

On some Records of Dragonflies (Insecta: Odonata: Anisoptera) from the West Bank (Palestine)

Shadi H. Adawi^{1,2}, Khalid R. Qasem¹, Mubarak M. Zawahra³ and Elias N. Handal^{2,*}

¹Salfit Primary Health Care Center, Ministry of Health;

²Palestine Museum of Natural History, Bethlehem University, Bethlehem,

³Environmental Quality Authority, Palestine

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Abstract

Three families with thirteen species were collected/observed from 35 localities representing various habitats and water bodies in the West Bank (State of Palestine) over the past four years. These are *Brachythemis impartita*, *Crocothemis erythraea*, *Orthetrum brunneum*, *O. chrysostigma*, *O. teniolatum*, *Sympetrum fonscolombii*, *S. meridionale*, *Trithemis annulata*, *T. arteriosa*, *Paragomphus genei*, *Anax imperator*, *A. pathenope*, and *A. ephippiger*. There may have been a decline in dragonfly diversity in the area due to human population growth accompanied by habitat destruction especially around springs.

Keywords: Dragonflies, Odonata, Anisoptera, West Bank, Palestine, Indicator species.

1. Introduction

About 5700 species of Odonata were described worldwide with most of them being tropical (Ellenrieder, 2004). Odonata are classified into three suborders: Anisoptera (true dragonflies), Zygoptera (damselflies) and Anisozygoptera (a very small suborder considered intermediate between damselflies and dragonflies). Anisoptera has ten families with Libellulidae being the largest with 140 genera and over 962 described species (Tennessee, 2003). The dragonfly fauna of Palestine were studied over the past decades (Morton, 1924; Schmidt, 1939; De Marmel, 1995; Schneider 1986; Dumont 1991). Dumont (1991) gave a comprehensive account of the dragonflies of the Levant, with localities from historic Palestine. Family Libellulidae is the largest family with 35 species in historic Palestine, 10 species detected in the West Bank (Boudot *et al.*, 2009). Dragonflies are susceptible to climate change, use of insecticides, and habitat modification, with several species at risk and are listed in the IUCN Red List as endangered or threatened (Schneider, 1982, 2004).

Qumsiyeh *et al.* (2014) and Salman *et al.* (2014) pointed out the urgent need to study the biodiversity in the

occupied Palestinian territories, especially since habitat destruction is accelerating and affecting many species. This communication documents the collected dragonflies of the families Libellulidae, Gomphidae, and Aeshnidae at the recently established Palestine Museum of Natural History (PMNH) (Qumsiyeh *et al.*, 2017).

2. Materials and Methods

The occupied Palestinian territory of the West Bank is located in central Palestine and characterized by geological and environmental diversity and, thus, includes four biogeographic regions: Mediterranean (including coastal and semi-coastal regions), Irano-Turanian, Saharo-Arabian, and Ethiopian/Sudanese. Significant biodiversity is thus noted in a small area of a few thousand square kilometers.

Specimens were collected from 35 localities representing the diverse habitats and biogeographic regions within the Occupied Palestinian Territory by the PMNH team during field trips from April 2012 until September 2016 (Table 1). Dragonflies were collected by means of insect nets, and deposited at PMNH collection. Identification was based on previous literature (Schneider 1986; Dumont, 1991; Dijkstra, 2006).

* Corresponding author. e-mail: eliashandal93@gmail.com.

