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Tiger Beetles (Coleoptera: Carabidae: Cicindelinae) of Mainit Hotspring and Mati Protected Landscape, Mindanao with Notes on their Ecology and Threats

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Abstract

A rapid survey of tiger beetles was conducted in two protected landscapes of Region XI (Davao Region) namely MainitHotspring Protected Landscape (MHSPL) and Mati Protected Landscape (MPL) on June to July of 2016. Eight (8) species of tiger beetles were recorded in the two landscapes where six (6) species were recorded from MHSPL while four (4) species were recorded from MPL. A total of five (62.5%) endemic species were recorded of which 3 (60%) are Philippine endemic while 2 (40%) are endemic to Mindanao. Two species namely Heptodonta lumawigi and Cylindera (Eugrapha) excisa were first provincial records in Compostela Valley raising its tiger beetle fauna from twelve (12) to fourteen (14). Ecologic data was also presented for the species as well as the threats that they experience in both protected landscapes. This provides the baseline data of tiger beetles for both protected landscapes. Conservation should be conducted to the tiger beetles especially the rare and endemic ones in MHSPL and MPL. Strengthened implementation of protection in both protected landscapes against mining, illegal logging, slash and burn farming and human settlements should also be done.

Keywords: Tiger beetles, protected landscape, MHSPL, MPL, threats, ecology.

Introduction

Mindanao Island is the second biggest island in the Philippines which covers a total land area of 104,530 km^2 and houses one of the remaining largest intact primary and secondary forests in the country. It is a home to several threatened species such as the Philippines eagle *(Pithecophaga jefferyi),* waling-waling *(Euanthe sanderiana), Rafflesia schadenbergiana, Isoetes philippinensis, Risiocnemis antoniea* among others[1,2]. The island is one of the remaining biodiversity hubs in the country as evidenced by the presence of 5 Asean heritage parks, one UNESCO world heritage site and a Ramsar site of which the latter is one of the most ecologically important wetland in the country.

One of the regions in Mindanao with the most number of protected area sites is Region XI (Davao Region) which belongs to the Eastern Mindanao Biodiversity Corridor (EMBC). EMBC is one of the largest blocks of remaining forest in the country and is considered as the timber and mining corridor of the Philippines[3]. Region XI (Davao Region) has one natural park, one wildlife sanctuary, two protected landscape and seascape, and four protected areas. Two of the protected areas in Davao Region namely Mainit Hotspring and Mati Protected Landscape are most affected by various anthropogenic disturbances related to mining, land use modification and human habitation. Despite its protected area status, both sites were not exempted from excessive human disturbances and environmental degradation so that some local dwellers in both sites are endorsing for the destabilization of its protected status. The two protected landscapes are also watersheds which serve as sources of water for Nabunturan, Comval Province and Mati, Davao Oriental. This calls for biologists and conservationists to conduct an inventory of its flora and fauna to retain its protected status.

Tiger beetle fauna which are habitat specific, with limited geographic distribution and well understood taxonomy is known as a good indicator of microhabitat changes[4- 6]. Their habitat specificity and narrow geographic distribution makes this taxona good bio indicator of local biodiversity and make them highly vulnerable for extinction especially when its habitat is experiencing various anthropogenic pressures. The tiger beetle fauna of the Philippines is still poorly known with no faunistic data available except for the work of Trautner, J.& Schawaller, W. in Leyte[7]. Most works done on this group in the country is taxonomic in nature. Studying the occurrence and status of tiger beetles is deemed necessary especially for their conservation as the country is facing one of the highest rate of deforestation. Tiger beetle which is highly associated with forest habitats is one of the most vulnerable taxon[8]. In this study, we investigated the occurrence and preferences of habitats of the tiger beetles in Mainit Hotspring and Mati Protected Landscape. Notes on their ecology and threats are also presented. This will serve as baseline data which is very important in conserving the tiger

beetles in both landscapes and backing up the two sites protection status.

