



## Morphological study of three native Odonata species from Basrah Governorate – South of Iraq

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### Abstract

The morphological description was done to identify three native species belonging to the family Libellulidae (Odonata: Anisoptera) from Basrah Governorate - South of Iraq, to consider as native species for the first time. The Specimens were collected from three different regions, during the period from December 2017 to November 2018. The diagnostic features of the adults and naiads of the breeding species: *Orthetrum sabina*, *Crocothemis servilia* and *Diplacodes trivialis*, shows the diversity of specific characters for each species which were photographed and figured.

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## Introduction

Odonata is one of the most attractive order of flying insects, their species have different colour, size and unusual reproductive behavior (Theischinger and Endersby, 2014). The term Odonata means "teeth" from the Ancient Greek, apparently because they have teeth on their mandibles (Mickel, 1934). Taxonomically this diverse order is divided into three suborders: Zygoptera, Anisoptera and Anisozygoptera. The fossil records indicate that the first forms of Odonata appeared about 250 million years ago in the Permian era (Miller, 1995; Grimaldi and Engel, 2005). In many countries, the name of Dragonflies refers to suborder Anisoptera which uniqueness in their medium-sized to large, robust and fast flying with subequal wings (hind wings are broader at the base than the forewings and at rest the wings are spread out away from the body) (Fonska, 2000). Anisoptera is further subdivided into 12 extant families with many species (Corbet and Brooks, 2008; Dijkstra and Kalkman, 2012). Most species belong to the families Aeshnidae and Libellulidae (Dijkstra and Lewington, 2006).

Dragonflies are skillful predators can be found in the hottest, coldest, in the driest and wettest regions of the world, their larval stages (called Naiads) live and develop in aquatic environment among macro vegetation, littoral sediments or burrowing into surficial deposit, they usually associated with clean water making them useful biological indicators of water quality and conservation management as the adults an effective environmental monitors (Samway, 1993; Corbet, 1999; Kalkman *et al.*, 2008). The number of larval instars is variable within and between species and is usually 9-15. At the end of larvae aquatic life and when they are ready to final moult, they stop feeding then climb of the marginal vegetation or exposed rocks, and rip its skin (Exuvia) to the emerged adults or teneral adults (Subramanian, 2005). During this phase, the insect has very pale pigmentation, a pale pterostigma, and very shiny wings (De Gabriele, 2013). They are incapable of immediate flight so they perch either on the same Exuvia or nearby vegetation spending a

maximum of two hours for expanding and drying out its wings and abdomen (Corbet, 1980; Hawking and Theischinger, 1999).

The morphological characters of adult dragonflies can be identified by numbers of key and field guides, whereas for larvae the situation is quite different because of the variable features within single species make them less diagnostic than those of adults, in addition, they significantly change with progress development and sometimes with different habitat conditions, therefore keys are constructed only for final instars or Exuvia and that require complete specimens for reliability descriptions (Theischinger and Endersby, 2014).

The literatures of Odonata for Iraqi fauna are limited and most of them includes check list of adult species, as Morton (1919 and 1920), Asahina (1973), Askew (1988), Kalkman (2006). Other studies were described morphological characters of the adults of some Anisoptera and Zygoptera species as: Al-Hashmi (2011), Abd (2011), Abd and Al-Asady (2012 and 2014), Ali and Khidhir (2015), Augul *et al.* (2016) and Al-Hashmi (2017). However, for naiads of some Odonata species there is only one identification study by Darweesh (2018).

The present study was aimed to describe the morphological features for identification three Odonata species (adults and naiads) includes: *Orthetrum Sabina* (Drury, 1773), *Crocothemis servilia* (Drury, 1773) and *Diplacodes trivialis* (Rambur, 1842) belonging to the Libellulidae family of suborder Anisoptera, as considered to be a native species of Basrah Governorate in the south of Iraq.

## Materials and methods

Sampling of the specimens were monthly done during the period between December 2017 to November 2018 from three stations of Basrah Governorate – South of Iraq (Fig.1): St.1- Abu Gosra in the south (30 25 45.1"N 47 55 52.1"E), St.2 Al Masehab in the north east (30 39 5.47"N 47 42 34.32"E) and St.3 Al Jilal in the north (30 55 51.7"N 47 14 29.6"E). All stations are

placed near a temporary ponds, St.1 with a semi rectangle shape, St.2 is L- shape and St.3 has a semi square shape, there dimensions are: 75, 50 and 8m lengths; 5, 4 and 6m width and 40, 35 and 50cm depth, respectively. The vegetation include: *Typha domingensis*, *Alhigrae carum*, *Suaeda aegyptica*, *Phragmites australis*, *Ceratophyllum demersu*, *Phoenix dactylifera*, *Ziziphus* sp. and algae of the genus *Chladophora*. Adult and mating individuals of

Odonata: Libellulidae were photographed by personal mobile camera (Huawei Mate 9 Leica Dual Camera), the adults were collected by using handle air net or sometimes they carefully be caught by hands.

They prepared to die slowly by cooling in 4C° to allow the excreted of gut contents, and conserved the colors of the preserved specimens, after die they were pinned (Usinger,1974; Miller, 1987).



**Fig. 1.** Map of the study stations, St.1: AbuGosar, St.2: Al Masehab and St.3: Al Jilal, in Basrah Governorate-South of Iraq.

Naiads were collected by aquatic insect net or sieve (30cm diameter and 1mm mesh size). The location of samples was divided into four corner and derived the sieve or the net into the water for one minute three times according to: Usinger, 1974 and Foneska, 2000.

Plastic bottles were used to transfer the specimens to the laboratory for isolating and preliminarily identification depending on shape, size and the length of wings buds, part of them were preserved in 70% alcohol for further identification. Naiads in final instars or before that, were identified when the length of wings buds reached the segments between 4 to 6 or 7 of the abdomen; they were selected for rearing until emergence to adults. Three individual of naiads of

each species were placed in separated plastic pails (10cm in diameter and 15cm in high) filled and maintained with free chlorinated tap water and some aquatic plants and rocks, the gars were put in room's temperature and covered with a sheets of net.

The naiads were fed on small aquatic animals such as gastropod (*Lymnea auricularia*), mosquito larvae and juveniles of Mysidacea (*Indomysis nybini*) (Usinger,1974; Miller, 1987; Fonseka, 2000).

