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Diversity and distribution of pachyrynchini (Coleoptera: Curculionidae: Entiminae) in Mt. Apo Natural Park, Philippines

Analyn Anzano Cabras^{1*}, Gerry Nique², Alma Mohagan³¹Department of Math and Science, University of Mindanao, Davao City, Philippines²University of Mindanao, Bansalan Campus, Davao del Sur, Philippines³Department of Biology, Central Mindanao University, Musuan, Maramag, Bukidnon, Philippines

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Abstract

The tribe Pachyrynchini (Coleoptera:Curculionidae:Entiminae) with a Philippine centered distribution is poorly studied with mountains like Mt. Apo Natural Park less explored. A combination of belt transect, visual encounter and photo documentation was conducted from May to December, 2015 to document the Pachyrynchini fauna in Mandarangan trail, Mt. Apo Natural Park. Twenty one (21) species belonging to two genera *Pachyrynchus* and *Metapocyrtus* were found. *Pachyrynchus* was represented by four species and 1 subspecies while 17 species represents *Metapocyrtus*. Species diversity was low with ($H' = 1.065$) as the highest record in the montane forest. *Pachyrynchus* species were not found in lower montane (800-1000masl) while *Metapocyrtus* species were more dispersed and observed from lower montane to mossy forest(800-2400 masl). Fifty percent (50%) of the Pachyrynchini species were noted to have altitudinal preference to either montane (1000-1500masl) or mossy forest (1600-2400masl). Land use modification (e.g.farming) which has eradicated food and larval host plants of Pachyrynchini species is believed to be one of the reasons of low diversity in the lower montane. The result of the survey represents the baseline data of Pachyrynchini fauna in Mt. Apo Natural Park, Philippines. Conservation efforts especially for the rare and endemic species should be conducted.

***Corresponding Author:** Analyn Anzano Cabras ✉ ann.cabras24@gmail.com

Introduction

Pachyrinchini is a tribe belonging to the largest group of beetles in the world Curculionidae with 51,000 species under 4600 genera (Oberprieler *et al.*, 2007). The tribe has its center of diversity in the Philippines with more than 300 species and 90% endemism. It is coveted by enthusiasts, entomologist and collectors for the conspicuous pattern and structure of its iridescent scales which makes them look like living jewels. Being flightless and with restricted geographic distribution makes them a prime candidate for biogeographic analysis (Starr and Wang, 1992). Schultze mentioned that the center of distribution of this group is in the Philippines between 500-2000 masl however recently a number of these species are observed at lower elevations and are becoming pest to crops and ornamental plants (Schultze, 1923; Yap and Gapud, 2007; Yoshitake 2012b).

The tribe has currently 15 described genera with the latest addition of the genus *Expachyrynchus* from Palawan (Alonzo-Zaraga and Lyal, 1999; Yap and Gapud, 2007; Yoshitake, 2013). Of these 15 genera, 10 genera are endemic to the country. Most of the work done on this tribe by early entomologist such as Waterhouse, Germar, Heller, and Schultze was in the 1800's and early 1900's. Knowledge about this taxon has been unchanged for nearly a century until recently few foreign taxonomists has been doing most

of the work on tribe by describing new species (Yoshitake, 2012b and 2013, Bollino and Sandel, 2015). However, no faunistic and ecologic researches have been done on this group.

Mindanao which is the second largest island in the Philippines and houses various mountains including Mt. Apo Natural Park, Mt. Kitanglad Natural Park and Mt. Hamiguitan Wildlife Sanctuary is poorly studied with the possibility of hoarding new species (Schultze, 1923; Yoshitake, 2012b). Currently there are more than a hundred species of *Pachyrynchus* in the Philippines while the genus *Metapocyrtus* has 227 species (Yap and Gapud, 2007; Yoshitake, 2011). With the current rate of habitat loss due to deforestation and conversion of lands to agricultural purposes, biologist, ecologist and taxonomist are in a race against time to document our species. This paper aims to provide the species richness, distribution and diversity of Pachyrinchini along Mandarangan trail, Mt. Apo Natural Park which will serve as baseline data.

Materials and methods

Sampling site description

The study area was located at Mandarangan trail, Mt. Apo Natural Park, Mindanao (07°021'1505"N, 125°19'7792"E) (Fig.1).

