Odonata fauna of Diomabok Lake and its surroundings, Davao Oriental, Mindanao Island, Philippines

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Abstract

During three visits in October and December 2010 and May 2011, a total of 56 Odonata species was recorded. All species reported here represent first Odonata records in the area. The most noteworthy discoveries were one novelty (*Hydrobasileus vittatus*) to the Philippine fauna and two first records (*Tetracanthagyna brunnea and Aethriamanta gracilis*) from Mindanao Island. Seven species represent either new species to science or potentially new species; one *Drepanosticta* and one *Amphicnemis* are new to science, and another *Drepanosticta*, *Amphicnemis, Pseudagrion, Gomphidia* and *Urothemis* are potentially new to science.

Introduction

The eastern coast of Mindanao is one of the most interesting regions in terms of biodiversity in the Philippines. Several species of flora and fauna are found only in this region. Odonatologically, several species of Platycnemididae and Platystictidae are confined here, even confined to a set of mountains in this region. Conservation International recognized this region as one of the biodiversity hotspots in the archipelago. Thus, high priority is given in terms of conservations. However, a huge part of this region is poorly or even virtually unexplored, this includes Mt. Kampalili (Figure 1-3).

Diomabok Lake (7°15'28.831''N 126°20'28.7315''E) is a small (over 20 hectares) upland lake situated on the eastern slope of Mt. Kampalili (Figures 4-5). It is relatively deep and is fed by numerous streams from the nearby slopes (Figures 6-8). A large part of the lake is bordered by swamp forest this continues as montane forest to the summit. However, the eastern section of the lake is in the process of conversion to agricultural use, and in some parts of the forest *Musa textalis* (Abaca) is planted in-

side (Figure 9). The nearest human settlement is around 400 meters from the eastern margin of the lake.

Figure 1. Study area at the eastern slope of Mt. Kampalili (map source: www.mindanomaps.com)

Figure 2. Eastern slope of Mt. Kampalili

Figure 3. Eastern slope of Mt. Kampalili

Figure 4. Diomabok Lake

Figure 5. Diomabok Lake

Figure 6. Section of the outlet of Diomabok Lake

Figure 7. Stream leading to Diomabok Lake

Figure 8. Stream leading to Diomabok Lake

Figure 9. Abaca fiber processing inside the forest

Ecological and biodiversity study in the area (Mt. Kampalili) is very limited, save for ongoing *Rafflesia* exploration that has resulted in the discovery of its newest described species, *R. verrucosa* (Balete et al. 2010), and for the Philippine Eagle surveys conducted by the Philippine Eagle Foundation (Department of Environment and Natural Resources pers. comm.) (For more details on the ornithological importance of the region see: http://www.globalspecies.org/birdareas/display/9788). The poor biological surveying in the area is attributed to strong presence of insurgents on the mountain. So far, odonatalogical information on eastern Mindanao is limited to few areas. Hämäläinen & Müller (1997) mentioned Mt Kampalili as one of the potentially most interesting mountains to explore.

In the past years Hilario Cahilog (HC) has been my assistant in the field. However, my present working condition does not permit me to travel outside Davao City. Hence I sent HC to do the field works for me. The present study list odonate species he encountered during his survey conducted around the lake and its surrounding areas.

Results

During three visits (22.x.2010, 1.-10.xii.2010, 12.-19.v.2011), totalling nearly three weeks of exploration, a total of 56 species in 13 families were recorded. However, most of the exploring days were limited to a few hours before noon, when there was sunshine. The area is very wet, and according to the locals even in the driest months

they still got rain. The species recorded here represents the first Odonata recorded in the area. The most noteworthy discoveries were one novelty (*Hydrobasileus vittatus*) to the Philippine fauna and two first records (*Tetracanthagyna brunnea and Aethriamanta gracilis*) from Mindanao Island. Seven species represent either new species to science or potentially new species; one *Drepanosticta* and *Amphicnemis* are new to science, and another *Drepanosticta*, *Amphicnemis, Pseudagrion, Gomphidia* and *Urothemis* are potentially new to science.

