Notes on the *Hoya* (Apocynaceae, Asclepiadoideae) from Pergau Forest Reserve, Kelantan, Peninsular Malaysia

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**Abstract.** A total of 18 species of *Hoya* (Apocynaceae, Asclepiadoideae) with two variants were recorded from Pergau Forest Reserve, Kelantan, Peninsular Malaysia. This represents more than half of species of *Hoya* reported for Peninsular Malaysia. Three species; *Hoya coriacea*, *H. coronaria* and *H. erythrostemma* are common and widely distributed. Two species are considered rare namely *H. ignorata* and *H. forbesii* based on lowest count. Suda and Renyuk River recorded the highest species number with ten species each. Suda and Long River is the most similar with 60% species similarity. Ability to produce flower and fruits by nine species were observed here indicating a healthy population.

1. **Introduction**

*Hoya* which known as wax plant, is the largest genus of the flowering plant in Apocynaceae family, under sub-family Asclepiadoideae. It is found throughout diverse habitats type from lowland to hill forest with at least 200-300 species spread from Asia to New Guinea [1]. Report by Hansen *et al.* [2] shows *Hoyas* grow best with high illuminance, high air humidity and many are found along rivers and lakes [3]. In Peninsular Malaysia, there are 25 *Hoya* species recorded [4]. However, two additional new record by Kiew [5] and Rodda and Simonsson Juhonewe [6] added the total number to 27 though there are undoubtedly a few more species yet to be discovered. The stem of climbing *Hoyas* are herbaceous, round, highly flexible and rarely exceed 1 cm diameter except for a few species [7]. A few species grows as epiphyte on woody trees such *H. javanica*, *H. lasiantha* and *H. ignorata* [8]. The *Hoyas* leaves never compound, oppositely arranged, with variable size, generally fleshy, thick, waxy and succulent.

The flowers are in umbelliform clusters (rarely single) which held by pedicels. The inflorescence varies in size and diameter, normally star-shaped [4]. Flower color varies, and often some species show variation in their flower color. Many are sweetly scented and produce abundant nectar. The follicle is pod-like in twin pods with many hairy seeds developed and dispersed by wind when mature.

Their habitat losses mainly due to logging and plantation are major threats to this plant, as this genus prefer undisturbed forest to grow and survive.

2. **Methodology**
Located in the heart of Kelantan, Pergau forested area with Gunung Basor at the background (> 1000 ha) is one of the last frontier forests left in the eastern part of Peninsular Malaysia. Even though not totally un touch by development, the forests here are largely intact because it is reserved as a water catchment area for Pergau Dam. Armed with many clear water streams and rivers they provide continuous water supply for the electricity generation by Pergau Dam under the Tenaga Nasional Berhad authority. The survey was conducted in four study sites in Pergau Forest Reserve, Kelantan as summarised in Table 1. The assessment was performed using modified line transect method. A 1,500 meters line transect was set-up at each study site/river. The Hoyas species available along the transect, in the area 10 meter on left and right sides of the riverbanks were recorded. Species identification was done in situ and only doubtful species was collected for further analysis in the School of Biological Sciences, Universiti Sains Malaysia, Pulau Pinang. Others information such as habitats, lifeforms, forest covers, elevations and locations (longitude and altitude) were also recorded. The specimens brought back were processes and kept in the university Herbarium for references and some were planted for species conformation in the future.

![Table 1. The study sites of Hoya in Pergau Forest Reserve.](image)

| No | Site         | Altitude (meter) | River and Forest type       |
|----|--------------|------------------|------------------------------|
| 1. | Suda River (SR) | 600-650          | Rocky Bed; Hill Forest      |
| 2. | Renyuk River (RR) | 500-600          | Rocky Bed; Hill Forest      |
| 3. | Long River (LR)  | 350-400           | Rocky Bed; Hill Forest      |
| 4. | Terang River (TR) | >800             | Rocky Bed; Upper Hill Forest|

It is hardly found in secondary or highly disturb forest. A few Hoya are used by native people for medicinal and other purposes [9] but latest trend shows that Hoyas is highly seek for ornamental and private collection as it is hardy, easy to maintain in pot and flowers regularly. Thus, to properly document the diversity and composition of Hoya in Pergau Forest Reserve, a rapid assessment has been conducted in predetermine locations. Our main objectives are to determined number of available Hoyas species between different altitude gradient and to identify rare and common Hoyas of Pergau Forest Reserve.

