

A New Trophic Association between the Native Leaf-Rolling Weevil *Cynotrachelodes cyanopterus* (Motschulsky, 1861) (Coleoptera, Attelabidae) and the North American Black Locust in the South of the Russian Far East

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Abstract—A new trophic association between the leaf-rolling weevil *Cynotrachelodes cyanopterus* (Motschulsky, 1861) and the North American woody plant *Robinia pseudoacacia* L. used in landscaping of populated areas of the region has been documented in the Primorsky Territory (south of the Russian Far East) for the first time. In the towns of Artem, Bolshoy Kamen, and Spassk-Dalny, isolated damage by the leaf-rolling weevil (fine leaflets rolled into tubes with larvae feeding inside) was found. The paper gives a brief overview of biology and ecology of the leaf-rolling weevil and illustrates the leaf damage as well as male and female adults reared from two leaf tubes. If the plant lacks resistance to this new consumer, an increase in the population density of *C. cyanopterus* can be expected in the Primorsky Territory. Further research is needed to monitor the spread of *C. cyanopterus* and to assess its potential impact on the new host plant.

Keywords: native leaf-rolling weevil, alien host plant, *Robinia pseudoacacia*, new trophic relationship, Primorsky Territory

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INTRODUCTION

A wide range of ornamental woody plants is used in the landscape design of populated areas of the Primorsky Territory (Malysheva, 2020). Phytophagous insects have a significant impact on their growth, development, and decorativeness (Kuznetsov and Storozhenko, 2010). Among the pests that damage ornamental plantings, there are both native and alien species (*Nasekomye-vrediteli* ..., 1995; Maslyakov and Izhevskii, 2011).

A North American introduced species, black locust *Robinia pseudoacacia* L. (Fabaceae), is quite widespread in landscaping of populated areas of the Primorsky Territory. This plant species has been known in the Russian Far East since the early 20th century. From 1908, *R. pseudoacacia* was cultivated by S.I. Elo-

vitskii in Vladivostok (Vasilyuk et al., 1987). Currently, in the south of the mainland part of the region, black locust is used in landscaping of 84 populated areas of the Primorsky Territory (Kolyada, 2021). In them, the species is represented by trees up to 23 m high. Recently, black locust has also been used in landscaping of the city of Khabarovsk (Borzenkova and Tsyrenova, 2024). The plant is highly decorative during flowering and has average winter hardiness (Kolyada, 2022). As a result of its withdrawal from cultivation and independent spread, *R. pseudoacacia* was included in the list of flora of the Russian Far East (Pavlova, 1989). In the Primorsky Territory, *R. pseudoacacia* exhibits invasive properties and penetrates into natural ecosystems. This North American plant exhibits the same properties in other regions of Russia and parts of the world (Roy et al., 2020; Vinogradova et al., 2021).

Black locust is associated with a whole range of insect pests. The latter often penetrate the territory of the secondary range of the species. Some of them have also appeared in the Russian Far East. Monitoring of plantings in the Primorsky Territory revealed a number of specialized phytophages of *R. pseudoacacia* that are alien to the region and Russia as a whole. These include the locust gall midge *Obolodiplosis robiniae* (Hald., 1847) (Diptera: Cecidomyiidae) (Gninenko and Glavendekich, 2010), the false acacia sawfly *Nematus tibialis* Newman, 1873 (Hymenoptera: Tenthredinidae) (Kolyada, 2024), and the leaf-mining moth *Chrysaster ostensackenella* (Fitch, 1859) (Lepidoptera: Gracillariidae) (Kirichenko et al., 2023, 2024).

The tube-rolling beetles (Coleoptera, Attelabidae) are a group of beetles characterized by the folding of leaves or parts of leaves into characteristic tubes in which their larvae feed and develop (Legalov, 2004). The world fauna of tube-rolling beetles includes about 1300 species, most of which are concentrated in the subtropical and tropical zones (Legalov, 2007). This group of insects plays an important role in human economic activity, since many of its representatives are pests of agriculture and forestry (Ter-Minasyan, 1950; Legalov, 2005b, 2006).