After 3 to 15 days, the naiads crawl up out of water, stick on the rough wall of the pail and being to emergence during early morning or sometimes at night, for 1-2 hours of time the emerged imago

collected and kept together with the Exuvia in the preserve box with small balls of naphthalene and complete information.

Samples of preserved adults and naiads were subjected to detailed examination and morphometric measurements by using a microscope and ruler with size nearest 0.5mm. Identification features were made according to taxonomic literatures available on the fauna such as: Fraser 1936, Carchini 1983, Dumont 1991, Forsake 2000, Dijkstra 2006, Kalkman 2006, Cham 2007, Theischinger 2009 and De Gabriele 2013, as well as many pictures were taken to

describe the specific diagnostic characters of different parts of each species body and drawing figures were made to illustrate some details.

## Results and discussion

### Scientific Taxonomy

Family: Libellulidae

1- Genus: *Orthetrum* Newmann, 1833

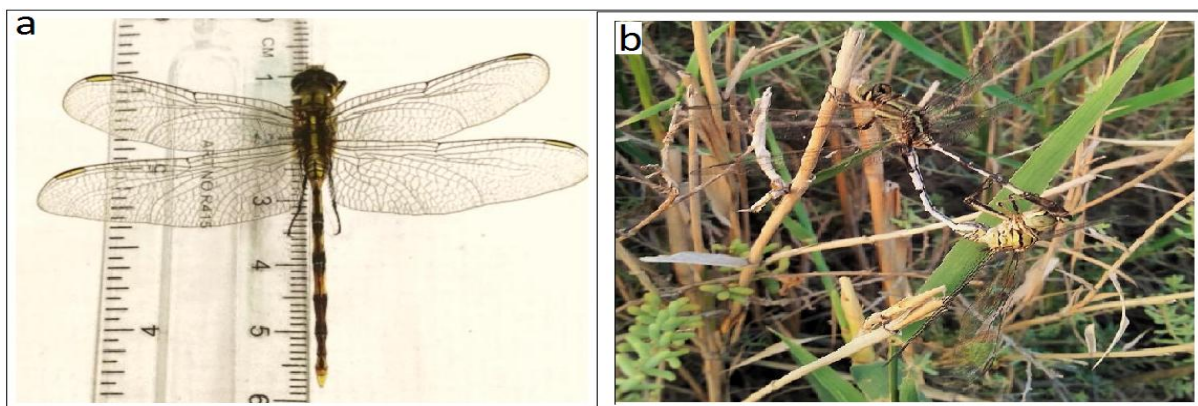
Species: *Orthetrum sabina* (Drury, 1773)

2-Genus: *Crocothemis* Brauer, 1868

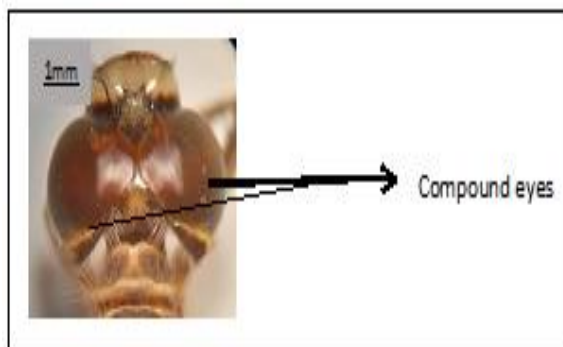
Species: *Crocothemis servilia* (Drury, 1773)

3-Genus: *Diplacodes* Kirby, 1889

Species: *Diplacodes trivialis*(Rambur,1842).



**Fig. 2.** *Orthetrum sabina* Drury, a: Male, b: Mating position.



**Fig. 3.** Head of *Orthetrum sabina* Drury, male.

### General diagnostic characters of Suborder Anisoptera

Adults: Robust cylindrical body between 30 to 70mm lengths. Globular head with two large complex eyes touch to gather top of the head. Wings sub equal, the hind wing wider than forewing, both of them not petiolate with complex venation and kept horizontal on the body at rest. Legs parts (Coxa, Femur, Tibia and Tarsi) different in size, colors and setae between

genera. Anal appendages of male with one pair of superior appendages and one single inferior appendage.

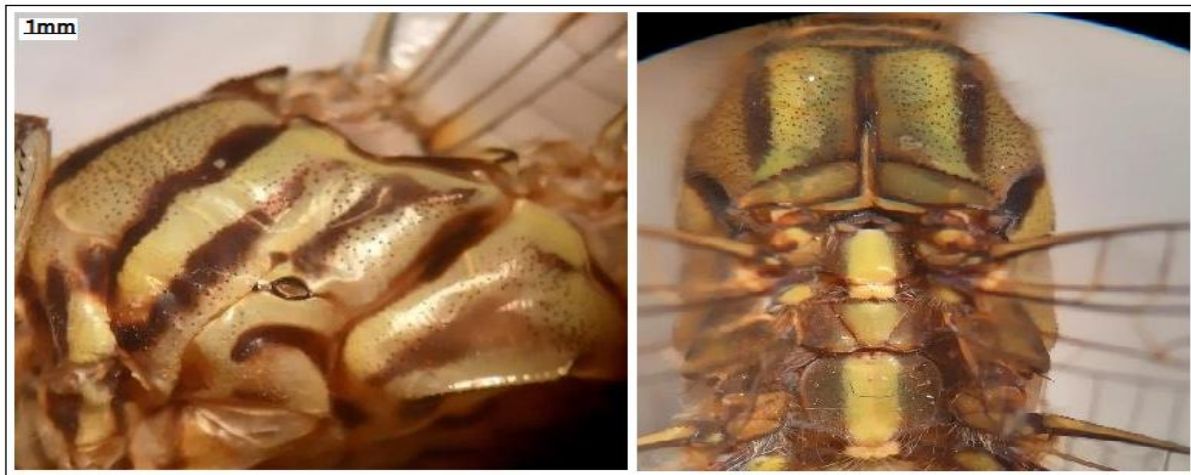
Naiads: Short and robust body either hairy or not. Semi rectangle head wider than abdomen with lateral large complex eyes. Labium with small teeth, labial mask is variable in length and shape, rounded or spoon shape covered the mouth parts.

Hind femur does not extend beyond abdominal segment. Rounded broad or elongated flat abdomen with or without mid-dorsal and lateral spines.

