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Odonata assemblage at a small marshy land in Khadki (Pune city) – An assessment

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Abstract

A total of 17 species of Odonata belonging to 11 genera under 4 families and spread over 2 suborders have been collected from a very small area of 350 m² in Khadki of Pune city during a study conducted from April 2012 to January 2014. Though the post- monsoon abundance of Odonata was high but Odonata diversity was greater in pre-monsoon period when the food and nutrition were abundant. In the present study it is found that Libellulidae is the richest family with maximum number of species (10 species) which is followed by family Coenagrionidae (4 species), Platycnemidae (2 species) and Ashnidae (1 species). The area therefore can be considered as a species rich diversity site in a purely urban backdrop.

Keywords: Assemblage, Diversity, Marshy land, Odonata.

1. Introduction

Being a flagship group, Odonates are often the top predators in aquatic ecosystem. Odonates can be found associated with just about every type of freshwater habitat in nature [1]. Though most of the species are highly specific to a habitat, some make use of man-made water bodies and have adapted to urban areas. Their sensitivity to environmental conditions makes them an excellent biological indicator of environmental changes [2, 3, 4]. Odonata occupy almost all kinds of habitat ranging from permanent running waters and lakes to small temporary rain pools. The adults are conspicuous, easy to record, taxonomically well studied and susceptible to habitat changes induced by human activities [2].

The order Odonata is quite big with worldwide distribution of 5,952 species, of which 474 species in 142 genera and 18 families exist in India [5]. The Western Ghats of India is highly diverse which alone records around 174 species comprising 56 endemics [6]. In recent years numerous literatures have been published regarding taxonomic information on Odonata of India as well as of the Western Ghats, which comprise of [7-18]. Recently, Kulkarni and Subramanian [19] have provided an account of Odonates of Mula-Mutha river basins of Maharashtra.

The objective of the present study is to explore the diversity and abundance of Odonata assemblages in a small and disturbed habitat, in middle of a highly urbanized city like Pune. This will in turn help to evaluate the essential ecological factors which support the Odonata diversity and richness.

2. Materials and Method

Pune city (Maharashtra, India) is located 560 m above sea level on the western margin of the Deccan plateau. The study area is a small marshy land (18°33'22.68" N latitude and 73°49'54.7574" E longitude) which is about 350 sq. m in area adjacent to a water tank located in Khadki Cantonment, Pune, Maharashtra (Fig-1). The study area is under military occupancy and adjacent to a construction site. Continuous leakage of water from the water pipes makes the land marshy and swampy throughout the year.

The findings presented here are based on field surveys and investigations carried out during the months of April, May, September, October and January of the year 2012-2014 (Pre-monsoon, Post-monsoon and Winter respectively) by random sampling method. Odonates were collected using insects net by sweeping method. Collected specimens were killed using chloroform in killing bottles. The killed specimens were then properly stretched and pinned and finally placed inside a drying chamber. After they were completely dried, specimens with proper labels containing their scientific names, details of specimen with date of collection were carefully placed in wooden boxes.

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In order to protect the specimens from fungus and insects, naphthalene balls were placed inside these boxes. Only a few representative examples of different species were collected and preserved dry. Rests were identified in the field itself. The number of individuals observed was noted down along with time and date in field notebook. The collected specimens were identified with the help of identification keys provided by Fraser [20, 21, 22] and Subramanian [23]. We followed Odonata taxonomy and binomial names by Subramanian [5]. The diagnostic characters for the identification are followed after Fraser [20, 21, 22] and Subramanian [5]. The specimens were identified, registered and deposited at National Zoological Collection (NZC) of Zoological Survey of India (ZSI), Western Regional Centre (WRC), Pune. Photographs of some of the specimens have been provided. The Odonates were categorized (as Very common, Common, Rare) according to their abundance in the study area [24].

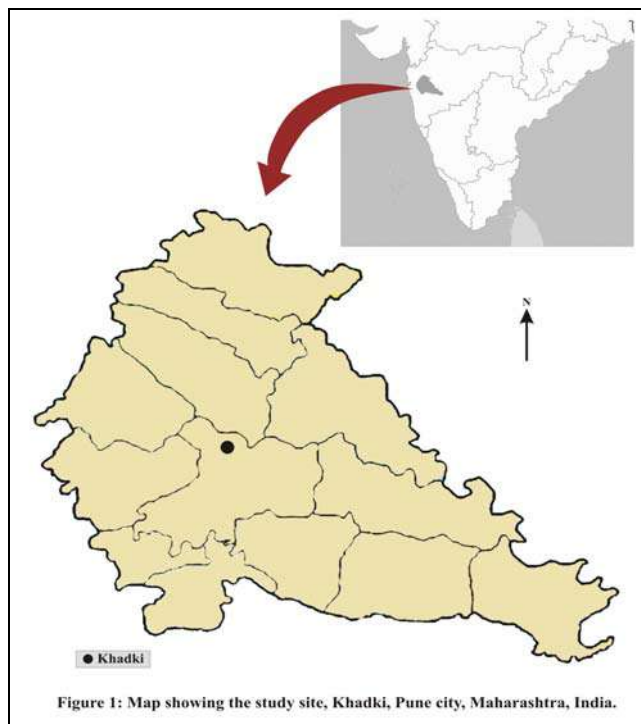


Figure 1: Map showing the study site, Khadki, Pune city, Maharashtra, India.

Fig 1: Map showing the study site, Khadki, Pune city, Maharashtra, India.

3. Results

A total number of 124 Odonates were observed out of which 27 individuals were collected. The rest were studied and identified in the field. The present study reveals a total of 17 species of Odonates pertaining to 11 genera, 4 families under two suborders. It has been revealed that Libellulidae, being the most dominant family was represented by 10 species (94 individuals) followed by Coenagrionidae represented by 4 species (18 individuals), Platynemidae by 2 species (5 individuals) and Aeshnidae by one species (2 examples).

