

Article

## ***Aeshna mixta* (Latreille, 1805), a new record for the Odonata (Anisoptera: Aeshnidae) fauna of Pakistan**

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### **Abstract**

*Aeshna mixta* (Latreille 1805) is added to the Anisoptera fauna of Pakistan by reporting it from district Neelum of Azad Jammu and Kashmir, Pakistan. Geopolitically the study area lies in an area facing uncertain ground conditions since inception of Pakistan. It is a hard to reach valley between India and Pakistan, very close to the line of control. Out of twenty sampling sites, specimens of *Aeshna mixta* were found from fifteen localities of the district. With the addition of this taxon, Anisoptera fauna of Pakistan now count 74 species. The area under district Neelum represents many lush green valleys with lots of natural water bodies that support a broad complex of Odonata. More surveys in the area are suggested to unveil more important records from the area.

**Keywords** Odonata; Anisoptera; Aeshnidae; *Aeshna*; Pakistan.

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### **1 Introduction**

Odonates are important predators in class Insecta that are currently represented under two living suborders, Anisoptera and Zygoptera (Mehmood et al., 2020). They are aquatic as immature (Nagy et al., 2019) and found near variable freshwater bodies such as rivers, lakes, ponds, and wetlands as adults (Zia et al., 2008). They play important role in food chain being fed on, and fed by various creatures in terrestrial as well as aquatic ecosystems (Bybee et al., 2016); their larvae consume a wide variety of small crustaceans, tadpoles and mosquito larvae (Nur-ul-Islam et al., 2021; Naeem et al., 2022) while adults feeds on noxious flies, mosquito adults and agricultural pests like bollworms, aphids, jassids and white flies etc (Nur-ul-Islam et al., 2021). They are themselves fed upon by frogs, fishes as well as humans (Zia et al., 2018) and also used in medical field for the treatment of throat and eye infections (Rehman et al., 2020). They are used in visual art, jewelry, pottery, clothing, patterns, paintings, and children's games like watching birds (Miguel et al., 2017).

Odonates are diverse group of flying insects representing more than 6500 species worldwide (Mehmood et al., 2021). Within order Odonata, family Aeshnidae of sub order Anisoptera is globally represented with a known record of 441 species (Mehmood et al., 2021). In Pakistan it is represented by six genera and ten species (Kalkman et al., 2020). Within family Aeshnidae, genus *Aeshna* represents specimens that are robust with eyes broadly contiguous, long and broad wings and paddle-shaped anal appendages (Fraser, 1936). Genus *Aeshna* is known from Pakistan only on the basis of single species record while in countries with similar ecology and topography i.e. Bangladesh, Bhutan, Sri Lanka, Nepal and India, four species are documented for this genus; these includes *Aeshna juncea* (Linnaeus, 1758), *Aeshna mixta* (Latreille, 1805), *Aeshna shennong* Zhang & Cai, 2014 and *Aeshna petalura* Martin 1906 (Kalkman et al., 2020). Among these, *Aeshna juncea* the only known *Aeshna* species of Pakistan appeared to be less common and restricted to northern areas of Pakistan (Zia et al., 2009). Pakistan occupies an important position on the globe and serve as house of many migratory species of birds and insects due to its transitional position representing many biogeographical regions (Zia et al., 2011; Zia, 2016). In Pakistan genus *Aeshna* was first time documented by Chaudhry (2010) from Khyber Pakhtunkhwa, Gilgit Baltistan and Azad Kashmir by exploring *Aeshna juncea* from Chitral, Dir, Mansehra, Kaghan and Gilgit. Yet, no additional record under this genus was brought to record prior to current study.

Keeping in view the figure count for Aeshnidae species in neighboring countries to Pakistan with similar climate and ecologies, it was planned to conduct a thorough field survey in district Neelum of Azad Jammu & Kashmir, Pakistan to explore new aeshnid records from the area.

