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## Original Research Article

### Odonata Fauna of Compostela, Valley Province, Mindanao Island, Philippines

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Abstract	Keywords
The first provincial-wide survey of Odonata was conducted in Compostela Valley Province (Comval). Opportunistic and segmented line transect method was employed in all fluvial systems visited between March and September 2014. A total of 2,883 individuals belonging to 12 families 24 genera and 32 species were recorded. Seventeen (17) out of 32 species or 53% belongs to suborder Anisoptera (dragonfly) while 15 species or 47% are Zygoptera. Compostela Valley province exhibits 56% endemism, one of the highest endemism records in Mindanao. An immediate conservation effort to fluvial systems containing high endemism and species quality is recommended.	Compostela valley Conservation Endemic Odonata

#### Introduction

The Philippines is considered as one of the 17 “Megadiverse” countries in the world (Catibog-Sinha and Heaney, 2006; Heaney and Regalado, 1998) with the highest level of endemism and richness in the world. However, Philippines is also one of the world’s biodiversity hotspot (Heaney and Regalado, 1998) where species extinction happens at an alarming rate especially in Mindanao where mixture of socio-economic activities threatens rich biodiversity areas. This calls for immediate action particularly in the scientific community to hasten conservation initiatives such as biodiversity research focusing on the documentation of our species especially endemic flora and fauna before they would be gone to extinction.

The Philippine archipelago has nearly 300 Odonates where the island of Mindanao has 130+ species (Hamalainen and Muller, 1997). Despite our fair knowledge of Mindanao’s Odonata fauna, new species are still regularly found (Villanueva, 2011) particularly from poorly explored regions including Compostela Valley Province (Jumawan et al., 2012).

On 2011, the first author has formed a biodiversity research program and created an expedition team to document the remaining biodiversity (flora and fauna) in the province. As the province is now gradually threatened by a mixture of socio-economic-anthropogenic activities such as mining, illegal logging, and forest harvesting, the biodiversity program is deemed timely and necessary. Among of its focused insect group being studied is Odonata (Damselfly and

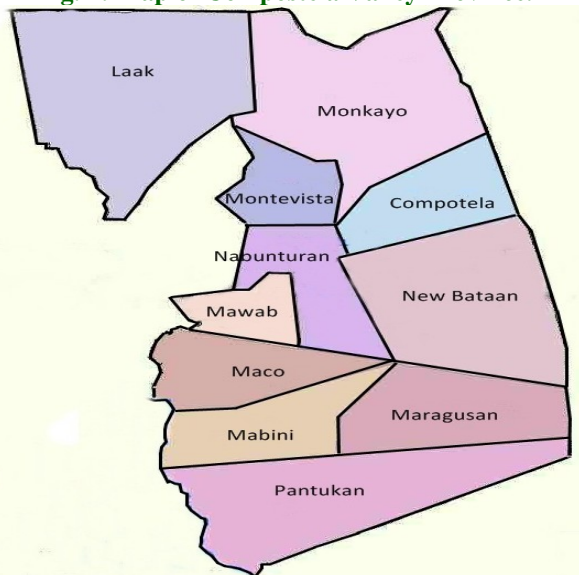
Dragonfly). The available records of Odonata in the province was produced first in 2012 by Jumawan et al. (2012) where 41 species was recorded from the Mainit Hot Spring Protected Landscape, Nabunturan, Compostela Valley Province and a new species of damselfly was also discovered in 2013 named *Pericnemis melansoni* (Villanueva et al., 2013).

Since the Odonata expeditions in 2011 are focused only in the Municipality of Nabunturan the proponents believed that there is more to discover in Compostela Valley particularly in the areas that still contains pristine and semi-pristine fluvial systems like in the municipalities of Compostela, Maragusan, Laak, Monkayo, Mabini, etc., As part of the long-term Odonata project of the proponents in the province and in Region XI, this provincial-wide odonata survey was conducted.

### Materials and methods

This study was conducted in the province of Compostela Valley (Fig. 1). Semi-pristine to pristine fluvial systems as suggested by the local government offices of the different municipalities in Comval were visited by the team. Another consideration in choosing the sites is the safety of the team since there is a strong presence of armed groups in the province.

Fig. 1: Map of Compostela Valley Province.



