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REVIEW OF THE GENUS *DIOCTRIA* MEIGEN, 1803 (DIPTERA ASILIDAE) FROM IRAN, WITH FOUR NEW SPECIES RECORDS FOR THE IRANIAN FAUNA

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Mohammadi R., Talebi A.A., Fathipour Y., Kazerani F., Van Den Broek R. – Review of the genus *Dioctria* Meigen, 1803 (Diptera Asilidae) from Iran, with four new species records for the Iranian fauna.

Based on specimens collected, using sweeping nets and Malaise traps, from the East Azarbaijan, Guilan, Alborz and Mazandaran Provinces of Iran between May 2010 and September 2015, six species of the genus *Dioctria* Meigen, 1803 were collected. They were subsequently identified, and four species: *Dioctria arnoldii* V. Richter, 1964, *D. humeralis* Zeller, 1840, *D. pilithorax* V. Richter, 1980, and *D. speculifrons* Wiedemann, 1820, had not been previously recorded from Iran. Diagnostic characters and geographical distribution of the newly recorded species are provided. An illustrated key to all known Iranian *Dioctria* species is given.

KEY WORDS: *Dioctria*, Asilidae, Key, New records, Iran.

INTRODUCTION

The flies of the genus *Dioctria* Meigen, 1803 (Insecta: Diptera: Asilidae) are rather small to medium sized (6-20 mm), nearly bare and often shiny black. The antennae are elongate, longer than the height of the eye and borne upon a protuberance which may be only slightly developed in some species. The fore tibia lacks an apical claw-like spur, the hind femora without strong bristles and the pulvilli are normally developed. Wings are relatively large, the 1st radial cell, all medial cells and posterior cubital cell are open (RICHTER, 1988). Among Asilidae, only the Dioctriinae possess an arched postmentum (DIKOW, 2009).

The genus *Dioctria* was placed within the tribe Dioctriini by HULL (1962) along with 14 genera of Dasypogoninae in which the 9th tergite of females lacks both acanthophorites and spines. PAPAVERO (1973) transferred the Dioctriini to the subfamily Stenopogoninae. LEHR (2001) lifted the tribe Dioctriini to the subfamily level. The Dioctriinae then comprised three tribes: Dioctriini, Echthodopini and Molobradii (ADISOEMARTO and WOOD, 1975; LEHR, 2002). DIKOW (2009), using multiple character states, verified that Dioctriini and Echthodopini were indeed Dioctriinae, but Molobradii was transferred back to the Dasypogoninae. With 90 species, *Dioctria* is the largest genus in the subfamily; 85 of these are known from the Palearctic region (GELLER-GRIMM *et al.*, 2015). Most of the species of the genus *Dioctria* can be found in the temperate belt and inhabit thick herbaceous grasslands, bushy thickets and wooded areas (LEHR, 1958).

Prior to this study, 11 *Dioctria* species had been reported from Iran. LEHR (1988) and LEHR *et al.* (2007) listed *Dioctria lugens* Loew, 1873, *D. abdominalis* Becker, 1923, *D. atricapilla* Meigen, 1804, *D. rufonigra* Theodor, 1980, *D. striata* Theodor, 1980 and *D. valida* Loew, 1856 from

Iran. GHAHARI *et al.* (2007) and HAYAT *et al.* (2008) added *D. dispar* Loew, 1871, *D. gracilis* Meigen, 1820, *D. hyalipennis* (Fabricius, 1794), *D. flavipennis* Meigen, 1820 and *D. linearis* (Fabricius, 1787) to the Iranian fauna.

This study was conducted to provide a comprehensive taxonomic treatment of *Dioctria* species known from Iran.

MATERIALS AND METHODS

Specimens of *Dioctria* were collected using sweeping nets and Malaise traps from May 2010 to September 2015 in East Azarbaijan, Guilan, Alborz and Mazandaran Provinces. The following references were used for identification of specimens and geographical distribution of species: ENGEL (1930); RICHTER (1960, 1964, 1988); LEHR (1988, 2001, 2002); GELLER-GRIMM (2003) and GELLER-GRIMM *et al.* (2015). Photos were taken using an Olympus TM SZX9 stereo-microscope equipped with a Sony TM digital camera. A series of 7-10 captured images were merged into a single in-focus image using the image-stacking software, Helicon Focus 6. The authors used Garmin, geko 301 to take GPS coordinates. The examined specimens are deposited in the Insect Collection of Department of Entomology, Tarbiat Modares University, Tehran, Iran (TMUC).

