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On the critically endangered red teruntum mangrove (*Lumnitzera littorea*)

Mangroves are ecologically important forest communities along tropical and subtropical coasts with 70 woody species belonging to about 30 genera in 20 families (Polidoro *et al*. 2010, Duke 2017). *Lumnitzera littorea* (Jack) Voigt of the Family Combretaceae is a critically endangered true mangrove species indigenous to Sri Lanka (Dassanayake *et al*. 1995, MOE 2012). This species is distributed widely on the east coast of Africa, northern Australia, Polynesia, and tropical Asian countries (Tomlinson *et al*. 1978, Su *et al*. 2007, Polidoro *et al*. 2010, Raju *et al*. 2014, Saenger *et al*. 2019). It is only known from a few locations in Sri Lanka (Jayatissa *et al*. 2002, Prassanna & Ranawana 2014). Therefore, in Sri Lanka *L. littorea* has been identified as a critically endangered (CR) species in 2007, 2012, and 2020 National Red Lists (IUCN & MOENR 2007, MOE 2012, BDS 2020).

The presence of *L. littorea* was first reported by Abeywickrema (1960) from the wet zone estuaries of Sri Lanka. Since 1983, it has been recorded only from Pathamulla Islet in the Madu Ganga estuary (Jayatissa *et al*. 2002) and the Bentota estuary (Jayatissa *et al*. 2002, De Silva & de Silva 2006). The population from the Bentota estuary has not been seen in recent times and is considered to have been destroyed (Prassanna & Ranawana 2014). However, Madhushanka & Ranawana (2022) recorded a different population of *L. littorea* from the Bentota estuary in 2021. With this new finding, the biogeographical distribution of *L. littorea* has been extended to a wider area. At present, this species is known from three sites in the Madu Ganga estuary and Dedduwa in the Bentota estuary (Fig. 1; Prassanna & Ranawana 2014, Madhushanka & Ranawana 2022).

These remaining populations are restricted to a small number of individuals and both locations are under immense pressure due to clearing for development purposes, cutting for wood, and clearing to access the inner parts of the mangroves (Perera *et al*. 2019, Gunawardana *et al*. 2022). *Lumnitzera littorea* is an evergreen tree growing to 8–15m with terminal racemose conspicuous red inflorescences and woody fruit (Zhang *et al*. 2020) (Fig. 2). It is an outcrossing non-viviparous species and has a regeneration time of 40 years (Tomlinson *et al*. 1978, Tomlinson 1986). Two species and one hybrid of the genus *Lumnitzera* have been identified (Tomlinson *et al*. 1978, Guo *et al*. 2011, Mabberley 2017, Saenger *et al*. 2019) where the second species, *L. racemosa* Willd. (S: Beriya), a true mangrove with a wide distribution in East Africa and Madagascar as well as Sri Lanka (Dassanayake *et al*. 1995, Saenger *et al*. 2019), has prominent white flowers. *Lumnitzera littorea* has heavy and fine-grained durable wood and is traditionally utilised as a remedy for tropical sprue (Manivannan *et al*. 2011).

The bacteriostatic and bactericidal properties of *L. littorea* are used against *Staphylococcus aureus*, *Bacillus cereus*, and *Escherichia coli* indicating that the plant contains therapeutic compounds that could be used in the treatment of infectious diseases (Saad *et al*. 2011). Despite its value, *L. littorea* populations have declined in other countries too (Su *et al*. 2007). Considering its critically endangered status and rarity, protecting this mangrove is of great significance in Sri Lanka. Here we discuss the distribution and the present status of *L. littorea* in Sri Lanka.

Study sites: Among the four study sites (Fig. 1), three sites are situated in the Madu Ganga estuary: site A and B, two nearby localities on either side of the River in the Pathamulla area and site C, an islet which is opposite Sathapaha Duwa Islet. Site D is situated in the Dedduwa area close to the irrigation road on the Bentota River. All the sites are in Gall District, Southern Province and fall within the southwestern low country wet zone of Sri Lanka that experiences a wet climate.