In District 1, the survey sites include Baobo River in Barangay Mayaon and Linoan River in the Municipality of Montevista (07°42'N, 125°59'E); Pasian River, Monkayo (07°49'N, 126°03'E); Bango River in

Barangay Bango, Compostela (07°40'N, 126°05'E), Falls 45 in Barangay Baluarte, Laak (07°50'N, 125°49'E), and Barangay Panagdagsaan, New Bataan (07°32'N, 126°08'E). District 2, Barangay Cabidanan and Mainit Hot Spring Protected Landscape, Municipality of Nabunturan (07°36'N, 125°58'E), Kawa-kawa River, Barangay Andili, Mawab (07°30'N, 125°56'E), Barangay New Albay, Maragusan (07°30'N, 126°00'E), Barangay Migum, Mabini (07°18'N, 125°51'E), Barangay Pindasan, Maco (07°22'N, 125°51'E), and Lahi River, Barangay Bongabong in Pantukan (07°09'N, 125°57'E) between the months of March and September 2014.

Combination of opportunistic sampling (Jumawan et al., 2012) and segmented line transect methods (Oppel, 2006) were employed to all selected fluvial systems. Odonatans were captured through hand picking and insect net. Collected specimens were soaked 24 hours in acetone and later dried and placed in individual paper triangle.

Since the primary authors institution has no proper depository area yet for specimens, all specimens collected is presently stored at the first author personal collection for safe keeping. Species richness was obtained using frequency count per municipality and species diversity was analyzed using the standard Shannon-Weiner Diversity Index. Endemism and geographic distribution of species were noted using IUCN Red List of Threatened Species (IUCN Red List, ver. 2014). Photo-documentation was also employed to species needing further analysis and comparison.

### Results and discussion

A total of 2,883 individuals belonging to 12 families, 24 genera, and 32 species were recorded from the different municipalities. Seventeen (17) out of 32 species (53%) belongs to the suborder anisoptera (dragonfly) while 15 species (47%) are zygoptera. Among of the abundant species (in percent) includes *R. colorata* (14.29), *D. bolivari* (13.32), *P. pillidorsum* (11.62), *V. melania* (10.20), *N. ramburii* (6.49), and *P. integra* (6.04). Surprisingly, among these species *V. melania* which is considered as an indicator species of fluvial systems integrity (Jumawan et al., 2012) is found to be abundant in the province. The rest of the species are present in a minimal abundance with few species *Drepanosticta sp.*, *Pericnemis sp.*, and *Devadatta podolestoides basilanensis* (Table 1).

**Table 1. List of species, abundance and percentage of Odonata in Comval.**

Sl. No.	Family	Species	Abundance	%	Geographic Distribution
<b>ZYGOPTERA</b>					
1.	Amphipterygidae	<i>D.podolestoides basilanensis</i>	1	0.03	GM
2.	Calopterygidae	<i>V.melania</i>	294	10.20	PE
3.	Chlorocyphidae	<i>R. colorata</i>	412	14.29	PE
		<i>R. turconii</i>	281	9.75	PE
4.	Coenagrionidae	<i>Pericnemis sp.</i>	15	0.52	ME
		<i>P. pelidorsum</i>	335	11.62	O
		<i>T. samaritis</i>	2	0.07	PE
5.	Euphaeidae	<i>E.amphicyana</i>	63	2.19	GM
6.	Platycnemididae	<i>C. dinocaerus</i>	7	0.24	GM
		<i>R. atripes</i>	73	2.53	ME
		<i>R. erythrura</i>	12	0.42	ME
		<i>R. flamea</i>	43	1.49	GM
		<i>R. tendepis</i>	33	1.14	ME
7.	Platystictidae	<i>Drepanosticta sp.</i>	32	1.11	ME
8.	Protoneuridae	<i>P.integra</i>	174	6.04	PE
<b>ANISOPTERA</b>					
9.	Aeshnidae	<i>Anax sp.</i>	4	0.14	O
10.	Corduliidae	<i>H.heterodoxa</i>	22	0.76	PE
		<i>I. philippa</i>	1	0.03	PE
11.	Gomphidae	<i>G. kirchii</i>	1	0.03	PE
12.	Libellulidae	<i>D. bolivari</i>	384	13.32	PE
		<i>D. trivialis</i>	32	1.11	O
		<i>N. ramburii</i>	187	6.49	O
		<i>N. terminata</i>	34	1.18	O
		<i>O.pruinosum clelia</i>	136	4.72	O
		<i>O.sabina sabina</i>	52	1.80	O
		<i>O.testaceum</i>	18	0.62	O
		<i>P.congener</i>	18	0.62	O
		<i>R. phylis subphylis</i>	1	0.03	O
		<i>T. aurora</i>	81	2.81	O
		<i>T.festiva</i>	117	4.05	O
		<i>T.tillarga</i>	17	0.59	O
<i>Z. obtosum</i>	1	0.03	O		
<b>TOTAL</b>			<b>2883</b>	<b>100</b>	
<b>Legend:</b> PE: Phil. Endemic, GM: Greater Mindanao, ME: Mindanao Endemic, O: Oriental					

