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SHORT COMMUNICATION

Does the Desert Skimmer *Orthetrum ransonnetii* (Odonata: Libellulidae) avoid perching on vegetation?

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For more than a half-century, it has been accepted to divide most of Odonata species into two categories based on their adult behavior (Corbet 1962): perchers, that sit much of the time on some commonly elevated points (vegetation, stones, bare ground or artificial objects) from which they make short flights to hunt or to interact with mates or competitors; and fliers, which spend most of their active time on the wing. This dissimilarity, although not absolute, has important implications for temperature regulation of the insects. Perchers are largely or completely ectothermic, while fliers are principally based on endothermy (Corbet 2004). While most of Libellulidae (Anisoptera) species can be provisionally classified as perchers, a relatively small number of libellulids have apparently become fliers (Corbet & May 2008).

Perching behavior of the Libellulidae dragonflies has been studied with respect to some aspects of their biology. It has been found that some libellulid species can indeed select body temperature by perching at an appropriate distance from the ground, whereas there is no correlation between temperature and perch height in some other species of this group (May 1976). Worthen and Jones (2006) concluded that increasing wind speed and its direction can have a stronger impact on perch selection than temperature, because these factors can restrict dragonfly's flying activity. They found a positive correlation between the dragonfly's body mass and the perch height (Worthen & Jones 2006). It was demonstrated experimentally that larger species of Libellulidae preferred higher perches and smaller species used lower perches, but also that perching height could be affected by species competitive interactions (Worthen & Patrick 2004; Worthen & Jones 2006; Worthen & Morrow 2016). Although the perching behavior of odonates was studied in several aspects, typically only perch height was considered, whereas little attention was paid to the perch structural habitat attributes (Hykel *et al*. 2020). Rarely and not in libellulids, but particularly in the Gomphidae species, the perching height was studied also in relation to the perch substrate (Martens 2001; May 2017).

The Desert Skimmer *Orthetrum ransonnetii* (Brauer, 1865) is an insufficiently known species distributed from Southwest Asia to Northwest Africa and the Canary

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Islands (Boudot *et al*. 2020). The perching behavior of this dragonfly first attracted my attention in 2010–2012 at the beginning of a long-term Odonata survey in the Dead Sea area (I. Blecher, M. Blecher, pers. obs.). One of the employed survey methods was walking monthly along fixed transects and counting dragonfly and damselfly imagoes seen at a defined distance (Brooks 1993; Pollard & Yates 1993; Bouwman *et al*. 2009). During observations on *O. ransonnetii*, the perching preference for stones or bare ground (Fig. 1) was evident along all transects relevant for this species. To test this impression quantitatively, as from 2013, it was decided to include the perch substrate aspect in each observation on *O. ransonnetii*: to record this dragonfly perching on vegetation versus on stones or bare ground.

The presented data were collected during observations at two sites (two streams) in the Dead Sea oases: Nahal Bokek (also known as Nahal Boqeq) (2013–2021, April–October) and Nahal Arugot (2013–2016, April–September). The survey transects were set along the permanent watercourses and included areas of both high and low concentrations of the Odonata species. The routes were subdivided into sections with boundaries based on changes in the landscape physical characteristics. The habitats for dragonfly perching in the streams of Nahal Bokek and Nahal Arugot

Fig. 1: Male of *O. ransonnetii* in Nahal David, Dead Sea area, Israel (25.vi.2015).

Fig. 2: Examples of landscape and habitats in the surveyed sites: Nahal Arugot (upper two photos), Nahal Bokek (lower two photos).

(Fig. 2) are dynamic. They can vary annually and monthly because of periodic flash floods changing vegetation cover and structure. Therefore, it was important to make observations on *O. ransonnetii* perching selection in different years and seasons, to include the whole spectrum of environmental conditions. Since this paper deals only with the perching behavior of dragonflies, further methodological details about the transects are not given here. The additional information about the surveyed sites can be found elsewhere, e.g. in Mischke (2015) for Nahal Bokek and in Furth (1983) for Nahal Arugot.

In the surveyed sites of Nahal Arugot and Nahal Bokek, 831 territorial males of *O. ransonnetii* were counted in 2013–2021 (Table 1). At the same time, 41 females of this species were also noted (Nahal Arugot, 23; Nahal Bokek, 18) engaged in reproductive behavior (copulation, oviposition). Among 872 observations on *O. ransonnetii*, no males or females were recorded using vegetation (live plants) for perching. In Nahal Bokek, two males of this species were seen perching on dry tree trunks on 10 July 2014, but these observations are not the 'exception to the rule', as dry wood objects are not live plants associated with vegetation.

Table 1. Numbers of *Orthetrum ransonnetii* territorial males counted in observations related to perching substrate.

