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ON THE NEST STRUCTURE IN TWO SPECIES OF THE GENUS *LEPTOCHILUS* (HYMENOPTERA, VESPIDAE, EUMENINAE)

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On the Nest Structure in Two Species of the Genus *Leptochilus* (Hymenoptera, Vespidae, Eumeninae). Fateryga A. V. — Two nests of the wasps *Leptochilus alpestris* (de Saussure, 1855) and *Leptochilus regulus* (de Saussure, 1855) collected in the Crimea were described. The nest of *L. alpestris* was found in the empty snail shell of *Monacha fruticola* under a stone; it contained one cell sealed with plug made of glued gravel bits. The nest of *L. regulus* was found in 3 mm hole of a reed stem from trap-nest; it contained 9 cells separated with partitions made of gravel and mud. The unusual larval habit was discovered in *L. regulus* — they moved mud from the plug of the cell to its bottom before cocoon spinning. Distinctions of the studied nests from ones of the other species of the genus *Leptochilus* de Saussure, 1853 were discussed.

Key words: *Leptochilus alpestris*, *Leptochilus regulus*, nest structure.

Строение гнёзд двух видов рода *Leptochilus* (Hymenoptera, Vespidae, Eumeninae). Фатерыга А. В. — Описано два гнезда ос *Leptochilus alpestris* (de Saussure, 1855) и *Leptochilus regulus* (de Saussure, 1855), собранных в Крыму. Гнездо *L. alpestris* обнаружено в пустой раковине улитки *Monacha fruticola* под камнем; оно содержало одну ячейку, запечатанную пробкой, изготовленной из склеенных мелких камешков. Гнездо *L. regulus* выявлено в трехмиллиметровом канале стебля тростника в искусственной гнездовой конструкции; оно содержало 9 ячеек, разделённых перегородками, изготовленными из мелких камешков и земли. У личинок *L. regulus* было обнаружено необычное поведение — перед плетением кокона они перемещали землю, содержащуюся в пробке ячейки, к её дну. Обсуждаются отличия изученных гнёзд от гнёзд других видов рода *Leptochilus* de Saussure, 1853.

Ключевые слова: *Leptochilus alpestris*, *Leptochilus regulus*, строение гнёзд.

Introduction

Leptochilus de Saussure, 1853 is the large widespread genus of small-size solitary wasps distributed in the Palearctic, Nearctic, Oriental and Neotropic Regions. The genus is the richest in Palearctic fauna, with more than 135 species belonging to 5 subgenera: *Euleptochilus* Blüthgen, 1943, *Leptochilus* s. str., *Lionotulus* Blüthgen, 1938, *Neoleptochilus* Blüthgen, 1961, and *Sarochilus* Gusenleitner, 1970 (Amolin, 2009). However, according to Kurzenko (1981), taxonomic rank of *Neoleptochilus* is unclear and the species of this subgenus can be considered within the subgenus *Lionotulus*. Despite this opinion, subgenus *Neoleptochilus* has been kept in more recent taxonomic publications (Gusenleitner, 1993).

Biological habits of *Leptochilus* are known only in relatively small number of species. Parker (1966) summarized the data on the nesting of 16 Nearctic species. These wasps are commonly nesting in preexisting holes such as hollow stems, old nest burrows of other wasp species in twigs of beetle burrows in wood. Nearctic species make cell partitions of sand or gravel and several ones use macerated pith in addition to mineral material. Seven species have larval habits, which are very unusual to wasps of the subfamily Eumeninae. They move plug material around the cell during the cocoon spinning and include sand into its outer layer.

On the contrary to Nearctic fauna, the nesting habits of only two Palearctic species have been observed and these observations are scanty. Both species nest in empty shells of terrestrial snails (Mollusca, Pulmonata). The nesting of *Leptochilus* (s. str.) *mauritanicus* Lepeletir, 1841 has been observed by Ferton (1901) in shells of *Sphincterochila candidissima* (Draparnaud, 1801), and the nesting of *Leptochilus* (*Lionotulus*) *alpestris* (de Saussure, 1855) has been observed by Fabre (1993) in shells of *Cepaea nemoralis* (Linnaeus, 1758), *Candidula unifasciata* (Poiret, 1801) and *Zebrina detrita* (Müller, 1774), and by Amolin (1995) in shells of *Xeropicta*

derbentina (Krynicki, 1936). The material of cell and nest plug in *L. mauritanicus* was shell bits confirmed with mud (Ferton, 1901). According to Fabre (1993), *L. alpertris* made nest plug and partitions between the cells from resin encrusted with sand.

