



BIOTOPIC DISTRIBUTION OF ENTOMOFAUNA IN TUGAI RIPARIAN FOREST ECOSYSTEMS OF KHOREZM REGION, UZBEKISTAN

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ABSTRACT

Entomological surveys (2022–2024) across tugai riparian forests of Khorezm Region, Uzbekistan documented 19 insect species across three study sites and three biotope types. The Amudarya Riparian Forest Massif yielded the highest richness (15 spp.; 78.9%), followed by the Urgench Peripheral Tugai Zone (14 spp.; 73.7%) and the Shovot Tugai Site (12 spp.; 63.2%). The arboreal biotope harboured the greatest diversity (11 spp.; 57.9%), dominated by xylobiont Cerambycidae and Lepidoptera, while shrub and meadow biotopes supported 5 (26.3%) and 3 (15.8%) species respectively. All taxa exhibited specific trophic associations with dominant components of the tugai phytocoenosis; Populus euphratica, Salix alba, and Elaeagnus angustifolia constituted the principal host complexes.

1. Introduction

Tugai riparian forests — phreatophytic woodland formations confined to the alluvial floodplains of major Central Asian rivers — represent one of the most ecologically significant biome types in the arid belt of Eurasia (Treshkin, 2001). Occurring as linear vegetation corridors along the Amu Darya, Syr Darya, and their tributaries, these ecosystems sustain disproportionately high biodiversity relative to the surrounding desert matrix, functioning as refugia and dispersal conduits for numerous faunal groups (WWF, 2024). Despite their recognised importance, the invertebrate fauna of Uzbek tugai forests remains poorly characterised at the biotopic level; insect assemblages, in particular, have been explicitly noted as insufficiently studied even within protected areas (tugai.uz, 2024).

The present study provides a quantitative faunistic and biotopic analysis of insect assemblages inhabiting three tugai localities in Khorezm Region. Specific objectives were: (i) to document species composition across three geographically distinct sites; (ii) to characterise biotopic distribution within three delineated habitat types; and (iii) to elucidate trophic associations between recorded insect taxa and dominant plant components of the tugai phytocoenosis.

2. Materials and Methods

Field surveys were conducted between May and September, 2022–2024 across three sites in Khorezm Region: the **Amudarya Riparian Forest Massif** (most intact, hydrologically

active tugai); the **Shovot Tugai Site** (partially degraded fragment, ~35 km SW of Urgench); and the **Urgench Peripheral Tugai Zone** (moderately disturbed peri-urban site). At each locality, three biotopes were delineated: the *arboreal biotope* (phreatophytic woodland), the *shrub biotope* (xero-halophytic thicket), and the *herbaceous meadow biotope* (open grassland).

Insects were sampled via sweep-netting (100 sweeps × 5 transects per biotope), beating trays, UV light traps (20 W), and direct substrate inspection. Species determination followed established taxonomic keys for Cerambycidae (Plavilshchikov, 1940; EPPO, 2005), Pentatomidae, Pyrrhocoridae, Acrididae, Gryllidae, Lepidoptera, and Carabidae of the Palaearctic region. Host-plant associations were recorded in situ; plant nomenclature follows the Flora of Uzbekistan.

3. Results

3.1. Species Richness Across Study Sites

A total of 19 insect species across six orders were recorded. The Amudarya Riparian Forest Massif yielded the highest richness (15 spp.; 78.9%), attributable to its structurally complex arboreal stratum, hydromorphic soils, and phytocoenotic diversity — factors consistently associated with elevated entomofaunal carrying capacity in riparian forests (Zhao et al., 2020). The Urgench Peripheral Tugai Zone produced 14 species (73.7%); despite anthropogenic disturbance, its connectivity to the main river channel sustained comparatively high diversity (Treshkin, 2001). The Shovot Tugai Site yielded the fewest taxa (12 spp.; 63.2%), consistent with the inverse relationship between habitat fragmentation and arthropod richness documented across riparian ecosystems (Rüger et al., 2005). The species richness gradient — Amudarya Massif > Urgench Zone > Shovot Site — corresponds directly to the habitat naturalness gradient inferred from phytocoenotic assessments.

