Russian Entomol. J. 13(3): 165–169

New data on the biology and distribution of the *Lathromeroidea silvarum* Nowicki, 1937 (Chalcidoidea: Trichogrammatidae) — an egg parasitoid of water beetles (Hydrophilidae and Dytiscidae)

Новые данные по биологии и распространению *Lathromeroidea silvarum* Nowicki, 1937 (Chalcidoidea: Trichogrammatidae) — паразита яиц водных жуков (Hydrophilidae, Dytiscidae)

V.N. Fursov
В.Н. Фурсов

I.I. Schmalhausen Institute of Zoology, Ukrainian Academy of Sciences, 15 Bogdan Khmelnitskiy Street, Kiev-30 01601 Ukraine. E-mail: v_fursov@yahoo.com
Институт зоологии им. И.И.Шмальгаузена НАН Украины, ул. Б. Хмельницкого 15, Киев-30 01601 Украина.

KEY WORDS: aquatic wasp, swimming, egg parasitoid, *Lathromeroidea,* Trichogrammatidae, Hymenoptera, Hydrophilidae, Dytiscidae, Palaearctics.

КЛЮЧЕВЫЕ СЛОВА: водный наездник, плавание, яйцеед, *Lathromeroidea,* Trichogrammatidae, Hymenoptera, Hydrophilidae, Dytiscidae, Палеарктика.

ABSTRACT: Males and females of *Lathromeroidea silvarum* Nowicki, 1937 were reared from eggs of water scavenger beetles (Hydrophilidae) and predaceous water diving beetles (Dytiscidae) in rice paddy fields in Japan for the first time. Recorded hosts are *Berosus punctipennis* Harold, *B. lewisius* Sharp (Hydrophilidae), *Rhantus pulverosus* (Stephens) and *Eretes sticticus* (L.) (Dytiscidae). Egg parasitoids of the family Hydrophilidae are reported for the first time. A description of morphology and biology of *L. silvarum* is given. The previously unknown male of *L. silvarum* is described. The unique capability of *L. silvarum* to swim under the water with the help of wings is reported. The genus *Lathromeroidea* and *L. silvarum* are recorded for the first time for the fauna of Japan. *L. silvarum* is widely distributed in the Palaearctic region.

РЕЗЮМЕ: Самки и самцы водного наездника *Lathromeroidea silvarum* Nowicki, 1937 впервые выведены из яиц жуков-водолюбов (Hydrophilidae: *Berosus punctipennis*, *B. lewisius*) и жуков-плавунцов (Dytiscidae: *Rhantus pulverosus* и *Eretes sticticus*), собранных на рисовых полях в Японии. Впервые обнаружены паразиты яиц жуков-водолюбов. Приводится описание морфологии и особенностей биологии *L. silvarum*. Впервые описаны самцы *L. silvarum.* Впервые для рода *Lathromeroidea* обнаружена уникальная способность имаго к плаванию под водой при помощи крыльев. Наездники *L. silvarum* впервые обнаружены в фауне Японии. Показано, что *L. silvarum* широко распространён в Палеарктике.

Introduction

The genus *Lathromeroidea* is known as a group of egg parasitoids of aquatic insects and some grasshoppers. The species *L. odonatae* was described from eggs of a damselfly of the genus *Lestes* (Lestidae) in the USA [Ashmead, 1900]. Another species, *L. ajmerensis*, was recorded in India from eggs of *Nephotettix* sp. (Homoptera, Cicadellidae) [Yousuf & Shafee, 1987]. An undescribed species of *Lathromeroidea* was reared in Canada from eggs of the two genera of water bugs, *Gerris* and *Limnoporus* (Gerridae) [Henriquez & Spence, 1993]. The genus *Lathromeroidea* includes 8 described species (*L. odonatae* Ashmead, 1900; *L. ajmerensis* Yousuf et Shafee, 1987; *L. angustipennis* Yousuf et Shafee, 1984; *L. domestica* Girault, 1920; *L. nigra* Girault, 1912; *L. nigrella* Girault, 1912; *L. silvarum* Nowicki, 1937 and *L. trichoptera* Lin, 1994).

Material and methods

Specimens of egg parasitoids (*L. silvarum*) were collected by the author in various localities of the Ukraine, Russia and Japan. Egg-parasitoids were collected with a sweep net and reared from eggs of various hosts (Hydrophilidae and Dytiscidae) in the laboratory. Most rearing was done at the Laboratory of Entomology, National Agriculture Research Center, Tsukuba, Japan in June–August 1997.

