

ODONATE FAUNA OF KHAJJIAR LAKE (MINI SWITZERTLAND) OF CHAMBA DISTRICT OF HIMACHAL PRADESH, INDIA

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ABSTRACT

A study of Khajjiar Lake was conducted from June 2008 to March 2012 which revealed the presence of 10 species belonging to 8 genera spread over 5 families of Odonates. It has been analysed that family Libellulidae supported the highest number of species (6 species, under 4 genera) and all other families have been represented by a single species each. Out of these ten eight species belongs to order Anisoptera (dragonflies) and two to Zygoptera (damsselflies).

INTRODUCTION

Dragonflies and damsselfies are amongst the most attractive creatures on the earth, the first to have conquered the aerial domain. The Odonata are relatively large and often beautifully coloured insects that spent most of their time on wings. The immature stages are aquatic while adults found usually near the water. Moreover, adults are large predacious insects while larvae are carnivorous and voracious feeders. Most of the species are generally beneficial. Nymphs develop rudimentary wing sheath in early stages and undergo incomplete metamorphosis. Most species of Odonates are highly specific to a habitat; some have adapted to urban areas and make use of man-made water bodies. Habitat specificity has an important bearing on the distribution and ecology of Odonates. Odonata is represented by 6,000 species belonging to 630 genera in 28 families, clubbed under 3 suborders namely, Zygoptera, Anisozygoptera and Anisoptera from all over the world (Prasad, 1998). In India, 499 species and subspecies under 139 genera in 17 families, 32 subfamilies and 7 superfamilies have been documented (Prasad and Varshney, 1995). Fraser (1933, 1934, 1936), Prasad (1996) and Kulkarni and Prasad (2002) have left their impact on systematic of Odonata of India. Prasad and Kulkarni (2001) reported 71 species from Nilgiri Biosphere reserve. Further, Prasad and Kulkarni (2002) reported additional 34 species from Kerala. Shinde and Sathe (2006) recorded a total of 36 species of dragonflies from Koyna dam area (Western Ghats).

The dragonflies of western Himalayas have been catalogued by Kumar and Prasad (1981) and Kumar (1995). Similarly, in the recent past this group has been well studied in Himachal

Pradesh by a number of field workers like Bhasin *et al.* (1953), Singh (1963), Kumar and Juneja (1976), Kumar (1978, 1982), Kumar and Prasad (1981) and Chandra (1983) who worked on Odonata fauna of different parts of Himachal Pradesh. Literature revealed the presence of 88 species under 52 genera belonging to Zygoptera (31 species) and Anisoptera (57 species) from Himachal Pradesh. Of these, 74 are Oriental, 11 Palaearctic, 02 Ethiopian and only 01 species is Circumtropical (Kumar, 2005). But no such study is there on Odonate fauna in the present study area which is one of the oldest protected areas of India and presently is under immense anthropological pressure. We don't have any knowledge about these beautiful biological indicators of the mini Switzerland of Himachal Pradesh. Keeping this in view a study was conducted to identify and catalogue the odonate fauna of Khajjiar lake area.

MATERIALS AND METHODS

Khajjiar Lake "The Mini Switzerland of Himachal Pradesh" is present in the western part of Chamba district of Himachal Pradesh. Khajjiar Lake has a clump of reeds and grasses exaggeratedly called an island in it. This glade is greenish in its turf and contains in its centre a small lake having approximate area of 5000 sq. yards. Khajjiar Lake lies 32°26' north and 76°32' east about 6300 feet (1920 meters) above sea level between Chamba and Dalhousie. Khajjiar Lake is situated in Khajjiar- Kalatop wild life sanctuary. This small sanctuary lies in the catchments of the Ravi River, located in western part of Chamba District. It is one of the oldest preserved forests of state (notified on 01.07.1949). Total area of sanctuary is 2,026.89 hectares (20.69 sq. km.) Its mean annual rainfall is

800mm. Temperature varies from -10°C to 35°C. The climate of Khajjiar varies from being mild in summers and cold and bitter in winters. It experiences south-western monsoon rains in July-September. The vegetation consists of mature mixed Blue Pine and Deodar forests, with some Green Oak and Tree Rhododendron.

