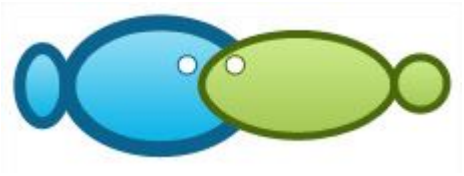

# Species diversity of Odonata in Bolyok Falls, Naawan, Misamis Oriental, Philippines

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**Abstract**. Odonata (dragonfly and damselfly) are important predators of disease vectors and agricultural pests. They are also useful as bioindicators of freshwater ecosystems due to their sensitivity to anthropogenic change. This study was conducted to assess the species composition of Odonata in the vicinity of Bolyok Falls in Brgy. Lubilan, Naawan, Misamis Oriental, Philippines. Field sampling was conducted in three sampling sites on March 9, 2019, using sweep netting and hand-picking methods. A total of nine species were identified belonging to seven families and seven genera of Odonata. *Risiocnemis appendiculata* was the most abundant Odonata species. The endemism is high at 77.78% with six species endemic to the Philippines and one endemic to Mindanao. The overall species diversity index of Bolyok Falls is very low at H' = 1.59. Identified threats of odonates include land clearing for agriculture and expansion of resort facilities near the sampling sites. The high levels of endemism indicate that the area is vital for odonates. Thus, the formulation of mitigation measures for conservation and preservation of species is needed in the area.
**Key Words**: anthropogenic, bioindicator, damselfly, dragonfly, endemic.

**Introduction**. Odonata play a vital role in the ecosystems. They are good bioindicator of freshwater habitats due to their ecophysiological adaptations that enable them to occupy different aquatic ecosystems (Benazzouz et al 2009; Mendes et al 2015; Vincy et al 2016; Abdul et al 2017). The species assemblages of dragonflies are also useful indicator of habitat degradation as a result of anthropogenic activities (Corbet 1993). For instance, generalist species of Odonata dominated in human-altered habitats with wide habitat preference and distribution. In contrast, specialist species were found in undisturbed riparian vegetation with a narrow distribution. Moreover, they also act as an important biocontrol agent of harmful insects, such as mosquitoes and other blood-sucking flies (Subramanian 2005; Seidu et al 2018).

At present, there are about 6400 species of Odonata described worldwide (Shah & Khan 2020). In the Philippines, there are about 300 known species of Odonata with a high percentage of endemic species, especially in Zygoptera which have a very limited range (Hämäläinen 2004). Moreover, several ecological studies have been conducted on Odonata in different areas of Mindanao that generates voluminous inventory and diversity data: in Mt. Hamiguitan Wildlife Sanctuary, Davao Oriental with 31 species (Villanueva & Mohagan 2010; Medina et al 2018); in Diomabok Lake, Davao Oriental with 56 species (Villanueva 2011); in Buru-un, Iligan City and in Plaridel, Misamis Occidental with 26 species (Aspacio et al 2013); in Sinacaban, Oroquieta, and Ozamiz in the province of Misamis Occidental with 22 species (Mapi-ot et al 2013); in freshwater systems of Aurora, Tukuran, and Lakewood in Zamboanga del Sur with 36 species (Cayasan et al 2013); in Lanuza and San Agustin, Surigao del Sur with 49 species (Quisil et al 2013); in Wato Balindong and Pualas, Lanao del Sur with 46 species (Malawani et al 2014); in four barangays of Samal island with 31 species (Medina et al 2015a); in Mainit Hot Spring Protected Landscape in Compostela Valley Province with 41 species (Medina et

al 2015b); in Bega Watershed, Prosperidad, Agusan del Sur with 27 species (Nuñeza et al 2015); in Mts. Pinukis and Gimamaw, Zamboanga del Sur with 35 species (Yuto et al 2015); in Sultan Naga Dimaporo, Lanao del Norte with 13 species recorded (Yapac et al 2016); and some species reported were new records in the islands of Mindanao.