Annotated species lists

Coenagrionidae

1. *Agriocnemis f. femina* (Brauer, 1868)

Material collected: 1♂1♀, 12-19.v.2011.

This species and its congener *A. pygmaea* are relatively scarce around the lake and its surrounding area. The low population density is striking for these two species given an open swampy habitat. It is likely that these two species recently arrived in the area after it was opened by deforestation.

2. *Agriocnemis pygmaea* (Rambur, 1842)

Material collected: 1♀**,** 12-19.v.2011.

3. *Amphicnemis cantuga* (Needham & Gyger, 1939)

Material collected: 1♂, 12-19.v.2011.

This species shows remarkable variation in the shape of its cerci. Further discussion on this matter is presented in a revision of this genus currently being prepared by the author.

Figure 10. Exuvia of *Amphicnemis cantuga* on the underside of *Pandanus* spp leaf

There is a healthy population of *Pandanus* spp plants around the lake and its surrounding areas. The leaf axils of this plant are the preferred habitat of this species. However despite the number of potential sites for this species only one specimen was found and collected. Based on experience, the presence of exuvia (Figure 10) on the underside of the *Pandanus* spp leaf is a sure sign that a territorial male is guarding that particular plant. This "marker" unfortunately was not observed during the surveys perhaps due to regular downpour that flush these exuvia.

4. *Amphicnemis* sp. (cf. *dentifer*) (Figure 11)

Material collected: 6♂♂ 1♀, 22.x.2010; 4♂♂, 1-10.xii.2010; 2♂♂3♀♀, 12-19.v.2011.

The specimens in the present population differ to some extend from the original description of *A. dentifer* by Needham & Gyger (1939). Since this group will be treated in a revision currently under work by the author, I refrain giving further comments in this connection.

Figure 11. *Amphicnemis* sp *(cf. dentifer)*

5. *Amphicnemis* sp.n.

Material collected: 1♂ 1-10.xii.2010.

This species will be described in the revision of Philippine species of the genus, currently under work by the author. This is a phytothelmatan species preferring tree holes. It is fairly widely distributed in Mindanao, but is very hard to find except in

areas with good lowland to montane dipterocarp forest. It requires a tree hole, which is relatively shaded with good surrounding vegetation and do not house tadpoles. The reason for this preference however is still unknown. Further ecological study on this species is urgently needed due to rapidly diminishing lowland forest in Mindanao.

6. *Argiocnemis rubescens intermedia* Selys, 1877
   Material collected: 2♂♂, 22.x.2010; 1♂, 1-10.xii.2010; 1♀, 12-19.v.2011.
7. *Ceriagrion lieftincki* Asahina, 1967 (Figure 12)
   Material collected: 2♂♂, 22.x.2010; 3♂♂, 1-10.xii.2010.

Figure 12. *Ceriagrion lieftincki* eating teneral *Xiphiagrion cyanomelas*

8. *Pseudagrion p. pilidorsum* (Brauer, 1868)
   Material collected: 1♂, 1-10.xii.2010.
9. *Pseudagrion* sp. (Figure 13)
   Material collected: 2♂♂, 22.x.2010; 3♂♂, 1-10.xii.2010; 7♂♂5♀♀, 12-19.v.2011.

Among the known Philippine *Pseudagrion*, this species closely resembles *P. microcephalum* (Rambur, 1842) and *P. evanidum* Needham & Gyger, 1939. However upon closer inspection, the male cerci are distinct from these two species. It lacks the medio-basal tooth which is present in *P. microcephalum*. The cerci and paraproct are also differently shaped in comparison to *P. evanidum* as illustrated by Needham & Gyger (1939). However, I will keep the status of this population open until I am able to study the type or secure topotypical specimen of *P. evanidum*.

Figure 13. *Pseudagrion* sp. in tandem

10. *Teinobasis annamaijae* Hämäläinen & Müller, 1989 (Figure 14)
Material collected: 1♂, 1-10.xii.2010.

This species prefers more shady sites compared to its congeners. The local population is not very abundant unlike that in some other areas in Mindanao.