Table 1. List of visited localities and their coordinates

Locality	N	E	Locality	N	E
Ain Al Hilweh	32° 21' 38.4726"	35° 32' 8.2386"	Jiftlik	32° 8' 33.2442"	35° 29' 47.3382"
Ain Al Sakout	32° 21' 55.3572"	35° 32' 50.1822"	Kafer al- Deek	32° 3' 41.1552"	35° 5' 16.2342"
Ain Al Shamsat	32° 22' 47.0922"	35° 30' 40.4058"	Kifl Haris	32° 7' 23.9268"	35° 8' 52.065"
Ain Al Sultan	31° 52' 45.3216"	35° 26' 50.0532"	Nahaleen	31° 41' 18.693"	35° 7' 0.9834"
Ain Fasayil	32° 1' 28.0842"	35° 26' 38.2338"	Naqura- Nablus	32° 15' 58.4706"	35° 11' 59.4666"
Ain Hijla	31° 49' 29.4312"	35° 30' 38.0124"	Nawama	31° 53' 27.6072"	35° 25' 59.9196"
Ain Qinia	31° 55' 34.683"	35° 8' 59.0166"	Qarawat Bani Hassan	32° 8' 48.4182"	35° 3' 20.0556"
Ain Samiya	31° 59' 19.6614"	35° 20' 2.8818"	Qbatia	32° 24' 8.2836"	35° 18' 3.1494"
Ain Yabroud	31° 57' 5.2842"	35° 15' 6.0984"	Salfit	32° 4' 57.7416"	35° 8' 49.9776"
Al Makhrouur	31° 43' 8.0538"	35° 9' 32.5398"	Wadi Al Badan	32° 15' 22.2006"	35° 19' 16.9212"
Al Walaja	31° 43' 49.8432"	35° 9' 14.619"	Wadi Al Hakeem	32° 0' 59.6262"	35° 5' 7.5834"
Artas	31° 41' 17.7504"	35° 11' 9.873"	Wadi Al Muqatta'	32° 29' 51.9462"	35° 16' 14.3832"
Bardala	32° 23' 29.9328"	35° 28' 58.5192"	Wadi Al Qelt	31° 51' 3.8952"	35° 25' 53.817"
Bethlehem	31° 43' 3.6258"	35° 12' 20.4006"	Wadi- Al Zarqa	32° 3' 37.4688"	35° 5' 7.2744"
Deir Istiya	32° 7' 32.5122"	35° 8' 45.7296"	Wadi Fukeen	31° 42' 24.714"	35° 6' 13.3986"
Ednha	31° 33' 42.588"	34° 59' 12.6312"	Wadi Qana	32° 9' 30.5382"	35° 6' 41.8242"
Husan	31° 42' 41.6232"	35° 7' 39.9144"	Za'tara	31° 40' 6.9096"	35° 14' 53.5848"
Iskaka	32° 6' 16.038"	35° 13' 23.127"			

3. Results

Thirteen species belonging to seven genera (*Orthetrum*, *Trithemis*, *Crocothemis*, *Sympetrum*, *Brachythemis*, *Paragomphus*, and *Anax*) in three families (Libellulidae, Gomphidae and Aeshnidae) were recorded during the present study. We did not study the damselflies and focused on the dragonflies.

3.1. Family Libellulidae

3.1.1. *Brachythemis impartita* (Karsch, 1890)

Fig.1A

Material examined (2♂♂): Ain Al Sakout (PMNH-E-10255, ♂, 21.9.2016) Ain Al Sakout. (PMNH-E-10254, ♂, 3.8.2015).

Remarks

Specimens were collected from a single habitat in the Jordan Valley. In this site, it was associated with *O. chrysostigma*, *T. arteriosa*, *T. annulata* and *S. fonscolombii*. The taxonomic status of this species was revised by Dijkstra, and Matushkina (2009). *Brachythemis impartita* is distributed from north and south of the Sahara, extending to Eurasia eastwards, while *B. leucosticta* is wide spread across most of tropical Africa and Madagascar (Dijkstra and Matushkina, 2009). All previous records of this species in the Levant should be assigned to *B. impartita*.

3.1.2. *Crocothemis erythraea* (Brullé, 1832)

Fig.1 B

Material examined (25♂♂, 5♀♀): Ain Al Sultan (PMNH-E-10256, ♀, 29.8.2016). Ain Al Zarqa (PMNH-E-10257, ♂, 19.9.2016; PMNH-E-10258, ♂, 19.9.2016). Ain Fasayel (PMNH-E-10081, ♀, 4.1.2015). Ain Qinia (PMNH-E-10049, ♂, 1.8.2014; PMNH-E-10063, ♂, 15.8.2014; PMNH-E-10065, ♂, 3.8.2015; PMNH-E-