Furthermore, twelve new species belonging to the family Coenagrionidae were described from different islands of the Philippines (Villanueva & Dow 2014; Villanueva & Dow 2019). This indicates that more studies are needed to document the extent of diversity and distribution of Odonatofauna in Mindanao. Hence, this study was conducted to determine the species diversity and distribution of Odonata in the stream of Bolyok Falls, barangay Lubilan, Misamis Oriental, Philippines.

## Material and Method

***Description of the study sites***. Odonata specimens were collected from three sampling sites (upstream, midstream, and downstream) along the vicinity of Bolyok Falls, located within the coordinates 8°24'46.54"N, 124°23'57.14"E and an elevation range from 250 to 300 meters above sea level (masl) in Sitio Mahangub, barangay Lubilan, Naawan, Misamis Oriental (Figure1).

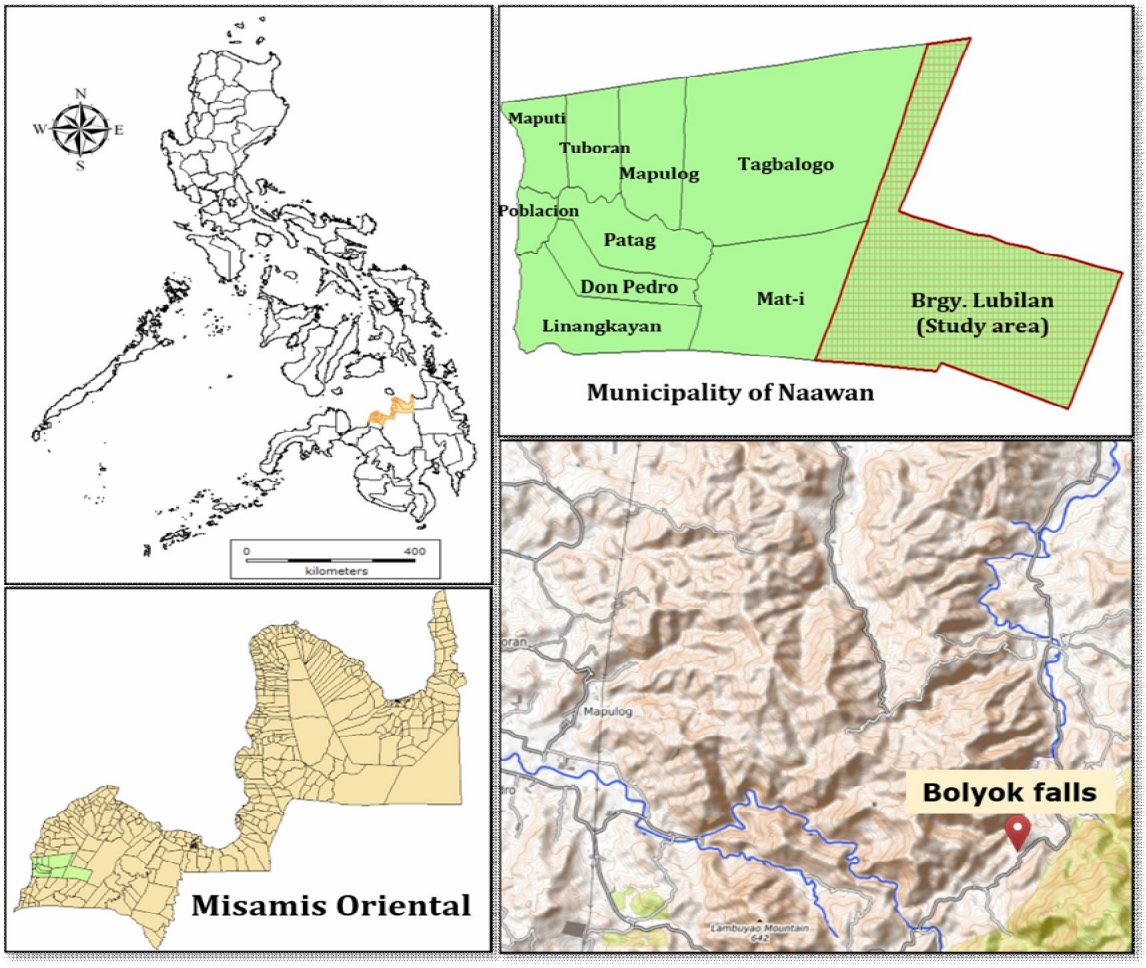


Figure1. The location of Bolyok Falls, Brgy. Lubilan, Naawan, Misamis Oriental, Philippines.

Sampling Site 1 (upstream) is located near Bolyok Falls. The slow-moving water flows continuously in the narrow stream channel. There are small pools formed in some parts of the stream channel. This site has a closed-canopy and notable abundance of *Schismatoglottis* species of the family Araceae. The species of bamboo are also common along the trail and in the proximity of the stream channel.

Sampling site 2 (midstream) is surrounded by a remnant of a secondary forest with vegetation cover along the rolling sides of the stream that provide shades. The most abundant ground cover includes ground ferns and *Schismatoglottis* sp. It has an open-canopy area and flat terrain where a man-made trail is visible. Also, the continuously slow-moving water is one of the distinct features of this site.

Sampling site 3 (downstream) is near the resort facility. The most abundant shrubs along the stream channel are "bugang" (*Saccharum* sp.), "hagonoy" (*Chromolaena odorata*) and wild sage (*Lantana camara*). The trees along the stream channel provide shade on the riparian area. The flow of water is very slow due to the presence of boulders on the stream.

