

First record of the rarely collected family Xylophagidae from Iran

(Diptera)

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During a study of saproxylic insects in the Hyrcanian forest from 2017 to 2019, we identified two species of the family Xylophagidae: *Xylophagus ater* Meigen, 1804 and *Xylophagus lukjanovitshi* Krivosheina & Mamayev, 1972. The present record of *Xylophagus lukjanovitshi* constitutes the first record since its description and the first record of a female. A description of the female is provided. The presence of these species in Iran expands the known range of Xylophagidae, underscoring the significance of continued exploration for biodiversity in the region.

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Introduction

The Xylophagidae (awl-flies) are a relatively small family of flies with wood-boring larvae, which has a worldwide distribution and 134 known species in nine genera (Woodley 2011, Lee et al. 2022). They are usually found in forests. Adults are typically medium to large-sized and have a mostly brown or black coloration. The larvae are found under the bark of fallen trees (*Xylophagus* Meigen, 1803) or associated with decaying wood (*Rachicerus* Walker, 1848), where they live as predators of other insect larvae (Nagatomi & Rozkošný 1997, Woodley 2009) and are part of the network of organisms involved in the decomposition of dead wood and the recycling of nutrients (xylophages and saprophages) and their predators and parasitoids. Krivosheina & Krivosheina (2015) note both true xylophages like bark beetles (Coleoptera: Curculionidae, Scolytinae) and insects that are not true xylophages like dark-winged fungus gnats (Diptera: Sciaridae) as prey.

Due to habitat loss and fragmentation caused by human activities such as logging and urbanization, some Xylophagidae species are considered rare or

endangered (Alexander 1993, 2018, Ulyshen 2018). Studying the diversity and ecology of these flies is thus crucial for establishing the importance of their role in forest ecosystems and for the possible need to develop conservation strategies to protect them.

In Iran, the Diptera fauna has been receiving more attention over the past few decades but relatively few families have been thoroughly investigated. A number of families were first recorded from Iran during that period, but the family Xylophagidae still was not recorded. The discovery of Xylophagidae in Iran is therefore a significant contribution to the knowledge of the country's insect fauna. The present records are based on specimens collected from decaying wood in a forested area in the north of the country. The documentation of the Xylophagidae from Iran adds to the development of more comprehensive inventories of insect biodiversity in the region, which can provide a basis for understanding the structure and dynamics of insect communities, and for designing effective conservation strategies.



Fig. 1. Pan traps installed in the Hyrcanian forests during 2017-2019.

Materials and methods

The research was carried out from 2017 to 2019 in the Hyrcanian forests, which cover an area of approximately 55 000 km² on the northern slopes of the Alborz Mountains in Iran. These forests extend through the southeastern Azerbaijan ecoregion, which includes the Lankaran lowland and the Talysh Mountains. They are characterized by temperate deciduous vegetation (Sagheb Talebi et al. 2014, Tohidifar et al. 2016) and range in elevation from sea level to 2800 m. The Hyrcanian forest is mainly composed of Oriental beech (*Fagus orientalis*) followed by chestnut-leaved oak (*Quercus castaneifolia*), Caucasian alder (*Alnus subcordata*), common hornbeam (*Carpinus betulus*), Cappadocian maple (*Acer cappadocicum*), velvet maple (*Acer velutinum*), mountain elm (*Ulmus glabra*), wild cherry (*Prunus avium*), yew (*Taxus baccata*), and lime trees (*Tilia* spp.) (Sagheb Talebi et al. 2014).

To conduct the study, 30 plots in the Golestan (2017), Mazandaran (2018), and Gilan (2019) provinces (Fig. 1) were surveyed over a three-year period. Each plot included two yellow pan traps (Devigne & Biseau 2014), which were placed near decaying trees or dead wood and left exposed from the end of March until the end of October. The pan traps were emptied every three weeks.

Trapped specimens were preserved in 75% ethanol and then identified. Specimens were identified by the first two authors using the keys provided by Kahanpää (2014) and Krivosheina & Mamaev (1972) bearing in mind the note on the correct name of the species known as *X. ater* (see Chandler 1998). Voucher specimens are deposited in the insect museum of the National Botanical Garden of Iran.