Placement of species geographic distribution is based on the biogeographic division of the areas of endemism in the Philippines suggested by Hamalainen and Muller where Philippine endemic as species found within Luzon, Mindoro, West-Visayan and Mindanao regions, Greater Mindanao comprises of eastern Visayas and Mindanao, and Mindanao region comprises the mainland of Mindanao (Hamalainen and Muller, 1997).

Eighteen (18) or 56% of Odonata species found in Compostela Valley are endemic to the Philippines while 14 (44%) are widespread in the Oriental region (Fig. 2). This is relatively higher compared to the level of endemism in other areas in Mindanao, such as Misamis Occidental with 32% endemism (Mapi-ot, 2013), Cagayan and Bukidnon has 50% endemism (Jomoc et al., 2013), 44 % endemism in Zamboanga del Sur

(Cayasan et al., 2013), and 47 % endemism in Surigao del Sur (Quisil et al., 2013). This suggests that Comval Province despite its various anthropogenic disturbances still holds one of the highest levels of endemism. So far this level of endemism is one of the highest in Mindanao.

Fig. 2: Level of Odonata endemism in Comval.

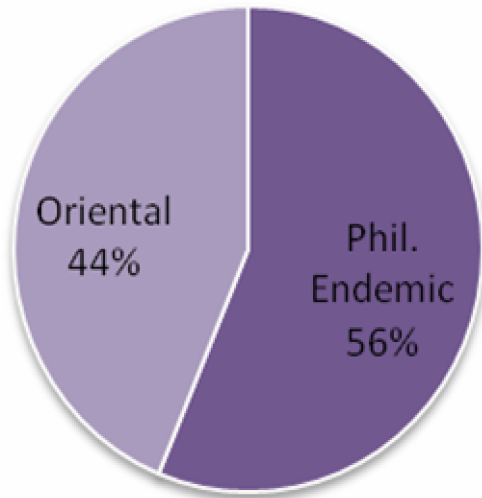
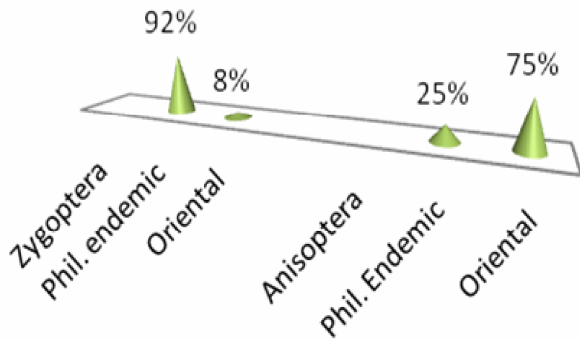


Fig. 3: Level of endemism of Anisoptera and Zygoptera.

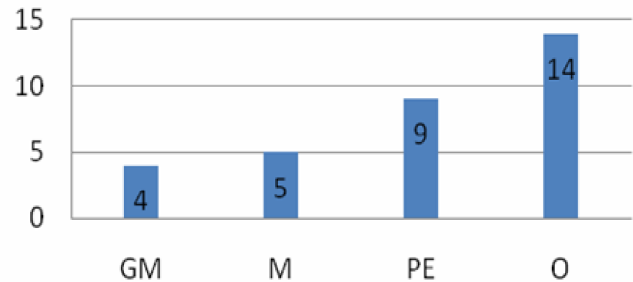


The species under suborder anisoptera (dragonfly) showed a very low level of endemism in the province with only 25%. While the suborder zygoptera (damselfly) holds the highest level of endemism with 92% (Fig. 3). This result is very similar to the study of Villanueva (2009) in Mt. Hamiguitan with 33% of anisopteran endemism while 94% zygopteran endemism. The 92% zygopteran endemism which is close to the 94% of Mt. Hamiguitan's level of endemism is interesting to note especially that the later is a UNESCO declared world heritage site in 2014.

Kalkman et al. (2008) argued that the high endemism level of damselfly which are generally low flyers and have a limited habitat range can be accounted to its different biogeographic origins especially in Mindanao.

