



Update on the Geographic Distribution of Philippine *Rubus* species

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Abstract: The genus *Rubus* has a cosmopolitan distribution, with Europe having the most number of taxa and species. The Philippines has 17 species of *Rubus* reported in the country based on the most recent published taxonomic revision. However, there are limited resources on the distribution of *Rubus* species in the Philippines. Some of the major problems observed on the studies of distribution of plant species is the misidentification of specimens, lack of information provided in the herbarium collections, and the lack of herbarium specimens altogether. A search through herbaria collections in different herbaria in the country revealed trends of distribution as well as correction on the identification of numerous specimens. The *Rubus* species are found in numerous islands in the Philippines, including Luzon, Mindanao, Palawan, and some of the islands in the Visayan region. Majority of the *Rubus* species in the country are found in montane regions. The mountainous region of the Cordillera region show increased diversity of *Rubus* plants. Five *Rubus* species are widely distributed across the country while others are very limited.

Key Words: *Rubus*; distribution update; Philippine plants; Rosaceae

1. INTRODUCTION

1.1 Global and Philippine Distribution

Rubus is a plant genus that are found primarily in the temperate regions of the Northern Hemisphere. The most number of species are found in Europe. Fewer species are present in the tropical areas and the Southern Hemisphere (Huang and Hu, 2009). Out of the total 700 to 750 species around the world (Alice and Campbell, 1999; Huang and Hu, 2009; Lingdi and Boufford, 2003), there are at least 50 species of *Rubus* described among the Malesian flora. (Kalkmann, 1993).

In the Philippines, there are four subgenera reported out of the total 12 subgenera of genus *Rubus*. These are the subgenera *Micranthobatus*, *Idaeobatus*, *Malachobatus* and

Chamaebatus. In the latest taxonomic revision by Kalkmann in 1993, the Philippines has 17 species of *Rubus* in the country of which 6 are endemic. Earlier studies by Elmer (1908, 1913, 1939), Focke (1913) and Merrill (1918, 1922) throughout the American colonization period have reported 19 species and one variety. Kalkman (1993) have reduced some of these species into synonyms of previously identified species.

1.2 Taxonomic Issues

The genus *Rubus* is a very diverse genus which species may show considerable discrepancy in appearance compared to *Rubus fruticosus* L., the type species. Thus, there are suggestions to subdivide the genus and delimit it to smaller genera (Holub, 1997). Nonetheless, there are morphological characteristics that define and unite



the genus, separating it from the other species under the family Rosaceae. These include the characteristics laid down by Huang and Hu (2009), Kalkman (1993), and Kraft and Nybom (1995). Kraft and Nybom (1995) noted that members of the genus *Rubus* includes perennial growth, bushy plants, vegetative reproduction through root suckering and tip rooting, and presence of ramets. These ramets can extend for a considerable distance. Kalkman (1993) and Huang and Hu (2009) noted that *Rubus* are primarily creeping shrubs, woody, prickly, rarely herbaceous, with either compound or simple leaves, alternate leaf attachments, incised leaf margins, terminal inflorescence, primarily solitary and pentamerous white bisexual flowers. Fruits of *Rubus* are drupe, and are found to be cohering into a drupeletum.

The genus *Rubus* is morphologically diverse due to high rates of hybridization, apomixis and polyploidy (Alice and Campbell, 1999; Angelo and Boufford, 2012; Gustafsson, 1942). These result to confusion on taxonomic treatment of species, given the similarity and intermediacy of features of the species, its hybrids and apomictics. This would have further resulted to confusion on the study of *Rubus* distribution which may have extended to studies in other regions which lack the taxa undergoing extensive hybridization and thus slowed down research in the field (Kalkmann, 1993). Moreover, this confusion and lack of interest may result to misidentification and incorrect reporting of the distribution of the species. There is also the possibility of newer collections which may add more information on *Rubus* taxonomy and distribution which needs to be reported

1.3 Objectives, Scopes and Limitations

The objective of this study is to provide an updated set of information of *Rubus* distribution through the inspection of herbaria collections present in local and international herbaria. The information will primarily be obtained from the notes provided by collectors along with the specimens and also some of the pertinent works to the study. The information therefore will be limited to the extent of information provided by the collectors to their specimens and published data. This will also focus on specimens that are separated by their morphological characteristics

without reliance or information coming from molecular data.

