

Species Composition of *Salix* Pests in the South Aral Sea Forest Ecosystem (Uzbekistan)

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Abstract The pest insects of the plant *Salix* in two neighboring regions of Khorezm and Karakalpakstan within the Aral Sea Basin, are listed and described based on literature data and the author's unpublished research, with a special emphasis on entomofauna. A checklist of pests insects associated with *Salix* in south Aral Sea areas is presented, incorporating literature records and the latest taxonomic and nomenclatural updates. This checklist of *salix* pest insects is the first time for Uzbekistan and represents a total of 35 species, within 28 genus, belonging to 19 families, of the pests, recorded from 1995 to 2024 in Uzbekistan. The species composition includes 6 species of Hemiptera, 13 species of Coleoptera, 1 species of Diptera, and 15 species of Lepidoptera.

Keywords *Salix*, Pest insects, Khorezm, Karakalpakstan, Aral Sea Basin, Uzbekistan, Biodiversity, Entomofauna

1. Introduction

Insect pests constitute a significant components of forest ecosystems yet their contributions in global environmental change and forestry dynamics has often been overlooked. Despite the mountainous nature of Central Asia, forests cover a relatively small proportion of each country. The forested areas are predominately composed of *Saxaul* (*Haloxylon* spp.), *Ulmus*, *Salix*, *Populus* and other shrubs, especially within the desert and semi-desert landscapes of the region. Willow is a tree belonging to the genus *Salix* of the Salicaceae family. Two species of it, *Salix songarica* and *Salix wilhelmsiana*, are found in the conditions of the South Aral Sea [12,13].

The insects of the two neighboring regions of region Khorezm and republic of Karakalpakstan in the Aral Sea Basin are listed and described based on literature data. These regions consist of irrigated farmland, forest-tugay and deserts of Kyzylkum and Karakum. They exhibit a series of different ecosystem types, and reference is made to the corresponding entomocomplexes [15]. Phytophagous insects or herbivorous, are significant pests in *Salix* and *Ulmus* forestry. By feeding on plant sap, they cause direct damage to their host plants, leading to discoloration, deformation of leaves and shoots, or the formation of galls and pseudo galls. Pest adults can be dislodged from branches by beating foliage. In spring, evidence of infestation includes

sap flow down the trunk and the presence of moist sawdust pushed out of galleries. Adults are often observed walking on trunks or branches, particularly at night. Additional signs of infestation include wilting suckers and pronounced holes in the young stems caused by adults feeding [2,5,6]. Currently, information on impact of pests and diseases affecting forests in Uzbekistan is incomplete. Among the pest, the order Heteroptera or true bugs are a large group with more than 40,000 species in approximately 50 families distributed across the world [11,26]. In Russia, 760 species in 285 genera, and 35 families, are recorded [25], however, more than 1250 species are distributed in Central Asia [7], and 700 species of true bugs are distributed in Uzbekistan [4]. An annotated list of the registered species of pests insects of *Salix* of the described region is provided. Furthermore, an updated checklist of pest insects affecting *Salix* in the South Aral Sea areas is presented based, on literature records with the latest taxonomic and nomenclatural changes.

2. Material and Methods

Study area

The Republic of Uzbekistan is located between the Amudarya and Syrdarya Rivers, and its total area is 448,900 km². The territory of the republic is 1,425 km from east to west and 930 km from north to south [16,20]. The Northeast biogeographic regional part of Uzbekistan is situated between the western part of the Tien Shan Mountains and the Syrdarya River [3,21].



Figure 1. Biogeographic region South Aral Sea areas in Uzbekistan

Uzbekistan's geographical position at the crossroads of several Central Asian bio-geographical regions underpins the remarkable richness of its flora and fauna. This biodiversity reflects the variety of natural conditions across the country, where vast plains occupied by various desert types, mountain steppes, forests, alpine meadows, tugai thickets, and water bodies form distinctive ecosystems [9,10]. Tugai and floodplain ecosystems persist in limited areas along the Amudarya River. Meanwhile, the degraded low mountains and escarpments of Ustyurt Plateau located amidst the desert provide refuge for many rare species. However, at the same time, they are subject to pressure from animal husbandry as well as from

the mining industry (building stone, gypsum raw material, etc.). Forest-tugai ecosystems play a vital role in both the economy and environmental protection efforts [19,24].

