Towards the conservation of Malaysian *Johannesteijsmannia* (Palmae)

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ABSTRACT. A total of 20 new localities were recorded for the genus *Johannesteijsmannia* since 1972, demonstrating that the genus is less restricted in its distribution in Malaysia than previously thought. Nevertheless, *Johannesteijsmannia* is regarded as threatened with *J. lanceolata*, *J. magnifica* and *J. perakensis* assessed as endangered and *J. altifrons* as vulnerable. Endangered status was given to endemic species with restricted occurrence and small population size found in less than five localities. Recommended conservation measures include the need to expand *in situ* protection for populations in vulnerable habitats, inclusion of the species into forest management plans, and establishment of a sustainable seed harvesting regime. We also suggest regular monitoring of populations situated along forest boundaries and initiation of long-term conservation biology research. Habitats at risk in Jerantut-Benta (for *J. lanceolata*), Serendah and Bukit Kinta Forest Reserves (for *J. magnifica*), and Perak, i.e., Bintang Hijau, Kledang-Saiong and Bubu Forest Reserves (for *J. perakensis*) should be given protected status and *ex situ* conservation should be implemented.

Keywords. Conservation, extent of occurence, *Johannesteijsmannia*, red list, threat assessment

Introduction

Johannesteijsmannia is a small genus with only four species, i.e., *Johannesteijsmannia altifrons* (Reichb.f. et Zoll.) Moore*, J. magnifica* J.Dransf.*, J. lanceolata* J.Dransf. and *J. perakensis* J.Dransf. (Dransfield 1972). All species are endemic to Peninsular Malaysia except *J. altifrons*, which is distributed from south Thailand to Peninsular Malaysia, Sumatra and Borneo. The genus is threatened (Walter & Gillett 1998), and seed harvesting for the ornamental plant trade contributes to its decline (Chan & Saw 2009).

Since Dransfield (1972), many new localities of *Johannesteijsmannia* have been recorded based on herbarium collections and field observations. The known extent of occurrence or distribution range in Malaysia for these species has thus greatly increased. *Johannesteijsmannia* is found in tropical lowland moist forest and lower montane forest, and the rapid change in land use patterns of such forests in the peninsula in the last decades of the 20th century had caused further loss of habitat and populations. This land use pattern had, however, slowed down significantly since the early 1990s and the time is now ripe to re-assess the conservation status of its species as more data on habitat status, population sizes, reproductive biology, and uses (Chan & Saw 2009) are available.

Here, we present the results of the threat assessment and discuss pertinent issues regarding the conservation of *Johannesteijsmannia*. We also recommend conservation and management measures for species which are threatened.

Materials and methods

Members of the genus were assessed following guidelines outlined in the Malaysia Plant Red List Guide for Contributors (Chua & Saw 2006) using the IUCN Red List Categories and Criteria version 3.1 (IUCN 2001). For each species, a map of its extent of occurrence (EOO) and area of occupancy (AOO) was prepared based on specimens lodged at the Kepong Herbarium (KEP) and the Sarawak Herbarium (SAR). This genus is absent in Sabah, hence there was no attempt to collate records lodged at the Sandakan Herbarium (SAN). Field observations and localities cited by Dransfield (1972) and Look (2007) were included. The EOO and AOO were calculated using the extensions Crime Analysis Tool 2.E and Conservation Assessment Tools (CATS) version 1.2 for ArcView GIS 3.2a, respectively. In assessing habitat decline for Peninsular Malaysia, we referred to the forest cover data based on the National and State Forest Inventories and land use data (MACRES & UTM 2008). Recent forest cover and land use data from Sarawak, however, were unavailable for use.

Results

Since Dransfield (1972), a total of 20 new localities were recorded for *Johannesteijsmannia*, with new records for Terengganu (*J. altifrons*) and Kedah (*J. perakensis*) (Fig. 1). *Johannesteijsmannia altifrons* is far more commonly distributed than once thought, especially in the east of the peninsula, with the majority of the populations occurring in Terengganu and Johor. The collection from Temengor Forest Reserve (FR) is a new record for Perak. With 16 additions of new localities since 1972, the EOO and AOO have dramatically increased for *J. altifrons* (Table 1). This species commonly inhabits valleys and hill slopes with lowland and hill dipterocarp forests on well-drained soils. It also grows at elevations of 1000–1200 m in the lower montane forests of Taman Negara, i.e., Gunung Tahan and Gunung Mandi Angin (Dransfield 1972). The population in Jerangau, Terengganu grows on waterlogged sandy soil in low-lying areas. The habitat of *J. altifron*s in the peninsula now seems more general and diverse than previously thought. In Sarawak, it is confined to the heath forests (Dransfield 1972) in sheltered valleys.

