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Study of odonates in South Gujarat in relation to their diversity and morphological characteristics

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Abstract

The present experiment was conducted to study the odonates in South Gujarat in relation to their diversity and morphological characteristics (Morphometrics of forewing, hind wing and abdomen), at Department of Agricultural Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) India, during 2014-15. Total 37 species of odonates belongs to 28 genera, from eight families of two suborders were recorded from different localities of South Gujarat. Among 37 species of odonates sub order anisoptera consisting Common Torrent Hawk, *Epophthalmia vittata* Burmeister (Family: Macromiidae) was the largest in relation to size of forewing (53.24 ± 0.13 mm), hind wing (51.32 ± 0.12 mm) and abdomen (58.32 ± 0.14 mm), while Trumpet Tail *Acisoma panorpoides* Rambur (Family: Libellulidae) was the smallest in size with measurement of forewing (19.81 ± 0.18 mm), hind wing (18.11 ± 0.11 mm) and abdomen (15.75 ± 0.20 mm). On the other hand Brown Spread-Wing *Lestes umbrinus* Selys (Family: Lestidae) was the largest considering the size of forewing (28.08 ± 0.04 mm), hind wing (29.68 ± 0.56 mm) and abdomen (32.19 ± 0.09 mm) in sub order zygoptera.

Keywords: Odonates, dragonflies, damselflies, diversity

1. Introduction

Dragonflies and damselflies are amongst the most attractive creatures on earth. Globally 5,952 species of odonates are known and of this 474 species in 142 genera and 18 families exist in India [1]. Gujarat State is on the west coast of India; its southern border encompasses the northern limit of the Western Ghats, a UNESCO World Heritage Site and one of the hot-spots of biological diversity. The Western Ghats are known to support a number of species of Odonata: 176 species have been recorded from the Western Ghats, including 68 species endemic to the region [2]. However, the northern region of the Western Ghats (which includes the states of Gujarat, Maharashtra, and Goa) is under-explored with little documentation of the Odonata [3]. However, very little is known about the odonates of Gujarat reported 48 species of odonates from Gujarat [4]. While, recently 42 species of odonates were reported from Central Gujarat [5]. Few author reported morphological character of odonates [6, 7]. To fill up the gaps in knowledge about different species of odonates with their morphological characters (length of forewing, hind wing and abdomen) in South Gujarat, the present study was done. Dragonflies have been proposed as indicators to assess the ecosystem health of freshwater wetlands [8] and also play an imperative role as prey and predator to maintain the balance of tropic levels of food chain as [9, 10].

2. Objectives

To study the diversity and morphological characteristics of odonates in South Gujarat.

3. Materials and Methods

Study on diversity and morphology of odonates in South Gujarat, India was carried out by the Department of Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat during 2014-15, India. Photographs of species and their behavioural patterns were captured with the help of digital camera (Canon Power shot SX160IS). Live specimens from the field were photographed, so that natural colouration and specific behavioural postures can be documented. Species were identified with the help consulting literature as published photographic catalogue with identification keys etc [11-13, 7, 14-19, 3, 20]. Apart from that few specimens were sent to Dr. S. S. Talmale, Assistant Research Scientist, Zoological Survey of India, at Jabalpur (M. P.) for confirmation of specimens. Simultaneously, collections of

odonates were also done for measurement of their fore wing, hind wing and abdomen with the help of digital vernier calliper.

3.1 Statistical analysis: The experimental data was analysed statistically by using minimum, maximum values and average \pm standard deviation of the length of different body parts.

4. Results

Order: Odonata

Suborder: Anisoptera

I. Family: Aeshnidae

1. Blue-Tailed Green Darner (*Anax guttatus* Burmeister, 1839)

Description: **Wings:** Transparent. Hind wing with large amber yellow patch.

Wing spot: Long narrow and reddish.

Abdomen: The first and second segment was pale green; however the second segment is turquoise blue dorsally. The third segment green with a pair of dorsal triangular turquoise blue spots (Image-1).

Distribution: Navsari and The Dang district.

Habitat: Pond.



Image 1: Blue-Tailed Green Darner, (*A. guttatus*)

2. Brown Darner (*Gynacantha dravida* Lieftinck, 1960)



Image 2: Brown Darner (*G. dravida*)

Description: **Wings:** Transparent and lightly tinted with reddish brown throughout.