During the present study Khajjiar lake was visited regularly (every month) from June, 2008 to March 2012. Nylon net with long handle was used for sweeping free flying and free living dragonflies. After collection specimens were put into killing bottles containing agents like chloroform. These insects were transferred to paper envelopes. Each envelope was numbered carefully and detail of specimen number, date, host etc. were written in field notebook. These packets containing specimens were kept in boxes with thin layer of cotton. Thereafter insects were properly stretched and pinned by using rust free entomological pins of different size depending upon the size of specimen. These stretched and pinned specimens were kept in wooden insect boxes in dry conditions. To protect them from fungal infection and other attacks naphthalene balls were placed in boxes. These balls were replaced regularly due to their volatile nature. Identification of these specimens was done on the basis of morphological characters only with the help of High Altitude Regional Centre, Zoological Survey of India, Saproon, Solan and Himachal Pradesh.

RESULTS

Present study revealed the presence of 10 species belonging to 8 genera spread over 5 families of odonates from Khajjiar lake area. Based on morphology, the members of order Odonata belonging to 2 groups, viz. damselflies (Zygoptera) and dragonflies (Anisoptera) have been recorded during the present study. It has been analysed that family Libellulidae supported the highest number of species (6 species, under 4 genera) and all other families have been represented by a single species each. Nine species were identified to the species level but one species was identified only upto genus level. A detail account of diagnostic characters, habits and habitat of these species is given here.

Key to the Groups (Sub-Orders)

Hind wings broader than the forewings; abdomen stout; the wings held perpendicular to the body.....Dragonflies (Anisoptera)

Fore and hind wings narrowed at base; similar in size and shape; abdomen slender; usually the wings kept closed over the body.....Damselflies (Zygoptera)

Sub-Order: Anisoptera

Family: Cordulegasteridae

Genus: *Anotogaster* Selys, 1854

1854. *Anotogaster* Selys, *Bull. Acad. Belg. (2)* vol. xxi, p. 101 Head very massive, eyes meeting at one point only, slightly tumid behind. Face deeper than broad, not concealing or overlapping the eyes in any way. Antennae seven-jointed, the basal joint short, rounded, the second long and very robust, the third as long as second but slim, the fourth to sixth each less than half the length of third, the terminal or seventh very short and filamentous. Prothorax short and massive, posterior lobe rounded, tumid.

Thorax relatively massive usually coated with fine downy hairs, especially on dorsum.

1. *Anotogaster basalis* Selys (Plate 1A)

1854. *Anotogaster basalis* Selys, *Bull. Acad. Belg. (2)* vol. xxi, p. 102

Material examined: Himachal Pradesh: Chamba district: grassy meadows around Khajjiar lake, 2♂, 4.vi.2009, 1♀, 7.vi.2009, 2♀, 15.vii.2010, 1♀, 2♂, 31.vii.2010, 3♀, 10.viii.2011, Vikram Singh.

Size: Male: Abdomen: 53-56 mm, Hind wing: 42-44 mm.

Female: Abdomen: 59mm, Hind wing: 51mm.

Diagnostic Characters: *Male*, frons in front bright citron-yellow narrowly bordered below with black, its upper surface citron-yellow, the basal half black, this colour extending to the sides. *Prothorax* black with a basal ring and the border of posterior lobe narrowly yellow. *Thorax* black, marked with greenish-yellow. Two pyriform antehumeral stripes, very broad and in close apposition above, tapered to a fine point. Laterally two broad oblique stripes. *Legs* black in colour. *Wings* hyaline. Abdomen black, broadly ringed with citron yellow. *Female*, very similar to the male in colour and markings. *Abdomen* more robust, markedly laterally compressed; segment 9 aborted, oblique, and produced ventral wards into a long ovipositor which extends well beyond end of abdomen. Adult females have the face-markings more restricted than in the male. Abdominal markings broader than in the male.

