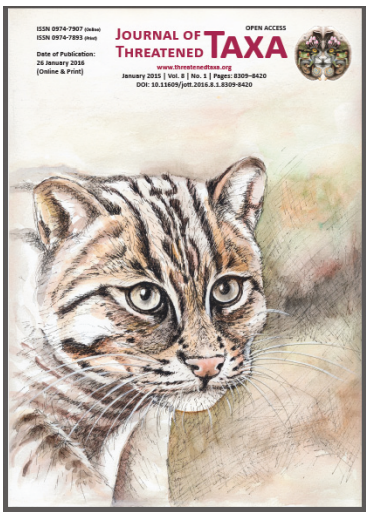

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SHORT COMMUNICATION

MAGNOLIA LANUGINOSA (WALL.) FIGLAR & NOOT. IN WEST KHASI HILLS OF MEGHALAYA, NORTHEASTERN INDIA: RE-COLLECTION AND IMPLICATIONS FOR CONSERVATION

Aabid Hussain Mir, Viheno Iralu, Ngakhainii Trune Pao, Gunjana Chaudhury, Clarence G. Khonglah, K.L. Chaudhary, B.K. Tiwari & Krishna Upadhaya

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Magnolia lanuginosa (Wall.) Figlar & Noot. in West Khasi Hills of Meghalaya, northeastern India: re-collection and implications for conservation

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Abstract: *Magnolia lanuginosa* (Wall.) Figlar & Noot. [= *Michelia lanuginosa* Wall.], a rare tree species of Meghalaya, is restricted to the West Khasi Hills District, Meghalaya. The species was considered to have become extinct from the state. The present paper reports a recent re-collection of the species from four locations in the West Khasi Hills after a lapse of almost 100 years. In addition, the population structure, regeneration status and the threat to the species are also discussed so as to develop effective strategies for its conservation.

Keywords: Conservation, Data Deficient, Khasi Hills, sacred grove.

Magnolia L. [Incl. *Elmerrillia*, *Kmeria*, *Manglietia*, *Michelia*, *Pachylarnax*, *Talauma*], belonging to the family Magnoliaceae, consists of 219 species distributed in the Himalaya to Japan and western Malaysia, eastern North America to tropical America (Mabberley 2008). According to Kumar (2014), a total of 30 species and one variety are recognised from the Indian region.

Magnolia lanuginosa (Wall.) Figlar & Noot.

[Synonyms: *Michelia lanuginosa* Wall., *Michelia lanceolata* E.H. Wilson, *Michelia velutina* DC., *Sampacca lanuginosa* (Wall.) Kuntze and *Magnolia velutina* (DC.) Figlar] is a threatened tree, which is less commonly found in Meghalaya. It is chiefly found in the forest slopes at 1500–2400 m of India (West Bengal, Sikkim, Arunachal Pradesh, Meghalaya, Nagaland and Manipur), Nepal, Bhutan, Myanmar, Tibet and southwestern China (Yunnan). In the Chinese Red List, the species has been assessed as 'regionally extinct' suggesting that it may have reduced its range of occurrence in China (Wheeler & Rivers 2014). It has also been reported as a less common tree in the Kanchenjunga range in Darjeeling (Chettri et al. 2008). In Meghalaya, it is restricted exclusively to the West Khasi Hills. The only collection was from Kynshi by U.N. Kanjilal in the year 1915 (ASSAM 5889). Kanjilal

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& Bor (1940) in 'Flora of Assam' reported it to be a less commonly found species. Haridasan & Rao (1985) in the 'Forest Flora of Meghalaya' stated that it might have been eliminated from the state. The species has been classified as 'Data Deficient' by the IUCN Red List of Threatened Species (Wheeler & Rivers 2014) as there is neither any information on existing subpopulations nor are the threats and uses known.

