BIOTROPIA Vol. 23 No. 2, 2016: 133 - 139 DOI: 10.11598/btb.2016.23.2.564

TIGER BEETLES (COLEOPTERA: CARABIDAE: CICINDELINAE) OF COMPOSTELA VALLEY PROVINCE, MINDANAO ISLAND, PHILIPPINES

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Received: 25 November 2015/Accepted: 16 September 2016

ABSTRACT

The first faunistic record of tiger beetles (Coleoptera: Carabidae: Cicindelinae) in Compostela Valley Province, Mindanao with notes on their habitat is presented. Opportunistic sampling, standard light trapping and photo documentation were conducted in selected areas from January to April 2013 and in September 2015. One hundred four tiger beetles belonging to twelve species and seven genera were recorded. An astonishing (100%) endemicity was observed identified to subspecies level. *Thopeutica* and *Calomera* species, specifically *Thopeutica anichtchenkoi* Wiesner, 2015 and *Calomera mindaoensis* Cassola, 2000 were observed to be abundant in the samples mostly found in the mountainous and forested open riparian ecosystem of Cagan, New Bataan. *Cylindera (Ifasina) discreta elaphroides* (Dokhtouroff 1882) was the most common species and was found in different habitat types, but the majority of the species showed a narrow and specialized habitat preference. Protection and conservation of remaining forest areas in Cagan is especially important in preserving endemic species.

Keywords: Compostela, conservation, endemics, fauna, tiger beetle

INTRODUCTION

The Philippine tiger beetle fauna is one of the most unique in the world that despite its small land area, Philippines ranks fifth in terms of tiger beetle richness and third on the level of endemism after Madagascar and Australia (Cassola & Pearson 2000; Cassola & Ward 2004; Cassola 2011). Based on endemism per unit area, Philippines ranks number one. With very limited entomological expeditions, the tiger beetle fauna of the Philippines is poorly known. Early collections date back to 1859 - 1865 by C.G. Semper and 1913-1919 by G. Boettcher. These tiger beetles were made known by European entomologist, Schaum (1860, 1862, 1863) and Horn (1907, 1908, 1909, 1923, 1924, 1937). Recent publications on the tiger beetle fauna of the Philippines were made by Bogenberger (1988), Cassola (2000, 2011), Cassola and Ward (2004), Cassola and Zettel (2006), Deuve (2015), Dheurle (2015), Naviaux (1992, 2002) and Wiesner (1980, 1988a, 1988b, 1989, 1992a, 1992b, 2015).

Since the early 1990's, new tiger beetle species have been described from the different, but poorly explored islands such as Palawan, Leyte, Mindoro and Mindanao. To date, there are 139 tiger beetle species known from the Philippines, of which 111 (86.3%) are endemic to this country with a limited geographic range (Santos 2014). In 1998, an international workshop on the Natural History of the Philippines held at Berlin, Germany was conducted where insect studies were greatly emphasized hurdling the concern on increasing loss of Philippines forest through deforestation (Cassola 2000). Since the majority of the species are forest dependent, loss of the forest has caused a tremendous threat to different species and others may have gone extinct without being known to science.

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Tiger beetles are often used as good bioindicators of the microhabitat changes of an ecosystem. Since many faunal elements including several tiger beetles are associated with forest ecosystems and have a limited habitat range, they are most vulnerable to deforestation (Cassola & Ward 2004). The Philippines had already lost 75% of its forest in the past century, so many tiger beetles may have disappeared without being described. Compostela Valley Province belongs to the Eastern Biodiversity Corridor which is known as one of the remaining biodiversity hotspot of the Philippines. However, there is a great concern over its biodiversity, as the province is experiencing major anthropogenic disturbances including illegal logging and mining. This paper presents the baseline data of tiger beetle fauna of Compostela Valley Province with notes on the habitat preference of tiger beetles. This information is important in drafting conservation efforts for this insect group.

MATERIALS AND METHODS

Opportunistic sampling, light trapping and photo documentation were conducted for diurnal and nocturnal tiger beetles in selected areas in Compostela Valley Province from January to April 2013 and in September 2015. Seven areas were sampled: (1) Cagan, New Bataan (07°41'N; 126°08'E), (2) Sampao (07°42' N, 125°59' E), (3) Mayaon, Montevista (07°48'N; 126°02'E), (4) Barangay Andili, Mawab (07°30' N, 125°56' E), (5) Pasian, Monkayo (07°56'N; 125°58'E), (6) San Isidro (07°36' N, 125°58' E) and (7) Cabalinan, Nabunturan (07°36' N; 125°57' E).