Systematic Account

Order: Odonata
Suborder: Zygoptera
Family: Coenagrionidae
Subfamily: Agriocnemidinae
Genus: Agriocnemis Selys, 1877

1. *Agriocnemis femina* (Brauer, 1868)

1868. *Ischnura femina* Brauer, *Verh. Zool. Bot. Ges. Wien*,

Vol. xviii, p. 554.

1933. *Agriocnemis femina*, Fraser, *Fauna Brit India, Odonata*, 1: 402 – 404.

Material examined: 1♂, 18.iv.2012, ZSI, WRC - Ent.4/2159

Diagnostic Characters: Size: Male: Abdomen 16-17 mm; Hindwing 11 mm; Female: Abdomen 18 mm; Hindwing 11 mm

Male: Head: Vertex and occiput black with azure blue postocular spots. Thorax black on dorsum, marked with pale blue antehumeral stripes, laterally apple-green paling below to yellow. Legs pale yellow with femora black on extensor surface. Wings hyaline with yellow pterostigma which is slightly darker at the center. Wing spots are similar in all the wings. Abdomen: ground color of segments 1-6 blue or pale green, segments 7-10 bright chrome- yellow, marked with black as follows: segment 1 with bright dorsal spot, sides' blue or bluish green, segment 2 with a thistle shaped mark on dorsum, segment 3-7 with broad dorsal stripe, 8 with fine mid-dorsal black bright stripe and 9-10 unmarked. Anal appendages yellow; Female: shows a series of color variations according to the ages. Head: in teneral female occiput cherry-red, post ocular spots pale lilaceous and in adults occiput is dark blood red and blue post ocular spots. Thorax in adult female black on dorsum, sides pinkish-brown with a small black spot at the upper end to the postero-lateral suture. In subadults, thorax cherry-red with a broad black band on dorsum. Abdomen: in subadults cherry red from segment 1-6, broad dorsal stripe on segment 7-10. In adult female abdomen with ground color blue from segment 1-6 changing to reddish on segment 7 or ochreous marked broadly with black.

Distribution

India: - Assam, Maharashtra (Pune), West Bengal, Andaman Islands.

Elsewhere: - Annam; China; Indonesia; Lombok; Myanmar; Philippines; Singapore and Sri Lanka.

Remarks: Not very common in the study area.

2. *Agriocnemis pygmaea* (Rambur, 1842)

1842. *Agrion pygmaea*, Rambur, *Ins. Neurop.* 278.

1933. *Agriocnemis pygmaea*, Fraser, *Fauna Brit. India, Odonata*, 1: 398 – 401.

1988. *Agriocnemis pygmaea*, Prasad and Ghosh, *Rec. zool. Surv. India*. 85 (2): 203.

Material examined: 2♀, 18.iv.2012, ZSI, WRC - Ent.4/2158.

Diagnostic Characters: Size: Male: Abdomen 16-17 mm; Hindwing 9.5-10 mm; Female: Abdomen 18 mm; Hind wing 11-12 mm

Male: Head: Vertex black, frons and postocular spots green. Eyes black above pale apple green below. Thorax black above with apple green antehumeral stripes, laterally apple green paling to yellow. A small black spot on upper part of the posterior lateral side. Leg yellow with outer surface of the femora black. Wings transparent with pale yellow pterostigma in forewing and black in hind wing. Abdomen: broadly black above. Segments 1-6 with ground color pale apple green and terminal segments brick red; female: Shows range of color variations. In red form, the head, thorax and abdomen are dark brick red in color. In subadult forms, broad black stripe on

dorsum and pale blue antehumeral stripes. Legs similar to male except the tibia which is black on flexor surface. Wings transparent with yellow pterostigma in all wings. Abdomen: in subadult apple-green, in adults ground colors of segments 2-6 bright yellow.

Distribution

India: Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Manipur, Maharashtra, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal.

Elsewhere: Afghanistan, Australia, Bangladesh, Cambodia, China, Hong-Kong, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Seychelles, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam.

Remarks

The species is found both in natural and man-made wetland habitat.

Subfamily: Ischnurinae

Genus: *Ischnura* Charpentier, 1840

3. *Ischnura aurora* (Brauer, 1856)

1858. *Agrion delicatum* Hagen, *Verh. Zool-bot. Ges. Wien.* 8: 479.

1865. *Ischnura aurora*, Brauer, *Verh. Zool. bot. Ges. Wein.* 15: 509.

1954. *Ischnura aurora*, Lieftinck, *Treubia*, 22:74.

1995. *Ischnura aurora aurora*, Prasad and Varshney, *Oriental Ins.*, 29:390.

Material examined: 2♂, 24.i.2014, ZSI, WRC - Ent.4/2343.

Diagnostic Characters: Size: Male: Abdomen 16-20 mm; Hindwing 10-12 mm; Female: Abdomen 18-20 mm; Hindwing 14-15 mm

Male: Head: Vertex black, eyes have black half-moon like cap above with blue post ocular spots. Thorax: Shinning black with two pale grass green stripes. Legs pale greenish white. Wings transparent with rose red wing spot in forewing and uniform pale grey in hind wings. Abdomen: bright citron yellow with second and seventh segments having upper narrow and broad black marks. Segment 8-10 are entirely azure blue expect a quadrate black dorsal spot on segment 10; female: less brightly colored with broad black stripe on upper side of abdomen. Segments 8-10 do not have azure blue markings.

Distribution

India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Manipur, Maharashtra, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere: Afghanistan, Australia, Bangladesh, Bhutan, China, Fiji, French Polynesia, Guam, Indonesia, Iran, Japan, Laos, Myanmar, Nepal, New Caledonia, New Zealand, Pakistan, Philippines, Papua New Guinea, Samoa, Sri Lanka, Taiwan, Thailand.

Remarks

Widely distributed, found in grasses & marshy places around

water bodies.

Subfamily: Pseudagrioninae

Genus: *Ceriagrion* Selys, 1876

4. *Ceriagrion coromandelianum* Fabricius, 1798

1798. *Agrion coromandelianum*, Fabricius, *Entr. Syst. Suppl.*: 287.