Field data collection was carried out in November and December 2021. Transect and quadrat methods were used to collect data on

species and the number of individuals of trees, saplings and seedlings (Sameer *et al*. 2007). A 10m wide belt transect was placed across the *L. littorea* patch from the shoreline of the river towards the inland. The transect was sub-divided into 10m × 10m smaller plots to count the individual mangrove species occurring within those plots. The species of true mangroves as well as other 'mangrove associate' species that co-occur with *L. littorea* were recorded. The girth at breast height (gbh) of each true mangrove was measured in centimetres using a girth tape (United Kingdom) and the approximate height was estimated in meters using a calibrated pole (Ramachandra *et al*. 2012). When a tree had two trunks, the gbh of the larger trunk was measured (Perara *et al*. 2019). When a tree was at an angle to the ground gbh was measured at a length equivalent gbh along the trunk from the ground (Kathiresan & Khan 2010).

Shannon Diversity index (*H*') followed by Hutcheson t-test, Shannon Evenness (*E*), and Simpson Dominance (*D*) were used to calculate the diversity at each site. Minitab version 19 and Excel version 2016 software were used to analyse the abundance data and make graphical representations. Geo coordinates were obtained using a handheld GPS receiver (Garmin eTrex Venture HC GPS Receiver). Arc GIS version 10.3 software was used to map the study area and *L. littorea* distribution in Sri Lanka. The calculated Shannon indices for the two locations and Hutcheson t-test (p = 0.973) showed no significant variation in terms of species diversity (Table 1). Out of ten recorded true mangroves from Madu Ganga (Prassanna 2008), four true mangroves were recorded in association with *L. littorea*. Out of ten true mangrove species recorded from the Bentota estuary (pers. obs.), five true mangrove species were found in the plots (Table 1). *Rhizophora apiculata*, *Heritiera littoralis*, and *Excoecaria agallocha* are the common true mangroves in both locations while *Sonneratia caseolaris* and *Bruguiera sexangula* were recorded only from Bentota and *Bruguiera gymnorhiza* was recorded only from the Madu Ganga.

Populations. A total of 26 trees of *L. littorea* from site A, one tree from site B, another three trees from site C in the Madu Ganga estuary and more than 200 individuals of trees and saplings from the Bentota estuary (site D) were recorded during the survey. A total of 231 plants and saplings were recorded from both locations in Sri Lanka. However, the geo coordinates with a single isolated *L. littorea* plant in the Madu Ganga were not able to be obtained during this study. A single planted tree was also located at the education center of the National Aquatic Resources Research and Development Agency (NARA) in Negambo. Although over 50 saplings were recorded at site D, not a single sapling was recorded from any of the Madu Ganga sites A–C. The absence of saplings and seedlings of *L. litorrea* in the Madu Ganga sites indicate low regeneration potential compared to the Bentota site D where more than 50 saplings were observed. Thus, the sites in the Madu Ganga have very low to no seed germination (Perara *et al*. 2019). The presence of saplings and seedlings in site D shows a considerable regeneration potential hence, this new population of *L. littorea* could be the turning point for the future conservation of this plant in Sri Lanka.

Table 1. Divesity values, true mangroves, and associates recorded from the plots surveyed in the two sites

Site	True mangorves	Families	Abundance	Associates	Shannon index (*H*')	Shannon Evenness (*E*)	Simpson index (*D*)
Madu Ganga estuary	*Rhizophora apiculata* *Bruguiera gymnorhiza* *Heritiera littoralis* *Excoecaria agallocha*	3	83	*Cerbera manghas* *Dolichandrone spathacea* *Acrostichum aureum* *Premna integrifolia*	1.30	0.81	0.32
Bentota estuary	*Rhizophora apiculata* *Bruguiera sexangula* *Heritiera littoralis* *Excoecaria agallocha* *Sonneratia caseolaris*	4	106	*Cerbera manghas* *Dolichandrone spathacea* *Acrostichum aureum* *Acanthus ilicifolius*	1.31	0.73	0.31