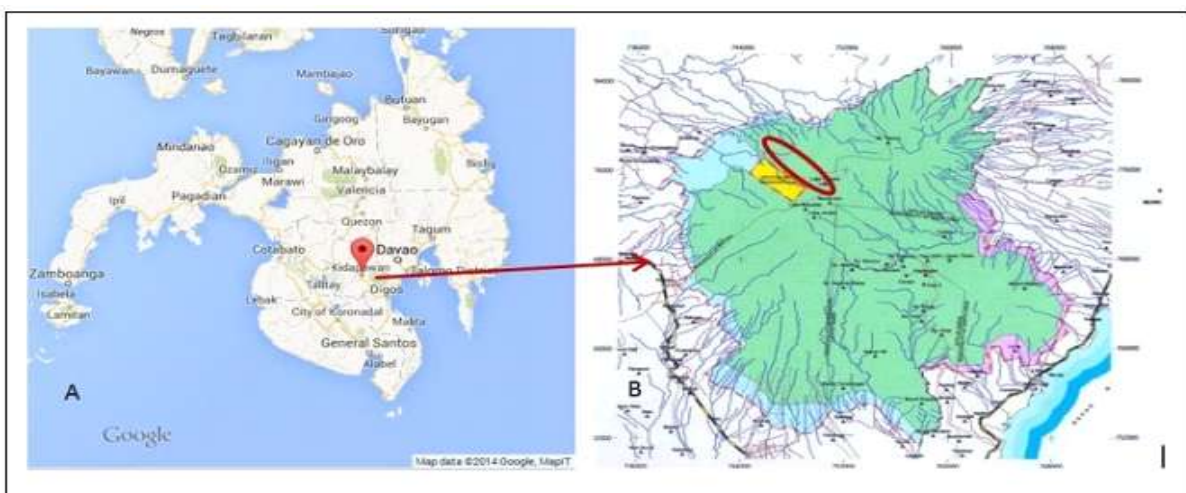


Fig. 1. Map of Mindanao showing the location of Mt. Apo Natural Park (A); Map of Mt. Apo showing the relative location of Mandarangan trail (B).

It is located at Barangay Illomavis, Kidapawan City, North Cotabato and is one of the six main trails of Mt. Apo Natural Park. Mt. Apo Natural Park is the highest peak of the Philippines and borders two regions namely Region XI (Davao Region) and Region XII (SOCCSKSARGEN). Three sampling sites across different vegetation types and elevations in Mandarangan trail were established which includes the lower montane (800-1000masl), montane forest (1000-1500masl) and mossy forest (1600-2400masl). The lower montane has already been converted into agricultural purposes and planted with crops like *Sechium edule* (sayote), *Brassica oleracea* and *Durio sp.* Clearing of areas in the lower montane planted with *Cyathea sp.* was also observed.

Sampling methods

A combination of belt transect walk, visual encounter and photo-documentation was employed between the months of May and December, 2015. Data collection was conducted between 0700 to 1500 hours. Samples were mostly obtained from shrubs at an elevation

between 800 to 2400 masl. The specimens were collected through beating sheet and handpicking and killed in vials with ethyl acetate. It was later air dried and card- mounted for longer storage and kept in the first author’s collection. Specimens for DNA analysis were soaked in 95% ethanol. Identification was done by examining specimens under stereo microscope and using taxonomic keys and monograph comparison and descriptions provided by Schultze and Yoshitake (Schultze, 1923 &1925; Yoshitake, 2012).

Statistical analysis

Shannon-Weiner diversity index, abundance and spatial distribution of Pachyrynchini species were determined using Bio Pro software version 2.0.

Results and discussion

A total of 21 species and 1 subspecies belonging to 2 genera- *Pachyrynchus* and *Metapocyrtus* were recorded. *Pachyrynchus* was represented by 4 species and 1 subspecies while *Metapocyrtus* with 17 species (Table 1).

Table 1. Distribution and endemism of Pachyrynchini along Mandarangan trail.