1933. *Ceriagrion coromandelianum*, Fraser, *Fauna Brit. India, Odon.* 1: 315-316.

Material examined: 1♂, 14.ix.2012, ZSI, WRC - Ent.4/2195; 1♂, 25.v.2012, ZSI, WRC - Ent.4/2131; 1♂, 24.i.2014, ZSI, WRC - Ent.4/2354.

Diagnostic Characters: Size: Male: Abdomen 28-30 mm; Hindwing 18-20 mm;

Female: Abdomen 29-32 mm; Hindwing 20 mm

Male: Head: Vertex pale greenish yellow, eyes olivaceous above and pale greenish yellow below. Thorax olive green above merging to yellow on sides. Underside is white. Legs pale yellow with black spine. Wings transparent with golden yellow pterostigma. Abdomen: uniformly citron yellow; Female: Thorax is golden brown. Abdomen: uniformly olivaceous with an ochreous or golden brown tint on dorsal side.

Distribution

India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Manipur, Maharashtra, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere: Bangladesh, China, Laos, Myanmar, Nepal, Pakistan, Sri Lanka.

Remarks

Recorded as a very common species from India. Breeds in weedy ponds and tanks and are found almost throughout the year.

Family: Platycnemididae
Subfamily: Platycnemidinae
Genus: *Copera* Kirby, 1890

5. *Copera marginipes* Rambur, 1842

1842. *Platycnemis marginipes* Rambur *Ins. Neurop*, 240

1993. *Copera marginipes*, Fraser, *Fauna Brit. India. Odon*, 1: 192-197.

Material examined: 1♀, 14.ix.2012, ZSI, WRC - Ent.4/2194; 1♂, 24.i.2014, ZSI, WRC - Ent.4/2353.

Diagnostic Characters: Size: Male: Abdomen 29-31 mm; Hindwing 16-18 mm;

Female: Abdomen 29-30 mm; Hindwing 20 mm

Male: Head: eyes have black above, greenish on sides and beneath with black equatorial band. Thorax: bronze black with fine yellow lines on side and a narrow pale greenish yellow humeral stripe. Legs: bright yellowish orange. Wings transparent with brown pterostigma. 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; Female: Eyes with brown cape Thorax: has a brown ground color with black stripes above similar to males and black stripe on sides is irregular. Legs: brownish. Wings transparent with pale brown wing spot. Abdomen: dorsally brown with similar

rings toward the end as male. Half of 8th segment and the whole of 9th and 10th segments pale brownish white.

Distribution

India: Andaman and Nicobar Islands, Assam, Chhattisgarh, Delhi, Goa, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Pondicherry, Rajasthan, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere: Bangladesh, China, Hong Kong, Indonesia, Laos, Malaysia, Myanmar, Nepal, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam.

Remarks

Found in herbage and stream side vegetation.

6. *Copera vittata* Selys, 1863

1914. *Copera vittata* Laidlaw, *Rec. Indian Mus.*, 8: 342.

1923. *Copera vittata deccanensis*, Laidlaw, *Rec. Indian Mus.*, 13: 322.

1995. *Copera vittata deccanensis*, Prasad and Varshney, *Oriental Ins.*, 29: 393.

Material examined: 1♂, 18.iv.2012, ZSI, WRC - Ent.4/2160.

Diagnostic Characters: Size: Male: Abdomen 28-34 mm; Hindwing 16-18 mm;

Female: Abdomen 28-30 mm; Hindwing 18 mm

Male: Head: eyes with black cap above, olivaceous green below with a black equatorial band. Thorax: black above, chocolate brown on sides with a few coarse yellow spots, a narrow humeral ochreous stripe. Underside is yellow. Legs: reddish yellow. Wings: Transparent with reddish brown pterostigma. Abdomen: black above. Segments 1 and 2 reddish yellow. A pale blue ring at the front end of segment 3-7. Segment 9 has a blue spot and 10 is entirely blue; female: Eyes with dark brown cape above and pale apple green below. Black equatorial belt similar to male. Thorax: pale brown. Legs: yellow. Wings: transparent with blackish brown wing spot. Abdomen: pale brown with segments 3-7 pale brown anterior rings. The 9th segments have a broad pale brown T-shaped mark. Segment 10 is pale brown dorsally.

Distribution

India: Andhra Pradesh, Karnataka, Kerala, Maharashtra and Tamil Nadu.

Remarks

Occupies a variety of standing water habitats like ponds, lake margins etc.

Suborder: Anisoptera

Super family: Libelluloidea

Family: Libellulidae

Subfamily: SYMPETRINAE

Genus: *Brachythemis* Brauer, 1868

7. *Brachythemis contaminata* Fabricius, 1793

1793. *Libellula contaminata*, Fabricius, *Ent. Syst.*, 2: 382.

1936. *Brachythemis contaminata*, Fraser, *Fauna Brit. India, Odonata*.3: 365-366.

Material examined: 2♂, 18.iv.2012, ZSI, WRC - Ent.4/2174; 2♀, 25.v.2012, ZSI, WRC - Ent.4/2127.

Diagnostic Characters: Size: Male: Abdomen 19-21 mm; Hindwing 20-23 mm;

Female: Abdomen 18-20 mm; Hindwing 22-25 mm

Male: Head: Face frons and vesicle olivaceous or faint

greenish-yellow, occiput brown. Eyes: olivaceous brown above, bluish grey below. Thorax olivaceous brown to reddish brown above with two reddish brown lateral stripes. Legs dark brown. Wings transparent with rusty pterostigma. A broad bright orange patch present in fore and hind wing. Abdomen bright red. Anal appendages ferruginous; Female: face is yellowish white. Eyes pale brown above and bluish grey below. Thorax pale greenish yellow with a narrow brown mid-dorsal strip. A dark brown lateral stripe is also present. Legs similar to males. Wings lack the bright orange patch. The hindwing tinted with yellow at the base. Abdomen: pale olivaceous brown with a black middorsal stripe. Anal appendages yellow and brown at apices.