Plate 35

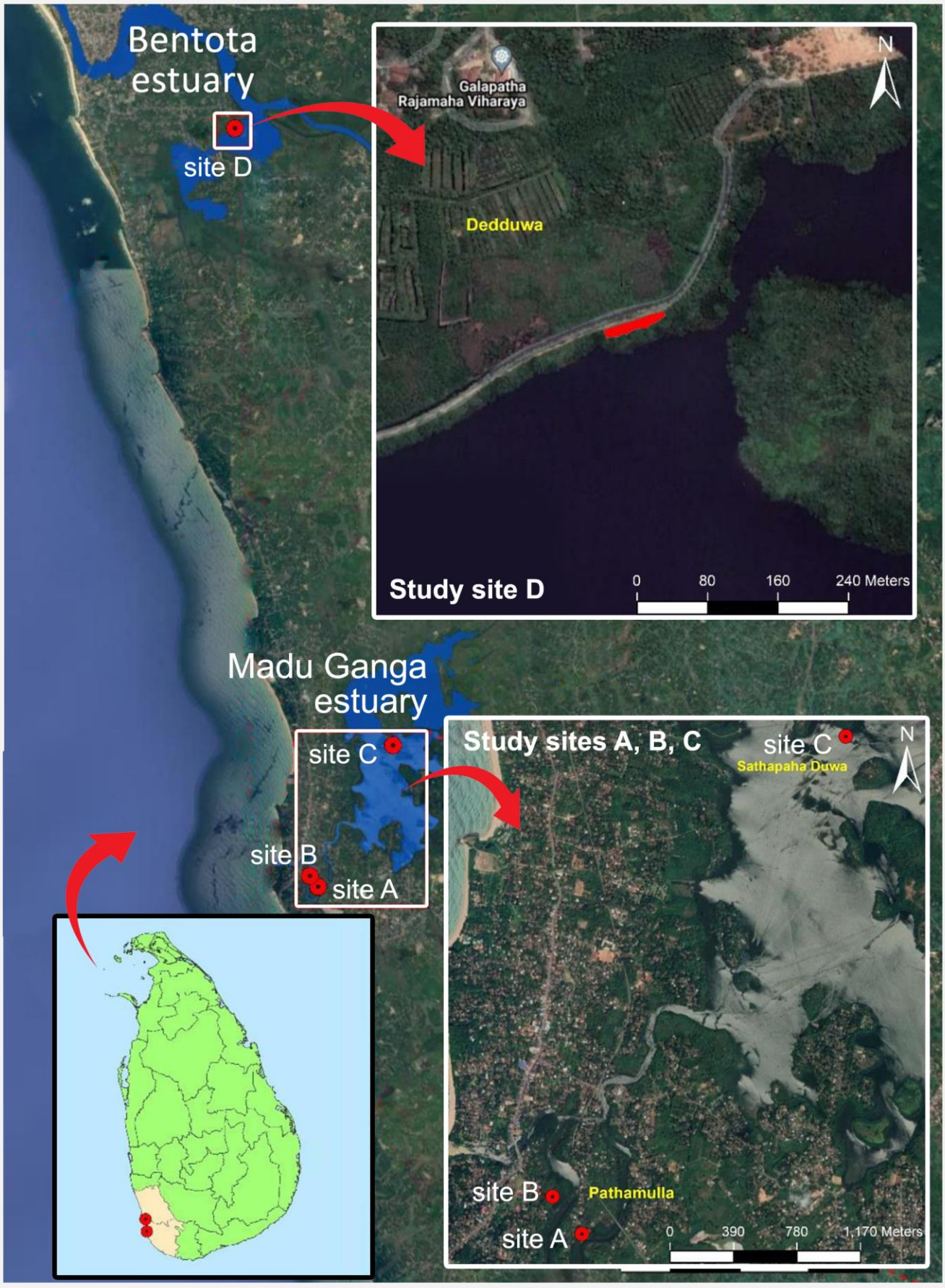

Figure 1. Present distribution of *L. littorea* in Sri Lanka: Bentota estuary and Madu Ganga estuary; the study sites (A, B, C, D) are marked on the map.

Plate 36

Figure 2. *Lumnitzera littorea* plants from its new location in the Bentota estuary: **(A)** a young tree, **(B)** typical red color flowers, **(C)** fruits, **(D)** a destroyed tree, **(E)** a sapling, and **(F)** a seedling