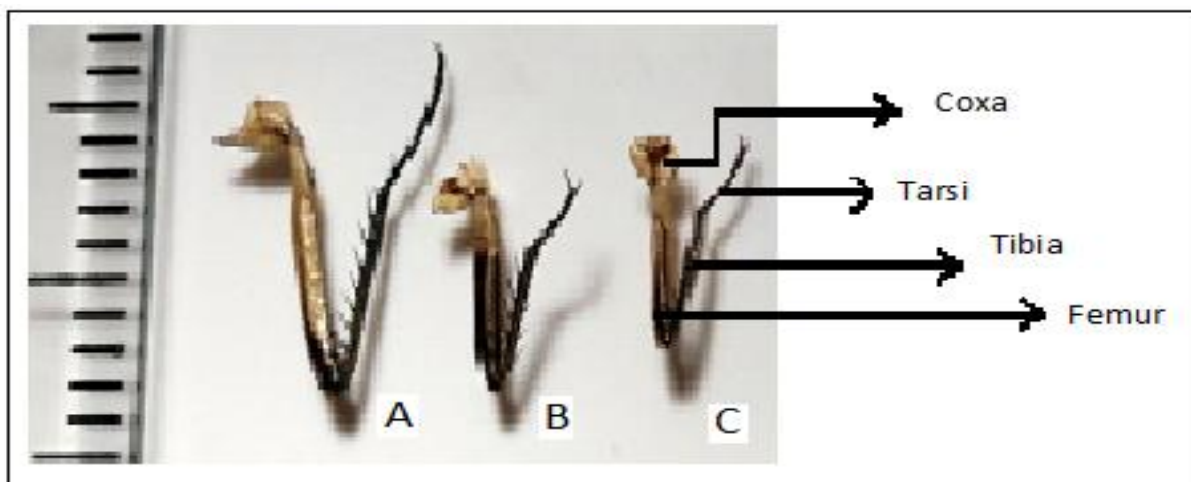
Five short anal appendages.

### Description of the species

A. *Orthetrum sabina* (Drury,1793).



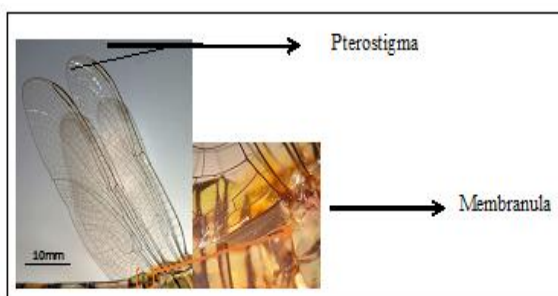
**Fig. 4.** Thorax of *Orthetrum sabina* Drury, male. a:Lateral view, b: Over view.



**Fig. 5.** Legs of *Orthetrum sabina* Drury, a:Fore-leg, b:Mid-leg,c: Hind-leg.

(1)Adult:

Large body total length: 45- 49mm in male and 42-48 mm in female, hindwing:32-34mm and 31-33mm, in male and female respectively; the mating position of this species were photograph in the field. (Fig. 2. A & b).



**Fig. 6.** Wings of *Orthetrum sabina* female.

Globular small head; big reddish black complex eyes with lateral yellow edge. (Fig. 3.).

Thorax greenish creamy with black slope strips like tiger. (Fig. 4. a& b).



**Fig. 7.** Abdomen of *Orthetrum sabina* female Drury.

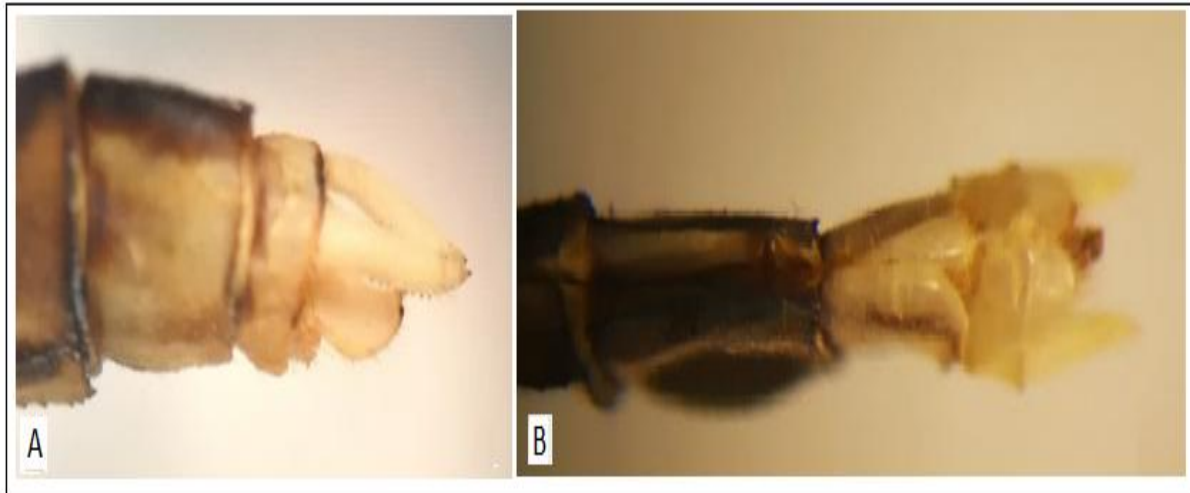
Black legs with yellow inner side of anterior femur. (Fig. 5. a,b& c).

Transparent wings with yellow spots in the bases; elongated rectangular pterostima with thick black

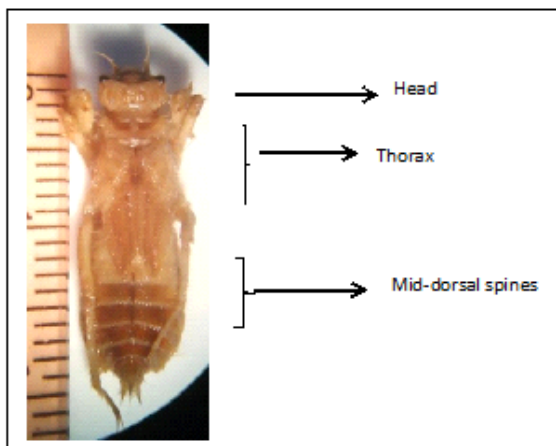
edge and light orange color; dark brown membranula. (Fig. 6).

