



Research Article

Sympetrum hypomelas (Selys, 1884), an Addition to Anisoptera Fauna of Pakistan

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Abstract | *Sympetrum hypomelas* (Selys, 1884) is added to the Anisoptera fauna of Pakistan by reporting it from district Swabi of Khyber Pakhtunkhwa province. Out of 33 sampling sites, specimens of *S. hypomelas* were found from a single locality of the district. Identification of the specimens was done at National Insect Museum, Islamabad. Detailed description including synonyms, differential characters for the species, previous global records, habitat description, measurements of body parts and ecological data for the positive localities are provided. With the addition of this taxon, Anisoptera fauna of Pakistan now counts 74 species. The area carries important ecology and is less explored for odonate fauna. Although in recent past, few faunistic studies were conducted in this area; yet these couldn't add anything new to the country's fauna. The area under district Swabi represents many lush green valleys and possesses lots of water bodies which support a broad complex of Odonata. More surveys in the district are suggested to unveil probable new records from the area.

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Introduction

Odonates are an important group of class Insecta. They have versatile qualities; being used in medical field for the treatment of throat and preparation of eye ointments (Rehman *et al.*, 2020), water pollution and ecosystem quality indication (Khan *et al.*, 2016; Zia *et al.*, 2018) and to control dengue, malaria, yellow fever vectors (Din *et al.*, 2013; Mehmood *et al.*, 2020), tsetse fly, aphid, jassids, bollworms, borers and white flies (Zia *et al.*, 2008, 2009; Rafi *et al.*, 2009). Odonates are diverse group of flying insects representing more than 6500 species worldwide (Zia *et al.*, 2011; Mehmood *et al.*, 2021).

Family Libellulidae is the largest family of order Odonata. It includes more than 1000 species (Silsby, 2001; Zia *et al.*, 2019). In Pakistan, family Libellulidae is reported as a dominant group too, by various workers like Ahsan *et al.* (2019), Zia *et al.* (2019). Among these, *Sympetrum* genus is known mostly from western parts of the country that comes under Oriental region. Within *Sympetrum* genus more than 60 species are known all over the world (Pilgrim and Von Dohlen, 2007).

Genus *Sympetrum* was first time described by Newman during the year 1883 (Dijkstra and Pilgrim, 2007). It has been reported from Nepal (Mahato and

Edds, 1993; Sharma *et al.*, 2018), Arunachal Pradesh (Ram and Prasad, 1999), Northern Italy (Ottolenghi, 1987), Belgium (Michiels and Dhondt, 1990), Japan (Matsura *et al.*, 1995; Ishizawa, 1998), Iran (Heidari and Dumont, 2002; Ebrahimi, 2009), India (Sharma, *et al.*, 2009; Babu and Nandy, 2010; Kulkarni and Subramanian, 2013; Subramanian and Babu, 2014; 2017; Tiple and Koparde, 2015), USA (Sformo and Doak, 2006; Pilgrim and Von Dohlen, 2007), Turkey (Kazanci, 2010), Taiwan (Tang *et al.*, 2013), Russia (Popova and Haritonov, 2014), Manipur (Takhelmayum and Gupta, 2014), West Bengal (Dawn, 2014), Southwestern Nigeria (Adu *et al.*, 2015), Western Bhutan (Mitra, 2006; Gyeltshen and Kalkman, 2017), Pakistan (Chaudhry *et al.*, 2016), Himachal Pradesh (Babu, 2017), China (Zhang *et al.*, 2018).

