

**PERCHING SITE CHOICE IN *ONYCHOGOMPHUS*  
*F. FORCIPATUS* (L.): AN EXPERIMENTAL APPROACH  
(ANISOPTERA: GOMPHIDAE)**

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At the rendezvous, ♂♂ prefer stones as perches. Discrimination experiments with pairs of substrates showed that they land preferentially on perches that correspond in height to the flight level of ♀♀ appearing at the water. When they first landed, ♂♂ preferred perches in the middle of the stream, but afterwards they also used those near the stream margin. The results are interpreted in terms of early recognition of ♀♀ and rapid formation of tandem linkage.

**INTRODUCTION**

At the encounter site, the males of many dragonfly species behave as perchers: they settle on sites offering a good opportunity to encounter receptive females. Until now, the analysis of the use of different perching sites was made in terms of thermoregulation (e.g. MAY, 1976, 1991; STERNBERG, 1989), or spatial separation of species with respect to interspecific competition (e.g. REHFELDT & HADRY, 1988; SOEFFING, 1990). Experimental manipulations of perches focus on habitat quality and attraction in territorial Libellulidae (e.g. WILDERMUTH, 1992; WOLF & WALTZ, 1993).

Males of *Onychogomphus f. forcipatus* perch on stones or bare ground and behave aggressively but are non-territorial (KAISER, 1974). In *O. f. unguiculatus*, MILLER & MILLER (1985) described rapid flights of females low over the water and several males taking off from their perches and pursuing them with high speed. They proposed that the female's flight behaviour allows her to select that partner which is the quickest to respond and the fastest in flight. Based on this consideration, one can assume that male's perching site choice is relevant for its mating success. I have tested two hypotheses:

- (1) A male should prefer perches which allow a good overview at the rendezvous, with a small amount of running water the middle of the stream being the preferred site.
- (2) A male should also have a preference for a certain perch height, which allows early recognition and successful pursuit of females.

For studying site preferences of a species in the field, the resources tested should be limited. In *O. f. forcipatus*, which breeds in both lotic and lentic waters (SUHLING & MULLER, 1996), males mostly perch on stones or bare ground (KAISER, 1974). In the Slovenian Bloke Plateau the species occurs at streams where stones in the water are rare and the margins are densely covered with vegetation. This situation offers good opportunities to test the hypotheses in field experiments.

#### STUDY SITE AND METHODS

The study was carried out from 19-VII to 26-VII-2000 at the Bloščica rivulet near Nova Vas (approx. 40 km S of Ljubljana, Slovenia; alt. 750 m; 45°47'40"N, 14°29'55"E; UTM VL67). This stream and its dragonfly fauna were described in detail by BEDJANIČ & KOTARAC (1996). Discrimination experiments were carried out at a 8 m long riffle section, flowing from E to W, having a width of 1.8 m and a maximum depth of 0.2 m (near loc. 4 of BEDJANIČ & KOTARAC, 1996). The stream margins consisted of wet grassland, sparse *Carex* sp. at one side formed the only aquatic vegetation. Within this section I removed all stones suitable as perching sites. Experiments were done between 8:30 and 13:20 h solar time.

To test the preference for perches within the water two stones projecting 10-12 cm out of the water and 18×8 cm resp. 17×7 cm wide were placed in the stream, one 10 cm from the northern margin resp. emerging *Carex* plants, the other in the middle of the stream. When a male landed the position and time of this and subsequent landings were recorded. After each trial the stones were exchanged.

In order to test whether there is a preference for a certain height of a perch, I fixed two pieces of corrugated cardboard, both 5×15 cm in size, horizontally at different heights above the water with a vertical stick near the shore. I tested the heights of 2 cm vs 20 cm above water, and 20 cm vs 40 cm, respectively. After each trial the cardboard pieces were exchanged.

After trials, when males had become residents, they were captured to avoid effects of individual peculiarities or knowledge of the place. They were marked with coloured wing bands using waterproof pens and released.

Data on flight levels were taken from observations during the choice experiments, by using landmarks and the manipulated sites as bench-marks.