2. METHODOLOGY

A total of 311 herbarium specimens from Philippine National Herbarium (PNH), University of the Philippines Los Baños Museum of Natural History (LBC and CAHUP), University of Santo Tomas Herbarium (USTRCH) and the University of the Philippines Diliman Herbarium (PUH) were examined. In addition, images of specimens, both types and subsequent collections, were obtained and inspected from Royal Botanical Garden Kew (K), National Herbarium of the Netherlands Leiden (L), and United States National Herbarium of the Smithsonian Institution (US) along with possible distribution data. Data published by Kalkmann, Merrill, and Elmer were also checked along with the specimens collected. The information from the herbarium labels, which may contain the location and related data of the collection along with the state of the specimen in the wild when collected. These pieces of information were recorded and tabulated. Altitude, topographical, and environmental data were recorded for discussion purposes (Zhang and Ma, 2008).

Specimens were identified to species level. The geographic distribution along with other pertinent pieces of information were noted. The distribution at provincial levels are placed in figures. The figures were made separately for species with smaller distribution. Species richness was measured using the number of species in a given location. For altitude-based distribution, observations were grouped into classes of 250m (Hijmans and Spooner, 2001). The data were illustrated using DIVA-GIS (Hijmans et. al., 2012).

3. RESULTS AND DISCUSSION

This report on the distribution of the *Rubus* species in the country is based on the herbarium specimens inspected. One notable finding is the lack of herbarium specimens in the local herbaria due to insufficient collections or high backlogs. Moreover, the majority of the collections during the American Colonization Period were destroyed during the Second World War and hence



one can only rely on specimens from foreign herbaria, which are primarily type specimens, and previously published data. These herbarium specimens are important as they can provide the highest-resolution data, or point data, for the plant distribution. However, these can be subject to shortcomings resulting from the uneven historical sampling of the plants due to collections performed at different time intervals in different locations. This may also result to have data focused on well-collected areas rather than biodiversity hotspots (Zhang and Ma, 2008). Changes in the circumscription of the species may also affect the studies of *Rubus* diversity and richness and in fact may totally change the results of the study (Hijmans and Spooner, 2001).

The observations of collections from local and foreign herbaria show at least 17 species. The *Rubus benguetensis* Elmer, *Rubus clementis* Elmer, *Rubus cumingii* Kuntze, Meth. *Rubus sorsogonensis* Elmer, *Rubus perfulvus* Merr. and *Rubus niveus* Thunb. Diss. Rubo were not present in any of the visited local herbaria and hence the information was derived from other sources which may include the type specimens and previous locations.

In the Philippines, *Rubus* is reported to be present in 39 provinces (Figure 1). In the herbarium specimens studied, *R. fraxinifolius* Poir. (77), *R. moluccanus* L. (67) and *R. rosifolius* JE Sm (39) are the most often collected and deposited in herbaria and thus these species are considered to be most frequently observed. These three species comprise 58% of all the observations and collections of *Rubus* available, despite only comprising 17.6% of the total number of species. Several species, like *R. sorsogonensis* Elmer, *Rubus perfulvus* Merr., *Rubus mearnsii* Elmer, and *R. glomeratus* Bl are reported in only once in the country with the former three species are reported only on the type locality. These, along with other species with less than 5 observations, are considered as rare species (Hijmans and Spooner, 2001).

The geographic distribution of *Rubus* species is uneven. From the figures, one can observe that the majority of the *Rubus* species found in the country, along with increased numbers of species in a locality are in mountainous, high-altitude locations (Figure 2). Twelve species are

only found in heights higher than 1000 meters above sea level (Figure 3). However, species found in lower altitudes have been collected more frequently from far more different locations. Three species, *R. moluccanus* L., *R. rosifolius* JE Sm, *R. fraxinifolius* Poir, can be found below 1000 meters above sea level. Some of the specimens are collected in riversides and lower portions of mountains. There are few, and rare, specimens of *R. pectinellus* Maxim found at around 850 m and *R. rolfei* Vidal at 950m. Majority of species are distributed in mountainous locations in the Cordillera and Sierra Madre mountains and the Ilocos regions in Luzon Island and the mountainous regions of Mindanao Island. Examples of these, going from North to South, are Mt. Pulag, Baguio City, Mt. Banahaw and Mt. Apo. Provinces, like Benguet and Ifugao in the Cordillera Administrative Region has numerous areas with collected specimens. Mt. Pulag is a site with considerable diversity of *Rubus* species, with eight species, and most of the species are found at 2000 mASL (Figure 2). There is noticeably more *Rubus* species in the higher latitudes, akin to the global trend for the species (Kalkman, 1993).

The species *R. moluccanus* L., *R. rosifolius* JE Sm, *R. fraxinifolius* Poir., *R. pectinellus* Maxim and *R. rolfei* Vidal are among the most widely distributed species of the plants across the country (Figure 4). The rest are narrow endemics and noticeably present in smaller distributions within the country (Figure 5). It is noted that the species present in lower altitudes have wider distribution than those found at higher altitudes. A noticeable observation is the update of the distribution for several species, which presence and distribution is confirmed through inspection of improperly identified specimens and correcting the distribution ranges for the species based on the new information.