Wing spot: Reddish brown.

Abdomen: Pale reddish brown. The third segment is constricted. Apical half of the first segment is black above. Segments 3-8 have dark brown triangular markings above and remaining segments are pale brown (Image-2).

II. Family: Gomphidae

3. Common Clubtail (*Ictinogomphus rapax* Rambur, 1842)

Description: **Wings:** Transparent.

Wing spot: Black. **Abdomen:** Black, marked with yellow. Dorsal stripe and lateral spot on segment 1 and 2 confluent. Basal half of segment 3 is yellow. Segments 4-6 have large dorsal basal spots. Basal half of segments 7 and 8 are yellow. A black wing like projection present in segment 8 (Image-3).

Distribution: Navsari, Surat and the Dang district.

Habitat: Pond, River, Irrigation Canal and Paddy Fields.



Image 3: Common Clubtail (*I. rapax*)

4. Common Hooktail (*Paragomphus lineatus* Selys, 1850)

Description: **Wings:** Transparent with yellowish white costa, which extends up to the wing spot.

Wing spot: Pale reddish brown.

Abdomen: Segments 1-7 have yellow with black apical rings and remaining segments are sandy brown. Eighth and ninth segments have lateral oar like expansions. There is considerable individual variation in the colouration of terminal abdominal segments (Image-4).

Distribution: Navsari, Narmada and Dang district.

Habitat: Mountain Hilly areas and Forest area.



Image 4: Common Hooktail (*P. lineatus*)

III. Family: Libellulidae

5. Black Marsh Trotter (*Tramea limbata* Desjardins, 1832)

Description: **Wings:** Transparent with reddish venation towards the base. The base of hind wing has an extremely variable blackish brown marking. The veins within this black area are reddish.

Wing spot: Dark brown.

Abdomen: Blood red marked with black triangles above (Image-5).



Image-5: Black Marsh Trotter (*T. limbata*)

Distribution: Navsari, Bharuch, Narmada, Surat and the Dang.

Habitat: Pond, River, Paddy fields and Forest area.

6. Black Stream Glider (*Trithemis festiva* Rambur, 1842)

Description: **Wings:** Transparent, with a dark opaque brown mark at the base of hind wing.

Wing spot: Black

Abdomen: Black covered with fine blue pruinescence (Image-6).

Distribution: Navsari and Narmada.

Habitat: Pond.



Image 6: Black Stream Glider (*T. festiva*)

7. Blue Marsh Hawk (*Orthetrum glaucum* Brauer, 1865)

Description: **Wings:** Transparent, with extreme base tinted with dark amber yellow. In old adults, wings are smoky brown.

Wing spot: Dark reddish brown.

Abdomen: Bulged at segments 1-3. Segments 1-8 are pruinose pale blue and the remaining segments black (Image-7).

Distribution: The Dangs.

Habitat: River and Forest area.



Image-7: Blue Marsh Hawk (*O. Glaucum*)

8. Brown Dusk Hawk (*Zyxomma petiolatum* Rambur, 1842)

Description: **Wings:** Transparent with dark brown tips.

Wing spot: Dark and blackish.

Abdomen: Dark reddish brown with black rings at the end of each segment. Abdomen is swollen from segments 1-3, then abruptly contracted and slim to the end (Image-8).



Image 8: Brown Dusk Hawk (*Z. Petiolatum*)

Distribution: Navsari, Tapi and the Dangs. **Habitat:** River and Forest area.

9. Coral-Tailed Cloud Wing (*Tholymis tillarga* Fabricius, 1798)

Description: **Wings:** Transparent with a broad fan shaped golden brown patch on the hind wing. This is bordered by a milky white patch.

Wing spot: Reddish brown

Abdomen: Bright rusty-red (Image-9).

Distribution: Navsari.

Habitat: Pond.



Image 9: Coral-Tailed Cloud Wing (*T. tillarga*)



Image 11: Crimson-Tailed Marsh Hawk (*O. Pruinosum*)

10. Crimson Marsh Glider (*Trithemis aurora* Burmeister, 1839)

Description: Wings: Transparent with crimson venation. Base of the wings has a broad amber patch.

Wing spot: Dark reddish brown.

Abdomen: Crimson with a violet tinge. The base of abdomen is swollen (Image-10).



