

Foraging behaviour of *Ischnura genei* in the early morning (Odonata: Coenagrionidae)

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Abstract

In August 2013, at two different locations in Sardinia, individuals of *Ischnura genei* were observed and photographically documented flying at sunrise close above the water surface and picking up prey items. The prey consisted mainly of emerging Ephemeroptera (*Caenis* sp.) and Culicomorpha (Diptera).

Riassunto

Comportamento di ricerca e caccia di prede (foraging) in *Ischnura genei* alla mattina presto (Odonata: Coenagrionidae) – Individui di *I. genei* sono stati osservati all'alba in volo su uno specchio d'acqua e raccogliere prede. Questo comportamento è stato osservato e documentato fotograficamente ad agosto 2013 in due diverse località in Sardegna. Le prede consistevano di Ephemeroptera (*Caenis* sp.) emergenti e piccoli Culicomorpha (Diptera).

Zusammenfassung

Beutefangverhalten von *Ischnura genei* am frühen Morgen (Odonata: Coenagrionidae) – Individuen von *I. genei* wurden beobachtet, wie sie bei Sonnenaufgang dicht über der Wasseroberfläche flogen und von dort Beute aufnahmen. Dieses Verhalten konnte im August 2013 in zwei unterschiedlichen Habitaten Sardiniens fotografisch dokumentiert werden. Beuteobjekte waren überwiegend schlüpfende Eintagsfliegen (Ephemeroptera: *Caenis* sp.) sowie Culicomorpha (Diptera).

Introduction

Ischnura genei is an endemic European species; information is lacking about virtually anything except its taxonomy and distribution (WILDERMUTH & MARTENS 2014: 221). In Sardinia, *I. genei* is widespread over the island (RISERVATO et al.

2014), in fact, it is the most common odonate species there. It can be found from early April to September (RISERVATO et al. 2014: 64) at nearly every water body. Maybe because *I. genei* resembles *I. elegans* in most of its appearance, no work on ecology or behaviour has ever been published on this particular species (WILDERMUTH & MARTENS 2014: 221). But if we take a closer look, even the daily diet of *I. elegans* remains unknown, except for some extraordinary events. CORBET (1999: 643), in his table A.9.3 “Examples of foraging by gleaning in Odonata”, lists only two references for *I. elegans*, both mentioning females plucking small dipterans from a spider’s web. Furthermore, cannibalism seems to be widespread in females (STERNBERG 1999: 344 ff.). In literature published more recently, *I. elegans* is reported to glean young larvae of orthopterans such as *Phaneroptera falcata* or *Leptophyes punctatissima* (KUNZ & WILDERMUTH 2006) and on an unidentified spider (HEIN & KUNZ 2008). Here I report on incidental observations of early morning foraging actions of *I. genei* at two different sites in Sardinia.

Observation localities and methods

On a short field trip from 30th July to 11th August 2013 throughout Sardinia, my daughter Paula and me thoroughly investigated the odonate fauna of higher altitudes of the island between 300 and 1500 m a.s.l:

- (1) Pond at Monte Lerno Forest, NE Sardinia, 40.6219°N, 9.2062°E, 915 m a.s.l. (Fig. 1a)
- (2) Stream Riu Cuguttu, a tributary of the Riu Murtazzolu, Altopiano di Abbasanta, Central Sardinia, 40.2466°N, 8.8635°E, 340 m a.s.l. (Fig. 1b).

Observations were made by chance but repeatedly at two different habitats. The activities of foraging individuals were documented using a DSLR camera as a digital notebook, releasing the shutter at any change of action. Behaviour could be reconstructed by the exact time given in the exif-metafile data of the pictures. Time is given in CEST. Location names and altitudes were taken from the Mapped della Sardegna IGM topographical maps 1:25.000. Pictures of ‘meant-to-be’ prey items were determined by Verena Lubini-Ferlin (Ephemeroptera) and Peter Duelli (Planipennia).

Observations

On two excursions starting at sunrise, the following observations were made.