RESULTS

In this study, six species of the genus *Dioctria* Meigen, 1803 were collected and identified, of which four species including *Dioctria arnoldii* V. Richter, 1964, *D. humeralis* Zeller, 1840, *D. pilithorax* V. Richter, 1980, and *D. speculifrons* Wiedemann, 1820 are recorded from Iran for

the first time. In addition, *Dioctria atricapilla* Meigen, 1804 and *Dioctria linearis* (Fabricius, 1787) are reported from the East Azarbaijan Province for the first time.

LIST OF DIOCTRIA SPECIES KNOWN FROM IRAN

Dioctria abdominalis Becker, 1923

Iranian records: Isfahan province (LEHR *et al.*, 2007).

General distribution: Turkey (GELLER-GRIMM *et al.*, 2015).

Dioctria arnoldii V. Richter, 1964

(Fig. I, 1-5)

Material examined: Guilan province (Roodsar, Rahim abad, Ziaz), 36°52'34.44" N, 50°13'17.40" E, 537 m, 15 June 2010, 2♂ (photographed specimen); Guilan province (Roodsar, Rahim abad, Ghazichak), 36°45'52.62" N, 50°20'01.08" E, 1787m, 5 July 2010, 2♀; Guilan province (Roodsar, Rahim abad, Orkom), 36°45'44.34" N, 50°18'11.88" E, 1201 m, 8 June 2010, 1♀.

Iranian records: Guilan province (current study), new record for Iran.

General distribution: Armenia, Azerbaijan, Georgia (LEHR, 1988, 2002).

Diagnostic characters: Large black species (12-15 mm) with a black stripe on the face. Facial tomentum only present along eye margins leaving a shiny black stripe on the face between mystax and frontal tubercle (Fig. I, 1); scape about 1.5x to 2x pedicel; mystax black (Fig. I, 3). Thorax black, scutum shiny black without tomentum; stripe of pale tomentum on pleura complete (Fig. I, 2); coxae black. Legs somewhat variable, usually front and mid-

dle femora yellowish-red with a black posterior side, hind femur black with a narrow red apex, front and middle tibiae yellowish-red with a black apex, hind tibia black with a red base, all tarsi black (Fig. I, 1). Wings faintly infusate (Fig. I, 5), darker in basal part, abdomen shiny black (Fig. I, 4).

Dioctria atricapilla Meigen, 1804

(Fig. II, 1-3)

Material examined: East Azarbaijan province, Arasbaran Forests, 46°26'32"N, 44°54'2"E, 1534m, 25 July 2012, 1♀, 3♂ (photographed specimen).

Iranian records: Golestan province (LEHR *et al.*, 2007), East Azarbaijan province (current study).

General distribution: Austria, Belgium, Bulgaria, Republic of Belarus, Corsica, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Kazakhstan, Latvia, Lithuania, Luxembourg, Moldavia, Mongolia, Netherlands, Poland, Romania, Russia, Sweden, Switzerland, Turkey, Ukraine, United Kingdom (GELLER-GRIMM *et al.*, 2015).

Dioctria dispar Loew, 1871

Iranian records: Guilan province (HAYAT *et al.*, 2008).

General distribution: Russia, Kyrgyzstan, Tajikistan, Uzbekistan (GELLER-GRIMM *et al.*, 2015).

Dioctria flavipennis Meigen, 1820

Iranian records: Provinces: Guilan (HAYAT *et al.*, 2008); Isfahan (GHAHARI *et al.*, 2007); Mazandaran (GHAHARI *et al.*, 2007; HAYAT *et al.*, 2008).

Fig. I – *Dioctria arnoldii* V. Richter, 1964 1-5: male. 1. General habitus, lateral view; 2. Thorax, lateral view; 3. Head, lateral view; 4. Abdomen, lateral view; 5. Wing, dorsal view.

Fig. II – *Dioctria atricapilla* Meigen, 1804 1-3: male. 1. General habitus, lateral view; 2. General habitus, laterofrontal; 3. Head, lateral view.

General distribution: Austria, Bulgaria, Republic of Belarus, China, Czech Republic, Estonia, France, Germany, Great Britain, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldavia, Poland, Romania, Russia, Tajikistan, Turkey, Turkmenistan, Ukraine, Uzbekistan, West Siberia (GELLER-GRIMM *et al.*, 2015).

***Dioctria gracilis* Meigen, 1820**

Iranian records: Southern Khorasan province (HAYAT *et al.*, 2008).