A peculiarity of most natural ecosystems is their heightened vulnerability, associated with climate aridity. As a result, the resistance of the ecosystems to external forces is rather low and any anthropogenic interference acts as an additional factor contributing to the degradation of natural systems. The geographical scope of this checklist covers the South Aral Sea areas (Fig. 1).

The studies conducted in Uzbekistan from 1995 to 2024 by many researchers on pests of *Salix* are examined in detail with information about each species sourced from the literature. The Latin names of pest insects taxa and classification follow Favret (2023) [8]. The names of specific subgenera and taxa of lower rank within genera are arranged in alphabetical order. Under each pest insect species and subspecies, the first publication from Uzbekistan is cited. All species studied and identified for the fauna of South Aral Sea areas are verified by Global Biodiversity Information Facility (GBIF). This is systematic checklist covers pests of *Salix* plants.

Pest description and damage. There are several species of pests known to feed on the foliage, stems, flowers, or bark of *Salix*. Insect material was collected using sweeping nets and glass containers, or by tube aspirators (Fig. 2).



Figure 2. Equipment used for collecting insects. Nets, aspirator, light trap

The research was conducted using standard entomological methods. Night species were collected with a special trap on plants, roadsides, tree trunks and leaves. The samples killed in the killing bottles are then placed in petri dishes with blotter paper and information slips indicating when, where and from which plant they were collected. Insects were killed in glass tubes with ethyl-acetate or were directly stored in 70% ethyl-alcohol [18].

3. Results

To date, 35 species and subspecies of *Salix* plant pests have been identified in the South Aral Sea region, based on data from research scientists and our own research. These

included 6 species of Hemiptera, 13 species of Coleoptera, 1 species of Diptera, and 15 species of Lepidoptera.

Order: Coleoptera Linnaeus, 1758

Family: Apionidae Schönherr, 1823

Genus: *Apion* Herbst, 1797

Apion sp.

Family: Buprestidae Leach, 1815

Genus: *Agrilus* Curtis, 1825

Agrilus uzbekistanus Stepanov, 1958

Genus: *Trachypteris* Kirby, 1837

Trachypteris picta (Pallas, 1773)

Family: Cerambycidae Latreille, 1802

Genus: *Aeolesthes* Gahan, 1890

Aeolesthes sarta Solsky, 1871.