Results

Xylophagus ater Meigen, 1804

Material examined. 1 ♂, Mazandaran, Neka forests, 36°21'52.3"N 53°32'51.6"E, 1495 m, 26.05.2018, leg. F. Kazerani.

Diagnostic characters. Male: body dark brown; basal segment of antenna long, length 3x width; scutum finely sculptured, almost shining, with two inconspicuous stripes of golden hairs; legs mainly yellow, distal segments of fore and mid tarsi brown, hind tarsi brown except basal parts of tarsomeres 1-3, hind tibia mostly light brown, darkened at distal third, hind femora brown at distal half; wings hyaline, darkened at the apex and at the middle, stigma dark brown (Fig. 2).

Distribution. Northern and Central Europe, Nearctic (Woodley 2011).

Xylophagus lukjanovitshi Krivosheina & Mamaev, 1972

Material examined: 1 ♀, Gilan, Shafarood forests, 37°40'12.7"N 48°45'05.6"E, 1141 m, 14.05.2019, leg. F. Kazerani.

The female of this species was not recorded or described before. The present specimen has distinct yellow stripes on the scutum, a feature that has not been described for any of the other Palaearctic *Xylophagus* species. This, in combination with the relative

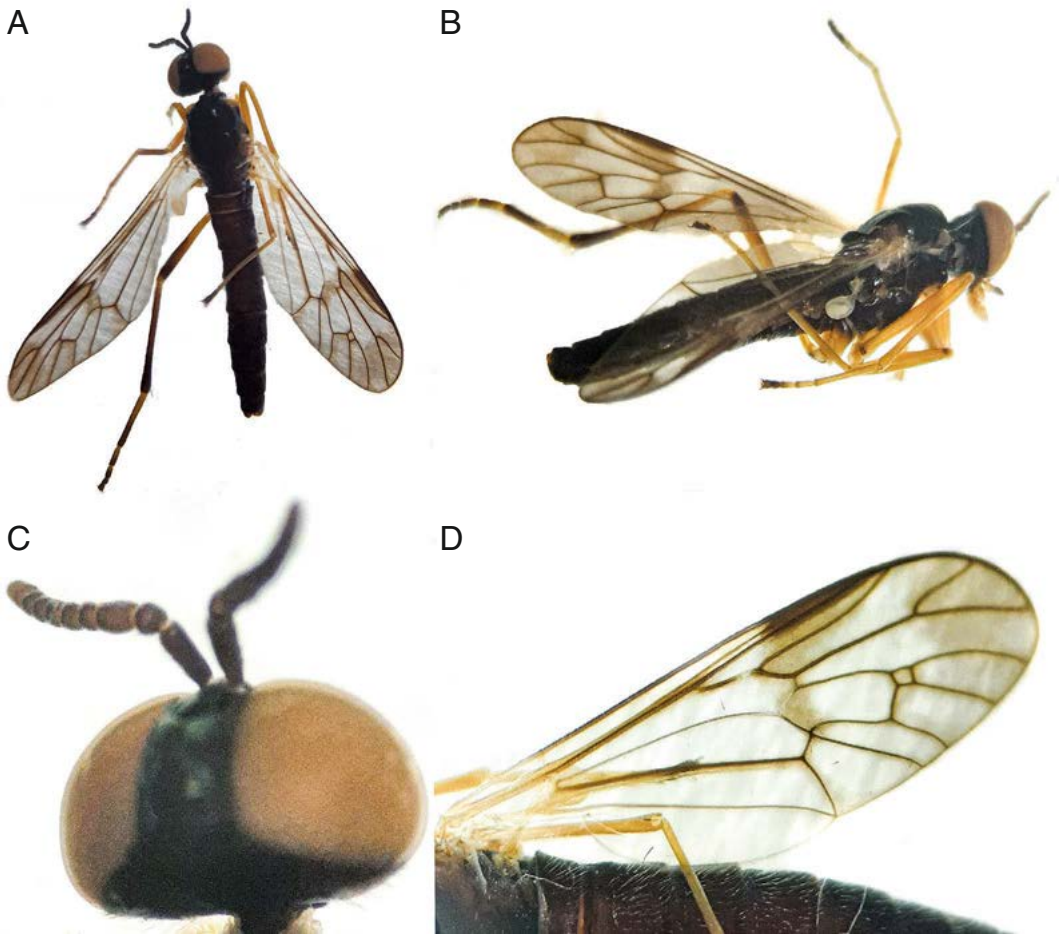


Fig. 2. *Xylophagus ater* Meigen, 1804, male: A. dorsal view; B. lateral view; C. head and antenna upper view; D. wing.

close proximity of the type location of *X. lukjanovitshi* (Azerbaijan), leaves little doubt that the present specimen does belong to that species, too.