General distribution: Algeria, France, Germany, Italy, Sardinia, Switzerland, Turkey (GELLER-GRIMM *et al.*, 2015).

***Dioctria humeralis* Zeller, 1840**
(Fig. III, 1-4)

Material examined: Guilan province (Roodsar, Rahim abad, Ziaz), 36°52'27.18" N, 50°13'24.78" E, 490 m, 4 June 2010, 1♀ (photographed specimen); Mazandaran province

(Tangheh vaz), 36°21'55" N, 52° 06'10" E, 692 m, 20 July 2012, 2♀.

Iranian records: Guilan and Mazandaran provinces (current study), new record for Iran.

General distribution: Bulgaria, Czech Republic, Germany, France, Hungary, Poland, former Yugoslavia, Kazakhstan, China, Hungary, Slovakia (Lehr, 1988; GELLER-GRIMM *et al.*, 2015).

Diagnostic characters: A small species (7-8 mm) with reddish-brown parts on thorax. Shiny tomentum on face, golden yellow; mystax yellow; scape about 2x pedicel. Thorax black, postpronotal lobes, often postalar calli and part of scutellum reddish-brown (Fig. III, 2). Scutum with the typical pattern of tomentum leaving the two para median stripes and the lateral spots black; stripe of pale tomentum on pleura complete and yellowish in colour; coxae yellow. Legs almost entirely yellow including tarsi. Wings almost hyaline (Fig. III, 1).

Fig. III – *Dioctria humeralis* Zeller, 1840 1-4: female. 1. General habitus, lateral view; 2. Thorax, lateral view; 3. Head, lateral view; 4. Abdomen, lateral view.

***Dioctria hyalipennis* (Fabricius, 1794)**

Iranian records: Sistan & Baluchestan province (HAYAT *et al.*, 2008).

General distribution: Algeria, Austria, Belgium, Bulgaria, Canada, Czech Republic, Denmark, England, Finland, France, Great Britain, Italy, Luxembourg, Poland, Romania, Russia, Spain, Switzerland, The Netherlands, Tunisia, USA, former Yugoslavia (GELLER-GRIMM *et al.*, 2015).

***Dioctria linearis* (Fabricius, 1787)**
(Fig. IV, 1-3)

Material examined: East Azarbaijan province, Arasbaran forests, 38°51'42" N, 46°58'17" E, 1568 m, 25 May 2013, 1♀ (photographed specimen); Ghurigol 37°55'12" N, 46°41'31" E, 1888 m, 22 July 2013, 1♀, 1♂; Hashtroud 37°31'10" N, 46°51'13" E, 1682 m, 4 August 2010, 1♀, 1♂.

Iranian records: Guilan province (HAYAT *et al.*, 2008), East Azarbaijan province (current study).

General distribution: Austria, Belgium, Bulgaria, Czech Republic, Denmark, England, former Yugoslavia, France, Germany, Hungary, Italy, Luxembourg, The Netherlands, Poland, Romania, Russia, Switzerland (GELLER-GRIMM *et al.*, 2015).

***Dioctria lugens* Loew, 1873**

Iranian records: Iran (no locality cited) (LEHR, 1988).

General distribution: Turkey (GELLER-GRIMM *et al.*, 2015).

***Dioctria pilithorax* Richter, 1960**
(Fig. V, 1-3)

Material examined: East Azarbaijan province, Arasbaran forests 38°51'32" N, 46°59'42" E, 1783 m, 1 June 2013, 2♀, 1♂ (photographed specimen); Ghurigol 37°55'12" N, 46°41'31" E, 1888 m, 29 May 2012, 1♂; Kandovan: 37°46' N, 46°15' E, 2341m, 23 June 2015, 2♀.

Iranian records: East Azarbaijan province (Current study), new record for Iran.

General distribution: Azerbaijan (LEHR, 1988).

Diagnostic characters: Rather small, black species (10 mm). Mystax black in both sexes (Fig. V, 2). Frontal tubercle large, as high as length of pedicel; scape about 1.5x pedicel (Fig. V, 2). Thorax black, scutum with remarkably erect black setae (Fig. V, 3); stripe of pale tomentum on pleura dorsally widely interrupted; coxae black. Legs entirely black (Fig. V, 1). Wings largely

Fig. IV – *Dioctria linearis* (Fabricius, 1787) 1-3: female. 1. General habitus, lateral view; 2. Thorax, laterofrontal; 3. Abdomen, dorsal view.

infused with black microtrichia, apex lighter in males, apical half lighter in females (Fig. V, 1). Abdomen shiny black (Fig. V, 1).