Study Site: Mainit Hotspring Protected Landscape (MHSPL) is a protected landscape in Nabunturan, Compostela Valley (Comval) Province in Region XI. It has a total land area of 1775 hectares and is part of the headwater basin of Manat River which is one of the major tributaries of Agusan River which also feeds the complex wetland ecosystem of Agusan Marsh. It lies between latitude 7°30'00" and longitude 125°59'00". It has several hot and cold spring and many creeks. The protected landscape has undergone major land modification due to mining, slash and burn farming and human habitation.Few threatened dipterocarps are still found in the protected landscape such as *Shorea negrosensis* and *Xanthostemon verdugonianus*. The agricultural part of the land is planted with *Zea mays*, *Cocos nucifera*, *Theobroma cacao*and *Durio zibethinus*.

Mati Protected Landscape (MPL) is one among the three protected landscape of Davao Oriental. It lies between 6°57'09" to 6°59'44" latitude and 126°09'58" to 126°11'54" longitude under the territorial jurisdiction of Sitio Sudlon and Ugilan, Barangay Central of Mati, Davao Oriental. It has a total of 914.26 hectares and is characterized by mountainous and hilly topography. In the past eleven years since its declaration as a protected landscape, it has gone through major land use modification which is highly attributed to conversion of forests to farmland. The whole area is currently devoid of forest cover with only agricultural crops thriving such as *Cocosnucifera*, *Leucaena leucocepala, Zea mays* and other fruit trees. MPL is also a watershed and a source of water supply of Mati, Davao Oriental.

Materials and Methods

Opportunistic and light trapping were conducted for diurnal and nocturnal tiger beetles in Mainit Hotspring and Mati Protected Ladscape from June to July, 2016. A two kilometre transect line was established in Banahaw Creek in Mati Protected Landscape while opportunistic sampling was conducted in selected sites in Mainit Hotspring Protected Landscape which are ideal habitat of tiger beetles which includes proximity to water source and presence of sandy soil. 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. Identification was conducted using a stereo microscope and comparing morphological characters using the taxonomic keys and published journals of Cassola[9], Wiesner[10-13], and Cassola & Ward[8] with species confirmation by the second author.

Results and Discussion

A total of eight (8) species belonging to six (6) genera and three (3) subtribes were recorded in Mainit Hotspring Protected Landscape and Mati Protected Landscape altogether. Six (6) species were recorded from Mainit Hotspring Protected Landscape while four (4) species were recorded from Mati Protected Landscape. A total of five (62.5%) endemic species were recorded of which 3 (60%) are Philippine endemic while 2 (40%) are endemic to Mindanao. This serves as a baseline data of tiger beetle for both protected landscapes.

Table-1
List of tiger beetles in MHSPL and MPL and their occurrence, geographical distribution and habitat type

Subtribe	Species	Occurrence	Geographical Distribution	Habitat type
Collyrina	*Neocollyris (Heterocollyris)similior* (Horn, 1893)	MHSPL	Philippine endemic	Shaded areas and found on branches and trunks of shrubs and trees in lowland mixed agricultural ecosystem.
	Neocollyris sp.	MPL		Shrubs in shaded riverine areas in lowland mixed agricultural ecosystem.
Theratina	*Therates coracinus coracinus* Erichson, 1834	MPL/MHSPL	Oriental	Shrubs in shaded riverine areas in lowland mixed agricultural ecosystem.
Cicindelina	*Calomera mindanaonesis* Cassola, 2000	MPL/MHSPL	Mindanao endemic	Open, riverine sandy areas in patches of secondary forest as well as mixed agricultural ecosystem.
	Cylindera (Ifasina) discreta elaphroides (Dokhtouroff, 1882)	MPL	Philippine endemic	Open, riverine sandy areas in lowland mixed agricultural ecosystem.
	Cylindera (Eugrapha) excisa (Schaum, 1862)	MHSPL	Oriental	Open, riverine sandy areas in patches of secondary forest.
	Heptodonta lumawigi Wiesner, 1980	MHSPL	Philippine endemic	Shaded, riverine in patches of secondary forest.
	Thopeutica (Thopeutica) rolandmuelleri Cassola, 2000	MHSPL	Mindanao endemic	Open, riverine sandy areas in patches of secondary forest.