- (1) After the coldest night during our trip, on 3rd August 2013, the excursion started at 07:00 h at ca 16°C to take photographs of roosting dragonflies at a man-made pond. Sunrise on this day was at 06:21 h (PHILIPP 2015). At 07:08 h the first rays of the sun hit some of the pond’s vegetation, the water surface was

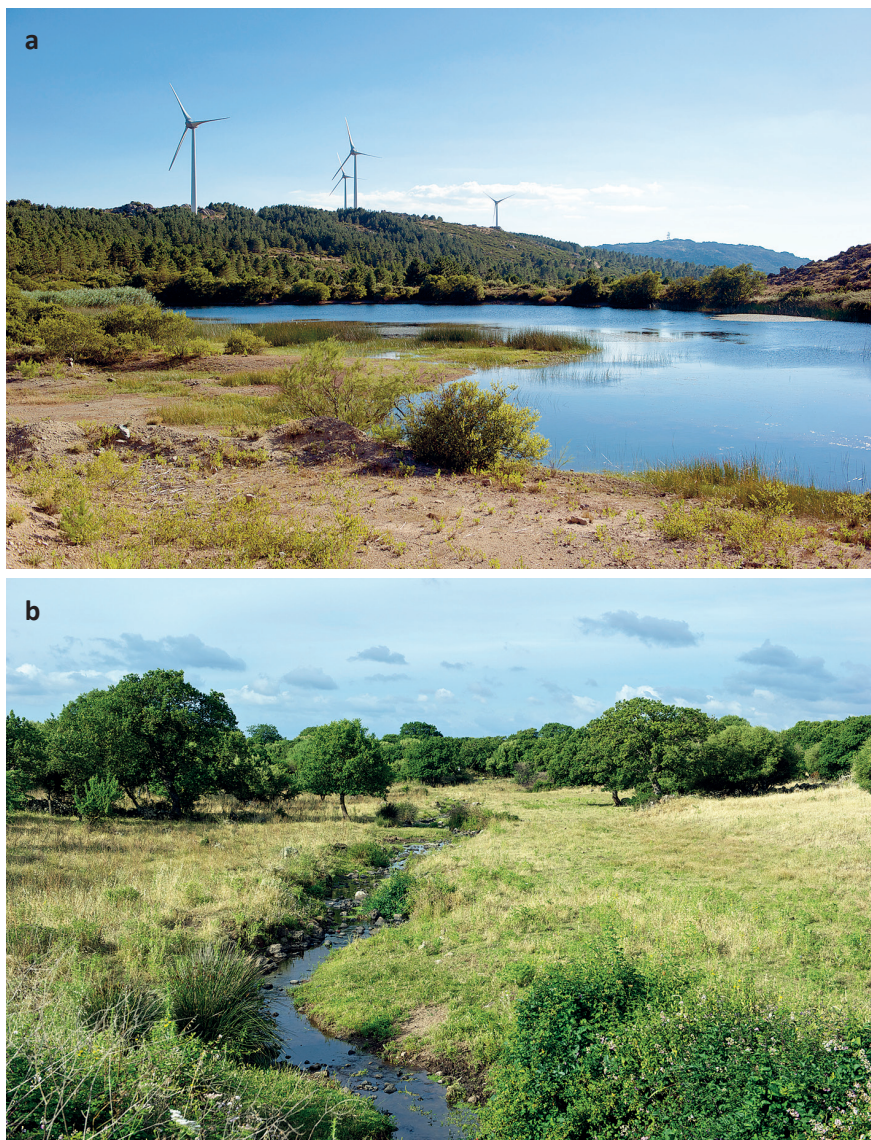


Figure 1. Locations where early morning foraging behaviour of *Ischnura genei* was observed: a) pond within the Monte Lerno Forest, Sardinia (02-viii-2013); b) Riu Cuguttu, Altopiano di Abbasanta, Sardinia (12-vi-2011). – Abbildung 1: Gewässer, an denen frühmorgendliches Beutefangverhalten von *Ischnura genei* beobachtet werden konnte: a) Teich in den Foresta Monte Lerno, Sardinien (02.08.2013); b) Riu Cuguttu, Hochebene von Abbasanta, Sardinien (12.06.2011).

