



Diversity of Odonates (Insecta: Odonata) in Fish farm, College of Veterinary and Animal Sciences, CSKHPKV, Palampur, Himachal Pradesh, India

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Abstract

Odonata diversity in fish farm of Department of Fisheries, CSKHPKV, Palampur, Kangra Valley, Himachal Pradesh were comprehensively studied and documented for the first time. A total of 27 species belonging to 19 genera and 7 families of two suborders are recorded. The suborder Zygoptera was represented by 13 species and 14 species represents Anisoptera. Among the families, Libellulidae was richest family with 13 species and followed by Coenagrionidae with 9 species. The wide range of habitats including foraging and nocturnal roosting habitat at Fish Farm, CSKHPKV leads to greatest species diversity.

Keywords: Damsel flies, Diversity, Dragonflies, Fish Farm, Himachal Pradesh, Palampur

Introduction

Dragonflies and damselflies are regarded as beneficial insects because they are carnivorous throughout their life, mostly feeding on smaller insects such as mosquitoes, termites, ants, mayflies, small moths etc. They are widely distributed in freshwater habitats like ponds, lakes, streams, rivers, canals, etc. and although some species roam widely and found far from their breeding sites. The presence of dragonflies and damselflies are good indicators of freshwater ecosystem because they dependent on both aquatic and terrestrial habitats to maintain viable populations (Briers & Biggs, 2003; Samways, 1993). The odonate larvae occupy a great diversity of aquatic habitats and form significant constituent of aquatic food webs involving many invertebrates, fishes and other vertebrates and serving as the dominant invertebrate predators of many aquatic insect larvae and as the prey of fish. The Odonata diversity in fish ponds are not yet studied well. In view of above context, the present attempt was undertaken to evaluate the Odonata diversity in the Fish Farm of Department of Fisheries, College of Veterinary

and Animal Sciences, CSK Himachal Pradesh Krishi Vishwavidyalaya, which is located at 32.097699° N and 76.556835° E in Palampur, Kangra Valley, Himachal Pradesh. Palampur is situated in the laps of Dhauladar range of mountains at a height of 1,270 meters above sea level.

Material and Methods

The field surveys were carried out by the author in the different localities in various districts of Himachal Pradesh during 2006-2007. During this period a valuable collections of odonates was collected from the Fish Farm, Department of Fisheries, College of Veterinary and Animal Sciences, CSK Himachal Pradesh Krishi Vishwavidyalaya, Palampur, Kangra District of Himachal Pradesh. All the collected specimens were identified and compared with the standard descriptions provided by Fraser (1933, 1934 and 1936). All the materials were deposited in the National Zoological Collection, Zoological Survey of India, Kolkata. Updated distribution of all these species in different states within India and

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countries outside India is also provided in the systematic account. The nomenclature followed here is after, Davies and Tobin (1984 & 1985), Tsuda (2000) and Subramanian and Babu (2017a).

Systematic Account

Suborder ZYGOPTERA

Superfamily COENAGRIONOIDEA

Family COENAGRIONIDAE

1. *Aciagrion pallidum* Selys, 1891

1891. *Aciagrion pallidum* Selys, *Ann. Civ. Genova*, (2) 10 (30): 512.

1933. *Aciagrion pallidum*, Fraser, *Fauna Brit. India, Odon.*, 1: 344-345.

Material examined: 1♂, 14-iv-2006; 7♂ 12♀, (4 pairs in copula), 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Jharkhand, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Odisha, Sikkim, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Bangladesh, Bhutan, Cambodia, China, Lao People's Democratic Republic, Myanmar, Nepal, Thailand, Viet Nam.

2. *Agriocnemis pygmaea* (Rambur, 1842)

1842. *Agriocnemis pygmaea* Rambur, *Ins. Nevrop.*, p. 278.

1933. *Agriocnemis pygmaea*, Fraser, *Fauna Brit. India, Odon.*, 1: 398-401.

Material examined: 6♀, 14-iv-2006; 2♂ 9♀, 16-iv-2006; 2♂ 2♀, 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Chhattisgarh, Goa, Gujarat, Hariyana, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Laccadive Islands, Madhya Pradesh, Manipur, Maharashtra, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Afghanistan, Australia, Bangladesh, Brunei Darussalam, Cambodia, China, Hong Kong, Indonesia, Iran (Islamic Republic of), Japan, Lao People's

Democratic Republic, Macao, Malaysia, Myanmar, Nepal, Oman, Pakistan, Papua New Guinea, Philippines, Seychelles, Singapore, Solomon Islands, Sri Lanka, Taiwan (Province of China), Thailand, Viet Nam.