Most of the trees in the Madu Ganga site are between 6–15m whereas in the Bentota estuary, they are between 1–10m (Fig. 3). The majority of mangroves in the Madu Ganga estuary have girths between 20–60cm (Fig. 3) while in Bentota estuary they are between 10–30cm (Fig. 3). The mean height of *L. littorea* in the Madu Ganga sites (sites A–C) are 13.6±2.4m while it is 4.7±1.3m in the Bentota estuary (site D). The mean girth of *L. littorea* in the Madu Ganga is 95.9±26.7cm whereas it is about 14.1±4.9cm in the Bentota estuary indicating that the *L. littorea* individuals are younger than those of the Madu Ganga sites. The *L. littorea* patches in both locations are found more than 10 meters away from the shoreline of the river indicating *L. littorea* is a back mangrove species except the "Sathapaha Duwa" (site C) location where three trees are found close to the river and lean towards the water. The main site in the Madu Ganga is located on a remnant mangrove island that has recently been occupied by people. On the other hand, the Bentota site is located further away from human settlements. Many flowers and seeds were observed at the Madu Ganga site and fewer flowers and seeds at the Bentota site. More than 50 trees and saplings have been cut down at the Bentota site indicating that it is under enormous anthropogenic pressures. The *L. littorea* patch is limited to a narrow strip (~600m^2) in the Bentota estuary site while in the Madu Ganga main site too, trees have been condensed into a small area (~400m^2) and a few other isolated patches. These fragmented and isolated populations could also lead to reduced reproductive output and thereby reduced population viability (Allnutt *et al*. 2003). According to the Allee effect, small populations are at higher risk of declining in numbers and are more likely to go extinct (Stephens & Sutherland 1999, Aaron & John 2003). These populations are vulnerable to extinction and therefore have a high conservation priority in Sri Lanka. Both locations are facing numerous human-related threats such as being cut down for wood and to access the inner parts of the mangroves. More than 50 individuals have already been destroyed in the Bentota estuary site. Therefore, this young *L. littorea* population in the Bentota estuary should be declared a protected forest according to the Forest Ordinance, and a proper awareness program should be established to inform the people of its significance and importance.

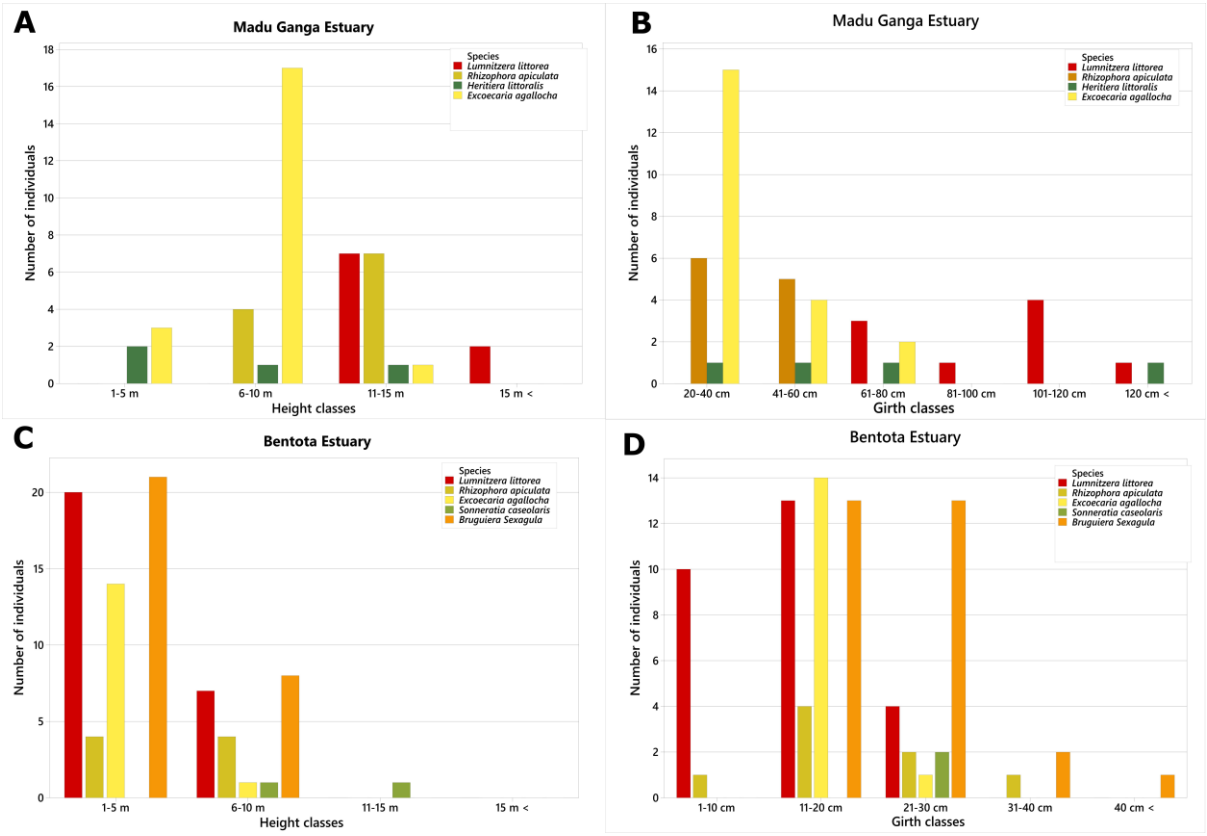

Figure 3. Height and girth class distribution of mangroves: (**A**) Height class in the Madu Ganga; (**B**) Girth class in the Madu Ganga; (**C**) Height class in the Bentota estuary; (**D**) Girth class in the Bentota estuary