Abdomen without blue pruinosity, segments 1 to 3 swollen distinctly in ventrally view colored greenish

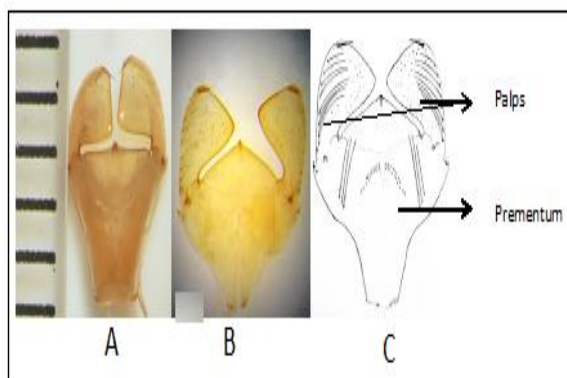
yellow marked with black thin rings and splotch, segments 4- 6 slender cylindrical pale yellow marked with black and 7-10 compressed laterally brownish black. (Fig. 7).



**Fig. 8.** Anal appendages of *Orthetrum sabina* Drury, a: Lateral view of male, b: Lateral view of female.



**Fig. 9.** Naiad of *Orthetrum sabina* Drury.



**Fig. 10.** Labium of *Orthetrum sabina* Drury naiad. a: Dorsal view, b: Ventral view, c: Drawing figure.

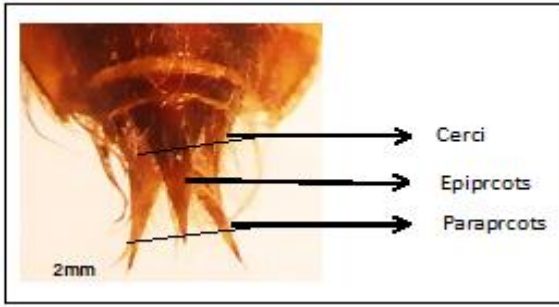
Anal appendages white creamy covered with pale hairs, the inferior are elongated cylindrical finger shape in male with bent plate paraprocts, and small cylindrical in female with vulvar scale as in Plate. (Fig. 8. a & b).



**Fig. 11.** Legs of *Orthetrum sabina* Drury, naiad. a: Fore-leg, b: Mid-leg, c: Hind-leg.

Number of specimens: 2♀ ( emergence ) , 2♂ ( catch )  
(2) Naiad:

Brownish very hairy body, total length 17 to 22mm; Semi quadrangle Head; frontal –lateral small eyes; 7-jointed segments antenna. (Fig. 9).



**Fig. 12.** Anal pyramid of *Orthetrum sabina* Drury, naiad.

Premental setae 3 +3 long and two unregularly rows of 17+16 short; labial palps seta 8+8; distal margin of palps formed beak-like crenations, two spiniform setae present near the base of the palps.(Fig. 10. a, b & c).

Cylindrical thorax, wings buds (sheaths) reached to S6 or S7, yellow legs short and robust, femur and tibia covered with scattered long and thick hairs. (Fig. 11. a, b & c).



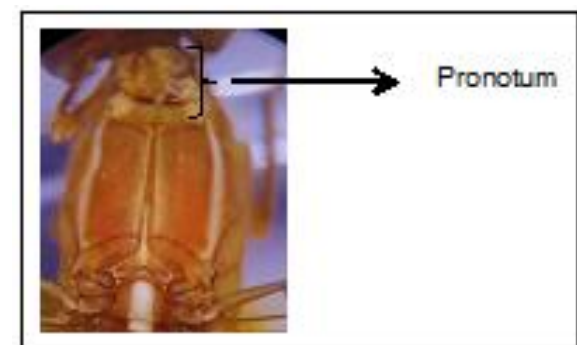
**Fig. 13.** *Crocothemis servilia* Drury.a&b: males, c: female.

Abdomen strongly convex dorsally, hairy posteriorly, setae along posterior margin of all abdominal terga, mid-dorsal spines on abdominal segments 4- 7. (Fig. 9).

female, hind wing: 30 - 32mm and 26-28mm, in male and female respectively. (Fig. 13.a, b & c). Globular small head with big complex eye, colored red purple or brownish red brown in old adults, and brown above with greenish gray below or hole green in young adults, with yellow color on the sides in below. (Fig. 14).



**Fig. 14.** Head of *Crocothemis servilia* Drury, young male.



**Fig. 15.** Thorax of *Crocothemis servilia* Drury, male.

Thorax bright red or orange, creamy-white stripes on front of thorax. Conspicuous; small posterior lobe of pronotum. (Fig. 15). Transparent wings base marked with rich amber and smoky tips; last antennodal nervure of forewing is incomplete; pterostigma large rectangle yellowish orang; membranula black or dark

Anal pyramid distinctly protruding hairy with brownish yellow colour. (Fig. 12). B. *Crocothemis servilia* ( Drury 1793) (1) Adult: A medium sized body total length: 36- 40mm in male and 32- 36mm in

brown. (Fig. 16. a & b). Legs pale reddish or yellow with regular rows of black spines in the inner sides. (Fig. 17. a, b & c). Abdomen depressed, bright red in male, yellowish brown in female with a mid-dorsal black stripe; inner branch of hamule in secondary

genitalia of the male strongly curved with single apical hook; in female each side of vulvar scale with a distinct basal swelling directed towards the head.(Fig. 18. a, b, c & d).