3. *Amphiallagma parvum* (Selys, 1876)

1876. *Enallagma parvum* Selys, *Bull. Acad. Belg.*, (2) 41: 537.

1933. *Enallagma parvum*, Fraser, *Fauna Brit. India, Odon.*, 1: 376-378.

2017. *Amphiallagma parvum*, Subramanian and Babu, *A Checklist of Odonata (Insecta) of India*, Version 3.0. p. 18. www.zsi.gov.in

Material examined: 2♀, 16-iv-2006.

Distribution: *India*: Himachal Pradesh, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Odisha, Punjab, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Bhutan, Myanmar, Nepal, Sri Lanka, Thailand.

4. *Ceriagrion coromandelianum* (Fabricius, 1798)

1798. *Agrion coromandelianum* Fabricius, *Ent. Syst. Suppl.*, 1: 287.

1876. *Ceriagrion coromandelianum*, Selys, *Bull. Acad. Belg.*, (2) 42: 528.

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

Material examined: 1♂, 14-iv-2006; 4♂ 1♀, 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Bangladesh, Bhutan, China, Lao People's Democratic Republic, Myanmar, Nepal, Pakistan, Sri Lanka.

5. *Ischnura aurora* (Brauer, 1865)

1865. *Agrion aurora* Brauer, *Verh. zool.-bot. Ges. Wein.*, 15: 510.

1933. *Ischnura delicata*, Fraser, *Fauna Brit. India, Odon.*, 1: 360-362.

2000. *Ischnura aurora aurora*, Tsuda, *A distributional list of World Odonata*, p. 36.

Material examined: 12♂ 2♀, 14-iv-2006; 12♂ 9♀, 16-iv-2006; 5♂ 9♀, 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Afghanistan, Australia, Bangladesh, Bhutan, China, Cook Islands, Fiji, French Polynesia, Guam, Indonesia, Japan, Kiribati, Lao People's Democratic Republic, Marshall Islands, Micronesia (Federated States of), Myanmar, Nepal, New Caledonia, Northern Mariana Islands, Pakistan, Philippines, Samoa, Solomon Islands, Sri Lanka, Taiwan (Province of China), Thailand, Tonga, Vanuatu.

6. *Ischnura forcipata* Morton, 1907

1907. *Ischnura forcipata* Morton, *Trans. Ent. Soc. Lond.*, p. 306.
1933. *Ischnura forcipata*, Fraser, *Fauna Brit. India, Odon.*, 1: 354-357.

Material examined: 1♀, 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Assam, Jammu & Kashmir, Uttarakhand, West Bengal. *Elsewhere*: Afghanistan, Bhutan, Iran (Islamic Republic of), Nepal, Pakistan.

7. *Pseudagrion decorum* (Rambur, 1842)

1842. *Agrion decorum* Rambur, *Ins. Névropl.*, p. 258.
1876. *Pseudagrion decorum*, Selys, *Bull. Acad. Belg.*, (2) 42: 504.
1933. *Pseudagrion decorum*, Fraser, *Fauna Brit. India, Odon.*, 1: 286-289.

Material examined: 1♀, 16-iv-2006.

Distribution: *India*: Himachal Pradesh, Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Mizoram, Odisha, Tamil Nadu, Telangana, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Bangladesh, Iran, Myanmar, Nepal, Oman, Pakistan, Sri Lanka.

8. *Pseudagrion microcephalum* (Rambur, 1842)

1842. *Agrion microcephalum* Rambur, *Ins. Névropl.*, p. 259.
1876. *Pseudagrion microcephalum*, Selys, *Bull. Acad. Belg.*, 2 (42): 504.
1933. *Pseudagrion microcephalum*, Fraser, *Fauna Brit. India, Odon.*, 1: 278-280.

Material examined: 1♀, 14-iv-2006.