Distribution

India: Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere: Bangladesh, Bhutan, China, Hong Kong, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam.

Remarks

It is very common species in India and found in large numbers flying over water surface throughout the year. They mostly prefer contaminated water.

Genus: *Diplacodes* Kirby, 1889

8. *Diplacodes trivialis* Rambur, 1842

1842. *Libellula trivialis*, Rambur, *Ins. Neurop.*; 115.

1936. *Diplacodes trivialis*, Fraser, *Fauna Brit. India, Odonata*. 3: 336-338.

Material examined: 2♂, 24.i.2014, ZSI, WRC - Ent.4/2344.

Diagnostic Characters: Size: Male: Abdomen 19-22 mm; Hindwing 22-23 mm;

Female: Abdomen 18-20 mm; Hindwing 22-24 mm

Male: Head: face pale azure blue. Eyes reddish brown above, pale blue or yellowish below. Thorax greenish yellow or olivaceous. The dorso-lateral area has numerous dots. In old adults the thorax is covered with fine blue pruinescence. Legs greenish yellow marked with black. Wings transparent with dark grey pterostigma. Abdomen: segments 1-7 greenish yellow with black mid-dorsal and sub-dorsal stripes. Fine blue are observed in old individuals. Anal appendages bright yellow. Female: resembles young or subadult male. The 10th abdominal segment and anal appendages are completely yellow.

Distribution

India: Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Jharkhand, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Sikkim, Tripura, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere: Australia, Bangladesh, Bhutan, China, Fiji, Hong Kong, Indonesia, Japan, Laos, Malaysia, Maldives, Myanmar, Nepal, Palau, Papua New Guinea, Philippines, Seychelles, Singapore, Solomon Islands, Sri Lanka, Taiwan, Thailand, Vietnam, Vanuatu.

Remarks

Common species found throughout the year near water bodies and also in grassy vegetation and agricultural fields.

Subfamily: Libellulinae

Genus: *Orthetrum* Newman, 1833

9. *Orthetrum luzonicum* Brauer, 1868

1868. *Libellula luzonica* Brauer, *Verch. Zool.-bot. Ges. Wein*, 18: 169, 732.

1936. *Orthetrum chryseostigma luzonicum*, Fraser, *Fauna Brit. India, Odonata*: 3 : 298-300.

1976. *Orthetrum chryseostigma luzonicum*, Singh & Prasad, *Rec. zool. Surv. India*, 70: 21-38.

1995. *Orthetrum luzonicum*, Prasad & Varshney, *Oriental Ins.*, 29: 409.

Material examined: 1♂, 2♂, 14.ix.2012, ZSI, WRC - Ent.4/2197.

Diagnostic Characters: Size: Male: Abdomen 28-30 mm; Hindwing 30-32 mm;

Female: Abdomen 28-32 mm; Hindwing 30-32 mm

Male: Head: face pale bluish or greenish yellow. Eyes bluish green with violet or brownish spots. Thorax pale olivaceous green with brown lateral stripes. Dorsal side has a distinct yellow "Y" shaped mark. Older individuals are totally pruinosed. Legs bluish black. Wings transparent with yellowish pterostigma. Abdomen pruinosed pale azure blue and dorsoventrally dilated at the base. Anal appendages blackish brown. Female: Markings similar to subadult males but less brightly colored. Abdomen: greenish yellow, a broad black stripe on each side, segments 9 and 10 with an oval yellow dorsal spot. Anal appendages and a conical protuberance yellow tipped with black.

Distribution

India: Jharkhand, Arunachal Pradesh, Assam, Chhattisgarh, Delhi, Goa, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Nagaland, Odisha, Punjab, Sikkim, Tamil Nadu, Uttarakhand, West Bengal.

Elsewhere: Afghanistan, Bangladesh, Bhutan, China, Hong Kong, Indonesia, Japan, Malaysia, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam.

Remarks

Found in marshes and swamps and edges of wetlands. They perch on herbage and short grasses.

10. *Orthetrum pruinatum* Burmeister, 1839

1842. *Libellula neglecta*, Rambur, *Ins. Neurop.*: 86.

1936. *Orthetrum pruinatum neglectum*, Fraser, *Fauna Brit. India, Odonata*. 3: 311-313.

Material examined: 1♂, 25.v.2012, ZSI, WRC - Ent.4/2128.

Diagnostic Characters Size: Male: Abdomen 28-31 mm; Hindwing 32-36 mm;

Female: Abdomen 30 mm; Hindwing 37 mm

Male: Head: face ochreous to pale reddish brown. Eyes blue black above and bluish grey below. Thorax: reddish brown to dark purple and covered with fine hairs. Legs: black and reddish brown at the base. Wings: Transparent with pale brown tip in old adult. Basal area is marked with reddish brown with reddish brown pterostigma. Abdomen: bright vermilion red in subadult, purplish red in old adult due to pruinescence. Anal appendages red; Female: Differs widely

from male. Face: pale olivaceous. Eyes yellowish and caped with brown. Thorax: reddish brown or dull ochreous with indistinct lateral brown strips. Wings: similar to male but basal markings are indistinct. Abdomen: dull ochreous with each segments thinly bordered with black. Anal appendages dull ochreous and shortly conical.

Distribution

India: Jharkhand, Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Delhi, Goa, Gujarat, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere: Afghanistan, Bangladesh, Bhutan, China, Hong Kong, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam.

Remarks

Breeds in small tanks; also recorded from altitude of 7,250 ft from Ooty, Nilgiris. Variation in nodal index is recorded. A quite common and widespread dragonfly found almost everywhere.

11. *Orthetrum sabina* Drury, 1770

1770. *Libellula sabina*, Drury, *III. Exot. Int.*, 1: 114.

1936. *Orthetrum sabina*, Fraser, *Fauna Brit. India, Odonata*: 3: 300-302.

1995. *Orthetrum sabina sabina*, Prasad and Varshney, *Oriental Ins.*, 29: 409.