***Collection and identification of specimens***. Field sampling was conducted on March 9, 2019 for a total of 16 person-hours. Opportunistic sampling, sweep netting, and hand-picking were employed to collect samples. Specimens directly identified in the field were released after photographed. All collected specimens were placed in a triangular glassine paper and stored in plastic box containing a naphthalene ball. The collected samples were then preserved in acetone: 12 hours for damselflies and 24 hours for dragonflies and then air-dried. Specimens were initially identified using published references of Philippine Odonata and verified by the third author.

***Statistical analysis***. Diversity indices, Analysis of Variance (ANOVA), and similarity percentage (SIMPER) for the Log (x+1) transformed abundance data was performed using the software Primer 7 ver.7.0.17. SIMPER was used to examine the species that contribute to the similarity pattern in species between sampling sites. The Shannon index of diversity was interpreted using the Fernando biodiversity scale wherein an index values less than 1.99 is very low, values between 2.00 and 2.49 is low, between 2.50 and 2.99 is moderate, between 3.00 and 3.49 is high, and greater than 3.50 values indicate a very high diversity. Furthermore, evenness index values between 0.05-0.14 is very low, between 0.15 and 0.24 is low, between 0.25 and 0.49 is moderate, between 0.50 and 0.74 is high, and index values between 0.75 and 1.00 is very high (Fernando 1998). Moreover, Analysis of Variance (ANOVA) was used to examine whether or not there is a difference in index of diversity between sampling sites along the stream of Bolyok Falls.

**Results and Discussion**. One hundred thirty-nine individuals were collected from three sampling sites along the stream of Bolyok Falls in Barangay Lubilan, Naawan, Misamis Oriental (Table 1). A total of nine species (including 1 morphospecies) were identified belonging to seven genera and representing seven families of Odonata. *Risiocnemis appendiculata* (38.13%) and *Rhinocypha turconii* (33.09%) were the most abundant species recorded in all sampling sites. The *R. appendiculata* is a forest specialist which prefers forested habitats, while *R. turconii* prefers less disturbed habitat (Villanueva 2009). Despite of the observed anthropogenic activities in the area these species were able to thrive in those habitats. The species of Odonata developed physiological and morphological adaptation as a result of disturbances in order to endure the deterioration in the habitat quality (Abdul et al 2017).