As far as species count is concerned, from neighboring countries to Pakistan a record of twenty-six species of *Sympetrum* genus are known. Among these, two species are known from China (Zhang, 2017), twelve species from India (Subramanian and Babu, 2017), eight are documented from Iran (Schneider *et al.*, 2018) and four are assessed from Afghanistan (Butler, 2020). In Pakistan there is a documented record of six species for genus *Sympetrum* (Kalkman *et al.*, 2020). These are *Sympetrum fonscolombii* (Selys, 1840), *Sympetrum meridionale* (Selys, 1841), *Sympetrum speciosum* Oguma, 1915 (earlier known as *Sympetrum haematoneura* Fraser, 1936), *Sympetrum striolatum commixtum* (Selys, 1884), *Sympetrum vulgatum decoloratum* (Selys, 1884) and *Sympetrum orientale* (Selys, 1883) (Fazlullah, 2016). Among these *Sympetrum orientale* (Selys, 1883) is a doubtful record for Pakistan, as the author just listed it in the document providing no details for its population, habitat description and ecology etc.

Within the documented species of *Sympetrum* genus, *Sympetrum hypomelas* is a rare known species. It was first reported from the foothills of the Himalayas (Northern Bengal) during 1884 (Dumont, 2003). Afterwards it was reported from India (Arunachal Pradesh, West Bengal, Himachal Pradesh, Jharkand, Sikkim, Manipur, Meghalaya, Mizoram, Assam, Uttar Pradesh), Myanmar, Bangladesh, China (Tibet or Xizang), Nepal (Subramanian, 2010) and Western Bhutan (Gyeltshen *et al.*, 2017). It is a late season flier and distinguished only by color differences (Pilgrim and Von Dohlen, 2007). *Sympetrum hypomelas* is

known with limited information for its lifecycle, population and distribution. Yet it has a known upper limit of 2,850 meters and habitat details including moist Savana, tropical moist and sub-tropical shrub lands, fresh water marshes, pools, shrub cover rivers, streams and even around water falls (Subramanian, 2010). Knowing its presence in neighboring countries to Pakistan and resemblance in ecology and topography of known sites, search for *S. hypomelas* was initiated in Pakistan by conducting hectic surveys and sampling in expected niches.

Materials and Methods

Surveys were conducted during active season of the years 2017–2018 in four tehsils (Lahore, Swabi, Topi and Razzar) of district Swabi. District Swabi lies at longitude 72.47° (East) and latitude 34.12° (North), with a total surface area of 1543km². It shares its North border with district Buner (Swat), South-East border with district Haripur of K.P. Province and district Attock of Punjab province while Western part adjoins district Nowshera and Mardan of K.P. Province. Topographically the district lies in the junction of rivers, Indus and Kabul and represents both hills as well as plains; hilly area in North and fertile land of plains in South. The region has distinct summer and winter seasons and total annual rainfall is 639 mm. Average annual temperature is 22.2°C and most of the rain received during the month of July. The area is situated 34.12055°N and 72.470154° E. Thirty-three sites were visited (Figure 1) in the whole district and for the positive sites (sites where *S. hypomelas* was found), details like, date of collection, latitude, longitude, and temperature were noted. Recorded samples were initially observed in field while their representatives were brought to laboratory for detailed study. Identification and measurements of the samples was done at National Insect Museum, NARC Islamabad under Olympus (SZ2-ILST) stereoscope. Specimens were identified following taxonomic keys of Chaudhry (2010) and Raza (2015) for generic level, while for the species identification and perplexing characters, Fraser (1936) was followed.

Results and Discussion

During current study among 33 visited localities, specimens of *Sympetrum hypomelas* were found at a single locality of tehsil Razzar; after complete search of one year. Both male and female specimens were

recorded. Details for the recorded samples is provided as below:

Name of the species: *Sympetrum hypomelas* (Selys, 1884)