Image 10: Crimson Marsh Glider (*T. aurora*)

Distribution: Navsari, the Dangs and Valsad.

Habitat: Pond and Irrigation canals.

11. Crimson-Tailed Marsh Hawk (*Orthetrum pruinosum* Rambur, 1842)

Description: Wings: Transparent. In old adults, it is pale brown towards the tip. On the fore and hind wings, the basal area is marked with reddish brown.

Wing spot: Reddish brown.

Abdomen: Bright red. In old adults it is purplish due to pruinescence (Image-11).

Distribution: Navsari, Surat, the Dangs and Valsad.

Habitat: Pond and Irrigation canals.

12. Ditch Jewel (*Brachythemis contaminata* Fabricius, 1793)

Description: Wings: Transparent with reddish venation. A Broad bright orange patch extending from wing base to wing spot is present in forewing and hind wing.

Wing spot: Rusty.

Abdomen: Bright red (Image-12).



Image 12: Ditch Jewel (*B. contaminata*)

Distribution: Navsari, Bharuch, Tapi, Narmada, Surat, the Dangs and Valsad.

Habitat: Pond, Coastal Belts, River, Irrigation canals, Sewage and Industrial Effluents, Paddy Fields and Mountain & Hilly areas.

13. Granite Ghost (*Bradinopyga geminate* Rambur, 1842)

Description: Wings: Transparent.

Wing spot: Black in the center and white at both the ends.

Abdomen: Is colored very similar to the thorax (Image-12).

Distribution: Navsari, Narmada, Surat, the Dangs and Valsad.

Habitat: Pond, River, Irrigation canals, and Mountain & Hilly areas



Image 13: Granite Ghost (*B. geminate*)



Image-15: Green Marsh Hawk (*O. Sabina*)

14. Greater Crimson Glider (*Urothemis signata* Rambur, 1842)

Description: Wings: Transparent with crimson reticulation. Extreme base of fore wings have a golden amber yellow spot. The amber colored spot on the base of hind wing is broader. The network of venation over the amber spot is bright crimson.

Wing spot: Ochreous above, pale yellowish below (Image-14).

Distribution: Navsari, Bharuch and Surat.

Habitat: Pond, Irrigation canals and Forest area.



Image 14: Greater Crimson Glider (*U. signata*)

15. Green Marsh Hawk (*Orthetrum sabina* Drury, 1770)

Description: Wings: Transparent; inner edge of hind wing tinted with yellow.

Wing spot: Black with reddish brown spot.

Abdomen: The segments 1-3 are green with broad black rings and distinctly swollen at the base (Image-15).

Distribution: Navsari, Bharuch, Tapi, Narmada, Surat, the Dangs and Valsad.

Habitat: Pond, River, Irrigation canals, Sewage and Industrial Effluents, Paddy Fields and Mountain & Hilly areas and Forest area.

16. Ground Skimmer (*Diplacodes trivialis* Rambur, 1842)

Description: Wings: Transparent.

Wing spot: Dark grey to black.

Abdomen: The segments 1- 7 greenish yellow with mid-dorsal and sub dorsal black stripes. Remaining segments black. In old individuals all markings are obscured by fine blue pruinescence (Image-16).



Image 16: Ground Skimmer (*D. trivialis*)

Distribution: Navsari, Bharuch, Tapi, Narmada, Surat, the Dangs and Valsad.

Habitat: Pond, River, Irrigation canals, Sewage and Industrial Effluents, Paddy Fields and Mountain & Hilly areas and Forest area.

17. Little Blue Marsh Hawk (*Brachydiplax sobrina* Rambur, 1842)

Description: Wings: Transparent with brown base.

Wing spot: Yellow with black border.

Abdomen: Black with bluish white dorsal pruinescence on segments 1-7 and remaining segments are fully black (Image-17).