Site	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Nahal Arugot	30	206	28	13	–	–	–	–	–	277
Nahal Bokek	20	163	112	92	7	26	122	2	10	554

For comparison with *O. ransonnetii* the perching behavior of a sympatric species *Orthetrum chrysostigma* (Burmeister, 1839) was also recorded on two occasions (13 June 2014 and 12 July 2014) at the Nahal Arugot transect (Table 2). The observed 46 males of *O. ransonnetii* were perching on stones or bare ground exclusively. On the other hand, among 146 males of *O. chrysostigma* 84 individuals (57.5 %) in the same sections of the transect and at similar time were perching on live plants. The behaviors of the two species in the aspect of perch substrate choice are statistically different (Table 2). It should be added that a similar situation was observed in other sites where these two species coexist in Israel (M. Blecher, I. Blecher, pers. obs.): Nahal David in the Dead Sea area, En Avdat and En Akev in the Negev Desert, or even near our private garden pools in the city of Arad (Judean Desert). It is important to accentuate that Nahal Arugot and Nahal Bokek are breeding sites for these dragonflies. There are no representative data on perching choice of *O. ransonnetii* while foraging.

Table 2. Perching substrate of males of two *Orthetrum* species in Nahal Arugot (June and July, 2014 observations).

	Orthetrum ransonnetii		***Orthetrum chrysostigma***	
	stone or bare ground	live plant	stone or bare ground	live plant
June	15	0	44	16
July	31	0	18	68
sum	46	0	62	84

χ^2 with Yates' correction = 44.74, $p < 0.001$.

Waterston and Pittaway (1991) noted *O. ransonnetii* in Oman around deep rocky pools in boulder-strewn wadis, where adults rest under overhanging rocks. In the UAE, *O. ransonnetii* perches on exposed rocks near pools, frequently handing on vertical surfaces, and is sympatric with *O. chrysostigma* (Feulner *et al*. 2007). According to recent work in Oman (Ball 2014), *O. ransonnetii* was observed exhibiting very similar behavior to *O. chrysostigma*, although perching more often on bare rock faces, and the author confirms that these two *Orthetrum* species

occur sympatrically. Boudot *et al*. (2020) highlighted the behavior in both sexes of *O. ransonnetii* landing rather abruptly vertically and hanging from vertical or sub-vertical rocks and walls, especially in shaded places. They concluded that ecological separation exists between *O. ransonnetii* and *O. chrysostigma* (Boudot *et al*. 2020). Based on their opinion, the two species are sympatric on a regional scale, but only rarely seen at the same field sites, although their co-occurrence has also been reported (Boudot *et al*. 2020).

As attested by the above publications, the stone preference of *O. ransonnetii* for perching has been noted for a long time, but the data presented here demonstrate this phenomenon as a total preference. The author did not find such pattern in the literature on Odonata. For example, the stone preference for perching was found in some Gomphidae species (Martens 2001; May 2017), but this preference was not absolute (included conspicuous exceptions – live plants). Landing on vertical surfaces is an additional interesting aspect of *O. ransonnetii* perching behavior, which was observed many times at the Dead Sea sites also (Fig. 3), but it is a particular case (less than 10 % from the author's observations) of the primary perching choice demonstrated here. Furthermore, this behavior is not so unique among dragonfly's species (I. Blecher, pers. obs.); for example, we have such cases documented also for *Trithemis arteriosa* (Burmeister, 1839).

Fig. 3: Male of *O. ransonnetii* landing on a vertical stone surface in Nahal David, Dead Sea area, Israel (12.v.2010).

Author's long-term data (M. Blecher, I. Blecher, pers. obs.) do not confirm an ecological separation between *O. ransonnetii* and *O. chrysostigma* at the level of habitats. In the Dead Sea area streams that include both wetland vegetation and rocky landscapes with flowing water, the two *Orthetrum* species persist sympatrically. Most likely, the choice of perching substrate by the Desert Skimmer is an adaptation to the desert rocky environment with sparse vegetation. It is also possible that the perching behavior of *O. ransonnetii* is a case of niche diferentiation in sympatric sites: using the environment differently in a way that helps to coexist. The Desert Skimmer is a distinctive desert dragonfly that was overlooked in the scientific literature until recently. It is worth noting here that in the important review of desert-inhabiting Odonata by Suhling *et al*. (2003), *Orthetrum chrysostigma* is considered one of typical examples, but *O. ransonnetii* is not mentioned to at all.

The regional data set used in this study includes about nine hundred observations (see above). For comparison: the number of available records used in the current world-wide review on *O. ransonnetii* (Boudot *et al*. 2020) is 317. Nevertheless, in accordance with our findings based on a large data set from the Dead Sea area, it would be advisable to test the issue of perching substrate selection by *O. ransonnetii* in additional regions of the species' range, in areas of different environmental conditions.

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