***Dioctria rufonigra* Theodor, 1980**

Iranian records: Mazandaran province (LEHR *et al.*, 2007).

General distribution: Israel, Palestine, Turkey (GELLER-GRIMM *et al.*, 2015).

***Dioctria speculifrons* Wiedemann, 1820**

(Fig. VI, 1-4)

Material examined: Guilan province (Roodsar, Rahim abad, Ghazichak), 36°45'57.54" N, 50°19'35.22" E, 1803 m, 3 August 2010, 2♂ (photographed specimen); Guilan province (Roodsar, Rahim abad, Orkom), 36°45'44.34" N, 50°18'11.88" E, 1201 m, 16 August 2010, 3♂; Alborz

province (Chalous Road), 35°55'07.20" N, 51°05'09.24" E, 1891 m, 5 July 2010, 2♂.

Iranian records: Alborz and Guilan provinces (current study), new record for Iran.

General distribution: Armenia, Azerbaijan, Georgia, Spain, Portugal (LEHR, 1988; GELLER-GRIMM *et al.*, 2015).

Diagnostic characters: A smaller sized (7-10 mm), black *Dioctria* species with a dark face. Shiny facial tomentum blackish, mystax black (Fig. VI, 2). Frontal tubercle about half as high as length of pedicel. Thorax black, scutum with distinct pattern of yellowish-brown tomentum leaving the two para median stripes and the lateral spots shiny black; Stripe of pale tomentum on pleura complete and brownish (Fig. VI, 3); coxae black. Legs black, only knees of legs sometimes light coloured (Fig. VI, 1). Wings hyaline (Fig. VI, 1). Abdomen shiny black (Fig. VI, 4).

Fig. V – *Dioctria pilithorax* Richter, 1960 1-3: female. 1. General habitus, dorsal view; 2. Head, lateral view; 3. Thorax, lateral view.

Dioctria striata Theodor, 1980

Iranian records: Fars, Kerman (LEHR *et al.*, 2007).

General distribution: Israel, Palestine, Turkey (GELLER-GRIMM *et al.*, 2015).

Dioctria valida Loew, 1856

Iranian records: Isfahan province (LEHR *et al.*, 2007).

General distribution: Israel, Lebanon, Palestine, Syria, Turkey (GELLER-GRIMM *et al.*, 2015).

KEY TO THE IRANIAN SPECIES
OF THE GENUS *DIOCTRIA*

This present and provisional key is based on ENGEL (1930), RICHTER (1988) and GELLER-GRIMM (2003). Important characters for the identification are the ratio of

the antennal segments, especially the scape and the pedicel and a stripe of pale tomentum and pubescence on the side of the thorax. This stripe starts just above the front coxa, up to the dorsal side of the anepisternum and down again to just above the hind coxa (Fig. VII, 4). This stripe can be complete but in some species it is interrupted or partly absent.

- 1a. Thorax largely red or black with reddish brown parts (Fig. III, 2) 2
- 1b. Thorax black, at most a small red spot on humeral callus (Fig. I, 2; Fig. V, 3; Fig. VI, 3) 4
- 2a. Thorax largely reddish brown with a black median stripe on the scutum; abdomen black, lateral sides of tergite 2 and tergites 3-4 wholly reddish; wings blackened in anterior basal two thirds *D. rufonigra*
- 2b. Only humeral and postalar calli red or brownish, sometimes also scutellum wholly or partly red; abdomen black 3
- 3a. Only humeral area brownish, rest of scutum shiny black with two broad stripes of tomentum bordering median bare stripe *D. striata*
- 3b. Both humeral and postalar calli and often part of scutellum

Fig. VI – *Dioctria speculifrons* Wiedemann, 1820 1-4: male. 1. General habitus, lateral view; 2. Head, lateral view; 3. Thorax, lateral view; 4. Abdomen, lateral view.

Fig. VII – *Dioctria dispar* Loew, 1871 1-2: male. 1. General habitus, lateral view; 2. General habitus, laterofrontal. *Dioctria hyalipennis* (Fabricius, 1794) 3-4: male. 3. General habitus, lateral view; 4. General habitus, laterofrontal. (Figs. 1 and 2 taken by Dr. Geller-Grimm).

