Research article

Characterization of Potential Molave (*Vitex parviflora* Juss.) Mother Trees in Lila, Bohol, Philippines

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Abstract Molave (*Vitex parviflora* Juss.) is a timber species which naturally grows in the province of Bohol and is considered as the province' flagship timber species. Molave is generally used for furniture, hand tools, and is known for its durability as beams on bridges and as railroad ties without artificial preservatives. Molave is also a recommended afforestation species in the marginal uplands. The lack of information about the location and distribution of superior Molave mother trees is a major constraint in scaling up the production of high quality seedlings of native timber trees in Bohol. The study aimed to phenotypically characterize the potential mother trees in Municipality of Lila, Bohol using the standard selection criteria (stem straightness, stem forking, branch angle, stem circularity, tree health, branch thickness, and branch persistence), which were developed by the Department of Environmental and Natural Resources (DENR). Specifically, to know the number of potential, Molave is a mother tree with its merchantable height, diameter and elevation. Molave trees with at least 28 cm in diameter and at least 3 meters in height were considered as potential mother trees. Out of 242 potential mother trees, only 160 trees satisfied the DENR Administrative Order 2010-11. The average height and Diameter at Breast Height (DBH) were 5.91 meters and 40.47 cm, respectively. The biggest DBH recorded is 110 centimeters while the highest merchantable is 12 meters. On the other hand, the average elevation was 120.9 meters above sea level. Many good Molave mother trees in Lila, Bohol, Philippines are qualified to provide seed for tree propagation and to produce quality seedlings for reforestation of the Bohol upland areas especially on the National Greening Program (NGP) of the Philippine government.

Keywords Molave tree, mother tree, phenotype, afforestation species

INTRODUCTION

In the Philippines, there is a scarcity of information on the distribution and phenology of premium indigenous timber species because of limited research and development effort (Gregorio et al., 2006), except for dipterocarps. Most research activities focus on a few exotics that have been used in large-scale industrial tree plantations, reforestation projects and smallholder tree plantings. The limited knowledge about the distribution and phenology of mother trees constrains seedling producers from diversifying their seedling production and has led to the use of wildlings, which often results in the production of seedlings of low physical quality (Gregorio, 2006). Because of these reasons, the scaling up of the domestication of native timber trees is constrained by the limited availability of planting materials and low quality germ plasm.

There is an increasing interest in planting premium indigenous timber species in tree farming, agroforestry, and reforestation in the Bohol, for ecological and economic reasons. Milan and Margraf (1994) argue that the planting of indigenous trees promotes biological diversity. Generally, the timber quality of native timber trees (including Molave) is superior to that of the common exotics, leading to a higher market value.

Molave is a flagship timber species in Bohol generally used for furniture, hand tools, and known for its durability as beams on bridges and as railroad ties without artificial preservatives. Molave is a medium to large tree attaining a diameter of 100 to 150 cm and a height from 25 to 30 m. In exceptional cases, it reaches a height of 35 m or more and a diameter up to 200 cm with a bole from 16 to 20 cm. It is a tree that grows irregularly too far with a clear bole of 2 m or less in length (Dichoso, 2000). Fortunately, Molave stands in Lila, Bohol attain a clear bole height of more than 3 m to a maximum of 8 m, which is sufficient enough to initially qualify as potential mother trees.

A mother tree is a tree selected from the forest stands, which gather seeds for propagation purposes (DAO 09, s. 1995). A mother tree should provide a sustained supply of forest tree seeds and other planting stock for the country's collection, distribution and use of forest tree seeds and other forms of plating materials.

The government, through Department of Environment and Natural Resources, promotes the use of high quality planting materials in its afforestation and other afforestation activities to promote biodiversity conservation in marginal uplands/watershed areas (Lomosbog, 2013), and to ensure sustainable production and supply of wood and other forest products in the country. In most recent government and non-government greening endeavor in the province of Bohol, they are using low quality planting stocks because of the limited access to phenotypically and genotypically – superior mother trees as a source of planting stocks especially Molave. To increase the possibility of collecting good quality seed, mother trees should be selected in stands that consist of good quality trees (Mulawarman et al., 2003).

Therefore, the intention of this study is to assess the possible potential mother trees of Molave in Lila, Bohol as future sources of seeds in the production of quality planting materials in support of the National Greening Program (NGP) and other related government and non-government reforestation endeavor.

OBJECTIVE

The study aimed to phenotypically characterize the potential Molave mother trees in municipality of Lila Bohol by using the standard DENR selection criteria. Specifically, it sought to know the number of potential Molave mother trees and its merchantable height, diameter, and elevation within each barangay[1].