10074, ♂, 3.8.2015; PMNH-E-10090, ♂, 3.8.2015). Ain Samia (PMNH-E-10075, ♀, 26.8.2015). Ain Yabroud (PMNH-E-10220, ♀, 5.10.2016; PMNH-E-10221, ♀, 5.10.2016). Artas (PMNH-E-10070, ♂, 18.7.2015; PMNH-E-10077, ♂, 13.8.2014). Deir Istia (PMNH-E-10158, ♂, 4.6.2016; PMNH-E-10159, ♂, 4.6.2016). Wadi Qana (PMNH-E-10185, ♂, 21.7.2016; PMNH-E-10188, ♂, 4.6.2016; PMNH-E-10189, ♂, 4.6.2016; PMNH-E-10202, ♂, 21.7.2016). Nawama (PMNH-E-10048, ♂, 24.4.2015). Qarawa (PMNH-E-10167, ♂, 29.6.2016; PMNH-E-10177, ♂, 14.7.2016). Salfit (PMNH-E-10168, ♂, 19.6.2016). Wadi Al Muqatta' (PMNH-E-10095, ♂, 8.4.2016). Wadi Fukeen (PMNH-E-10050, ♂, 6.6.2015; PMNH-E-10064, ♂, 29.7.2015; PMNH-E-10072, ♂, 7.3.2016; PMNH-E-10082, ♂, 27.5.2015).

Remarks

We collected specimens from 14 different locations throughout the West Bank, including springs and irrigation canals. It was associated with *O. chrysostigma*, *T. arteriosa*, *T. annulata*, *S. meridionale* and *S. fonscolombii*. It has a pan-African and Mediterranean distribution reaching Iraq (Schmidt, 1939; Dumont, 1991; Schneider, 2013; Kalkman, 2003; Katbeh-Bader *et al.*, 2004; Dia *et al.*, 2011 and Amr *et al.*, 2013).

3.1.3. *Orthetrum brunneum* (Fonscolombe, 1837)

Fig.1 C

Material examined (2♂♂): Ain Al Hilweh (PMNH-E-10259, ♂, 21.9.2016). Ain Yabroud (PMNH-E-10213, ♂, 5.10.2016).

Remarks

Specimens were collected from two locations. It is a widespread species in central and southern Europe, North Africa and the Levant (Dumont, 1991; Boudot *et al.*, 2009; Schneider, 2013; Amr *et al.*, 2013). It was found along with *O. chrysostigma* and *C. erythraea*.

3.1.4. *Orthetrum chrysostigma* (Burmeister, 1839)

Fig.1 D

Material examined (63♂♂,1♀): Ain Al Hilweh (PMNH-E-10262, ♂, 21.9.2016; PMNH-E-10263, ♂, 21.9.2016). Ain Al Shamsat (PMNH-E-10264, ♂, 21.9.2016; PMNH-E-10265, ♂, 21.9.2016). Ain Al Sultan (PMNH-E-10260, ♂, 29.8.2016; PMNH-E-10261, ♂, 29.8.2016). Ain Hijla (PMNH-E-10046, ♂, 18.4.2014). Ain Qinia (PMNH-E-10030, ♂, 3.8.2015; PMNH-E-10034, ♂, 15.8.2014; PMNH-E-10039, ♂, 20.5.2015; PMNH-E-10040, ♂, 1.8.2014; PMNH-E-10041, ♂, 15.8.2014; PMNH-E-10045, ♂, 15.8.2014; PMNH-E-10054, ♂, 20.5.2015; PMNH-E-10061, ♂, 3.8.2015). Ain Al Sakout (PMNH-E-10227, ♂, 10.10.2016; PMNH-E-10231, ♂, 10.10.2016; PMNH-E-10239, ♂, 10.10.2016; PMNH-E-10242, ♂, 10.10.2016; PMNH-E-10245, ♂, 10.10.2016; PMNH-E-10246, ♂, 10.10.2016). Ain Samia (PMNH-E-10084, ♂, 7.9.2015). Ain Yabroud (PMNH-E-10214, ♂, 5.10.2016; PMNH-E-10215, ♂, 5.10.2016; PMNH-E-10216, ♂, 5.10.2016; PMNH-E-10217, ♂, 5.10.2016; PMNH-E-10218, ♂, 5.10.2016; PMNH-E-10219, ♂, 5.10.2016; PMNH-E-10222, ♂, 5.10.2016; PMNH-E-10223, ♂, 5.10.2016; PMNH-E-10224, ♂, 5.10.2016). Al Walaja (PMNH-E-10056, ♂, 8.8.2014). Deiristia (PMNH-E-10144, ♂, 4.6.2016; PMNH-E-10145, ♂, 4.6.2016; PMNH-E-10146, ♂, 4.6.2016; PMNH-E-10184, ♂, 20.7.2016; PMNH-E-10186, ♂, 21.7.2016; PMNH-E-10199, ♂, 21.7.2016; PMNH-E-10200, ♂, 21.7.2016). Iskaka (PMNH-E-10164, ♂, 26.6.2-16). Nahaleen (PMNH-E-10033, ♂, 8.6.2015; PMNH-E-10035, ♂, 8.6.2015; PMNH-E-10062, ♂, 8.6.2015). Qarawa (PMNH-E-10165, ♂, 29.6.2016; PMNH-E-10166, ♂, 29.6.2016; PMNH-E-10175, ♂, 14.7.2016; PMNH-E-10196, ♂, 14.7.2016). Salfit (PMNH-E-10047, ♂, no date; PMNH-E-10161, ♂, 19.6.2016; PMNH-E-10162, ♂, 19.6.2016; PMNH-E-10169, ♂, 19.6.2016; PMNH-E-10178, ♂, 17.7.2016; PMNH-E-10204, ♂, 16.8.2016; PMNH-E-10205, ♂, 16.8.2016). Tal Al Sultan (PMNH-E-10121, ♀, 25.7.2016). Wadi Al Badan (PMNH-E-10032, ♂, 16.9.2015). Wadi Al Hakeem - Abood (PMNH-E-10038, ♂, 27.7.2015). Wadi Al Qelt (PMNH-E-10036, ♂, 4.4.2015). Wadi Fukeen (PMNH-E-10031, ♂, 6.6.2015; PMNH-E-10037, ♂, 6.6.2015; PMNH-E-10042, ♂, 6.6.2015). Wadi Qana (PMNH-E-10043, ♂, 18.5.2013; PMNH-E-10044, ♂, 18.5.2013).

