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PAPER

COMPOSITION, DYNAMICS, AND BIOECOLOGICAL CHARACTERISTICS OF THE ENTOMOFAUNA OF TUGAI FORESTS

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Abstract

This article examines the ecological characteristics of tugai (riparian) forests in Central Asia and the mechanisms underlying the formation of their entomofauna. The study analyzes the influence of species composition, climatic conditions, and soil–hydrological factors on the structure and dynamics of insect communities. Special attention is given to phytophagous, xylophagous, rhizophagous, and dendrophilous insect groups, their distribution patterns, population fluctuations, and impacts on plant communities. Significant pest species from the orders Coleoptera, Lepidoptera, Hymenoptera and others are described in terms of their ecological roles, adaptive features, and relationships with dominant riparian vegetation.

Key words: tugai forests, entomofauna, Coleoptera, Curculionidae, Chrysomelidae, xylophages, phytophages, halophytic plants, ecological groups, Central Asia.

Introduction

Tugai forests represent hydrologically complex and ecologically unique biotopes of Central Asia, whose formation is closely linked to the alluvial processes of major river systems such as the Amu Darya and Syr Darya. These forests are characterized by a selective assemblage of plant species shaped by a harsh continental climate, varying degrees of soil salinity, and uneven moisture distribution. Such environmental heterogeneity directly influences the composition and development of the local entomofauna. Tugai ecosystems host a wide range of phytophagous, xylophagous, rhizophagous, and dendrophilous insect groups that maintain intricate trophic relationships with plant communities. The structural diversity and ecological roles of these groups make them an essential component of the biocenotic stability of riparian landscapes. Methodological Framework. The study was conducted using a set of comprehensive methods aimed at examining the composition, ecology,

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and population dynamics of the entomofauna of tugai forests. Insect collection involved the use of entomological nets, fermentative and light traps, bark-cutting techniques, and soil sample analysis. Morphological identification relied on classical taxonomic keys and regional monographs. Ecological assessment included estimations of population density, gradation levels, distribution patterns, and trophic interactions. The damage caused by phytophagous and xylophagous insect groups to plant communities was evaluated through phenological observations. This methodology provided insights into the functional roles of key insect taxa and their responses to the hydrological and climatic conditions of tugai ecosystems.

Literature Review. Scientific investigations on the entomofauna of tugai forests have been developing since the early twentieth century. Zaktregger (1927) analyzed the ecological structure of tugai forests in the lower Amu Darya, while Sinadskiy (1963) systematically described the major pest groups characteristic of Central Asian tugai habitats. Khromtsov and Padiy (1965) provided fundamental insights into the ecological significance of bark- and wood-inhabiting insects. Samadov and Mirzoyeva (1985) identified a rich diversity of Chrysomelidae species in the tugai forests of Azerbaijan and examined their trophic associations with local vegetation. Collectively, these works form the scientific basis for understanding the taxonomic composition, ecological roles, and biogeographical patterns of tugai forest entomofauna.

Analysis

The ecological characteristics of tugai forests—including their species composition, climatic conditions, and soil–hydrological regime—serve as the fundamental factors shaping the structure of their entomofauna. As a result of these environmental parameters, the insect complexes formed within tugai ecosystems differ markedly from those of other biogeographical regions. Similar to other arid zones of Central Asia, the entomofauna of tugai landscapes is distinguished by a high proportion of endemic species. This pattern is primarily attributable to the long-term isolation of the region and the relative stability of its ecological components, which together promote the persistence and diversification of locally adapted insect taxa [2,p.304].

Despite the harsh continental climate, low humidity, and the limited diversity of woody plant species, the insect fauna of tugai forests is exceptionally rich, structurally complex, and ecologically diverse. In particular, phytophagous (leaf-feeding) insect groups demonstrate high species diversity and belong to several taxonomic orders, including Lepidoptera (Linnaeus, 1758) and sawflies and leaf-rollers of the suborder Symphyta (Hymenoptera, Gerstaecker, 1867). These groups are characterized by pronounced population fluctuations, with periodic outbreak (gradation) phenomena commonly observed.

Among other phytophagous assemblages, leaf beetles (Chrysomelidae Latreille, 1802), weevils (Curculionidae Latreille, 1802), and blister beetles (Meloidae Gyllenhal, 1810) frequently form local foci of infestation on young saplings, thereby exerting a substantial negative impact on the phytosanitary condition of forest stands. Most leaf-feeding insects possess a broad trophic spectrum: in addition to major tree species such as poplars and willows, they also inhabit and feed on camelthorn (Alhagi Gagnebin, 1755) and various herbaceous and shrubby plants.

At the same time, tugai ecosystems harbor a number of narrowly specialized, habitat-specific species. These include the twelve-spotted leaf beetle Paropsides duodecimpustulata (Gebler, 1825), the fourteen-spotted beetle Crioceris quatuordecimpunctata (Scopoli, 1763), the green weevil Hypomeces squamosus (Fabricius, 1792), Otiorhynchus singularis (Linnaeus, 1767), and the poplar flea weevil Rhynchaenus (Orchestes) populi (Fabricius, 1792), all of which are tightly associated with specific components of the vegetation cover.