Figure 14. *Teinobasis annamaijae*

11. *Teinobasis filamentum* Needham & Gyger, 1939 (Figure 15)
Material collected: 4♂♂, 1♀, 1-10.xii.2010.

Figure 15. *Teinobasis filamentum*

12. *Teinobasis samaritis* Ris, 1915
Material collected: 1♂♂, 22.x.2010.

This is one of the most widely distributed species in the archipelago. Surprisingly, it is not common around Diomabok Lake.

13. *Xiphiagrion cyanomelas* Selys, 1876
Material collected: 3♂♂1♀, 22.x.2010; 3♂♂, 2♀♀, 1-10.xii.2010; 1♀, 12-19.v.2011.

This is the commonest damselfly found along the lake.

Platystictidae

14. *Drepanosticta lestoides* (Brauer, 1868)
Material collected: 1♀, 1-10.xii.2010.

This species is very scarce in the area. Despite extensive searches only one female specimen was secured. The specimen was found along one of the feeding stream.

15. *Drepanosticta* sp.n.

Material studied. 3♂♂, 12-19.v.2011

This species belongs to the *Drepanosticta lymetta* group. It is close to *D. taurus* Needham & Gyger, 1941 in having an elongate posterior lobe that is not forked. It differs from *D. taurus* in the size of the pale sub-basal patch on S3-S7, in the shape and orientation of the posterior lobe, and in the shape of the tubercle on the cerci.

Drepanosticta taurus was described by Needham & Gyger (1941) from specimen collected in "La Lun River, Davao Province". Since no further material is available and La Lun River could not be found, and the type material could not be studied, van Tol (2005) re-described *D. taurus* based on Davao Oriental specimen with some doubt. The recent collecting efforts located La Lun River (sitio La Lun, Brgy. Little Baguio, Malita, Davao del Sur) and few specimen of *D. taurus* was collected (from another location in Little Baguio).

The *Drepanosticta* specimens (closely related to *D. taurus*) I have in my collection from various areas in Davao Oriental and Compostella Valley is composed of two new species. Though I do not have specimens from Boston, Davao Oriental where van Tol (2005) based the description of his supposed *D. taurus*, his description suggests another new species not present on my collection, and very distinct from the true *D. taurus.*

Proper taxonomic treatment on the present population and other taxonomic issues on the *Drepanosticta lymetta*-group will be treated on a separate paper.

16. *Drepanosticta* sp. (cf. *flavomaculata*)

Material collected: 5♂♂**,** 12-19.v.2011.

This species closely resembles *D. flavomaculata* van Tol, 2005. It differs from that species on the shape of the posterior lobe of the prothorax. *D. flavomaculata* has broadly curved posterior pronotal lobe processes, whereas this species has narrowly elongate and slightly curved processes.

D. flavomaculata shows a degree of variation across its known range. The northern Mindanao populations are much larger than those from eastern and southern Mindanao. Besides the variation in size, notable differences are also present in the posterior lobe of the prothorax and dorsal tubercle of the cerci.

Platycnemididae

17. *Coeliccia dinocerus* Laidlaw, 1925

Material collected: 1♂, 1-10.xii.2010.

18. *Risiocnemis (Igneocnemis) tendipes* (Needham & Gyger, 1941)

Material collected: 7♂♂ 2♀♀, 1-10.xii.2010; 2♂♂, 12-19.v.2011.

This species is the most variable species of the subgenus *Igneocnemis*. It is confined

to the island of Mindanao, and ranges from the very dark (almost blackish) form in some areas of Bukidnon to a reddish population with distinct orange/red stripe on the synthorax in Davao del Sur. Specimens of the Diomabok population have reddish brown synthorax.

19. *Risiocnemis (Risiocnemis) appendiculata* (Brauer, 1868)
Material collected: 1♂ 1♀, 1-10.xii.2010.

This species is confined to Greater Mindanao bio-geographic region. It is the most widely distributed member of its genus in the region. Across its known range the size varies from large individuals in some areas of Mindanao to relatively smaller ones on Dinagat Island. Individuals in the northern and eastern populations are principally red, whereas those in the western populations have blackish dorsum of the synthorax.

