GORTANIA
Botanica, Zoologia 46 (2024) 29-36 Udine, 30.XII.2024 ISSN: 2038-0402

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DISTRIBUTION, HABITAT AND EVIDENCE OF BREEDING OF *AESHNA GRANDIS* (ODONATA: AESHNIDAE) IN FRIULI VENEZIA GIULIA (NORTH-EASTERN ITALY)

DISTRIBUZIONE, HABITAT E RIPRODUZIONE DI *AESHNA GRANDIS* (ODONATA: AESHNIDAE) IN FRIULI VENEZIA GIULIA (ITALIA NORD-ORIENTALE)

Abstract - The occurrence of adults of the uncommon species *Aeshna grandis* (Linnaeus, 1758) (Odonata: Aeshnidae) in several sites of the Friuli Venezia Giulia region (FVG) has been known for several years. However, it has always been assumed that these specimens were migrants or vagrants. In this note, all literature reports and news up to 2023 relating to the presence of the species in the regional territory have been considered. In FVG, *A. grandis* is distributed only in the alpine area of Tarvisio (south-eastern Alps). Adults of the species have been detected mainly near lotic freshwater habitats, such as pools, ponds, peat bogs, and wetlands, and sometimes along streams and clearings in woods. Due to the repeated observations over the years of adults in hunting, tandem and oviposition, as well as of an emerging adult and exuviae (i.e. certain reproductive events), *A. grandis* can be considered resident in FVG. However, further investigations are necessary to find any new reproductive sites of the species, especially in the Tarvisio area, which will need to be appropriately protected.
Key Words: Dragonflies, Anisoptera, Faunistic survey, Diversity, Conservation.

Riassunto breve - *La presenza di adulti di* Aeshna grandis *(Linnaeus, 1758) (Odonata: Aeshnidae), specie non comune, in diversi siti della Regione Friuli Venezia Giulia (FVG) è nota da diversi anni, ma si è sempre supposto che si trattasse di esemplari migranti o erratici. Nella presente nota sono state prese in considerazione tutte le segnalazioni della specie sul territorio regionale provenienti dalla letteratura e i nuovi ritrovamenti fino al 2023. In FVG* A. grandis *è distribuita solo nell'area alpina del Tarvisiano (Alpi sud-orientali). Adulti della specie sono stati rinvenuti soprattutto in prossimità di habitat lotici di acqua dolce, come pozze, stagni, torbiere, zone umide, ma anche lungo corsi d'acqua e radure nei boschi. Per le ripetute osservazioni negli anni di adulti in caccia, in tandem, in ovideposizione, nonché di un adulto in sfarfallamento e di esuvie (sicuri eventi riproduttivi),* A. grandis *può considerarsi residente in FVG. Sono tuttavia necessarie ulteriori indagini per individuare eventuali nuovi siti riproduttivi della specie, soprattutto nel Tarvisiano, che dovranno essere opportunamente tutelati..*
Parole chiave: Dragoni, Anisoptera, Indagine faunistica, Diversità, Conservazione.

Introduction

The brown hawker *Aeshna grandis* (Linnaeus, 1758) (Odonata: Aeshnidae) is one of the most common species of dragonflies in central and eastern Europe, especially in forested areas (Dijkstra & Lewington 2006; Boudot et al. 2009). The adults are very distinctive, even in flight, due to their large size, the tobacco-brown colour of the body, the evenly bronze wings and two lemon-yellow lateral stripes on the thorax. Moreover, a series of blue spots on the sides of the male's abdomen can be observed, whereas these are yellow in the female (Dijkstra & Lewington 2006; Galliani et al. 2015).

The species flies mainly from July to September. For oviposition, females prefer lentic habitats, such as natural lakes and pools, fringed by a belt of helophytes, with rich submersed vegetation. In central and northern Europe most populations of *A. grandis* are found in lowlands up to 500 m a.s.l., but in the southern European area populations are confined to higher altitudes (up to 2000 m). The eggs overwinter and hatch in spring. The species is semivoltine, completing one generation in two years (Corbet et al. 2005).