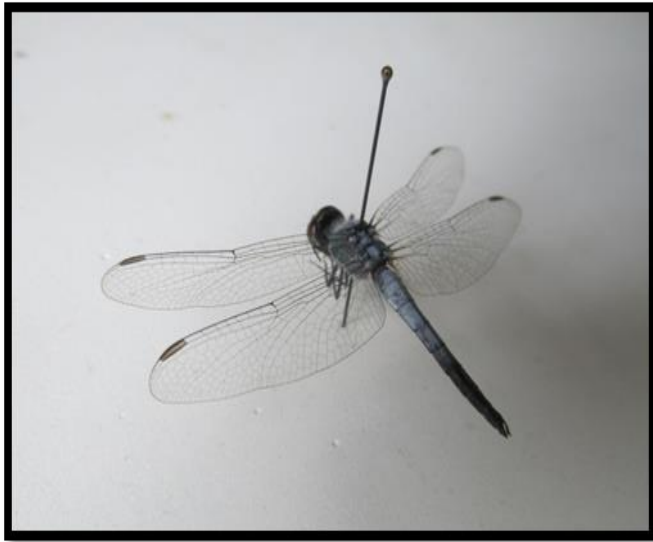


Image 17: Little Blue Marsh Hawk (*B. sobrina*)

Distribution: Navsari, Narmada and Surat.
Habitat: River and Paddy Fields.

18. Long-legged Marsh Glider (*Trithemis pallidinervis* Kirby, 1889)

Description: **Wings:** Transparent with reddish venation. The forewings have amber colored basal markings. The wings have a golden sheen when viewed from certain angle.

Wing spot: Black with creamy white ends.

Abdomen: Bright yellow with black median and lateral stripes. These stripes are confluent at the end of each abdominal segment to enclose a wedge shaped yellow spot (Image-18).



Image 18: Long-legged Marsh Glider (*T. pallidinervis*)

Distribution: Navsari, Bharuch, Surat, the Dangs and Valsad.
Habitat: Pond, River, Irrigation canals and Paddy Fields.

19. Pied Paddy Skimmer (*Neurothemis tullia* Drury, 1773)

Description: **Wings:** Basal half is opaque blue black which is bordered by a milky white patch towards the tip. The wing tips are transparent.

Wing spot: Dull brown.

Abdomen: Black with a broad mid dorsal creamy white stripe on the upper side (Image-19).

Distribution: Navsari, Narmada, Surat and the Dangs.
Habitat: Pond and Paddy Fields



Image 19: Pied Paddy Skimmer (*N. tullia*)

20. Rufous Marsh Glider (*Rhodothemis rufa* Rambur, 1842)

Description: Large rusty dragonfly with transparent wings.

Wings: Transparent amber yellow spot at the base of fore and hind wing.

Wing spot: Light ochreous.

Abdomen: Brilliant scarlet red (Image-20).



Image 20: Rufous Marsh Glider (*R. rufa*)

Distribution: Navsari. **Habitat:** Pond and Forest area.

21. Red Marsh Trotter (*Tramea basilaris* Palisot de Beauvois, 1805)

Description: A medium sized red or yellow dragonfly with brown and yellow hind wing patches.

Wings: Transparent. The hindwing base has a reddish brown marking surrounded by golden amber at the base. The Veins in this area are bright golden yellow.

Wing spot: Bright ochreous.

Abdomen: Bright brick-red with median black triangular markings. The black rings of segments 4-7 interrupted dorsally and segment 8 black. The segments 9 and 10 are black with small spots on sides (Image-21).



Image 21: Red Marsh Trotter (*T. basilaris*)

Distribution: Navsari and Narmada.
Habitat: Pond and Forest area.

22. Ruddy Marsh Skimmer (*Crocothemis servilia* Drury, 1770)

Description: A medium sized blood red or reddish yellow dragonfly with amber colored patch at wing base.
Wings: Transparent base marked with rich amber.
Wing spot: Dark brown.
Abdomen: Blood red (Image-22).



Image 22: Ruddy Marsh Skimmer (*C. servilia*)

Distribution: Navsari, Bharuch, Tapi, Narmada, Surat, the Dangs and Valsad.
Habitat: Pond, Coastal Belts, Irrigation canals, Sewage and Industrial Effluents, Paddy Fields and Forest area.

23. Tricoloured Marsh Hawk (*Orthetrum luzonicum* Brauer, 1868)

Description: A medium sized dragonfly with blue, yellow and brown markings.
Wings: Transparent.
Wing spot: Yellowish.
Abdomen: Is pruinosed pale azure blue in colour and dorsoventrally dilated at base (Image-23).



Image 23: Tricoloured Marsh Hawk (*O. Luzonicum*)

Distribution: Navsari, the Dangs and Valsad.
Habitat: Pond, Irrigation canals and Paddy Fields.