Fig. 4 shows the detailed biogeographic distribution of species where 9 species are found across the country, 4 species from the Greater Mindanao, and 5 species are found only in mainland Mindanao. Fourteen (14) species are coming from the oriental region.

Fig. 4: Geographic distribution of Odonata in Comval.



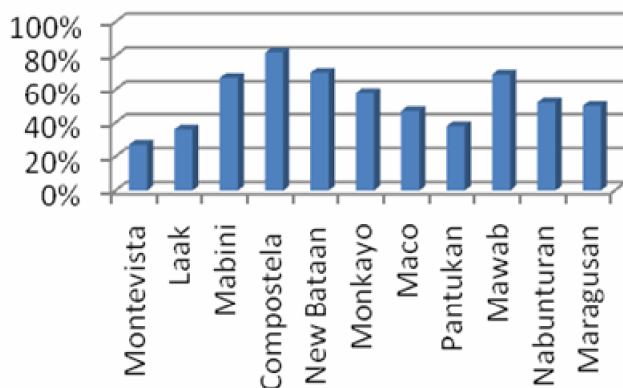
Among of the oriental species includes *P. pillidorsum*, *T. aurora*, *N. ramburi*, *N. terminata*, *D. trivialis*, *O. sabina sabina*, *Z. obtosum*, *P. congener*, *T. tillarga*, *O. testacium*, *R. phylis subphylis*, *T. festiva* and *O. p. clelia*. Philippine endemic species *V. melania*, *R. turconii*, *D. bolivari*, *R. colorata*, *P. integra*, *H. heterodoxa*, *I. philippa*, *G. kirski* and *T. samaritis*.

Four (4) species found in Greater Mindanao *R. flamea*, *E. amphicyana*, *C. dinocerus* and *D. polodestoides basilanensis*. Three Mindanao endemic species all belongs to the same genus *Risioconemis*: *erythrura*, *atripes* and *tendepis*. *Risioconemis* species are scattered in Mindanao areas like in Cagayan de Oro and Bukidnon (Jomoc et al., 2013), Lanao del Sur (Malawani, et al., 2014), Davao Oriental (Villanueva, 2011) and Compostela Valley Province.

Fig. 5 represents the endemism of Odonate species in Comval where the municipalities of Compostela (82%), New Bataan (70%), Mawab (69%), and Mabini (67%) have the highest level of endemism among the 11 municipalities. As mentioned earlier, this high level of endemism can be accounted to the different biogeographic origins of Mindanao (Kalkman et al., 2008). In addition, this can be attributed to the remaining thick vegetation and semi-pristine characteristic of the fluvial systems in these municipalities. Most of the endemic zygopterans tend to inhabit undisturbed habitats with pristine water source. Moreover, Oppel (2006) reported that the distinction between the odonate species found in pristine and disturbed habitats with pristine areas host more endemic species. The municipalities with the lowest level of endemism are Pantukan (38%), Laak (36%) and

Montevista (27%) in which most of its fluvial systems are already disturbed with numerous anthropogenic disturbances like mining activities, cyanide fishing, slash-and-burn (kaingin) farming, and proliferation of households near the rivers which contribute to increasing domestic wastes in the rivers. These areas have also suffered serious illegal logging activities and most of its lands are converted in agricultural purposes. It has little vegetation along the rivers which is dominated by cogon grass, ferns, and small shrubs exposed to direct sunlight disabling the survival of most odonatan nymphs.

**Fig. 5: Level of endemism of different municipalities in Comval.**



Furthermore, the high level of endemism in semi-pristine areas and the low endemism in disturbed habitats indicates that most of the endemic species survive in habitats that have thick canopy cover and pristine waters while non-endemic species proliferate in areas with high anthropogenic disturbances (Samways, 1999). Thus, the survival of our endemic species is highly dependent on our forest and clean waters (Stewart and Samways, 1998). This also suggests that serious environmental degradation endangers our endemic species. This is very important to note for conservation efforts.

Other municipalities like Monkayo, Maco, Nabunturan and Maragusan also hold a relatively high level of endemism. Monkayo has an endemism level of 58%, Nabunturan has 52%, Maragusan has 50% and Maco has 47%.

### Recommendation

An immediate conservation and protection effort in fluvial systems that contain high endemism and species

quality specifically in the municipalities of Compostela, Monkayo, New Bataan, Mabini, Maco, Nabunturan, Laak, Mawab, and Maragusan. Rehabilitation must be conducted to fluvial systems of Montevista and Pantukan.

### Acknowledgement

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