Distribution: Found in north western India, reported from Punjab, Kumaon hills and Bengal (Subramanian, 2009).

Habits and Habitat: A dragonfly of fresh water ponds. Found up to 4,600 feet.

Observations: Recorded in good numbers from Khajjiar Lake.

Family: Aeshnidae

Genus: *Anax* Leach

1815. *Anax* Leach, *Edinb. Encycl.* vol. ix, p. 137. Wings hyaline, but often partly tinted with yellow or pale brown. Head very large and globular. Eyes broadly contiguous. Frons with sharply angled fore-border or crest, but not elevated; occiput very small. Thorax robust; legs long and robust, femora armed with rows of short, closely-set spines.

2. *Anax immaculifrons* Rambur, 1842 (Blue Darner)

(Plate 1B) **1842. *Anax immaculifrons* Rambur, *Ins. Nevrop.* p. 189**

Material examined: Himachal Pradesh: Chamba district: grassy meadows around Khajjiar lake, 2♂, 1♀, 4.vi.2009, 1♂, 1♀, 7.vi.2009, 1♂, 2♀, 15.vii.2010, 1♀, 2♂, 31.vii.2010, 1♀, 10.viii.2011, Vikram Singh.

Size: Male: Abdomen: 52-55mm, Hind wing: 55mm.

Female: Abdomen: 56 mm, Hind wing: 58-60mm.

Diagnostic Features: *Male*, face pale bluish-green, with a very narrow black border to base of frons above. Eyes sapphire blue, narrowly bordered with black behind. *Prothorax* dark reddish-brown, paler laterally, posterior lobe with heavy fringe of long hairs. Thorax pale bluish green dorsally and turquoise blue laterally with two black stripes. *Legs* black. *Wings* transparent, tinted with amber yellow from apex to base of discoidal cell,

palely at apex, rather deeply towards base of wing. The first segment of abdomen black and the second segment turquoise blue with a black suture and a middorsal transverse mark shaped like 'Sea gull bird'. Segment 3 with its base laterally broadly turquoise blue. Segments 4 to 8 with apical half black this gradually changing to pale reddish-brown towards base of segments and finally pale dirty blue. The segment 9 black and 10th segment black or brown on dorsum. *Female*, very similar to the male, but the turquoise-blue replaced by pale greenish-yellow on thorax and base of abdomen. Segment 1 warm reddish-brown instead of black; dorsum of thorax pale brown instead of bluish.

Distribution: Found in whole of the Oriental region. In India recorded from Mumbai, Madhya Pradesh, Eastern Ghats and northern Ghats. Relatively less common in Himalayas (Tiple *et al.*, 2012).

Habits and Habitat: A common insect at altitudes from 1500 to 7500 feet. Frequents slow flowing streams. Breeds in hill streams. Female inserts eggs into a submerged water plant.

Observations: Recorded in good numbers from meadow area of Khajjiar.

Family: Libellulidae

Key to the genera

1. More than 12 antenodal nervures in forewing; shape of abdomen variable.....*Orthetrum*
2. Eyes more broadly contiguous; discoidal cell in hind-wing traversed; costal border of fore-wing sinuous near base; frons metallic above; discoidal field beginning with at least 3 rows of cells.....*Palpopleura*
3. Discoidal cell in forewing broader, its costal side about one-half the length of basal; no supplementary nervure*Trithemis*
4. Wings with small basal yellow markings; face red.....*Crocothemis*

Genus: *Orthetrum* Newman

1833. *Orthetrum* Newman, *Ent. Mag.* vol. i, p. 511

3. *Orthetrum sabina* (Drury) (Green Marsh Hawk)

1770. *Libellula sabina* Drury, *IB. Exot. Ins.* vol. i, pi. xviii, pp. 114, 115

1889. *Orthetrum sabina* Kirby, *Trans. Zool. Soc. Lond.* vol. xii, p. 302

Material examined: Himachal Pradesh: Chamba district: grassy meadows around Khajjiar lake, 1♂, 1♀, 4.vi.2009, 1♂, 7.vi.2009, 2♀, 15.vii.2010, 1♀, 2♂, 31.vii.2010, 1♂, 2♀, 10.viii.2011, Vikram Singh.

