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Invasive Pests of *Robinia pseudoacacia* Foliage in Plantings of the Lower Volga region, Russia †

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† Presented at the 1st International Electronic Conference on Entomology (IECE 2021), 1–15 July 2021; Available online: https://iece.sciforum.net/.

Abstract: Plants of generic complex Robinia L., 1753 are characteristic of the dendroflora of the Lower Volga region. They are not native to the arid zone, their natural range is confind to North America. The beginning of the introduction of plants of this generic complex in Russia falls on the late 18th – early 19th centuries. They began to be used most massively in planting from the middle of the 20th century. Robinia species have been resistant to pests for many years. For the last decade, damage to the foliage of the robinia (whiteacacia) marginal gall midge *Obolodiplosis robinia* (Haldeman, 1847) (Diptera: Cecidomyiidae) and *Nematus tibialis* (Newman, 1837) (Hymenoptera, Tenthredinidae) has been recorded annually in the crowns of *Robinia pseudoacacia* L. On the territory of the Russian Federation, gall midge was first recorded in 2006 and by 2010, it reaches the Volgograd region. Here, *Obolodiplosis robiniae* successfully masters the assimilation apparatus of Robinia of different ages in plantations of various types and ecological categories. The density of galls in plantings on average is 1.9 pcs. / leaf, the maximum is 7.0 pcs. / leaf. Since 2017, on the territory of the Lower Volga region, *Nematus tibialis* has been recorded in plantations with the participation of woody plants of the genus Robinia. This pest prefers the foliage of trees of intra-quarter plantings and squares located near buildings or adjacent to them. On average, the density of larvae in the crown of a tree is 2.12 pcs. / leaf.

Keywords: *Robinia*, *Obolodiplosis robiniae*, *Nematus tibialis*, invader insects, pests, abundance, plantings.

Citation: Gribust, I.R.; Belitskaya, M.N.; Blyum, K.Y.; Bak-radze, N.Y.; Karpenko, R.V. Invasive Pests of *Robinia pseudoacacia* Foliage in Plantings of the Lower Volga region, Russia, in Proceedings of the 1st International Electronic Conference on Entomology, 1–15 July 2021, MDPI: Basel, Switzerland, doi:10.3390/IECE-10402

Published: 30 June 2021

1. Introduction

The creation of multifunctional protective plantings for various purposes is one of the main elements of landscape optimization in sparsely wooded regions. Woody plants of the generic complex *Robinia spp*., 1753 [12] are of the great practical importance in the problem of expanding the range of plantings, increasing the decorativeness and durability of plantings.

For a long time, plantings of the genus *Robinia* retained resistance to phyllophages. However, in recent years, insect species alien to the region have occupied stable positions among the entomocommunites. At present, the phyllophagous complex contains invading insects closely related to *Robinia pseudoacacia* L. [1; 3; 8; 11; 13].

Among the identified invasive insects in the plantings of the Lower Volga Region, the most common in the crowns of *Robinia* spp. *Obolodiplosis robiniae* Haldeman, 1847 (Diptera, Cecidomyiidae) and *Nematus tibialis* (Newman, 1837) (Hymenoptera, Tenthredinidae) [1]. Damage to the *O. robiniae* and *N. tibialis* assimilation apparatus of trees over time threatens to develop into a serious problem for plantations of the Lower Volga region. In this regard, a detailed study of the characteristics of the life, distribution and settlement of foliage by these phyllophages, the

identification of their biotopic preferences, taking into account the environmental conditions of planting, becomes especially relevant in the region.

The purpose of this study is to study and analyze the biotopic distribution of *Obolodiplosis robiniae* и *Nematus tibialis* in protective plantings of different types and ecological categories of the Lower Volga region.

2. Objects and methods of research.

Studies were carried out in dendrological collections and protective forest plantations of the Federal Research Center for Agroecology of the Russian Academy of Sciences (FSUE «Volgogradskoye» cadastre. № 34:34:000000:122; Land use «Kachalinskoye» cadastre. № 34:08:000000:6), as well as in recreational landscaping plantations on the city of Volgograd.

The subjects of research were insects living in the crowns of *R. pseudoacacia* L. The collection and accounting of phyllophages was carried out every 7-10 days throughout the growing season. On the tree, three model branches 1 m long were selected from different parts of the crown [4; 9]. They counted the number of leaves, including damaged by pests. To take into account the number of phylophages from trees, 100 complex leaves were collected from different parts of the crown; determined the proportion of leaves inhabited by pests; the average number of simple leaves on one complex sheet, the number of simple leaves inhabited by phyllophages, the proportion of leaves with different numbers (1-7) of galls on one sheet [5; 6]. When comparing the quantitative abundance of phyllophages, relative numbers were used: the number of individuals per 100 pieces of leaves.

3. Research results and discussion.

In the plantations of the Lower Volga region in the *R. pseudoacacia* insect complex, 4 invasive species were identified. They are representatives of 3 squads and three insect families (Table 1).