Similarly, *J. lanceolata, J. perakensis* and *J. magnifica* which were thought to be narrowly distributed endemics, now have wider distributions with new records from Negeri Sembilan, Kedah and Perak, respectively. They are found in sheltered hill slopes and valley bottoms, and are almost absent on ridges. One population of *J. magnifica* in Bukit Kinta FR, Perak, was recorded from a limestone area.

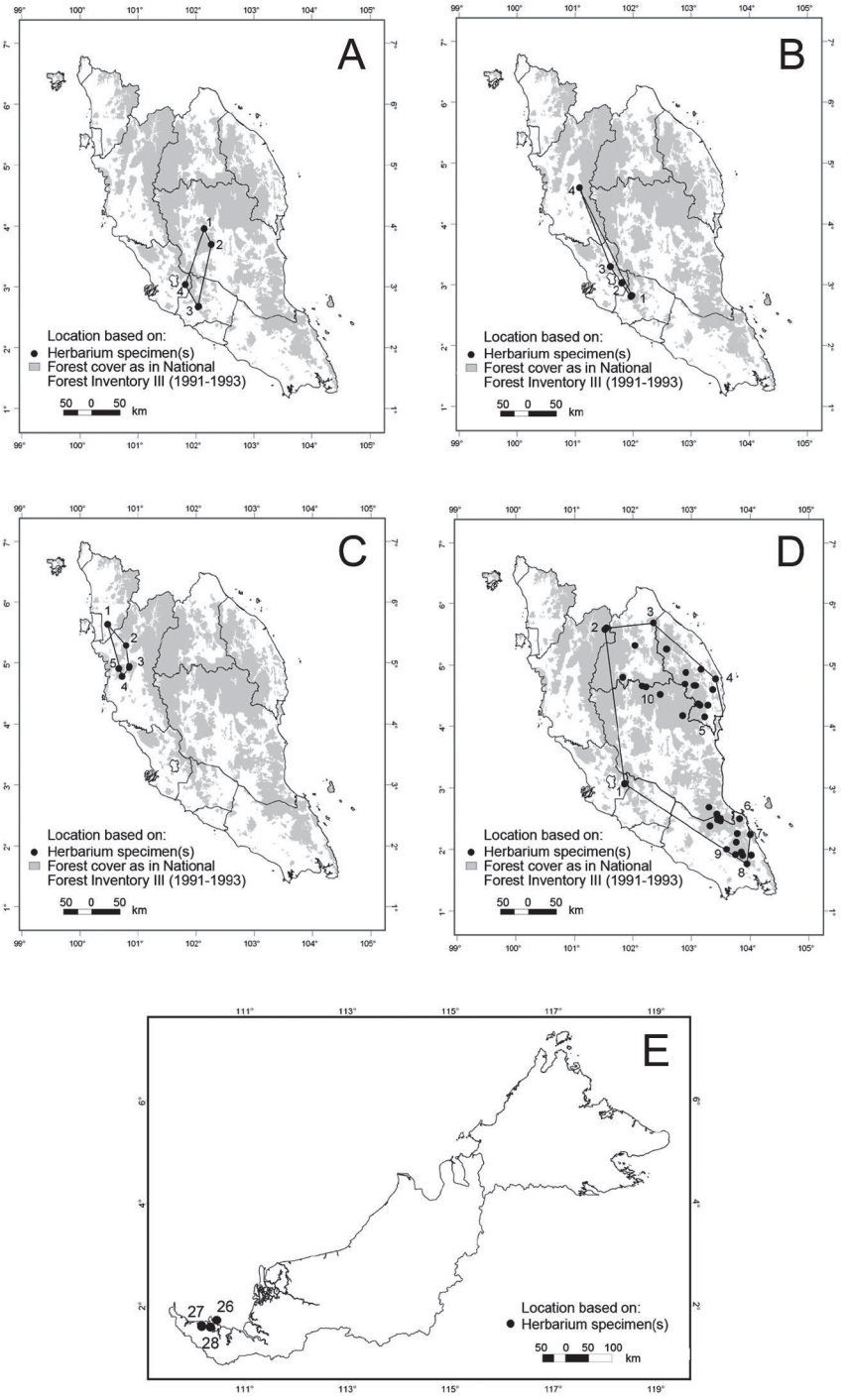

Fig. 1. Distribution of *Johannesteijsmannia* in Malaysia. **A.** *J. lanceolata*. **B.** *J. magnifica*. **C.** *J. perakensis*. **D–E.** *J. altifrons*. Polygons represent Extent Of Occurrence (EOO). See Appendix A for locality details. National Forest Inventory, NFI III information in A–D courtesy of Forest Department, Peninsular Malaysia.