- reddish, scutum with yellowish grey tomentum leaving two lines along medium stripe and the two connected lateral spots shiny black *D. humeralis*
- 4a. Scape equal to, or very slightly longer (1x to 1.2x) than pedicel 5
- 4b. Scape clearly longer (more than 1.4 x) than pedicel (Fig. I, 3; Fig. V, 2; Fig. VI, 2) 6
- 5a. Coxae yellow, front and middle legs yellow, tarsi darker, hind leg largely black *D. gracilis*
- 5b. Coxae black, all legs largely reddish yellow, tarsi brownish except last segment always yellow *D. valida*
- 6a. Legs entirely or largely black (Fig. II, 1, 2) 7
- 6b. Legs largely yellow or red (Fig. I, 1; Fig. IV, 1) 10
- 7a. Wings hyaline; knees sometimes yellow or red; mystax black in both sexes (Fig. VI, 2) *D. speculifrons*
- 7b. Wings largely or partly darkened; knees never yellow or red; mystax white or black 8
- 8a. Scutum covered with erect long black hairs (Fig. V, 3); mystax black in both sexes (Fig. V, 2) *D. pilithorax*
- 8b. Scutum with only very short hair in varying colour; mystax not black in both sexes 9
- 9a. Stripe of pale tomentum on pleura is brownish white and interrupted on dorsal side of anepisternum; parts of hind legs lighter coloured; mystax white in both sexes *D. lugens*
- 9b. Brownish or yellowish stripe of pale tomentum on pleura complete (Fig. II, 2); hind legs not with lighter parts; mystax black in males, white in females *D. atricapilla*
- 10a. Face with only tomentum on the lateral edges leaving a bare, vertical black stripe; mystax black (Fig. I, 3); wings darkened on anterior basal half (Fig. I, 5) *D. arnoldii*
- 10b. Face covered with shiny tomentum; mystax white or yellow; wings hyaline or anterior base coloured 11
- 11a. Coxae black; abdomen black, at most posterior margins of tergites lighter in colour; scutum largely, but rather thinly covered with greyish tomentum leaving lines along median stripe and the lateral spots black; stripe of white tomentum on pleura complete with a thin additional stripe just above the middle coxa (Fig. VII, 3, 4) *D. hyalipennis*
- 11b. Coxae yellow or brown; scutum with or without tomentum, the yellowish stripe of tomentum on pleura complete but without additional stripe 12
- 12a. Scutum somewhat shiny black and without tomentum; tergite 3 with a reddish brown band in the middle, tergite 4 and anterior part of tergite 5 reddish brown *D. abdominalis*
- 12b. Scutum black with a distinct pattern of tomentum; abdomen black or black with yellow lateral spots 13
- 13a. Tergites 3-5 black with light coloured posterior margins and yellow spots on the lateral sides (Fig. IV, 3); hind femur yellow with a dark spot on the anterior side that can be variable in size (Fig. IV, 1) *D. linearis*
- 13b. Abdomen black, at most posterior margins lighter in colour; hind femur different coloured 14
- 14a. All legs reddish yellow; base of wing somewhat brownish infuscate in male, yellowish in female *D. flavipennis*
- 14b. Legs largely reddish yellow, femur of the hind legs dorsally black, front tibia with darkened apex, middle tibia darkened with a lighter base, hind tibia black; basal half of wing in male darkened (Fig. VII, 2), in female wings almost hyaline (Fig. VII, 1) *D. dispar*

DISCUSSION

The Asilidae are thermophilic predacious flies that mainly found in arid and semiarid areas of the planet (HULL, 1962). Iran is located on the crossroad of three ecological zones, the Palearctic, Afrotropical and the Oriental (GHAHARI *et al.*, 2014). Consequently, Iran harbors a rich vegetation as well as a rich insect fauna, including many species of robber flies (Diptera: Asilidae). Between 2008 and 2014 the number of species, including subspecies, of Asilidae recorded from Iran almost doubled from 156 (HAYAT *et al.*, 2008) to 289 (GHAHARI *et al.*, 2014). In many recent studies (MOHAMMADI and KHAGHANINIA, 2015, 2016; MOHAMMADI *et al.*, 2017) including this study, more species are added. It seems that the study of Asilidae has long been neglected in Iran and many species can be expected in future studies

in different parts of the country. With four new records of this study, the number of species of the genus *Dioctria* in Iran has increased to 15. However, as many areas of Iran remain unexplored, we expect that the *Dioctria* fauna of Iran will be substantially increased.

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12 - Blank Page