



ODONATA (INSECTA) AT A WADI POOL NEAR NIZWA, NORTHERN OMAN

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ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

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OPEN ACCESS

Abstract: Fourteen damselfly and dragonfly species were recorded in 68 visits to a wadi pool in northern Oman, March 2012 to June 2014. All identifications were based on photographs. Apparently the pool has a core community of eight resident species. *Paragomphus sinaiticus*, globally Near Threatened, was regularly recorded.

Keywords: Anisoptera, Arabia, phenology, reproduction, species inventory, Zygoptera.

The damselflies and dragonflies, Odonata, of Oman are known largely through the collection of specimens and photographic records. In the latest checklist of the odonate fauna of Oman, Schneider & Dumont (1997) recorded 40 species, collating information from 1912 onwards. Two species have been added recently. *Ischnura fountaineae* Morton, 1905 was photographed in northern Oman (Reimer et al. 2009) and *Tholymis tillarga* (Fabricius, 1798) was reported from Dhofar (Ball 2014), over 1000km to the south. Oman is largely a desert country with a mainly arid climate. Rainfall in the north is in the winter though monsoon-induced summer rainfall sometimes occurs (e.g., Fisher et al. 1999).

The present paper describes odonates recorded over an extended period at a wadi (valley) pool in the southern foothills of the Jebel Akhdar mountain range, near Nizwa, northern Oman. In all, 68 visits of several hours each were made to the pool during 23 months between March 2012 and June 2014. Cowan & Cowan (2013) described the wadi pool and odonate species seen there from March 2012 to June 2013. Here we present monthly occurrence of odonates, including mating and egg laying, over the full period for the 14 species observed including four first seen after June 2013.

STUDY AREA

The pool (23°4.53'N & 57°21.57'E, 680m, Fig. 1, Image 1) is in the southern foothills of the Jebel Akhdar range, the highest section of the Hajar mountains of northern Oman. It is a few kilometres from the Al Hoota cave, a tourist attraction, and about 22km northwest of the rapidly developing city of Nizwa. The pool is fed by seepage from a mountain spring and varies in size



DOI: <http://dx.doi.org/10.11609/JoTT.o4207.7538-46> | **ZooBank:** urn:lsid:zoobank.org:pub:D83BD6B0-0559-4A37-87F2-08F97BBAE89F

Editor: Jean-Pierre Boudot, French National Centre for Scientific Research, Paris, France.

Date of publication: 26 July 2015 (online & print)

Manuscript details: Ms # o4207 | Received 05 January 2015 | Final received 25 June 2015 | Finally accepted 30 June 2015

Citation: Cowan, E.M. & P.J. Cowan (2015). Odonata (Insecta) at a wadi Pool near Nizwa, northern Oman. *Journal of Threatened Taxa* 7(9): 7538–7546; <http://dx.doi.org/10.11609/JoTT.o4207.7538-46>

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Funding: None.

Competing interests: The authors declare no competing interests.

Acknowledgements: The JoTT review process significantly improved the manuscript.



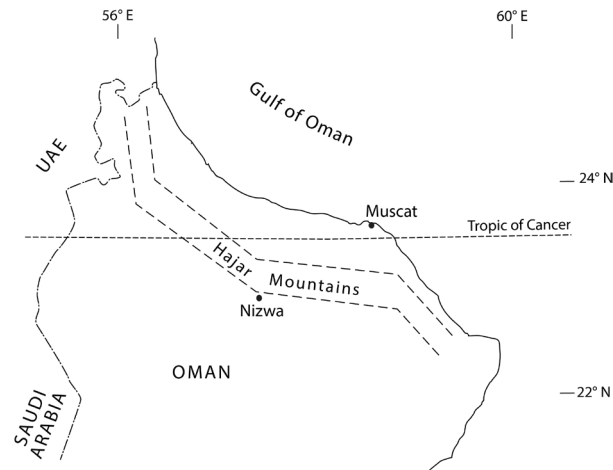


Figure 1. Location of the wadi pool study site, near Nizwa, in the southern foothills of the Jebel Akhdar range, the highest section of the Hajar mountains of northern Oman.



Image 1. The wadi pool study site near Nizwa, northern Oman, 02 January 2014.

dramatically over time due to rainfall, or the lack of it, in the wadi's catchment. The southern and eastern sides of this apparently permanent pool are a popular picnic site especially at weekends.