Remarks

This is a common and widespread species collected from most visited habitats, noted perching near water bodies especially around springs. This species has a wide distribution range extending North Africa, southern Europe to western Asia (Dumont, 1991; Boudot *et al.*, 2009). It was the most common species in 19 sites, and was found along all other species at different habitats ranging from 1-5 species.

3.1.5. *Orthetrum taeniolatum* (Schneider, 1845)

Material examined (7♂♂,1♀): Ain Qinia (PMNH-E-10060, ♂, 15.8.2014; PMNH-E-10076, ♂, 15.8.2014; PMNH-E-10083, ♂, 3.8.2015). Deri Istia (PMNH-E-10147, ♂, 4.6.2016). Wadi Qana. (PMNH-E-10148, ♂, 4.6.2016; PMNH-E-10183, ♂, 20.7.2016; PMNH-E-

10195, ♂, 4.6.2016). Wadi Al Qelt (PMNH-E-10079, ♀, 4.4.2015).

Remarks

This species collected from different habitats in West Bank, including arid and humid areas. It was reported from the Greek Islands, Cyprus, Turkey, Jordan, Lebanon, Syria, Sinai, and Iraq (Dumont, 1991; Kalkman, 2003; Katbeh-Bader *et al.*, 2004; Amr *et al.*, 2013; Dia *et al.*, 2011; Schneider, 2013). It was collected from four different sites, along with 1-4 other species.

3.1.6. *Sympetrum fonscolombii* (Selys, 1840)

Fig.1 E

Material examined (1♂, 6♀♀): Ain Al Sakout (PMNH-E-10270, ♀, 21.9.2016). Wadi Al Zarqa (PMNH-E-10271, ♀, 19.9.2016; PMNH-E-10272, ♀, 19.9.2016). Wadi Fukeen (PMNH-E-10207, ♂, 7.3.2016). Za'tara (PMNH-E-10267, ♀, 5.9.2016; PMNH-E-10268, ♀, 5.9.2016; PMNH-E-10269, ♀, 5.9.2016).

Remarks

Collected specimens from three different sites including springs, open ponds and irrigation canals. It was found along with *O. chrysostigma*, *T. arteriosa*, *T. annulata*, *C. erythraea* and *S. meridionale*. It is distributed along Central and southern Europe, North Africa, and southwestern Asia (Dumont, 1991; Katbeh-Bader *et al.*, 2004; Boudot *et al.*, 2009).

3.1.7. *Sympetrum meridionale* (Selys, 1841)

Fig.1 F

Material examined (3♂♂): Wadi Al Zarqa (PMNH-E-10275, ♂, 19.9.2016). Za'tara (PMNH-E-10273, ♂, 5.9.2016; PMNH-E-10274, ♂, 5.9.2013).