While carrying out floristic studies in the Mawnai sacred grove at West Khasi Hills, one of the species was identified as *Magnolia lanuginosa*. The identity of the species was confirmed by comparing it with the herbarium specimens housed at the Botanical Survey of India, Eastern Regional Centre, Shillong (ASSAM). It was collected after a lapse of almost 100 years from the state. Therefore, a detailed study was conducted with the following objectives: (i) to assess the distribution of the species in the state of Meghalaya, (ii) estimate the population structure and regeneration status, (iii) examine the threat operating on the species, and (iv) to suggest measures for its conservation.

Materials and Methods

Study site

Extensive field surveys were carried out in different parts of the West Khasi Hills from January 2013–2015 to locate the species with the help of available herbarium information and local people. In addition to the Mawnai Sacred grove (25^{0}34.51'N & 91^{0}35.56'E, altitude 1741m), the species could be collected from three additional sites viz., Mawnai Village forest (25^{0}34.79'N & 91^{0}35.35'E, 1800m) Kynshi Village forest (25^{0}28.38'N & 91^{0}18.32'E, 1620m) and Rngisawlia Village Reserve forest (25^{0}26.66'N & 91^{0}28.09'E, 1592m). Hereafter, these sites have been abbreviated as site I (Mawnai sacred grove), site II (adjacent to Mawnai Village forest), site III (Kynshi village forest) and site IV (Rngisawlia village reserve forest) respectively.

Study species

Magnolia lanuginosa (= *Michelia lanuginosa*) is a medium-sized tree that grows in subtropical broadleaved forests (Champion & Seth 1968). It was however observed that the species also grows along with Pine *Pinus kesiya*. It has an average height of 15m but there were some individuals that had attained a height of 25m. The tree has a broad crown. It often formed the canopy layer in site-I and site-IV. It attains a girth of ≈ 180cm. Young parts very hairy. The leaves measure 12–21 by 2–5 cm and are densely hairy tomentose beneath. Flowering buds are initiated in late July and it attains peak flowering in August. Fruiting starts from August and the fruit matures during the months of September–October. The fruit is made up of 12–20 follicles which contain 2–4 seeds covered by a pale orange fragrant aril during the early stages of growth which turns deep orange at maturation (Image 1).

Field survey and data analysis

The forests where the species was present in the West Khasi Hills were thoroughly surveyed and a plot of 20 × 20 m was laid to enumerate the species and its associates. The species occurred in 12, 4, 6 and 15 plots at site -I, -II, -III and -IV respectively. The population structure and regeneration status of the species were studied by classifying the species into: (1) adult individuals (≥5cm diameter at breast height (dbh) measured at 1.37m from the ground level), and (2) regenerating individuals that include saplings (<5cm dbh and >1m height) and seedlings (<1m height). The adult individuals of *Magnolia lanuginosa* were assigned to five dbh classes (5–15, 16–25, 26–35, 36–45 and >45 cm) to analyze the population structure. The regeneration status of the species was assessed following Sukumar et al. (1992) as: (a) 'good', if seedling > sapling > adult; (b) 'fair', if seedling > sapling ≤ adult; (c) 'poor', if a species survives only at the sapling stage, but not as seedlings (though saplings may be less, more or equal to adults) (d) 'none', if the species is absent both at the sapling and seedling stages, but present as adults and (e) 'new', if the species has no adults, but only saplings and/or seedlings.

The disturbance index for each site was computed following Uotila & Kouki (2005), Tang et al. (2010, 2011) with a slight modification. A score of five was assigned to each of the human disturbance factors, viz., logging for timber, fuel wood harvesting, NTFP's collection, clearing forest land for agriculture, grazing, building roads and fire. Any site with all these disturbances would have a total score of 35.

Results and Discussion

Site characteristics

The Mawnai sacred grove (site-I) was the least disturbed site and represents the subtropical broad-leaved forest. The dominant tree species in the forest include *Citrus latipes, Castanopsis purpullera, Casearia glomerulata*, *Litsea salicifolia* and *Macropanax dispermus.* Adjacent to the sacred grove was a village forest (site-II), which is a severely degraded mixed-pine forest, with a dominance of *Pinus kesiya, Lithocarpus elegans* and *Castanopsis tribuloides.* In

Image 1. Flowering twig (A), flower (B), fruit initiation (C) and mature fruits with seeds (D) of *Magnolia lanuginosa*

site-III, *Pinus kesiya* was the dominant tree species followed by *Rhododendron arboreum* and *Lithocarpus dealbatus* whereas in site-IV, the associated species includes *Schima wallichii, S. khasiana, Pinus kesiya* and *Castanopsis tribuloides.* All the sites were exposed to anthropogenic disturbances, of which site-II and site-III were highly disturbed (Table 1).