METHODS

All our identifications at the pool (Table 1) were based on digital photos, allowing for later deliberation and confirmation. All photos were taken by E.M.C. using a handheld Sony Cybershot compact camera. The data includes the monthly occurrence of odonate species, presenting the number of visits in a month in which we photographed the species. No visit was made in June, July, November, December 2012 or July 2013. The occurrence of mating and egg laying by month except for the 'no-visit' months are also presented. Every datum is supported by a 'voucher photo' in E.M.C.'s personal collection. Identification was facilitated in many cases by reference to Dijkstra & Lewington (2006), the field guide to the odonates of Europe and western Turkey, Cyprus and northwestern Africa. Also useful were well-illustrated papers on the odonate fauna of the adjoining United Arab Emirates (Giles 1998; Feulner et al. 2007; Reimer et al. 2009), the Asia/Africa Dragonfly website (www.allodonata.com), Samways (2008), Subramanian (2009), and Smallshire & Swash (2014).

RESULTS

Table 1 lists the 14 odonate species (Images 2 to 31) we recorded at the pool. Images 2 to 30 were taken at the pool during our study period and identification notes are given in their captions. Table 2 presents monthly occurrence whilst Table 3 notes the months when

Table 1. Odonate species recorded at the wadi pool, March 2012 to June 2014. Scientific nomenclature follows IUCN (2013).

Species name	Common name	Image no.
Zygoptera		
Damselflies		
Coenagrionidae		
<i>Ischnura evansi</i> Morton, 1919	Evans' Ischnura	2–4
<i>Pseudagrion decorum</i> (Rambur, 1842)	Elegant Sprite	5–7
Anisoptera		
Dragonflies		
Aeshnidae		
<i>Anax imperator</i> Leach, 1815	Blue Emperor	8, 9
<i>Anax parthenope</i> Selys, 1839	Lesser Emperor	10
Gomphidae		
<i>Paragomphus genei</i> (Selys, 1841)	Green Hooktail	11
<i>Paragomphus sinaiticus</i> (Morton, 1929)	Sinai Hooktail	12, 13
Libellulidae		
<i>Orthetrum chrysostigma</i> (Burmeister, 1839)	Girdled Skimmer	14, 15
<i>Orthetrum sabina</i> (Drury, 1773)	Slender Skimmer	16, 17
<i>Crocothemis erythraea</i> (Brullé, 1832)	Carmine Darter	18–20
<i>Diplacodes lefebvrii</i> (Rambur, 1842)	Black Percher	21–23
<i>Trithemis annulata</i> (Palisot de Beauvois, 1807)	Purple-blushed Darter	24, 25
<i>Trithemis arteriosa</i> (Burmeister, 1839)	Gulley Darter	26, 27
<i>Trithemis kirbyi</i> Selys, 1891	Orange Darter	28, 29
<i>Pantala flavescens</i> (Fabricius, 1798)	Wandering Glider	30, 31

mating and laying were observed and photographed. A variety of different exuviae were observed around the pool. Large *Anax*-type exuviae were most frequently recorded but usually several other types of exuviae were present sometimes in large numbers on the poolside

Table 2. Monthly occurrence of odonate species at the wadi pool, March 2012 to June 2014. No visit was made June, July, November, December 2012 and July 2013. The number of visits in a month, and the number of visits of a month when a species was recorded and photographed, are presented. Blank = not recorded. For example, *Ischnura evansi* was recorded on one of the two visits March 2012, and on both visits February 2013.

Month	2012						2013										2014						
	M	A	M	A	S	O	J	F	M	A	M	J	A	S	O	N	D	J	F	M	A	M	J
Number of visits	2	3	2	1	1	1	3	2	3	5	6	2	2	5	3	2	4	3	2	5	4	4	3
<i>Ischnura evansi</i>	1		1				1	2		1		2	1	5	3	2	3	3	1	4	2	2	3
<i>Pseudagrion decorum</i>	1						3	1	1	3	3	2	3	5	1	2	4	2	2	5	4	4	3
<i>Anax imperator</i>		1				1	1	1	1	3	5	2	2	1	3	2	4	3	2	5	4	3	3
<i>Anax parthenope</i>																				2			
<i>Paragomphus genei</i>																					1	1	
<i>Paragomphus sinaiticus</i>	1	1				1	1	1	2	3		1		1				2	3	4	4	3	
<i>Orthetrum chrysostigma</i>	2	2	1			1	2	1	3	4	5	2	2	3		2	1	3	2	5	3	4	3
<i>Orthetrum sabina</i>		2				1	2	1	3	3	2	2	1	4	3	2	4	3	2	4	3	3	3
<i>Crocothemis erythraea</i>	2	2				1	2	1	2	4	5	2	2	5	3	2	4	3	2	5	2	4	3
<i>Diplacodes lefebvreii</i>														4	2	2	1	2			1	1	3
<i>Trithemis annulata</i>		3	1			1	3	2	3	5	4	2		5	2	1	3	3		5	5	2	3
<i>Trithemis arteriosa</i>						1	1		2		1		1		1			3	1	2	4	3	2
<i>Trithemis kirbyi</i>	2	2	2	1	1	1	3	2	3	4	5	2	2	5	2	2	4	3	2	5	4	4	3
<i>Pantala flavescens</i>													1	1				2				2	1