24. Trumpet Tail (*Acisoma panorpoides* Rambur, 1842)

Description: A small blue dragonfly with bulged abdomen.
Wings: Transparent.
Wing spot: Pale yellow.
Abdomen: Azure blue in colors. Abdomen from segments 1-5 widely dilated and abruptly slim and cylindrical from segments 6-10. The underside of segments 1-5 have broad black border. Dorsal black stripe broadens at apical borders of segments. The segments 3-5 are with large lateral spots. The segments 6-10 are black; however 6th and 7th segments have a large spot of azure blue (Image-24).
Distribution: Navsari, Bharuch, Tapi, Narmada, Surat, the Dangs and Valsad.
Habitat: Pond and Irrigation canals.



Image 24: Trumpet Tail (*A. panorpoides*)

25. Wandering Glider (*Pantala flavescens* Fabricius, 1798).

Description: A medium sized dragonfly with rusty thorax and yellow abdomen.
Wings: Transparent and base of hind wing amber yellow.
Wing spot: Bright reddish brown.
Abdomen: Bright reddish brown and is tinted with brick red dorsally. The segments 8-10 have black spots above. (Image-25).
Distribution: Navsari, Bharuch, Tapi, Narmada, Surat, the Dangs and Valsad.
Habitat: Pond, Coastal Belts, River, Irrigation canals, Sewage and Industrial Effluents, Paddy Fields and Mountain & Hilly areas and Forest area.



Image 25: Wandering Glider (*P. flavescens*)



Image 27: Yellow-Tailed Ashy Skimmer (*P. congener*)

26. Common Picture Wing (*Rhyothemis variegata* Linnaeus, 1763)

Description: A medium sized dragonfly with butterfly like yellow and brown wings.

Wings: The forewing is transparent and golden yellow. The wing tip, leading edge and centre of the wing are marked with deep coffee brown spots. The hind wing also has similar spots; however the central spot is absent. Moreover, the wing base is marked with an irregular brown patch. The trailing edge of the hind wing has a characteristic 'W' shaped coffee brown mark.

Wing spot: Black.

Abdomen: Black (Image-26).

Distribution: Navsari, Bharuch, Surat, and Valsad.

Habitat: Pond, River, Irrigation canals and Paddy Fields.



Image 25: Common Picture Wing (*R. variegata*)

27. Yellow-Tailed Ashy Skimmer (*Potamarcha congener* Rambur, 1842)

Description: A medium sized dragonfly with bluish black thorax and yellow tail with black markings.

Wings: Transparent and tipped with brown.

Wing spot: Dark reddish brown.

Abdomen: Basal segments covered with bluish pruinescence. The segments 1-8 with medial and lateral yellow stripe bordered with black (Image-27).

Distribution: Tapi and Valsad.

Habitat: River, Forest area.

IV. Family: Macromiidae

28. Common Torrent Hawk (*Epophthalmia vittata* Burmeister, 1839)

Description: Dragonflies of very large size and robust build, coloured ochreous, dark reddish-brown or blackish, with cupreous dark green, and marked with bright yellow spots or stripes (Image-28).

Distribution: Tapi Narmada and Surat.

Habitat: Pond



Image 28: Common Torrent Hawk (*E. vittata*)

Suborder: Zygoptera

I. Family: Coenagrionidae

29. Blue Grass Dartlet (*Pseudagrion microcephalum* Rambur, 1842)

Description: A small blue damselfly with broad blue medial thoracic stripe

Wings: Transparent.

Wing spot: Grey.

Abdomen: Azure blue. Second segment with a goblet shaped black mark on the upper side. Segment 3-7 has broad black markings above. Segment 8 has a thick ring towards the end and the 9th segment is unmarked. A broad saddle shaped black mark is present on the upper side of 10th segment (Image-29).



Image 29: Blue Grass Dartlet (*P. microcephalum*)

Distribution: Navsari and Narmada.

Habitat: Pond, River, Irrigation Canals and Paddy Fields.

30. Coromandel Marsh Dart (*Ceragrion coromandelianum* Fabricius, 1798)

Description: Medium sized pale green damselfly with bright yellow (male) or pale green tail (female).

Wings: Transparent.

Wing spot: Golden yellow.

