ISSN 0013-8738, Entomological Review, 2022, Vol. 102, No. 1, pp. 63–70. © Pleiades Publishing, Inc., 2022.
Russian Text © The Author(s), 2022, published in Entomologicheskoe Obozrenie, 2022, Vol. 101, No. 1, pp. 87–96.

Phenology of *Molipteryx fuliginosa* (Uhler) (Heteroptera, Coreidae) in the South of the Russian Far East

T. O. Markova[a,*], E. V. Kanyukova[b], and M. V. Maslov[a]

[a] *Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok, 690022 Russia*

[b] *Far Eastern Federal University, Zoological Museum, Vladivostok, 690091 Russia*

**e-mail: martania@mail.ru*

Received June 13, 2021; revised July 12, 2021; accepted July 12, 2021

Abstract—Seasonal development of *Molipteryx fuliginosa* (Uhler) in Primorskii Territory, including the timing of oviposition and development until the emergence of adults, was studied during 6-year monitoring under natural and seminatural conditions. The species has a univoltine seasonal cycle. Eggs are laid randomly on various substrates, including the ground. The embryonic stage lasts from 12 to 36 days, depending on the air temperature. The development of nymphs from hatching to the final molt lasts from 55 to 83 days. The total duration of preimaginal development varies from 80 to 117 days. The optimal conditions and timing of seasonal development of *M. fuliginosa* in nature were determined.

Keywords: bugs, *Molipteryx fuliginosa*, seasonal development, phenology, egg, nymphs, overwintering, Primorskii Territory, Heteroptera, Coreidae

DOI: 10.1134/S0013873822010055

The genus *Molipteryx* Kiritshenko, 1916 is represented in the Russian fauna by a single species *M. fuliginosa* (Uhler, 1860), while the other four species of the genus occur in the southeastern Palaearctic and the Oriental Region. Before the 1990s *M. fuliginosa* was known only from Northeast China, the Korean Peninsula, and Japan, but in 1987 and 1992 its first occasional specimens were found in the south of the Russian Far East (Kerzhner and Kanyukova, 1998; Kanyukova and Vinokurov, 2009). This was the only *Molipteryx* species that expanded its range as far northward as 49°26′26″N in the south of Khabarovsk Territory and was able to adapt to the new climatic conditions. In the recent years *M. fuliginosa* has naturalized in the south of the Russian Far East, where it now forms outbreaks and acts as a pest of raspberries (Kanyukova, 2012), reducing the yield. This largest representative of the family Coreidae in the Russian fauna has become a convenient object for studying the processes of introduction and adaptation of an alien species (Markova et al., 2021).

Earlier we summarized and analyzed the available information on the presence of *M. fuliginosa* in the Russian Far East and the primary data on its biotopic distribution in the south of Primorskii Territory (Kanyukova, 2012; Kanyukova and Ostapenko, 2013; Markova et al., 2016a, 2016b, 2021). The morphology of the immature stages, the reproductive behavior of the females, and their fecundity were studied under seminatural conditions, in stationary cages located on a household plot (Markova et al., 2017a, 2017b).

The first data on the development cycle of *M. fuliginosa* were obtained in South Korea, where the species was observed under laboratory conditions during one summer season (Park, 1996). The timing of emergence in spring and overwintering of adults of the next generation was determined under the local climatic conditions. The adult bugs collected in nature were kept in an insectarium at a constant temperature of +25°C, relative humidity of 65%, and a photoperiod of 12 : 12 h.

Table 1. Sites of stationary research in Primorskii Territory in 2014–2020

Locality	Coordinates
Khankaiskii District	
Pervomaiskoe	044°00′05″N, 131°58′54″E
Spasskii District	
Spasskoe	44°36′52″N, 132°47′49″E
Chuguevskii District	
Chuguevka	44°10′00″N, 133°51′30″E
Novomikhailovka	44°14′01″N, 133°51′59″E
Ussuriisk Urban District	
Kaimanovka	43°37′49″N, 132°13′49″E
Ussuri Nature Reserve	43°40′00″N, 132°30′00″E

The number of eggs laid, the timing of nymphal development, and the survival curve of *M. fuliginosa* were determined. Only 4 adults were obtained from a total of 90 eggs, indicating a low survival rate of the immature stages. The seasonal dynamics of the species and the behavior of the bugs when choosing the trophic objects were analyzed, and the cited author concluded that *M. fuliginosa* produced one generation a year. The overwintering sites were not found.