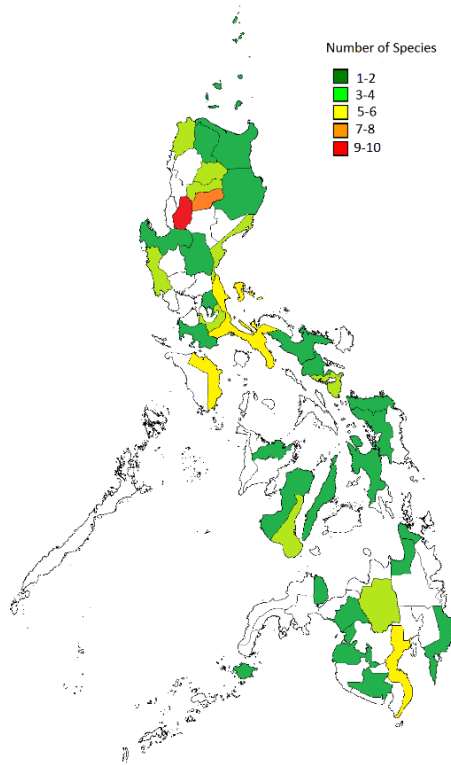


Figure 1. Provinces in the Philippines with *Rubus* species along with species numbers per province.

Among the politically-defined areas, the Cordillera Administrative Region is noted to contain the largest number of *Rubus* species in the country. In this region, the provinces of Benguet and Ifugao have high number of *Rubus* species. Bukidnon, Quezon and Davao del Sur are also considerably diverse in *Rubus* species. The specimens were collected at similar altitudes among these different locations. Other areas with reported *Rubus* species contain either *R. moluccanus* L, *R. rosifolius* JE Sm, or *R. fraxinifolius* Poir. Many of these places are low-altitude areas and have low diversity of *Rubus* species (Figure 1, 4).

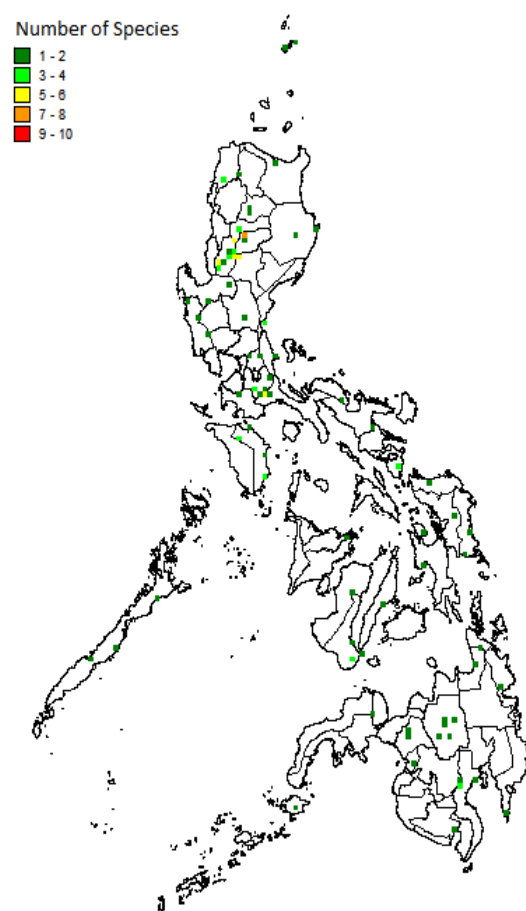


Figure 2. Number of *Rubus* species in areas where collection occurred

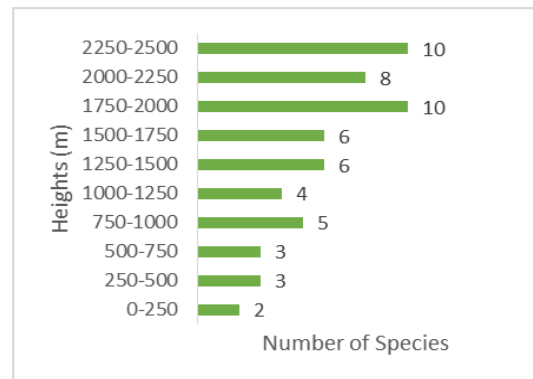


Figure 3. The number of recorded *Rubus* species in different ranges of heights.