Abdomen: Uniform yellow (Image-30).



Image 30: Coromandel Marsh Dart (*C. coromandelianum*)

Distribution: Navsari Bharuch, Tapi, Narmada, Surat, the Dangs and Valsad.

Habitat: Pond, Coastal Belts, River, Irrigation Canals, Paddy Fields and Forest area.

31. Golden Dartlet (*Ischnura aurora* Brauer, 1865)

Description: A small apple green damselfly with black thoracic stripes and blue tipped yellow tail.

Wings: Transparent.

Wing spot: The wing spots are different in forewing and hind wing. It is rose-red in forewings and uniform pale grey in hind wings

Abdomen: Bright yellow. The second and seventh segment has upper narrow and broad black marks respectively. Segments 8-10 are entirely azure blue. The 10th segment has an upper black spot (Image-31).



Image 31: Golden Dartlet (*I. aurora*)

Distribution: Navsari, Bharuch, Tapi, Narmada, Surat, the Dangs and Valsad.

Habitat: Pond, River, Irrigation Canals and Paddy Fields

32. Pigmy Dartlet (*Agriocnemis pygmaea* Rambur, 1842)

Description: A small apple green damselfly with black thoracic stripes and orange coloured terminal abdominal segments

Wings: Transparent.

Wing spot: Pale yellow in forewings and black in hind wings.

Abdomen: Broadly black above Segments 1- 6 with ground colour pale apple green. Terminal segments brick red (Image-32).

Distribution: Navsari, Tapi, Surat and the Dangs.

Habitat: Pond, River, and Paddy Fields.



Image 32: Pigmy Dartlet (*A. pygmaea*)

33. Senegal Golden Dartlet (*Ischnura senegalensis* Rambur, 1842)

Description: A small pale green damselfly with black and yellow thoracic stripes. Abdomen is yellow and has basal and terminal blue spots.

Wings: Transparent.

Wing spot: Diamond shaped and black in forewing and dull white in the hind wing.

Abdomen: The first segment is pale green and the second is azure blue with steel blue black on upper side. The segments 3-7 are bright yellow with black upper side (Image-33).



Image 33: Senegal Golden Dartlet (*I. senegalensis*)



Image 35: Brown Spread-Wing (*L. umbrinus*)

Distribution: Navsari, Bharuch, Tapi, Narmada, Surat, the Dangs and Valsad.

Habitat: Pond, River, Irrigation canal Paddy Fields and Forest area.

34. Three Striped Blue Dart (*Pseudagrion decorum* Rambur, 1842)

Wings: hyaline

Wing spot: diamond-shaped.

Abdomen: pale azure blue, except segment 8 to 10, which are deep azure blue, and segment 2, bluish-green on dorsum (Image-34).

Distribution: Navsari, Bharuch, Narmada and the Dangs.

Habitat: Pond, River, Irrigation canal and Paddy Fields.



Image 34: Three Striped Blue Dart (*P. decorum*)

II. Family: Lestidae

35. Brown Spread-Wing (*Lestes umbrinus* Selys, 1891)

Description: Pale yellowish or reddish brown in colour, laterally without marking; the intersegmental suture is dark brown.

Wings: Palely enfumed, hyaline.

Wing spot: Elongate pale brown.

Abdomen: Reddish-brown, the dorsum darker brown but paler in some specimens; the intersegmental sutures dark brown (Image-35).

Distribution: Navsari and Tapi.

Habitat: Irrigation canal and Forest area.

III. Family: Platynemididae

36. Yellow Bush Dart (*Copera marginipes* Rambur, 1842)

Description: A black band extends from eye to eye.

Wings: Transparent

Legs: Bright yellowish orange.

Wing spot: Brown.

Abdomen: Bronzed black above. Segments 3-6 with a pale stripe along the side and a narrow pale greenish white ring at the end of each segment (Image-36).



Image 36: Yellow Bush Dart (*C. marginipes*)

IV. Family: Protoneuridae

37. Black-winged Bamboo Tail (*Disparoneura quadrimaculata* Rambur, 1842)

Description: A medium sized brick red damselfly with black banded wing.

Wings: Transparent with broad blackish brown bands in the centre.

Wing spot: Rusty brown.

Abdomen: Brick red. The first segment is black above and the second segment has a large black ring above. The base of segments 3-6 has a pair of small whitish spots above.