The fauna and biology of tube-rolling beetles in certain regions of Russia, mainly its Asian part, have been studied quite well (Legalov, 2006). In the Far East, the biology of tube-rolling beetles has been studied since 1915 (Dyukin, 1915), and numerous data on their biology and ecology have been obtained since then (Azarova and Kupyanskaya, 1972; Azarova, 1974, 1981; Egorov, 1996).

In published sources, tube-rolling beetles on *R. pseudoacacia* have not been mentioned to date. This article provides information on the first find of the native tube-rolling beetle species *Cynotrachelodes cyanopterus* (Motschulsky, 1861), which is widespread in the Far East, on the North American black locust.

MATERIALS AND METHODS

The research was conducted in the Primorsky Territory in seven population centers (the cities of Artem, Spassk-Dalniy, Arsenyev, Ussuriysk, Partizansk, Bolshoy Kamen, and the settlement of Siny Gai) in June–October 2024 using the route method. In each settlement, leaves on 10–15 *R. pseudoacacia* trees were visually inspected for insect damage.

The material for this publication was the findings of leaf tubes on *R. pseudoacacia* in three population centers of the Primorsky Territory. Four leaf tubes were transported to the laboratory of the Gornotaezhnaya Station, a branch of the Federal Scientific Center of Biodiversity, Far Eastern Branch of the Russian Acad-

emy of Sciences. They were placed one by one in Petri dishes and kept at a temperature of 25°C and a humidity of 60% until the imago hatched (one female was reared in this way). The fifth leaf tube was delivered to the Forest Zoology Laboratory of the Institute of Forest of the Siberian Branch of the Russian Academy of Sciences (Krasnoyarsk), where a male beetle was reared under similar conditions. Both beetle imagoes were mounted and placed in the entomological collection of the Institute of Forest.

The damaged leaves were photographed with a Sony Cyber-Shot DSC-W830 camera (Japan, Sony Group Corporation), and the beetle was photographed in the camera mode of a Honor200 ELI-NK9 smartphone (China, Huawei Honor).

RESULTS AND DISCUSSION

Coleoptera, Attelabidae (tube-rolling beetles)

Cynotrachelodes cyanopterus (Motschulsky, 1861)

Synonyms: *Apoderus coloratus* Faust, 1882

Studied Localities and Samples (Fig. 1)

RUSSIA, Primorsky Territory, Artem, 43°22'45" N, 132°17'20" E, 40 m above sea level, two leaf tubes on *R. pseudoacacia*, July 6, 2024, Kolyada N.A. (coll.), a female beetle was reared from one tube, July 25, 2024 (em.), Akulov E.N., Legalov A.A. (leg.); Bolshoy Kamen, 43°07' N 132°21' E, 50 m above sea level, one tube on *R. pseudoacacia*, August 3, 2024, Efremenko A.A. (coll.), a male beetle was reared from one tube, August 23, 2024 (em.), Akulov E.N., Legalov A.A. (leg.); Spassk-Dalniy, 44°36' N, 132°49' E, 93 m above sea level, one tube on *R. pseudoacacia*, August 4, 2024, Kolyada N.A. (coll.).

Species Distribution

The species is found in Northeast Asia—in Russia (southeast of the Zabaykalsky Territory, south of the Amur Region, the Jewish Autonomous Region, and south of the Khabarovsk and Primorsky territories), as well as in China, Korea, and Japan (Legalov, 2005a, 2009, 2020; Alonso-Zarazaga et al., 2023).