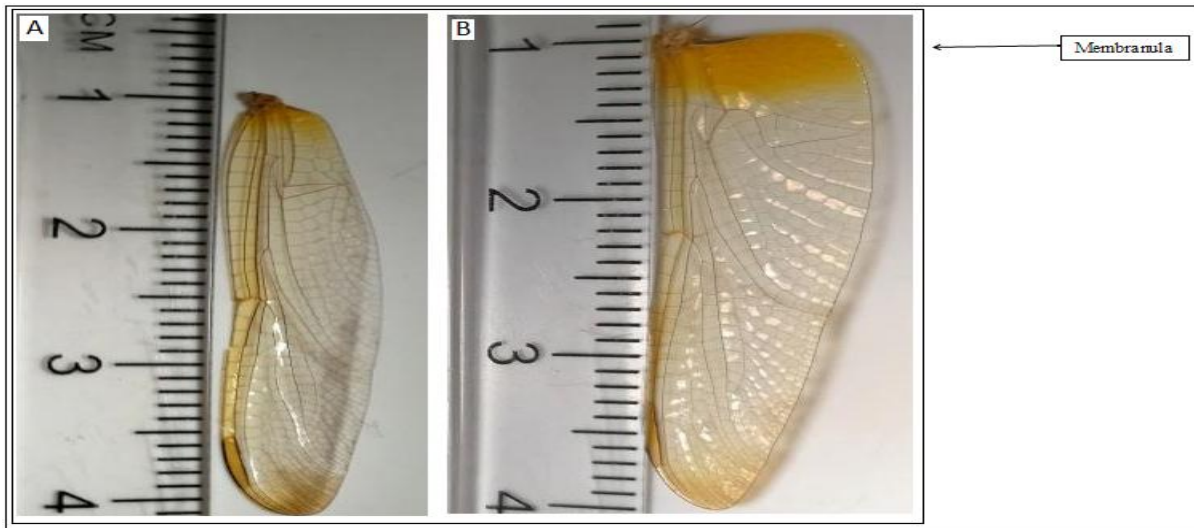


Fig. 16. Wings of *Crocothemis servilia* Drury, male. a: Fore wing, b: Hindwing.

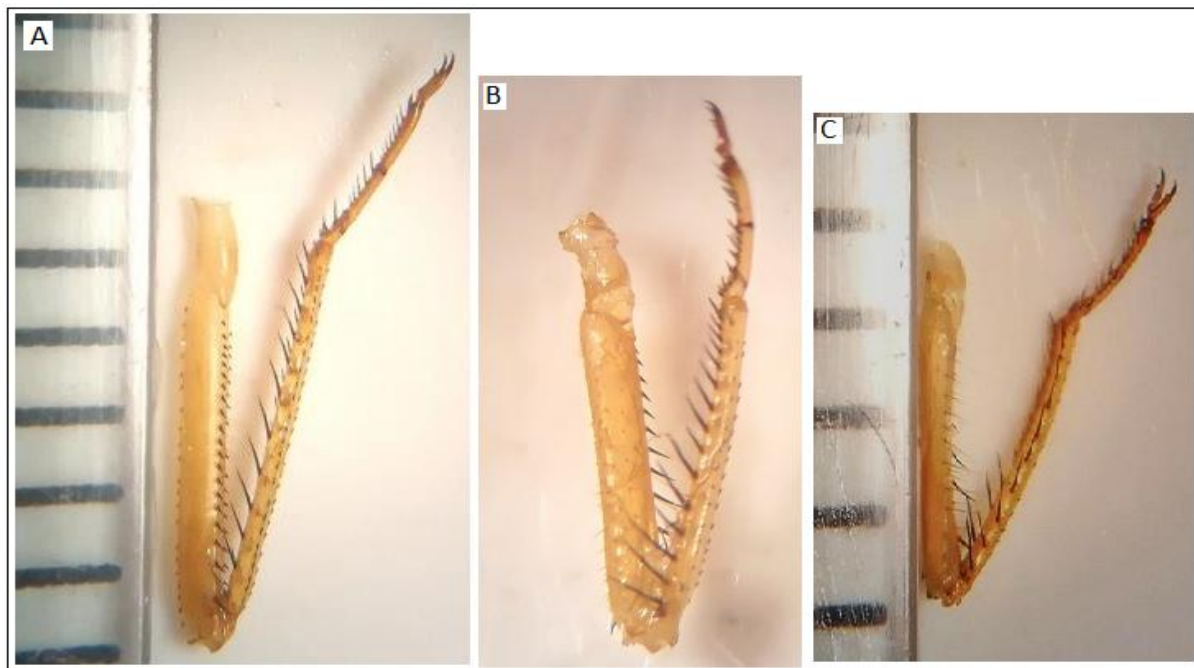


Fig. 17. Legs of *Crocothemis servilia* Drury, male. a:Fore-leg, b: Mid-leg, c:Hind-leg.

Number of specimens: 2♀ + 2♂ (emergence), 2♀ + 2♂ (catch) (2) Naiad: Yellowish-brown body, total length between 18- 20mm.(Fig. 19. a & b).

Semi square head, Eyes protruding laterally big whitish with a darker lower region, 7-jointed antenna

segments, 3-6 filiform with tapering apical. (Fig. 20. a & b).

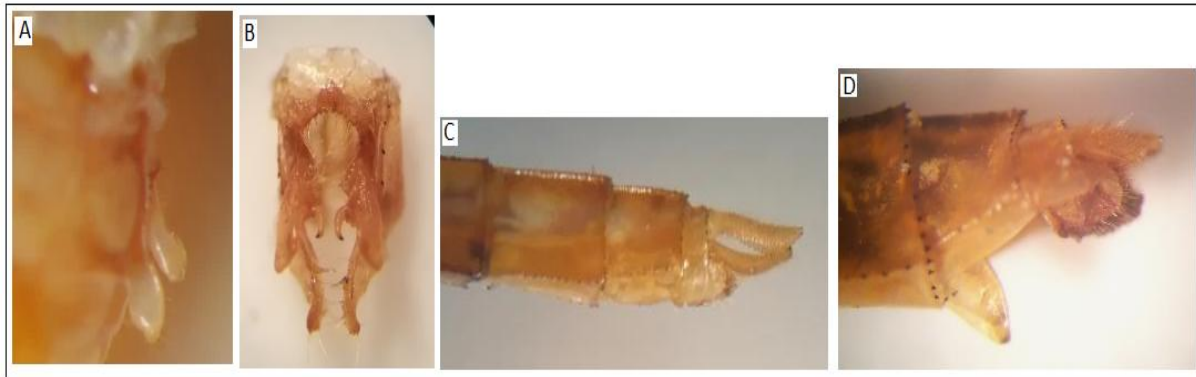
Labium spoon-shaped, prementum convex with 13+13 to 15+15 premental setae, palpal setae 10+10 to 11+11, median lobe of labium studded with setae,



distal margin of palps crenate, each crenation bearing setae. (Fig. 21. a, b &c).