rock faces, boulders, grass and other vegetation in and around the pool.

Trithemis kirbyi was the only species recorded in all 23 months in which observations were made. On occasion this species was very numerous (in their hundreds) and generally it was the most numerous species at the pool. On very hot afternoons, *T. kirbyi* crowded into the shade in large groups. It was the sole species we located in August and September 2012 when the pool was deeply flooded after summer rains and water was fast flowing over the head dam wall.

Both zygopteran species were recorded mating and ovipositing. A popular mating site for *Ischnura evansi* was in the lower branches of a sidr tree *Ziziphus spina-christi* (L.) Desf. that overhangs the pool. Photographic data showed that one pair of *I. evansi* was in copula on the same branch for more than two hours (Image 3). Female *Ischnura* damselflies seen laying (they oviposit without a male in attendance and are notoriously difficult to identify to species) were presumed to be *Ischnura evansi* (Image 4) as no other *Ischnura* species was recorded at the pool (see Table 3). *Pseudagrion decorum* also mated regularly (Image 6) but chose a wider range of sites—the branches of the sidr, but also

twigs or rocks in the pool. Oviposition (Image 7) took place in the way described by Feulner (2001) with the pair mating and then descending in tandem on a stem or into a weed patch with the female below the water surface. Oviposition by this *Pseudagrion* species was usually observed as lasting for 1–2 minutes rather than up to five minutes submerged as noted by Feulner (2001).

Reproductive behaviour was recorded for eight of the anisopteran species. Both *Orthetrum chrysostigma* and *O. sabina* were recorded in mating wheels (Images 15, 17) and then ovipositing on many occasions. *Anax imperator* was not seen mating but females were observed on many occasions ovipositing (Image 8, Table 3). Often two or three females were recorded but, on one occasion, seven females were seen ovipositing simultaneously in patches of floating weed or other vegetation in the pool. Sometimes, when several males were patrolling the pool, one pursued a female but she flew along pulling down her abdomen into a laying pose, indicating rejection of mating (Corbet 1999: 471–472). *Crocothemis erythraea* was observed mating on many occasions in winter/spring 2014. As a pair began to copulate in flight over the pool, there was a characteristic

Table 3. Monthly occurrence of mating and laying by odonate species at the wadi pool, March 2012 to June 2014. No visit was made June, July, November, December 2012 and July 2013. M - mating photographed. L - laying photographed. For example, *Anax imperator* was photographed laying on at least one of the visits May 2012.

Month	2012						2013										2014						
	M	A	M	A	S	O	J	F	M	A	M	J	A	S	O	N	D	J	F	M	A	M	J
Number of visits	2	3	2	1	1	1	3	2	3	5	6	2	2	5	3	2	4	3	2	5	4	4	3
<i>Ischnura evansi</i>												L	M	L	L		M		L	M		M	L
<i>Pseudagrion decorum</i>									M	M		L	M	L	L	M	M		M	M	M		M
<i>Anax imperator</i>			L			L		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
<i>Anax parthenope</i>																				L			
<i>Paragomphus genei</i>																							
<i>Paragomphus sinaiticus</i>																							
<i>Orthetrum chrysostigma</i>	L	M								L	M	M		M					L	M	M	M	
<i>Orthetrum sabina</i>							M		M	L			M	M	M	M	M	M		M		L	M
<i>Crocothemis erythraea</i>	L	L					M	L	L		L	M		M	M	M	M	M	M	M	L	L	M
<i>Diplacodes lefebvrii</i>																M							
<i>Trithemis annulata</i>										L													
<i>Trithemis arteriosa</i>																							
<i>Trithemis kirbyi</i>								L		L					M								
<i>Pantala flavescens</i>																							

wing-clattering sound. They remained *in copula* for much less than a minute flying over the pool, sometimes settling momentarily on a stone, twig or the bank (Image 20). They quickly break apart with the male guarding the female during oviposition against other males which aggressively attempted to intrude.