Remarks

We collected specimens from two locations: one in the center of the West Bank and the other in the arid region of Bethlehem. It was found to coexist with *O. chrysostigma*, *T. arteriosa*, *T. annulata*, *C. erythraea* and *S. fonscolombii*. Its distribution range extends along southern Europe, North Africa, the Levant reaching Iraq (Schmidt, 1939; Dumont, 1991; Kalkman, 2003; Katbeh-Bader *et al.*, 2004; Boudot *et al.*, 2009; Dia *et al.*, 2011; Amr *et al.*, 2013; Schneider, 2013).

3.1.8. *Trithemis annulata* (Palisot de Beauvois, 1805)

Fig.1 G

Material examined (31♂♂): Ain Al Sakout (PMNH-E-10277, ♂, 21.9.2016; PMNH-E-10278, ♂, 21.9.2016; PMNH-E-10279, ♂, 21.9.2016). Ain Al Sultan (PMNH-E-10276, ♂, 29.8.2016). Ain Al Zarqa (PMNH-E-10280, ♂, 19.9.2016). Ain Al Sakout (PMNH-E-10226, ♂, 10.10.2016; PMNH-E-10228, ♂, 10.10.2016; PMNH-E-10230, ♂, 10.10.2016; PMNH-E-10233, ♂, 10.10.2016; PMNH-E-10234, ♂, 10.10.2016; PMNH-E-10235, ♂, 10.10.2016; PMNH-E-10236, ♂, 10.10.2016; PMNH-E-10237, ♂, 10.10.2016; PMNH-E-10238, ♂, 10.10.2016; PMNH-E-10240, ♂, 10.10.2016; PMNH-E-10244, ♂, 10.10.2016; PMNH-E-10247, ♂, 10.10.2016; PMNH-E-10248, ♂, 10.10.2016; PMNH-E-10249, ♂, 10.10.2016; PMNH-E-10250, ♂, 10.10.2016; PMNH-E-10251, ♂, 10.10.2016; PMNH-E-10252, ♂, 10.10.2016; PMNH-E-10253, ♂, 10.10.2016). Deir Istia (PMNH-E-10149, ♂,

4.6.2016; PMNH-E-10150, ♂, 4.6.2016; PMNH-E-10151, ♂, 4.6.2016; PMNH-E-10201, ♂, 21.7.2016). Husan (PMNH-E-10017, ♂, no date). Salfit (PMNH-E-10206, ♂, 16.8.2016). Wadi Fukeen (PMNH-E-10096, ♂, 29.7.2015). Wadi Qana (PMNH-E-10097, ♂, 1.6.2016).

Remarks

This species was found in seven different areas in the West Bank. It was found along with *O. chrysostigma*, *T. arteriosa*, *C. erythraea*, *S. meridionale*, *S. fonscolombii* and *B. impartita*. It is known from southern Europe, North Africa, the Levant, and northern Arabia to Iraq (Schmidt, 1939; Dumont, 1991; Kalkman, 2003; Katbeh-Bader *et al.*, 2004; Boudot *et al.*, 2009; Amr *et al.*, 2013; Schneider, 2013; Dia *et al.*, 2011).

3.1.9. *Trithemis arteriosa* (Burmeister, 1839)