Synonym/s: *Sympetrum himalayanum* Navás, 1934

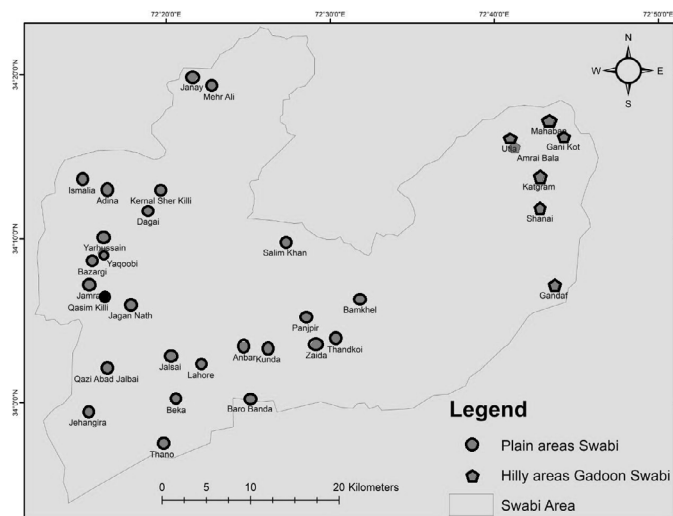


Figure 1: Map showing surveyed localities during present study.

Material(s) examined

Locality: Tehsil Razzar: Village, Qassam Killi/ also known as Shadad Killi (34.10759°N, 72.27002°E; 1112ft), 19. ix. 2018, 1♂; 24. ix. 2018, 1♀.

Measurements of body parts were observed as below;

Male (♂): Forewing = 31-32 mm, hind wing = 33-35 mm, abdomen = 25-26 mm

Female (♀): Forewing = 31-32 mm, hind wing = 30-31 mm, abdomen = 25-26 mm

The specimens tally with the description in Fraser (1936) except for some minor differences which are cited as follows,

Male

Head: labium mat black ventrally, labrum and face bright yellow, frons non-metallic, eyes grayish-brown above, bluish laterally with narrow black border. Prothorax: small, black bearing hairs. Thorax: Dorsum of thorax with one broad black and two yellow markings while laterally thorax covered by two yellow strips separated from one another through black strip. Legs: black. Wings: transparent wings except base of hind wings with small yellowish-brown spot, pterostigma unicolorous, short and same sized in all wings, $11\frac{1}{2}$ - $11\frac{1}{2}$ antenodals, 9-9 postnodals nerves present in forewings and 8-8 antenodals, 10-9 postnodals nerves in hind wings. Abdomen: medium sized slim, black with yellow dorsal markings, first

three segments bright yellow but laterally yellow markings start from fourth to seven segments and last two segments of abdomen dark black color. Male and female closely resemble to each other except for few characters discussed below. Anal appendages: black apically, superior and inferior anal appendages make an oval shape structure.

Female

Similar to male except for following differences. Wings: $11\frac{1}{2}$ -10 antenodals, 8-7 postnodal veins present in forewings and 8-8 antenodals, 10-9 postnodals in hindwings. Anal appendages: tapering, black.

Comments on habitat

Specimens were collected from a perennial stream in a plain, fertile village (Shadad Killi) of tehsil Razzar. Although the source of water was natural spring, yet the clean water in the stream get polluted during rainy seasons due to frequent flooding faced in the area. Stream was surrounded by dwarf as well as tall flora such as *Arundo donax* L. and *Cynodon plectostachyus* (L.). There were maize fields and lots of herbs grown in close vicinity. A thick shrub cover was also present all around.

Sympetrum hypomelas is hereby first time reported from Pakistan, thus adding new topographical record to its known distribution. Selys (1884) reported it from foothills of the Himalayas in Indian side. With its addition, Anisoptera fauna of Pakistan now counts 74 species. If we see its global distribution, Mitra and Thinley (2005) collected it from Northeastern Bhutan while in Maharashtra India, Tiple and Koparde (2015) collected its specimens from plains. Gyeltshen and Kalkman (2017) recorded it from western Bhutan from a water field and Satpathi (2017) reported it from rice fields in Eastern India. It is evident from these records that the species has a variable habitat preference; it is recorded from plains as well as hilly areas, rivers as well as crop fields. It is not restricted to any specific water body as noticed for many odonate species, especially of Zygoptera. In the present work, it is reported from district Swabi which comes under himalayan foothills of Pakistan, yet in the form of some distant part. The positive site shows similar niche for the species as earlier documented in above works.