Size: Male: Abdomen: 30-36mm, Hind wing: 30-36mm.

Female: Abdomen: 35mm, Hind wing: 31-35mm.

Diagnostic Characters: *Male*, face and frons yellowish, becoming brighter citron-yellow on upper surface of the later and variably marked on anterior surface with black or dark brown. Frons very deeply notched so as to form two triangular facets in front. Eyes green mottled with black. *Prothorax* bright yellow, with anterior and middle lobes blackish-brown posteriorly. Thorax Greenish yellow with black tiger like stripes. Legs black and inner side of anterior femora yellow. Wings transparent; inner

edge of hind wing tinted with yellow. Membrane dark brown. Abdomen greenish-yellow, marked with black. The segments 1-3 green with broad black rings and distinctly swollen at the base. Segments 4 to 6 with a broad oval dorsal black spot on basal third of segments. Segments 7 to 9 black. Segment 10 with base broadly so, apical border finely black. *Female*, very similar to the male both in colour and the remarkable shape of abdomen, differing only in sexual characters. Anal appendages pale yellow, shortly conical.

Distribution: Widely distributed in Ethiopia, Oriental and Australian region. In India found in Karnataka, Andaman and Nicobar, Chhattisgarh, Goa, Kerala (Thiruvananthapuram), Madhya Pradesh (Jabalpur), Rajasthan (Thar Desert), Uttar Pradesh (Sivaperuman and Shah, 2012; Husain and Sharma, 2012; Tiple *et al.*, 2012)

Habits and Habitat: On wings, throughout year except the months of extreme cold, found upto the altitude of 2000m. One of the most predaceous of all dragonflies, eats even its own species. A common dragonfly of gardens and fields. Perches motionless on shrubs and dry twigs for a long time. Species can be seen far away from water and occasionally enters houses at night. Hawks flying insects such as flies, small butterflies and dragonflies.

Observations: Recorded in good numbers in Khajjiar meadow during present study.

4. *Orthetrum triangulare* (Selys) (Blue-tailed Forest Hawk)

(Plate 1 C). 1878. *Libella triangularis* Selys, *Mitth. Mus. Dresden*, p. 314

1886. *Orthetrum triangulare* Kirby, *Proc. Zool. Soc. Lond.* p. 327

Material examined: Himachal Pradesh: Chamba district: grassy meadows of Khajjiar lake, 2♂, 1♀, 4.vi.2009, 1♀, 7.vi.2009, 2♂, 2♀, 15.vii.2010, 1♀, 2♂, 31.vii.2010, 2♂, 1♀, 10.viii.2011, Vikram Singh.

Size: Male: Abdomen: 29 - 33mm, Hind wing: 37-41mm.

Female: Abdomen: 29 - 32mm, Hind wing: 37mm.

Diagnostic Characters: A medium sized dragonfly with black thorax, black-brown patch at wing bases and blue tail. *Male*, face glossy black, behind head black with a single yellow spot; eyes dark blue; *prothorax* and *thorax* velvety-black; *legs* black; *wings* hyaline, with a broad triangular blackish-brown spot at the base of hind-wing, membrane black. Abdomen broad at base and gradually tapering towards the tip; segments 1-2 and 8-10 black; segment 3-7 azure blue, covered with fine hair. Anal appendages black. *Female*, face dark brown. Mid-dorsum of thorax olivaceous-green often suffused at mid-dorsal carina with reddish-brown. The sides dark reddish brown with two bright yellow stripes. *Wings* more often suffused with brown. The hind wing tinted with yellow lacks basal black area. Abdomen black and without fine hairs. A mid-dorsal yellow or olivaceous green stripe runs from segments 1-7. The segments 2-7 have two yellow spot underneath.