DISCUSSION

We recorded 14 odonate species, all included in the checklist of Oman’s Odonata by Schneider & Dumont (1997). All were globally assessed as Least Concern (IUCN 2013) except for *Paragomphus sinaiticus* which is globally Near Threatened (Boudot et al. 2013a).

Our phenological and reproductive behaviour data suggest that there is a core odonate community at the pool consisting of eight permanently resident species, each present on over 70% of our visits. This comprises two coenagrionid species (*Ischnura evansi*, *Pseudagrion decorum*) and *Anax imperator*, *Orthetrum chrysostigma*, *O. sabina*, *Crocothemis erythraea*, *Trithemis annulata* and *T. kirbyi*. Other species were recorded on less than 50% of visits and could represent nomadic (wanderer or migrant) individuals, although opportunistic egg-laying may occasionally occur. *Paragomphus sinaiticus*



Image 2. Male *Ischnura evansi*, 4 January 2014. Greenish-blue face, postocular spots and thorax with visible antehumeral stripes. Abdomen dark above and paler below. The black pattern on the top of the second abdominal segment does not extend as a black saddle on the sides, which are greenish. The posterior ‘tail-light’ on abdominal segment 8 extends all around the abdomen

was recorded at the pool on 41% of visits and *Trithemis arteriosa* 37% of visits, though we did not record reproductive behaviour for either of these two species. *Diplacodes lefebvrii* was present on 23% of the visits and one pair was observed mating and laying in the pool in



Image 3. *Ischnura evansi* mating wheel, 12 March 2014. Female brownish with small humeral black stripes and abdomen lighter ventrally. Image rotated 90° right.



Image 4. Group of presumed female *Ischnura evansi*, some egg-laying, 7 October 2013.



Image 5. Male *Pseudagrion decorum*, 2 January 2014. Pale blue eyes, blue-greenish antehumeral stripes. Segments 8 and 9 dorsally blue. Rest of abdomen dark above but pale blue on sides below. Light-coloured legs.



Image 6. *Pseudagrion decorum* mating wheel, 24 December 2013. Female: greenish face and upper thorax; underside of abdomen, lower face and lower sides of thorax pale blue-grey



Image 7. *Pseudagrion decorum* pair in tandem, egg-laying female almost totally submerged, 16 November 2013



Image 9. Male *Anax imperator*, 2 January 2014. Blue eyes, bright blue abdomen.



Image 8. Female *Anax imperator* egg-laying, 16 November 2013. Blue on frons and bluish-green eyes. Wings tinged brown. Blue on abdomen.

November 2013. *Diplacodes lefebvrii*'s first appearance was after a late summer storm as was that of *Pantala flavescens*, an obligate strong migrant (Boudot et al. 2013b). Two species, *Paragomphus genei* and *Anax parthenope*, were rare visitors to the pool.



Image 10. *Anax parthenope* egg-laying in tandem, 10 March 2014. Male: green eyes, brown thorax, blue saddle around abdominal segments 2 and 3. Female: eyes above green with yellow below, brown thorax, yellowish band near base of abdomen.



Image 11. Male *Paragomphus genei*, 5 May 2014. Greenish-blue eyes, green thorax with narrow brown lines, straw and sandy coloured abdomen with brown and black markings and hooked terminal appendages. Dark pterostigmas with light centre



Image 12. Male *Paragomphus sinaiticus*, 12 March 2014. Greyish eyes, pale frons, grey thorax with black stripes, black and whitish banded abdomen with hooked terminal appendages.



Image 13. Female *Paragomphus sinaiticus*, 17 May 2014. Abdomen less clearly marked than male, sandy and cream coloured with dark brown and light rings. No terminal appendage hooks



Image 14. Male *Orthetrum chrysostigma*, 31 March 2014. Blue eyes, blue/black legs, blue thorax. Blue abdomen 'waisted' near base

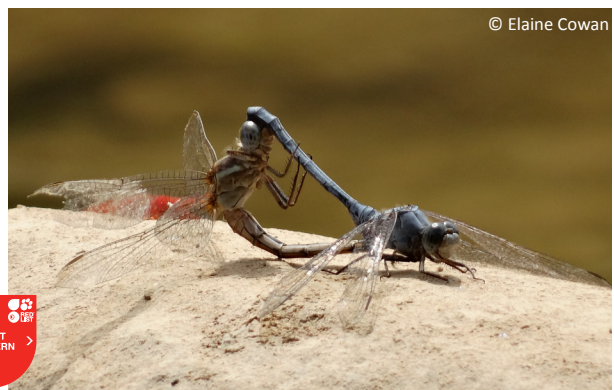


Image 15. *Orthetrum chrysostigma* mating wheel, 23 April 2014. Female brown with a lateral whitish dark-bordered thoracic stripe.