Species name	Geographic Distribution	Lower montane 800-1000	Montane 1000-1500	Mossy 1600-2400	Total	%
1. <i>P. apoensis</i>	ME	-	40	7	47	19.83
2. <i>P. hirokii</i>	ME	-	4	1	5	2.10
3. <i>P. erichsoni</i>	PE	-	1	1	2	0.84
4. <i>P.erichsoni eschscholtzi</i>	PE	-	1	1	2	0.84
5. <i>P. pseudamabilis</i>	ME	-	5	-	5	2.10
6. <i>M.apoensis</i>	ME	7	33	-	40	16.88
7. <i>M. cf. obscurus</i>	ME	5	20	-	25	10.55
8. <i>Metapocyrtus sp.1</i>	ME	-	-	28	28	11.81
9. <i>Metapocyrtus sp.2</i>	ME	-	5	-	5	2.10
10. <i>Metapocyrtus sp. 3</i>	ME	2	4	-	6	2.53
11. <i>Metapocyrtus sp.4</i>	ME	-	2	-	2	0.84
12. <i>Metapocyrtus sp. 5</i>	ME	-	3	-	3	1.26
13. <i>Metapocyrtus sp. 6</i>	ME	-	2	-	2	0.84
14. <i>Metapocyrtus sp.7</i>	ME	4	21	-	25	10.55
15. <i>Metapocyrtus sp. 8</i>	ME	2	7	-	9	3.80
16. <i>Metapocyrtus sp. 9</i>	ME	2	6	-	8	3.38
17. <i>Metapocyrtus sp. 10</i>	ME	4	5	-	9	3.80
18. <i>Metapocyrtus sp. 11</i>	ME	-	2	-	2	0.84
19. <i>Metapocyrtus sp. 12</i>	ME	-	2	-	2	0.84
20. <i>Metapocyrtus sp. 13</i>	ME	-	11	-	11	4.64
21. <i>Metapocyrtus sp. 14</i>	ME	-	5	-	5	2.11
22. <i>Metapocyrtus sp. 15</i>	ME	-	-	10	10	4.22
Total # of individuals		26	186	48	237	
Total # of species		7	20	6		

Legend: PE- Philippine endemic; ME- Mindanao endemic.

This presents the first faunistic data of Pachyrynchini in Mt. Apo Natural Park and in the Philippines. *Pachyrynchus* species includes *Pachyrynchus apoensis* Yoshitake, 2012 (Fig.5), *Pachyrynchus erichsoni* Waterhouse, 1841 (Fig.8), *Pachyrynchus erichsoni eschscholtzi* Waterhouse, 1841 (Fig.7) and the recently described species *Pachyrynchus hirokii* Yoshitake, 2012 (Fig.4) and *Pachyrynchus pseudamabilis* Yoshitake, 2012 (Fig.6). For *Metapocyrtus* 2 were identified namely

Metapocyrtus apoensis Schultze, 1925 (Fig.9) and *Metapocyrtus cf. obscurus* (Fig.10). The high number of *Metapocyrtus* is attributed to the fact that this genus has 227 species whereas *Pachyrynchus* has only more than a 100 species in the Philippines (Yap and Gapud, 2007; Yoshitake, 2012b). A notable abundance of *P. apoensis* and *M. apoensis* was observed in Mandarangan trail which agrees with previous records of Schultze (Schultze, 1925).

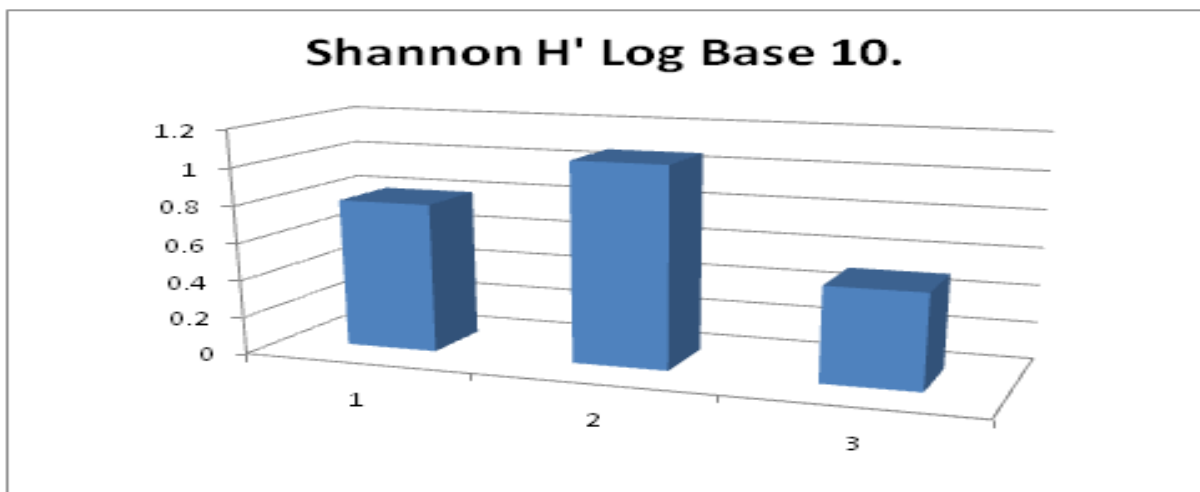


Fig. 2. Shannon-diversity index and Evenness of Pachyrynchini along Mandarangan trail, Mt. Apo Natural Park.