District Swabi was initially surveyed in recent past by

Rehman *et al.* (2019, 2020) reporting 36 species from the area. Yet, the surveys did not bring forward any new information for scientific community and listed commonly occurring species of the area. Knowing the topography, ecology and presence of unlimited water resources in the district, it was hypothesized that thorough field surveys in the district can bring forward valuable records. Present study was therefore planned and special emphasis was given to localities which were ignored in work of Rehman *et al.* (2019, 2020). The effort became fruitful by finding specimens of *S. hypomelas*. It is however suggested that further deep in the valleys surveys can bring forward more important records of Odonata from the area. Also, search for *S. hypomelas* should be initiated in district Attock, Buner and Haripur to add-up its topographical and geographical range.

Novelty Statement

This paper hereby reports first record of *Sympetrum hypomelas* for Pakistan.

Author's Contribution

Hajira Nur-ul-Islam: Recorded data and specimens being student.

Ahmed Zia: Did identification of the specimens being country expert on Odonata and also did writeup of the manuscript.

Khurshaid Khan and Hira Ali: Supervised all research work conducted in laboratory and field being an academic supervisor and field collection helper respectively.

Abdul Aziz: Did proof reading and paid publication fee.

Conflict of interest

The authors have declared no conflict of interest.

References

- Adu, B.W., E.O. Akindele and A.A. Obadofin. 2015. Composition and distribution of dragonflies and damselflies (Insecta: Odonata) in Iloyin forest, Akure, southwestern Nigeria. *Eth. J. Env. St. Mgt.*, 8(5): 517-529. <https://doi.org/10.4314/ejesm.v8i5.5>
- Ahsan, H., A. Zia, S.M. Ghaffar, S. Ahmed, A.R. Bhatti and S.A. Mehmood. 2019. Dragonflies (Anisoptera: Odonata) of district Neelum, Azad Jammu and Kashmir, Pakistan. *Pak. Entomol.*, 41(1): 7-12.
- Babu, R. and S. Nandy. 2010. New Odonata records from Himachal Pradesh, India. *Notul. Odonatol.*, 7(6): 53-60.
- Babu, R., 2017. Diversity of odonates (Insecta: Odonata) in Fish Farm, College of Veterinary and Animal Sciences, CSKHPKV, Palampur, Himachal Pradesh, India. *Rec. Zool. Sur. India.* 117(4): 367-375. <https://doi.org/10.26515/rzsi/v117/i4/2017/121291>
- Butler, R.A., 2020. List of INSECTA species in Afghanistan. <https://rainforests.mongabay.com/biodiversity/en/afghanistan/INSECTA.html>.
- Chaudhry, M.T., 2010. Systematics of dragonflies (Anisoptera: Odonata) of Pakistan. Ph.D. Dissertation, Pir Mehr Ali Shah Arid Agric. Univ. Rawalpindi, Pakistan.
- Chaudhry, M.T., A. Mohsin, F.A. Shaheen, M. Arshad and A. Zia. 2016. Dragonflies (Odonata: Anisoptera) of Pakistan. *Pak. J. Zool.*, 48(6): 1957-1962.
- Dawn, P., 2014. Taxonomic study of Odonata [Insecta] in Kolkata and surroundings, West Bengal, India. *J. Ent. Zool. St.*, 2(3): 147-152.
- Dijkstra, K.D.B. and E.M. Pilgrim. 2007. *Trithetrum*, a new genus of African dragonflies formerly placed in *Sympetrum* (Odonata, Libellulidae). *J. Afrotrop. Zool.*, 3: 77-81.
- Din, A., A. Zia, A.R. Bhatti and M.N. Khan. 2013. Odonata naiads of Potohar plateau, Punjab, Pakistan. *Pak. J. Zool.*, 45(3): 695-700.
- Dumont, H.J., 2003. Odonata from the Republic of Mongolia and from the Autonomous Region of Inner Mongolia. *Int. J. Odonatol.*, 6(2): 127-146. <https://doi.org/10.1080/13887890.2003.9748384>
- Ebrahimi, A., 2009. Dragonflies (Odonata) from South-Eastern Iran. *Cas. J. Environ. Sci.*, 7(2): 107-112.
- Fazlullah, M., A. Saeed, A. Zia, M.S. Farid, T. Khan, Badshah and N. Zada. 2016. Libellulidae (Anisoptera) of upper Swat, Khyber Pakhtunkhwa, Pakistan. *J. Ent. Zool. St.*, 4(1): 227-228.
- Fraser, F.C., 1936. The fauna of British India including Ceylon and Burma. Vol. 3, Today and Tomorrow's Printers and Publisher. New Dehli.
- Gyeltshen, T. and V.J. Kalkman, 2017. Odonata records from western Bhutan, with six