## 2 Materials and Methods

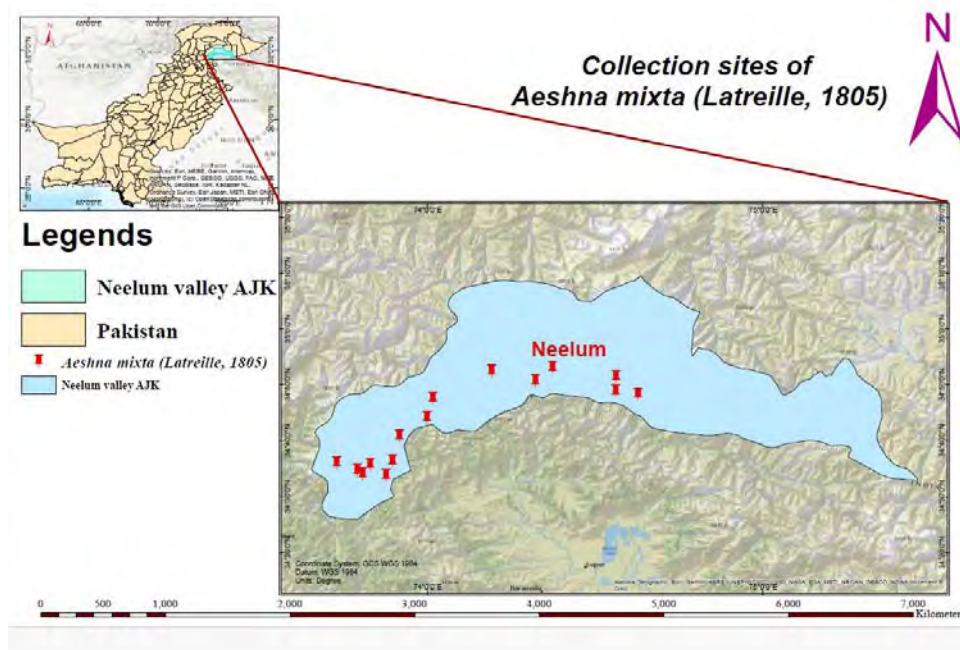
Surveys were carried out during May to September (2023) at active timings of the day for Odonata. Collection was done in areas having maximum probability of *Aeshnid* fauna. Selection of localities was done by keeping in view the reported niches (i.e. localities presenting similar ecologies and other physical factors to already documented niches) for *Aeshnid* fauna in neighboring countries to Pakistan. Samples were collected using aerial nets and brought to National Insect Museum for identification. Mating pairs were kept separately in paper pockets to ascertain pairing record and identification status. Pinning, stretching, mounting and preservation protocols were based on Chaudhry (2010) while measurements were taken following Zia (2010). Samples were identified under Olympus Stereoscope (CZM3) following taxonomic literature of Fraser (1936).

## 3 Results

Specimens of *Aeshna mixta* were found in 10 localities out of 15 surveyed localities of district Neelum (Fig. 1).

### Materials Examined:

Locality: Pakistan; Azad Jammu & Kashmir; District Neelum; Localities visited: Taobat (Coordinates: 34°72'68.67"N 74°71'22.67"E), Halmat (Coordinates: 34°75'19.16"N 74°66'03.12"E), Phullawai (Coordinates: 34°79'39.00"N 74°56'21.97"E), Janwai (Coordinates: 34°79'30.58"N 74°53'38.30"E), Kel (Coordinates: 34°82'65.58"N 74°36'05.06"E), ArangKel (Coordinates: 34°80'77.98"N 74°34'07.29"E), Sharda (Coordinates: 34°79'15.58"N 74°19'51.61"E), Lawat (Coordinates: 34°68'55.32"N 73°97'72.90"E), Keran (Coordinates: N34°66'20.94" 73°96'06.08"E), Athmuqam (Coordinates: 34°58'51.33"N 73°91'67.61"E), Kundalshai (Coordinates: 34°55'24.03"N 73°84'94"96E), Jagran (Coordinates: 34°51'92.02"N 73°83'56.27"E), Kutton (Coordinates: 34°56'15.00"N 73°80'32.86"E), Dowarian (Coordinates: 34°72'33.56"N 74°00'34.45"E), Sardari (Coordinates: 34°5'78.71"N 74°62'88.81"E), Collection dates: 05.v.2023 to 05.ix.2023; Samples recorded: 12♂, 13♀.



**Fig. 1** Map showing positive localities for *Aeshna mixta* in district Neelum, AJ & K, Pakistan.

Measurements of body parts were taken following Zia (2010) and observations are presented below.

**Male:** forewing = 40-42 mm, hindwing= 44-46 mm, abdomen= 46-48 mm, superior anal appendage = 6-8 mm, inferior anal appendage = 4-5 mm. **Female:** forewing= 40-42 mm, hindwing= 45-47 mm, abdomen= 45-47 mm, superior anal appendage 7-9 mm, inferior anal appendage 4-6 mm.

The specimens tally with the published description of (Fraser, 1936). The major taxonomic description for the studied specimens can be sum up as below.

**Male:** Head: Labium dull orange brown, labrum greenish-yellow, above frons two dull yellow spot with “T” shaped margin, occiput orange-yellow. Prothorax: small with dull bluish markings. Thorax: vestigial ante-humeral stripes lying at mid dorsum that varies in shape and size having blue markings. Wings: clear, long and broad, anal triangle extremely narrow, discoidal cell in all wing equal and similar consisting of 4 cells. Pterostigma dark brown covering 2 ½ cells, base of the wings angulated. Abdomen: brownish to black in base color with blue markings. Anal appendages: Chocolate brown.