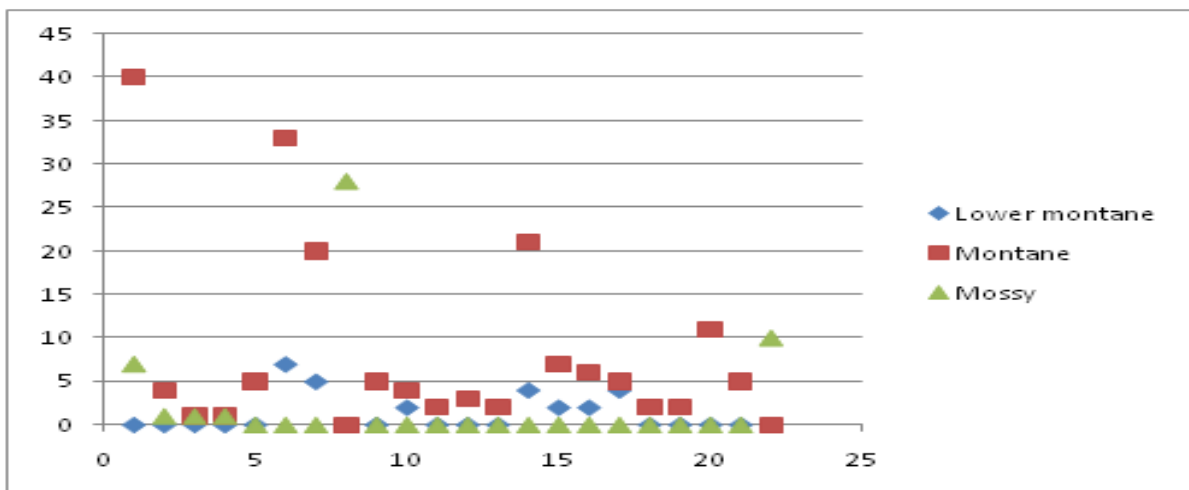


Fig. 3. Species distribution of Pachyrynchini along Mandarangan trail.

Highest species richness was observed in the montane forest with 20 species followed by lower montane with 7 recorded species and mossy with 6 recorded species (Table 1). Majority of the species were observed near Marbol River which agrees with

Schultze that Pachyrynchini’s favoured habitat is “vast tropical vegetation, open, mixed forests with dense undergrowth along rivers and ravines or on ridges and mountains, with most species living on smaller trees, bushes, shrubs, or ferns.”

(Schultze,1923). *Pachyrynchus* were found at 1100 masl and was not found at lower elevation. *Metapocyrtus* species were more dispersed and found in elevation as low as 800 masl until a much higher elevation of 2400 masl along the Peak trail. The narrow distribution of *Pachyrynchus* and the wider distribution of *Metapocyrtus* was also observed in Mt. Malindang with *Pachyrynchus* found only in 4 vegetation namely mossy forest, montane forest, almaciga forest and submontane dipterocarp forests while *Metapocyrtus* was found in 9 identified vegetation (Ballentes *et.al.*, 2006). However, low species richness was observed in the montane forest in Mt. Malindang as compared to Mt. Apo (Ballentes *et.al.*,2006).



Fig. 4. *P. hirokii* Yoshitake, 2012.



Fig. 5. *P. apoensis* Yoshitake, 2012.

Both *Pachyrynchus* and *Metapocyrtus* have a narrow geographic range and are often confined to a certain island or mountain ranges since these beetles are flightless. To date, there is no study yet with the actual distribution of the Pachyrynchini species but

based on the monograph of Schultze each species is limited in a specific mountain or island except for *P. erichsoni* and its subspecies *P. e. eschscholtzi* which was recorded in several islands in the archipelago (Schultze, 1923). These two species has also been observed in other localities in Mindanao such as Mt. Hamiguitan, Davao Oriental and Mt. Kiamo, Malaybalay, Bukidnon. Majority of the species found are Mindanao endemic except for *P. erichsoni* and its subspecies *P. e. eschscholtzi*. The narrow distribution of Pachyrynchini was also observed in Green and Orchid islands in Taiwan (Starr and Wang, 1992).