Table 1. Threat assessment of *Johannesteijsmannia* based on extent of occurrence (EOO) and area of occupancy (AOO) following the IUCN Red List Category and Criteria ver 3.1 (2001).

Species	EOO (km^2)	AOO (km^2)	Category	Criteria
Johannesteijsmannia altifrons	58,804	176	VU	A4acd, C1
J. lanceolata	2,783	16	EN	A4acd,B1ab(ii,iii), C2a(i)
J. magnifica	1,306	16	EN	B1ab(ii,iii,iv), C2a(i)
J. perakensis	1,309	20	EN	A4acd,B1ab(ii,iii,iv),C2a(i)

The genus is considered threatened, with three species endangered and one vulnerable (Table 1). Populations of all species have declined or are declining due to deforestation and dam construction, and the possibility that seed harvesting for the ornamental trade could be a damaging factor requires to be better studied (Chan & Saw 2009). *Johannesteijsmannia lanceolata, J. magnifica* and *J. perakensis* qualified for the endangered category because they are endemics with restricted EOO and small population sizes (with less than 250 mature individuals in the largest subpopulation).

Generally, *Johannesteijsmannia* spp. are gregarious but with patchy distribution and probably limited dispersal ability. It is common to find populations confined to a single hill or valley. Because the populations are so restricted, they are extremely vulnerable to extinction. Clearly, any major catastrophe or destruction of a single site is likely to wipe out the entire subpopulation. Although many new localities have been added since 1972, the forest structure and quality in these sites and in sites predating the Dransfield's (1972) account have declined significantly. The species favour pristine sites in the lowland forests and many of these sites, with the exception of those in the National and State Parks, are no longer as pristine.

Populations located in the production forests of the Permanent Reserved Forests (PRF) network are not spared from logging damage. The creation of large gaps in the forest canopy and the disintegration of forest structure during logging could harm *Johannesteijsmannia*, either by direct physical damage or physiologically. We have examined a *Johannesteijsmannia* population in a logged-over forest of Berembun FR and found that these palms are apparently failing to regenerate as juveniles are rare.

A few localities are within water catchment areas where no logging is allowed and these populations are considered safe. Some of these populations, e.g., in Sungai Lalang, Tembat and Linggiu, are now remnants of an originally larger population, after dams were built. Only a handful of populations are in the totally protected areas of the National and State Parks and Wildlife Reserve.

While most of the populations are located within the PRF, some occur in state lands (Appendix A). A state land is land bank set aside by a state government to accommodate future development. Populations that occur on state lands are thus highly vulnerable to extermination. For example, the site of *J. altifrons* in Semariang Road has probably been developed into a town. The population of *J. lanceolata* in

Jerantut-Benta Road is threatened by farm encroachment and future road expansion, whereas the one along the Kota Tinggi – Mersing Road may have been destroyed by conversion of the site to an oil palm plantation.

As the number of mature seeds is usually low, ranging from only 5 to 40 per palm in each flowering episode (Dransfield 1970; pers. obs.), the long-term impact of over-harvesting of seeds for the local ornamental trade needs to be examined.

Discussion

Although many new populations were recorded, the conservation status of the genus remains threatened. Conservation measures are needed for *Johannesteijsmannia* particularly for the endangered endemics *J. magnifica, J. lanceolata* and *J. perakensis*. Key issues, challenges and suggestions pertaining to the conservation of the genus are discussed below.

Many populations of *Johannesteijsmannia altifrons* are in the lowland forests and there is a need to provide protection status to the habitats where they occur. The initiative taken by a logging licencee to conserve a portion of the *J. altifrons* population in the Temengor FR, Perak, through the High Conservation Value Forest approach should be emulated. During logging, every effort should be taken to minimise niche damage and leaving ample canopy cover.

The importance of keeping existing populations intact cannot be over-emphasised. For *Johannesteijsmannia lanceolata*, *J. magnifica* and *J. perakensis*, all localities should preferably be protected as they are endemics with small population sizes found in less than five localities. Several localities were found to have populations with high genetic diversity (Look 2007), i.e., Kledang-Saiong (for *J. perakensis*), Temengor (for *J. altifrons*), Kinta (for *J. magnifica)* and Sungai Lalang FRs (for *J. lanceolata*). These populations should be given utmost priority when proposals are weighted. Among these, only the populations in the Sungai Lalang FR are protected. The Sungai Lalang FR is a special area where three species, *J. altifrons, J. lanceolata* and *J. magnifica*, grow sympatrically. Regular monitoring of populations sited within several hundred metres from forest boundaries or fringes is also highly recommended because past experiences have shown that these areas are easily encroached and illegally converted into other land uses.