First description of female

Head. Eyes bare; frons black, occupying about $\frac{1}{5}$ of the width of the head; occiput and face beneath antennae and area around antennal socket pollinose; ocellar tubercle and occiput black and pruinose; postocular area to lower part of head with pale hairs. Maxillary palpus yellow, darkened in distal third, two-segmented, with pale hairs. Proboscis yellow with pale hairs. Antenna black; scape slender and cylindrical with black hairs, three times as long as wide; pedicel short, about a third of the length of the scape and with black hairs; flagellum long,

eight-segmented, nearly 2.4 times as long as length of scape and pedicel combined (Fig. 3C).

Thorax. Black and lustrous. Scutum including postpronotal lobes and notopleural areas yellow and lustrous, clothed with short recumbent pale hairs, lateral parts with broad black longitudinal markings that are all but interrupted at the transverse suture; median part rather yellowish-orange with a broad brown band that extends from the anterior margin for almost two-thirds of the length of the scutum. Scutellum black with pale hairs; laterotergite black, glossy and glabrous, not pruinose. Halteres yellow (Fig. 3A-B).

Legs. Mainly yellow with pale hairs; apex of hind femur and hind tibia darkened on approximately distal sixth, tibial spurs yellow; tarsomeres 4-5 darkened; coxae yellow with pale hairs. Fore