Figure 2 shows the species composition by families of Odonata. Both Platycnemididae and Chlorocyphidae families were common in all sampling sites (downstream, midstream, and upstream). Most species belonging to family Platycnemididae and Chlorocyphidae are habitat-specific, that is, they prefer to thrive in a habitat that is suitable for proper physiological functioning, and hence their distribution is aggregated (Horák et al 2010; Koli et al 2015).

Moreover, 66.67% of the species recorded in three sampling sites are Philippine endemic and 11.11% are Mindanao endemic species (Table 1). These include: *Cyrano unicolor, Risiocnemis appendiculata, Diplacina bolivari, Rhinocypha turconii, R. colorata, Vestalis melania*, and *Prodasineura integra.*

Table 1

Species composition, relative abundance and distribution of Odonata in Bolyok Falls

| Taxon | Sampling sites | | | Total | R.A. (%) |
|---|---|---|---|---|---|
| | Downstream | Midstream | Upstream | | |
| Suborder: Anisoptera | | | | | |
| Libellulidae<br>*Diplacina bolivari* [PE]<br>(Selys, 1882) | 3 | 2 | 0 | 5 | 3.60 |
| Suborder: Zygoptera | | | | | |
| Platycnemididae<br>*Risiocnemis appendiculata* [ME]<br>(Brauer, 1868) | 4 | 31 | 18 | 53 | 38.13 |
| Chlorocyphidae<br>*Rhinocypha turconii* [PE]<br>(Selys, 1891) | 14 | 11 | 21 | 46 | 33.09 |
| *Cyrano unicolor* [PE]<br>(Selys, 1869) | 0 | 3 | 0 | 3 | 2.16 |
| *Rhinocypha colorata* [PE]<br>(Hagen in Selys, 1869) | 0 | 4 | 0 | 4 | 2.88 |
| Calopterygidae<br>*Vestalis melania* [PE]<br>(Selys, 1873) | 0 | 3 | 13 | 16 | 11.51 |
| Coenagrionidae<br>*Agriocnemis femina* [O]<br>(Brauer, 1868) | 0 | 4 | 0 | 4 | 2.88 |
| Protoneuridae<br>*Prodasineura integra* [PE]<br>(Selys, 1882) | 0 | 5 | 0 | 5 | 3.60 |
| Platystictidae<br>*Drepanosticta* sp. | 3 | 0 | 0 | 3 | 2.16 |
| Total no. of individuals | 24 | 63 | 52 | 139 | |
| Total no. of species | 4 | 8 | 3 | 9 | |
| Relative abundance (%) | 17.27 | 45.32 | 37.41 | 100 | |
| Total no. of endemic | 3 | 7 | 3 | 7 | |
| Endemism | 75 | 87.50 | 100 | 77.78 | |

Legend: R.A. = relative abundance; ME = Mindanao endemic; O = Oriental; PE = Philippine endemic.