Distribution: Distributed throughout the Oriental region. Occurs all along the Himalayas from Kashmir, Bengal to Myanmar. In Himachal Pradesh present in Great Himalayan National Park, Kullu and Chandertal wildlife sanctuary, Lahol and Spiti (Subramanian, 2009; Uniyal *et al.*, 2000 and Singh,

2010)

Habits and Habitat: Typically hilly species usually found in marshes associated with hill streams. Breeds in brooks flowing through marshes in foothills.

Observations: Recorded in good numbers from Khajjiar meadow.

5. *Orthetrum pruinosum neglectum* (Rambur) (Marsh Hawk) (Plate 1 D). **1842.** *Libellula neglecta* Rambur, *Ins. Nevrop.* p. 86

1886. *Orthetrum pruinosum* Kirby, *Proc. Zool. Soc. Lond.* p. 327

1890. *Orthetrum neglectum* Kirby, *Cat. Odon.* p. 182

1931. *Orthetrum pruinosum neglectum* Fraser, *Rec. Ind. Mus.* vol. xxxiii, p. 446

Material examined: Himachal Pradesh: Chamba district: grassy meadows around Khajjiar lake, 1♂, 4.vi.2009, 1♂, 2 ♀, 7.vi.2009, 2♂, 1♀, 15.vii.2010, 3♂, 1♀, 2♂, 31.vii.2010, 1♂, 1♀, 10.viii.2011, Vikram Singh.

Size: Male: Abdomen: 28-31 mm, Hind wing: 32-36mm.

Female: Abdomen: 25-30mm, Hind wing: 31-36mm.

Diagnostic Characters: *Male*, face ochreous to pale reddish brown; eyes blue-black above and bluish-grey below; *prothorax* and *thorax* reddish-brown to dull purple in colour; legs black and reddish brown at the base. *Wings* transparent, in old adults, pale brown towards the tip; basal area marked with reddish brown in both wings. *Wing spots* reddish brown. *Abdomen* bright red but in old adults, purplish due to prunescence; *anal appendages* red. *Female*, differs widely from the male. *Face* pale olivaceous in colour; *thorax* reddish-brown or dull ochreous, with an ill-defined brown stripe on each side of dorsum. *Wings* similar to male, but the basal marking paler and almost obsolete. *Abdomen* dull ochreous with each segment thinly bordered with black, sides of segment 8. *Anal appendages* dark ochreous, shortly conical.

Distribution: Found throughout India (Andaman and Nicobar Island, Madhya Pradesh) and Myanmar (Sivaperuman and Shah, 2012; Tiple *et al.*, 2012). Also found in Tibet, China and Hing- Kong.

Habits and Habitat: One of the commonest dragonflies in the plains and found around wells, ponds, ditches, tanks and rivers. Males very conspicuous and seen perched on shrubs and stones, seen on wings throughout the year up to 7250feet. Breeds in puddles, ponds and tanks, also pools in river beds.

Observations: Recorded in Khajjiar area mostly during summer months.

Genus: *Palpopleura* Rambur 1842. *Palpopleura* Rambur, *Ins. Nevrop.*, 26, 129

6. *Palpopleura sexmaculata* (Fabricius) (Blue-tailed Yellow Skimmer) (Plate 1 E)

1787. *Libellula sexmaculata* Fabricius, *Mant. Ins.* vol. i, p. 338

1868. *Palpopleura sexmaculata* Brauer, *Verh. zool.-bot. Ges. Wien*, vol. xviii, p. 716

Material examined: Himachal Pradesh: Chamba district: grassy meadows around Khajjiar lake, 3♂, 2♀, 4.vi.2009, 4♂, 2♀, 7.vi.2009, 2♂, 2♀, 15.vii.2010, 1♀, 2♂, 31.vii.2010, 4♂,

3♀, 10.viii.2011, Vikram Singh.

Size:

Male: Abdomen: 14-16mm, Hind wing: 15-21mm.

