

РОССИЙСКАЯ АКАДЕМИЯ НАУК  
Южный научный центр

RUSSIAN ACADEMY OF SCIENCES  
Southern Scientific Centre



# Кавказский Энтомологический Бюллетень

CAUCASIAN ENTOMOLOGICAL BULLETIN

Том 20. Вып. 2

Vol. 20. Iss. 2



Ростов-на-Дону  
2024

# New data on the biology and natural regulation of the population of the ant parasitoid *Menoziola tanaitica* Shevchenko, Dubovikoff et Disney, 2024 (Diptera: Phoridae)

© D.M. Shevchenko<sup>1,2</sup>

<sup>1</sup>D.I. Ivanovsky Academy of Biology and Biotechnology of the Southern Federal University, Stachki Avenue, 194/4, Rostov-on-Don 344090 Russia. E-mail: cheff7627d@gmail.com

<sup>2</sup>Federal Research Centre the Southern Scientific Centre of the Russian Academy of Sciences, Chekhov Street, 41, Rostov-on-Don 344006 Russia

**Abstract.** The paper provides new data on the distribution and possible ways of natural population regulation of the little-studied scuttle fly *Menoziola tanaitica* Shevchenko, Dubovikoff et Disney, 2024, which parasitizes ants *Camponotus vagus* (Scopoli, 1763), by another species of ants and mold fungi. Additional information about the life cycle of the parasitoid and ways of infection of ants is provided.

**Key words:** Phoridae, *Menoziola*, life cycle, parasitization, ant's infection.

## Новые данные о биологии и природной регуляции численности *Menoziola tanaitica* Shevchenko, Dubovikoff et Disney, 2024 (Diptera: Phoridae) – паразитоида муравьев

© Д.М. Шевченко<sup>1,2</sup>

<sup>1</sup>Академия биологии и биотехнологии имени Д.И. Ивановского Южного федерального университета, пр. Стачки, 194/1, Ростов-на-Дону 344090 Россия. E-mail: cheff7627d@gmail.com

<sup>2</sup>Федеральный исследовательский центр Южный научный центр Российской академии наук, пр. Чехова, 41, Ростов-на-Дону 344006 Россия

**Резюме.** Приведены новые данные о распространении и возможных способах естественной регуляции численности малоизученного вида мух-горбатов *Menoziola tanaitica* Shevchenko, Dubovikoff et Disney, 2024, паразитирующего на муравьях *Camponotus vagus* (Scopoli, 1763), посредством других видов муравьев и плесневых грибов. Представлены дополнительные сведения о жизненном цикле паразитоида и о путях заражения муравьев.

**Ключевые слова:** Phoridae, *Menoziola*, жизненный цикл, паразитизм, заражение муравьев.

## Introduction

Information about the biology and symbiotic relationships of scuttle flies (Diptera: Phoridae) with ants remains fragmentary. In 2019, *Camponotus vagus* (Scopoli, 1763) females infected with phorids were detected for the first time in the lower reaches of the Don River [Shevchenko et al., 2024].