The brown hawker is rare in Italy, where it has been found only in some alpine regions (Riservato et al. 2014a): Aosta Valley (Riservato et al. 2014b), Trentino-South Tyrol (Maiolini & Carolli 2009, Assandri 2019, A. Festi, personal communication) and Friuli Venezia Giulia (FVG) (Kiauta 1971; Pecile 1991). In the latter region, the species had not yet been detected in the first comprehensive survey on the Odonata fauna, published at the end of the 1960s (Kiauta 1969). The first reports on *A. grandis* in FVG concern the Tarvisio area, in particular a pasture pool of Malga Lussari (Kiauta 1971), and subsequently a small wetland along the road leading to the Fusine Lakes, near the stream named Rio del Lago (Pecile 1991).

https://doi.org/10.57614/GORT20380402.2024.46.4

The present study aims to illustrate the distribution and the habitat of *A. grandis* in FVG, based on findings reported in the literature and new original records and to describe any reproductive events in the region.

Material and methods

Investigations on *A. grandis* and other Odonata species were carried out during the years 2018–2023 in mountain areas of the Friuli Venezia Giulia region, in the context of the Project "Atlas of the Odonata of Friuli Venezia Giulia" started in 2009 (Fiorenza et al. 2012, 2013; Zandigiacomo et al. 2015, 2020) and completed in 2024 (Fiorenza et al. 2024). In particular, field observations were conducted several times around a pasture pool of the Malga Lussari (Fig. 1) and the artificial pond of Rutte Piccolo (Fig. 2), both in the Tarvisio area. The records on *A. grandis* collected in 2018 had already been reported by Zandigiacomo et al. (2020).

During the present study, it was planned to collect exuviae but not adult specimens, for whose identification the discriminating characters were photographed with digital cameras. For the identification of adults, we referred to the volumes of Conci & Nielsen (1956), Dijkstra & Lewington (2006), Grand & Boudot (2006) and Galliani et al. (2015), in addition to constant contact with experts in Odonata. For the identification of exuviae, the volumes of Carchini (2016) and Doucet (2016) were used. The nomenclature adopted is according to Riservato et al. (2014b).

The records on Odonata of FVG are regularly updated in a database by the authors of this investigation and by some members of the Italian society for the study and conservation of dragonflies "Odonata.it". A large number of observations have also been entered into the "Ornitho" database, a website for the collection and validation of records of several faunistic groups, in particular birds, reptiles, amphibians, mammals and odonates (the latter in close cooperation with Odonata.it). Moreover, the information reported by Fiorenza et al. (2012, 2013) and Zandigiacomo et al. (2015, 2020) have also been considered.

The following abbreviations and acronyms have been used in the text and Table 1: IC = Ivan Chiandetti; TF = Tiziano Fiorenza; RP = Renato Pontarini; FVG = Friuli Venezia Giulia region; UD = Udine district; M = male; F = female; ex./exx. = specimen/specimens.

Fig. 1 - Recent overview of the pasture pool of Malga Lussari (1568 m a.s.l.) (photo by T. Fiorenza).
- *Panoramica recente della pozza di alpeggio di Malga Lussari (1568 m s.l.m.) (foto T. Fiorenza).*

Fig. 2 - Recent overview of the artificial pond of Rutte Piccolo (815 m a.s.l.) (photo by I. Chiandetti).
- *Panoramica recente dello stagno artificiale di Rutte Piccolo (815 m s.l.m.) (foto I. Chiandetti).*

Results

Distribution

From 1969 to 2023, twenty-eight records of *A. grandis* were reported in FVG. Eight records consisted of several specimens. Of all the records, twenty-six related exclusively to adults, one to an adult emerging from its exuvia and another one to three exuviae. All specimens were found in the alpine area of Tarvisio in the south-eastern Alps (Table 1, Fig. 3), within the municipalities of Tarvisio and Malborghetto-Valbruna (UD). Until now, the overall surface frequented by adults of the brown hawker in this area is about 60 km^2.