Collection was done in various aquatic habitats with a range of vegetation. Many specimens were collected at the rice paddy fields near Tsukuba-city (Ibaraki Pref., Japan). Although rice paddy fields are temporary aquat-

ic reservoirs, they are common habitats of aquatic beetles (Hydrophilidae and Dytiscidae), especially in the first half of summer. It was observed that some water scavenger beetles (Hydrophilidae) often lay egg cocoons on the surface of living leaves of water plants (*Potamogeton* sp., *Alisma* sp. and *Sagittaria* sp.) and rice (*Oryza sativa* L.) floating on the water surface in the rice paddy fields. Water diving beetles (Dytiscidae) frequently lay their eggs inside outer leaf stalks of aquatic plants (such as *Alisma* sp., *Sagittaria* sp. and *Potamogeton* sp.) submerged in the water. The females of egg parasitoids easily parasitize the hosts' eggs when they are laid either inside stems of water plants or on the surface of the plants.

The specimens collected are deposited in the Schmalhausen Institute of Zoology, Kiev, Ukraine (SIZK) and Meijo University, Nagoya, Japan (MUNJ).

Results

The original description of *L. silvarum* was published in an obscure source, few specimens having been recorded only from Poland. The biology of this species was previously unknown. Adults of *L. silvarum* were first reared from eggs of aquatic beetles (Hydrophilidae and Dytiscidae) in Japan. This is the first record of egg parasitoids of the family Hydrophilidae. Adults of *L. silvarum* were also collected in the Ukraine and Far East Russia for the first time. *Lathromeroidea silvarum* is recorded as a new genus and a new species for the fauna of Japan. The male of *L. silvarum* was previously unknown, and it is described here for the first time. A redescription and original data on the biology of *L. silvarum* and its wide distribution are given here.

Lathromeroidea silvarum Nowicki, 1937
Figs. 1–12.

Lathromeroidea silvarum Nowicki, 1937: 137−139 [coll. in Poland; location of the types is unknown, and the types are likely to be lost].

Lathromeroidea nigrum Girault in Lin, 1994: 106−107 [misidentification].

EXAMINED MATERIAL. 30 ♂♂, 65 ♀♀, Japan, Ibaraki, near Tsukuba, Yawara, rice fields, 10.VI.−25.VIII.1997 (Fursov); reared from egg packages of *Berosus (Berosus) punctipennis* Harold, on rice leaves; 15 ♀♀, same locality and host, 20−25.VIII.1997 (Fursov), on leaves of *Potamogeton* sp.; 20 ♀♀, 8 ♂♂, Japan, Ibaraki, Tsukuba, Hanare, rice fields, 20.VI−20.VIII.1997 (Fursov), reared from egg packages of *Berosus (Enoplurus) lewisius* Sharp on rice leaves; 10 ♀♀, 4 ♂♂, same locality, 20.VII.1997, from egg cocoons of the same host, on leaves of *Alisma* sp. and *Sagittaria* sp.; 5 ♀♀, Japan, Ibaraki, near Tsukuba, Yawara, rice fields, 20−25.VIII.1997 (Fursov), reared from eggs of *Rhantus pulverosus* (Stephens) inside egg cocoons of *Hydrochara affinis* (Sharp); 4 ♀♀, same locality, 20−25.VIII.1997 (Fursov), reared from eggs of *Eretes sticticus* (L.) inside egg cocoons of *H. affinis*; 4 ♀♀, Japan, near Tsukuba, Yawara, 27.VII.1997 (Fursov), by sweeping (in collection of SIZK); 2 ♀♀, Japan, Tsuchikawa, Ojiya-shi, Niigata Pref., 7−13.VIII.1968 (K.Yamagishi); 4 ♀♀, Japan, Kyushu, Nagasaki, Kuchinotsu, 21.VIII.1978, slide 938; 28.VII.1978, slide 939; 1.VIII.1979, slide 940; 6.VII.1978, slide 941 (K.Takagi), in sticky traps (in collection of MUNJ); ♀, Russia, Far East, Primorsky Kray, Barabash-Levada, 28.08.1989 (Fursov); 5 ♀♀, 2 ♂♂, Ukraine, near Kiev, Makichukovo, 23.VIII.1990 (Fursov), sweeping on grass near water stream (in collection of SIZK).