This paper deals with description of two nest records of two species of the genus *Leptochilus* collected in the Crimea (Southern Ukraine): *L. alpestris* been fragmentary described by the previous authors, and *Leptochilus* (*Neoleptochilus*) *regulus* (de Saussure, 1855), described in this paper for the firs time.

Material and methods

The nests were collected in 2010–2011 in the South Coast of the Crimean Peninsula. The nest of *L. alpestris* was found in July 2, 2011 in Lisya bay in the vicinities of Feodosiya (= Theodosia) (44°54′02″ N, 35°09′30″ E). The nesting site was situated on the rocky steppe slope with predomination of *Elytrigia caespitosa* subsp. *nodosa* (Nevski) Tzvelev, *Atraphaxis replicata* Lam. and *Teucrium chamaedrys* L. (fig. 1, *1*). The nest was found in the empty shell of *Monacha fruticola* (Krynicky, 1833) (Mollusca, Pulmonata, Hygromiidae) lain under a small stone (fig. 1, *3*). This shell was taken to the laboratory and dissected.

The nest of *L. regulus* was found on Karaul-Oba Mountain in the vicinities of Novy Svet village (44°49′31″ N, 34°54′08″ E). The nesting site was situated on the mountain slope covered with juniper open woodland (*Juniperus excalsa* M. Bieb.) (fig. 1, *2*). The nest was found in the winter 2010–2011 in a reed stem (*Phragmites australis* (Cav.) Trin. ex Steud.) from the trap-nest placed here in spring 2010. The trap-nest was situated in a natural conglomeration of stones (fig. 1, *4*). The inner diameter of the reed stem was 3 mm. The nest was dissected in the winter when the wasps were at the prepupal stage.

Results

Nest structure in *Leptochilus alpestris*. The nest of this species contained one cell disposed in the first volution of the shell (fig. 2). The cell was sealed with the plug which had been made of strongly glued gravel bits. The origin of the glue was uncertain because it was present in a very little amount. The gravel bits were simply attached to each other without any visible cementation (i. e., resin or clay mastic). The thickness of this plug was about 2 mm and it seemed to be uncompleted due to death of the mother wasp. The inner surface of the plug and cell walls were covered with cocoon, which had a compound multilayered structure. Its outer layer entirely covered the inner surface of the cell (i. e., the walls of the shell) except the places where prey feces had been stored. This layer was thin and had a white coloration. Prepupa was disposed inside an additional inner cocoon layer, which had a structure similar to the outer one. In addition, the inner surface of the plug was covered with much thick multilayered part of the cocoon with yellowish-white coloration. The feces of prey were stored outside of the cocoon in two places: near the bottom of the cell across the volution of the shell and on the one of its lateral walls above the inner cocoon layer. A meconium was inside the inner layer of the cocoon near the bottom of the cell. Adult wasp had been not reared from the prepupa in this nest.

Nest structure in *Leptochilus regulus*. The nest of this species contained 9 cells separated with partitions and one additional empty cell between 8th and 9th ones (fig. 1, *5*). It had no separate nest plug and was finished by the plug of the last cell. As well as in *L. alpestris*, the walls of the cells were not covered with any building material. Each partition except the plugs of the 8th and 9th cells had the similar structure (fig. 3). It consisted of several bits of gravel laid in the hole of reed stem without any gluing or joined only with the cocoon from the previous nest cell. Then there was a disc of prey feces gradually substituted by mud. The plugs of the 8th and 9th cells did not contain prey feces, but the mud had been discovered within them as a cementing material between gravel bits. Such structure of partitions (i. e., prey feces within them) apparently was not a result of the building behavior of the mother wasp. Most probably the larva stored prey feces in the bottom of the cell before spinning a cocoon and then moved the mud from the plug of the cell to its bottom. Only after these actions it began cocooning. Thus the partitions made by *L. regulus* female had consisted of gravel bits slightly cementing with mud and this mud was moved from the plugs of the cells to their bottoms by larvae.