Distribution: *India*: Himachal Pradesh, Andaman & Nicobar Islands, Andhra Pradesh, Assam, Goa, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal. *Elsewhere*: Australia, Bangladesh, China, Hong Kong, Indonesia, Japan, Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Philippines, Papua New Guinea, Singapore, Solomon Islands, Sri Lanka, Taiwan, Thailand, Vietnam.

9. *Pseudagrion rubriceps* Selys, 1876

1876. *Pseudagrion rubriceps* Selys, *Bull. Acad. Belg.*, (2) 42: 510.
1933. *Pseudagrion rubriceps*, Fraser, *Fauna Brit. India, Odon.*, 1: 296-299.

Material examined: 3♂ 4♀, 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Chhattisgarh, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Nagaland, Odisha, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Bangladesh, Bhutan, Cambodia, China, Hong Kong, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Taiwan (Province of China), Thailand.

Family PLATYCENEMIDIDAE

10. *Copera marginipes* (Rambur, 1842)

1842. *Platycnemis marginipes* Rambur, *Ins. Névropl.*, p. 240.
1890. *Copera marginipes*, Kirby, *Syn. Cat. Neur. Odon.*, p. 129.
1933. *Copera marginipes*, Fraser, *Fauna Brit. India, Odon.*, 1: 192-197.

Material examined: 4♂ 5♀ (1 pair in copula), 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Andaman & Nicobar Islands, Assam, Chhattisgarh, Delhi, Goa,

Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Rajasthan, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Bangladesh, China, Hong Kong, Indonesia, Lao People's Democratic Republic, Macao, Malaysia, Myanmar, Nepal, Singapore, Sri Lanka, Taiwan (Province of China), Thailand, Vietnam.

Superfamily LESTOIDEA

Family LESTIDAE

11. *Lestes praemorsus decipiens* Kirby, 1893

1893. *Lestes decipiens* Kirby, *J. Linn. Soc. Lond., Zool.*, **24**: 565-566.

1933. *Lestes praemorsa praemorsa*, Fraser, *Fauna Brit. India, Odon.*, **1**: 30-33.

2000. *Lestes praemorsus decipiens*, Tsuda, *A distributional list of World Odonata*, p. 63.

Material examined: 21♂ 10♀ (4 pairs in copula), 14-iv-2006; 2♂, 16-iv-2006.

Distribution: *India* : Himachal Pradesh, Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Jammu & Kashmir, Karnataka, Kerala, Goa, Madhya Pradesh, Nagaland, Odisha, Sikkim, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Cambodia, China, Hong Kong, Indonesia, Malaysia, Myanmar, Nepal, Singapore, Sri Lanka, Thailand, Vietnam.

Superfamily CALOPTERYGOIDEA

Family CALOPTERYGIDAE

12. *Neurobasis chinensis* (Linnaeus, 1758)

1758. *Libellula chinensis* Linnaeus, *Syst. Nat.*, **1**: 545.

1776. *Agrion nobilitata* Fabricius, *Gen. Ins.*, p. 248.

1842. *Calopteryx chinensis* Rambur, *Ins. Nevrop.*, p. 226.

1890. *Neurobasis chinensis* Kirby, *Syn. Cat. Odon.*, p. 102.

1934. *Neurobasis chinensis chinensis* Fraser, *Fauna Brit. India, Odonata*, **2**: 121-124.

Material examined: 1♀, 16-iv-2006.

Distribution: *India*: Himachal Pradesh, Arunachal Pradesh, Assam, Goa, Jharkhand, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Tamil Nadu, Tripura, Uttarakhand, West Bengal. *Elsewhere*: Bangladesh, Bhutan, Cambodia, China, Hong Kong, Indonesia, Lao People's Democratic

Republic, Malaysia, Myanmar, Nepal, Singapore, Sri Lanka, Thailand, Vietnam.

Family CHLOROCYPHIDAE

13. *Aristocypha trifasciata* (Selys, 1853)

1853. *Rhinocypha trifasciata* Selys, *Bull. Acad. Belg.*, 20 (Annexe) *Syn. Calopt.*, p. 61.

1934. *Rhinocypha trifasciata*, Fraser, *Fauna Brit. India, Odonata*, **2**: 31-33.

2017. *Aristocypha trifasciata*, Subramanian and Babu, *A Checklist of Odonata (Insecta) of India*, Version 3.0. p. 15. www.zsi.gov.in

Material examined: 1♂ 1♀, 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Chhattisgarh, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Nagaland, Uttarakhand, West Bengal. *Elsewhere*: Nepal, Pakistan.