DESCRIPTION. **Female**. Based on both dry and slide-mounted materials. Body black, wings with dark brownish spot in their basal part under veins. Body length 0.45–0.50 mm.

Eyes with short black hairs, face with 2 lateral setal lines, vertex with 6 long black post-ocellar setae, 1 ocellar-ocular seta and 1 long post-ocular seta.

Antenna (Fig. 1) with clava 2.78 times as long as its maximum width, 0.46–0.47 times as long as hind tibia, 1.17–1.24 times as long as scape; ratio of the length of the longest setae to the maximum width of clava = 1.03–1.09. Formula of sensillae of 1st–5th claval segments: long chaetoid sensillae — 1.(1–2).3.3.4; basiconic peg sensillae — (1–2).2.(1–2).1.1; placoid sensillae — 0.0.1.2.2; short hairs — 0.(7–8).6.(3–4).(2–3).

Mandibles have 2 large and 4 short teeth, 2 setae and 1 strong horn. Maxillary palps 1-segmented, elongate, 3.64 as long as wide, narrowed to apex, with 1 short hair, 1 strong seta and 1 horn; labial palps short, 1-segmented, with 3 short setae. Clypeus with median pattern.

Pronotum 2-lobed, with 10 strong setae close to its anterior margin and 2 short hairs, and with distinct cellular sculpture. Mesoscutum 1.08 times as wide as long, scutellum 1.97 times as wide as long. Both mesoscutum and scutellum with 4 equally-sized strong setae; length of setae / distance between posterior setae and posterior margin of mesoscutum = 1.05–1.15.

Fore wings (Fig. 4) elongate, 0.62 mm long, 2.53–2.6 times as long as wide. Submarginal vein with 2 long and 2 short hairs, marginal vein with 3 strong setae and 5–7 short hairs on anterior margin, 1 strong seta and 3 small hairs on posterior margin. Costal cell with 3 long setae and 2 short hairs. Radial vein with 3 small hairs; RS1 bears 10 long and strong setae; longest fringe setae 0.37 maximum wing width. Disc of fore wing with 15 distinct setal lines. Length of submarginal / marginal vein = 0.79–0.89. Length of marginal / radial vein = 2.21–2.36. Length / width of marginal vein = 5.77–6.29. Hind wing 10.88–11.68 times as long as wide, with 3 regular setal lines, longest fringe setae 1.77 maximum wing width.

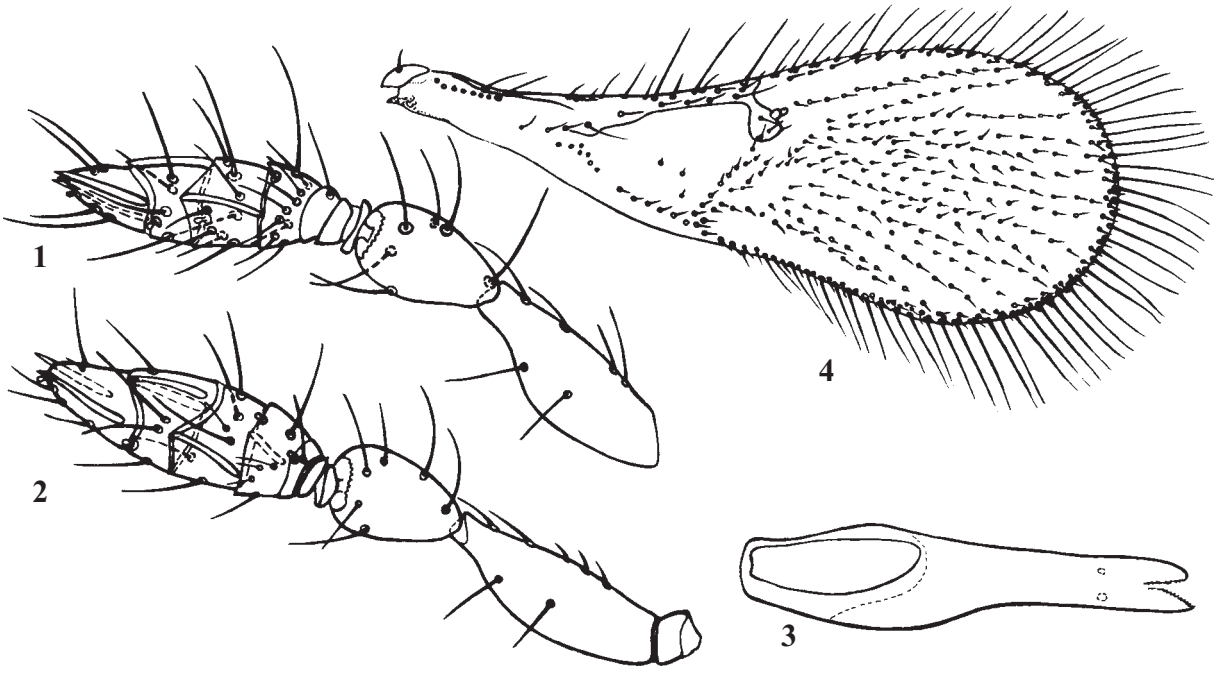
Propodeum short, with distinctly enlarged triangular median part, median triangle 2.35 times longer than length of postscutellum.