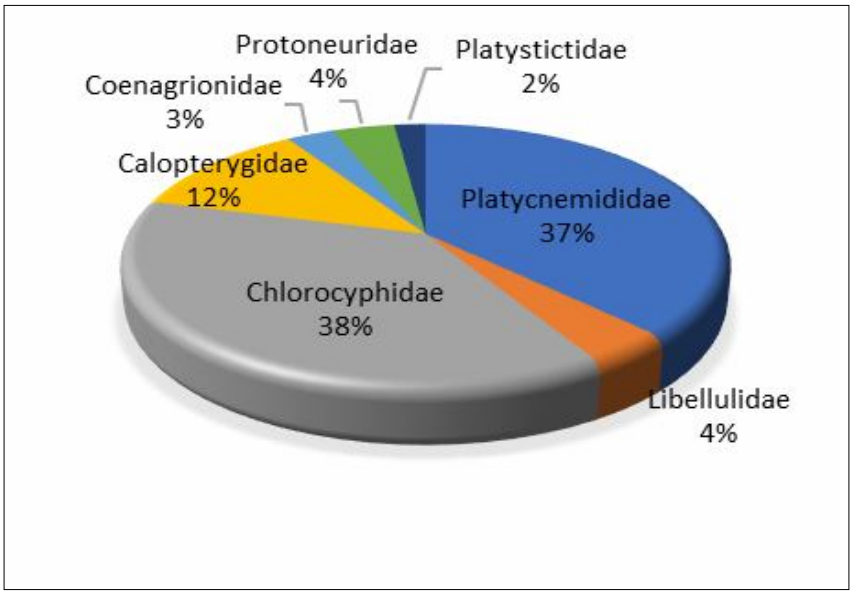


Figure 2. Species composition based on families of Odonata in Bolyok Falls, Naawan, Misamis Oriental.

The highest endemism was recorded in the upstream sampling site, where all species are 100% endemic. Endemic species usually dwell on a specific habitat where the basic resources are readily available to support their physiological needs. In Odonata, the presence of aquatic habitat, type of substrate and organic matter, and food availability are very important in both larval and adult odonates (Scheffer et al 1984; Corbet 1999; Che Salmah et al 2005). Also, the success of larval development requires suitable physico-chemical characteristics of the aquatic habitat (Johansson & Suhling 2004).

Furthermore, the result of this study supports previous findings that endemism of Odonata increases in forested areas, less disturbed habitats, presence of shaded areas along the stream and aquatic vegetation, and pristine waters (Mapi-ot & Enguito 2014; Harisha & Hosetti 2017; Luke et al 2017; Seidu et al 2017). On the other hand, results of Similarity Percentages (SIMPER) analysis showed that the average similarity between sampling sites based on the Bray-Curtis similarity measure is 54.61% (Figure 3). The observed similarities were due to *R. turconii* (44.32%) and *R. appendiculata* (42.38%) that contribute the most to the group/species similarities of the three sampling sites (Table 2). This indicates that the observed relatively abundant species *R. turconii* and *R. appendiculata* influence the similarity values between sampling sites. Also, there were species found restricted only on a particular sampling site: *Drepanosticta* sp. in sampling site 1 (downstream); *Cyrano unicolor*, *Rhinocypha colorata*, *Agriocnemis femina*, and *Prodasineura integra* in sampling site 2 (midstream). These species are known to inhabit relatively pristine water systems (Caparoso et al 2016). In this study, despite of the observed disturbances in sampling site 1 (downstream) and sampling site 2 (midstream) noteworthy species were able to thrive in the area. This indicate that these species demonstrate tolerance to anthropogenic disturbances as a result of alteration of the structure of the landscape that favor certain groups of species, depending on their habitat preferences and on their behavioral and physiological characteristics (da Silva Monteiro Júnior et al 2015).

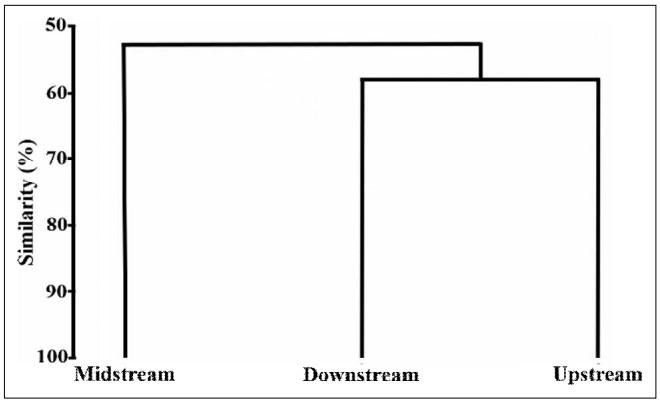


Figure 3. Cluster analysis using Bray-Curtis similarity (Primer ver.7.0.).