Protoneuridae

20. *Prodasineura integra* (Selys, 1882) (Figure 16)
Material collected: 2♂♂ 1♀, 1-10.xii.2010.

This species is mainly seen along the streams feeding the lake.

Figure 16. ***Prodasineura integra***

Lestidae

21. *Lestes p. praemorsus* (Selys, 1862) (Figure 17)

Material collected: 2♂♂, 22.x.2010; 6♂♂, 4♀♀, 1-10.xii.2010; 2♂♂2♀♀, 12-19.v.2011.

Specimens of the lake population differ from those of the other populations of this species which I have collected in various localities in Mindanao, Cebu, Dinagat and Polillo. It appears that each island has a slightly but distinct variation except (at least) for Mindanao (I do not have enough material from Luzon); the lake population differs in some detail from all other populations. Lieftinck (1949) commented on the need of sufficient material from different parts of the archipelago to understand the taxonomic ranking of this variability.

Figure 17. *Lestes p. praemorsus*

Chlorocyphidae

22. *Cyrano angustior* Hämäläinen, 1989 (Figures 18-19)

Material collected: 4♂♂, 1-10.xii.2010; 1♂1♀, 12-19.v.2011.

Two colour forms are found in the area. To my knowledge this is the first site in Mindanao where the two colour forms co-occur.

Figure 18. *Cyrano angustior* female

Figure 19. *Cyrano angustior* male

23. *Rhinocypha colorata* (Hagen *in* Selys, 1869)
Material collected: 1♂, 1-10.xii.2010.

24. *Rhinocypha turconii* Selys, 1891
Material collected: 1♂, 1-10.xii.2010.

Amphipterygidae

25. *Devadatta podolestoides basilanensis* Laidlaw, 1934 (Figure 20)
Material collected: 2♂♂, 1-10.xii.2010; 1♂, 12-19.v.2011.

Figure 20. ***Devadatta podolestoides basilanensis***

Euphaeaidae

26. *Euphaea amphicyana* Ris, 1930 (Figure 21)
Material collected: 1♂, 1-10.xii.2010; 1♂, 12-19.v.2011.

Figure 21. ***Euphaea amphicyana***

Calopterygidae

27. *Vestalis melania* Selys, 1873

Material collected: 6♂♂**,** 1-10.xii.2010.

Aeshnidae

28. *Anax* sp. (Figure 22)

Material collected: 2♀♀, 22.x.2010; 2♂♂ 2♀♀, 1-10.xii.2010.

Two described species of *Anax* are known from Mindanao Island: *A. guttatus* (Burmeister, 1839) and *A. panybeus* Hagen, 1867. Hämäläinen & Müller (1997) list a third species from various areas of Mindanao. It could represent a new species, but a thorough revision of the genus is badly needed.

Figure 22. ***Anax sp.***

29. *Gynacantha* sp.
Material collected: 1♂, 22.x.2010.

30. *Tetracanthagyna brunnea* McLachlan, 1898
Material collected: 1♀, 12-19.v.2011.

Hämäläinen & Müller (1997) first recorded this species from Palawan, Philippines based on two female specimens. Six years ago, after rearing several aeshnid larvae collected in the mountains of Davao City, I found this species to occur also in Mindanao. Subsequently I collected few additional adult females from Datu Salumay, Davao City. The recent survey conducted around Diomabok Lake yield another female specimen. The present account is the first reporting of this species from the island of Mindanao even though I collected a few specimens before.

Gomphidae

31. *Gomphidia* sp. (cf. *kirschii*) (Figures 23-25)
Material collected: 2♂♂, 1-10.xii.2010.

I have a long series of *Gomphidia* from various areas in Mindanao, Leyte, Luzon, Polillo and Catanduanes islands. Hämäläinen & Müller (1997) considered *G. kirschii* and *G. platerosi* as synonyms since they could not find any structural differences between the two taxa. However, I find the colour variation to be constant across the known bio-geographic region. The Greater Luzon population has a broken antehumeral stripe. It is not unlikely that future molecular study will find the two taxa to be molecularly distinct.