This paper presents for the first time the results of long-term phenological monitoring of the embryonic and nymphal development and adult flight of *M. fuliginosa* under the climatic conditions of the southern Russian Far East. In the text below, *m* is the mean value; *n* is the number of specimens.

MATERIALS AND METHODS

The study was carried out from May to October 2014–2020 at the field stations and during research trips in Primorskii Territory. The study localities are listed in Table 1.

In the field, the bugs were kept in stationary cages made of mesh fabric with zippers. The cages were built around living host plants on which the insects could move freely and had sufficient food (Markova et al., 2017a, 2017b, 2018). Comparative observations were performed in stationary cages and natural cenoses from oviposition to the completion of nymphal development and the emergence of adults. To determine the diapause timing and the overwintering conditions, adults of the new generation were kept in cages during autumn and winter, so that they were exposed to the natural climatic conditions (Fig. 1). To summarize the long-term phenological data for *M. fuliginosa* in the Russian Far East, we also used the collection material and photos obtained in 2016–2020.

RESULTS

Molipteryx fuliginosa (Uhler, 1860)

Material. Russia. *Khabarovsk Territory*. Nanaiskii District: Anyuysky National Park, Pikhtsa River basin, Pikhur forestry base, 24.V.2019 (N.M. Yavorskaya), 2 spms. Khabarovskii District: Khekhtsir, household plot, 21.VI.2020 (A.Yu. Oleinikov), 2 spms.; Osinovaya Rechka, Lider non-commercial gardening partnership, 21.VII.2020 (D.A. Tikhonov), 2 spms. *Primorskii Territory*. Pozharskii District: Luchegorsk, household plot, 31.VIII.2020 (N.A. Kolyada), 1 spm. Krasnoarmeiskii District: Roshchino, household plot, herbage vegetation, 26.VI.2018 (A.D. Grebenyuk), 4 spms. Terneiskii District: Sikhote-Alin Nature Reserve, env. of Ternei, Serebryanka River floodplain, 26.VI.2015 (M.E. Sergeev), 1 spm. Dalnegorsk Urban District: env. of Dalnegorsk, country road, 23–24.VI.2018 (D.M. Chernyak), 1 spm. Khankaiskii District: Pervomaiskoe, household plot, herbage, VI–VIII.2017–2019 (A.V. Khovrina), 15 adults, 14 nymphs of III–V instars; Kamen-Rybolov, household plot, 20.VI and 22.VIII.2018 (Yu.S. Zavarzina), 4 spms.; Turii Rog, motley weed herbage on roadside, 10.VI.2017, 1.VII.2018 (K.A. Ostapenko), 2 spms.; Komissarovka River valley, Dvoryanka, tall roadside herbage, 1 and 15.VI.2017 (K.A. Ostapenko), 4 spms. Spasskii District: env. of Evseevka, floodplain forest, herbage under forest canopy, 12.V.2018 (A.K. Mrikot), 2 spms.; Chkalovskoe, household plot, 20.VII.2018 (N.V. Repsh), 1 spm.; Spasskoe, household plot, on ground, 22.V.2020 (A.K. Mrikot), 1 spm. Yakovlevskii District: Mineralnoe, shrubbery, 20.VII.2017 (S.V. Veriga), 2 spms.; Yakovlevka, household plot, 16–25.VII. 2020 (S.A. Makarevich), 7 adults, 3 nymphs of III instar. Chernigovskii District: Sinii Gai, household plot, 22.VIII.2020 (N.A. Kolyada), 1 spm.; Sibirtsevo, household plot, 26.V.2018 (Yu.N. Glushchenko), 1 spm. Anuchinskii District: Sinegorka, herbage under forest canopy, 1.VI.2015 (S.V. Veriga), 1 spm.; Bolshoi Spring, floodplain, coppice of Japanese elm *Ulmus propinqua*, 10.VI.2017 (K.A. Ostapenko), 1 spm. Arsenyev Urban District: Arsenyev, household plots, roadside weed