3.2. Biotopic Distribution of Entomofauna

Arboreal biotope (11 spp.; 57.9%). The dominant woody taxa — *Populus euphratica* Oliv., *Salix alba* L., *Salix songarica* Anderss., and *Elaeagnus angustifolia* L. — sustained a diverse assemblage of xylobiont Cerambycidae and associated Lepidoptera. Longhorn beetles were ecologically dominant: *Xylotrechus namanganensis* (Heyden, 1885) (EPPO, 2005), *Aeolesthes sarta* (Solsky, 1871) (Hayat et al., 2022), *Chlorophorus faldermanni* (Faldermann, 1837), and *Turanium scabrum* (Kraatz, 1882) exploit cambium and sapwood as larval feeding substrates. The noctuid moths *Catocala elocata* (Esper, 1787) and *Catocala lupina* (Herrich-Schäffer, 1851) (Lepidoptera: Erebididae), and *Nymphalis polychloros* (Linnaeus, 1758) (Nymphalidae), were recorded as foliage-associated canopy taxa. The dominance of xylobiont species reflects patterns documented globally for floodplain woodland insect communities, wherein structural wood heterogeneity constitutes a primary driver of local diversity (Vodka & Cizek, 2012).

Shrub biotope (5 spp.; 26.3%). Dominated by *Tamarix hispida* Willd., *Alhagi pseudalhagi* (M.Bieb.) Desv., *Phragmites australis* (Cav.) Trin. ex Steud., *Salsola richteri* Karel. ex Litv., and *Halostachys belangeriana* (Moq.) Botsch. The fire bug *Pyrrhocoris apterus* (Linnaeus, 1758) (Hemiptera: Pyrrhocoridae) and four Pentatomidae — *Aelia acuminata* (L., 1758), *Dolycoris baccarum* (L., 1771), *Graphosoma lineatum* (L., 1758), and *Mustha gigantea* Mulsant & Rey, 1865 — constituted the dominant phytophagous Hemiptera assemblage, exploiting foliar and stem tissues of the xero-halophytic shrubs.

Herbaceous meadow biotope (3 spp.; 15.8%). Open grassland dominated by *Elytrigia repens* (L.) Nevski, *Cynodon dactylon* (L.) Pers., *Carex pachystylis* J. Gay, *Atriplex tatarica* L., and *Bromus inermis* Leyss. harboured three acridoid Orthoptera: the migratory locust *Locusta migratoria* Linnaeus, 1758 (Latchininsky & Gapparov, 2010), the Italian locust *Calliptamus italicus* (Linnaeus, 1758) (Sergeev et al., 2021), and *Gryllus desertus* Pallas, 1771 (Gryllidae). The low richness reflects the structural simplicity of open grassland relative to the multi-layered arboreal biotope.

3.3. Trophic Associations

Populus euphratica Oliv. was the most frequently recorded host, supporting eight species — including all dominant Cerambycidae and noctuid Lepidoptera — constituting the keystone trophic substrate of the arboreal biotope. *Elaeagnus angustifolia* L. and *Salix alba* L. each supported three specialist wood-boring and foliage-feeding taxa. In the shrub biotope, *Tamarix ramosissima* Ledeb. and *Alhagi pseudalhagi* were the principal trophic resources for Hemiptera. Meadow acridoids utilised gramineous species — *Elytrigia repens*, *Cynodon dactylon*, and *Bromus inermis* — consistent with the oligophagous to polyphagous feeding ecology documented for both *L. migratoria* and *C. italicus* in Uzbekistan (Chernova et al., 2022).

4. Discussion and Conclusions

Entomofaunal richness and community composition in the tugai forests of Khorezm Region are governed by a clear hierarchy of ecological determinants. At the landscape scale, phytocoenotic integrity and intact arboreal cover predict site-level species richness. At the biotope scale, structural complexity of the woodland stratum — particularly the availability of senescent wood and foliar resources of *P. euphratica* and associated trees — constitutes the overriding driver of local diversity. These findings align with the resource diversity hypothesis applied to riparian insect communities (Zhao et al., 2020).

The results carry direct conservation implications. Tugai ecosystems across Central Asia face sustained pressure from water diversion, land reclamation, and riparian deforestation linked to Aral Sea desiccation (Treshkin & Bakhiev, 1998). The dependence of xylobiont Cerambycidae and specialist Lepidoptera on mature arboreal substrates underscores the priority of preserving structurally complex, old-growth woodland patches within the tugai mosaic. The arboreal biotope, dominated by *P. euphratica*, *Salix* spp., and *E. angustifolia*, constitutes the ecological nucleus of the tugai entomofauna and must be central to biodiversity monitoring and riparian restoration strategies across the Amu Darya basin.

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