Fore tibia with 18 long setae and apical spur; tibial spur 0.83 times as long as basitarsus, longest seta 0.96 times as long as basitarsus. Mid tibia with 21–22 long setae and 1 long apical spur, spur 1.2 times as long as basitarsus; longest seta 1.12 times as long as basitarsus. Hind tibia with 24–27 long setae and 1 long apical spur, spur 0.52 times as long as basitarsus, longest seta 0.62 times longer than basitarsus.

First abdominal tergite with median striation and cellular lateral sculpture, each tergite I–VII with 4–5 lateral lines of strong black long setae. Abdominal setae 1.0–1.1 times longer than hind basitarsus. Abdominal sternite VII has 2 wide lobes with median pattern and 2 long median setae. Ovipositor long, slightly exserted, length of ovipositor / hind tibia = 1.71.

Male. Body length 0.4 mm. Body colour similar to that of female. Antenna (Fig. 2) with clava 2.9–3.1 times as long as its maximum width, 1.09–1.22 times as long as scape; length of the longest setae / maximum width of clava = 1.39. Scape 2.65–2.69 times as long as wide, with 3-4 strong setae and 3 hairs; pedicel with 5–6 setae and 1 hair.

Formula of sensillae of 1st–5th claval segments: long chaetoid sensillae — 1.1.2.1.4; basiconic peg sensillae — 0.1.1.1.(1–2); placoid sensillae — 0.0.1.1.2; short hairs —



Figs. 1–4. *Lathromeroidea silvarum* Nowicki: 1 — female antenna, 2 — male antenna, 3 — male genitalia, 4 — fore wing of female.
Рис. 1–4. *Lathromeroidea silvarum* Nowicki: 1 — усик самки, 2 — усик самца, 3 — гениталии самца, 4 — переднее крыло самки.

0.(9–10).6.3.0. Fore wing 2.66 times as long as wide, longest fringe setae 0.33 times as long as maximum wing width; 15 discal setal lines similar to these of female. RS1 bearing 9 setae.

Genital capsule (Fig. 3) narrow, tube-like, with very narrow apical half and 2 small divided parts on top, 3.91 times as long as maximum width, with elongate dorsal aperture, dorsal aperture 0.39 times as long as genital capsule.