Female: Abdomen: 13-14mm, Hind wing: 18-21mm.

Diagnostic Characters: A small dragonfly with greenish yellow thorax and blue abdomen. *Male*, face creamy yellow with brilliant iridescent blue frons; *prothorax* dark brown, with posterior collar and a geminate spot on dorsum of middle lobe bright yellow. *Thorax* pale greenish-yellow, marked with dark brown and black. Dorsal side warm reddish brown. *Legs* bright yellow, flexor surface of tibiae, tarsi and outer sides of middle and anterior pairs of femora black. Forewings transparent with three black streaks extending from the wing base to the tip. The hind wings tinted with yellow and have two short black streaks extending from the wing base to the tip. Abdomen light blue and covered with pruinescence. *Female*, differs from males in many aspects. *Face* yellow without iridescent; markings of thorax and pro-thorax very restricted. *Thorax* rich orange-brown with lateral brown stripe. *Wings* transparent and more broadly marked with blackish-brown and black and more deeply tinted with amber yellow. *Abdomen* bright reddish brown with a median black stripe.

Distribution: Found throughout the western India, Tibet, Malayasia and China (Subramanian, 2009).

Habits and Habitat: Inhabits ponds marshes, lakes and tanks. Shows slow, circling flight.

Observations: During summer months, good population of this species has been recorded in Khajjiar area.

Genus: *Crocothemis* Brauer

1868. *Crocothemis* Brauer, *Verh. Zool. Bot. Ges. Wien*, vol. xviii, (2): 367, 736

7. *Crocothemis servilia* (Drury) (Ruddy Marsh Skimmer) (Plate 1F)

1770. *Libellula servilia* Drury, *IIIEx. Ins.* vol. xlvi, pp. 112-113

1868. *Crocothemis servilia* Brauer, *Verh. Zool. Bot. Ges. Wien*, vol. xviii, pp 737

Material examined: Himachal Pradesh: Chamba district: grassy meadows around Khajjiar lake, 2♂, 4.vi.2009, 1♀, 7.vi.2009, 2♀, 15.vii.2010, 1♀, 2♂, 31.vii.2010, 3♀, 10.viii.2011, Vikram Singh.

Size:

Male: Abdomen: 24-35 mm, Hind wing: 27-38 mm.

Female: Abdomen: 25-32 mm, Hind wing: 31-37 mm.

Diagnostic Characters: Medium sized blood red or reddish yellow dragonflies with amber coloured patch at wing base. *Male*, face and frons blood red; eyes blood red above, purple on the sides and paler below; *prothorax* ferruginous, with a spot on middle of anterior lobe; *thorax* bright ferruginous, often blood red on dorsum. Colour of legs reddish; wings transparent base; abdomen blood red, segment 8 and 9 with mid-dorsal carina blackish. *Female*, differs widely in colouration from male. *Face* pale yellow; eyes brown above and olivaceous below; *prothorax* and *thorax* olivaceous brown, often tinted with ferruginous. *Legs* dark brown; wings

similar to males but basal amber marking paler than in the males. Abdomen yellowish brown with a mid dorsal black stripe.

Distribution: Widely distributed in Oriental and Australian regions. Also present in South Asia, Japan and Philippines. In India present in Karnataka, Andaman and Nicobar Island, Chhattisgarh, Delhi, Goa, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh (Sivaperuman and Shah, 2012; Husain and Sharma, 2012; **Tiple et al., 2012**).

Habits and Habitat: One of the commonest red dragonflies. Perches on aquatic weeds and chases any passing-by dragonflies. Frequently found in ponds, puddles, rivers, big wells, tanks, ditches and paddy fields. Breed in marshes associated with ponds, rivers and tanks.

Observations: Recorded in good numbers in Khajjiar area during summer and monsoon months.