Two species namely *Therates corracinus* and *Calomera mindanaonesis* were shared by MPL and MHSPL while the rest of the six species were found either in MPL or MHSPL. *Heptodonta lumawigi* and *Cylindera (Eugrapha) excise* are recorded in Compostela Valley for the first time raising the total number of tiger beetles in this province from twelve (12) to fourteen (14). *Calomera mindanaoensis* is also recorded in Mati for the first time although it is not the first record for Davao Oriental. Cassola[9] recorded *C. mindanaoensis* in Mt Agtuuganon, Boston, Davao Oriental when he described the species. This species is observed to be the most abundant and found in both protected landscape which infers the high distribution of this species and its resilience to anthropogenic disturbances. This species was observed to prefer open riparian ecosystems with visible sandy bars along the river which is a characteristic of the sites where it was recorded in both MHSPL and MPL. It was observed up to 20 meters away from the river. It fed on any smaller insect including flies, spiders and even smaller tiger beetles from the subtribe Collyrina.

The most dominant subtribe recorded is Cicindelina with 5 species recorded followed by Collyrina with two species. Theratina is only represented by one species. For Compostela Valley, the data in MHSPL generated two new records of tiger beetle for the province namely *H. lumawigi* and *C. E. excisa* raising its tiger beetle fauna to 14 species. For Davao Oriental, previous records show that Davao Oriental has more or less 9 species of tiger beetles of which only 3 species were recorded in MPL[9]. The low number of tiger beetle species in Mati MPL can be attributed to its land devoid of forest cover since tiger beetles are known to be highly associated with forested habitats. Farming on the slopes of the Banahaw Creek which is the only creek in MPL may cause disturbance of the larvae of tiger beetles further reducing their diversity in the area. Although MPL seems a suitable habitat for tiger beetles due to its open and sandy riverine ecosystem which is preferred especially by tiger beetles from the subtribe Cicindilinae, the severe conversion of its forest to agricultural land and human settlements can cause the diversity of tiger beetle in the area to dwindle.

The higher number of species in MHSPL which accounts to 42.86% of tiger beetle in Comval can be attributed to its remaining sparse vegetation cover in selected areas sampled as compared to MPL. Tiger beetle's preference to sandy soil with sparse vegetation was also mentioned by Hoback et al.[14] who said that sandy areas provide more ease for females' oviposition. The high abundance of insect in MHSPL was also noted by Jumawan et al.[15] who recorded 41 species of Odonata in the area. This is a testament of the rich invertebrate fauna of MHSPL despite the anthropogenic disturbances it experiences. In the paper of Jumawan et al., a predominance of forest dwelling zygopterans were recorded which shows the need for further protection of this biologically rich area[15]. The same is true for tiger beetle fauna where rare species such as *T. rollandmulleri* and *H. lumawigi* were recorded.

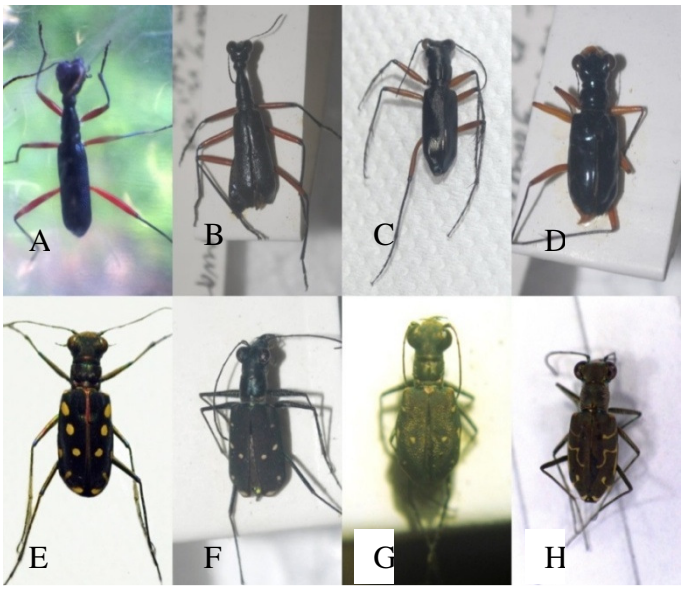

Figure-1
Photos of tiger beetles in MHSPL and MPL
A-Necollyris sp., B- ***Neocollyris (Heterocollyris)similior*** **(W.Horn, 1893), C-** ***Heptodonta lumawigi*** **Wiesner, 1980, D-** ***Therates coracinus coracinus*** **Erichson, 1834, E-** ***Calomera mindanaonesis*** **Cassola, 2000, F-** ***Thopeutica (Thopeutica) rolandmuelleri*** **Cassola, 2000, G-** ***Cylindera (Ifasina) discreta elaphroides*** **(Dokhtouroff, 1882), H-** ***Cylindera (Eugrapha) excisa*** **(Schaum, 1862)**