Suborder ANISOPTERA

Superfamily AESHNOIDEA

Family AESHNIDAE

14. *Anax nigrolineatus* Fraser, 1935

1935. *Anax nigrolineatus* Fraser, *J. Darjeeling Nat. Hist. Soc.*, **10**: 23-25.

1936. *Anax nigrolineatus* Fraser, *Fauna Brit. India, Odonata*, **3**: 138-140.

Material examined: 1♀, 16-iv-2006.

Distribution: *India*: Himachal Pradesh, Nagaland, Sikkim, Uttarakhand, West Bengal. *Elsewhere*: Bhutan, China, Nepal, Thailand.

Superfamily LIBELLULOIDEA

Family LIBELLULIDAE

15. *Brachythemis contaminata* (Fabricius, 1793)

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

1868. *Brachythemis contaminata*, Brauer, *Verh. zool.-bot. Ges. Wien.*, **18**: 736.

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

Material examined: 5♂, 16-iv-2006; 2♂ 1♀, 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh,

Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Rajasthan, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Bangladesh, Bhutan, Cambodia, China, Hong Kong, Indonesia, Japan, Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Taiwan (Province of China), Thailand, Vietnam.

16. *Crocothemis servilia* (Drury, 1770)

1770. *Libellula servilia* Drury, III. *Exotic Ins.*, 1: 112-113.
 1868. *Crocothemis servilia* Brauer, *Verh. zool.-bot. Ges. Wein.*, 18: 737.
 1936. *Crocothemis servilia servilia* Fraser, *Fauna Brit. India, Odonata*, 3: 345-347.

Material examined: 9♂, 14-iv-2006; 8♂, 16-iv-2006; 2♂, 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Afghanistan, Armenia, Bangladesh, Bhutan, Cambodia, China, Cuba, Egypt, Hong Kong, Hawaii, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Korea (Democratic People's Republic of), Korea (Republic of), Kuwait, Kyrgyzstan, Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Niger, Pakistan, Philippines, Qatar, Russia, Saudi Arabia, Singapore, Sri Lanka, Taiwan (Province of China), Thailand, Turkey, USA, Uzbekistan, Vietnam.

17. *Orthetrum pruinosum* (Burmeister, 1839)

1839. *Libellula pruinosus* Burmeister, *Handb. Ent.*, 2: 853.
 1842. *Libellula neglecta* Rambur, *Ins. Neurop.*, p. 86.
 1909. *Orthetrum pruinosum neglectum*, Ris, *Cat. Coll. Selys fasc.* 9: 181.
 1936. *Orthetrum pruinosum neglectum*, Fraser, *Fauna Brit. India, Odonata*, 3: 311-313.
 2017. *Orthetrum pruinosum*, Subramanian and Babu, *A Checklist of Odonata (Insecta) of India*, Version 3.0. p. 33. www.zsi.gov.in

Material examined: 4♂, 14-iv-2006; 3♂ 2♀ (1 pair in copula), 16-iv-2006; 4♂ 1♀ (1 pair on copulation), 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Delhi, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Afghanistan, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Hong Kong, Indonesia, Japan, Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Philippines, Singapore, Sri Lanka, Taiwan (Province of China), Thailand, Vietnam.

18. *Orthetrum sabina* (Drury, 1770)

1770. *Libellula sabina* Drury, III. *Exot. Ins.*, 1: 114.
 1889. *Orthetrum sabina* Kirby, *Trans. zool. Soc. Lond.*, 12: 302.
 1936. *Orthetrum sabina*, Fraser, *Fauna Brit. India, Odonata*, 3: 300-302.

Material examined: 4♂, 14-iv-2006; 2♂ 1♀, 16-iv-2006; 13♂ 4♀ (4 pairs in copula), 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Afghanistan, Algeria, Armenia, Australia, Azerbaijan, Bahrain, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, Chad, China, Cyprus, Egypt, Eritrea, Ethiopia, Georgia, Greece, Hong Kong, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kazakhstan, Kuwait, Lao People's Democratic Republic, Lebanon, Libya, Malaysia, Micronesia (Federated States of), Myanmar, Nepal, New Caledonia, Oman, Pakistan, Papua New Guinea, Philippines, Qatar, Russian Federation, Samoa, Saudi Arabia, Singapore, Solomon Islands, Somalia, Sri Lanka, Sudan, Syrian Arab Republic, Taiwan (Province of China), Tajikistan, Thailand, Timor-Leste, Tunisia, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Viet Nam, Yemen.