METHODOLOGY

The study was conducted in all barangays of Lila, Bohol, namely: Taug, La Fortuna, Tiguis, Calvario, Lumanoy, Catugasan, Cayupo, Candulang, Poblacion, Macalingan, Cogon, Nagsulay, Malinao East, Malinao West, Bonkokan Ilaya, Bonkokan Ubos, Janbawan, and Banban. Lila is a town on the southern coast of Bohol, twenty-eight and a half km from Tagbilaran City. It lies between Loay and Dimiao. Sometimes it was a part of the latter municipality. The climate is type four characterized by even distribution of rainfall with dry season in January to May and wet season in June to December (BAMP, 2006). The classification of land is karst and limestone areas with a vegetation of grassland and forest areas.

Selection Criteria of the Potential Mother Trees

Potential mother trees were determined based on its: (a) diameter measurement ≥28 cm; (b) merchantable height ≥3 m; (c) stem straightness; (d) stem forking; (e) branch angle; (f) stem circularity; (g) tree health; (h) branch thickness; and (i) branch persistence (DAO, 2010-11). The candidate mother trees were rated from 1-6 as shown in Table 1.

[1] A *barangay* (Brgy. or Bgy.; Filipino: baranggay, [baraŋˈgaj]), formerly called barrio, is the smallest administrative division in the Philippines and is the native Filipino term for a village, district or ward.

Table 1 Selection criteria for potential mother trees and their corresponding ratings

Criteria	Rating Scales			
	6	5	4-3	2-1
Stem straightness	Perfectly straight	Slight bending	Bending	Over bending
Stem forking	Forking above 6m	Forking between 6m and 3m	Forking below 3m	Multi-stem forking
Branch angle	Branches forming 90˚	Branches forming between 90˚ and 75˚	Branches forming between 75˚ and 60˚	Branches forming between 60˚ and 45˚
Stem circularity	Stem is round	Not perfectly round	Oblong shape	No shape
Tree health	Green-lush vigorous crown	Intermediate	Thin yellow crown	
Branch thickness	Thin branches relative to tree size		Intermediate	Thick coarse branches relative to tree size
Branch persistence	Dry branches shed relatively fast after canopy closure		Intermediate	Dry branches remain on the stem for several years after canopy closure

Source: DAO (2010) (1 as very unacceptable; 2 as unacceptable; 3 for relatively acceptable; 4 as fair; 5 as good; and 6 as highly acceptable)

Data Collection and Analysis

Diameter at breast height of each potential Molave mother tree was measured using improvised Molave tree caliper. The tree caliper was placed at the right angle to the trunk at a point 1.3 m above the ground. For trees growing on slopes, it was recommended that DBH be measured from the uphill side of the tree.

Merchantable heights of potential mother trees of Molave were determined using simple ocular estimation. Merchantable height was estimated from the first big branch of the Molave tree.

After determining the diameter and height of the potential mother trees, the trees were marked with yellow enamel paint to serve as permanent marker or a guide mark during the determination of elevation and coordinates.

Assessment of the potential mother trees of Molave was limited only on the stem straightness, stem branching, stem circularity, tree health, branch angle, branch thickness, and branch persistence as physical tree attributes.

Global Positioning System (GPS) units were used to determine the locations (elevation) of each potential Molave mother tree per barangay. Each mother tree was given its own unique code for future mapping purposes.

The study used frequency counts and simple percentage functions of Microsoft Office Excel 2007 Data Analysis as statistical analysis.

RESULTS AND DISCUSSION

Number of Potential Mother Trees

The potential mother trees of Molave in Lila, Bohol were evaluated using the DENR assessment criteria. Out of 242 potential mother trees of Molave, only 160 (66.12%) trees obtained a rating of "good"; on the other hand, 82 (33.88%) trees garnered a rating of "fair". Of the 160 Molave mother trees rated as "good", barangay Bongkokan Ubos had the most number of mother trees with 22 (68.75%), followed by barangay Catugasan with 21 (80.77%). On the other hand, barangays Cayupo, Candulang and Macalingan had the same number of good Molave mother trees with 16, while barangay Calvario had the least number of good mother tree with only one (Table 2).

Table 2 Number of Molave mother trees per barangay

Name of Barangays	Number of trees				
	Good	%	Fair	%	Total
1. Bongkokan Ubos	22	68.75	10	31.25	32
2. Catugasan	21	80.77	5	19.23	26
3. Candulang	16	64.00	5	36.00	21
4. Cayupo	16	76.19	9	23.81	25
5. Macalingan	16	94.12	1	5.88	17
6. Lumanoy	11	40.74	16	59.26	27
7. Cogon	8	88.89	1	11.11	9
8. Taug	7	46.67	8	53.33	15
9. Tiguis	7	70.00	3	30.00	10
10. Malinao West	6	66.67	3	33.33	9
11. Jambawan	6	54.55	5	45.45	11
12. Bongkokan Ilaya	4	80.00	0	20.00	4
13. Malinao East	4	80.00	4	20.00	8
14. La Fortuna	4	50.00	1	50.00	5
15. Banban	4	100.00	1	0.00	5
16. Nagsulay	4	80.00	1	20.00	5
17. Poblacion	3	33.33	6	66.67	9
18. Calvario	1	25.00	3	75.00	4
Total	160	66.12	82	33.88	242

%=percentage

Merchantable Height

Table 3 presents the average merchantable height (m) of potential mother trees of Molave per barangay in Lila, Bohol. A total of 242 potential mother trees was identified in the study. Potential Molave mother trees in barangay Bongkokan Ilaya had the highest average height of 8.75 m, followed by barangays Lomanoy, Malinao East, Malinao West, and Jambawan with 7.33 m, 6.65 m, 6.56 m, and 6.18 m, respectively. The said barangays were the first five barangays in Lila, Bohol having the most abundant potential Molave trees, which at least 3 meter height were found (Fig. 1b). On the other hand, barangay Poblacion of Lila, Bohol had the lowest average height of potential Molave mother trees with 4.11m.