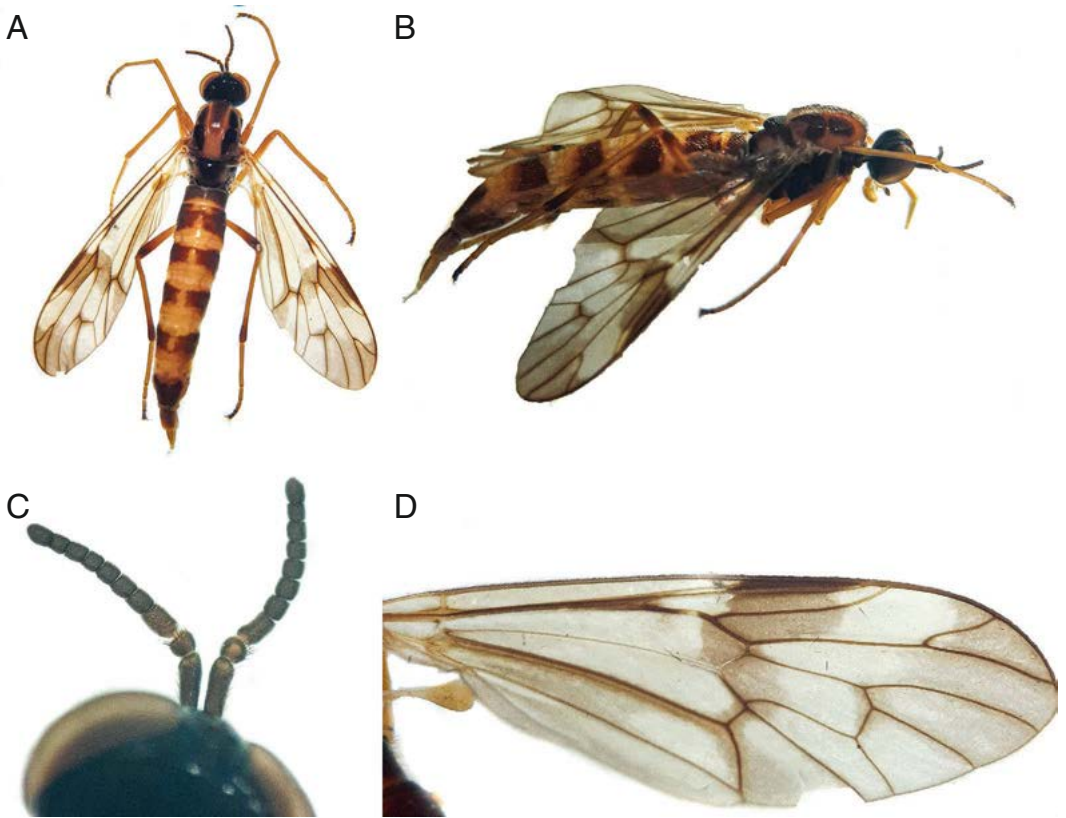


Fig. 3. *Xylophagus lukjanovitshi* Krivosheina & Mamayev, 1972, male: A. dorsal view; B. lateral view; C. head and antenna upper view; D. wing.

tibia with one spur; mid and hind tibia with two spurs. Empodium and pulvillus well developed, yellowish-white (Fig. 3A-B).

Wing. Membrane tinged with yellowish brown but distal parts prominently infuscate to dark brown on stigma, middle part of cell r_1 , basal half and apex of cell r_{2+3} , apex of first basal cell, cell r_4 , extreme base and apical half of cell r_5 , about basal third and extreme apex of discal cell, cell m_1 (except at middle), and extreme base of cell m_2 - m_3 , cell m_4 (except at middle of upper margin), area around crossvein m - cu , cell cup at about basal third and around vein CuA ; posterior margin of wing slightly tinged with brown (Fig. 3D).

Abdomen. Elongate and tapering distally; mostly glossy yellow and covered with short semi-erect pale hairs; tergite 1 brown but narrowly yellow at posterior margin; tergites 2-5 each with a medially interrupted brown band; tergite 6 brown, anterior margin narrowly yellow; tergite 7 brown; tergite 8 light brown, nearly rectangular shaped, significantly smaller than tergites 1-6; sternite 1 brown, sternites

2-5 brown, slightly pale at middle, posterior margin yellow; sternite 6 brown, anterior margin narrowly yellow; sternites 7-8 brown (Fig. 3A-B).

Body length: 17.2 mm. Wing length: 12.1 mm.

Distribution. Azerbaijan (Krivosheina & Mamayev 1972) and Iran (first record).

Discussion

Recording the rare family Xylophagidae from Iran in the present study increases the knowledge of the biodiversity of this region, as well as the geographical range and characteristics of the family Xylophagidae. The identification of two species associated with dead wood in forested areas of northern Iran, prompts further investigation of insect biodiversity in the region.

The report of *X. lukjanovitshi* is particularly significant, as it is the first record of this species since its original description in 1972 and it provides new

information on the morphology of this little-known species. This species was first found in Azerbaijan, specifically in Lenkoran, which is located in the Hyrcanian forest region (Krivosheina & Mamayev 1972). The discovery of the species in the current study in the Hyrcanian forest, but now of Iran, suggests that the species may be endemic to the Hyrcanian forest region.

Xylophagus ater larvae feed on beetle larvae from the Cerambycidae and Pyrochroidae families, which develop in dead branches of various broad-leaved trees (Clements & Alexander 1987). According to Alexander (1993), the adults of this species are active in Ireland in May and June, and larvae have been found under the bark of dead oak in old-established oak woodlands. However, *X. ater* is rare in Ireland and is typically associated with areas of higher rainfall and greater humidity, particularly in hill areas (Alexander 1993). In this study, we observed this species in late May in temperate rainforests, which is consistent with the recorded flight period and occurrence in broad-leaved forests by other authors (like Alexander 1993).

In conclusion, the report of the family Xylophagidae in the Hyrcanian forest of Iran also has important implications for the conservation of forest ecosystems and their associated fauna. The potential impacts of anthropogenic activities such as deforestation, habitat fragmentation, climate change and maybe even forest hygiene on insect diversity and ecosystem functioning have been well documented (Müller et al. 2018, Kazerani et al. 2020, 2021, Farashiani et al. 2022). Further investigation should establish how rare and vulnerable *X. lukjanovitshi* and *X. ater* are in the Hyrcanian forest of Iran and if they should be addressed in conservation measures to protect and maintain biodiversity in forested areas.

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