Material examined: 1♂, 25.v.2012, ZSI, WRC - Ent.4/2128.

Diagnostic Characters: Size: Male: Abdomen 32-35 mm; Hindwing 30-36 mm;

Female: Abdomen 32-35 mm; Hindwing 31-35 mm

Male: Head: face yellowish green. Eyes green mottled with black. Thorax: greenish yellow with black tiger like stripes. Legs: black, inner side of the anterior femora is yellow. Wings: transparent with inner side of the hind wing tinted yellow. Pterostigma black. Abdomen: segments 1-3 green with broad black markings and distinctly swollen at the base. Anal appendages creamy white in color. Female: exactly similar to male. Anal appendages pale yellow and shortly conical.

Distribution

India: Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere: Afghanistan, Africa, Australia, Bangladesh, Bhutan, Cambodia, China, Europe, Hong Kong, Indonesia, Iran, Iraq, Israel, Japan, Laos, Malaysia, Micronesia, Myanmar, Nepal, Oman, Papua New Guinea, Qatar, Philippines, Russia, Saudi Arabia, Singapore, Sri Lanka, Taiwan, Thailand, Turkey, UAE, Vietnam.

Remarks

One of the most common and readily seen species even found away from water bodies. Found near stagnant and flowing water bodies.

12. *Orthetrum taeniolum* (Schneider, 1845)

1842. *Libellula neglecta*, Rambur, *Ins. Neurop.*, 86.

1936. *Orthetrum taeniolum*, Fraser, *Fauna Brit. India, Odonata*. 3: 296-298.

1996. *Orthetrum taeniolum*, Prasad, *Rec. zool. Surv. India*, 95 (3-4):315

Material examined: 1♂, 14.ix.2012, ZSI, WRC - Ent.4/2196

Diagnostic Characters Size: Male: Abdomen 22-25 mm; Hindwing 25-27 mm;

Female: Abdomen 24 mm; Hindwing 28 mm

Male: Head: face, frons and vesicles palest brown changing to dirty bluish grey above. Thorax: uniformly pulverulent blue in full adults. Legs: black, hinder surface yellow. Wing hyaline, rarely efumed, costal border finely yellow with ochreous pterostigma. Abdomen: pulverulent blue throughout in adult but resembling the females in teneral example. Anal appendages black. Female: Differs widely from male, never pulverulent. Face: very pale olivaceous, nearly white. Thorax palest brown on middorsum, outwardly bordered with a vertical pale olivaceous stripe, a narrow blackish brown stripe followed by a dark reddish brown fascia, laterally olivaceous brown with a bright ochreous strip. Leg olivaceous brown with black spine and a black ring at distal end of hind femora, tarsi dark reddish on extensor surface. Wings: hyaline sometime evenly effumed with pale brown, venation similar to male. Abdomen: olivaceous yellow with a narrow black stripe extending mid-dorsally from segment 2 to segment 9. Anal appendages brown and shortly conical.

Distribution

India: Andhra Pradesh, Arunachal Pradesh, Bihar, Chhattisgarh, Goa, Gujarat, Jammu & Kashmir, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Nagaland, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere: Afghanistan, Algeria, Bhutan, Cyprus, Egypt, Greece, Iran, Iraq, Israel, Nigeria, Nepal, Oman, Pakistan, Saudi Arabia, Somalia, Sudan, Syria, Turkey, Yemen.

Remarks

Prefers slow flowing marshy stream. The flight period is almost all the year round.

Subfamily: Trameinae

Genus: *Pantala* Hagen, 1861

13. *Pantala flavescens* Fabricius, 1798

1798. *Libellula flavescens*, Fabricius, *Ent. Syst. Suppl.*, 285.

1936. *Pantala flavescens*, Fraser, *Fauna Brit. India, Odonata*. 3: 414-416.

Material examined: 1♀, 14.ix.2012, ZSI, WRC - Ent.4/2352.

Diagnostic Characters: Size: Male: Abdomen 29- 35 mm; Hindwing 38-40 mm;

Female: Abdomen 30-33 mm; Hindwing 39-41 mm

Male: Head: face bright golden yellow or orange. Eyes: reddish brown above and bluish grey below. Thorax: olivaceous or rusty and coated with thick fine yellow hairs, sides are pale green or bluish green. Legs: black. Wings: transparent with bright reddish brown pterostigma. Base of hindwings is amber yellow. Abdomen: bright reddish brown and tinted with brick red dorsally. Segments 8-10 have mid-dorsal pyriform black spots; Female: quite similar to male.

Eyes olivaceous brown above and wings are evenly smoky. Abdomen: lacks the dorsal red color found in males.

Distribution

Circumtropical and subtropical in distribution; throughout India;

Elsewhere: China, Indonesia, Malaysia, Morocco, Myanmar, Sri Lanka, and Thailand.

Remarks: Common species, breeds in marshes and weedy tanks. Large number of specimens emerges out and takes to swarming from September to November/December.

Genus: *Rhyothemis* Hagen, 1867

14. *Rhyothemis variegata* (Linnaeus, 1763)

1763. *Libellula variegata* Linnaeus, *Amoenitates, Acad.*, 6: 412.

1936. *Rhyothemis variegata variegata*, Fraser, *Fauna Brit. Ind. Odonata*. 3: 423 - 424.

1995. *Rhyothemis variegata variegata*, Prasad and Varshney, *Oriental Ins.*, 29: 412.

1996. *Rhyothemis variegata variegata*, Prasad, *Rec. zool. Surv. India*, 95 (3-4): 325

Material examined: The species was observed in the field and was identified.