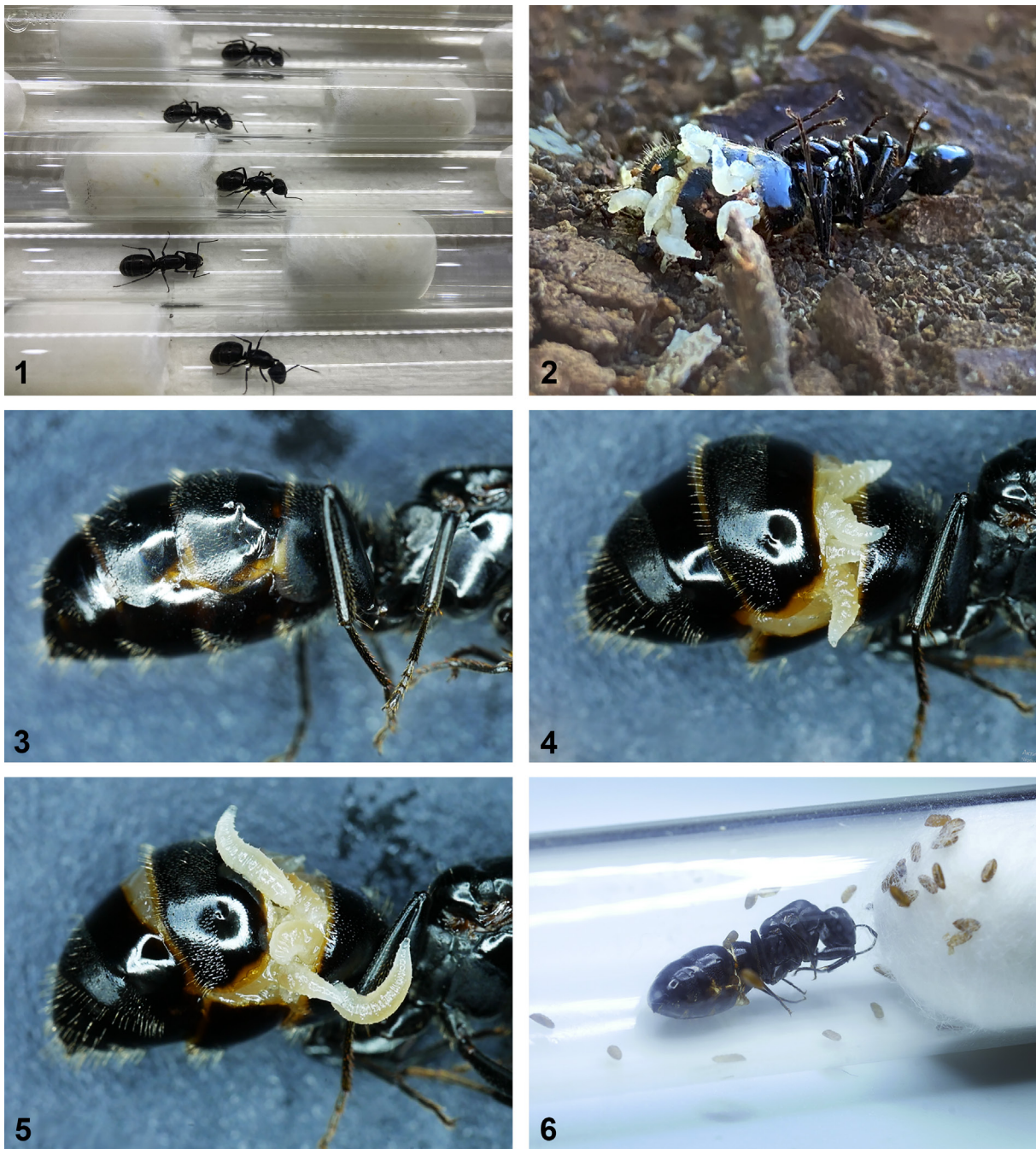
The paper provides additional information on the findings of *Menoziola tanaitica* Shevchenko, Dubovikoff et Disney, 2024 in the territory of the Lower Don basin and the natural population regulation of the parasitoid.

## Material and methods

The collection of females and workers of *Camponotus vagus* was carried out in 2019–2024 in the period from the third decade of April to the first decade of June in the territory of the Rostov urban agglomeration (lower reaches of the Don River, near the cities of Rostov-on-Don and Novocherkassk, Russia). The collected females were divided into two groups. The first group included individuals found on the trunks and branches of fallen trees (or near them on the grass) immediately after the nuptial flight and began to

search for shelter. The second group included individuals that have already chosen appropriate shelters under the bark and have begun to arrange a nesting chamber. In total, more than 300 females were collected (173 of them were assigned to the first group, 127 to the second). The predominant part of the females was collected in April 2024 (82 individuals from the first group and 32 from the second). Workers (more than 50) were collected from tree trunks and branches, as well as from nests, which were usually located in rotting trunks.

All ants were placed in individual test tubes (Fig. 1). Test tubes were kept in a dark room at temperature 24–27 °C. The dead females remained in incubators for 15–20 days. In the case of fly larvae emerging from them, the incubation process was completed after the transformation of the larvae into imago. During the laboratory maintenance of ants, the time indicators of the observed changes were carefully recorded (the presence of live ants in incubators, the time of the deaths of females, the time of the larvae emerging from dead ants, the time of passing through all stages of metamorphosis). Some of the scuttle flies in different stages of metamorphosis were preserved in 70% ethanol. Specimens of preserved flies are kept at the Zoological Institute of the Russian Academy of Sciences (St Petersburg, Russia) and in the personal collection of D.M. Shevchenko.