Coleoptera (Linnaeus, 1758) occupy a particularly significant position within the tugai entomofauna. Bark beetles of the family Curculionidae play an especially important ecological role: as xylophagous insects, they damage the woody tissues of trees [3,p.22], while certain species act as vectors of phytopathogenic fungi, thus contributing to the spread of forest diseases. These ecological interactions have a substantial impact on the stability, vitality, and regeneration dynamics of tugai forest ecosystems.

Results

A wide range of insect groups representing diverse ecological guilds is found within the entomofauna of tugai forests. Among them, bark- and wood-inhabiting species such as Scolytinae (Latreille, 1804), longhorn beetles of the family Cerambycidae (Latreille, 1802–1815), and root- and weed-associated weevils (Curculionidae Latreille, 1802) are particularly significant. Several representatives of Hymenoptera (Linnaeus, 1758), including members of Symphyta, Siricoidea, and the family Siricidae (Billberg, 1820), are also notable for their ability to damage lignified plant tissues. Among lepidopterans feeding on woody material, species from the families Cossidae (Leach, 1815) and Sesiidae (Boisduval, 1836) are widely distributed and play an important role in xylophagous complexes. The root-feeding guild of tugai ecosystems includes larvae of Melolonthinae (Samouelle, 1819), along with other Scarabaeidae (Latreille, 1802) species, as well as wireworms (Elateridae Leach, 1815) and false wireworms of the family Tenebrionidae (Latreille, 1802). These insects complete their development within soil layers and frequently inflict substantial damage to the root systems of trees and shrubs.

Fruit- and seed-feeding species from various families also hold considerable ecological importance. By damaging generative plant organs, these insects directly affect the reproductive capacity and overall productivity of tugai forest stands.

Xylophilous Coleoptera—species that spend their entire life cycle, or most of it, in dead, weakened, or subcortical woody tissues—represent a key ecological group characteristic of tugai forests. The dominant tree species of tugai landscapes are closely associated with many cryptic wood-boring pests. Studies conducted in Populus diversifolia and P. pruinosa stands have documented the presence of several harmful beetles, including: — Capnodis miliaris (Klug, 1829), the poplar jewel beetle; — Eurythyrea aurata (Pallas, 1776), a metallic buprestid pest; — Agrilus pratensis (Ratzeburg, 1837), a narrow-bodied borer; — Aromia pruinosa (Reitter, 1903), the longhorn beetle associated with desert poplar.

Various representatives of longhorn beetles are also recorded from other regions of Central Asia. For instance, the short-winged longhorn beetle Molorchus kiesenwetteri (Mulsant & Rey, 1861) is primarily associated with Elaeagnus angustifolia (oleaster) forests. In addition, species such as Turanus scabrosus (Kraatz, 1882), Xylotrechus grumi (Semenov, 1889), and Antaxia elaeagni (Rikhter, 1945) are widely distributed across tugai landscapes of the region.

Tugai ecosystems also harbor a range of xylophagous and phyllophagous species associated with tamarisk vegetation. These include the tamarisk wood-borer Holcocerus arenicola (Staudinger, 1879), the comb-shaped bostrichid Xylosandrus dilatatus, and the gall-forming moth Amblypalpis tamarisella (Danilevsky, 1955).

Numerous sap-feeding and leaf-symptom–inducing insects are likewise characteristic of tugai habitats. Among them are the desert poplar psyllid Rhinocola aceris (Flor, 1861), the leafy poplar psyllid Egeirotrioza ceardi (De Bergevin, 1926), the tamarisk leaf-miner Psectrosema tamaricis (Stefani), and the comb-winged leaf-moth Amblypalpis tamarisella (Danilevsky, 1955), among others.

Coleoptera (Linnaeus, 1758) constitute the dominant component of tugai entomofauna. Within this order, the families Curculionidae, Buprestidae (Leach, 1815), Chrysomelidae (Latreille, 1802), Cerambycidae (Latreille, 1802), and Lyctidae (Latreille, 1802) play particularly important ecological roles. Leaf beetles (Chrysomelidae), in particular, are known for forming outbreak populations or local infestation foci, causing substantial damage to the phytomass of riparian forests [4,pp.705–714].

Analysis of materials collected from the tugai forests of Azerbaijan revealed 75 species belonging to 34 genera of Chrysomelidae (Latreille, 1802). These taxa occupy a critical position within the phytophagous insect assemblages of the region. Several species are widely distributed and have been documented as causing significant damage to valuable forest tree species and associated vegetation.

The poplar leaf beetle (Chrysomela populi Linnaeus, 1758), in both its adult and larval stages, feeds on the foliage of various Populus species, including P. tremula and P. nigra. This species is capable of causing substantial damage in nurseries, young plantations, and natural regeneration sites.