Fig. 6. *P. pseudamabilis* Yoshitake, 2012.

All species of Pachyrynchini found at the lower montane were all *Metapocyrtus*. Member of this genus was recently found and described in Honshu, Japan after it was found feeding on an English ivy plant (Yoshitake, 2012a). It is believed to have originated from the Philippines. This result agrees with Yap and Gapud that some members of this tribe are already considered as pest to agricultural and ornamental plants possibly due to deforestation (Yap and Gapud, 2007). In 1900's it was mentioned that members of this tribe do not feed on any cultivated plants however due to adaptation these species are now observed feeding even on ornamental plants and crops (Schultze, 1923). A close form of *M. apoensis* and *M.cf.obscurus* were also observed on several ornamental plants such as *Codiaeum* sp. found in the botanical stores in Davao City which is believed to have been transported together with the ornamental plants. These species were also collected from Mt. Candalaga, Compostela Valley, Mt. Musuan, Bukidnon and Malagos, Davao City.



Fig. 7. *P. erchsoni eschscholtzi* Waterhouse, 1841.

Shannon-Weiner diversity was highest in the montane forest ($H' = 1.065$) followed by the lower montane ($H' = 0.798$) while the mossy has the lowest with ($H' = 0.505$) (Fig. 2). Average diversity of Pachyrynchini along Mandarangan trail is quite low ($H' = 0.798$). The high species diversity in the montane forest can be attributed to the abundance of the food plants of the Pachyrynchini species which includes *Melastoma malabaticum*, *Impatiens platypetala*, *Greeniopsis* sp., *Diplazium davaoense*, *Saurauia* sp., *Rhaphidophora* sp., etc.



Fig. 8. *P. erchsoni* Waterhouse, 1841.

The low diversity in the lower montane is believed to be caused by land use modification which includes clearing of land for farming. Locals started clearing the land including areas planted with *Cyathea* sp. and planted it with crops like *Sechium edule* (sayote), *Brassica oleracea* and *Durio* sp. These anthropogenic disturbances can cause food plants and larval host

plants of the Pachyrynchini especially of *Pachyrynchus* species to be eradicated. Just like any phytophagous insect, diversity and abundance of Pachyrynchini are dependent on the diversity and abundance of food plants and host plants of the larva (Nacua, *et.al.*, 2015).



Fig. 9. *M. apoensis* Schultz, 1925.

Species distribution shows that 11 species has a random distribution whereas 11 species has an aggregate distribution (Fig. 3). *Pachyrynchus* species were found only from the montane to the mossy forest while *Metapocyrtus* species were abundant from the lower montane (800-1000masl) up to the mossy forest (1600-2400masl). *P. pseudamabilis* was observed only in the montane forest (1000-1500masl) whereas *P. hirokii*, *P. apoensis*, *P. erchsoni* and *P. e. eschscholtzi* were found in both montane and mossy forest. For *Metapocyrtus*, 7 species were randomly distributed and found in both the lower montane and montane forest while 8 species were found only in the montane forest and 2 were found in the mossy forest. Some species were noted to have altitudinal preference and are only found in a specific altitudinal level.

Majority of the Pachyrynchini species found in Mandarangan trail especially in the higher elevation were observed to be unique and not found in other mountains in Mindanao namely Mt. Hamiguitan, Mt. Candalaga and Mt. Kiamo. This shows the unique species composition of Mt. Apo Natural Park and

further proves the narrow distribution of Pachyrhynchini species.

The low dispersal ability and distribution of food and larval host plants across vegetation types and elevations are mentioned to be important factors that determine population structure of flightless weevils (Sequiera *et.al.*2011). This calls for conservation efforts not only for these species but for their food plants and larval host plants. Since these species are forest dwelling, the dwindling status of the Philippine forest poses a great threat to their existence.



Fig. 10. *M. cf. obscurus*.

Conclusion and recommendation

The lack of insect species representation of various island groups including Mindanao requires more extensive sampling as these islands especially the mountainous regions may harbor many endemic and new species. With the Philippines being a biodiversity hottest of hotspots, species are getting extinct at an alarming rate without being documented. More ecologic and taxonomic work is needed in the tribe Pachyrhynchini especially for its conservation.

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