Figure 23. Inferior anal appendage of *Gomphidia kirschii* (Bislig, Surigao)

Figure 24. Inferior anal appendage of *Gomphidia kirschii* (Diomabok Lake)

The two Diomabok specimens are interesting. The thoracic markings clearly suggest this population to belong to the Greater Mindanao form. However, the paraproct is very distinct. It has four dorso-apical tubercles with the most basal one situated adjacent to the third tubercle, or at the midline. Further material is needed to evaluate the taxonomic status of this local form.

Figure 25. ***Gomphidia kirschii***

32. *Heliogomphus bakeri* Laidlaw, 1925
Material collected: 1♀12-19.v.2011.

33. *Ictinogomphus tenax* (Hagen *in* Selys, 1854) (Figure 26)
Material collected: 3♂♂, 22.x.2010; 2♂♂, 1-10.xii.2010; 5♂♂, 12-19.v.2011.

This species is relatively common around the lake margin. Each male guards a particular perch.

Figure 26. ***Ictinogomphus tenax***

Corduliidae

34. *Hemicordulia m. mindana* Needham & Gyger, 1937
Material collected: 5♂♂, 1-10.xii.2010; 3♂♂, 12-19.v.2011.

35. *Heteronaias heterodoxa* Needham & Gyger, 1937
Material collected: 1♀, 1-10.xii.2010; 1♀, 12-19.v.2011.

The strong water current on the out flow section of the lake offers a suitable habitat for ovipositing females of this species. However, due to recent flooding no exuviae could be found clinging on the undersides of the boulders along the shore.

36. *Idionyx philippa* Ris, 1912 (Figure 27)
Material collected: 3♀♀, 1-10.xii.2010.

Figure 27. *Idionyx philippa*

Libellulidae

37. *Aethriamanta gracilis* (Brauer, 1878)
Material collected: 2♂♂, 22.x.2010; 3♂♂, 1-10.xii.2010.

This is the first record of the species in Mindanao. Hämäläinen & Müller (1997) recorded this species in Tawi tawi (Sulu region) based from a handful of specimens.

38. *Agrionoptera insignis* (Rambur, 1842) (Figure 28)
Material collected: 1♂, 22.x.2010; 2♂♂, 4♀♀, 1-10.xii.2010; 1♂, 12-19.v.2011.

Figure 28. ***Agrionoptera insignis***

39. *Brachydiplax duivenbodei* (Brauer, 1866) (Figure 29)

Material collected: 7♂♂, 22.x.2010; 8♂♂ 2♀♀, 1-10.xii.2010; 1♂4♀♀, 12-19.v.2011.

This is my first material of this species despite being recorded from few islands in the Philippines (Hämäläinen & Müller, 1997).

Figure 29. ***Brachydiplax duivenbodei***

40. *Crocothemis s. servilia* (Dury, 1770) (Figure 30)
Material collected: 1♂, 22.x.2010; 5♂♂, 1-10.xii.2010; 4♂♂5♀♀, 12-19.v.2011

This is the most abundant dragonfly noted in the area after *Urothemis* sp.

Figure 30. *Crocothemis s. servilia*

41. *Diplacina bolivari* Selys, 1882
Material collected: 1♂, 1-10.xii.2010.

42. *Diplacina braueri* Selys, 1882
Material collected: 1♂, 1-10.xii.2010.

This is by far the most commonly encountered species of *Diplacina* in the area.

43. *Diplacina nana* Brauer, 1868 (Figure 31)
Material collected: 5♂♂, 1-10.xii.2010.