Figs 1–6. Infected *Camponotus vagus* females and some life cycle stages of *Menozziola tanaitica*.

1 – *Camponotus vagus* females in test tube incubators; 2 – Phoridae larvae emerging from the abdomen of *C. vagus* female, which was taken out of the poplar trunk in the vicinity of Bagaevskaya Cossack village; 3 – *C. vagus* female abdomen 1 hour before releasing of the Phoridae larvae; 4 – *C. vagus* female abdomen in the moment of opening of the tergites; 5 – *C. vagus* female abdomen in the moment of releasing of Phoridae larvae; 6 – Phoridae pupae and the body of *C. vagus* female in the test tube incubator.

Рис. 1–6. Зараженные самки *Camponotus vagus* и некоторые стадии жизненного цикла *Menozziola tanaitica*.

1 – *C. vagus* в инкубаторах; 2 – личинки Phoridae, выходящие из брюшка самки *C. vagus*, извлеченной из ствола тополя в окрестностях станции Багаевской; 3 – брюшко самки *C. vagus* за 1 час до выхода личинок Phoridae; 4 – брюшко самки *C. vagus* в момент раскрытия тергитов; 5 – брюшко самки *C. vagus* в момент выхода личинок Phoridae; 6 – куколки Phoridae и тело самки *C. vagus* в инкубаторе.

## Results

To date, no worker ants infected with Phoridae larvae have been found in the surveyed territory. Infected males were also not found, since males were not collected.

The new locality with parasitoid phorids was found on April 30, 2024 in the floodplain of the Grushevka River (the basin of the Lower Don, near the Verkhnegrushevskiy settlement, Oktyabrskiy District of Rostov Region, 47°35'49.4"N / 40°9'12.1"E). This coastal area was occupied



by plantations of holly maple *Acer platanoides* L., which in recent years have remained without proper forestry maintenance. Here, three females of *Camponotus vagus* were caught in old decaying tree trunks lying at a distance of 30 m from the water's edge. The females were kept in individual test tubes and deprived of top dressing. One of them was infected with scuttle flies. The next day its abdomen was literally fell apart and phorid larvae came out of it. In total, about 60 larvae emerged from its abdomen. All imagoes obtained from these larvae belonged to the species *Menoziola tanaitica*.

The main information about the biological features of *M. tanaitica* was obtained as a result of observations of phorids and ants inhabiting the site in the vicinity of Bagaevskaya Cossack village. Here, *C. vagus* females infected with scuttle flies were detected annually, throughout the entire observation period (2019–2024). In April 2024, when examining tree trunks, a large number of dead females were found (for example, under the bark of a fallen fragment of a poplar trunk 1 m long, with a diameter of about 50 cm, in addition to numerous live females, there were more than 10 dead individuals). Most of the dead ants had a swollen abdomen. With light pressure on it, it burst and phorid larvae began to crawl out of it. They moved fast enough and tried to hide in the folds of the bark or crawl under it, avoiding the sunlight falling on the tree trunk (Fig. 2). It was found that *Tetramorium* sp. (*ferox*-complex) workers, whose nests are located in the same trunk where the *C. vagus* females were found, actively hunt the phorid larvae.

The live females found here were placed in test tubes and were initially deprived of top dressing. 20–30 hours after capture, the abdomen of some of them noticeably increased in size and became similar to the abdomen of "overfed" physogastric individuals. After 15–20 hours, lying on their side, they began to make convulsive movements with their legs and head and died (Fig. 3). 20–25 hours after death, their abdomen was torn between the first and second tergites and the first larvae appeared from it (Figs 4, 5). At the same time, the main part of the larvae continued to remain in the abdomen for 5–10 hours, probably eating out its contents. In total, the abdomen of infected *C. vagus* females contained from 49 to 63 larvae. Two days after the larvae were released, the first pupae were found in the incubators (Fig. 6). 16 days after pupation, the first imagoes appeared in incubators. The main part of the flies came out on the 18<sup>th</sup> day after pupation.