### 3. Results and Discussion

During a four-day surveys in Pergau Forest Reserve, a total of 19 Hoya (18 species with 2 variant) and more than 160 individuals were successfully documented as shown in Table 2. This species list are more than half of all Hoya species recorded by Rintz [4] from Peninsular Malaysia with a few new additional records namely H. beccarii, H. glabra, H. ignorata, H. macrophylla, H. plicata and H. preatorii. Most of them are recorded either in Borneo or Thailand. In addition to that, three species are common namely Hoya coriacea, H. coronaria and H. erythrostemma with H. forbesii is quite rare here but it is a common species elsewhere in Peninsular Malaysia species (present with low number). Two of the common species (H. coriacea and H. coronaria) are recorded from Borneo [9] but H. erythrostemma is originally recorded from Peninsular Malaysia. All species are slender herbaceous climber except for H. ignorata, H. javanica, H. lasiantha and H. preatorii which are herbaceous creeper.

H. erythrostemma is the most abundant species recorded in the study sites followed by H. coriacea. Based on the survey, both species prefers to grow on overhanging woody trees near rocky rivers and establish well on many medium dbh size woody trees along all the study sites especially for Long, Renyuk and Suda rivers. Their population is stable and healthy, many are seen producing flowers and fruits. It also grows on woody trees further inland but was noticed in lower number. The third widest distributed species is H. lasiantha. The total number of individuals recorded is lower compare to the two, but it is found in all the studied rivers. Total of 19 species of Hoyas recorded here indicating a new high record compared to our previous studies in Pulau Pangkor, Perak by Rahmad et al. [7] where only 4 species were recorded (the humidity is low, high overall temperature and with obvious coastal effects) and for Ulu Sat, Kelantan only 7 species were recorded (high human disturbances, sandy
rivers). We believe no human disturbances, pristine rivers, high humidity, and low overall temperature are contributing factors for the high number of *Hoya* recorded here.

Two notable species are *H. ignorata* and *H. preatorii* which are rarely recorded elsewhere [4] from Peninsular Malaysia. *H. ignorata* was recently described by Tran et al. [8] and was widely distributed throughout Southeast Asia including Peninsular Malaysia. This species produces one of the smallest flowers in this genus [8] and it grow in hole on plant stem which behave similarly to the new species reported by Rahayu and Rodda [10]. In Pergau Forest, this species was recorded from Suda and Long rivers. Other species are recorded elsewhere in Peninsular Malaysia, but different river and forest are dominated by different species of *Hoya*. It is rather difficult to point which species are more dominant in Peninsular Malaysia but in Pergau Forest Reserve, *H. erythrostemma* is the obvious dominant species and *H. forbesii* is the rarest (only one record).