- new records and a note on the synonymy of *Himalagrion* with *Coenagrion*. Notul. Odonatol., 8(9): 319-374.
- Gyeltshen, T., T. Nidup, P. Dorji, T. Dorji and V.J. Kalkman. 2017. Bibliography and checklist of the dragonflies and damselflies of Bhutan. J. Thr. Tax., 9(1): 9743-9747. <https://doi.org/10.11609/jott.2758.9.1.9743-9747>
- Heidari, H. and H.J. Dumont. 2002. An annotated check-list of the Odonata of Iran. Zool. Mid. East. 26(1): 133-150. <https://doi.org/10.1080/09397140.2002.10637929>
- Ishizawa, N., 1998. Thermoregulation in *Sympetrum frequens* (Selys), with notes on other *Sympetrum* species (Anisoptera: Libellulidae). Odonatology, 27(3): 317-334.
- Kalkman, V.J., R. Babu, M. Bedjanič, K. Conniff, T. Gyeltshen, M.K. Khan, K.A. Subramanian, A. Zia, A.G. Orr. 2020. Checklist of the dragonflies and damselflies (Insecta: Odonata) of Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka. Zootaxa, 4849(1): 001-084. <https://doi.org/10.11646/zootaxa.4849.1.1>
- Kazanci, N.İ.L.G.Ü.N., 2010. Contribution to the knowledge of Odonata (Insecta) fauna of Turkey: Eastern and Southeastern Anatolia. Rev. Hydrobiol., 3: 1-11.
- Khan, J. Saifullah and A. Zia. 2016. Biodiversity of dragonflies and their life threatening factors in tehsil Chamla and Daggarr of district Buner, Khyber Pakhtunkhwa. Pak. J. Zool. 48(4): 1077-1082.
- Kulkarni, A.S. and K.A. Subramanian. 2013. Habitat and seasonal distribution of Odonata (Insecta) of Mula and Mutha river basins, Maharashtra, India. J. Thr. Tax., 5(7): 4084-4095. <https://doi.org/10.11609/JoTT.o3253.4084-95>
- Mahato, M. and D. Edds. 1993. Altitudinal distribution of odonate larvae in Nepal's Gandaki River. Odonatology, 22(2): 213-221.
- Matsura, T., K. Komatsu, K. Nomura and M. Oh'Oto. 1995. Life history of *Sympetrum striolatum imitoides* Bartenev at an outdoor swimming pool in an urban area (Anisoptera: Libellulidae). Odonatology, 2(3): 291-300.
- Mehmood, S.A., A. Zia, A. Shabir, W.A. Panhwar, W. Khan, M. Shah and Irfanullah. 2020. Seasonal abundance and distribution of dragonflies in upper Siran valley of district Mansehra Pakistan. Braz. J. Biol., pp. 1-7.