Cylindrical thorax, wing sheaths extend to base of S<sub>7</sub>

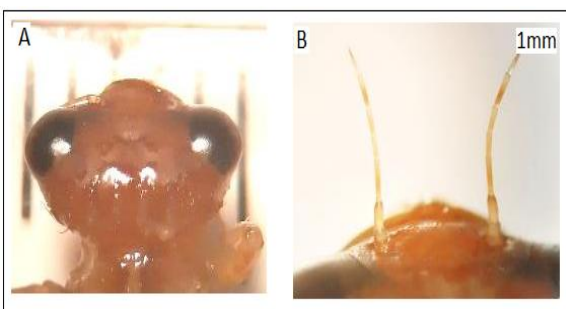
abdomen segment; legs slender quadridentate setae on the tip of tibia with dark bands on femur, tibia and dark spots on tarsi. (Fig. 22. a, b &c).



**Fig. 18.** Abdomen appendages of *Crocothemis servilia* Drury. a& b:lateral and ventral view of male secondary genitalia. c&d: lateral view of male and female anal appendages.



**Fig. 19.** Naiad of *Crocothemis servilia* Drury, a:Final instar, b:Exuvia.



**Fig. 20.** Naiad of *Crocothemis servilia* Drury, a: Head, b: Antennas.

Abdominal semi oval shape, segment 10 sunken into segment 9, mid-dorsal abdominal spines absent; lateral spines on S<sub>8-9</sub> short, those on S<sub>9</sub> not more than 1/4 of the length of that segment; anal pyramid

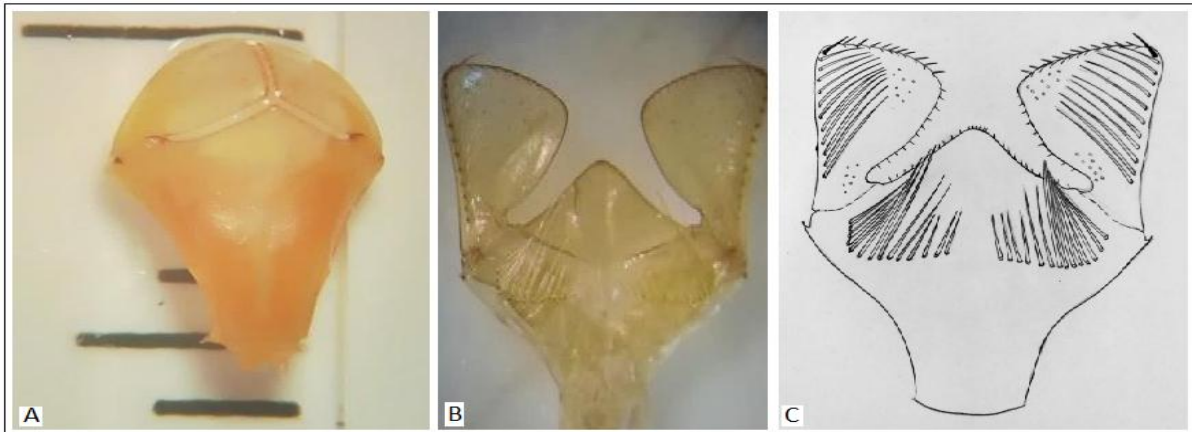
not distinctly protruding, epiproct and paraprocts beset with rows of setae on sides.(Fig. 23).

(C) *Diplacodes trivialis* Rambur, 1842

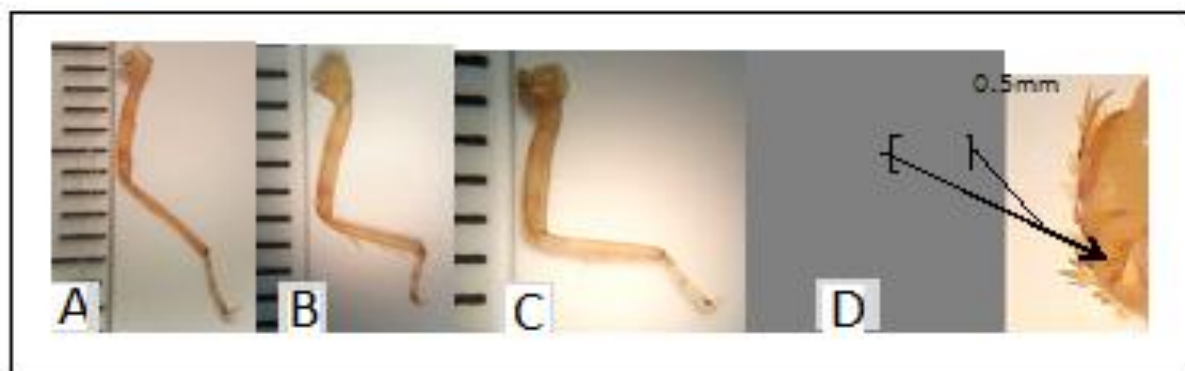
(1) Adults:

Small body greenish yellow or blue dragonfly with black markings, total length between 26- 31mm in male, 23-27mm in female; hind wings between 18-22mm and 17- 21mm in male and female respectively. (Fig. 24.).

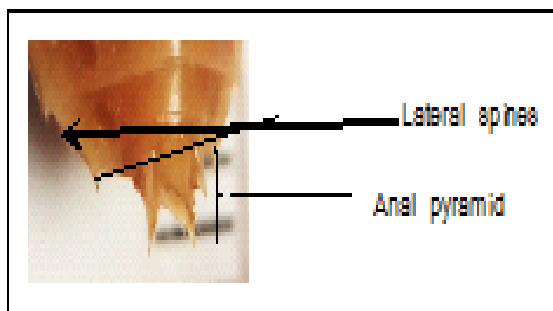
Small helmet shape head, eyes reddish-brown above, pale yellowish or bluish below. (Fig. 25.).