Figure 31: *Diplacina nana*

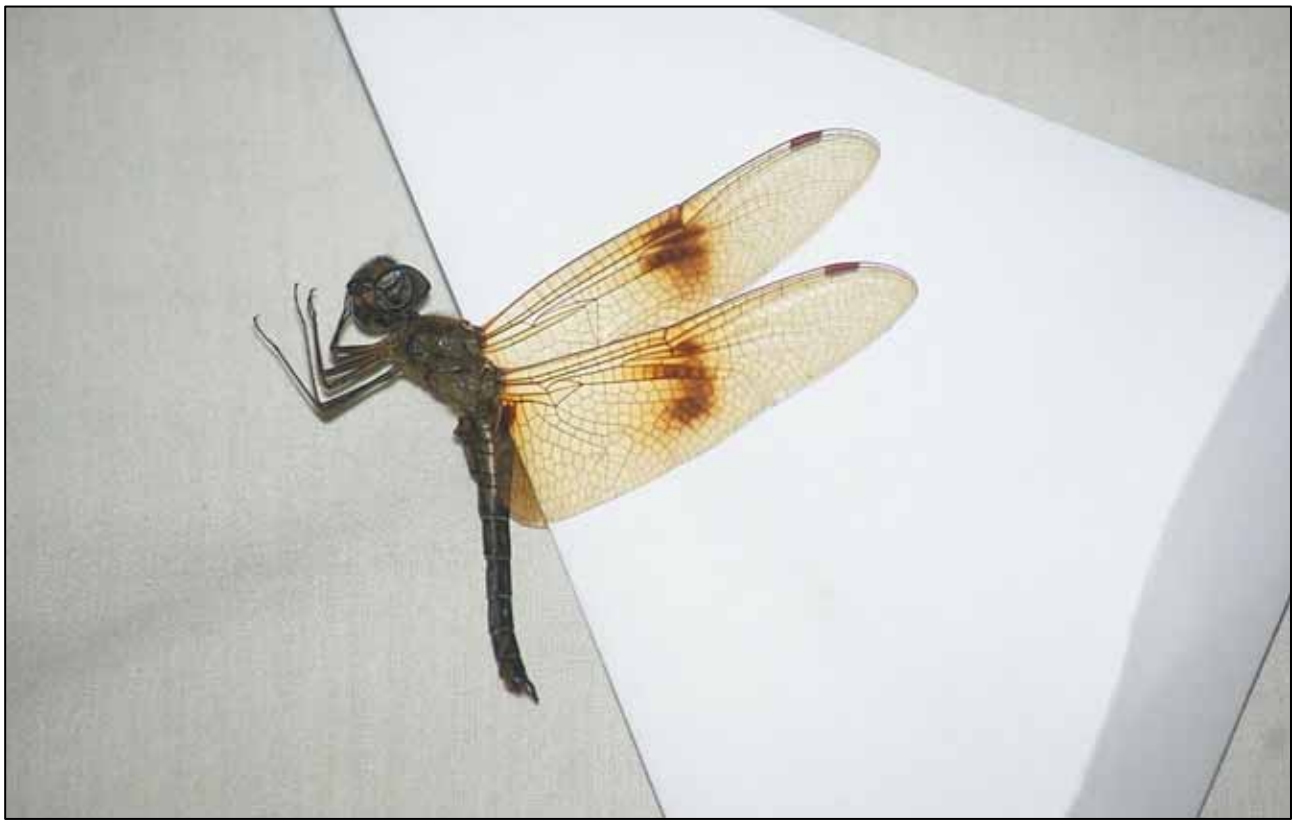

Figure 32. *Hydrobasileus vittatus*; male lateral view

Figure 33. *Hydrobasileus vittatus*; female lateral view

44. *Hydrobasileus vitattus* Kirby, 1889 (Figures 32-33)
Material collected: 1♂, 1♀, 1-10.xii.2010; 3♀♀, 12-19.v.2011

This is the first record of the species in the Philippine archipelago. It is widespread in the Sulawesi region. A wing photograph was sent to Dr. K.-D.B. Dijkstra (Leiden, Netherlands) who said that the lightly coloured patch is similar as in the specimens preserved at RMNH.

45. *Neurothemis r. ramburii* (Brauer, 1866)
Material collected: 1♂, 1-10.xii.2010.

46. *Neurothemis t. terminata* Ris, 1911
Material collected: 1♂, 22.x.2010.