herbage, shrubbery, V–VIII.2014, 2016–2018 (K.A. Ostapenko, S.V. Veriga), 10 spms.; 25.VII.2020 (A.E. Kovaleva), 4 adults, 2 nymphs of III instar. Oktyabrskii District: Chernyatino, Mt. Sinelovka, motley herbage in place of abandoned farmland, 9.VII.2017, 3.VII.2018 (K.A. Ostapenko), 3 spms. Chuguevskii District: Koksharovka, household plot, 8.VII.2020 (A.K. Mrikot), 4 spms.; Chuguevka, household plot, 30.V.2020 and 14.VI.2020 (A.K. Mrikot), 4 spms.; Novomikhailovka, household plot, V–VIII.2018–2020 (Z.A. Limachko), 14 adults, 14 nymphs of II–V instars. Ussuriisk Urban District: Pushkino, herbaceous vegetation under forest canopy, 29.V.2018 (Yu.N. Glushchenko), 1 spm.; Ussuriisk outskirts, fur farm (household plot), 13.VI and 20.VI.2018; 4–20.IX.2019 (T.O. Markova, E.N. Bolovtsov), 12 spms.; Gornotaezhnoe, household plots, shrubs, motley and weed herbage, V–VIII.2016–2018 (K.A. Ostapenko, M.M. Omelko), 12 adults, 1 nymph of IV instar; household plot, 16.IX.2019 (N.A. Kolyada), 1 spm.; plant nursery, 5.VIII.2020 (A.V. Kuprin), 1 nymph of IV instar; Zarechnoe, orchard nursery, 23.VI.2020 (S.A. Makarevich), 1 spm.; Kamenushka, floodplain forest, field margin, 24.VIII.2016; 30.V–28.VIII.2017; 10.VI–25.VIII.2018; 30.V–8.VIII.2019; 15.VIII and 30.IX.2020 (T.O. Markova, M.V. Maslov), 17 adults, 13 nymphs of IV–V instars; Kaimanovka, forest edge, forest road side, household plot, 30.V–30.IX.2016–2020 (T.O. Markova, M.V. Maslov), 79 adults, 46 nymphs of II–V instars; Ussurisky Nature Reserve, herbage under forest canopy, forest road side, glade, V–IX.2016–2019 (M.V. Maslov, L.A. Fedina), 20 adults, 2 nymphs of IV instar, 3 nymphs of V instar. Shkotovskii District: Ussuri Nature Reserve, roadside vegetation, shrubbery, V–X.2016–2019 (M.V. Maslov, L.A. Fedina), 4 spms.; Anisimovka, Smolnyi Spring, overgrown forest roads, tall herbage, 12.VII.2016 (K.A. Ostapenko), 2 spms. Partizanskii District: Sergeevka, household plot, herbage, 10.V.2016 (E.A. Novaya), 1 spm.; Nikolaevka, household plot, 20.VIII.2019; 30.V.2020 (S.E. Egorenchev), 5 spms.; Vasilievka, 23–29.VIII.2020 (I.D. Solodkii), 1 adult, 4 nymphs of V instar. Vladivostok Urban District: env. of Vladivostok, Sputnik station, 11.V.2016 (K.A. Ostapenko), 1 spm.; middle course of Bogataya River, under canopy of valley forest, household plots, VII.2017–2018 (S.V. Veriga), 5 spms. Nakhodka Urban District: Nakhodka, Nakhodka non-commercial gardening partnership, 21.VII and 6.VIII.2020 (M.V. Analeeva), 2 spms. Khasanskii District: Furugelma Island, motley meadow, 17–22.VIII.2018 (M.E. Sergeev), 4 nymphs of IV and V instars; Gamova Peninsula, Vityaz Bay, motley meadow, 12–14.VIII.2019 (M.E. Sergeev), 2 spms.; 13.IX.2019 (A.M. Nikolaeva), 4 adults, 6 nymphs of V instar; 20–22.VII and 28.VII.2020 (Yu.A. Chistyakov), 4 adults, 1 nymph of III instar.

Fig. 1. A stationary cage in winter.

The complete life cycle of bugs (the periods of active life and diapause) includes three stages: embryonic, nymphal, and adult. The life cycle of *M. fuliginosa* is univoltine (Saulich and Musolin, 2007), i.e., it lasts one year, from autumn to the next summer. According to our long-term observations, in Primorski Territory overwintered adults of *M. fuliginosa* can be found since early May (Table 2). Females are the first to appear (recorded on 2–4.V.2017), and mass mating is observed in agrocenoses since the end of the beginning third of May. During this period adult bugs of both sexes form clusters of 10 individuals or more on their preferred host plants of the family Rosaceae: raspberry and blackberry, which are in the budding phase. Copulation is interrupted for feeding and is then resumed. The period of maturation feeding before oviposition lasts from 2 h to 3 days.