Food Plants

The only food plant known for this species is *Lespedeza bicolor* Turcz. (Fabaceae) (Ter-Minasyan, 1950). Our findings of leaf tubes on *R. pseudoacacia* in the Primorsky Territory and the successful rearing of imagoes from them indicate a new trophic relationship between the native beetle and the North American plant. Considering the phylogenetic relationship between the beetle's usual food plant (*Lespedeza*) and the new one (*Robinia*), which are both from the Fabaceae family, the new trophic relationship is entirely logical. Isolated findings of damage on *R. pseudoacacia* in the Primorsky Territory in 2024 and the absence

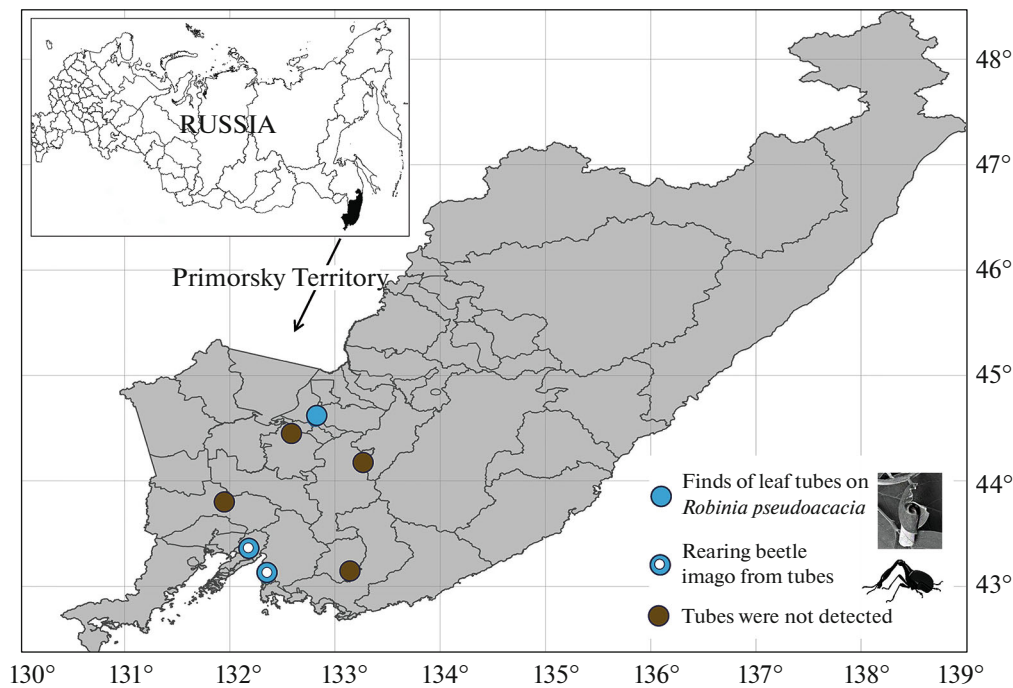


Fig. 1. Locations of damage by the leaf-rolling weevil *Cynotrachelodes cyanopterus* on *Robinia pseudoacacia* leaves in the Primorsky Territory in June–October 2024.

of any evidence of characteristic damage on this plant in previous years (despite long-term monitoring of plant stands in the territory) indicate that this trophic relationship between the local beetle species and the alien plant species is quite recent in Russia. This relationship is not new to science: in 2004, the beetle was also reared by A.A. Legalov from leaf tubes with *R. pseudoacacia* in the vicinity of Beijing (China) (unpublished data). For other countries of Northeast Asia (Korea, Japan), where *R. pseudoacacia* was also introduced at one time, we did not find any information in the literature on the development of *C. cyanopterus* on this alien plant.

Biology

The process of preparing a future place for the development of offspring by a female *C. cyanopterus* is described in the study by Egorov (1992). Females make both left- and right-twisted leaf tubes from leaflets, which remain hanging on the branch of the host plant after the imago has emerged (Egorov, 1992). In the Primorsky Territory, in the three above-mentioned localities (Fig. 1, Figs. 2a, 2b), we found five dense right-twisted leaf tubes of cylindrical shape on the leaves of the apical shoots of *R. pseudoacacia*. Each tube was formed from a separate leaflet of a compound leaf (Figs. 2c, 2d). The length of the tube was 8–9 mm, and the diameter was 5–6 mm.