Image 37: Black-winged Bamboo Tail (*D. quadrimaculata*)

A narrow pale stripe on each side and a broad black ring towards the end is present. The segments 7-9 are black and the 10th segment is reddish (Image-37).

Total 37 species of odonates belongs to 28 genera, from eight families of two suborders were recorded from different localities of South Gujarat (Table 1). Among 37 species of odonates sub order anisoptera consisting Common Torrent

Hawk, *Epophthalmia vittata* Burmeister (Family: Macromiidae) was largest in relation to forewing (53.24±0.13mm), hind wing (51.32±0.12mm) and abdomen (58.32±0.14mm) while in contrast of Trumpet Tail *Acisoma panorpoides* Rambur (Family: Libellulidae) which shows forewing (19.81±0.18mm), hind wing (18.11±0.11mm) and abdomen (15.75±0.20mm) was smallest in size. On other hand Brown Spread-Wing *Lestes umbrinus* Selys (Family: Lestidae) shows largest in size in context with forewing (28.08±0.04mm), hind wing (29.68±0.56mm) and abdomen (32.19±0.09mm) in sub order zygoptera (Table 2).

Table 1: Species distribution of odonates in South Gujarat

Order	Sub order	Family	Genus	Species
Odonata	Anisoptera	Libellulidae	16	23
		Aeshnidae	2	2
		Gomphidae	2	2
		Macromiidae	1	1
		Total	21	28
	Zygoptera	Coenagrionidae	4	6
		Platycnemididae	1	1
		Protoneuridae	1	1
		Lestidae	1	1
		Total	7	9
Grand total	2	8	28	37