Table 2. Phenology of *Molipteryx fuliginosa* (Uhler) under natural conditions and in stationary cages in Primorskii Territory of Russia, by months and 10-day intervals: data of 2014–2020

Stage or physiological period	May			June			July			August			September			October		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Adult	+	+	+	+	+	+	+	+	+	+	+	–	–	–	–	–	–	–
Mating	+	+	+	+	+	+	+	+	+	+	–	–	–	–	–	–	–	–
Egg	–	+	+	+	+	+	+	+	+	+	–	–	–	–	–	–	–	–
Nymph																		
I instar	–	–	–	–	+	+	+	+	+	+	+	–	–	–	–	–	–	–
II instar	–	–	–	–	–	+	+	+	+	+	+	+	+	–	–	–	–	–
III instar	–	–	–	–	–	–	+	+	+	+	+	+	+	–	–	–	–	–
IV instar	–	–	–	–	–	–	–	+	+	+	+	+	+	–	–	–	–	–
V instar	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+	–	–	–
Adult	–	–	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+	+

Table 3. Oviposition sites of *Molipteryx fuliginosa* (Uhler)

Biotope	Position of eggs		Number of eggs
Household plot in the countryside	*Lonicera edulis* Turcz. ex Freyn	Upper leaf surface	2
	Trifolium repens L.	Lower leaf surface	5
		Stem	2
Stationary cage	Bark fragments on the ground	Lower surface	2
	Dry leaves and grass stems	Upper surface	3
	Soil surface		2
	Ambrosia artemisiifolia L.	Upper leaf surface	1
		Lower leaf surface	1
		Stem	1
	Solanum tuberosum L.	Upper leaf surface	8
		Lower leaf surface	2
		Stem	1
Total			30

The earliest eggs were observed in the stationary cages at the end of the beginning third of May, whereas in forest habitats the earliest females and their egg batches were recorded somewhat later, since mid-May, and the earliest males, since the middle third of June. Copulation and oviposition were extended and could be observed until the end of the beginning third of August.

The eggs were placed randomly on the substrate. One female in a stationary cage laid on average 28.4 eggs ($n = 25$). The localization of *M. fuliginosa* eggs on plants in nature and in stationary cages was studied by us earlier (Markova et al., 2017b). Observations of 2016–2020 yielded new data on the oviposition sites that included the soil surface under plants (Table 3; Fig. 2).

Fig. 2. Oviposition sites of *Molipteryx fuliginosa* (Uhler): (*1*) fragment of bark, (*2*) stem of *Ambrosia artemisiifolia*.

Molipteryx fuliginosa is a polyphagous species. Of the plants listed above, the blue honeysuckle *Lonicera edulis* (Caprifoliaceae) and the white clover *Trifolium repens* (Fabaceae) were not previously known as host plants of *M. fuliginosa*, but they are apparently used as oviposition substrates. An egg batch on the stem of the potato *Solanum tuberosum* (Solanaceae) was found earlier in nature, while in the stationary cage the eggs were laid on the leaf laminae of this plant. The caged bugs also laid eggs on the common ragweed *Ambrosia artemisiifolia* (Asteraceae), though no nymphs of *M. fuliginosa* were found on this plant in nature (see Fig. 2).

The duration of embryonic development of *M. fuliginosa*, determined by us in stationary cages under natural conditions, ranged from 12 to 36 days ($m = 23.6$; $n = 343$). The nymphs passed through five instars before the final molt (Markova et al., 2017a) (Fig. 3). Each of the consecutive nymphal instars lasted longer than the preceding one: 5–7 days for the I instar ($m = 6.0$), 13–16 days for the II instar ($m = 14.5$), 7–8 days for the III instar ($m = 7.5$), 11–23 days for the IV instar ($m = 16.6$), and 19–38 days for the V instar ($m = 27.9$) ($n = 68$). The total nymphal development lasted from 55 to 83 days, and the total period of development from oviposition to adult emergence lasted from 80 to 117 days.

Adults of the overwintered generation die off during July: females starting with the middle third and males, with the end of the month. Dead females that had not finished oviposition were found by us in mid-July 2015, on the ground at the stationary study site near Kaimanovka. Some overwintered bugs survived until mid-August.