It was found that females collected immediately after the end of the nuptial flight (173 specimens) and females engaged in shelter equipment or having already completed this process and located under the bark and inside the trunks of fallen trees (127 specimens) show different degrees of infection with phorid larvae. Among the females captured immediately after the nuptial flight, the number of infected individuals never exceeded 5%. In the second group of *C. vagus* females, the number of infected ants in some years reached 80%. The different degree of infection by scuttle flies in females of the first and second groups is obviously associated with the greater vulnerability of individuals engaged in shelter equipment. The results of observations of *C. vagus* females *in vivo*

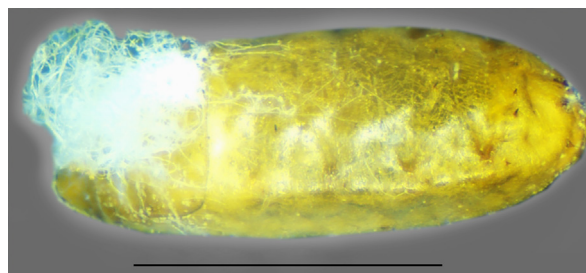


Fig. 7. *Menoziola tanaitica* puparium infected with mold fungi. Scale bar 1 mm.

Рис. 7. Пупарий *Menoziola tanaitica*, зараженный плесневыми грибами. Масштабная линейка 1 мм.

confirm this statement. Ants moving in search of shelter actively react to attacking flies. They tend to scare away parasitoids with sharp attacks and do not linger on open spaces for a long time. Females of *C. vagus*, gnawing through passages in wood with the help of mandibles, are more accessible to infection by scuttle flies. In this position, their head is under the wood, and they are unable to detect the attack of the parasitoid. Therefore, flies are able to lay eggs almost unhindered in the unprotected abdomen of such females. Obviously, the vast majority of *C. vagus* become infected with parasitoids during invasion into tree trunks.

Observations of the metamorphosis of scuttle flies under artificial conditions allowed us to establish that the viability of their larvae and pupae is significantly reduced if mold fungi enter the incubators. For example, in 2023, mold often appeared in many test tubes. That year, only 8% of the larvae that emerged from the female's abdomen have successfully completed their metamorphosis. Most of the pupae were covered with mold and the flies inside them died (Fig. 7). It should be noted that in 2023, the females were extracted from waterlogged rotting wood and, obviously, could carry a significant number of mold spores. Probably, in natural conditions, phorid pupae are also exposed to mold fungi.

## Discussion

Probably, scuttle flies specializing in a specific host inhabit mainly intrazonal floodplain forests and artificial plantings in floodplains of rivers in Rostov Region, where *C. vagus* families often settle in old wood.

The percentage of females infected with flies varies greatly from year to year in one local area, which may indicate population waves of these parasitoids in changing conditions.

The data accumulated over five years of collection of these flies allows us to say that the full life cycle of *M. tanaitica* from an egg laid in the body of an ant to the release of an imago is on average 24–25 days. Obviously, subsequent generations of scuttle flies have to parasitize workers, which is less profitable, since they have a much smaller fat reserve, which means that the number of imagoes that have emerged from the worker ant will be less than from the female. This is evidenced by the observations of Quirvin and co-authors [Quirvin et al., 2009].

## Acknowledgements

The author is much obliged to G.B. Bakhtadze (Department of Zoology, D.I. Ivanovsky Academy of Biology and Biotechnology of the Southern Federal University, Rostov-on-Don, Russia) for valuable comments and corrections during the preparation of the draft of the manuscript. The author is also cordially grateful to anonymous reviewers for important corrections and comments.

## References

- Quirvin M., Disney R.H.L., Duvallet G. 2009. The first record of *Menozziola obscuripes* Schmitz (Diptera, Phoridae) parasitizing *Camponotus vagus* (Scopoli) (Hymenoptera, Formicidae), with comments on the recognition of the fly. *Entomologist's Monthly Magazine*. 145: 211–212.
- Shevchenko D.M., Dubovikoff D.A., Disney R.H.L. 2024. A new species of scuttle flies (Diptera, Phoridae) from the genus *Menozziola* Schmitz that's a parasitoid of ants (Hymenoptera, Formicidae) *Camponotus vagus* Scopoli. *Ecologica Montenegrina*. 73: 138–145. DOI: 10.37828/em.2024.73.14

Received / Поступила: 31.07.2024

Accepted / Принята: 23.09.2024

Published online / Опубликовано онлайн: 17.12.2024