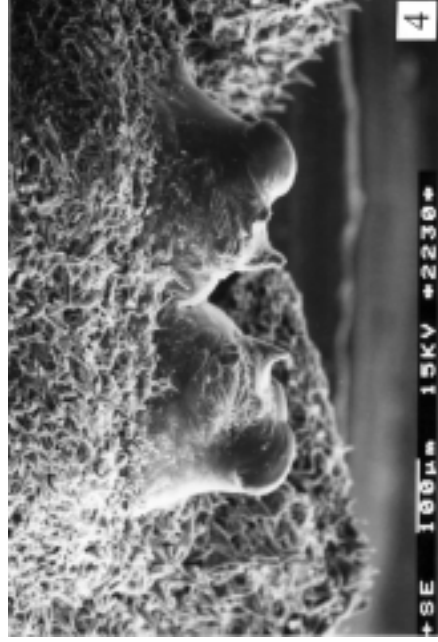
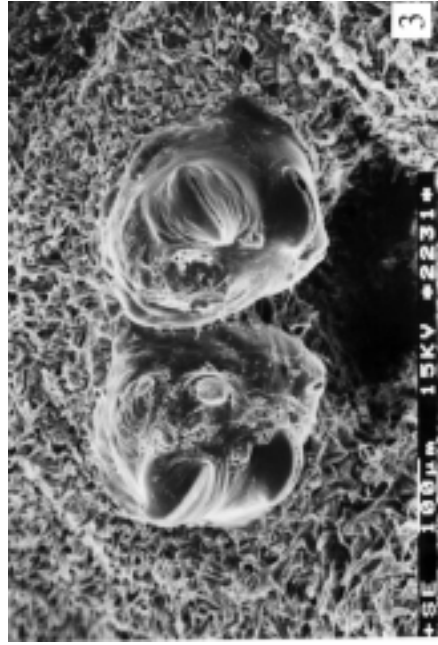
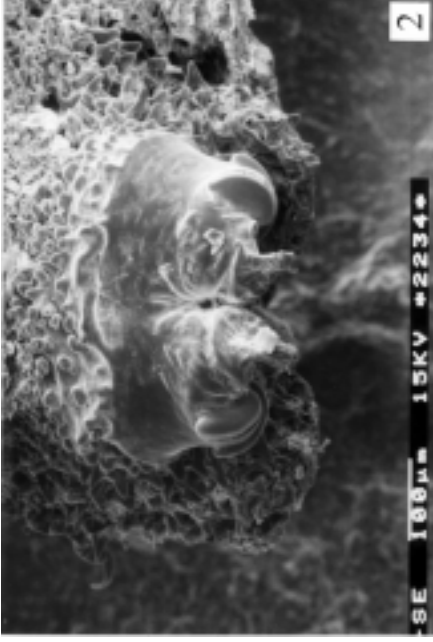
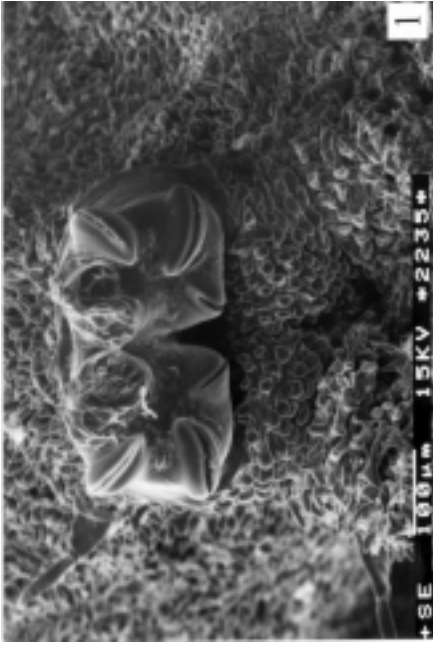
(Figs. 11, 12)

Puparium almost regularly convex above. Posterior end of puparium broad with less expressive dorsal keel. Whole puparium about 6.5–7 mm long, 3 mm broad, 3 mm high. Empty puparium unicolorous brown, range of dorsomedial spots more or less visible. Segmental spines distinctly black, short, about 0.11–0.13 mm long (including about 0.03 mm of broadened basal part), often some darkened integumental thorns around spines. Integument covered by pin like thorns with broadened base, about 0.02 mm long, the longest thick thorns on posterior end of puparium about 0.05 mm.