19. *Orthetrum triangulare* (Selys, 1878)

1878. *Libellula triangularis* Selys, *Mitt. Mus. Dresden*, p. 314.
1886. *Orthetrum triangulare*, Kirby, *Proc. Zool. Soc. Lond.*, p. 32.
1909. *Orthetrum triangulare triangulare*, Ris, *Cat. Coll. Selys fasc. 9*: 181, 243-244.
1936. *Orthetrum triangulare triangulare*, Fraser, *Fauna Brit. India, Odon.*, 3: 305-307.

Material examined: 1♂, 29-ix-2007.

Distribution: India : Himachal Pradesh, Andhra Pradesh, Arunachal Pradesh, Assam, Haryana, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Afghanistan, Bhutan, China, Hong Kong, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Pakistan, Russia, Sri Lanka, Taiwan (Province of China), Thailand, Vietnam.

20. *Palpopleura sexmaculata* (Fabricius, 1787)

1787. *Libellula sexmaculata* Fabricius, *Mant. Ins.*, 1: 338.
1868. *Palpopleura sexmaculata* Brauer, *Verh. zool.-bot. Ges. Wien.*, 18: 716.
1936. *Palpopleura sexmaculata sexmaculata* Fraser, *Fauna Brit. India, Odonata*, 3: 318-320.

Material examined: 5♂, 14-iv-2006; 2♂ 2♀, 16-iv-2006.

Distribution: India: Himachal Pradesh, Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Goa, Jharkhand, Karnataka, Kerala, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Sikkim, Tamil Nadu, Tripura, Uttarakhand, West Bengal. *Elsewhere*: Afghanistan, Bangladesh, Bhutan, China, Hong Kong, Lao People's Democratic Republic, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam.

21. *Rhyothemis variegata* (Linnaeus, 1763)

1763. *Libellula variegata* Linnaeus, *Amoenitates Acad.*, 6: 412.
1867. *Rhyothemis variegata* Hagen, *Stett. Ent. Zeit.*, 28: 232.
1936. *Rhyothemis variegata*, Fraser, *Fauna Brit. India, Odonata*, 3: 423-424.

Material examined: 1♀, 29-ix-2007.

Distribution: India: Himachal Pradesh, Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Sikkim, Tamil Nadu, Telangana, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Bangladesh, Cambodia, China, Hong Kong, Lao People's Democratic Republic, Maldives, Myanmar, Nepal, Sri Lanka, Taiwan (Province of China), Thailand, Vietnam.

22. *Sympetrum commixtum* (Selys, 1884)

1884. *Diplax commixta* Selys, *Ann. Soc. Ent. Belg.*, 28: 38.
1890. *Sympetrum commixtum* Kirby, *Cat. Odon.*, p. 16.
1936. *Sympetrum commixtum*, Fraser, *Fauna Brit. India, Odonata*, 3: 372-373.

Material examined: 1♂, 16-iv-2006; 10♂ 1♀ (1 pair in copula), 29-ix-2007.

Distribution: India: Himachal Pradesh, Arunachal Pradesh, Jammu & Kashmir, Uttarakhand. *Elsewhere*: Bhutan, Nepal.

23. *Sympetrum fonscolombii* (Selys, 1840)

1840. *Libellula fonscolombi* Selys, *Mon. Lib. Eur.*, pp. 29, 49, 208.
1874. *Sympetrum fonscolombi*, Meyer-Dur, *Mitt. Schwiez. Ent. Ges.*, 4: 327.
1936. *Sympetrum fonscolombi*, Fraser, *Fauna Brit. India, Odonata*, 3: 377-379.
2000. *Sympetrum fonscolombii*, Tsuda, *A Distributional list of World Odonata*, p. 180.

Material examined: 1♂ 1♀ (in copula), 14-iv-2006; 1♂, 29-ix-2007.