Genus: Trithemis Brauer

1868. *Trithemis Brauer*, *Verh. Zool. Bot. Ges. Wien*, vol. xviii, pp. 176

8. *Trithemis festiva* (Rambur) (Black Stream Glider) (Plate 1G)

1842 *Libellula festiva* Rambur, *Ins. Nevrop.*, pp. 92

1868. *Trithemis festiva* Brauer, *Verh. Zool. Bot. Ges. Wien*, vol. xviii, pp. 736

Material examined: Himachal Pradesh: Chamba district: grassy meadows around Khajjiar lake, 2♂, 4.vi.2009, 1♀, 7.vi.2009, 2♀, 15.vii.2010, 1♀, 2♂, 31.vii.2010, 3♀, 10.viii.2011, Vikram Singh.

Size:

Male: Abdomen: 22-28mm, Hind wing: 26-32mm.

Female: Abdomen: 21- 24mm, Hind wing: 29mm.

Diagnostic Characters: *Male*, frons dark brown in front and iridescent violet above; eyes dark brown above with a purple tinge, bluish grey laterally and beneath. Thorax black coated with purple pruinescence. Legs black; wings transparent, with a dark opaque brown mark at the base of hind wing. Abdomen black and segment 1-3 covered with fine blue pruinescence. Anal appendages black. *Female*, differs markedly from the males. Face dirty brown in front and changes to brown above. Eyes dark brown above and grey below. Thorax greenish yellow to olivaceous with a medial and lateral dark brown stripe. On the sides inverted 'Y' shaped stripes present. Legs black and anterior femora yellow on the inner side. Abdomen cylindrical and of equal length throughout. Colouration bright yellow with medial, lateral and ventral black stripes.

Distribution: Found throughout Oriental region. Also found in Myanmar, Malaysia and China. Present in Chhattisgarh, Kerala, Madhya Pradesh, Maharashtra and Andaman and Nicobar Island (Sivaperuman and Shah, 2012; Husain and Sharma, 2012; **Tiple et al., 2012**).

Habits and Habitat: Common in slow flowing streams and canals. Usually perches on boulders and aquatic plants. Breeds in still waters or more commonly in sluggish streams.

Observations: Recorded on wings from May to October in Khajjiar area.

Sub-Order: Zygoptera

Family: Coenagrionidae

Genus: Pseudagrioni, Selys

1876. *Pseudagrionii*, Selys, *Bull. Acad. Belg. (2)* vol. xxii, p. 490

9. *Pseudagrioni* sp. (Plate 1 H)

Material examined: Himachal Pradesh: Chamba district: grassy meadows of Khajjiar lake, 2 specimens, 4.vi.2009, 1 specimen 7.vi.2009, 3 specimens, 15.vii.2010, 1 specimens.vii.2010, Vikram Singh

Size: Abdomen: 34mm, Hind wing: 22mm.

Diagnostic Characters: Identified up to genus level based upon characters viz., medium sized and slender built damselfly with non-metallic bright blue colour with black stripes. Head narrow; eyes globalate; prothorax pale blue, posterior lobe bluish green, middle lobe with base narrowly black. Thorax rather slender, azure blue, the mid dorsal with a black band, equal black lines run on both sides of thorax. Legs short, labial spines of moderate length. Wings transparent; pterostigma present but very narrow, braced, covering less than a segment. Abdomen slender, cylindrical, not nearly twice the length of hind wing. Abdomen azure blue in colour with variable black markings from segment 1 to 10.

Distribution: Genus widely distributed to the Old World. Found in Africa, Madagascar, India, Myanmar, Malaysia, Java, Sumatra, Australia, China and Philippines. Present in Andaman and Nicobar Island, Chhattisgarh, Gujarat, Madhya Pradesh, Maharashtra, Rajasthan (Sivaperuman and Shah, 2012; Husain and Sharma, 2012; **Tiple et al., 2012**).

Habits and Habitat: Frequents banks of rivers, ponds, lakes and other water bodies. Usually perches on aquatic plants on the bank and usually found in small groups of 3-4 individuals.

Observations: Recorded on wings during summer months in the Khajjiar area.