47. *Orthetrum pruinosum clelia* (Selys, 1878) (Figure 34)
Material collected: 3♂♂, 1-10.xii.2010.

Figure 34. *Orthetrum pruinosum clelia*

48. *Orthetrum s. sabina* (Drury, 1770)
Material collected: 1♂, 22.x.2010; 1♂, 1-10.xii.2010.

49. *Orthetrum t. testaceum* (Burmeister, 1839)
Material collected: 2♂♂, 1♀, 1-10.xii.2010; 3♂1♀, 12-19.v.2011.

50. *Potamarcha congener* (Rambur, 1842)
Material collected: 1♂, 1♀, 1-10.xii.2010.

51. *Rhyothemis r. regia* (Brauer, 1867)
Material collected: 4♂♂, 22.x.2010; 4♂♂, 1♀, 1-10.xii.2010; 2♂♂1♀, 12-19.v.2011.

The local population include some of the smallest individuals (hind wing: 33mm; abdomen: 23mm) I have seen of this species.

52. *Tetrathemis i. irregularis* Brauer, 1868 (Figure 35)
Material collected: 2♂♂, 1-10.xii.2010; 2♂♂, 12-19.v.2011.

Figure 35. ***Tetrathemis i. irregularis***

53. *Tholymis tillarga* (Fabricius, 1798)
No specimen was collected. Among the crepuscular libellulids (*Zyxomma* spp) this is the first one to fly around the lake margin in late afternoon.

54. *Urothemis* sp. (Fig 36)
Material collected: 2♂♂, 22.x.2010; 5♂♂, 1-10.xii.2010; 12♂♂ 12-19.v.2011.

Comparison done with *Urothemis signata bisignata* specimens from Cebu Island [specimens which were compared at RMNH (Leiden) with specimens identified as *Urothemis signata bisignata*] and Zamboanga, Mindanao Island suggests that the

Diomabok population is distinct. It is relatively darker and generally bulkier. The hamulus is more robust, and the form of the metapostepimeron is very distinct.
According to Asahina (1972), *U. s. bisignata* is recorded in the Philippines, while Papua New Guinea, Taiwan and Borneo have its own subspecies of *signata*. The difference between some of these subspecies is very subtle. However, the presence of another form in Mindanao makes study of the group necessary.

Figure 36. *Urothemis* sp

55. *Zyxomma obtusum* Albarda, 1881
No specimen was collected though it is relatively a common species in the area.

56. *Zyxomma* **petiolatum** Rambur, 1842
No specimen was collected though several individuals were observed.

Discussion

This study further stresses the need to conduct fieldwork in various areas in the archipelago. The presence of a new national Philippine record and the discovery of

two new species and other potential new taxa clearly shows how rewarding any fieldwork can still be in this country. Hämäläinen & Müller (1997) stated that a major part of the specimens in the R.A. Müller Philippine Odonata collection came from forested areas. Thus the discovery of additional species from a lake habitat is not surprising.

The Philippine archipelago has several lakes and marshes. Mindanao Island alone has four large known freshwater ecosystems; Agusan and Liguasan marshes, and Lanao and Mainit lakes. Agusan Marsh is considered to be an important wetland, which requires conservation measures. Liguasan Marsh is unfortunately poorly explored due to constant security problems. Lanao Lake is an important freshwater reserve, and the presence of several endemic freshwater fishes suggests the long isolation of this freshwater body. Mainit Lake is considered the deepest lake in the archipelago and flanks the northern border of the Eastern Mindanao bio-geographic corridor. These freshwater ecosystems are virtually unexplored for their odonate fauna. Therefore several lotic species can be expected there.

Although R.A. Müller and his collaborators explored the Archipelago widely, several mountain regions still remain unstudied for their odonate fauna. Mallari et al. (2004) listed several forested areas in the archipelago which are poorly known for their avian fauna. Since vertebrate study in the Philippines is more advanced than entomological study, this implies that further more interesting species of invertebrates are expected, including new species (Yoshitake, 2011).

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