Table 2

Resuls of SIMPER species contribution (Primer ver.7.0.)

| *Species* | *Ave. abundance* | *Ave. similarity* | *Similarity/SD* | *Contribution %* | *Cumulative %* |
|---|---|---|---|---|---|
| *Rhinocypha turconii* | 3.57 | 24.20 | 3.25 | 44.32 | 44.32 |
| *Risiocnemis appendiculata* | 3.45 | 23.15 | 6.57 | 42.38 | 86.70 |
| *Vestalis melania* | 1.67 | 4.10 | 0.58 | 7.50 | 91.24 |
| *Diplacina bolivari* | 1.34 | 3.16 | 0.58 | 5.79 | 100.00 |

Table 3 shows the calculated Shannon diversity index (H') for each sampling site and the overall diversity index for all sampling sites. Overall, the stream flowing from Bolyok Falls has a very low index of diversity at H' = 1.59 and high evenness index at E = 0.55. Moreover, a comparison between sampling sites showed that site 2 (midstream) has higher diversity index than site 1 (downstream) and site 3 (upstream). Furthermore, eight species were recorded in site 2 and 50% of which were not documented in other sampling sites. Sampling site 2 is surrounded by a remnant of secondary forest with vegetation cover along the rolling sides of the stream that provide shades.

Table 3

Species diversity indices in three sampling sites of Bolyok Falls, Naawan, Misamis Oriental

| *Diversity indices* | *Sampling sites* | | | *Overall* |
|---|---|---|---|---|
| | *Downstream* | *Midstream* | *Upstream* | |
| Species | 4 | 8 | 3 | |
| Dominance | 0.40 | 0.29 | 0.35 | 0.27 |
| Shannon (H') | 1.13 | 1.60 | 1.08 | 1.59 |
| Evenness (E) | 0.78 | 0.62 | 0.98 | 0.55 |

The continuously slow-moving water is one of the distinct features of site 2. It has an open-canopy area and flat terrain where a man-made trail is visible. This might explain the higher diversity index in site 2 than in site 1 and site 3. This could also be associated to the species habitat preference as reported in previous studies on Odonata that some species prefer a habitat (e.g. pristine) that can support the physiological requirements for its survival (Hof et al 2006). On the other hand, results of Analysis of Variance (ANOVA) found no significant difference in index of diversity between sampling sites along the stream of Bolyok Falls.

**Conclusions**. In this study, the high endemism of Odonata indicate that the streams of Bolyok Falls are considerably in good condition. This was demonstrated by the aggregated distribution of identified indicator species *Risiocnemis appendiculata, Rhinocypha turconii,* and *Vestalis melania* in all sampling sites. Furthermore, increasing sampling effort is recommended in future studies in the area in order to generate more comparative results with other studies on Odonatofauna in Bolyok Falls and its neighboring aquatic ecosystems.

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## References

Abdul N. H., Rawi C. S. M., Ahmad A. H., Al-Shami S. A., 2017 Effect of environmental disturbances on Odonata assemblages along a tropical polluted river. Ekologia (Bratislava) 36(4):388-402.

Aspacio K. T., Yuto C. M., Nuñeza O. M., Villanueva R. J. T., 2013 Species diversity of Odonata in selected areas of Buru-un, Iligan City and Tubod, Lanao del Norte, Philippines. ABAH Bioflux 5(2):145-155.

Benazzouz B., Mouna M., Amezian M., Bensusan K., Perez C., Cortes J., 2009 Assessment and conservation of the dragonflies and damselflies (Insecta: Odonata) at the marshes of Smir. Bulletin de l'Institut Scientifique, Rabat, section Sciences de la Vie 31(2):79-84.

Caparoso K. R., Medina M. N. D., Jumawan K. M., Villanueva R. J. T., 2016 Species composition and status of Odonata in Malabog, Paquibato District Davao City, Philippines. University of Mindanao International Multidisciplinary Research Journal 1(2):158-163.