Population characteristics

The total population of *Magnolia lanuginosa* including seedling, sapling and adult individuals varied significantly among the four sites. Site-I had the highest number of total individuals (123), followed by site –IV (80 individuals), site-II (39 individuals) and site-III, which had only 11 individuals. The highest number of individuals in site-I may be attributed to least disturbances and the related favorable habitat as compared to other sites. Of all the sites, site-IV had the highest number of adult individuals (54), followed by site-I (36), site-II (18) and site-III (6). A high proportion (67%) of cut individuals of the species were observed in site-III (Table 1).

The population structure of adult trees (≥5cm dbh) of *Magnolia lanuginosa* depicted through a density diameter distribution yielded a discontinuous distribution of individuals. Except site-I, there were no individuals in the highest (>45 cm) dbh class (Fig. 1). The low density and discontinuous distribution of the species in different diameter classes in all the sites could be attributed to selective felling and human disturbance. A similar observation has been made with *Grewia pandaica,* a rare and endemic species of the Western Ghats (Parthasarathy & Karthikeyan 1997) and

Table 1. Site characteristics and population of *Magnolia lanuginosa* in different sites of West Khasi Hills in Meghalaya

Site	Forest type	Number of Individuals of *M. lanuginosa*				Other associated species	Current disturbances
		Seedling	Sapling	Adult	No. of cut individuals		
Site-I	Broad leaved forest	50	37	36	1	*Citrus latipes, Castanopsis purpullera, Casearia glomerulata*, *Litsea salicifolia* and *Macropanax dispermus*	Fuel wood harvesting, NTFP's collection and grazing
Site-II	Mixed pine forest	21	0	18	4	*Pinus kesiya, Lithocarpus elegans, Schima wallichii* and *Castanopsis tribuloides*	Logging for timber, fuel wood harvesting, NTFP's collection, clearing forest land for agriculture, grazing, and fire
Site-III	Mixed pine forest	1	4	6	4	*Pinus kesiya, Rhododendron arboreum* and *Lithocarpus dealbatus*	Logging for timber, fuel wood harvesting, NTFP's collection, clearing forest land for agriculture, grazing, building roads and fire
Site-IV	Mixed pine forest	5	21	54	6	*Schima wallichii, Schima khasiana, Pinus kesiya, Myrica esculenta* and *Castanopsis tribuloides*	Logging for timber, fuel wood harvesting, NTFP's collection, grazing and fire

Alphonsea sclerocarpa, an endemic tree species from the Eastern Ghats (Kadaval & Parthasarathy 2001).

Regeneration status

The overall age structures of the population based on the density of seedling, sapling and adult individuals varied among the four sites. The highest seedling density (50 individuals) was recorded at site-I, followed by 21 individuals in site-II, 5 individuals insite -IV, and only 1 individual in site-III. Similarly, the sapling density was highest in site-I (37 individuals) followed by site-IV (21), site-III (4) and site-II, which had no seedlings (Table 1). Based on the number of seedlings, saplings and adult trees, the regeneration status was good only in site -I, while in all other forests sites it was poor (Fig. 2).