Remarkable are the repeated reports at the pasture pool of the Malga Lussari and the artificial pond of Rutte Piccolo. In several cases, the observation of single adults must refer to males in patrolling and hunting activities, which can also take place far from the breeding sites.

Habitat

Adults of *A. grandis* have been detected mostly near lotic freshwater habitats, such as pasture pools, artificial ponds, peat bogs, and wetlands, but also along streams as well as clearings in woods.

In the still water-bodies of the Tarvisio area, other Odonata species shared these habitats with the brown hawker, especially *Aeshna cyanea* (Müller, 1764) and *A. juncea* (Linnaeus, 1758), as already observed at the pasture pool of Malga Lussari in 1969, 2019 and 2020, and at the artificial pond of Rutte Piccolo in 2020 (Table 1). Moreover, other odonates have also been observed in association with *A. grandis*: *Coenagrion hastulatum* (Charpentier, 1825), *Lestes sponsa* (Hansemann, 1823) and *Libellula quadrimaculata* Linnaeus, 1758 (Table 1).

Evidence of breeding

In 2020, it was possible to document that *A. grandis* can reproduce in the mountain area near Tarvisio, in particular in the artificial pond of Rutte Piccolo, where an adult was photographed just emerged from the exuvia (Fig. 4, 5) and other three exuviae were observed in the next days (Tab. 1). In 2017 two adults were observed in tandem, and in both 2017 and 2019 some egg-laying females had been observed in the same site (Fig. 6, 7; Tab. 1).

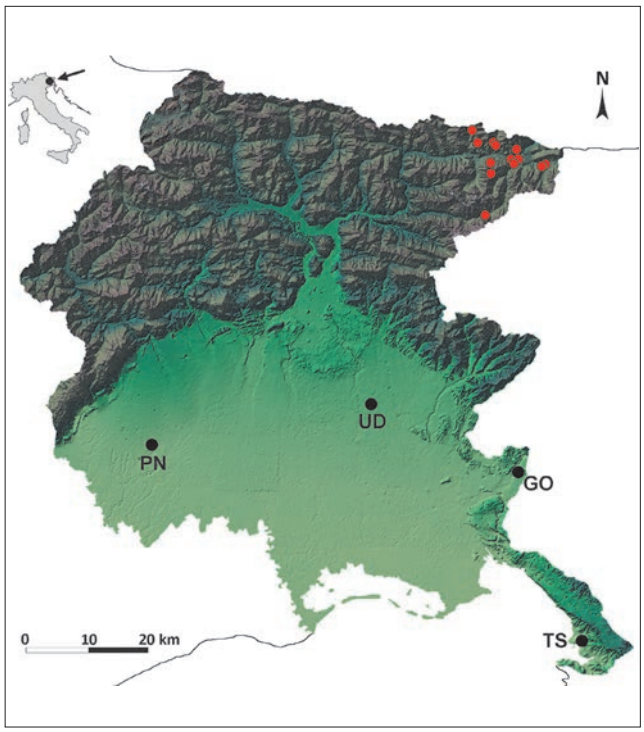

Fig. 3 - Distribution map of Aeshna grandis in the Friuli Venezia Giulia region (red dots).
- *Mappa della distribuzione di Aeshna grandis in Friuli Venezia Giulia (pallini rossi).*