Genus: *Xylotrechus* Chevrolat, 1860
Xylotrechus namanganensis Arkhangel'skii, 1941
Family: Chrysomelidae Latreille, 1802
Genus: *Altica* Geoffroy, 1762
Altica deserticola (Weise, 1889)
Genus: *Chrysomela* Linnaeus, 1758
Melosoma populi Linnaeus, 1758
Genus: *Clytra* Laicharting, 1781
Clytra quadripunctata (Linnaeus, 1758)
Genus: *Cryptocephalus* Geoffroy, 1762
Cryptocephalus melanoxanthus Lopatin, 1952.
Cryptocephalus bipunctatus (Linnaeus, 1758)
Genus: *Plagioderia* Chevrolat in Dejean, 1836
Plagioderia versicolora Laicharting, 1871
Family: Curculionidae Latreille, 1802
Genus: *Chlorophanus* Schönherr in Sahlberg, 1823
Chlorophanus caudatus Fähræus, 1840
Genus: *Platymycterus* Marshall, 1918
Platymycterus trapezicollis (Ballion, 1878)
Order: Diptera Linnaeus, 1758
Family: Agromyzidae Fallen, 1823
Genus: *Melanogromyza* Hendel, 1920
Melanogromyza schlingeri Sasakawa, 1992
Order: Hemiptera Linnaeus, 1758
Family: Aphididae Latreille, 1802
Genus: *Chaitophorus* Koch, 1854
Chaitophorus salicti (Schrank, 1801)
Chaitophorus salijaponicus niger (Mordvilko, 1929)
Family: Diaspididae Maskell, 1878
Genus: *Chionaspis* Signoret, 1869
Chionaspis polypora Borchsenius, 1949
Family: Eriococcidae Brues 1932
Genus: *Gossyparia* Signoret, 1875
Gossyparia salicicola Borchsenius, 1949
Family: Pentatomidae Leach, 1815
Genus: *Apodiphus* Spinola, 1837
Apodiphus integriceps Horvath, 1888
Family: Tingidae Laporte, 1832
Genus: *Monosteira* A. Costa, 1862
Monosteira discoidalis (Jakovlev, 1883)
Order: Lepidoptera Linnaeus, 1758
Family: Cossidae Leach, 1815
Genus: *Cossus* (Fabricius, 1793)
Cossus cossus (Linnaeus, 1758)
Family: Erebidæ Leach, 1815
Genus: *Catocala* (Schrank, 1802)
Catocala elocata (Esper, 1787)
Catocala lupina (Herrich-Schäffer, 1851)
Catocala neonympha (Esper, 1805)
Catocala nupta (Linnaeus, 1767)
Catocala optima Staudinger, 1888
Catocala puerpera (Giorna, 1791)
Genus: *Lymantria* (Hubner, 1819)
Lymantria dispar (Linnaeus, 1758)
Family: Geometridæ Leach, 1815
Genus: *Cabera* (Treitschke, 1825)

Cabera pusaria (Linnaeus, 1758)
Genus: *Campaea* (Lamarck, 1816)
Campaea margaritaria (Linnaeus, 1761)
Family: Noctuidæ Latreille, 1809
Genus: *Acronicta* (Ochsenheimer, 1816)
Acronicta psi (Linnaeus, 1758)
Family: Nolidae Bruand, 1847
Genus: *Earias* (Hubner, 1825)
Earias clorana (Linnaeus, 1761)
Family: Nymphalidæ Rafinesque, 1815
Genus: *Nymphalis* (Kluk, 1780)
Nymphalis polychloros (Linnaeus, 1758)
Family: Psychidæ Boisduval, 1828
Genus: *Ptilocephala* Rambur, 1866
Ptilocephala plumifera (Ochsenheimer, 1810)
Family: Sphingidæ Latreille, 1802
Genus: *Laothoe* (Fabricius, 1807)
Laothoe populi (Linnaeus, 1758)
Total 35 species

4. Discussion

There are very few studies have been conducted on *Salix* pests in Uzbekistan. Prior to this study, there was no comprehensive checklist of pests *Salix* in Uzbekistan before this study. In contrast, there are several checklists for other insect groups in this country particularly in recent years [1,14,15,17]. Due to the unique ecosystem, biodiversity and high level of endemism of vascular plants in South Aral Sea forest ecosystem (Uzbekistan) there is a high probability of finding additional new record species and even new species to science. Despite this, the pests fauna of Uzbekistan has not been well investigated yet, considering the country's high floral and landscape diversity of this country. About 60% of the pests species spend all or part of their life feeding on trees.