### Table 2. *Hoya* species (Family Apocynaceae) recorded in Pergau Forest Reserve, Kelantan.

| No | Species                              | Suda River (SR) | Renyuk River (RR) | Long River (LR) | Terang River (TR) |
|----|--------------------------------------|----------------|-------------------|----------------|-------------------|
| 1  | *Hoya beccarii***                    | *              |                   | *              | *                 |
| 2  | *Hoya coriacea***                   | *              |                   | *              |                   |
| 3  | *Hoya coronaria*                    | *              |                   |               |                   |
| 4  | *Hoya elliptica***                  | *              |                   |               |                   |
| 5  | *Hoya erythrina*                    |               |                   |               |                   |
| 6  | *Hoya erythrostemma***              | *              |                   | *              | *                 |
| 7  | *Hoya forbesii*                     | *              |                   |               |                   |
| 8  | *Hoya glabra*                       | *              |                   |               | *                 |
| 9  | *Hoya ignorata*                     | *              |                   |               |                   |
| 10 | *Hoya javanica***                   | *              |                   |               |                   |
| 11 | *Hoya lacunosa***                   | *              |                   |               |                   |
| 12 | *Hoya lasiantha***                  | *              |                   | *              | *                 |
| 13 | *Hoya macrophylla*                  |               |                   |               |                   |
| 14 | *Hoya mitrata*                      |               |                   |               |                   |
| 15 | *Hoya plicata*                      |               |                   |               |                   |
| 16 | *Hoya preatorii***                  | *              |                   |               | *                 |
| 17 | *Hoya revoluta***                   | *              |                   |               | *                 |
| 18 | *Hoya verticillata var hendersonii* |               |                   |               |                   |

Notes: * = present; ** = flowering

Based on the total number of *Hoya* individual recorded, Suda River and Long River contained the highest count but when comparing number of species occurred, Suda River and Renyuk River recorded the highest number species present (Table 2) with 10 species each. From the UPGMA analysis performed, Long River only recorded 6 species of *Hoya* compared to 10 species in Suda River, but they are the most similar at almost 60% similarity (Figure 1). Finally, during the survey, nine species of the *Hoya* were seen flowering. We believe high rainfall during end of year monsoon season might be the factor that trigger flowering of Peninsular Malaysia. This might also indicate the healthy population of *Hoya* in Pergau forested area. Some of the flowering species are as shown in Plate 1 to 9.
4. Conclusion

In Pergau Forest Reserve, especially on riverbank and forest edge, a total of 18 species of *Hoya* were recorded. *H. erythrostemma* is the most widely distributed species while *H. forbesii* is the rarest species. *Hoya* ecology and diversity study in Peninsular Malaysia is limited to date, therefore, more study needs to be conducted to better understand the genera. In can be be concluded that, *Hoya* is one species that need more attention as it is limited in distribution and occur in low number when available. It also depends on woody tree as host, so any attempt to log or forest clearing for sure will affect the Hoyas. *Hoya* is also not fully study in Peninsular Malaysia and most likely to be affected if the forest reserve in Pergau area is continuously degraded by human activities and interferences. This Pergau forested area harbor high number of *Hoya* species compare to other area in Peninsular Malaysia, thus any attempt to develop or log should consider the affect it may have on the overall *Hoya* population here.

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Plate 1. *Hoya lacunosa*. Prefer riverine area but not strictly. Flowers white to pinkish, with fragrance smell but the overall diameter is small (less than 1 cm in diameter) and hairy. 

Plate 2. *Hoya erythrostemma*. This species is widely distributed in the northern region of Peninsular Malaysia. The leaves are coriaceous, and flowering occur continuously on the same peduncle time after time. Corolla color might differ from, yellowish to pinkish to purplish. Recorded from all the Pergau Forest rivers involved in the study.

Plate 3. *Hoya elliptica* flower (corolla color may differ, but other form and structure remains). Single peduncle may produce up to 15 to 20 flowers.

Plate 5. *Hoya coriacea*. During the expedition this species produce abundant flowers. Another *Hoya* species scented flowers.
Plate 7. *Hoya mitrata*. Well distributed in rocky rivers area of Peninsular Malaysia. Only recorded from Suda and Terang river. This species produces big flower (2.5-3.0 cm diameter) and usually ant inhabitant (under folding layers of leaves).

Plate 5. *Hoya lasiantha* flower with fruit. This species is not a climber but a herbaceous herb with an overall thin leaves blade (compare to other *Hoya* species). Quite rare in Peninsular Malaysia. Often flower in captivity when under water stress.

Plate 6. *Hoya javanica*. Formerly known as *Hoya multiflora* is one of a favorite collector species as its flowers shape like a rocket ship ready take off when fully bloom. Rarely recorded in other part of Peninsular Malaysia but quite abundant in Pergau forest riverine area.