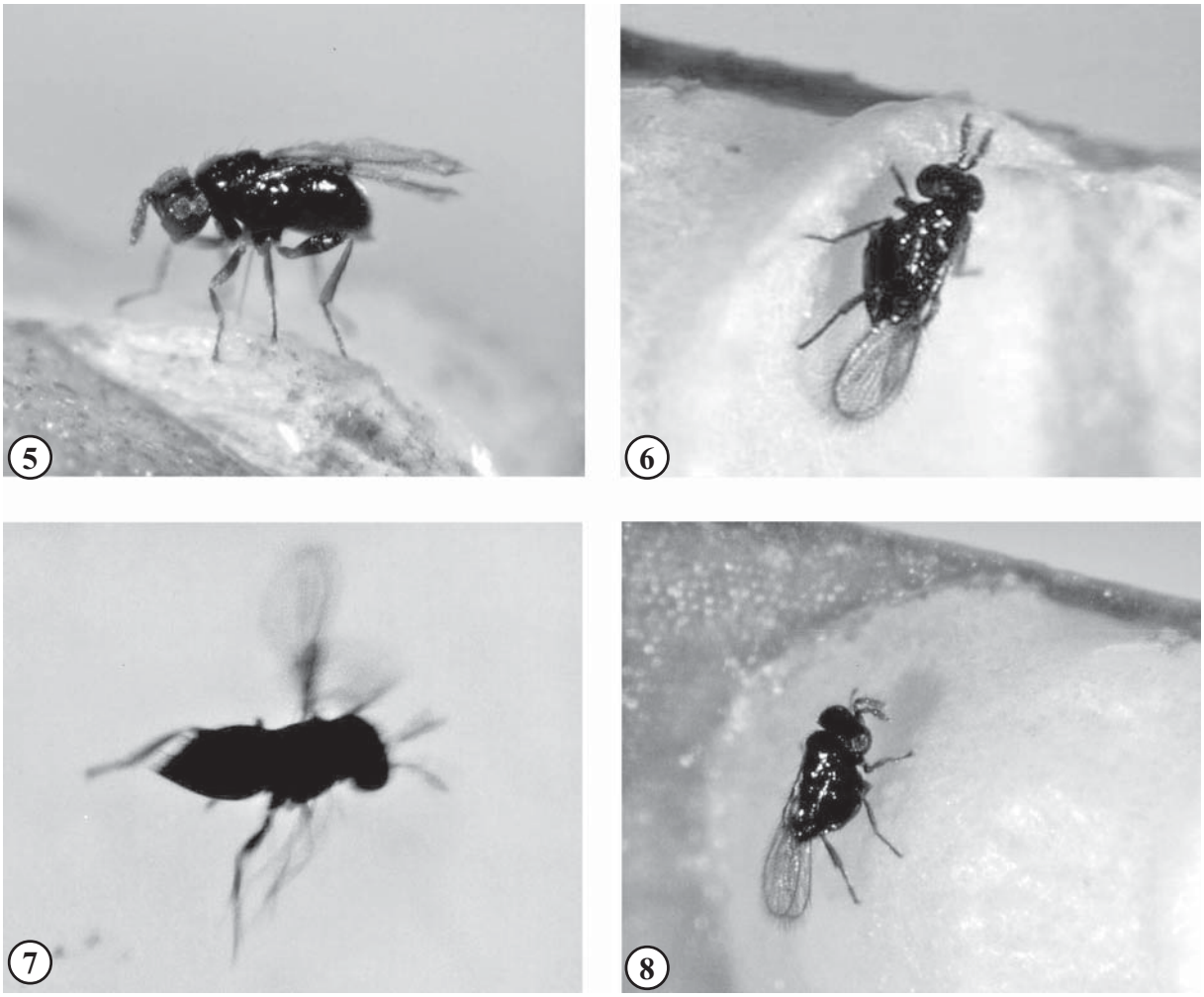
HOSTS. Aquatic beetles: *Berosus* (*Berosus*) *punctipennis* Harold, *Berosus* (*Enoplurus*) *lewisius* Sharp (Hydrophilidae), *Rhantus pulverosus* (Stephens) and *Eretes sticticus* (L.) (Dytiscidae).

BIOLOGY. Many specimens of *L. silvarum* were reared from eggs of two species of water scavenger beetles (Hydrophilidae): *Berosus (Berosus) punctipennis* Harold and *Berosus* (*Enoplurus*) *lewisius* Sharp, collected in rice fields. Fresh eggs of these hosts have also been laid on water plants in glass jars in the laboratory. These eggs were given to females of *L. silvarum* and successfully parasitized (Figs. 5, 6, 8–12). Developmental period of *L. silvarum* in the laboratory was 10–11 days at 25°C. Studied species of beetles (Hydrophilidae) laid eggs inside peculiar small egg cocoons (about 3–5 mm), covered by fine white web (similar to that of spiders), on the surface of leaves of water plants (*Potamogeton* sp., *Alisma* sp. and *Sagittaria* sp.) and rice leaves (*Oryza sativa*) that floated on the water surface in rice paddy fields. A single long leaf of a plant had several egg cocoons of beetles. Only one individual of *L. silvarum* developed inside a single egg of both studied species of Hydrophilidae (Fig. 9–12). About 10–12 individuals of *L. silvarum* were reared from large egg cocoons of *B. punctipennis* Harold, which contained a large group of eggs. Only 2–3 specimens of *L. silvarum* developed inside a small egg-cocoon of *B. lewisius* Sharp, which contained a small group of eggs.