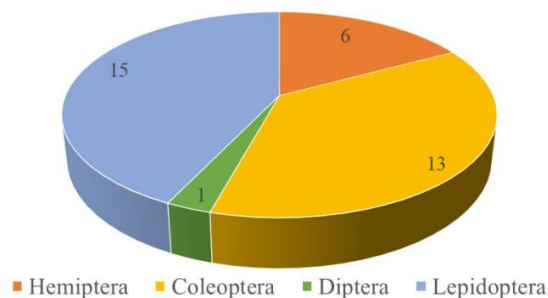
According to our research, out of the 35 pest species identified on *Salix* plants, 22 species (63%) were found to damage the stems, while 13 species (37%) were recorded to damage the leaves. Additionally, when studying the relationship of insects with the plants, they were classified into dominant species, incidental species, secondary species, and tertiary species. Four insect species (*Gossyparia salicicola*, *Chionaspis polypora*, *Chaitophorus salicti*, and *Chaitophorus salijaponicus niger*) were classified as incidental species. One insect species (*Apodiphus integriceps*) belonged to the secondary species category, one species (*Plagioderia versicolora*) to the tertiary species category, while the remaining 29 insect species were identified as dominant species (Table 1).

An analysis of pest species found on *Salix* plants in the Southern Aral Sea region revealed that 12 phytophagous species matched the information reported in the literature [22,23]. Thus, the 35 pest insect species identified were recorded as belonging to 4 orders, 19 families, and 28 genera (Figure 3).

Table 1. The species composition and damage caused by willow (*Salix*) pests under the conditions of Karakalpakstan

Species	occurrence in plants *	damage	Distribution status**
<i>Gossyparia salicicola</i>	+	stem	&**
<i>Chionaspis polypora</i>	+	stem	&**
<i>Chaitophorus salicti</i>	+	leaf	&**
<i>C.salijaponicus niger</i>	+	leaf	**
<i>Monosteira discoidalis</i>	++++	leaf	&**
<i>Apodiphus integriceps</i>	++	leaf	&**
<i>Trachypteris picta</i>	++++	stem	**
<i>Agrilis uzbekistanus</i>	++++	stem	&**
<i>Aeolesthes sarta</i>	++++	stem	**
<i>Xylotrechus namanganensis</i>	++++	stem	**
<i>Melosoma populi</i>	++++	leaf	**
<i>Altica deserticola</i>	++++	leaf	**
<i>Cryptocephalus melanoxanthus</i>	++++	leaf	&**
<i>Cryptocephalus bipunctatus</i>	++++	leaf	**
<i>Clytra quadripunctata</i>	++++	leaf	&**
<i>Plagiodera versicolora</i>	+++	leaf	**
<i>Platymycterus trapezicollis</i>	++++	leaf	&**
<i>Chlorophanus caudatus</i>	++++	leaf	&**
<i>Apion</i> sp.	++++	leaf	**
<i>Melanagromyza schlingeri</i>	++++	stem	&**
<i>Ptilocephala plumifera</i>	++++	stem	**
<i>Cabera pusaria</i>	++++	stem	**
<i>Campaea margaritaria</i>	++++	stem	**
<i>Cossus cossus</i>	++++	stem	&**
<i>Nymphalis polychloros</i>	++++	stem	**
<i>Laothoe populi</i>	++++	stem	**
<i>Catocala elocata</i>	++++	stem	**
<i>Catocala puerpera</i>	++++	stem	**
<i>Catocala lupina</i>	++++	stem	**
<i>Catocala optima</i>	++++	stem	**
<i>Catocala neonympha</i>	++++	stem	**
<i>Catocala nupta</i>	++++	stem	**
<i>Earias clorana</i>	++++	stem	**
<i>Lymantria dispar</i>	++++	stem	**
<i>Acronicta psi</i>	++++	stem	**

(+) incidental species; (++) secondary species; (+++) tertiary species; (++++) dominant species;
 (&) reference information; (**) species identified in our research

**Figure 3.** The ratio of pest orders of willow (*Salix*) under the conditions of Karakalpakstan

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CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