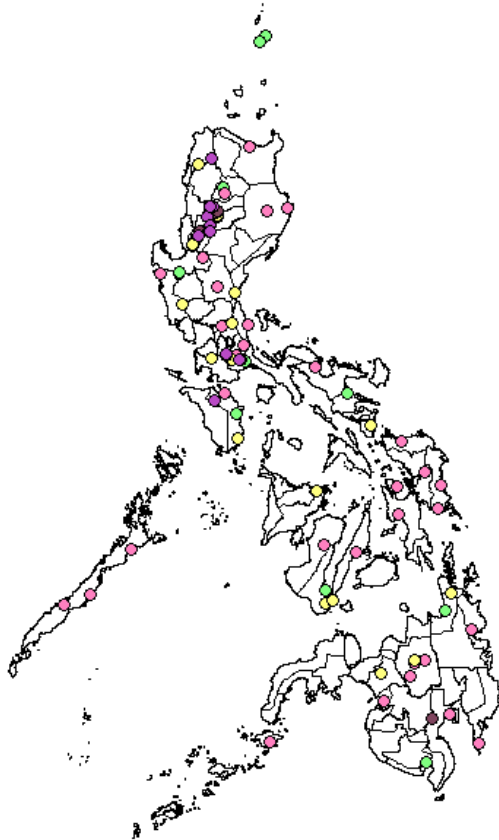


Figure 4. The locations of the more widely distributed *Rubus* species based on records from local herbaria. Legends: Purple (*Rubus rolfei* Vidal), Brown (*Rubus pectinellus* Maxim), Yellow (*Rubus rosifolius* JE Sm), Pink (*Rubus moluccanus* L.), and Green (*Rubus fraxinifolius* Poir).

Different locations within the country are found to contain species endemic, or at least limited, in these areas. For Luzon, the island contains species including *R. luzoniensis* Merr., *R. copelandii* Merr., and *Rubus heterosepalus* Elmer. Mindanao contains *R. perfulvus* Merr. and *R. pyriferolius* JE Sm. The latter is not endemic to Mindanao but its presence in the country is limited to Mindanao (Figure 5).

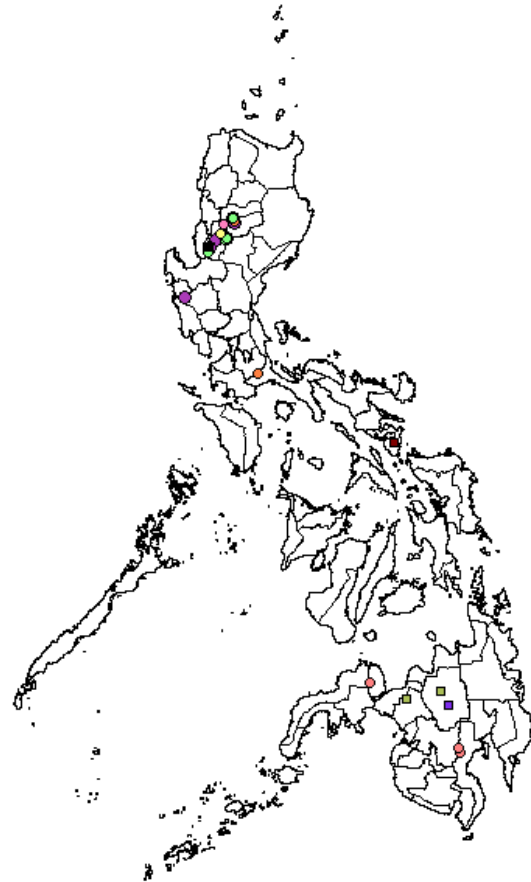


Figure 5. The provincial locations of certain *Rubus* species based on local herbaria. Legends: Blue-green circle (*Rubus pyriferolius* JE Sm), Yellow circle (*Rubus mearnsii* Elmer), Green circle (*Rubus luzoniensis* Merr), Orange circle (*Rubus heterosepalus* Merr), Sky-blue circle (*Rubus glomeratus* Bl.), Purple circle (*Rubus ellipticus* JE Sm), Pink circle (*Rubus copelandii* Merr), purple square (*Rubus perfulvus* Merr), brown square (*Rubus sorsogonensis* Elmer), green square (*Rubus clementis* Elmer), and black square (*Rubus benguetensis* Elmer).

4. CONCLUSION

The *Rubus* species in the Philippines are well distributed and relatively diverse. Mountainous areas and areas of high altitudes are natural habitats and have shown to foster great diversity of the genus. Many of the species have



limited distribution while at least five species are widely distributed. However, the lack of taxonomic research, herbarium specimens as well as misidentification of certain specimens may result to problems in the distribution studies and hence, further taxonomic studies and explorations on the genus are necessary.

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