In laboratory conditions, two beetles (male and female) were reared from two leaf tubes (Fig. 3). The time from the moment of collecting the tubes in nature until the emergence of the imago was about two weeks.

Potential Damage and Further Spread

The production of tubes has a certain effect on the host plant: the beetle gnaws at the leaves, which leads to a loss of turgor, and the tubes themselves dry out over time. However, with a low population of the leaf-rolling weevil, such damage is insignificant and does not affect the general condition of the plant. Egorov (1992) noted the presence of dozens of tubes in *Lespedeza bicolor* thickets. So far, we have found only single tubes on *R. pseudoacacia*. The successful adaptation to a new food plant by the local leaf-rolling weevil can contribute to an increase in its population in the Primorsky Territory. In this case, more noticeable damage to the black locust can be expected. It is difficult to say as yet how much this will affect the condition of the black locust stands and whether it will lead to inhibition of plant growth. This will require further observations of the dynamics of the leaf-rolling weevil population. The new trophic relationship formed by the native leaf-rolling weevil with an introduced plant, a representative of the North American flora, should be taken into account when studying the further spread of the new consumer of black locust to its homeland, North America.



Fig. 2. Habitats and damage by the leaf-rolling weevil *Cynotrachelodes cyanopterus* on *Robinia pseudoacacia* in the Primorsky Territory in June–October 2024: (a) external view of the North American black locust stand along the pedestrian path in the town of Artem; (b) a separately growing young North American black locust tree in Spassk-Dalny; (c, d) tubes of leaflets. Photo: N.A. Kolyada.

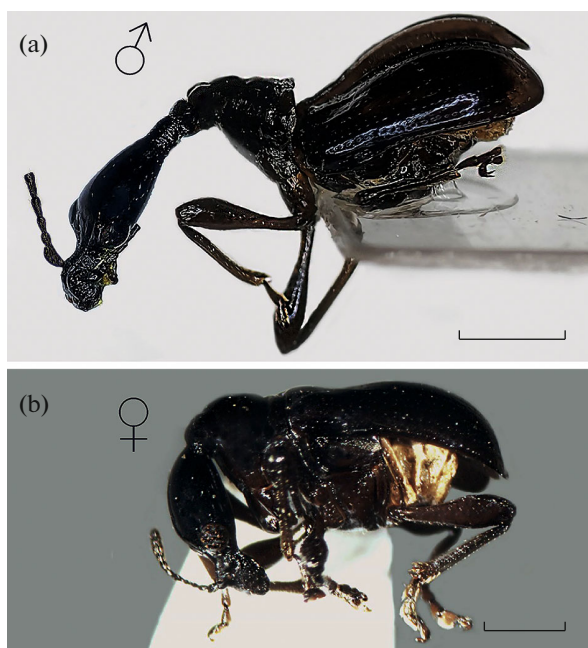


Fig. 3. Imago of the leaf-rolling weevil *Cynotrachelodes cyanopterus* reared from leaf tubes on *Robinia pseudoacacia* in the Primorsky Territory in 2024: (a) male (antennae were broken off randomly); (b) female. Photo: (a) N.I. Kirichenko, (b) E.N. Akulov.

CONCLUSIONS

Thanks to regular monitoring of plantings of introduced plants in the south of the Far East, in the Primorsky Territory, a new trophic relationship was identified between the leaf-rolling weevil *C. cyanopterus* and the North American black locust *R. pseudoacacia*, widely used in landscaping the region. In 2024, damage caused by the leaf-rolling weevil was found only once: in total, only five leaf tubes were found, from which two adult beetles were reared. If *R. pseudoacacia* turns out to be unstable to the new consumer, the latter will be able to significantly increase its numbers in the Primorsky Territory. Further study of the distribution of *C. cyanopterus* is required, taking into account the new trophic relationship, as well as an assessment of the potential of the leaf-rolling weevil to reproduce massively on this new host plant.

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ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This work does not contain any studies involving human and animal subjects.

CONFLICT OF INTEREST

The authors of this work declare that they have no conflicts of interest.

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