Table 2: Morphometric variation of different odonates

Sr. No	Species of Odonates	Abdomen (mm)			Forewing (mm)			Hind wing (mm)		
		Min.	Max.	Avg. ± SD	Min.	Max.	Avg. ± SD	Min.	Max.	Avg. ± SD
1	Black Marsh Trotter	33.23	33.88	33.44±0.26	47.14	47.50	47.25±0.14	44.10	44.40	44.20±0.12
2	Black Stream Glider	20.12	20.30	20.23±0.07	28.23	28.56	28.47±0.14	27.40	27.53	27.47±0.05
3	Black-winged Bambootail	29.04	29.10	29.07±0.03	20.70	20.79	20.75±0.03	20.05	20.09	20.06±0.02
4	Blue Grass Dartlet	17.20	17.84	17.53±0.31	12.10	12.12	12.11±0.01	11.20	11.56	11.42±0.16
5	Blue Marsh Hawk	29.23	29.98	29.43±0.32	35.21	35.78	35.44±0.30	35.23	35.66	35.52±0.19
6	Blue-tailed Green Darner	54.00	54.96	54.21±0.42	50.02	52.05	51.02±0.70	50.00	50.17	50.05±0.07
7	Brown Darner	52.33*			45.02			45.30		
8	Brown Dusk Hawk	33.02	35.00	34.23±0.74	30.50	31.60	31.26±0.44	30.02	30.85	30.36±0.33
9	Brown Spread-Wing	32.10	32.32	32.19±0.09	28.02	28.13	28.08±0.04	29.02	30.23	29.68±0.56
10	Common Clubtail	49.02	49.85	49.66±0.36	42.13	42.45	42.32±0.14	40.22	40.24	40.23±0.01
11	Common Hooktail	35.05	35.50	35.20±0.18	25.00	26.70	26.08±0.64	24.06	24.69	24.38±0.28
12	Common Picture Wing	21.03	30.06	22.95±3.98	32.08	32.31	32.20±0.10	30.05	30.58	30.27±0.25
13	Common Torrent Hawk	58.16	58.48	58.32±0.14	53.15	53.45	53.24±0.13	51.20	51.50	51.32±0.12
14	Coral-Tailed Cloud Wing	28.87*			35.26			33.66		
15	Coromandel Marsh Dart	26.04	26.16	26.10±0.10	20.03	20.75	20.03±0.30	19.02	19.50	19.30±0.20
16	Crimson Marsh Glider	20.10	20.50	20.21±0.17	25.12	25.89	25.35±0.28	24.10	24.37	24.23±0.31
17	Crimson- Tailed Marsh Hawk	28.14	28.56	28.35±0.17	36.23	36.86	36.57±0.26	35.21	35.45	35.31±0.11
18	Ditch Jewel	19.20	19.26	19.22±0.02	24.12	24.82	24.41±0.36	24.12	24.23	24.20±0.05
19	Golden Dartlet	18.02	18.70	18.23±0.27	12.05	12.34	12.24±0.12	11.20	11.32	11.29±0.05
20	Granite Ghost	25.76	25.95	25.89±0.07	33.12	33.58	33.31±0.18	31.01	31.65	31.25±0.24
21	Greater Crimson Glider	27.01	27.30	27.09±0.10	37.45	37.65	37.59±0.09	34.40	34.46	34.43±0.02
22	Green Marsh Hawk	36.12	36.36	36.23±0.12	34.01	34.40	34.19±0.14	32.02	32.80	32.19±0.34
23	Ground Skimmer	22.12	22.53	22.27±0.16	24.10	24.95	24.44±0.40	23.10	23.23	23.18±0.05
24	Little Blue Marsh Hawk	20.13	20.46	20.30±0.20	26.03	26.15	26.01±0.10	25.13	25.16	25.20±0.00
25	Long-legged Marsh Glider	25.13	25.23	25.19±0.04	35.22	35.78	35.37±0.23	35.02	35.20	35.07±0.08
26	Pied Paddy Skimmer	17.04	17.29	17.10±0.10	20.23	20.66	20.50±0.20	20.00	20.13	20.00±0.10
27	Pigmy Dartlet	22.01	23.00	22.21±0.44	17.02	17.05	17.03±0.01	15.21	15.54	15.41±0.12
28	Red Marsh Trotter	30.55	30.72	30.65±0.06	43.22	43.84	43.50±0.22	42.26	42.45	42.34±0.08
29	Ruddy Marsh Skimmer	26.05	26.60	26.17±0.24	32.22	32.67	32.46±0.20	30.45	30.79	30.63±0.13
30	Rufous Marsh Glider	26.23	29.13	27.29±1.27	30.12	32.20	31.37±1.05	32.12	32.32	32.18±0.09
31	Senegal Golden Dartlet	22.46	22.87	22.65±0.18	15.20	15.87	15.57±0.27	14.45	14.91	14.68±0.21
32	Three Striped Blue Dart	27.35	27.94	27.67±0.25	19.08	19.32	19.25±0.10	18.14	18.44	18.31±0.14
33	Tricoloured Marsh Hawk	30.23	30.92	30.43±0.28	33.02	33.16	33.11±0.06	32.02	32.32	32.20±0.11
34	Trumpet Tail	15.55	15.97	15.75±0.20	19.50	19.94	19.81±0.18	18.03	18.30	18.11±0.11
35	Wandering Glider	29.30	31.03	29.99±0.67	41.20	44.07	42.13±1.15	40.03	41.92	40.86±0.80
36	Yellow Bush Dart	30.25	30.32	30.29±0.03	19.46	19.77	19.59±0.12	18.40	18.52	18.45±0.05
37	Yellow-Tailed Ashy Skimmer	29.40	29.60	29.47±0.09	36.02	36.40	36.16±0.19	34.20	34.93	34.50±0.27

* Data showing is the measurement of only one individual of the odonate

5. Discussion

The present findings are in agreement with consulting the literature published by Fraser ^[11, 12, 13], Subramanian ^[15] and Emiliyamma *et al.* ^[7] to ascertain the above results, similarly Nair ^[17] has published Dragonflies and Damselflies of Orissa and Eastern India with colourful photographs and marks of identification for odonates. Rohmare *et al.* ^[20] published photographic catalogue with identification keys at Central Gujarat. However, 55 species belonging to two suborders and 37 genera under eight families were recorded from South Gujarat ^[21].

6. Conclusion

From the above mentioned results, it becomes clear that South Gujarat consisting huge diversity of odonates which gives 37 species among them sub order anisoptera consisting Common Torrent Hawk, *E. vittata* (Family: Macromiidae) was largest in size, while Trumpet Tail *A. panorpoides* (Family: Libellulidae) was smallest in size, other hand Brown Spread-Wing *L. umbrinus* (Family: Lestidae) was largest in size with measurement of forewing, hind wing and abdomen in sub order zygoptera.

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