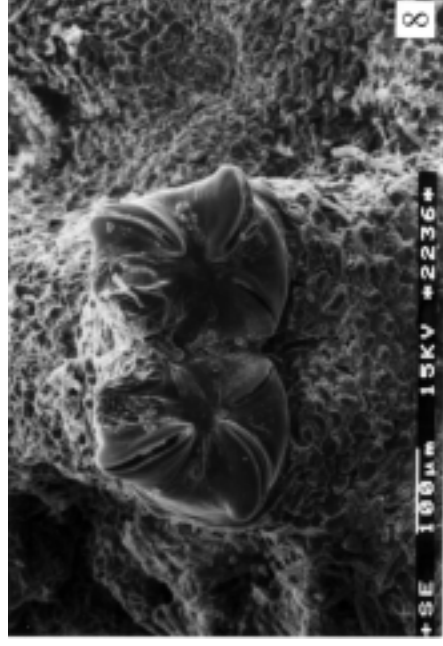
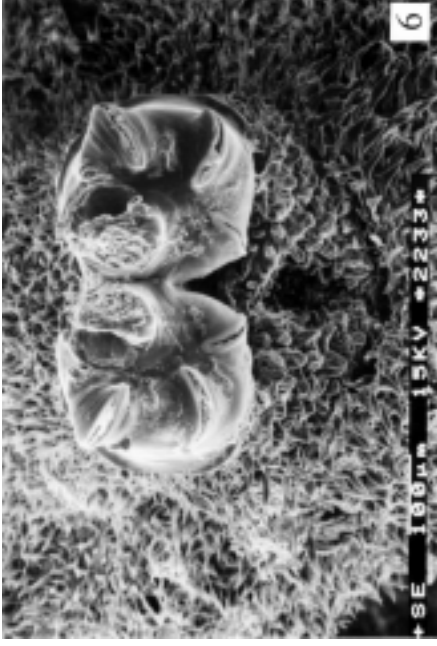
PRP somewhat submerged on the posterior end of keel. The length from base to apex of dorsal spur about 0.2 mm. Nodular portion almost absent. The width of spiracular plate about 0.4 mm apically, the height about 0.21 mm. Spiracular plate oblique. Orificia on distinct black carinae. Dorsal spur about 0.03 mm high, as high as carina I, sharper in lateral view. Angle of orificia I and III about 140°. Distance between median ends of orificia I and III about 0.1 mm.

**Examined material.** Africa, Kenya, Nairobi: 1 ♀ 15. 1. 1971 on *Macrosiphum rosae* (KENYA, C.I.E. A5020); 1 ♂ 10. 9. 1970 on *Aphis fabae solanella*. All leg. and reared by Schmutterer.

**Photos. 1–4:** Posterior respiratory process: 1, 2. *B. claripennis* (Chiromo): 1 – spiracular plate, 2 – from above. 3, 4 – *B. inflaticornis* (Hunter's lodge): 3 – spiracular plate, 4 – from above.



**Photos. 5-8:** Posterior respiratory process: 5 – *B. luci* (Nairobi, 5. 9. 1970) spiracular plate, 6, 7 – *B. sp. A* (Nairobi, 23. 9. 1970): 6 – spiracular plate, 7 – from above, 8 – *B. sp. B* (Chiromo, ♀) spiracular plate.



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## References

- BHATIA, M. L. (1939): Biology, morphology and anatomy of aphidophagous Syrphid larvae. *Parasitology* 31: 78–129.
- DUŠEK, J. & LÁSKA, P. (1964): A contribution to distinguishing the European species of the subgenus *Syrphus* Fabricius (Diptera, Syrphidae) according to male genitalia and larvae. *Acta. Soc. Ent. Českoslov.* 61: 58–70.
- NINOMIYA, E. (1959): Further Notes on the Immature Stages of Aphidophagous Syrphid Flies of Japan (in Japanese). *Science Bulletin of the Faculty of Liberal Arts and Education Nagasaki University*, No. 10: 23–52.
- OKUNO, T. (1967): On the syrphid larvae attacking the aphids in Japan (Diptera). *Mushi* 41(10): 123–141.
- SCHMUTTERER, H. (1972): Zur Beutespezifität polyphager, räuberischer Syrphiden Ostafrikas. *Zeitsch. angew. Entomol.* 71: 278–286.
- VOCKEROTH, J.R. (1969): A revision of the genera of the Syrphini (Diptera: Syrphidae). *Mem. Ent. Soc. Can.* 62: 1–176.
- VIMMER, A. (1925): Larvy a kukly dvojkřídleho hmyzu středoevropského se zvláštním zřetelem na škůdce rostlin kulturních. [The larvae and puparia of Diptera of Central Europe with special aspect on pests of cultivated plants]. Prague. 379 pp. (in Czech).



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