According to the data obtained in stationary cages under seminatural conditions, the optimal period of oviposition of *M. fuliginosa* lasted from the end of the beginning third of May to the end of the middle third of June. Correspondingly, the I instar nymphs appeared at the beginning of the middle third of June, the II instar nymphs, at the boundary of the middle and last thirds of June, the III instar nymphs, at the beginning of July, the IV instar nymphs, at the boundary of the beginning and middle thirds of July, and the V instar nymphs, at the beginning of the last third of July (see Table 2). Adults of the new generation emerged from mid-August to mid-September; unusually small individuals with weakly sclerotized integuments and incompletely developed wings appeared since the end of the beginning third of September. Mass emergence of adults of the new generation occurred in nature from late August to early September (according to our observations, in 30.VIII–

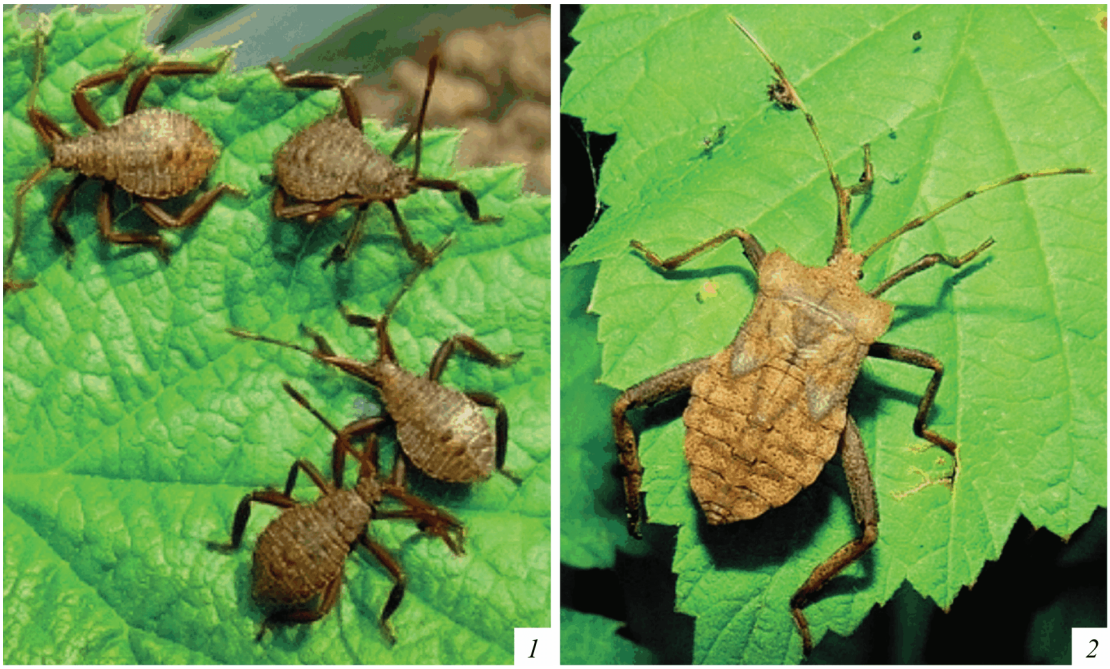

Fig. 3. Nymphs of *Molipteryx fuliginosa* (Uhler): (*1*) II instar, (*2*) V instar.

2.IX.2016, 20–21.VIII.2017, and 21.VIII–1.IX.2020). Before diapause the bugs actively fed until the end of August, accumulating fat reserves for successful overwintering. Adults of the new generation were occasionally observed on their host plants in good weather until early October.

Molipteryx fuliginosa has an obligate adult diapause (Markova et al., 2017a, 2017b) that is induced at the end of the vegetation season and is marked with cessation of reproduction and migration of adults from their original habitats. The nymphs that have not molted to adults in time continue feeding, but as the night air temperatures fall, they gradually die off before completing development. The abundance of bugs in agrocenoses decreases since late August as the insects migrate to other stations, including forest ones. Observations of the adults kept in stationary cages exposed to all the atmospheric factors during autumn and winter have shown that *M. fuliginosa* hibernate near the soil surface and in the upper soil layers under leaf litter and dry plant debris.

CONCLUSIONS

The seasonal development of *M. fuliginosa* has been studied under the climatic conditions of the south of the Russian Far East. The following conditions are optimal for successful completion of the development cycle.

1. Oviposition lasts for a total of 40–43 days, from the late 1st third of May to the late 2nd third of June. One female lays an average of 28.4 eggs ($n = 25$). The embryonic stage in *M. fuliginosa* lasts from 12 to 36 days ($m = 23.6$).