Image 16. Male *Orthetrum sabina*, 5 June 2014. Greenish eyes and striped thorax. Black and white abdomen terminally club-shaped with white terminal appendages



Image 17. *Orthetrum sabina* pair in mating wheel, 16 November 2013. Female (below) similar to but paler than male.



Image 18. Male *Crocothemis erythraea*, 2 June 2014. Scarlet with broad abdomen with no black markings. Eyes bluish below. Reddish legs. Amber patch at wing bases and long pale pterostigmas.



Image 19. Female *Crocothemis erythraea*, 31 March 2014. Brownish-yellow with pale antehumeral stripes, white dorsal stripe on thorax and dark lines on abdomen. Pale eyes, amber patch at wing bases and long pale pterostigmas. Vulvar scale at about right angles to the abdomen.



Image 20. *Crocothemis erythraea* pair separating from mating wheel, 5 June 2014. Note vulvar scale near tip of female's abdomen (also visible in Image 19).

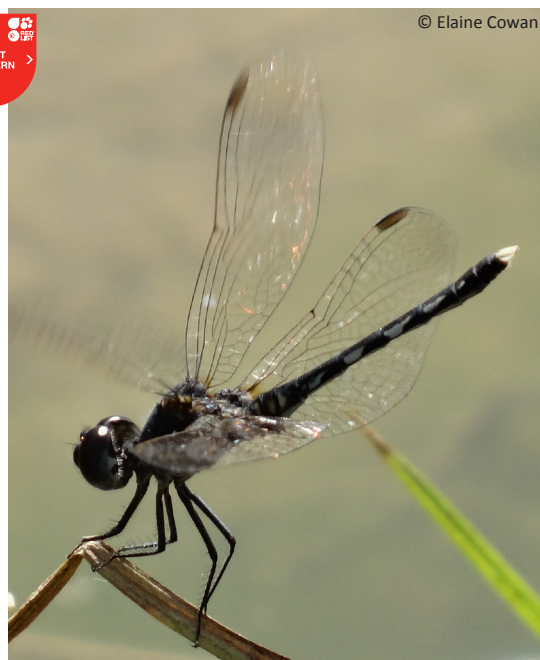


Image 21. Male *Diplacodes lefebvrei*, 25 September 2013. Small with black frons. Small brown patch at base of hindwing. Black and whitish abdomen. Terminal abdominal appendages white



Image 22. Older mature male *Diplacodes lefebvrii*, 7 October 2013. Black abdomen. White terminal abdominal appendages



Image 23. Female *Diplacodes lefebvrii* resting after egg laying, 16 November 2013. Pale abdomen with heavy black markings. Small yellowish-brown patch at hindwing base.



Image 24. Male *Trithemis annulata*, 23 April 2014. Dark red eyes, red veins on wings with large amber patch at hindwing base. Purplish abdomen with dorsal blackish markings. This male still has some red coloration on abdomen.



Image 25. Female *Trithemis annulata*, 9 April 2014. Yellowish-brown abdomen with dorsal line and thick black bar on segments 8 and 9. Amber patch at hindwing base.



Image 26. Male *Trithemis arteriosa*, 28 May 2014. Red wing-veins and black legs. Slender red abdomen with lateral black markings. Large amber patch at hindwing base.



Image 28. Male *Trithemis kirbyi*, 24 May 2014. Reddish-orange with large orange wing patches.



Image 27. Female *Trithemis arteriosa*, 28 May 2014. Slender black-sided abdomen. Amber apical, nodal and basal patches on wings.



Image 29. Female *Trithemis kirbyi*, 28 May 2014. Black dashes along abdomen sides and two dorsal dashes at segments 8 and 9. Extensive orange on wings and short dark pterostigmas.



Image 30. Male *Pantala flavescens*, 2 June 2014. Orange-yellow abdomen and long broad hindwings.



Image 31. Male *Pantala flavescens*, 1 September 2013 (photographed at silt flat above the pool, 23°05.37'N & 57°25.90'E, elevation 1310m). Note hindwing is very broad (to abdominal segment 5) with wavy veins in outer wing and brown wingtips. Long terminal abdominal appendages

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