Family: Calopterygidae

Genus: Neurobasis Selys

1853. *Neurobasis* Selys, *Syn. Cal.* p. 17. Fore wings of male transparent, while hind wings opaque and coloured partly with brilliant metallic green and blue. All wings of female hyaline but with an opaque whitish spot at nodes. Pterostigma absent in males, false and whitish in females. Males commonly seen flitting up and down the stream, hugging the surface of water very closely. Rests on over hanging ferns and herbage besides the stream, or commonly perch with closed wings on a rock.

10. *Neurobasis chinensis chinensis* (Linnaeus, 1758) (Stream

Glory)

1758. *Libellula chinensis*, Linnaeus, *Syst. Nat.* Vol. I, p. 515

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

Material examined: Himachal Pradesh: Chamba district: grassy meadows around Khajjiar lake, 2♂, 1♀, 4.vi.2009, 1♂, 1♀, 7.vi.2009, 2♀, 15.vii.2010, 2♂, 1♀, 31.vii.2010, 3♀, 10.viii.2011, Vikram Singh.

Size:

Male: Abdomen: 45-50mm, Hind wing: 32-38mm.

A. *Anotogaster basalis*B. *Anax immaculifrons*C. *Orthetrum triangulare*D. *Orthetrum pr. Neglectum*E. *Palpopleura sexmaculata*F. *Crocothemis servilia*G. *Trithemis festiva*H. *Pseudagrioni sp.*

Plate 1: Some Odonates recorded in Khajjiar area

Female: Abdomen: 44- 50mm, Hind wing: 36-40mm.

Diagnostic Characters: *Male*, antennae with basal and second joint pale blue. Eyes with two sharply defined area viz., upper two third blackish brown and lower third bluish green. Prothorax bronzy green with a coppery reflex. Thorax brilliant metallic green; legs very long and slim. Wings moderately rounded at tips especially hind wings. Forewings transparent, tinted with pale yellowish green with emerald green venation. Hindwings opaque, basal two thirds iridescent green or peacock blue. Abdomen narrow and cylindrical much longer than wings, bronzy green above and on sides, under sides of abdomen black. *Female*, prothorax and thorax as in males, but humeral and lateral sutures finely white, with black borders. Wings tinted with yellow, palely infused with brown, especially at the apices and along the costa in forewing and generally deeper in tint throughout the whole of hind wing.

Distribution: Found throughout India except desert area, from sea level up to an altitude of 2250m. commonly found between 500-1200m (Subramanian, 2009).

Habits and Habitat: Common in hill streams. Perches on emergent boulders and fallen logs in streams. Males flash its iridescent green marking of hindwing immediately after alighting. Female lays eggs on submerged decaying logs in streams during southwest monsoon.

Observations: Recorded on wings from May to October in Khajjiar area.

DISCUSSION

Himachal Pradesh is known to harbour 88 species of Odonata (Kumar, 2005) and present study revealed the presence of 10 species belonging to 8 genera spread over 5 families of odonates from Khajjiar lake area. Out of these ten eight species

belongs to order Anisoptera (dragonflies) and two to Zygoptera (damselflies). It has been analysed that family Libellulidae supported the highest number of species (6 species, under 4 genera) and all other families have been represented by a single species each. Some species like *Anotogaster basalis*, *Anax immaculifrons*, *Orthetrum sabina sabina*, *Orthetrum triangular triangular*, *Orthetrum pruinosum neglectum*, *Palpopleura sexmaculata sexmaculata*, *Trithemis festiva*, *Neurobasis chinensis* etc. recorded during present study from Khajjiar area have also been earlier recorded from Himachal Pradesh by Kumar (2005). Similarly, he has enlisted Libellulidae as the largest family of Odonates from Himachal Pradesh. Mani (1974) has elucidated that there is presence of distinct zoogeographical distributional patterns in the Himalayan fauna. The fauna of Western Himalaya is composed largely of Oriental elements, partly of Palaearctic and lesser of Mediterranean and Ethiopian elements. Present study showed the presence of *Orthetrum triangular triangular* of Indian element in Khajjiar area.

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