Specimens were obtained using insect net during the day and light trapping during the night. The specimens were killed using ethyl acetate, dried and stored in the first authors' collection.

RESULTS AND DISCUSSION

A total of 104 individuals belonging to 12 species and seven genera of tiger beetles were recorded. Three species were recorded for each of the genera *Therates* and *Thopeutica*, while two species were recorded for the genera *Calomera* and *Cylindera*. *Prothyma, Tricondyla* and *Neocollyris* were represented only by one species. Seven species (58%) widely distributed from Luzon to Mindanao are Philippine endemics (Table 1, while five species have no known record except in Mindanao and at the moment they are recognized as Mindanao endemics (Table 1, Fig. 2) unless new records say otherwise. Two species out of three *Calomera* present in Mindanao were recorded in Compostela Valley Province namely *Calomera lacrymosa* (Dejean 1825) and *Calomera mindaoensis* (Cassola 2000).

Majority of the species were collected close to the riverbanks using light trapping method. Species of the genera *Thopeutica, Prothyma,*

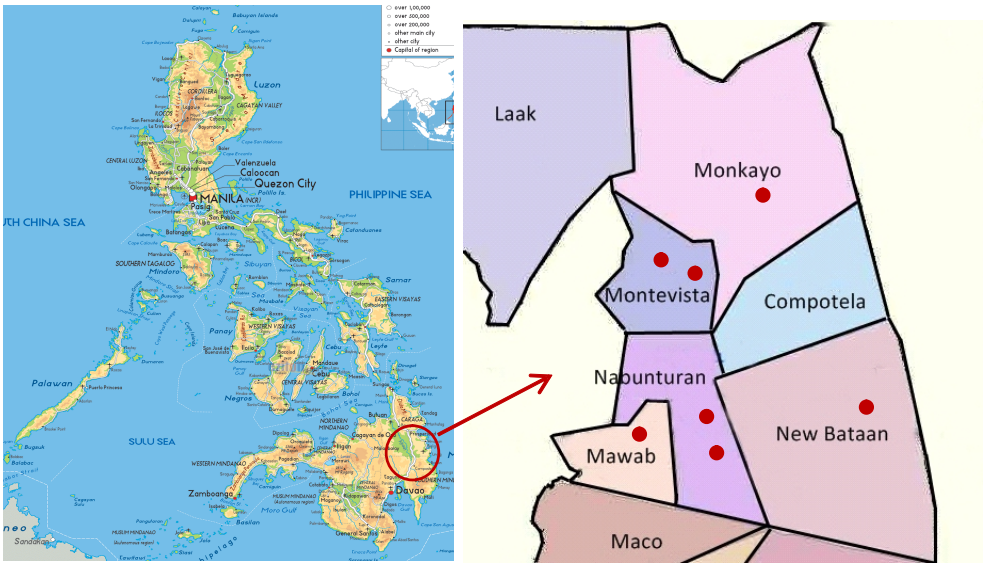

Figure 1 Map of sampling sites in Compostela Valley Province, Philippines

Table 1 Species distribution, habitat and abundance of Tiger beetles in the Compostela Valley Province

Species	Habitat type	Geographic distribution	Cg	Cb	SI	Sm	Ma	An	Pa	N	Percentage
Calomera mindanaoensis (Cassola 2000)	Open, riverine sandy areas in mountainous secondary forest	Mindanao endemic	13	-	-	-	1	-	7	21	20.19
Calomera lacrymosa (Dejean 1825)	Open, riverine, lowland sandy areas mixed agricultural ecosystem	Philippine endemic	-	-	-	-	3	-	-	3	2.88
Cylindera (Ifasina) mouthiezi (Dheurle 2015)	Both found in the open, riverine sandy areas of a secondary forest in mountainous area and lowland mixed agricultural ecosystem	Mindanao endemic	1	-	-	-	4	-	1	6	5.77
Cylindera (Ifasina) discreta elaphroides (Dokhtouroff 1882)	Both found in the open, riverine sandy areas of a lowland secondary forest and mixed agricultural ecosystem	Philippine endemic	-	4	1	-	16	-	6	27	25.96
Neocollyris (Heterocollyris) similior (Horn 1893)	Shaded areas and branches of shrubs in the mixed agricultural ecosystem	Philippine endemic	-	3	-	-	-	-	-	3	2.88
Prothyma (Symplecthyma) heteromallicollis heteromallicollis (Horn 1909)	Open, riverine sandy areas in a mixed agricultural ecosystem	Mindanao endemic	-	-	-	-	-	1	-	1	0.96
Therates coracinus coracinus (Erichson 1834)	Shaded riverine sandy areas and shrubs in mixed agricultural ecosystem	Philippine endemic	-	-	-	1	1	-	-	2	1.92
Therates fasciatus fasciatus (Fabricius 1801)	Shaded riverine sandy areas and shrubs in mixed agricultural ecosystem	Philippine endemic	-	-	-	1	2	-	3	6	5.76
Therates fulvipennis everetti (Bates 1878)	Shaded riverine sandy areas and shrubs in mixed agricultural ecosystem	Philippine endemic	-	-	-	3	1	-	-	4	3.85
Thopeutica (Thopeutica) anichtchenkoi (Wiesner 2015)	Open, riverine sandy areas in secondary forest in mountainous area	Mindanao endemic	24	-	-	-	-	-	-	24	23.07
Thopeutica (Thopeutica) rolandmuelleri (Cassola 2000)	Open, riverine sandy areas in secondary forest in mountainous area and lowland mixed agricultural ecosystem	Mindanao endemic	3	-	-	-	1	-	-	4	3.84
Tricondyla (Tricondyla) elongata (Horn 1906)	Shaded areas and branches of shrubs in the mixed agricultural ecosystem	Philippine endemic	-	3	-	-	-	-	-	3	2.88
									Total	104	