Diagnostic Characters: Size: Male: Abdomen 23-25 mm; Hindwing 33-36 mm;

Female: Abdomen 20-22 mm; Hindwing 28-37 mm

Male: Head: frons iridescent green. Eyes dark reddish brown above. Thorax: iridescent green. Legs: black. Wings: forewing is transparent with golden yellow. The wing tip, leading edge and centre are marked with deep coffee brown spots. The hind wing also has similar spots without the centre one. The wing base is marked with irregular brown patch. The trailing edge of hindwing has a "W" shaped coffee brown spot. Pterostigma black. Abdomen: black with long and slim anal appendages; Female: head, thorax and abdomen similar to male. Wings: tips of forewing transparent. A dark brown opaque area extends to the centre of forewing. This area borders a bright yellow hockey-stick shaped patch. Brown opaque area more extensive in hind wing enclosing a long yellow central patch and a small yellow spot at wing tip. Pterostigma black. Abdomen: bluish black.

Distribution

India: Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Pondicherry, Punjab, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal.

Elsewhere: China, Laos, Maldives, Myanmar, Nepal, Sri Lanka, Thailand, Vietnam.

Remarks

Found in marshes and in weeded lakes. It is a weak flier and flutters like butterflies. Andromorphic females of this species (Fraser 1936) are frequently observed.

Subfamily: Trithemistinae

Genus: *Trithemis* Brauer, 1868

15. *Trithemis aurora* Burmeister, 1839

1839. *Libellula aurora* Burmeister, *Handb Ent.* 2:859.
1936. *Trithemis aurora*, Fraser, *Fauna Brit. India, Odonata.* 3: 383-385.

Material examined: 1♂, 14.ix.2012, ZSI, WRC - Ent.4/2356
Diagnostic Characters: Size: Male: Abdomen 21-29 mm; Hindwing 24-34 mm;

Female: Abdomen 19-27 mm; Hindwing 24-31 mm
Male: Head: face reddish brown changing to reddish above. Eyes crimson above and brown on side. Thorax red with fine dull purple pruinescence. Legs black. Wings transparent with dark reddish brown pterostigma. Base of wings has a broad amber patch. Abdomen: crimson with violet tinge with red anal appendages; Female: Face is olivaceous or bright reddish brown. Eyes purplish brown above and grey below. Thorax olivaceous with brown medial and lateral stripes. Legs dark grey with narrow yellow stripe. Wings transparent with brown tip and dark brown pterostigma. Abdomen: reddish brown with medial and lateral black stripes which are confluent to enclose a reddish brown spot. Anal appendages black.

Distribution

India: Jharkhand, Andaman and Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Delhi, Goa, Gujarat, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal.
Elsewhere: Bhutan, Cambodia, China, Hong Kong, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam

Remarks

It is a common species found near water bodies almost throughout the year.

16. *Trithemis festiva* Rambur, 1842

1842. *Libellula festiva*, Rambur, *Ins. Neurop*, 92
1936. *Trithemis festiva*, Fraser, *Fauna Brit. India, Odonata.* 3: 387-389.

Material examined: 1♂, 14.ix.2012, ZSI, WRC - Ent.4/2355.
Diagnostic Characters: Size: Male: Abdomen 22-28 mm; Hindwing 26-32 mm;

Female: Abdomen 21-24 mm; Hindwing 24-29 mm
Male: Head: frons dark brown in front and metallic violet above. Eyes dark brown above with a purple tinge. Thorax: black covered with purple pruinescence giving a deep blue appearance. Legs: black. Wings: Transparent with black pterostigma. Dark opaque brown mark at the base of hindwing. Abdomen: black with blue pruinescence with black anal appendages; Female: Face is dirty brown. Eyes dark brown above and grey below. Thorax greenish yellow to olivaceous. A medial and lateral dark brown stripe present. Also on the sides inverted "y" shaped stripes present. Legs: black with anterior femora yellow on inner side. Wings transparent with black wing spot and dark reddish brown tip. Abdomen: bright yellow with medial, lateral and ventral black stripes which are confluent to enclose a wedge-shaped yellow spot. Anal appendages black.

Distribution

India: Andaman and Nicobar Islands, Arunachal Pradesh, Assam, Chhattisgarh, Goa, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal.
Elsewhere: Afghanistan, Bhutan, Cambodia, China, Cyprus, Hong Kong, Indonesia, Iraq, Laos, Malaysia, Myanmar, Nepal, Papua New Guinea, Philippines, Russia, Singapore, Sri Lanka, Taiwan, Thailand, Turkey, Vietnam.

Remarks

It is a common species found near all types of flowing water bodies perching on aquatic plants and boulders.

Family: Aeshnidae

Subfamily: Aeshninae

Genus: *Anax* Leach, 1815

17. *Anax guttatus* (Burmeister, 1839)

1839. *Aeschna guttata* Burmeister, *Handb. Ent.*, 2 ; 840
1842. *Anax magnus*, Rambur, *Ins. Neurop*, 188.
1867. *Anax guttatus*, Hagen, *Verh.zool.-bot.Ges.Wien.* 16:39.
1922. *Anax goliathus*, Fraser, *J.Bombay Nat. Hist. Soc.*, 28: 900.
1995. *Anax guttatus*, Prasad & Varshney, *Oriental Ins.*, 29: 403.

Material examined: 1♂, 14.ix.2012, ZSI, WRC - Ent.4/2357
Diagnostic Characters: Size: Male: Abdomen 56-62 mm; Hindwing 50-54 mm;

Female: Abdomen 56-58 mm; Hindwing 52-54 mm
Male: Head: face and frons yellow to bright greenish yellow. Eyes blue with yellow and black behind. Thorax: pale green with reddish brown sutures beneath. Legs: black with outer and inner surface of anterior femora yellow. Wings: Transparent a large amber yellow spot on hind wing. Long narrow and reddish pterostigma. Abdomen: 1st 2nd segment is pale green, 2nd behind turquoise blue dorsally, 3rd segment green with a pair of dorsal turquoise blue spot. This is flanked by a pair of anterior and posterior bright orange spots. Segments 4-7 have 3 pair of bright orange spots and segment 10 is entirely yellow. Female: Similar to the male in most respects. However the hindwing often lack the amber patch. The turquoise blue of 2nd segment is broken into four square patches.