perfectly glassy, no wind, and all odonates, mainly zygopterans, were still roosting motionless within the vegetation. Even a copulation-wheel of *Ischnura genei*, presumably from the day before, was observed. No dragonflies were seen flying over the water surface or perching close above the water body. After having taken some pictures of *I. genei* males (cf. WILDERMUTH & MARTENS 2014: 220), the first anisopteran appeared at 07:47 h flying over the pond, and the first *Ischnura* individuals were noticed sitting 1–5 cm above the water surface. From time to time these individuals took off and flew 2–5 cm over the water surface, sometimes backwards, dipping down here and there and alighted on *Eleocharis* stems or other supports, handling some kind of small prey. At 08:20 h the first photos of an *Ischnura* with prey (Fig. 2b) could be taken, identified later by V. Lubini-Ferlin as *Caenis* sp. (Ephemeroptera). Within the next few minutes some more photos of both sexes of *I. genei* with prey were taken (Fig. 2a, prey unidentified). There was no sexual behaviour recognizable at this time, although 20–30 individuals were sitting and flying within an area of 10 × 20 m. At around 08:30 h the ordinary odonate life started at the pond with mating behaviour and more individuals and



Figure 2. Foraging individuals of *Ischnura genei* in the early morning sun. a + b) female (a) with unidentified prey, and male (b) with a *Caenis* sp. (Ephemeroptera) at the pond in the Monte Lerno Forest, Sardinia (02-viii-2013); c + d) two times the same female sitting (c) beside zygopteran wings and (d) nibbling an unidentified prey. Riu Cuguttu (10-viii-2013). – Abbildung 2: Fressende Individuen von *Ischnura genei* in der ersten Morgensonne. a + b) Weibchen (a) mit unidentifizierter Beute, und Männchen (b) mit einer Eintagsfliege *Caenis* sp. am Teich in den Foresta Monte Lerno, Sardinien (02.08.2013); c + d) Zwei mal dasselbe Weibchen: (c) neben Zygopteren-Flügeln sitzend und (d) an einer unidentifizierbaren Beute fressend. Riu Cuguttu, Sardinien (10.08.2013).

species in the air. No *Ischnura* was seen flying close over the water surface then. Later on, several photos of all available wings or other remains of insects floating on the water surface, considered odonate prey items, were taken. Again, some of these belonged to the genus *Caenis* (det. V. Lubini-Ferlin), but mainly to different Planipennia: two species of the genus *Pseudomallada* and one of *Chrysoperla* (det. P. Duelli) as well as the remains of *Ectobius vittiventris* (Blattodea). All but the *Caenis* sp. were presumably food items of bats (Chiroptera) from the previous night. Because of their sole activity at night, these were rejected as prey of *Ischnura*.

(2) One week later, on 10th August 2013, we stayed at a small brook within a pasture interspersed with trees and shrubs. Sunrise was at 06:30 h on this day (PHILIPP 2015). We started our excursion on a somewhat hazy morning at 07:15 h, at a temperature of ca 25°C. At this time of summer the stream was only gently running through the open pasture, in most sections it was hard to trace any flow at all. At 07:47:07 h the first picture of a female *I. genei* (Fig. 2c) was taken, sitting on floating *Callitriche* leaves directly on the water surface close to a pair of zygopteran wings (presumably belonging to *Coenagrion caerulescens*, but not taken). Following this individual female with the camera at a safe distance, not disturbing her behaviour, was an instant decision. At 07:47:46 h she had already darted to a new prey item (presumably a small dipteran), picked it from the water surface, alighted on a stone and processed the prey (Fig. 2d). Just a minute later, at 07:48:48 h, she had caught an emerging *Caenis* sp. (Ephemeroptera) from the



Figure 3. A male of *Ischnura genei* perching in the early morning sun close to the water surface, with an emerging Ephemeroptera beneath as possible prey. Riu Cuguttu, 10-viii-2013. – Abbildung 3: Männchen von *Ischnura genei* in der ersten Morgensonne, knapp über der Wasseroberfläche sitzend, mit einer schlüpfenden Eintagsfliege (Ephemeroptera) als mögliche Beute in Reichweite. Riu Cuguttu, 10.08.2013.

water surface (det. V. Lubini-Ferlin), sitting on floating vegetation and processing it. At 07:51:13 she alighted on a vertical grass blade after an unsuccessful attack on another emerging ephemeropteran. The next attack on a smaller prey item also failed, and the female alighted at 08:01:20 h without prey, on *Lemna* leaves. Suddenly, the female darted to another prey on the water surface near-by (around 15–20 cm) and returned to a horizontal grass blade with a small dipteran as prey (8:02:40 h). When a bull suddenly turned up right next to me, I decided it was better to terminate this research and left gingerly for breakfast. Within 15 minutes the observed *I. genei* female had successfully caught at least three prey items (two dipterans, one ephemeropteran), processed them and failed to pick up two further prey items from the water surface.