Notes: Cg = Cagan; Cb = Cabalinan; SI = San Isidro; Sm = Sampao; Ma = Mayaon; An = Andili; Pa = Pasian

Figure 2 Endemic species (a) *Calomera mindanaoensis*; (b) *Prothyma (Symplecthyma) heteromallicollis heteromallicollis*

Cylindera and *Calomera* were all found in the open and sandy riverbanks and caught using both light trapping and hand netting methods. These four genera were found to inhabit open and sandy riverine ecosystems, agreeing with Dangalle *et al.* (2012). Species of the genera *Therates, Neocollyris* and *Tricondyla* were often found perching or running in the shrubs and trees near rivers preferring shade rather than exposed open areas. These species were easily caught using a hand net or by hand. Species from the genus *Therates* were especially found in close proximity to river banks while the species from the genera *Neocollyris* and *Tricondyla* were found along the roads and some were near creeks and rivers.

The most common species found to be widespread in Compostela Valley were *Cylindera* (*Ifasina*) *discreta elaphroides*, *Therates fasciatus fasciatus* and *Calomera mindanaoensis* (Table 1). *Cylindera (Ifasina) discreta elaphroides*) was the most dispersed species found in four municipalities, while *Therates fasciatus fasciatus* and *Calomera mindanaoensis* were found in three municipalities indicating the wide distribution of these species in the province. *Thopeutica anichtchenkoi* was abundant but exclusively found in a single locality in Cagan which is characterized by mountainous secondary forest. Other species from the genera *Therates*, *Tricondyla*, *Neocollyris* and *Prothyma* were exclusively distributed in the lowland riparian ecosystems with mixed agricultural vegetation, while species from the genera *Calomera*, *Cylindera* and *Theopeutica* were found either in riverine ecosystems with secondary forest in mountainous areas as well as in lowland open riverine ecosystem with mixed agricultural vegetation.

Among the areas sampled, Mayaon had the highest species richness. The lowland riparian ecosystem with mixed agricultural vegetation with patches of remaining secondary forests was the most preferred habitats by eight species of tiger beetles including *Calomera mindanaoensis, Calomera lacyrmosa, Cylindera (Ifasina) mouthiezi*, *Cylindera (Ifasina) discreta elaphroides*, *Therates coracinus coracinus* Erichson, 1834, *Therates fasciatus fasciatus*, *Therates fulvipennis everetti* and *Thopeutica rollandmulleri*. Cagan which is a mountainous ecosystem was represented by four species of tiger beetles namely *Calomera mindanaoensis*, *Thopeutica anichtchenkoi*, *Thopeutica rollandmuelleri* and *Cylindera (Ifasina) mouthiezi*. Among the species mentioned only *Thopeutica anichtchenkoi* was exclusively found in Cagan which inferred the high habitat preference of this species to forested riverine ecosystems in mountainous areas.

The species of the genera *Calomera, Cylindera* and *Thopeutica* showed a high preference to mountainous and forested riverine ecosystems as indicated by their high abundance in Cagan, whereas the species of the genera *Therates, Neocollyris*, *Tricondyla* and *Prothyma* showed high preference to lowland riparian ecosystem with

mixed agricultural vegetation. The arboreal nature of the species of the genera *Therates*, *Neocollyris* and *Tricondyla* agreed with Cassola (2000) and Dangalle *et al.* (2014) about the habit of these beetles. The preference of the tiger beetles to live in close proximity to the water enables them to be near water and food and provides a good habitat for their reproduction (Bhargav & Uniyal 2008).