Large egg-cocoons of *Hydrochara affinis* (Sharp), attached to floating leaves of rice, were collected in rice fields during June–July 1997. They were studied as a possible host of *L. silvarum*. Nevertheless, we did not find parasitized eggs of *H. affinis* inside cocoons. Females of *L. silvarum* did not parasitize large eggs of *H. affinis* in the laboratory. At the same time, we found some eggs of predaceous diving beetles (Dytiscidae) that were laid inside egg cocoons of *H. affinis*, probably after the emergence of *H. affinis* larvae. Eggs of *Rhantus pulverosus* (Stephens) and *Eretes sticticus* (L.) were found inside large open holes of egg cocoons of *H. affinis*. Some females of *L. silvarum* were reared from eggs of *R. pulverosus* (Stephens) and *E. sticticus* (L.) inside egg cocoons of *H. affinis*. During our studies, we did not observe the process of egg-laying of Dytiscidae inside egg cocoons of Hydrophilidae.

Egg parasitoids of water scavenger beetles (Hydrophilidae) are reported here for the first time. The chalcid wasp *Horismenus mexicanus* Burks (Chalcidoidea, Eulophidae) was recorded as a larval parasitoid of the water penny beetles (Psephenidae) which are similar to the water scavenger beetles in their behaviour [Burks, 1968; Schauff, 1991]. Egg parasitism on predaceous water diving beetles (Dytiscidae) was reported for several species of parasitic wasps of the families Trichogrammatidae, Mymaridae and Eulophidae [Rimsky-Korsakow, 1916, 1920, 1931; Jackson, 1961; Fursov & Kostjukov, 1987; Fursov, 1995; Shumakova et al., 2003].

BEHAVIOUR. Females and males of *L. silvarum* easily swim under the water using their wings (fig. 7). Wing movements under the water are relatively slow, but adults can easily penetrate water surface and walk upon it. Adults of *L. silvarum* also freely fly in the air. The unique phenomenon of underwater "flight" was reported for the first time for the mymarid wasp, *Caraphractus cinctus* Lubb. (Hymenoptera, Mymaridae) [Lubbock, 1863]. While moving in this way, in the water or air, aquatic egg-parasitoids can successfully find and parasitize eggs of their hosts. The unique capability of *L.*



Figs.5–8. *Lathromeroidea silvarum* Nowicki: 5 — female, ovipositing into eggs of *Berosus lewisius* Sharp; 6 — female, ovipositing into an egg cocoon of *B. punctipennis* Harold on a rice leaf; 7 — female, swimming under the water using wings; 8 — female, ovipositing into an egg cocoon of *Berosus lewisius* Sharp.

Рис. 5–8. *Lathromeroidea silvarum* Nowicki: 5 — самка, заражающая яйца жука *Berosus lewisius* Sharp; 6 — самка, заражающая яйцевой кокон жука *B. punctipennis* Harold на листе риса; 7 — самка, плавающая под водой при помощи крыльев; 8 — самка, заражающая яйцевой кокон жука *B. lewisius* Sharp.

silvarum to swim under the water with the help of wings was reported for the genus *Lathromeroidea* and in the family Trichogrammatidae as a whole for the first time. Species of other aquatic trichogrammatid genus *Prestwichia* are known to swim under the water by means of their legs. The capability to swim using wings was reported for several species of parasitic wasps of the families Mymaridae, Eulophidae and Scelionidae [Jackson, 1961; Masner, 1980; Fursov & Kostjukov, 1987; Fursov, 1995; Shumakova et al., 2003].

DISTRIBUTION. Ukraine, Poland, Far East Russia, China, Japan (Ibaraki, Niigata, Nagasaki Pref.).

ACKNOWLEDGEMENTS. I express sincere thanks to Dr K.Hirai (currently NIAES, Tsukuba, Japan) and Japan Science and Technology Corporation for the opportunity to undertake a part of this research at the National Agriculture Research Center (Tsukuba, Japan). I would like to express sincere thanks for kind help with material to Prof. K.Yamagishi (Meijo University, Nagoya, Japan) and Dr K.Takagi (Ushiku Plant Protection Association, Tsukuba, Japan). I appreciate the kind help of Prof. M. Sato (Nagoya Women's University, Japan) and Mr M.M. Bilyashivsky (Zoological Museum, Shevchenko State University, Kiev, Ukraine) for the identification of Hydrophilidae and Dytiscidae, respectively. I would like to thank Michael Cripps (University of Idaho, USA) for a linguistic review and corrections to the manuscript.