Distribution: India: Himachal Pradesh, Jammu & Kashmir, Kerala, Maharashtra, Tamil Nadu, Uttarakhand. *Elsewhere*: Afghanistan, Albania, Algeria, Angola, Armenia, Austria, Azerbaijan, Bahrain, Bangladesh, Belgium, Bhutan, Bosnia and Herzegovina, Botswana, Bulgaria, Burundi, Cameroon, Cape Verde, Chad, Croatia, Cyprus, Czech Republic, Egypt, Equatorial Guinea, Eritrea, Ethiopia, France, Gambia, Georgia, Germany, Gibraltar, Greece,

Guinea, Hungary, Iran (Islamic Republic of), Iraq, Israel, Italy, Jordan, Kazakhstan, Kenya, Kyrgyzstan, Latvia, Lebanon, Lesotho, Libya, Liechtenstein, Luxembourg, Macedonia (the former Yugoslav Republic of), Madagascar, Mali, Malta, Mauritania, Monaco, Mongolia, Montenegro, Morocco, Mozambique, Namibia, Nepal, Netherlands, Niger, Oman, Pakistan, Palestinian Territory (Occupied), Poland, Portugal, Qatar, Réunion, Romania, Russian Federation, Rwanda, Saudi Arabia, Senegal, Serbia, Slovakia, Slovenia, Somalia, South Africa, Spain, Sri Lanka, Sudan, Swaziland, Sweden, Switzerland, Syrian Arab Republic, Tajikistan, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Arab Emirates, United Kingdom, Uzbekistan, Western Sahara, Yemen, Zambia, Zimbabwe.

24. *Tramea virginia* (Rambur, 1842)

1842. *Libellula virginia*, Rambur, *Ins. Neurop.*, p. 33.
 1890. *Tramea virginia*, Kirby, *Cat. Odon.*, p. 3.
 1936. *Tramea virginia*, Fraser, *Fauna Brit. India, Odonata*, **3**: 435-436.

Material examined: 4♂, 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Andaman & Nicobar Islands, Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Maharashtra, Mizoram, Odisha, Punjab, Tamil Nadu, Telangana, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Bangladesh, Bhutan, Cambodia, China, Hong Kong, Indonesia, Japan, Korea (Democratic People's Republic of), Korea (Republic of), Malaysia, Myanmar, Nepal, Pakistan, Taiwan (Province of China), Thailand, Vietnam.

25. *Trithemis aurora* (Burmeister, 1839)

1839. *Libellula aurora* Burmeister, *Handb. Ent.*, **2**: 859.
 1868. *Trithemis aurora* Brauer, *Verh. zool.-bot. Ges. Wein.*, **18**: 177.
 1936. *Trithemis aurora*, Fraser, *Fauna Brit. India, Odonata*, **3**: 383-385.

Material examined: 12♂ 1♀, 14-iv-2006; 13♂ 3♀, 16-iv-2006; 6♀, 29-ix-2007.

Distribution: *India*: Himachal Pradesh, Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Bihar, Chandigarh, Chhattisgarh, Delhi, Goa, Gujarat, Haryana,

Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Hong Kong, Indonesia, Japan, Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan (Province of China), Thailand, Timor-Leste, Vietnam.

26. *Trithemis festiva* (Rambur, 1842)

1842. *Libellula festiva* Rambur, *Ins. Neurop.*, p. 92.
 1868. *Trithemis festiva*, Brauer, *Verh. zool.-bot. Ges. Wein.*, **18**: 736.
 1936. *Trithemis festiva*, Fraser, *Fauna Brit. India, Odonata*, **3**: 387-389.

Material examined: 1♀, 16-iv-2006.

Distribution: *India*: Himachal Pradesh, Andaman & Nicobar Islands, Arunachal Pradesh, Assam, Chhattisgarh, Goa, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Afghanistan, Bhutan, Cambodia, China, Cyprus, Greece, Hong Kong, Indonesia, Iran (Islamic Republic of), Iraq, Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Russian Federation, Singapore, Sri Lanka, Taiwan (Province of China), Thailand, Turkey, Vietnam.

27. *Trithemis pallidinervis* (Kirby, 1889)

1889. *Sympetrum pallidinervis* Kirby, *Trans. Zool. Soc. Lond.*, **12**: 327.
 1891. *Trithemis dryas*, Selys, *Ann. Mus. Civ. Genova*, **30**: 465.
 1907. *Trithemis pallidinervis*, Morton, *Trans. Ent. Soc. Lond.*, p. 304.
 1936. *Trithemis pallidinervis*, Fraser, *Fauna Brit. India, Odonata*, **3**: 389-391.