Table 1 Species composition of *Robiniae* invaders

Species	Squad	Family
Obolodiplosis robiniae Haldeman, 1847	Diptera	Cecidomyiidae
Phyllonorycter robiniae Clemens, 1859	Lepidoptera	Gracillariidae
Parectopa robiniella Clemens, 1863	——"——	——"——
Nematus tibialis Neuman, 1837	Hymenoptera	Tenthredinidae

In plantings, the most pronounced destructive activity of such species as *O. robiniae* and *N. tibialis* [1; 2].

In the spectrum of the surveyed protective plantings, *R. psevdoacacia* in street plantings is maximally populated with these pests – 41.6 % and 72.8 % of the total number of surveyed trees, respectively. The number of galls of *O.robiniae* and the density of individuals of *N. tibialis* on the leaves of *R. psevdoacacia* vary considerably.

The last decade in the crowns of *R. pseudoacacia* annually recorded damage to the foliage of gall *O. robiniae*. For the first time, the gallite is celebrated on the territory of the Russian Federation in 2006, and, by 2010, reaches the Krasnodar Territory [Gninenko, 2010]. In the conditions of the Volgograd region, it was recorded by us in 2010 [1; 2].

The population of the leaves of *O. robiniae* woody plants of the genus *Robinia* in plantings of various types and ecological categories ranged from 31.8-62.0%. The density of galls in plantings is on average – 1.9 pcs. / leaf, maximum – 7.0 pcs. / leaf.

O. robiniae prefers to settle in the crowns of trees of intra-quarter and street plantings (14.2-3.8 % and 17.3-5.5 %, respectively). Most simple leaves recorded 1 to 3 galls. In plantings of other ecological categories, galls *O. robiniae* were rare. Analysis of the localization of galls on a complex leaf showed that gall midge most often forms its terata [10] in the

lower (52.0 %) and middle (42.0 %) thirds of the leaf, damaging mainly (in descending order) 4, 5, 1, 2 and 6 pairs of simple leaves.

In the territory of the Lower Volga region since 2017, there has been an increase in the number of *N. tibialis* in arboretum and parks. Observations showed that in recreational landscaping, this pest prefers tree foliage in intra-quarter planting (27.7% of the examined complex leaves) and squares located near or adjacent to buildings (50.7% of the damaged leaves of the number examined). At the same time, the number of larvae on 1 leaf ranges from 1 to 5 individuals. On average, the density of larvae in the crown of a tree is 2.12 pcs. / leaf.

N. tibialis prefers the foliage of intra-quarter plantings, where on the majority of leaves (27.7 %) it is localized by one larva, and about 35 % of the leaf blades are inhabited by two-three larvae. On trees in arboretums and parks, most leaves are colonized by only one larva (16.8 % and 12.6 %, respectively).

Among plantings of different types and ecological categories, galliths are more harmful to the foliage of water protection plantings (31.28%) and arboretum (24.3%) (Table 2). The malpractice of *Nematus tibialis* is more pronounced in squares (14.0%), roadside and water protection forest bands (12.36 and 15.77%, respectively).

Table 2. Robinia damage with *O. robinae* and *N. tibialis* galley in various planting.

Category of plantings	Number of leaves, pcs.		Including damaged simple leaflets	
	complex	simple	pcs.	%
Obolodiplosis robiniae				
Urban plantatings: parks	32	490	17±0,06	3,47
squares	170	2172	60±1,30	2,76
intra-quarter	83	1126	46±1,35	4,09
urban street	175	2374	34±1,26	1,43
arboretum	10	111	27±0,07	24,3
Forest bands: roadside	152	2055	58±0,01	2,82
field-protecting (Kamyshinsky district)	140	1866	58±0,01	3,11
water protection (Tsimlyansk sands)	126	1592	498±29,29	31,28
Nematus tibialis				
Urban plantatings: parks	32	490	13±0,01	2,65
squares	170	2172	304±10,86	14,00
intra-quarter	83	1126	28±0,04	2,49
urban street	175	2374	106±0,06	4,47
arboretum	10	111	0±0,00	0,00
Forest bands: roadside	152	2055	254±0,43	12,36
field-protecting (Kamyshinsky district)	140	1866	178±0,71	9,54
water protection (Tsimlyansk sands)	126	1592	251±12,31	15,77

4. Conclusion

Thus, invaders are present in plantings of various types and ecological categories with the inclusion of *R. pseudoacacia*. The most numerous of them are *O. robiniae* and *N. tibialis*. The settlement of foliage and its damage by these insects in protective plantings varies greatly.

O. robiniae is characterized by the fact that the maximum proportion of simple leaflets contains 1 gall in intra-quarter and urban street plantings. At the same time, galley foliage is more harmful to trees of water protection planting (31.28%) and in arboretum (24.3%).

N. tibialis prefers foliage of intra-quarter woodlands, where on most leaves (27.7%) it is localized to the 1st larva, and about 35% are inhabited by 2-3 larvae. On trees in the arboretum and park, 16.8% and 12.6% of leaves, respectively, are inhabited by only one larva. The malpractice of phyllophage is more pronounced in squares (14.0%), roadside and water conservation forest bands (12.36 and 15.77%, respectively).

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