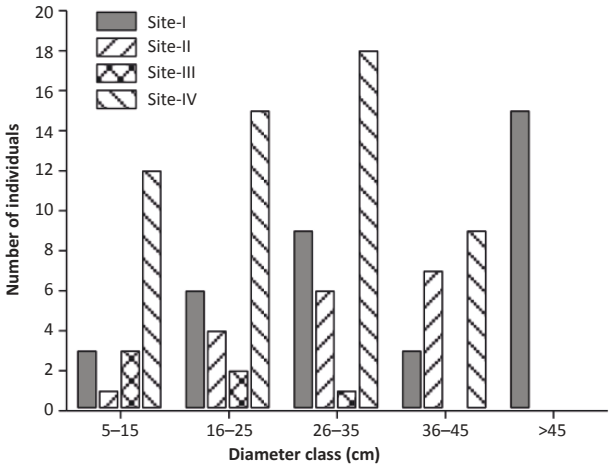

Figure 1. Density-diameter distribution of adult individuals (≥ 5cm dbh) of *Magnolia lanuginosa* in different sites of West Khasi Hills in Meghalaya

Threat status

The threat to the species is mainly anthropogenic disturbances, which had a negative impact on its performance. This is evident by a negative correlation (Y = 212.2 - 5.67429X, R = 0.99, p = 0.008, n=4) between the population size of the species and disturbance. Such a disturbance-linked decline in population size of the species has also been observed in *Alphonsea sclerocarpa* from the Eastern Ghats (Kadaval & Parthasarathy 2001) and *Ilex khasiana* from northeastern India (Upadhaya et al. 2009). Disturbance in the form of timber extraction drastically reduces the densities of naturally occurring plants. Except site-I, all the sites were exposed to high disturbances. A combined effect of all these factors (Table 1) might have contributed to the very low population of the species.

Except the sacred grove, the low seedling and sapling density of the species in all the sites could be due to its association with pine. Pine-or pine-mixed forests are exposed to fire every year leading to high mortality of the young individuals. Tree felling for use as poles and timber was another threat responsible for the species decline. The species is considered good timber and is preferred to make furniture, building houses and the wood is highly priced. This could be the reason for its absence in >45cm dbh class in highly disturbed patches. Moreover, forest clearing for agriculture and construction of roads is leading to the habitat destruction of the species.

Habitat destruction has been recognized as one of the important threats responsible for species extinction,

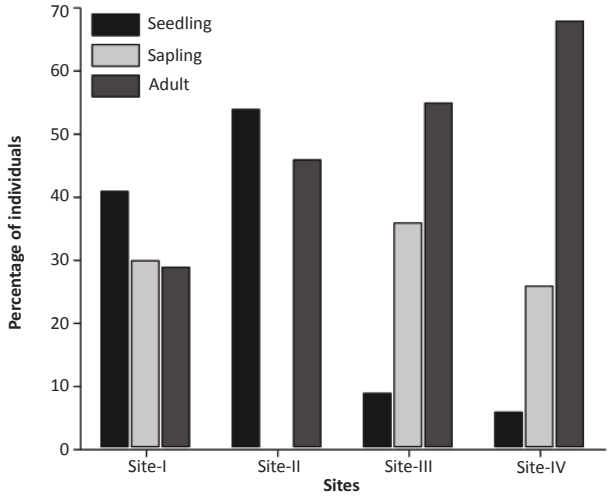

Figure 2. Population structure of *Magnolia lanuginosa* in different sites of West Khasi Hills in Meghalaya

followed by fire, hence hindering the regeneration process. Another factor for low regeneration of the species can be attributed to the fact that many of the fruits fall from the tree before they mature. The heavy fruits are vulnerable to gushes of wind and tend to fall easily. The fruits are also predated by squirrels and insects on the forest floor. Another factor for its low density especially in disturbed sites could be that the species germinates during February–March and is soon exposed to fire followed by competition with other species in the rainy season (April–October). Recently, a similar observation has been made by Iralu and Upadhaya (2015) with another species of *Magnolia* (*M. punduana*).

Conservation implications

The study reveals that the population of the species is very low and there is an urgent need for taking up effective conservation measures, so as to save it from extinction in the state. Thus the forest patches, where the species occurs need to be protected. The local people should be encouraged to grow the species in their home gardens and agroforestry. This will reduce the pressure on the species in the wild. Forest fire is another major threat to the species and needs to be checked. The species is required to be raised both through seeds and tissue culture, and introduced in suitable habitats as well as in botanical gardens.

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