Material examined: 1♂, 14-iv-2006; 3♂ 1♀, 16-iv-2006.

Distribution: *India*: Himachal Pradesh, Andaman & Nicobar Islands, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Chhattisgarh, Delhi, Goa,

Gujarat, Haryana, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Bangladesh, Bhutan, Cambodia, Hong Kong, Indonesia, Iran (Islamic Republic of), Lao People's Democratic Republic, Malaysia, Myanmar, Nepal, Oman, Philippines, Singapore, Sri Lanka, Taiwan (Province of China), Thailand, Vietnam.

Discussion

Globally 6256 species in 686 genera and 39 families of odonates are known of this, 487 species and 27 subspecies in 152 genera and 18 families exist in India (Subramanian and Babu, 2017ab). A total of 125 species/subspecies belonging to 62 genera and 13 families of two suborders are reported from the Himachal Pradesh (Babu, 2011, 2014; Babu and Nandy, 2010) of this, 27 species in 19 genera and 7 families were documented in the present study. The Odonata of Fish Farm ponds at CSKHPKV, Palampur was fairly diverse.

The present study revealed 13 species of damselflies and 14 species of dragonflies. The most abundant odonate species are *Ischnura aurora*, followed by *Trithemis aurora*, and *Lestes praemorsus decipiens*; and abundant species are *Orthetrum sabina*, *Agriocnemis pygmaea*, *Aciagrion pallidum*, *Crocothemis servilia*, *Orthetrum prunosum* and *Sympetrum commixtum*. Family Libellulidae (Anisoptera) were dominant by 13 species from 8 genera followed by Coenagrionidae 9 species of 6 genera. Families Platycnemididae, Lestidae, Calopterygidae, Chlorocyphidae and Aeshnidae are represented by only one species each. A small area of Fish Farm harbours a 27 species of odonates, due to its location and fish ponds contains permanent water and emergent vegetation that supported odonate breeding. In addition, the surrounding landscape structure at Fish Farm, CSKHPKV, Palampur, provided a good foraging and nocturnal roosting habitat including dispersal and maturation for several adult odonate species. Three species of stream habitat odonates, *Neurobasis chinensis*, *Aristocypha trifasciata* and *Trithemis festiva* are also collected from the fish farm, these species are might be sporadic visitors from nearby streams.

Specimens of *Lestes praemorsus decipiens* (33 nos. including 4 pairs in copula), *Palpopleura sexmaculata* (9 nos.) and *Trithemis pallidinervis* (5 nos.) were collected during the month of April, 2006, and not even single specimen of these species are collected during September, 2007. Likewise specimens of *Pseudagrion rubriceps* (7 nos.), *Copera marginipes* (9 nos. including one pair in copula), *Tramea Virginia* (4 nos.) were collected only during September. More individuals of *Aciagrion pallidum* and *Sympetrum commixtum* collected during September and only single specimen was collected in April. This might be suggest that their emergence and flight period of these species. Flight period and adult numbers of different dragonfly species are determined for two general reasons, duration and synchronism of adult emergence and period of adult life (Khrokalo & Sheshurak, 2006). Among the species recorded, 9 species were recorded only from the collections made during April, 2006 and 7 species only from the September collections and rest of the species are collected in both the months. Around 10 species are recorded with one or two individuals. Monthly collections may be carried out to find out the exact adult numbers and flight period of odonates in the Fish Farm.

Mc Cauley (2006) stated that increased distance to the nearest source habitat and reduced connectivity negatively affect species richness of odonates. Thus the wide range of habitats at Fish Farm, CSKHPKV leads to greatest species diversity. Any habitat destruction in surrounding landscape structure at Fish Farm, CSKHPKV, Palampur, may affect the diversity of odonates. Since only two surveys during the months of April and September leads to record a 27 species of odonates from seven families, hence the future studies may be emphasized to make seasonal sampling of adult odonates; it may reveal the complete diversity and their seasonal flight period of Odonata in the Fish Farm of Department of Fisheries, CSKHPKV, Palampur.

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