Cayasan R. D., Limitares D. E., Gomid J. V., Nuñeza O. M., Villanueva R. J. T., 2013 Species richness of Odonata in selected freshwater systems in Zamboanga del Sur, Philippines. AACL Bioflux 6(4):378-393.
Che Salmah M. R., Abu Hassan A., Wazhizatul-Afzan A., 2005 Preliminary study on the composition and distribution of Odonata in Perlis State Park. Malayan Nature Journal 57(3):317-326.
Corbet P. S., 1993 Are Odonata useful as bioindicators? Libellula 12(3/4):91-102.
Corbet P. S., 1999 Dragonflies: behavior and ecology of Odonata. Comstock Publishing Associates, 864 pp.
da Silva Monteiro Júnior C., Juen L., Hamada N., 2015 Analysis of urban impacts on aquatic habitats in the central Amazon basin: adult odonates as bioindicators of environmental quality. Ecological Indicators 48:303–311.
Fernando E. S., 1998 Forest formations and flora of the Philippines: handout in FBS 21. College of Forestry and Natural Resources, University of the Philippines at Los Baños.
Hämäläinen M., 2004 Critical species of Odonata in the Philippines. International Journal of Odonatology 7(2):305-310.
Harisha M. N., Hosetti B. B., 2017 Status, diversity and conservation threats of odonates in Kundavada Lake, Davanagere district, Karnataka, India. Journal of Entomology and Zoology Studies 5(1):312-316.
Hof C., Brandle M., Brandl R., 2006 Lentic odonates have larger and more northern ranges than lotic species. Journal of Biogeography 33(1):63-70.
Horák J., Vávrová E., Chobot K., 2010 Habitat preferences influencing populations, distribution and conservation of the endangered saproxylic beetle *Cucujus cinnaberinus* (Coleoptera: Cucujidae) at the landscape level. European Journal of Entomology 107:81-88.
Koli V. K., Bhatnagar C., Shekhawat D. S., 2015 Diversity and species composition of Odonates in Southern Rajasthan, India. Proceedings of the Zoological Society 68(2):202-211.
Luke S. H., Dow R. A., Butler S., Khen C. V., Aldridg D. C., Foster W. A., Turner E. C., 2017 The impacts of habitat disturbance on adult and larval dragonflies (Odonata) in rainforest streams in Sabah, Malaysian Borneo. Freshwater Biology 62(3):491-506.
Malawani A. D., Ampang-Macabuat N. M., Nuñeza O. M., Villanueva R. J. T., 2014 Odonata of Lanao del Sur, Mindanao, Philippines. International Research Journal of Biological Sciences 3(1):42-48.
Mapi-ot E. F., Enguito M. R., 2014 Species richness of adult Odonata in Labo river, Ozamiz City, Philippines. The Journal of Multidisciplinary Studies 3(1):86-99.
Mapi-ot E. F., Taotao A. U., Nuñeza O. M., Villanueva R. J. T., 2013 Species diversity of adult Odonata in selected areas from Misamis Occidental Province, Philippines. AACL Bioflux 6(4):421-432.
Medina M. N. D., Cabras A. A., Villanueva R. J. T., 2015a Odonata of Island Garden city of Samal and its relation to other small islands in the Philippines. International Research Journal of Biological Sciences 4(9):54-60.
Medina M. N. D., Cabras A. A., Villanueva R. J. T., 2015b Odonata fauna of Compostela, Valley Province, Mindanao Island, Philippines. International Journal of Current Research in Biosciences and Plant Biology 2(10):104-109.
Medina M. N. D., Cabras A. A., Villanueva R. J. T., Colong R., 2018 Odonata recorded in the buffer zone of Mt. Hamiguitan Range Wildlife Sanctuary with remarks on the distribution of endangered *Risiocnemis antoniae* in Davao Oriental Philippines. Notulae Scientia Biologicae 10(1):14-20.
Mendes T. P., Cabette H. S. R., Juen L., 2015 Setting boundaries: environmental and spatial effects on Odonata larvae distribution (Insecta). Annals of the Brazilian Academy of Sciences 87(1):239-248.
Nuñeza K. J. M., Nuñeza O. M., Villanueva R. J. T., 2015 Species diversity of Odonata in Bega watershed, Agusan del Sur, Philippines. Journal of Biodiversity and Environmental Sciences 7(5):69-82.