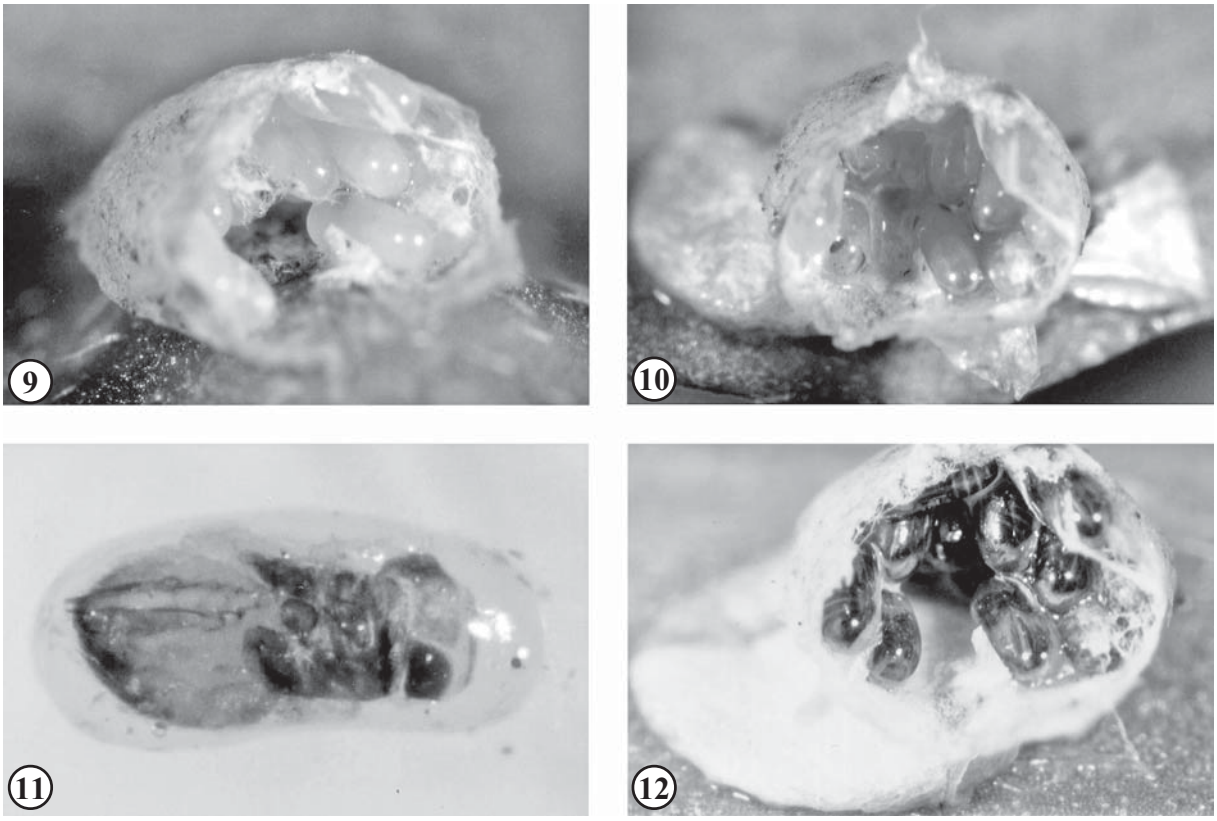
References

Ashmead W.H. 1900. Some hymenopterous parasites from dragonflies eggs // Entomological News. Vol.9. P.615–617.

Burks B.D. 1968. *Psephenus* (Coleoptera: Psephenidae) parasitized by a new chalcidoid (Hymenoptera: Eulophidae). 1. Description of the parasite // Annals of the Entomological Society of America. Vol.61. No.2. P.450–452.

Fursov V.N. 1995. A review of Chalcidoidea (Hymenoptera) parasitising the eggs of aquatic insects in Europe // Bulletin of Irish Biogeographical Society. No.18(1). P.2–12.