**Fig. 21.** Labium of *Crocothemis servilia* Drury, naiad. a: Dorsal view, b: Ventral view, c: Drawing figure.



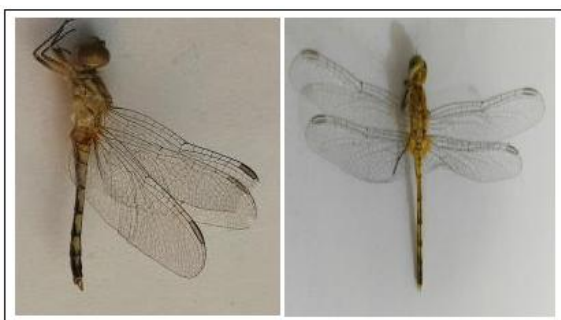
**Fig. 22.** Legs of *Crocothemis servilia* Drury, a: Fore-legs, b: Mid-leg, c: Hind-leg and d: branched spines in the tip of mid- leg tibia.



**Fig. 23.** Lateral spines and anal pyramid of *Crocothemis servilia* Drury, naiad.



**Fig. 25.** Head of *Diplacodes trivialis* Rambur, Male.



**Fig. 24.** Adult males of *Diplacodes trivialis* Rambur.

Thorax pale greenish yellow with brownish black mid-dorsal stripe, speckled with minute dots; the whole thorax pruinated blue in old adults. (Fig. 26. a & b).

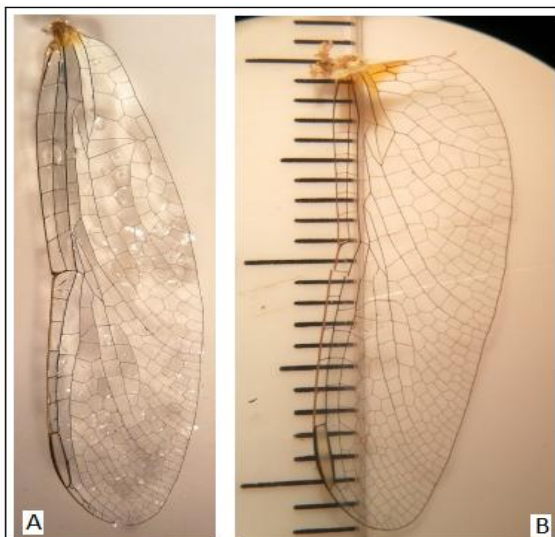
Hyaline wings with blackish gray or brownish venation , only hind wings with small yellow or amber basal spots; distal antennodal incomplete; pterostigma

elongated rectangle pale gray color, dark posterior and anterior veins bordering it. (Fig. 27. a & b).

Legs brownish yellow marked with black strips and spins. (Fig. 28 a, b & c).



**Fig. 26.** Thorax of *Diplacodes trivialis* Rambur, male. a: Overview, b: lateral view.



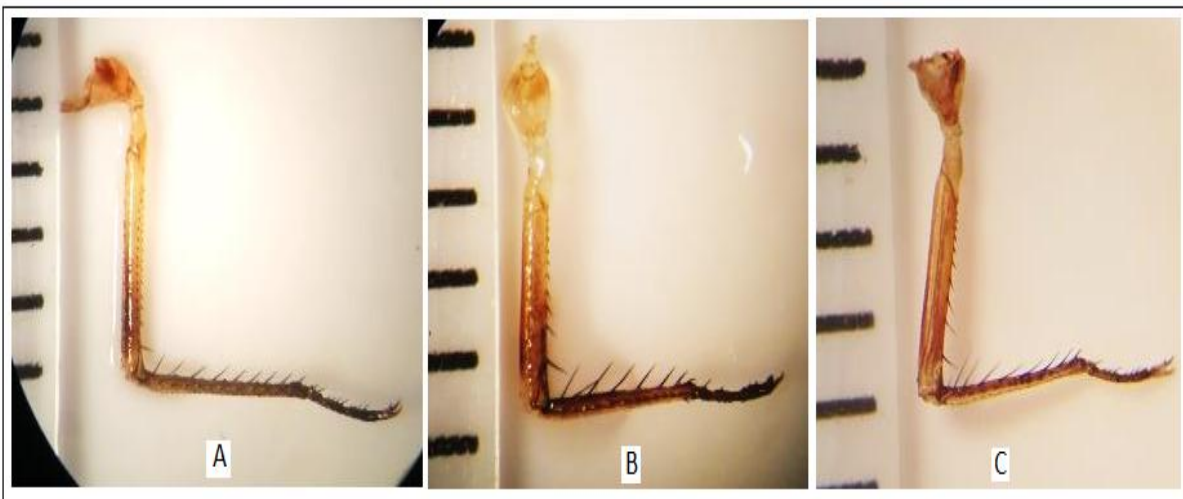
**Fig. 27.** Wings of *Diplacodes trivialis* Rambur, male. a: Forewing, b: Hindwing.

Abdomen often largely black blue in old individuals, segments 1 to 3 greenish yellow, segments 3-9 greenish yellow with variance thickness of mid-dorsal and sub-dorsal black stripes; female very similar, but abdominal markings extend from 8 to 10; accessory genitalia of male not prominent; vulvar scales of female not elongate; anal appendages short, hairy and completely yellowish white. (Fig. 29. a, b, c & d).

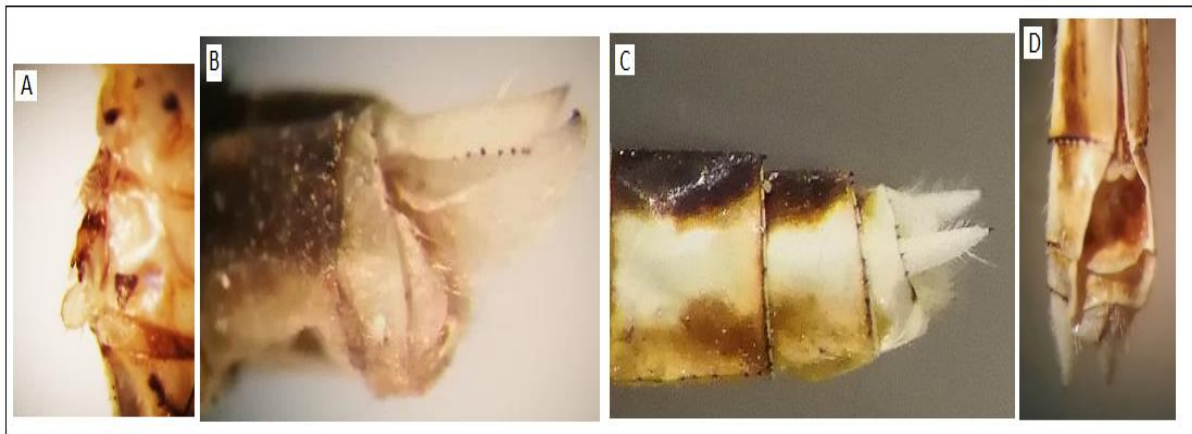
Number of specimens: 5♀ + 4♂ (emergence), 5♀ + 6♂ (catch).