N.	Site (locality)	Altitude (m a.s.l.)	Municipality	Coordinates	Specimens observed	Date	Environmental characteristic (and biological notes)	Observers	References
1	Malga Lussari (Monte Lussari) (see Note 1)	1568	Tarvisio (UD)	46°28'35''N, 13°32'10''E	1 M	Jul 1969	a pasture pool in a small mountain wet area	BK	Kiauta 1971
2	near the Rio del Lago (Fusine)	880	Tarvisio (UD)	46°29'28''N, 13°40'17''E	some exx.	21 Jul 1984	a small mountain wet area near a stream	IP	Pecile 1991
3	near the Rio del Lago (Fusine)	880	Tarvisio (UD)	46°29'28''N, 13°40'17''E	some exx.	18 Aug 1984	a small mountain wet area near a stream	IP	Pecile 1991
4	along the Torrente Uque (above the Rifugio Nordio-Deffar)	1350	Malborghetto-Valbruna (UD)	46°33'17''N, 13°29'02''E	1 M	20 Aug 2011	along a stream in a mountain area	IC	Zandigiacomo et al. 2015
5	along the Torrente Bartolo (Val Bartolo)	1000	Tarvisio (UD)	46°31'56''N, 13°32'31''E	1 M	24 Aug 2012	along a stream in a mountain area	IC	Zandigiacomo et al. 2015
6	along the Rio Lussari (Monte Lussari)	1000	Tarvisio (UD)	46°29'44''N, 13°32'02''E	1 M	23 Jul 2016	along a stream in a mountain area	IC	Zandigiacomo et al. 2020
7	Rutte Piccolo	8150	Tarvisio (UD)	46°29'35''N, 13°35'46''E	1 M + 1 F	8 Aug 2017	an artificial pond in a meadow and pasture area (a tandem pair)	RP	Zandigiacomo et al. 2020
8	Rutte Piccolo	815	Tarvisio (UD)	46°29'35''N, 13°35'46''E	1 M	9 Aug 2017	an artificial pond in a meadow and pasture area	IC	Zandigiacomo et al. 2020
9	Rutte Piccolo	815	Tarvisio (UD)	46°29'35''N, 13°35'46''E	1 F	9 Aug 2017	an artificial pond in a meadow and pasture area (one female during oviposition)	RP	Zandigiacomo et al. 2020
10	Val Filza bassa (loc. Gacceman)	1280	Malborghetto-Valbruna (UD)	46°31'52''N, 13°29'53''E	1 ex.	21 Jun 2018	a clearing in a spruce forest	RP	Zandigiacomo et al. 2020
11	Coccau di Sopra	800	Tarvisio (UD)	46°31'16''N, 13°36'08''E	1 F	16 Jul 2018	a clearing in a mixed forest near the Rio dei Carri stream	RP	Zandigiacomo et al. 2020
13	along the Rio del Lago (Fusine)	850	Tarvisio (UD)	46°29'28''N, 13°40'17''E	1 M	Jul 2018	a small mountain wet area near a stream	RP	the present paper
12	Malga Lussari (Monte Lussari) (see Note 2)	1568	Tarvisio (UD)	46°28'35''N, 13°32'10''E	1 M + 2 exx.	20 Jul 2019	a pasture pool in a small mountain wet area	TF	the present paper
14	along the Rio Lussari (Monte Lussari)	1000	Tarvisio (UD)	46°29'44''N, 13°32'02''E	1 M	22 Jul 2019	along a stream in a mountain area	IC	the present paper
15	Rutte Piccolo	815	Tarvisio (UD)	46°29'35''N, 13°35'46''E	2 FF	18 Aug 2019	an artificial pond in a meadow and pasture area (two females during oviposition)	RP	the present paper
16	Rutte Piccolo	815	Tarvisio (UD)	46°29'35''N, 13°35'46''E	2 FF	20-25 Aug 2019	an artificial pond in a meadow and pasture area (two females during oviposition)	RP	the present paper
17	Torbiera Scichizza (Fusine)	840	Tarvisio (UD)	46°29'35''N, 13°40'49''E	1 M	Aug 2019	a peat bog in a large mountain wet area	RP	the present paper
18	Rutte Piccolo (see Note 3)	815	Tarvisio (UD)	46°29'35''N, 13°35'46''E	1 ?F	12 Jun 2020	an artificial pond in a meadow and pasture area (one adult just emerged from the exuvia)	RP	the present paper
19	Rutte Piccolo	815	Tarvisio (UD)	46°29'35''N, 13°35'46''E	3 exu.	15-18 Jun 2020	an artificial pond in a meadow and pasture area	RP	the present paper
20	Malga Lussari (Monte Lussari) (see Note 4)	1568	Tarvisio (UD)	46°28'35''N, 13°32'10''E	1 F	20 Aug 2020	a pasture pool in a small mountain wet area	TF	the present paper
21	Torbiera Scichizza (Fusine)	840	Tarvisio (UD)	46°29'35''N, 13°40'52''E	1 M	20 Jul 2021	a peat bog in a large mountain wet area	RP	the present paper
22	Tarvisio	475	Tarvisio (UD)	46°30'08''N, 13°35'22''E	1 M	14 Aug 2021	an artificial pond within a golf course	RP	the present paper
23	Val Rio del Lago (above the Predil lake)	1000	Tarvisio (UD)	46°24'02"N, 13°30'56"E	1 M	14 Aug 2021	along a stream in a mountain area (probably a vagrant specimen)	IC	the present paper
24	Torbiera Scichizza (Fusine)	840	Tarvisio (UD)	46°29'35''N, 13°40'49''E	1 M	5 Set 2021	a peat bog in a large mountain wet area	IC	the present paper
25	Torbiera Scichizza (Fusine)	840	Tarvisio (UD)	46°29'31''N, 13°40'43''E	1 M	23 Jul 2022	a peat bog in a large mountain wet area	IC	the present paper
26	Rutte Piccolo	815	Tarvisio (UD)	46°29'35''N, 13°35'46''E	1 M + 1F	27 Jul 2022	an artificial pond in a meadow and pasture area	RP	the present paper
27	along the Torrente Bartolo (Val Bartolo)	965	Tarvisio (UD)	46°31'37''N, 13°32'49''E	1 M	29 Jul 2022	along a stream in a mountain area	RP	the present paper
28	Rutte Grande (see Note 5)	810	Tarvisio (UD)	46°30'06''N, 13°36'31''E	1 M	19 Aug 2023	a pond in a meadow and pasture area with single trees	RP	the present paper