2. The I instar nymphs appear since the early 2nd third of June; II instar, since the late 2nd and early last thirds of June; III instar, since the early 1st third of July; IV instar, since the late 1st and early 2nd thirds of July; V instar, since the early last third of July. The duration of the nymphal instars in *M. fuliginosa* increases from the I to the V instar.

3. The total duration of development from oviposition to the adult stage is from 80 to 117 days. Mass emergence of adults of the new generation is observed from late August to early September. Adult bugs overwinter on the soil surface under leaf litter and dry plant debris.

Under natural conditions, adults live on average 91 days after the end of hibernation; the overwintered generation dies off during July.

ACKNOWLEDGMENTS

We are sincerely grateful to D.L. Musolin (St. Petersburg State Forest Technical University) and N.N. Vinokurov (Institute for Biological Problems of Cryolithozone, Siberian Branch of the Russian Academy of Sciences, Yakutsk) for valuable advice and comments during preparation of this paper, to L.A. Fedina (Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok), A.K. Mrikot, A.V. Khovrina (Far Eastern Federal University, Teachers' College, Ussuriisk), and Z.I. Limachko (Secondary School No. 7, Novomikhailovka, Chuguevskii District) for help with stationary research. We also thank N.M. Yavorskaya ("Zapovednoe Priamurye," Khabarovsk), A.Yu. Oleinikov (Institute for Aquatic and Ecological Studies, Far Eastern Branch of the Russian Academy of Sciences, Khabarovsk), N.A. Kolyada, A.V. Kuprin, M.M. Omelko, M.E. Sergeev, D.M. Chernyak, Yu.A. Chistyakov (Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok), A.M. Nikolaeva (Oka Nature Reserve), K.A. Ostapenko (Far Eastern Federal University, Zoological Museum, Vladivostok), Yu.N. Glushchenko, N.V. Repsh, E.N. Bolovtsov, A.D. Grebenyuk, S.E. Egorenchev, Yu.S. Zavarzina, E.A. Novaya (Far Eastern Federal University, Teachers' College, Ussuriisk), S.A. Makarevich (Makarevich private farm, Zarechnoe), M.V. Analeeva, S.V. Veriga, A.V. Kovaleva, and I.D. Solodky for the provided data from Krasnoarmeiskii, Terneiskii, Khankaiskii, Spasskii, Yakovlevskii, Chernigovskii, Anuchinskii, Oktyabrskii, Chuguevski, Shkotovskii, Partizanskii, Khasanskii districts and Dalnegorsk, Arsenyev, Ussuriisk, Vladivostok, and Nakhodka urban districts of Primorskii Territory.

COMPLIANCE WITH ETHICAL STANDARDS

Conflict of interest. The authors declare that they have no conflict of interest.

Statement on the welfare of animals. All the applicable international, national, and/or institutional guidelines for the care and use of animals were followed. All the procedures performed in studies involving animals were in accordance with the ethical standards of the institution or practice at which the studies were conducted.

REFERENCES

Aistova, E.V., Bezborodov, V.G., Markova, T.O., Maslov, M.V., and Fedina, L.A., The formation of the consortia relations of *Molipteryx fuliginosa* (Uhler, 1860) (Hemiptera, Coreidae) with *Ambrosia artemisiifolia* in the Primorskii Krai of Russia, *Ecol. Montenegr.*, 2019, vol. 21, p. 90.
https://doi.org/10.6084/m9.figshare.9917987

Kanyukova, E.V., Leaf-footed bug *Molipteryx fuliginosa* (Heteroptera: Coreidae) – a new pest of raspberry in the south of the Far East of Russia, *Amur. Zool. J.*, 2012, vol. 4, no. 4, p. 331.
https://www.elibrary.ru/item.asp?id=18775679

Kanyukova, E.V. and Ostapenko, K.A., New and little known species of Heteroptera from Primorskii Krai, *Amur. Zool. J.*, 2013, vol. 5, no. 4, p. 405.
https://www.elibrary.ru/item.asp?id=21020727

Kanyukova, E.V. and Vinokurov, N.N., New data on the fauna of superfamilies Lygaeoidea, Pyrrhocoroidea, and Coreioidea (Heteroptera) of the Asian part of Russia, in *Problemy izucheniya i okhrany zhivotnogo mira na severe: Materialy dokladov Vserossiiskoi nauchnoi konferentsii s mezhdunarodnym uchastiem (Syktyvkar, Respublika Komi, Rossiya, 16–20 noyabrya 2009 g.)* (Study and Conservation of the Northern Fauna: Abstracts of Papers of the All-Russian Conference with International Participation, Syktyvkar, Komi Republic, November 16–20, 2009), Taskaev, A.I. et al., Eds., Syktyvkar, 2009, p. 57.