Fig.1 H

Material examined (71♂♂): Ain Al Sakout (PMNH-E-10281, ♂, 21.9.2016). Ain Hijla (PMNH-E-10058, ♂, 18.4.2014). Ain Najjar (PMNH-E-10142, ♂, no date). Ain Qinia (PMNH-E-10001, ♂, 15.8.2014; PMNH-E-10005, ♂, 15.8.2014; PMNH-E-10006, ♂, 15.8.2014; PMNH-E-10024, ♂, 15.8.2014; PMNH-E-10025, ♂, 15.8.2014; PMNH-E-10027, ♂, 3.8.2015). Ain Al Sakout (PMNH-E-10229, ♂, 10.10.2016; PMNH-E-10232, ♂, 10.10.2016; PMNH-E-10241, ♂, 10.10.2016; PMNH-E-10243, ♂, 10.10.2016). Al Makhrour (PMNH-E-10029, ♂, 3.5.2015). Bardala (PMNH-E-10085, ♂, 18.4.2014). Deiristia (PMNH-E-10152, ♂, 4.6.2016; PMNH-E-10153, ♂, 4.6.2016; PMNH-E-10154, ♂, 4.6.2016; PMNH-E-10155, ♂, 4.6.2016; PMNH-E-10156, ♂, 4.6.2016; PMNH-E-10163, ♂, 28.5.2016; PMNH-E-10187, ♂, 21.7.2016; PMNH-E-10190, ♂, 4.6.2016; PMNH-E-10191, ♂, 4.6.2016; PMNH-E-10192, ♂, 4.6.2016; PMNH-E-10193, ♂, 4.6.2016; PMNH-E-10194, ♂, 4.6.2016; PMNH-E-10197, ♂, 21.7.2016; PMNH-E-10198, ♂, 21.7.2016). Edna (PMNH-E-10011, ♂, 23.8.2014; PMNH-E-10015, ♂, 23.8.2014). Husan (PMNH-E-10009, ♂, no date). Kefel Haris (PMNH-E-10171, ♂, 11.7.2016; PMNH-E-10172, ♂, 11.7.2016; PMNH-E-10173, ♂, 11.7.2016). Kufer aldeek (PMNH-E-10157, ♂, 4.6.2016). Kefer aldeek (PMNH-E-10174, ♂, 11.7.2016). Nablus (PMNH-E-10007, ♂, Jul.2014; PMNH-E-10089, ♂, Apr.2011). Qarawa (PMNH-E-10176, ♂, 14.7.2016). Salfit (PMNH-E-10002, ♂, Aug.2014; PMNH-E-10010, ♂, 22.8.2014; PMNH-E-10012, ♂, 22.8.2014; PMNH-E-10019, ♂, no date; PMNH-E-10020, ♂, Nov.2014; PMNH-E-10023, ♂, 22.8.2014; PMNH-E-10028, ♂, Aug.2014; PMNH-E-10160, ♂, 19.6.2016; PMNH-E-10170, ♂, 19.6.2016; PMNH-E-10179, ♂, 17.7.2016; PMNH-E-10180, ♂, 17.7.2016; PMNH-E-10181, ♂, 17.7.2016; PMNH-E-10182, ♂, 17.7.2016). Wadi Al Muqatta' (PMNH-E-10208, ♂, 8.4.2016). Wadi Fukeen (PMNH-E-10003, ♂, 27.5.2015; PMNH-E-10004, ♂, 6.6.2015; PMNH-E-10008, ♂, 29.8.2014; PMNH-E-10013, ♂, 6.6.2015; PMNH-E-10014, ♂, 6.6.2015; PMNH-E-10016, ♂, 6.6.2015; PMNH-E-10018, ♂, 6.6.2015; PMNH-E-10021, ♂, 29.7.2015; PMNH-E-10026, ♂, 6.6.2015; PMNH-E-10059, ♂, 29.7.2015; PMNH-E-10068, ♂, 6.6.2015; PMNH-E-10069, ♂, 29.8.2014; PMNH-E-10071, ♂, 7.3.2016; PMNH-E-10073, ♂, 7.3.2016; PMNH-E-10106,

♂, 7.5.2015). Wadi Qana (PMNH-E-10057, ♂, 18.5.2013; PMNH-E-10067, ♂, 18.5.2013).

Remarks

This is a common species in all Palestinian areas and was collected from 16 different sites, including swimming and irrigation pools. It was associated with five other species including (*O. chrysostigma*, *T. annulata*, *C. erythraea*, *S. meridionale* and *S. fonscolombii*). The species is found in Africa and the circum-Mediterranean region (Dumont, 1991; Kalkman, 2003; Katbeh-Bader *et al.*, 2004; Boudot *et al.*, 2009; Dia *et al.*, 2011; Schneider, 2013).

3.2. Family Gomphidae

3.2.1. *Paragomphus genei* (Sélys, 1841)

Material examined (1♂): Wadi Al Qelt (PMNH-E-10115, ♂, 4.4.2015).

Remarks

Collected specimen from one site in West Bank (northern the Dead Sea). It is distributed in Western Mediterranean region and in tropical Africa, (Dumont, 1991; Katbeh-Bader *et al.*, 2004; Boudot *et al.*, 2009).

3.3. Family Aeshnidae

3.3.1. *Anax imperator* (Leach, 1815)

Fig.1 I

Material examined (4♂♂): Naqura (PMNH-E-10143, ♂, 31.7.2012). Bethlehem (PMNH-E-1010052, ♂, 20.7.2015). Wadi Al Muqatta' (PMNH-E-10086, ♂, 8.4.2016, PMNH-E-10123, ♂, 5.9.2016).