Fig. 1. Nesting of *Leptochilus alpestris* and *L. regulus*: *1* — nesting site of *L. alpestris* in Lisya Bay; *2* — nesting site of *L. regulus* in Karaul-Oba Mountain; *3* — shell of *Monacha fruticola* with the nest of *L. alpestris* under a stone; *4* — trap-nest with the nest of *L. regulus*; *5* — dissected reed stem with the nest of *L. regulus*.

Рис. 1. Гнездование *Leptochilus alpestris* и *L. regulus*: *1* — стация гнездования *L. alpestris* в Лисьей бухте; *2* — стация гнездования *L. regulus* на горе Караул-Оба; *3* — раковина *Monacha fruticola* с гнездом *L. alpestris* под камнем; *4* — искусственная гнездовая конструкция с гнездом *L. regulus*; *5* — вскрытый стебель тростника с гнездом *L. regulus*.

The cocoon of *L. regulus* as well as in *L. alpestris* had several layers, but not a thick multilayered part. The outer layer densely covered the whole inner surface of the cell and sometimes was subdivided near the plug of the cell in two additional layers. The inner layer was inside the outer one. Its volume was some larger than in *L. alpestris* in relation to the size of the prepupa. A meconium was inside the inner layer of the cocoon on the bottom of the cell. The 1st–4th cells contained females and other ones contained males. Males emerged in June 23–25 and females emerged in July 10, 2011.

Discussion

The nest of *L. alpestris* described above has some distinctions from the nests of this species described by Fabre (1993). First of all, the nest plug was not made of resin incrusted with sand but entirely consisted of gravel bits glued with indistinct material. Though it could be resin too but it was present in a very little amount as compared to Fabre's description. However, it could also be a salivary secretion recorded as the gluing material of the nest partitions in the other species of the genus, Nearctic *Leptochilus perialis* Parker, 1966 (Parker, 1966). Secondly, the nests described by Fabre contained several cells: 3–4 in the shells of *C. nemoralis* and *C. unifasciata*, and 2–3 in the shells of *Z. detrita*. The nest in the shell of *M. fruticola* described above had one cell obviously due to small size of this snail.

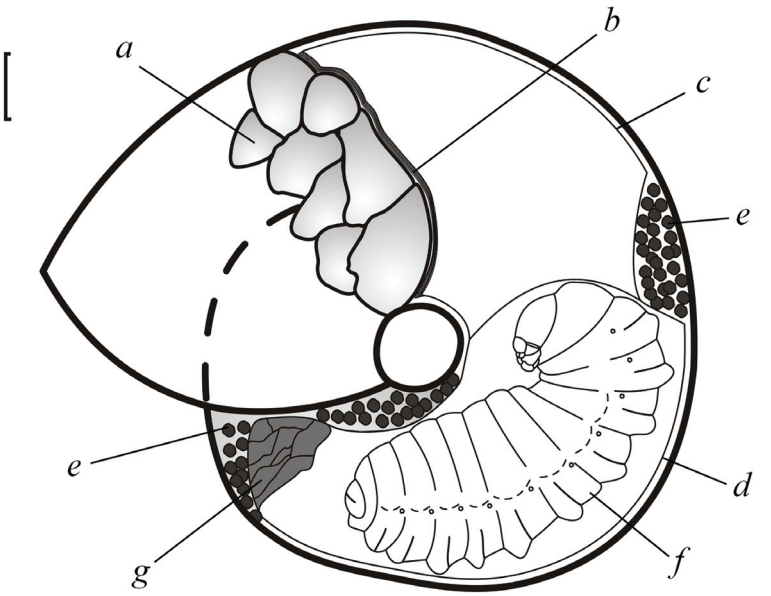

Fig. 2. Structure of the nest of *Leptochilus alpestris* in the shell of *Monacha fruticola*: *a* — gravel; *b* — multilayered part of the cocoon; *c* — outer layer of the cocoon; *d* — inner layer of the cocoon; *e* — prey feces; *f* — prepupa; *g* — meconium. Scale bar 1 mm.