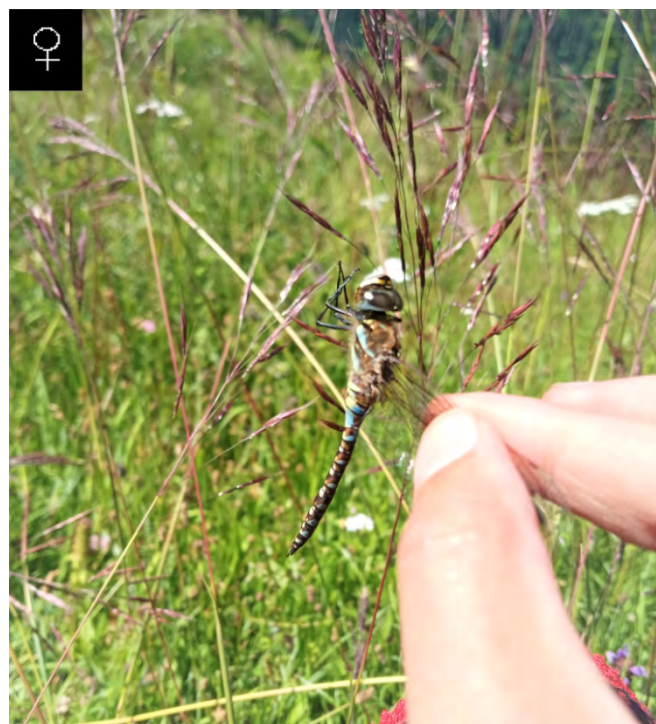
#### **Female**

Similar to male except for following differences. Anal triangle absent, abdomen brownish black with green marking and hindwings and anal appendages longer as in male.

**Habitat:** It was observed that the specimens prefer ponds, lakes and slow-moving water channels. They were recorded in areas having abundant vegetation cover all around, that was providing both; hunting ground and shelter for these dragonflies.



**Fig. 2** Picture of the captured (Male) of *Aeshna mixta*.



**Fig. 3** Picture of the captured (Female) of *Aeshna mixta*.

#### 4 Discussion

*Aeshna mixta* is hereby first time reported from Pakistan, thus adding new topographical record to its known distribution. It was first time named by Latreille in (1805) and documented from Yusimarg, Gulmarg, Srinagar and Kashmir from altitudes of 7500 ft (Fraser, 1936). The areas of Kashmir documented by Fraser (1936) includes the territories that are part of Indian held Kashmir (disputed territories of Jammu & Kashmir since 1947 i.e. partition of Subcontinent). After wards the species (*A. mixta*) was reported from Japan (Ishida, 1996; Ozono et al., 2012), Europe (Gerken and Sternberg, 1999), and India (Kalkman et al., 2020). According to Oelmann et al. (2023), *Aeshna mixta* is Palearctic in distribution, and extends across North Africa, and Central Asia, southeast European mountain ranges, Russia, Fennoscandia, and Finland. His work states that these are migratory dragonflies and not restricted to any specific water body as noticed for many odonate species, especially of Zygoptera. In the present work, it is reported from district Neelum of Azad Jammu and Kashmir, which is situated in the Northeastern part of Pakistan. Pakistan occupies an important positioning being a transitional zone between the Oriental and the Palearctic biogeographical (Shah et al., 2016). Further search of this species in the country can certainly add new geographic range to it.

The positive sites show similar niche for the species as earlier documented above. It is unfortunate that Odonata fauna of Northern areas are not well investigated in the past (Zia et al., 2009). Northern areas of Pakistan are mostly represented by the area under Gilgit-Baltistan and Azad Jammu & Kashmir. District Neelum, the area explored in current study comes under administrative boundary of Azad Jammu & Kashmir. The Kashmir valley is the liberated part of State of Jammu and Kashmir. It lies between longitude 73°–75° and latitude of 33°–36° and is spread over an area of 13,297 Km<sup>2</sup>. The topography is mostly hilly and mountainous along with valleys and plains encompassing unlimited natural water bodies and lush green vegetation cover (Rafi et al., 2009). District Neelum is located at an elevation of 900–6325 m above sea level in Pakistan. It is located between the latitudes from 32° and 35°N and longitude between 73° and 75°E and lies at the northern end of Pakistan with a hilly and mountainous terrain and an average annual precipitation of 1511 millimeters. It is located in the northeastern part of Muzaffarabad district of Azad Jammu & Kashmir, Pakistan that runs parallel along the border of Jammu & Kashmir (Indian-held Kashmir), thereby facing tension between the two countries, India and Pakistan since inception of these countries in 1947 as a result of historical partition of Sub-Continent (Zia, 2021). The Neelum valley is the largest district in AJK and climate here is temperate, with summers pleasant (average temperature 37.0°C) and winters extremely cold (average temperature -2.0°C), with the average annual rainfall of 165cm. It is an area with the less disturbed ecology and abundant natural resources for insect fauna. The area encompass many small lakes, ponds, streams, and natural perennial springs scattered throughout the lush green valley (Ahsan et al., 2019). All these conditions favor complex of odonates and resemble reported ecologies of many *Aeshnid* species in Asia. This is why the current study was planned in this area with focus on exploring new records for the aeshnid dragonflies. The study became successful by reporting *A. mixta* from the area and stresses the future searches on other odonate species as well. It is also hereby suggested that search for *A. mixta* should also be planned in district Skardu and few other areas of Gilgit-Baltistan in Pakistan that represents similar altitudes and ecologies and can add-up to its geographical range.

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