Discussion

Gleaning as a foraging tactic in dragonflies is constrained by the difficulty to detect motionless prey, especially when the latter is sitting on leaves, ground or the water surface. A low incidence angle of sunlight will help gleaners in general to perceive their prey by a higher contrast (CORBET 1999: 356). As the majority of odonates are obligate predators, every individual could confine itself for a certain time to a certain prey, just depending on the availability of the food source (CORBET 1999: 382). In this respect, *I. genei* seems to use the short time between awaking from the night and starting reproductive activity to refuel needed energy during adult life. In the first case, the damselflies having been observed from the beginning, this time lasted about 90 minutes. Sunrise is an episode of high prey availability over the day (CORBET 1999: 349), and both sexes gain access to this source collectively. The female that was tracked for 15 min at location (2) gained three food items and failed to collect two. Thus, during the 90 minutes of usable time, an individual may possibly catch 18 prey items.

In the cases observed at a pond and a brook in Sardinia, emerging Ephemeroptera and Diptera were the main targets. These insects float under the water surface as larvae or pupae, break through while emerging and fly off immediately. By the very low angle of the sunlight early in the morning, often being the only windless time of the day in Sardinia, objects on the mirror-like water surface are highly detectable. This may be the reason why the *I. genei* individuals perch low above the water surface (Fig. 3); against the gleaming light of the morning sky any dark subject appears crystal clear on the surface. Thus, emerging water insects constitute plentiful and easily caught prey, only available at dawn. During summer in Sardinia, the temperature rarely drops below 16°C, even at altitudes of 1.000 m a.s.l., thus activity of odonates is always possible.

Why do other odonates not utilize this plentiful food source? First of all, not every species usually remains overnight directly by the water, but *Ischnura* does (Jäckel et al 2014). When other species come to the water during forenoon, this food source is no longer available. Furthermore, with upcoming winds, it would

be too risky to pick up prey items from the water surface. On the other hand, *Ischnura* is known to perform long copulations, often longer than 60 min, and especially *I. elegans* for the longest among all dragonflies (CORBET 1999: 524). While performing the mating wheel, individuals – particularly the female – are unable to catch prey. *Ischnura elegans* and *I. genei*, being closely related, it is assumed that both exhibit very similar copulation behaviour. The observed wheel at location (1) may have persisted overnight, and taking sunset at 20:40 h into account, the copulation presumably lasted at least 680 min. To gain enough food, *Ischnura* individuals are therefore forced to feed before or after the reproductive activities, or leave the water during the day to forage in terrestrial habitats.

Gleaning prey items from the water surface is a risky manoeuvre, at least far more dangerous than gleaning from leaves, stems, or plain ground. Odonates have to avoid contact with the water. Flying slowly and very close to the water surface they expose themselves to predators such as fish, frogs, or birds. This may be the reason why the female at locality (2) just made a single attack on the prey, not trying any more; many zygopterans have been observed trying to pick dark spots from leaves again and again (H.M. Robertson in CORBET 1984: 21). Gleaning prey from the water surface is in fact a rarely witnessed behaviour in odonates in general. R.W. Garrison (in CORBET 1984: 20) mentions a male of *I. gemina* picking up a larval water strider (Gerridae) from the water surface. *Pseudagrion sjoestedti* was observed picking larvae of gerrids and veliids (Heteroptera) repeatedly from the water surface in Liberia (LEMPERT 1988: 51). Thus, this behaviour may not turn up every day as a routine but only on occasions with suitable conditions like warm, windless days or moments and the presence of a lot of emerging insects (or high density of larval Gerridae). The variations of this unique behaviour would be rewarding for further research.

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