REFERENCES

- [1] Abdullaev, I.I., Bekchanova, M., Gandjaeva L., Kholmatov, B., Raxmatullayev, A., Tajiyev, Z., Razzakov, K., Matyakubov, Z., Doschanova, M. & Ruzmetov, R. (2023b) Checklist of the earthworm fauna (Oligochaeta: Lumbricidae) of Uzbekistan. *Biodiversitas*, 24(8), 4392–440. <https://doi.org/10.13057/biodiv/d240820>.
- [2] Abdullayeva, M.I., Abdullaev, I.I., Rahimov, M.Sh. & Matyakubov, Z.Sh. (2023) Morphology and biology of *Chaitophorus salijaponicus niger* (Hemiptera: Aphididae), new recorded for the fauna of Uzbekistan. The journal Bulletin of National University of Uzbekistan: - Tashkent, 2023. No. 3.2.1. - p. 8-11.
- [3] Abdullaev, I.I., Khamraev, A.S., Martius, Ch., Nurjanov, A.A. & Eshchanov, R.A. (2002) Termites (Isoptera) in Irrigated and Landscapes of Central Asia (Uzbekistan). *Sociobiology*, USA. Florida State University, Vol. 40, №3, 605-614.
- [4] Animal World of Uzbekistan (2023) Animal World of Uzbekistan. <http://www.orient-tracking.com/Fauna.htm> [Accessed on 01.10.2023].
- [5] Bekbergenova Z.O., Koschanova R.E., Torenliyazov E.Sh. State of knowledge and prospects of entomological research in Karakalpakstan // BULLETIN OF KKO ANRUz. -2009. -№4. - P. 36-38.
- [6] Bekchanova M.Kh.. Biotopic distribution and ecological groups of nocturnal butterflies (Noctuidae, Lepidoptera) of the Lower Amu Darya district // Bulletin of the Khorezm Mamun Academy. – Khiva, 2021. - No. 5. – P. 35-39.
- [7] Esenbekova PA (2013) True bugs (Heteroptera) of Kazakhstan. Nur-Print, Almaty, 349 pp. https://zool.kz/wp-content/uploads/2020/04/esenbekova2013_poluzhestkokrylye_kz.pdf [In Russian].
- [8] Favret, C. (2023) Aphid Species File. Available from <http://Aphid.SpeciesFile.org>. (Accessed 27th July 2023).
- [9] Gandjaeva, L.A., Hudayberdieva, Marifat O., Abdullaev, I.I., Mirzayeva, G.S. & Yusupboev, E.K. (2022) First record of *Halyomorpha halys* (Heteroptera: Pentatomidae) from Uzbekistan. *Zoosystematica Rossica*, 31, 329-331. <https://doi.org/10.31610/zsr/2022.31.2.329>.
- [10] Gandjaeva, L., Abdullaev, I., Iskandarov, A., Allabergenova, K., Yusupova, S., Narimanova, G., Yusupboev, E., Ibragimova, S., Begliev, S. & Bobojonova, K. (2023) A zoogeographical analysis of true bugs (Insecta, Heteroptera) from Uzbekistan. *Zookeys*, 121–142. <https://doi.org/10.3897/zookeys.1163.99414>.
- [11] Henry TJ (2017a) Biodiversity of Heteroptera. In: Footitt RG, Adler PH (Eds) *Insect Biodiversity. Science and Society* (Vol. I. 2nd edn.). Wiley-Blackwell Press, Oxford, 904 pp. <https://doi.org/10.1002/9781118945568.ch10>.
- [12] Jalgasbaev J. Vegetation of the Southern Aral Sea region and its changes. Nukus "Bilim", 1995, 155 p.
- [13] Jollybekov B. Changes in the soil cover and landscapes of the Southern Aral Sea region in connection with anthropogenic impact. - Nukus, 1995. - 244 p.
- [14] Iskandarov, A., Abdullaev, I., Gandjaeva, L., Musaev, D., Mirzayeva, G., Kholmatov, B., Jumanazarov, H., Jangabaeva, A., Razzakov, K. & Abdullaev, U. (2022) Updated Checklist of the Pentatomidea (Heteroptera: Pentatomomorpha) of Uzbekistan. *WSEAS Transactions on Environment and Development*, 18, 1283–1295. <https://doi.org/10.37394/232015.2022.18.121>.