Remarks

Collected specimens from three different sites including springs, open ponds and irrigation canals. It is distributed along Europe, North Africa, and in Mediterranean region (Dumont, 1991; Katbeh-Bader *et al.*, 2004; Boudot *et al.*, 2009).

3.3.2. *Anax pathenope* (Sélys, 1839)

Fig.1 J

Material examined (1♂): Qabatia (PMNH-E-10053, 7.9.2015).

Remarks

Collected specimens from one site in the northern of West Bank, around open ponds and irrigation canals. It is distributed along southern Europe, North Africa, and in Mediterranean region. (Dumont, 1991; Katbeh-Bader *et al.*, 2004; Boudot *et al.*, 2009).

3.3.3. *Hemianax ephippiger* (Burmeister, 1839)

Fig.1 K

Material examined (2♂♂): Jiftlik (PMNH-E-10053, 27.3.2013). Wadi Al Qelt (PMNH-E-10087, 7.3.2016).

Remarks

Collected specimens from one site in the northern of West Bank, around open ponds and irrigation canals. It is distributed along southern Europe, North Africa, and in Mediterranean region. (Dumont, 1991; Katbeh-Bader *et al.*, 2004; Boudot *et al.*, 2009).

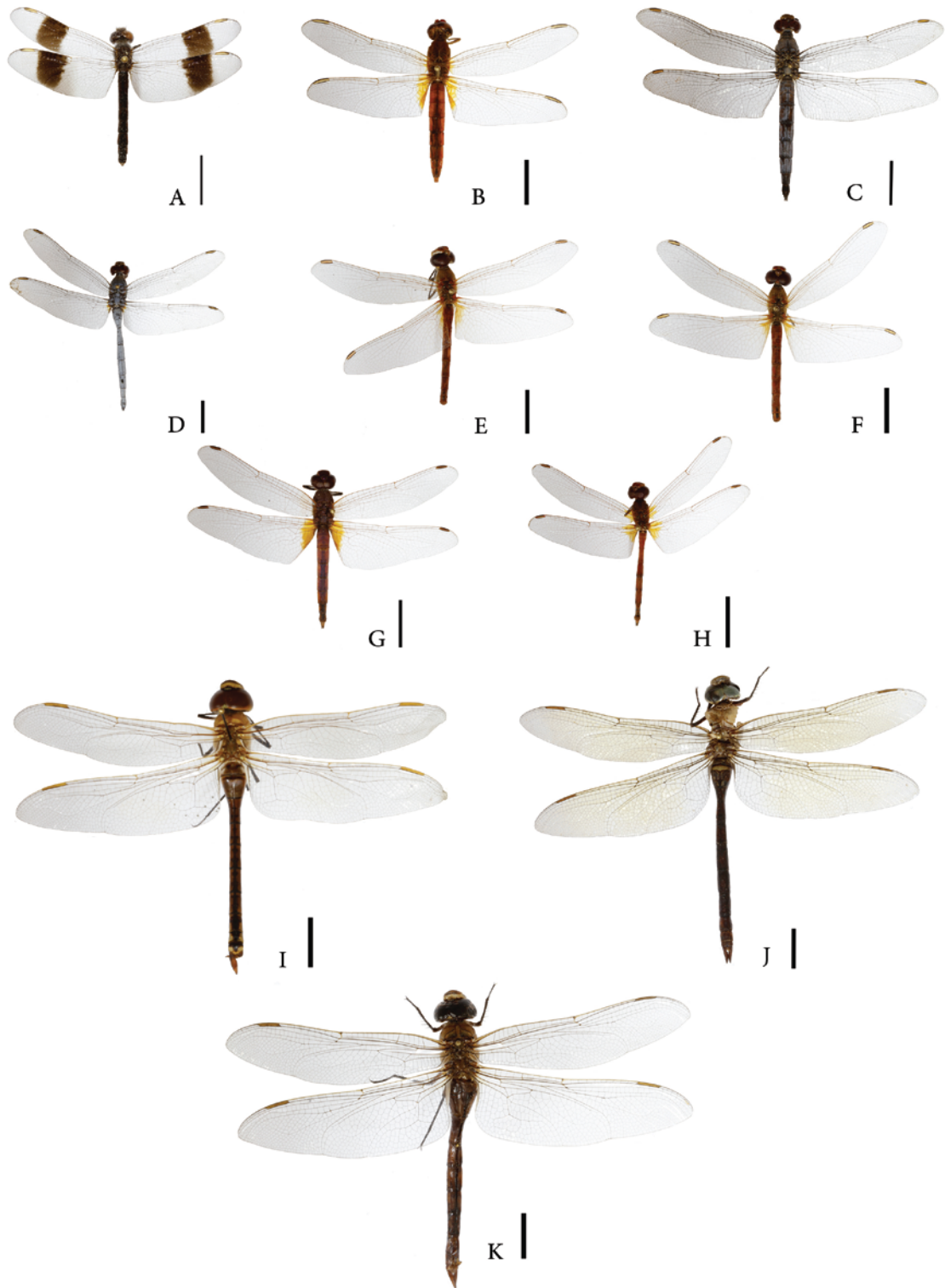


Figure 1.A. *Brachythemis impartita* B. *Crocothemis erythraea* C. *Orthetrum brunneum* D. *Orthetrum chrysostigma* E. *Sympetrum fonscolombii* F. *Sympetrum meridionale* G. *Trithemis annulata* H. *Trithemis arteriosa* I. *Anax imperator* J. *Anax pathenope* K. *Hemianax ephippiger*. Scale is 10 mm.

4. Discussion

The nine species of Libellulidae family recorded from the Palestinian areas include four widespread African and circum-Mediterranean species (Dument, 1991; Schneider *et al.*, 1986). In historic Palestine and nearby areas, family Libellulidae is represented by more than 30 species (Borton, 1924; Boudot *et al.*, 2009; Dument, 1991; Schneider *et al.*, 1986). In an unpublished doctoral thesis, Schneider (1986) reported other species from the area of the West Bank collected between 1979 and 1983 including *Epallage fatime*, *Coenagrion syriacum*, *Ischnura evansi*, *I. fontainei*, *I. elegans ebneri*, *Pseudagrion sublacteum*, *P. syriacum*, *Gomphus davidi*, *Onichogomphus lefebvrei*, *Orthetrum anceps*, *O. trinacrium*, *Eurothemis edwardsi*, *Zygonyx torridus*, and *Pseudagrion sublacteum*. Thus, a total of 27 species of dragonflies were reported in this area over this period of time (1979 until today). We were able to find only 13 species. This could have two explanations: our sampling may not have been covering all the areas visited by Schneider (1986) or that there has been a significant decline in