Kerzhner, I.M. and Kanyukova, E.V., First record of *Molipteryx fuliginosa* Uhler from Russia (Heteroptera: Coreidae), *Zoosyst. Ross.*, 1998, vol. 7, no. 1, p. 84.

Markova, T.O. and Maslov, M.V., *Ambrosia artemisiifolia* L. (Asteraceae) in the diet of leaf-footed bugs (Heteroptera: Coreidae) in the south part of Primorskii Krai, *A.I. Kurentsov's Ann. Memor. Meet.*, 2020, no. 31, p. 165.
https://doi.org/10.25221/kurentzov.31.14

Markova, T.O., Maslov, M.V., and Repsh, N.V., On the ecology of the bug *Molipteryx fuliginosa* (Heteroptera, Coreidae) in Ussuriisk District of Primorskii Krai, *A.I. Kurentsov's Ann. Memor. Meet.*, 2016a, no. 27, p. 80.
https://www.elibrary.ru/item.asp?id=26190037

Markova, T.O., Maslov, M.V., Repsh, N.V., and Ogorodnikov, E.G., New data on the distribution of *Molipteryx fuliginosa* (Heteroptera: Coreidae) in Russia, *Far East. Entomol.*, 2016b, vol. 316, p. 26.
https://www.elibrary.ru/item.asp?id=26533238

Markova, T.O., Kanyukova, E.V., Maslov, M.V., and Repsh, N.V., Immature stages of *Molipteryx fuliginosa* (Uhler) (Heteroptera, Coreidae) in the south of the Russian Far East, *Entomol. Rev.*, 2017a, vol. 97, no. 6, p. 723.
https://doi.org/10.1134/S0013873817060021

Markova, T.O., Kanyukova, E.V., Maslov, M.V., and Repsh, N.V., Reproductive behavior of the bug *Molipteryx fuliginosa* Uhler (Heteroptera, Coreidae) in the south of the Russian Far East, *Entomol. Rev.*, 2017b, vol. 97, no. 9, p. 1227.
https://doi.org/10.1134/S0013873817090044

Markova, T.O., Maslov, M.V., and Repsh, N.V., Modifications of rearing cages for insect research, *Euroasian Entomol.*

J., 2018, vol. 17, no. 5, p. 345.
https://doi.org/10.15298/euroasentj.17.5.06

Markova, T.O., Kanyukova, E.V., and Maslov, M.V., True bugs (Heteroptera) on *Ambrosia artemisiifolia* L. in southern areas of Primorskii Krai, Russia, *Euroasian Entomol. J.*, 2019, vol. 18, no. 1, p. 16.
https://doi.org/10.15298/euroasentj.18.1.03

Markova, T.O., Kanyukova, E.V., and Maslov, M.V., Dynamics of spreading of the bug *Molipteryx fuliginosa* (Uhler) (Heteroptera, Coreidae) in the Russian Far East, *Ross. Zh. Biol. Invazii*, vol. 2021, vol. 14, no. 2, p. 70.
https://doi.org/10.35885/1996-1499-2021-14-2-70-80

Park, S.O., Development of the leaf-footed bug, *Molipteryx fuliginosa* (Heteroptera: Coreidae), *Korean J. Ecol.*, 1996, vol. 19, no. 6, p. 575.

Saulich, A.Kh. and Musolin, D.L., Four seasons: Diversity of seasonal adaptations and ecological mechanisms controlling seasonal development in true bugs (Heteroptera) in the temperate climate, *Tr. Biol. Nauchno-Issled. Inst. S.-Peterb. Gos. Univ.*, 2007, vol. 53, p. 25.

Vinokurov, N.N., Kanyukova, E.V., and Ostapenko, K.A., Homoptera (Cicadina) and Heteroptera of the Sikhote-Alinsky State Nature Biosphere Reserve, *Amur. Zool. J.*, 2016, vol. 8, no. 4, p. 233.
https://www.elibrary.ru/item.asp?id=30322575