Palms and many understorey or herbaceous plants are traditionally ignored in forest censuses and pre-felling inventory exercises, because only some targeted economically valuable species and fruit trees are considered important. Ignorance, which eventually leads to the lack of expertise of forest managers in the field to recognise rare and threatened species, is a significant hindrance to conservation. In this respect, *Johannesteijsmannia* should be listed in the forest management plan as a species requiring conservation attention.

For some populations in logged-over forests, the after-logging effects on the demography and population viability are not documented. A long-term demographic monitoring on populations in logged-over forests, and preferably comparative studies

with populations in undisturbed sites, can help to assess population health and determine further conservation actions needed to conserve the affected populations. Demographic studies have only been conducted on one undisturbed population of *J. lanceolata* in the Angsi Forest Reserve (Rozainah & Sinniah 2005, Chan 2009). The species is concentrated in valleys with densities ranging from 65 to 171 palms ha^{-1}. In a 3.2 ha plot, the ratio of seedlings, juveniles and adult was 1:3:5 (Chan 2009), indicating recruitment limitation. This could be because the population has reached the maximum carrying capacity of the environment, or failed to regenerate because of low seed production and significant seed loss. We also observed a low number of seedlings in populations of *J. perakensis* and *J. magnifica* in the respective logged-over forests of Kledang-Saiong and Berembun.

Although an export ban for all species of *Johannesteijsmannia* has been in place under the Malaysia Customs (Prohibition of Export) Order since 1998, this merely reduced demand from the international trade, but not the local trade (Chan & Saw 2009). Seeds are still being harvested indiscriminately without regulatory limits. A seed harvesting regime is needed to allow seed collection that does not jeopardise the viability and regeneration of the populations. Permits are required for seed collection and we suggest seed harvesting only at intervals of 3–5 years, during the mast flowering years when flowering and fruiting are more intense. No seed collection from a site should be allowed if the population shows poor regeneration. This can be indicated by a demography census which can be easily carried out by visual enumeration or, better still, with permanent tagging and proper count. We further recommend a certification process for plants in trade. This would encourage nurseries to establish domestication and propagation programmes and ultimately reduce harvesting pressures from the wild. Palms in cultivation are known to flower and fruit more regularly. *Ex situ* conservation should be the last resort because maintaining living collections in botanical gardens is costly and often difficult. If this option is to be adopted, priority should be given to the high-risk populations such as those on state lands.

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Appendix A. Distribution of *Johannesteijsmannia* in Malaysia. # state land; * new localities recorded since Dransfield (1972); FR – Forest Reserve.

Species	Locality	State
Johannesteijsmannia lanceolata	1. Jerantut-Benta Road #	Pahang
	2. Krau Wildlife Reserve	Pahang
	3. Angsi FR *	Negeri Sembilan
	4. Sungai Lalang FR	Selangor
Johannesteijsmannia magnifica	1. Berembun FR	Negeri Sembilan
	2. Sungai Lalang FR	Selangor
	3. Serendah FR *	Selangor
	4. Bukit Kinta FR *	Perak
Johannesteijsmannia perakensis	1. Gunung Bongsu FR *	Kedah
	2. Bintang Hijau FR	Perak
	3. Kledang Saiong FR	Perak
	4. Bubu FR	Perak
	5. Bubu FR	Perak

Johannesteijsmannia altifrons	1. Sungai Lalang FR	Selangor
	2. Temengor FR *	Perak
	3. Sungai Durian FR *	Kelantan
	4. Bukit Bauk FR *	Terengganu
	5. Bukit Bandi FR *	Terengganu
	6. G. Arong FR	Johor
	7. Jemaluang FR *	Johor
	8. Panti FR	Johor
	9. Kluang FR *	Johor
	10. Taman Negara	Pahang & Terengganu
	11. Ulu Sedili FR *	Johor
	12. Endau-Rompin State Park	Johor
	13. Kluang FR	Johor
	14. Lenggor FR	Johor
	15. Kota Tinggi – Mersing Road #	Johor
	16. Linggiu *	Johor
	17. Serasa FR	Kelantan
	18. Batu Papan *#	Kelantan
	19. Berkelah FR *	Pahang
	20. Lesong FR *	Pahang
	21. Tembat FR *	Terengganu
	22. Jerangau FR *	Terengganu
	23. Sungai Nipah FR *	Terengganu
	24. Rasau Kerteh FR *	Terengganu
	25. Pasir Raja Selatan FR *	Terengganu
	26. Bako National Park	Sarawak
	27. Kubah National Park	Sarawak
	28. Semariang Road #	Sarawak