- Mehmood, S.A., M.S. Ahmad, A. Zia, S. Ahmed, M. Shah, W. Khan, W.A. Panhwar. 2021. Molecular and Phylogenetic analysis of family Aeshnidae of Hazara region, Pakistan. Int. J. Agric. Biol., 25: 109-116. <https://doi.org/10.17957/IJAB/15.1644>
- Michiels, N.K. and A.A. Dhondt. 1990. Costs and benefits associated with oviposition site selection in the dragonfly *Sympetrum danae* (Odonata: Libellulidae). Anim. Behav., 40(4): 668-678. [https://doi.org/10.1016/S0003-3472\(05\)80696-7](https://doi.org/10.1016/S0003-3472(05)80696-7)
- Mitra, A. and P. Thinley. 2005. Odonata of Bumdeling Wildlife Sanctuary, Trashigang, eastern Bhutan, with the description of two new species. Technical Report, pp. 1-58.
- Mitra, A., 2006. Current status of the Odonata of Bhutan: A checklist with four new records. Bhutan J. Ren. Nat. Res., 2(1): 136-143.
- Mitra, A., C. Dem, K. Gyeltshen, L. Dorji, N.K. Puri, P. Tshering, P. Wangdi, Acharya, P.R. Namgyel, S. Dorji, and S.P. Lhaden. 2014. Odonata survey in Central and Western Bhutan covering eight Dzongkhags (Districts): an annotated species list with nine new records. J. Ent. Zool. St., 2(2): 11-15.
- Ottolenghi, C., 1987. Reproductive behaviour of *Sympetrum striolatum* (Charp) at an artificial pond in northern Italy (Anisoptera: Libellulidae). Odonatology, 16(3): 297-306.
- Pilgrim, E.M. and C.D. Von Dohlen. 2007. Molecular and morphological study of species-level questions within the dragonfly genus *Sympetrum* (Odonata: Libellulidae). Ann. Entomol. Soc. Am., 100(5): 688-702. [https://doi.org/10.1603/0013-8746\(2007\)100\[688:MAM SOS\]2.0.CO;2](https://doi.org/10.1603/0013-8746(2007)100[688:MAM SOS]2.0.CO;2)
- Popova, O.N. and A.Y. Haritonov. 2014. Mass reproductive wanderings of dragonflies of the genus *Sympetrum* (Odonata, Libellulidae). Ent. Rev., 94(1): 21-28. <https://doi.org/10.1134/S0013873814010023>
- Rafi, M.A., Khan, M.R., A. Zia and A. Shehzad. 2009. Diversity of Odonata in district Poonch and Sudhnoti of Kashmir Valley-Pakistan, with a new record for the country. Halteres, 1(1): 28-35.
- Ram, R.A.J.A. and M. Prasad. 1999. On the collection of Odonata from Arunachal Pradesh, India. Rec. Zool. Sur. India, 97(2): 113.
- Raza, K.N., 2015. Altitudinal variation affecting