Quisil S. J. C., Arreza J. D. E., Nuñeza O. M., Villanueva R. J. T., 2013 Species richness of Odonata in Lanuza and San Agustin, Surigao del Sur, Philippines. AES Bioflux 5(3):245-260.
Scheffer M., Achterberg A. A., Beltman S., 1984 Distribution of macroinvertebrates in a ditch in relation to the vegetation. Freshwater Biology 14(4):367-370.
Seidu I., Danquah E., Nsor C. A., Kwarteng D. A., Lancaster L. T., 2017 Odonata community structure and patterns of land use in the Atewa Range Forest Reserve, Eastern Region (Ghana). International Journal of Odonatology 20(3-4):173-189.
Seidu I., Nsor C. A., Danquah E., Lancaster L. T., 2018 Odonata assemblages along an anthropogenic disturbance gradient in Ghana's Eastern Region. Odonatologica 47(1/2):73-100.
Shah M. N. A., Khan M. K., 2020 OdoBD: an online database for the dragonflies and damselflies of Bangladesh. PLoS ONE15(4):e0231727.
Subramanian K. A., 2005 Dragonflies and damselflies of peninsular India - a field guide. E-Book of Project Lifescape. Centre for Ecological Sciences, Indian Institute of Science and Indian Academy of Sciences, Bangalore, India, 118 pp.
Villanueva R. J. T., 2009 Odonata of Dinagat Island, the Philippines: updated species list and notes on conservation of species and habitats. Notulae Odonatologicae 7(3):27-35.
Villanueva R. J. T., 2011 Odonata fauna of Diomabok Lake and its surroundings, Davao Oriental, Mindanao Island, Philippines. International Dragonfly Fund – Report 38:1-29.
Villanueva R. J. T. Mohagan A., 2010 Diversity and tatus of Odonata across vegetation types in Mt. Hamiguitan Wildlife Sanctuary, Davao Oriental. Asian Journal of Biodiversity 1(1):25-35.
Villanueva R. J. T., Dow R. A., 2014 Review of the Philippine taxa formerly assigned to the genus *Amphicnemis* Selys, II. Genus *Sangabasis* with descriptions of eight new species (Odonata: Coenagrionidae). Zootaxa 3815(1):1-28.
Villanueva R. J. T., Dow R. A., 2019 Review of the Philippine taxa formerly assigned to the genus *Amphicnemis* Selys. Part III. Genus *Pericnemis*: *Bonita*- and *Incallida*-groups with descriptions of four new species (Odonata: Coenagrionidae). Philippine Journal of Systematic Biology 13(1):51-70.
Vincy M. V., Brilliant R., Pradeep Kumar A. P., 2016 Checklist of Odonata species as indicators of riparian ecosystem of a tropical river, the southern Western Ghats, Kerala, S. India. Journal of Entomology and Zoology Studies 4(2):104-108.
Yapac L. A., Villanuaeva R. J. T., Nuñeza O. M., 2016 Species richness of Odonata in the agricultural area of Sultan Naga Dimaporo, Lanao del Norte, Philippines. Bulletin of Environment, Pharmacology and Life Sciences 5(3):60-67.
Yuto C. M. M., Nuñeza O. M. Villanueva R. J. T., 2015 Species diversity of the odonatofauna of Mts. Pinukis and Gimamaw, Zamboanga del Sur, Philippines. Journal of Biodiversity and Environmental Sciences 7(4):135-146.

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