During outbreak periods, beetles may also harm buds and juvenile shoots, thereby suppressing early growth and reducing plant vitality. In tugai ecosystems, a number of frugivorous and seed-feeding insects also play an important role by damaging the generative organs of dominant plant species. In addition, soil-dwelling taxa such as scarab beetles (Scarabaeidae Latreille, 1802) and false wireworms (Tenebrionidae Latreille, 1802) inflict significant injury to root systems, thereby exerting a continuous influence on forest growth dynamics and regeneration processes [5,p.152].

T. Nurmuratov (1998) documented several noteworthy insect species occurring in tugai forests. Among them is Sphenoptera komarovi (Jakobson, 1886) (Tenebrionidae), a species inhabiting clay deserts and tugai zones, feeding mainly on the green tissues of Haloxylon, Anabasis, Karelinia, and other desert shrubs. Another representative, Zofozus nitidus (Gebler, 1876), is a phytodetritophage distributed across sandy, saline, and clay desert landscapes as well as tugai forests; its adults generally appear from April to September.

Within the family Chrysomelidae, Cryptocephalus sarafschanensis (Solskiy, 1882) inhabits foothills and the margins of tugai forests, developing on tamarisk, narrow-leaved shrubs, and Caragana species. Rare species such as Stilodes mayor (Breit, 1918) occur in saline marshes dominated by tamarisk and Haloxylon.

Among Curculionidae (Latreille, 1802), Phacephorus tumidulus (Fahraeus) is observed in sandy riverbanks and tugai habitats, primarily feeding on Haloxylon buds. Isomer granosus (Zoubkoff, 1833) is an oligophag associated with sugar beet and related Chenopodiaceae, occasionally found on Haloxylon near tugai forests. Particularly noteworthy is Lixus rubicundus (Zoubkoff, 1833), which develops in the subterranean organs of quinoa, sugar beet, and other members of the Chenopodiaceae family.

Conclusion

Research on dendrophilous insects of the clay semi-deserts of Central Asia was first initiated by A. I. Vorontsov, who provided a detailed characterization of the main xylophagous groups inhabiting old forest plantations. Later, G. V. Lindeman identified the principal ecological patterns governing the development of dendrophilous insects in clay semi-desert zones [6,p.160]. These studies demonstrate that soil mechanical composition, moisture regime, and heterogeneity of plant cover play a decisive role in shaping the entomofauna of tugai forests.

Before canopy closure, artificial plantations are primarily inhabited by entomocomplexes typical of desert–steppe zones. At this early successional stage, soil-dwelling insect groups predominate, particularly root-feeding weevils (Curculionidae Latreille, 1802) and leaf beetles (Chrysomelidae Latreille, 1802), which frequently occur in high numbers. In certain years, sharp increases in population density lead to outbreak dynamics involving Lepidoptera (Linnaeus, 1758).

As plantations mature and canopy closure occurs, significant biocenotic shifts emerge: desert–steppe insect forms gradually diminish, replaced by dendrophilous species more closely associated with arboreal habitats. This dendrophilous complex consists of taxa that naturally migrate from older plantations or share historical ecological links with natural forests. Within tugai habitats, species connected to willow–poplar phytocenoses predominate, especially in alluvial plains, sandy riverbanks, and ravine forests, whereas broadleaf forest species typical of the forest–steppe zone are comparatively rare.

Unlike tree species of the steppe and forest–steppe belts, tugai vegetation—particularly Elaeagnus angustifolia (oleaster), Tamarix spp., and other native shrubs—is more frequently affected by specialized Central Asian insects associated with halophytic flora of the southern Caspian region. This highlights the importance of biogeographical history and halophytism (salt tolerance) in the formation and evolution of tugai entomofauna [1, pp.299–357].

References

1. Hodkinson I. D. 1986 The psyllids (Homoptera: Psylloidea) of the Oriental Zoogeographical Region: an annotated check-list // Journal of Natural History 20: pp. 299-357.

2. Воронцов А. И., Мозолевская Е.Г., Соколова Э.С. Технология защиты леса.–М.: Экология,1991. – 304 с.

3. Зактрегер И.Я. Тугаиные леса нижнего тече-

ния р. Аму-Дарьи. – Ленинград, 1927. – 22 с.

4. Самедов Н.Г., Мирзоева Н.Б. Обзор фауны жуков-листоедов (Coleoptera, Chrysomelidae) тугаиных лесов Азербаиджана // Энтомологическое обозрение. – 1985. – No4 (LXIV). – С. 705-714.

5. Синадскии Ю.В. Вредители тугаиных лесов Среднеи Азии и меры борьбы с ними. – М-Л: АН СССР, 1963. – 152 с.

6. Храмцов Н. Н., Падии Н. Н. Стволовые вредители леса и борьба с ними. – М.: Лесная промышленность, 1965. – 160 с.