The high abundance of *Cylindera (Ifasina) discreta elaphroides* being found in five sampling sites as compared to other species could indicate the high adaptability of the species to habitat modification since it was found inhabiting the mountainous forested riverine ecosystem of Cagan as well as the low land river banks with mixed agricultural ecosystems in Mayaon, San Isidro, Cabalinan and Pasian. On the contrary, *Thopeutica anichtchenkoi* was abundant but exclusively found in a single locality in Cagan which was characterized by mountainous secondary forest. The exclusive distribution and high abundance of this species could indicate its high preference to mountainous forested riparian ecosystem. Many species of tiger beetles are known for their association with forest habitats and limited distributional range as well as narrow habitat preferences as related to temperature, exposure to sunlight, pH and soil moisture and salinity (Dangalle *et al.* 2014).

The other species recorded in Cagan such as *Calomera mindanaoensis*, *Thopeutica rollandmulleri* and *Cylindera (Ifasina) mouthiezi* were also found in the lowland riverine ecosystems with mixed secondary forest and agricultural vegetation indicating the species association with forested habitats. This also implied the species ability to adapt and thrive in habitats with human encroachment brought by conversion of land to farming. Santos (2014) mentioned that further studies should be conducted in tiger beetles' ability to adapt to the changing environmental conditions brought by human disturbances and non-forested habitats.

Cagan which is a mountainous forested ecosystem had the highest abundance of tiger beetles with 41 (39.2%) individuals belonging to four species and three genera followed by Mayaon with 29 (27.88%) individuals recorded belonging to eight species and four genera. Pasian had the third highest abundance of tiger beetles with seventeen individuals recorded belonging to five species and three genera. The high abundance of tiger beetles in Cagan may indicate the preference of the two most abundant species i.e. *Calomera mindaoenses* and *Thopeutica anichtchenkoi* for riparian ecosystems in mountainous and forested ecosystem due to its vegetation, soil moisture and pH which are important factors that determine tiger beetles' habitat preference (Dangalle *et al.* 2014). The high abundance could be due to the ample availability of food resources which is a key factor in most insect taxon abundance. Although Mayaon had the highest species richness, species abundance was quite low indicating the high competition of food among the different species of tiger beetles.

Species coexisting in a locality had been observed. *Calomera lacrymosa* and *Calomera mindaoensis* as mentioned by Cassola (2000) can occur sympatrically. Both were found occurring in Mayaon. *Calomera lacrymosa* was most common in Mayaon, while *Calomera mindaoensis* was most abundant in Cagan and Pasian. These two species can be easily mistaken as one species. However, upon closer inspection it could be found that *Calomera lacrymosa* was smaller at 10 - 11 mm with paler and dull elytra with the two discal dots connected to each other by a narrow lineole, while *Calomera mindaoensis* was bigger with a size that ranged about 13 - 14 mm and had velvety and darker elytra with elytral punctuation poorly or not visible at all and the two discal dots not connected. In Cagan *Calomera mindanaoensis* and *Thopeutica anichtchenkoi* were the most dominant. However, *Thopeutica rolandmulleri* and *Cylindera (Ifasina) mouthiezi* were also found, but in very low number.

Mayaon which was inhabited by seven species of tiger beetles was dominated by *Cylindera (Ifasina) discreta elaphroides* with 16 recorded individuals, while the other species were only represented by low abundance of around 1 - 4 individuals. The high species richness in Mayaon could be attributed to the optimum sunlight and brightness, which were necessary in the predatory activities as well as thermoregulation of the different species of tiger beetles (Knisley 1984). Areas sampled with the lowest species richness and abundance were Cabalinan, Barangay. Andili and Sampao with only one to two species recorded. These riparian areas have a mixed agricultural ecosystem with few standing forest and high anthropogenic disturbances which can inhibit the diversity by reducing the habitat.

CONCLUSIONS

Most Philippine species of tiger beetles showed a consistent habitat preference. Species of the genera *Tricondyla*, *Neocollyris* and *Therates* were arboreal species found in shrubs and trees near the rivers and roads, while other species of the tiger beetles were found in open riparian ecosystems. A narrow distribution of *Thopeutica anichtchenkoi* was observed and found exclusively in Cagan. *Cylindera (Ifasina) discreta elaphroides* was the most dispersed species found in almost all areas sampled indicating its high adaptability. Immediate conservation efforts should be conducted for the tiger beetles *Thopeutica anichtchenkoi, Cylindera (Ifasina) mouthiezi* and *Thopeutica rollandmulleri* which were highly associated with forested riparian ecosystems and had narrow distribution.

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