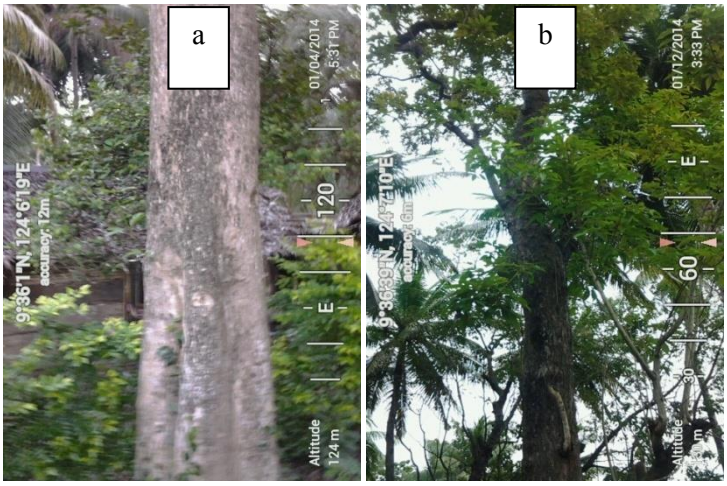

Fig. 1 Molave mother tree assessed based on stem growth such as (a) diameter measurement and (b) merchantable height

Diameter at Breast Height (DBH)

Among the 242 potential mother trees of Molave in Lila Bohol, barangay Catugasan had the biggest average Diameter at Breast Height of 55.85 cm, followed by barangays Bongkokan Ubos,

Macalingan, Tiguis and La Fortuna with average DBH of 46.69 cm, 45.53 cm, 44.50 cm and 43.80 cm, respectively. Moreover, barangay Jambawan had the smallest average DBH of 33.82 cm (Table 3).

Elevation

Table 3 illustrates the average elevation in meters above sea level (masl) of potential mother trees of Molave per barangay in Lila, Bohol. The table further shows that barangay Jambawan had the highest elevation of 221.6 masl, followed by barangay Calvario with 220 masl. On the other hand, barangays Malinao West, Malinao East and La Fortuna had the next top elevations of 132.2, 126.4, and 123.2 masl, respectively.

Table 3 Merchantable height, diameter at breast height and elevation of Molave mother trees per barangay

	Name of Barangays	Merchantable Height (m)	Diameter at Breast Height (cm)	Average Elevation (masl)
1.	Bongkokan Ubos	5.61	46.69	80.10
2.	Catugasan	5.12	55.85	112.40
3.	Candulang	6.00	36.00	113.80
4.	Cayupo	5.68	40.68	117.90
5.	Macalingan	5.29	45.53	119.70
6.	Lumanoy	7.33	39.37	120.50
7.	Cogon	5.56	39.00	123.00
8.	Taug	5.40	39.33	100.10
9.	Tiguis	5.40	44.50	115.70
10.	Malinao West	6.56	34.89	132.20
11.	Jambawan	6.18	33.82	221.60
12.	Bongkokan Ilaya	8.75	41.25	109.20
13.	Malinao East	6.75	35.67	126.40
14.	La Fortuna	6.00	43.80	123.20
15.	Banban	5.60	36.25	75.60
16.	Nagsulay	5.00	36.80	73.20
17.	Poblacion	4.11	42.89	92.00
18.	Calvario	6.00	36.20	220.00
	Average	5.91	40.47	120.92

masl (meters above sea level)

CONCLUSION

A lot of good Molave mother trees in Lila, Bohol, Philippines met the requirements to provide quality seed and seedlings based on DAO 2010-11 for reforestation of the Bohol upland areas, especially on the National Greening Program (NGP) of the Philippine government. A total of 160 Molave trees was considered as good mother trees sporadically distributed in five barangays of Lila, Bohol namely Bongkokan Ubos, Catugasan, Cayupo, Candulang and Macalingan. The height measurements of the good mother trees ranged from 6.18 m to 8.75 m while its diameter ranged from 43.80 cm to as big as 55.85 cm.

It is recommended to conduct Geo Tagging of the identified good Molave mothers for seed documentation and exact location of seed sources. Furthermore, it is needed to provide financial benefits and technical assistance to land owners who continuously protect the growing Molave mother trees.

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