Рис. 2. Строение гнезда *Leptochilus alpestris* в раковине *Monacha fruticola*: *a* — камешки; *b* — многослойная часть кокона; *c* — внешний слой кокона; *d* — внутренний слой кокона; *e* — экскременты жертв; *f* — предкуколка; *g* — меконий. Масштабная линейка 1 мм.

The nest of *L. regulus* had some characters, which were not typical to other European species of the genus. First of all, its nest was found in a hollow stem in contrasted to other species nested in snail shells. Secondly, the larvae of *L. regulus* moved plug material before cocooning. This behavior character is typical to several Nearctic species of *Leptochilus*. For example, larvae of *L. perialis* and *Leptochilus erubescens* (Bohart, 1940) move the sand from the plug around the cell and include it to the material of outer layers of their cocoons. Larvae of other species such as *Leptochilus republicanus* (Dalla Torre, 1889) *Leptochilus rufinodus* (Cresson, 1868) and *Leptochilus washo* Parker, 1966 in addition make a transversal partition of sand from cell plug fastened with silk before cocooning (Krombein, 1959; Parker, 1966). Such cocooning behavior was not observed among other genera of the subfamily Eumeninae except two Nearctic species of the genus *Odynerus* Latreille, 1802 (Parker, 1984). However, the larvae of *L. regulus*

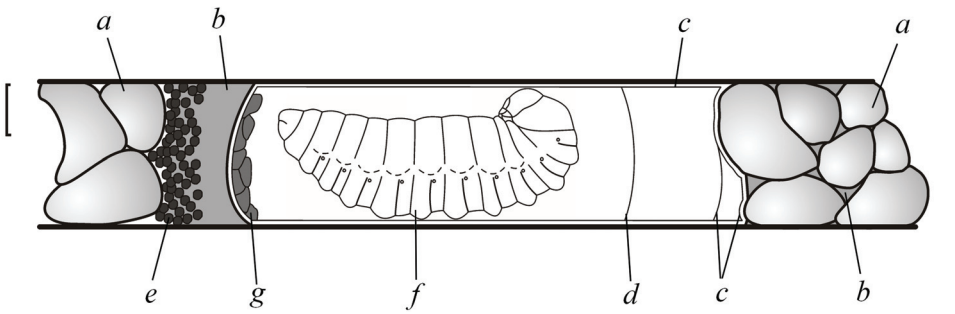

Fig. 3. Structure of the last nest cell and the nest plug of *Leptochilus regulus* in a reed stem: *a* — gravel; *b* — mud; *c* — outer layers of the cocoon; *d* — inner layer of the cocoon; *e* — prey feces; *f* — prepupa; *g* — meconium. Scale bar 1 mm.

Рис. 3. Строение последней ячейки и пробки гнезда *Leptochilus regulus* в стебле тростника: *a* — камешки; *b* — земля; *c* — внешние слои кокона; *d* — внутренний слой кокона; *e* — экскременты жертв; *f* — предкуколка; *g* — меконий. Масштабная линейка 1 мм.

did not include plug material into their cocoons but simply moved mud from plug to the bottoms of the cells.

The Palaeactic species of the genus *Leptochulis* with known nesting habits — *L. mauritanicus* (Ferton, 1901), *L. alpestris* (Fabre, 1993; Amolin, 2005; this paper) and *L. regulus* (this paper) belong to three different subgenera: *Leptochilus* s. str., *Lionotulus* and *Neoleptochilus*, respectively. Distinctions in their biology can be regarded as the subgeneric characters. But of course it can not be concluded without doubts until the other species of each subgenus will be studied in respect of their nest structure and larval habits.

Only a few genera of the solitary wasps of the subfamily Eumeninae use gravel as the building material for their nests. According to F. D. Parker (1966) this character is present also in *Microdynerus* Thomson, 1874, *Maricopodynerus* Viereck, 1808, and *Hypalastoroides* de Saussure, 1856. Similar habits can be also found in *Katamenes* Meade-Waldo, 1910 which use pebbles fastened with clay mortar (Fateryga, Ivanov, 2009). However, the species of the genus *Leptochilus* seem to be the wasps which generally do not use plastic mineral material for their nests. Neacrtic species use mainly packed sand and gravel as well as macerated pith and *L. alpestris* use glued gravel, according to present observation. Only *L. mauritanicus* and *L. regulus* can probably make mud mastic but their building methods are still unclear and require further investigations.

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