- [15] Khamraev, A.Sh. (2003) Soil organisms and entomocomplexes in Khorezm and Karakalpakstan (Uzbekistan). Tashkent. ZEF Work Papers for Sustainable Development in Central Asia, 63 pp. <https://www.zef.de/fileadmin/webfiles/downloads/projects/khorezm/downloads/Publications.wps.ZEF-UZ-WP06-Khamraev1.pdf> [in Russian].
- [16] Khamraev, A.S., Lebedeva, N.I., Zuginisov, T.I., Abdullaev, I.I., Rakhmatullaev, A. & Ashok, R. (2007) Food Preferences of the Turkistan termite *Anacanthotermes turkestanicus*. *Sociobiology*, Florida State University (US), Vol. 50(2), 469-478. <https://www.ars.usda.gov/research/publications/publication/?seqNo115=209367>.
- [17] Khusanov, A.K. (2012) Ecological classification of the aphid fauna of the Ferghana Range. "Animal world of Kazakhstan and adjacent territories" Proceedings of the International scientific conference dedicated to the 80th anniversary of the Institute of Zoology of the Republic of Kazakhstan. - Almaty, - 80-181.
- [18] Kholmatov, B. and Hudayberdiev, M. (2019). Formation of relational structures of information identification models for insecta orthoptera bioobject. In: 2019 International Conference on Information Science and Communications Technologies. ICISCT.
- [19] Nurjanov, A. A., Medetov, M.Zh, Gapparov, F.A, Kholmatov, B.R., Abdullayev, I.I., Tufliyev, N.Kh. & Nurjonov, F.A. (2023) Orthoptera (Insecta) fauna of the Kashkadarya region, Uzbekistan. *Biodiversitas*, 24(1), 112–121. <https://doi.org/10.13057/biodiv/d240115>.
- [20] Ruzmetov, R., Matyakubova, Y. & Abdullaev, I. (2020) Cytosporosis diseases of apple trees (*Reinette simirenkomalus*) and its distribution in the lower Amudarya region. *International Journal of Current Research and Review*, 12 (14), 62-67. <http://dx.doi.org/10.31782/IJCRR.2020.121413>.
- [21] Ruzmetov, R., Abdullaev, I., Gandjaeva, L., Matyakubov, Z., Razzakov, K., Iskandarov, A., Otaev, O. & Ibragimov, Sh. (2022) Fundamentals of using Geographical Information Systems in predicting the distribution of *Helicoverpa armigera* (Lepidoptera: Noctuidae). *Biodiversitas*, 23(6), 3251–3256. <https://doi.org/10.13057/biodiv/d230653>.
- [22] Sinadskiy Yu.V. Pests of tugai forests of the lower reaches of the Amu Darya // *Forestry*. - 1957. No. 2.
- [23] Sinadskiy Yu.V. Pests and diseases of tugai forests of Karakalpakstan. - Publishing house "Karakalpakstan". - Nukus., - 1972.
- [24] UNDP/GEF/Government of the Republic of Uzbekistan Fifth National Report on the Conservation of Biological Diversity. Republic of Uzbekistan.
- [25] Vinokurov NN, Golub VB, Zinovieva AN (2015) Plant bugs (Heteroptera, Miridae) of the South Urals State Natural

Reserve. I. Bryocorinae, Deraeocorinae, Mirinae. Bulletin of Belgorod State University. Series Natural Sciences, BGNIU 15(212): 84–93. <https://cyberleninka.ru/article/n/klopy-slepn-yaki-heteroptera-miridae-yuzhno-uralskogo-gosudarstvenno-go-prirodnogo-zapovednika-i-bryocorinae-deraeocorinae-mirinae> [In Russian].

[26] Weirauch C, Schuh RT (2011) Systematic and Evolution of Heteroptera: 25 years of progress. *Annual Review of Entomology* 56(1): 487–510. <https://doi.org/10.1146/annurev-ento-120709-144833>.

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