#### RESULTS

At the Bloščica rivulet males of *Onychogomphus f. forcipatus* mostly perched on stones in or near the water. They also settled on roots, dry twigs or timber laying in water. Only occasionally they perched on diagonal or horizontal *Carex* leaves (maximum 4 observations per day). Males patrolled at heights of 15 to 20 cm above the water surface and repeatedly returned to their perches. They took off rapidly to chase approaching or passing dragonflies, mostly conspecific males.

Males appearing at the investigated stretch of the stream preferentially landed on the perch in the middle of the stream (Tab. I), for some seconds to 16 minutes (median = 2 min; N = 14). Those that returned to this section of stream showed no preference

for perch site (Tab. I). Seven times they changed to the perch nearby, seven times they returned to the same perch and twice they left the area.

Given the choice between two out of three alternative perch heights, males clearly preferred the height of 20 cm

above water level (Tab. II). There was no tendency to use the higher perch, regardless of whether the 20 cm perch was the higher or lower perch. In a third trial, given the choice between a substrate just near the water surface (= 2 cm) and the alternative (40 cm in height) only one landing occurred at the perch near the water surface, while several males passed the site. During the trials males settled on the cardboard for some seconds to 8 minutes (median = 2 min; N = 24). After landing, males normally rotated to face towards the water.

Females arrived at the water and hovered approx. 15 cm above the water surface. During cold and cloudy periods, when there were no males present at the water, they were seen clearly to exhibit two different modes of movement: (1) dipping for oviposition, at the open water in the middle of the stream or near the margin, several times also at sites sparsely overgrown with *Carex*; (2) several times they hovered conspicuously over the water for some seconds without making oviposition movements.

## DISCUSSION

Do males prefer perches in the middle of the stream? The results lead to a more diverse concept: a good overview of the rendezvous site seems to be important on first landing. However, with increasing knowledge of the site the central position loses its significance, and randomised changes to perches nearby may offer the

Table I  
Perching site choice in male *Onychogomphus f. forcipatus*. The first and second landing of each male were recorded

Landing	Number of landings on		Difference from 1:1	
	stone in the middle of the stream	stone near the margin	$\chi^2$	P
First	12	4	4.00	<0.05
Second	7	7	0.00	NS

Table II  
Choice of perching height in *Onychogomphus f. forcipatus* in two pairwise tests. The first and second, subsequent landing of each male were recorded

Numbers of landings	Perch height above water surface			Difference from 1:1	
	2 cm	20 cm	40 cm	$\chi^2$	P
First	1	18	-	15.21	<0.001
Second	2	15	-	9.94	<0.01
First	-	11	0	11.00	<0.001
Second	-	7	0	7.00	<0.01

advantage of unpredictability and decrease the risk of predation. On the other hand, a rock in the middle of the stream is probably easier to detect for an animal unfamiliar with the site.

Hypothesis 2 could not be rejected: males clearly prefer a certain perch height. They prefer perches 20 cm above the water level, this being approximately at the level of approaching females. The experimental design with artificial substrates (cardboard) exposed in an untypical manner (substrates in two levels) lead to clear results. However, as only three discrete alternative heights were tested, no data on the real optimal height can be presented here. In perches very close to the water surface there might be the disadvantage that males cannot strike their wings with maximum amplitude, a motion reported as being characteristic for strong wing accelerations (RÜPPELL, 1989) and needed to pursue the female successfully. On the other hand, perches which are situated too high may be too exposed to cooling wind and may not warm up like substrates in lower strata. Additionally, a lower perch offers a better view against the sky. For female recognition this might be better than the view of the uneven background of vegetation or other structures near the ground. We do not know much about visual sex recognition in the Gomphidae. PRITCHARD (1966) offers some information on the visual fields of adults but further details are needed.

I suggest that males prefer perches which offer a good overview of the rendezvous site and proximity to the flight level of receptive females. One can assume that this would be a general pattern in perchers. In territorial species, the components of defence against rivals may play an additional role.

For ectothermic warming settling on light and reflecting surfaces is widespread in Odonata (cf. CORBET, 1999). The species and the use of artificial perches described here will give a good opportunity to test the effects of the respective preferences for colour and reflection intensity which might be important, too.

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