- species distribution of dragonflies (Anisoptera: Odonata) in sub-himalayan hill tracts of Pakistan. M.Phil. Thesis, Dept. Plant and Environmental Protection, PARC Institute of Advance Studies in Agric. Quaide-i-Azam Uni, Pakistan.
- Rehman, A., S. Ahmad, A. Zia, A. Latif, T. Khan, M. Afzaal, W. Kamal, S. Khan and H. Tariq. 2019. Damselflies (Odonata: Zygoptera) fauna of district Swabi Khyber Pakhtunkhwa, Pakistan. J. Ent. Zool. St., 7(2): 190-193. <https://doi.org/10.17582/journal.sja/2020/36.2.675.684>
- Rehman, A., S. Ahmad, A. Zia, A. Ali, K. Shahjeer, A. Latif and T. Khan. 2020. Dragonflies (Anisoptera: Odonata) fauna of district Swabi Khyber Pakhtunkhwa, Pakistan. Sarhad J. Agric., 36(2): 675-684. <https://doi.org/10.17582/journal.sja/2020/36.2.675.684>
- Satpathi, C.R., 2017. A treatise on dragonflies (Order: Odonata, Class: Insecta) of rice ecosystems in Eastern India. World Sci. News, 86(2): 67-133.
- Schneider, T., D. Ikemeyer, O. Mueller, and H.J. Dumont. 2018. Checklist of the dragonflies (Odonata) of Iran with new records and notes on distribution and taxonomy. Zootaxa, 4394(1): 1-40. <https://doi.org/10.11646/zootaxa.2581.1.1>
- Selys-Longchamps, E.D., 1884. Revision des *Diplax paléarctiques*. In: Ann. de la Soc. Entomol. de Belgique, 28: 29-45.
- Sformo, T. and P. Doak, 2006. Thermal ecology of interior Alaska dragonflies (Odonata: Anisoptera). Funct. Ecol., 20(1): 114-123. <https://doi.org/10.1111/j.1365-2435.2006.01064.x>
- Sharma, G., V.V. Ramamurthy and R. Kumar. 2009. Collection of damselflies and dragonflies (Odonata: Insecta) in National Pusa Collection, Division of Entomology, Indian Agricultural Research Institute, New Delhi, India. Biol. For., 1(2): 47-50.
- Sharma, M., B.R. Oli, S. Awasthi, N. Subedi, and P.R. Pokhrel. 2018. Dragonflies and damselflies (Insecta: Odonata) of western Nepal: A checklist. Int. J. Faun. Biol. St. 5(6): 140-146.
- Silsby, J., 2001. Dragonflies of the world. Washington, DC: Smithsonian institute press. <https://doi.org/10.1071/9780643100879>
- Subramanian, K.A. and R.A. Do. 2010. *Sympetrum hypomelas*. The IUCN Red List of Threatened Species 2010.
- Subramanian, K.A. and R. Babu. 2014. A checklist of Odonata (Insecta) of India. Zool. Sur. India, Kolkata, WB.
- Subramanian, K.A. and R. Babu. 2017. Checklist of Odonata (Insecta) of India. Version 3.0.
- Takhelmayum, K. and S. Gupta. 2014. Odonata larvae of Keibul Lamjao National Park, Manipur, northeastern India. J. Thr. Tax., 6(6): 5858-5863. <https://doi.org/10.11609/JoTT.o3453.5858-63>
- Tang, H.C., W. Yeh and S.L. Chen. 2013. Description of an endemic and endangered new *Sympetrum* species (Odonata: Libellulidae) from the subtropical area of Taiwan. Zootaxa, 3693(3): 351-357. <https://doi.org/10.11646/zootaxa.3693.3.5>
- Tiple, A.D. and P. Koparde. 2015. Odonata of Maharashtra, India with notes on species distribution. J. Ins. Sci., 15(1): 1-47. <https://doi.org/10.1093/jisesa/iev028>
- Zhang, F., T. Liu, M. Liu, Y. Yang and H. Liu. 2018. A checklist of Odonata from Baiyang Lake, Xiongan New Area, China. Int. J. Faun. Biol. St., 5(6): 87-91.
- Zhang, H., 2017. Odonata fauna of Dai-Jingpo Autonomous Prefecture of Dehong in the western part of the Yunnan Province, China-a brief personal balance from seven years of surveys and workshop report on current studies. Int. Dragon. Fund. Rep., 103: 1-49.
- Zia, A., M. Naeem, M.A. Rafi and S.A. Hassan. 2008. A list of damselflies (Zygoptera: Odonata) recorded from Azad Jammu and Kashmir (AJ and K). Pak. J. Sci. Ind. Res., 51(1): 329-332.
- Zia, A., M.A. Rafi, Z. Hussain and M. Naeem. 2009. Occurrence of Odonata in Northern areas of Pakistan with seven new records. Halteres, 1(1): 48-56.
- Zia, A., M. Naeem, M.A. Rafi, F. Naz, S. Afsheen, M. Ilyas. 2011. Damselflies (Zygoptera: Odonata) of Pakistan: Part 1. J. Ins. Sci., 11: 102. Available online: [insectscience.org/11.102](https://doi.org/10.1673/031.011.10201) <https://doi.org/10.1673/031.011.10201>
- Zia, A., A. Din, I. Azam, A. Munir and S. Afsheen. 2018. Effect of salinity gradients on species composition of Odonata naiads. Arthropods, 7(1): 11-25.
- Zia, A.I., Hussain, S.A. Mehmood, S. Ahmad, M. Shah and A.R. Bhatti. 2019. Richness and distribution of Odonata in Kurram district,