Distribution

India: Andaman and Nicobar Islands (South Andaman), Arunachal Pradesh, Assam, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Tamil Nadu, Uttarakhand and West Bengal.
Elsewhere: Afghanistan, Australia, China, Hong-Kong, Indonesia, Japan, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam.

Remarks

Found near marshes, bank of reservoirs and ponds. They are seen mostly in strong and swift flight.
The study indicates that family Libellulidae shows greater dominance with 11 species. Among the recorded species, *Diplacodes trivialis* and *Pantala flavescens* accounts for a maximum number (Table: 2). The most dominant species was

Diplacodes trivialis (Rambur, 1842) which accounted for 18.54% of total number of individuals. This was followed by *Pantala flavescens* (Fabricius, 1798) with 17.74% of population. *Agriocnemis femina* (Brauer, 1868), *Copera vittata* Selys, 1863, and *Orthetrum taeniolatum* (Schneider, 1845) were rather encountered less.(Fig.2). Greater species diversity

was recorded in pre-monsoon (April-May) with a total of 13 species followed by post-Monsoon (September-October) with 11 species and winter with 7 species (Table: 1). Species abundance was highest in post-monsoon (Fig.3). Species abundance and species diversity therefore varies with season.



Plate 1:

A: *Brachythemis contaminata* (Fabricius,1793); B: *Trithemis aurora* Burmeister, 1839; C: *Orthetrum sabina* (Drury, 1770); D: *Orthetrum pruinosum* (Burmeister,1839); E: *Copera marginipes* (Rambur, 1842); F: *Ischnura aurora* (Brauer, 1865); G: *Ceriagrion coromandelianum* (Fabricius, 1798); H: *Rhyothemis variegata* (Linnaeus, 1763 I: *Anax guttatus* (Burmeister, 1839)



Plate 2: J: *Trithemis festiva* (Rambur, 1842); K: *Orthetrum luzonicum* (Brauer, 1868); L: *Diplacodes trivialis* (Rambur, 1842) M: *Agriocnemis pygmaea* (Rambur, 1842); N: *Pantala flavescens* (Fabricius, 1798); O: *Orthetrum taeniolatum* (Schneider, 1845); P, Q, R: Marsh (study site) in Dry, Post-monsoon and Winter respectively

Table 1: Taxonomic composition, occurrence, seasonal variation of Odonates from the study area

Sr. No.	Species	Family	Sampling Data					
			Actual Collection			Observed Data		
			Apr.-May (Pre-monsoon)	Sep.-Oct. (Post-Monsoon)	January (Winter)	Apr.-May (Pre-monsoon)	Aug.-Sep. (Post-monsoon)	January (Winter)
1	<i>Agriocnemis femina</i> (Brauer, 1868)	Coenagrionidae	1			2		
2	<i>Agriocnemis pygmaea</i> (Rambur, 1842)	Coenagrionidae	2			4		
3	<i>Ceriatrigon coromandelianum</i> (Fabricius, 1798)	Coenagrionidae	1	1	1	2	6	2
4	<i>Ischnura aurora</i> (Brauer, 1865)	Coenagrionidae			2	2		
5	<i>Copera marginipes</i> (Rambur, 1842)	Platynemididae		1	1		7	2

6	<i>Copera vittata</i> Selys,1863	Platynemididae	1			1		1
7	<i>Brachythemis contaminata</i> (Fabricius,1793)	Libellulidae	2		2	3		4
8	<i>Diplacodes trivialis</i> (Rambur,1842)	Libellulidae			2	11	8	4
9	<i>Orthetrum luzonicum</i> (Brauer, 1868)	Libellulidae		3		3	11	
10	<i>Orthetrum pruinosum</i> (Burmeister,1839)	Libellulidae	1			7	2	
11	<i>Orthetrum sabina</i> (Drury, 1770)	Libellulidae	1			4		
12	<i>Orthetrum taeniolatum</i> (Schneider,1845)	Libellulidae		1			2	
13	<i>Pantala flavescens</i> (Fabricius, 1798)	Libellulidae		1			20	2
14	<i>Rhyothemis variegata</i> (Linnaeus, 1763)	Libellulidae				1		
15	<i>Trithemis aurora</i> (Burmeister, 1839)	Libellulidae		1		1	7	
16	<i>Trithemis festiva</i> Rambur, 1842	Libellulidae		1		2	1	
17	<i>Anax guttatus</i> (Burmeister, 1839)	Aeshnidae		1		1	1	
Total number of Individuals			9	10	8	44	65	15

Table 2: Abundance status of Odonata recorded from the study area

Sr. No	Family	Species	Status
Suborder: Zygoptera (Damselflies)			
1	Coenagrionidae	<i>Agriocnemis femina</i> (Brauer, 1868)	Rare
2	Coenagrionidae	<i>Agriocnemis pygmaea</i> (Rambur, 1842)	Common
3	Coenagrionidae	<i>Ceriagrion coromandelianum</i> (Fabricius, 1798)	Very Common
4	Coenagrionidae	<i>Ischnura aurora</i> (Brauer, 1865)	Common
5	Platynemididae	<i>Copera marginipes</i> (Rambur, 1842)	Common
6	Platynemididae	<i>Copera vittata</i> Selys,1863	Common
Suborder: Anisoptera (Dragonflies)			
7	Libellulidae	<i>Brachythemis contaminata</i> (Fabricius,1793)	Very Common
8	Libellulidae	<i>Diplacodes trivialis</i> (Rambur,1842)	Very Common
9	Libellulidae	<i>Orthetrum luzonicum</i> (Brauer, 1868)	Common
10	Libellulidae	<i>Orthetrum pruinosum</i> (Burmeister,1839)	Common
11	Libellulidae	<i>Orthetrum sabina</i> (Drury, 1770)	Very Common
12	Libellulidae	<i>Orthetrum taeniolatum</i> (Schneider,1845)	Rare
13	Libellulidae	<i>Pantala flavescens</i> (Fabricius, 1798)	Very Common
14	Libellulidae	<i>Rhyothemis variegata</i> (Linnaeus, 1763)	Common
15	Libellulidae	<i>Trithemis aurora</i> (Burmeister, 1839)	Common
16	Libellulidae	<i>Trithemis festiva</i> Rambur, 1842	Common
17	Aeshnidae	<i>Anax guttatus</i> (Burmeister, 1839)	Rare