(1) In the same site and day several adults of *Aeshna juncea* (including two females in oviposition), one male of *Aeshna cyanea* and one male of *Libellula quadrimaculata* were observed.
(2) In the same site and day several adults of *Aeshna cyanea, Aeshna juncea* and one male of *Coenagrion hastulatum* were observed.
(3) In the same site and day several adults of *Aeshna cyanea* and *Aeshna juncea* were observed, also during the emergence from their exuviae.
(4) In the same site and day several adults of *Aeshna cyanea, Aeshna juncea* and Lestes sponsa were observed.
(5) The same site hosts important populations of *Hyla arborea* (Linnaeus, 1758) and Lissotriton vulgaris vulgaris (Linnaeus, 1758).

Tab. 1 - Reports of *Aeshna grandis* specimens observed in the Friuli Venezia Giulia region from 1969 to 2023.
- *Segnalazioni di esemplari di* Aeshna grandis *osservati in Friuli Venezia Giulia dal 1969 al 2023.*

Fig. 4 - Adult (probably a female) of *Aeshna grandis* just emerged from the exuvia with the integuments still soft (Rutte Piccolo, 12 June 2020) (photo by R. Pontarini).
- *Adulto (probabilmente una femmina) di* Aeshna grandis *appena emerso dalla sua esuvia con i tegumenti ancora molli (Rutte Piccolo, 12 giugno 2020) (foto R. Pontarini).*

Discussion

In FVG, adults of *A. grandis* have been observed for a long time only in the Tarvisio area. The observation of an adult just emerged from its exuvia in a pond at Rutte Piccolo proved definitively that the species can complete its biological cycle in the survey area. This confirms what was previously hypothesized based on the observation of a tandem pair and ovipositing females. Therefore, we assume that the brown hawker is sedentary in this alpine area of the FVG and the adults observed in different years and sites are members of a local breeding population.

In recent decades, some freshwater habitats suitable for odonate breeding have undergone major changes. In the pasture of Malga Lussari, five pools were present in 1969 (Kiauta 1971), while currently only one survives. The floristic component of the pool has also changed, as in 1969 *Eleocharis palustris* (L.) Roem & Schult. was widespread (Kiauta 1971), but most recently it was not detected (Franceschinis 2011). Even the wet area near the Rio del Lago, where in 1984 adults of *A. grandis* had been observed (Pecile 1991), has undergone a drastic reduction in recent years due to drainage and the progression of vegetal communities that have gradually formed dense emergent plants and shrubs (R. Pontarini personal communication).