species richness of dragonflies in this area since the work of Schneider (1986, collected 1979-1983). Schneider (1982) examined man-induced changes on the dragonfly fauna of the Jordan Valley and warned of impending dangers. On the eastern banks of the Jordan River, many species of the dragonflies of Jordan disappeared in the past fifty years (*Erythromanalindenii zemyi* and *Agriocnemis sania*) or underwent retraction in their distribution ranges (*Cabpteryx syriaca*) (Katbeh-Bader *et al.*, 2004).

Thus, the weight of the evidence points to man induced changes. Many streams from which earlier records existed have been altered so that water is removed directly from the spring source (no more open stream in the area). Salman *et al.* (2014) commented on the potential impact of these practices on the declining amphibian populations. Dragonfly fauna in other parts of the world are affected by these factors (Watson *et al.*, 1982; Ward *et al.*, 1982; Wright *et al.*, 1995; Clark *et al.*, 1996; Stewart *et al.*, 1998; Bell, 1971). Further, the population in the West Bank has more than doubled since Schneider's study (1986) both by natural increase of the native Palestinian population and by settler population increase (from less than 200,000 then to over 750,000 now). This has resulted in habitat destruction and pollution that impacts water sources for both humans and animals (Hammd and Qumsiyeh, 2013; Qumsiyeh *et al.*, 2014; Salman *et al.*, 2014; Handal *et al.*, 2015). More studies are needed especially in the Northern parts of the West Bank and the Jordan Valley.

At the global level, many dragonfly species have shown a dramatic decline in their distribution and abundance patterns since the second half of the 20th century (Westfall and May, 1996; Sahlen *et al.*, 2004; Inoue, 2004). The causes of such decline are mainly due to habitat destruction, eutrophication, acidification, pollution and water mismanagement (channelization, dam's construction, and modifications of the structure of rivers). Effects of water extraction and pollution of natural water resources on the natural populations of dragonflies in the Palestinian regions should be a first priority.

The present study documents species composition and distribution in the Palestinian areas. Further assessment is

required to study the other families of both dragonflies and damselflies all over the West Bank especially with a focus to habitat changes and threats to populations.

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