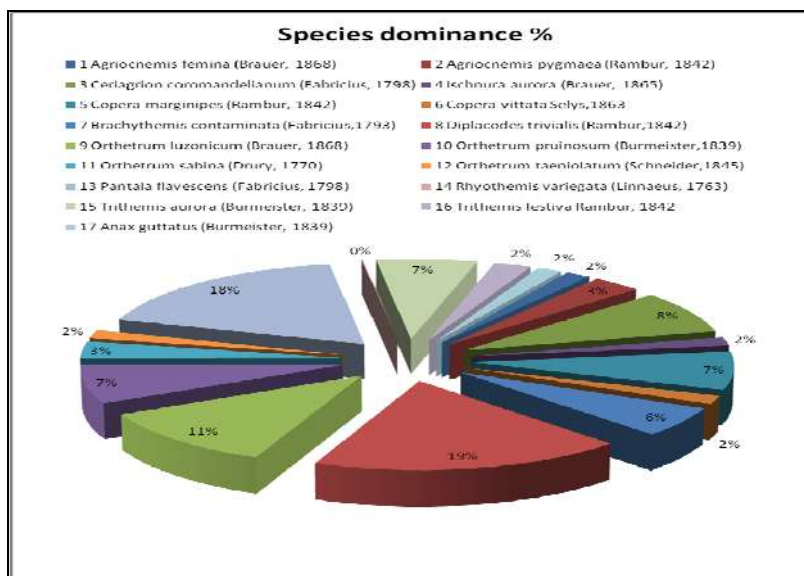


Fig 2: Graph showing percentage dominance of various species from the study area

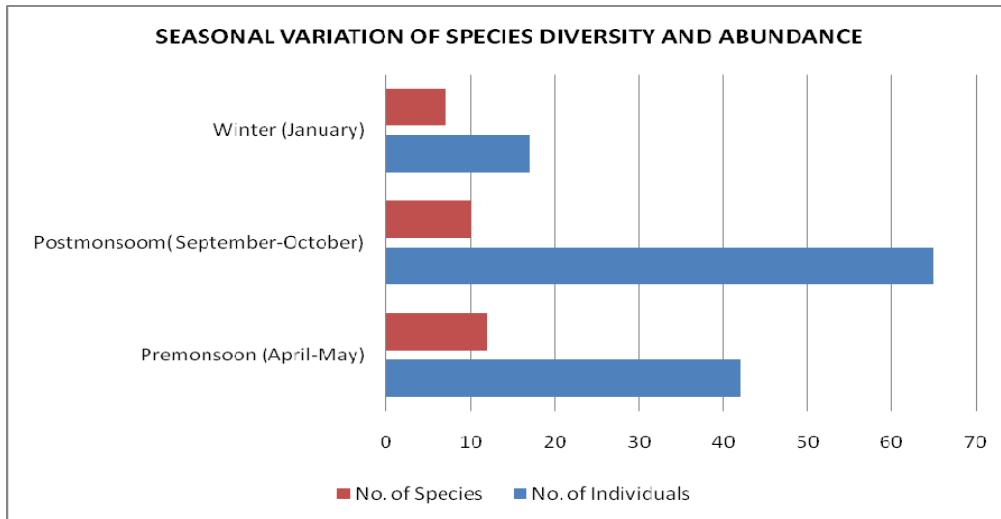


Fig 3: Graph showing the seasonal variations of species diversity and species abundance

4. Discussion

The water present in the study site is perennial in nature and is covered with floating macrophytes. Water is mostly polluted with degradable and non-degradable pollutants comprising of animal and human excreta, plastic bottles, brick and cement wastes from the construction site. Three successive steps are important in dragonfly habitat selection: biotope selection, habitat selection and oviposition site selection [25, 26]. The importance of macrophytes in influencing Odonata assemblages has been identified for several ecosystems [3, 4, 27, 28]. Adult Odonates use sub-merged aquatic vegetation and tall wetland plants as sites for emergence, hardening of the wings, oviposition, to attract mates and as well as to locate prey. The study records low species diversity in Post-monsoon in comparison to Pre-monsoon. This may be because of flooding during monsoon which results in the loss of habitat and absence of perching sites. During Monsoon, due to excess water this area becomes inaccessible for grazing cattle and human activities which in turn minimizes the food source for dragonflies like *Brachythemis contaminata* (Fab.), since this species is associated with polluted water. Benthic aquatic insects are sensitive indicators of environmental changes. Odonates, being both aquatic and terrestrial, can contribute much to the evaluation of environmental quality. They are known to be very sensitive to habitat quality and therefore can be used as a tool to evaluate landscape degradation and have been used as an indicator species [3, 4]. Odonata diversity and abundance can decline due to removal of macrophytes or over pollution of the habitat. The observations recorded in the present study may act as a valuable reference for assessing the changes in environmental condition because of over pollution due to anthropogenic activities. Family Libellulidae was found to be the most specious and common. This was in accordance with the result of Shelton & Edward [29] which states that “common species has more individuals than rare species and had the ability to survive in existing environmental condition.” The present communication aims to portray the Odonata diversity in a very small plot of marshy land which being used as a dumping site for degradable and non-degradable wastes.

5. Conclusion

This study highlights how a small manmade habitat in the heart of a highly industrialized city sustains an important fraction of the species diversity on a larger scale. Urban and industrial development across Pune city resulting in habitat destruction for Odonates, is a matter of concern. This small

piece of marshy land with stagnant water has a very rich diversity of Odonates creating a small hotspot. This type of small hotspots should therefore be conserved and kept pollution free across the city limit as they support a good congregation of aquatic/semi aquatic insects.

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