Considering that *A. grandis* in alpine areas of FVG frequents lakes, pasture pools and artificial ponds rich in hydrophytes and helophytes on the banks, it is necessary to maintain intact or restore these sites suitable for the reproduction of odonate and amphibian species. For example, the restoration of the pasture pool of Malga Ungarina (Julian Pre-Alps, 1300 m a.s.l.) quickly gave excellent results, especially as regards the protection of local populations of amphibians (Fiorenza & Mainardis, 2014) and odonates [such as *Ischnura elegans* (Vander Linden, 1820), *Coenagrion puella* (Linnaeus, 1758), *Libellula depressa* Linnaeus, 1758, *A. cyanea* and *A. juncea*; T. Fiorenza, unpublished data]. The creation of new ponds (such as that at Rutte Piccolo) and new pools in mountain areas, such as those at Plan di Tapou, 880 m a.s.l., in the Julian Pre-Alps (Fabian & Lapini 2007), can also contribute to improving the biodiversity of the local fauna and flora. These activities are very important, as in other mountain areas, such as those in Trentino, there has been a strong and progressive reduction over the years in the number of sites where the brown hawker and oth-

Fig. 5 - The same *Aeshna grandis* adult as in the figure 4 near its exuvia (Rutte Piccolo, 12 June 2020) (photo by R. Pontarini).
- *Lo stesso individuo di* Aeshna grandis *della figura 4 vicino alla sua esuvia (Rutte Piccolo, 12 giugno 2020) (foto R. Pontarini).*

Fig. 6 - A female of Aeshna grandis *while laying eggs in the artificial pond of Rutte Piccolo (18 Aug 2019) (photo by R. Pontarini).*
- Una femmina di *Aeshna grandis* mentre depone le uova nello stagno artificiale di Rutte Piccolo (18 agosto 2019) (foto R. Pontarini).

Fig. 7 - Another female of *Aeshna grandis* while laying eggs in the artificial pond of Rutte Piccolo (18 Aug 2019) (photo by R. Pontarini).
- *Una seconda femmina di* Aeshna grandis *mentre depone le uova nello stagno artificiale di Rutte Piccolo (18 agosto 2019) (foto R. Pontarini).*

er Odonata species are present (Maiolini & Carolli 2009; Assandri 2021).

In any case, further surveys on the lentic water-bodies, specifically in the Tarvisio area, are required to detect the occurrence of sites suitable for the reproduction of this species, in particular by searching for tandem pairs, ovipositing females, nymphs, teneral adults, and exuviae. In this way, targeted activities could be implemented to maintain or restore environments as a result of anthropogenic-driven transformations, and to monitor the population density of the brown hawker over time. Furthermore, some still water-bodies in the Tarvisio area, e.g. the Rutte Grande pond (see site no. 15 in Tab. 1), host other species of conservation importance, such as the Central European tree frog *Hyla arborea* (Linnaeus, 1758) (Anura, Hylidae) and the common smooth newt *Lissotriton vulgaris vulgaris* (Linnaeus, 1758) (Caudata, Salamandridae).

Given the rarity of *A. grandis* in Italy, present only in a few sites in some alpine regions, it has been included among the "Vulnerable" species (VU) according to IUCN categories and criteria (Riservato et al. 2014c). In Carinthia the species is quite common and is therefore considered as "Least Concern" (LC) (Holzinger & Komposch 2012). On the contrary, in Slovenia the species is rather rare and therefore is classified as "Vulnerable" (VU) (Kotarac 1997).

Manuscript received on 15.VII.2024, accepted on 03.VIII.2024

Acknowledgements

The authors dedicate this note to the memory of the odonatologist Professor Dr. Boštjan Kiauta who amicably supported us several times during our research. Furthermore, the authors would like to thank Alex Festi (Bolzano) for the information regarding the presence of *Aeshna grandis* in South Tyrol, and Francesco Pavan and Elena Cargnus for useful suggestions on a previous version of the manuscript.

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