Fursov V.N. & Kostjukov V.V. 1987. New species of the genus *Tetrastichus* (Hymenoptera, Eulophidae), egg-parasites of damselflies and dragonflies and of predaceous diving beetles // Zoologicheskii Zhurnal. Vol.66. No.2. P.217–228 [in Russian, with English summary].



Figs. 9–12. *Lathromeroidea silvarum* Nowicki: 9, 10, 12 — parasitized eggs inside an egg cocoon of *B. punctipennis*: 9 — on the 1st day; 10 — on the 5th day; 12 — on the 10th day; 11 — pupa inside a host egg.

Рис. 9–12. *Lathromeroidea silvarum* Nowicki: 9, 10, 12 — заражённые яйца жука *B. punctipennis* внутри яйцевого кокона: 9 — на 1-й день, 10 — на 5-й день, 12 — на 10-й день; 11 — куколка наездника внутрия яйца жука.

Girault A.A. 1912. Australian Hymenoptera, Chalcidoidea. 1. The family Trichogrammatidae with descriptions of new genera and species // Memoirs of Queensland Museum. No.6. P.66–116.

Girault A.A. 1920. New genera and species of Australian Trichogrammatidae (Hymenoptera) // Insecutor Inscitae Menstruus: a monthly journal of entomology, Washington D.C. Vol.8. P.42–43, 199–203.

Henriquez N.P. & Spence J.R. 1993. Studies of *Lathromeroidea* sp. nov. (Hymenoptera: Trichogrammatidae), a parasitoid of gerrid eggs // The Canadian Entomologist. Vol.125. No.4. P.693–702.

Jackson D.J. 1961.Observations on the biology of *Caraphractus cinctus* Walker (Hymenoptera, Mymaridae), a parasitoid of the eggs of Dytiscidae. II. Immature stages and seasonal history with a review of mymarid larvae // Parasitology. Vol.51. P.269–294.

Lin N. 1994. Systematic studies of Chinese Trichogrammatidae (Hymenoptera: Chalcidoidea). Fujian: Fujian Science and Technology Publishing House, Fuzhou. 363 pp.

Lubbock J. 1863. On two aquatic Hymenoptera, one of which uses its wings in swimming // Transactions of Linnean Society, London. Vol.24. No.2. P.135–142.

Masner L. 1980. Key to genera of Scelionidae of the Holarctic region, with descriptions of new genera and species (Hymenoptera: Proctotrupoidea) // Memoirs of Entomological Society of Canada. No.113. P.1–54.

Nowicki S. 1937. Description of new genera and species of the family Trichogrammatidae (Hymenoptera, Chalcidoidea) from the Palaearctic region, with notes. II // Zeitschrift für angewandte Entomologie. Vol.28. H.4. P.114–118.

Rimsky-Korsakow M.N. 1916. Biological observations on aquatic Hymenoptera // Russian Entomological Review. Vol.16. No.3–4. P.209–225 [in Russian].

Rimsky-Korsakow M.N. 1920. Observations on variation and heredity of parasitic wasps // Trudy Petrogradskogo Obzhestva Estestvoispytatelej. Vol.51. Ser.1. No.5–6. P.89–111 [in Russian].

Rimsky-Korsakow M.N. 1931. Methoden zur Untersuchung von Wasserhymenopteren // Handbuch der biologischen Arbeitsmethoden. Berlin, Wien, Urban, Schwarzenberg. Bd.7. Hf.1. S.227–258.

Schauff M.E. 1991. The Holarctic genera of Entedoninae (Hymenoptera: Eulophidae) // Contributions of the American Entomological Institute Vol.26. No.4. P.1–109.

Shumakova I., Fursov V.N., Gladun D., Frantsevich L.I. 2003. Swimming in *Prestwichia aquatica* Lubbock (Hymenoptera, Chalcidoidea, Trichogrammatidae) // Entomologia Generalis. Hf.1. S.55–65.

Yousuf M. & Shafee S.A. 1984. First report of *Zaga* Girault and *Oligositoides* Doutt (Hymenoptera, Trichogrammatidae) from India, with descriptions of three new species // Mitteilungen der schweizerischen entomologischen Gesellschaft. Hf. 57. Nr.4. S.367–370.

Yousuf M. & Shafee S.A. 1987. Taxonomy of Indian Trichogrammatidae (Hymenoptera, Chalcidoidea) // Indian Journal of Systematic Entomology. Vol.4. No.2. P.55–200.