(2) Naiads

Brownish yellow body, total length 11-14mm. (Fig. 30. a & b).



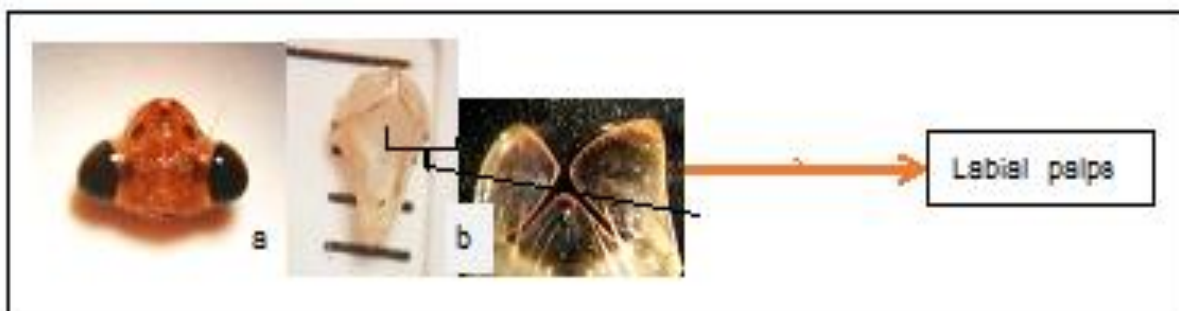
**Fig. 28.** Legs of *Diplacodes trivialis* Rambur, male. a: Fore-leg, b: Mid-leg, c: Hind-leg.



**Fig. 29.** Abdomen appendages of *Diplacodes trivialis* Rambur, a:lateral view of male secondary genitalia; b&c: lateral view of the male and female anal appendages, d: vulvar scales of female.



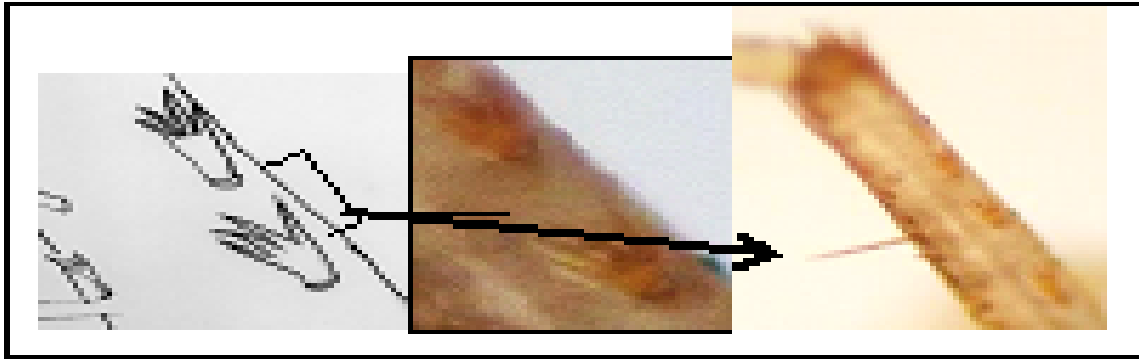
**Fig. 30.** Naiad of *Diplacodes trivialis* Rambur, a: Final instar, b: Exuvia.



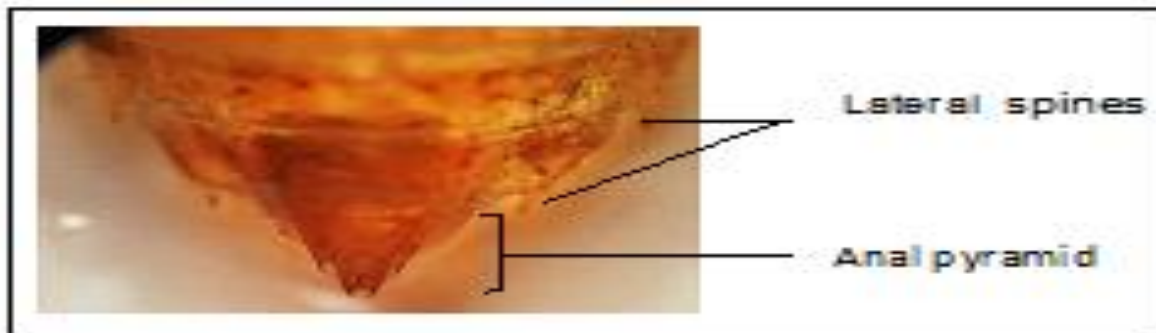
**Fig. 31.** Naiad of *Diplacodes trivialis* Rambur, a: head , b: Labium spoon-shaped and the median lobe of labium without setae.

Semi triangle broadly head, black lateral eyes; typically labium and labial palps spoon-shaped, premental setae 14 + 14, palps setae 10 + 11, no setae on median lobe of labium. (Fig. 31. a & b).

Cylindrical thorax; wing sheaths reach to the middle of abdomen segment 7; legs slender spotted with dark bands, tarsi of hind legs embayed with rows of tridentate setae. (Fig. 32).



**Fig. 32.** Quadridentate setae on hind-legs of *Diplacodes trivialis* Rambur, naiad.



**Fig. 33.** Lateral spines and anal pyramid of *Diplacodes trivialis* Rambur, naiad.

Abdominal oval shape; no mid-dorsal abdominal spines; lateral spines on S8-9 straight and short with lengths equal 1/3 of their segments length; anal pyramid distinctly protruding, tips of epiproct, paraprocts and cerci ends with reddish black spines. (Fig. 33).

### Conclusion

The present study shows for the first time that the three species: *Orthetrum sabina*, *Crocothemis servilia* and *Diplacodes trivialis* which belonging to the family of Libellulidae, are native species of Basrah Governorate-South of Iraq.

Their naiads were collected from the shallow ponds of three different regions, as well as the adults and mating individuals were recorded around the ponds, therefore The specific morphological features that distinguish the adults and naiads of each species were described.

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