T. rollandmulleri and *H. Lumawigi* recorded in MHSPL but not recorded in MPL were found in areas with better vegetation cover, lesser area turned into farm land and less human disturbance. This can be an indication of these species' higher sensitivity to human disturbances as compared to other species which seem to thrive even in a disturbed environment. *T. rollandmulleri* which was described by Cassola[9] from Mt. Agtuuganon, Davao Oriental seems to be highly associated with forested habitats with only minimal anthropogenic disturbances present[9]. This species was not abundant in the area however it seems to be widespread in Comval Province where it was also recorded in New Bataan and Montevista. Aside from Davao Oriental and Comval, this species is not recorded anywhere as of the moment. More field surveys should be conducted to determine the actual geographic distribution of this species which seems to be endemic and rare to Eastern Mindanao. As for *H. lumawigi*, this is the second record of this species in Mindanao. This species which was described by Wiesner[10] from Panay and was believed to be endemic to Panay until new materials were recorded in Mt. Parker, South Cotabato by Cassola[9]. The present record shows that *H. lumawigi* might be more widespread in Mindanao as more field surveys of tiger beetles will be conducted.

The subtribes Collyrina and Theratina were both observed on shrubs and trunks of the trees which agree that these species are arboreal in nature. Subtribe Cicindelina were all found in the

open riparian ecosystems and collected by both hand netting and light trapping. All species found in the protected landscapes were recorded at the river banks or within 20 meters away from the river. Tiger beetle's preference to areas with close proximity to water due to availability of food and high humidity was also mentioned by Bhargav&Uniyal[16] and Dangalle et al.[17]. *T. coracinus coracinus* was recorded on the leaves of the shrubs in a shady area near the river. Similarly, *H. lumawigi* was found in the shady dark rocks near the river. The black coloration of both two species seems to give them an advantage of not being easily recognized by predators as they seem to camouflage the dark and shady environmentand dark substrate. Tiger beetle's general coloration tends to match their substrate as a tool to evade and confuse predators[18,19].

Despite the different anthropogenic disturbances in the two protected landscape, tiger beetles still thrive which indicates how these species are adapting to their environment. However, the conversion of land in both MHSPL and MPL human settlements denuding the forest due to illegal harvesting of timber and conversion of land to agricultural lands poses a tremendous threat to the species of tiger beetles found in both landscapes. Slash and burn farming which destroys the steepest slopes and the streams and rivers which causes siltation by mine tailings as observed by the murky waterin the rivers of MHSPL poses further threat to the species dwelling near rivers [15]. Tiger beetles which are habitat specific and has a narrow geographic distribution should be a subject of priority especially in the conservation as the current loss of our forests ecosystems has a profound effect in their survival in the wild. Special attention should be given to species which are endemic, rare and with narrow distribution such as *T.rollandmulleri* which is at high risk of extinction.

Figure-2
Habitat and some threats in MHSPL and MPL
A- Habitat of *C.mindanaoensis, C.E.excisa* and *T. rollandmulleri* in MHSPL, B- Habitat of beetles in Banahaw creek, MPL, C- Mine tails in one of the rivers in MHSPL, D- Illegal logging activities in MHSPL, E- Slash and burn farming MPL, F- Presence of human habitation in MPL.

Conclusion

Despite the different anthropogenic disturbances experienced in Mainit Hospring and Mati Protected Landscape, eight species of tiger beetle of which five are endemic were recorded in both sites. Two rare and endemic species such as *T. rollandmulleri* and *H. lumawigi* are found in MHSPL which signifies the importance of the landscape in hoarding rare and endemic species of tiger beetles. Strengthened conservation efforts should be done in the two protected landscapes which experiences a handful of anthropogenic disturbances related to mining, slash and burn farming, illegal logging and human habitation. These disturbances which should not be allowed in the protected landscape should be addressed. More surveys and studies are recommended to the other unknown flora and fauna in the landscape to assess its remaining biodiversity.

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