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Literature Cited

Aaron, R. and S.P. John (2003). Conservation of the critically endangered *Rumex rothschildianus* as implied from AFLP diversity. *Biological conservation*, 114(2): 299–303.

Abeywickrema, B.A. (1960). Estuarine vegetation of Ceylon. *Proceedings of the Abidjan symposium on the humid tropics, UNESCO, Paris*: 207–210.

Allnutt, T.R., A.C. Newton, A. Premoli, and A. Lara (2003). Genetic variation in the threatened South American conifer *Pilgerodendron uviferum* (Cupressaceae), detected using RAPD markers. *Biological Conservation*, 114(2): 245–253.

BDS (2020). *The National Red List 2020. Conservation status of the Flora of Sri Lanka*. Biodiversity Secretariat of the Ministry of Environment and the National Herbarium, Department of National Botanic Gardens: 254pp.

Dassanayake, M.D., F.R. Fosberg, and W.D. Clayton (1995). *A revised handbook to the flora of Ceylon* (Vol. IX). Oxford & IBH Publishing Co. Ltd., New Delhi, Culcutta: 482pp.

De Silva, P.K. and M. de Silva (2006). *A Guide to the Mangrove Flora of Sri Lanka*. WHT Publications, Colombo, Sri Lanka: 64pp.

Duke, N.C. (2017). Mangrove floristics and biogeography revisited: further deductions from biodiversity hot spots, ancestral discontinuities, and common evolutionary processes. Pp. 17–53. *In*: Rivera-Monroy, V.H., S.Y. Lee, E. Kristensen, and R.R. Twilley (eds.). *Mangrove Ecosystems: A Global Biogeographic Perspective: Structure, Function, and Services*. Cham: Springer International Publishing.

Guo, M, R. Zhou, Y. Huang *et al*. (2011). Molecular confirmation of natural hybridization between *Lumnitzera racemosa* and *Lumnitzera littorea*, Aquatic Botany, 95(1): 59–64.

Gunawardana, B.H.S.M., K.B. Ranawana, and M.G. Prassanna (2022). Density of Critically Endangered Mangrove *Lumnitzera littorea* (Jack) Voigt in Newly Recorded Locality of Bentota Estuary, Southwestern Sri Lanka. *Proceedings of the 26th International Forestry & Environment Symposium, the Department of Forestry & Environmental Science, University of Sri Jayewardenepura, Sri Lanka*: 40.

IUCN & MOENR (2007). The 2007 Red List of Threatened Fauna and Flora of Sri Lanka, Colombo, Sri Lanka: 148pp.

Jayatissa, L.P., F.D Guebas, and N. Koedam (2002). A review of the floral composition and distribution of mangroves in Sri Lanka. *Botanical journal of Linnean Society*, 138(1): 29–43.

Kathiresan, K. and S.A. Khan (2010). *International Training Course on Costal biodiversity in Mangroves: Course Manual*. Annamalie University (CAS in Marine Biology, Parangipettai), India: 744pp.

Mabberley, D.J. (2017). *Mabberley's Plant-book: A Portable Dictionary of Plants, their Classification and Uses*, 4th ed. Cambridge University Press, Cambridge: 1102pp.

Madhushanka, S. and K.B. Ranawana (2022). Rediscovery of critically endangered mangrove *Lumnitzera littorea* (Jack) Voigt (Combreataceae) from Bentota Estuary, Sri Lanka. *World News of Natural Sciences*, 40: 86–90.

Manivannan, K., P. Anantharaman, and T. Balasubramanian (2011). Antimicrobial potential of selected brown seaweeds from Vedalai coastal waters, Gulf of Mannar. *Asian Pacific journal of tropical biomedicine*, 1(2): 114–120.

MOE (2012). The National Red List 2012 of Sri Lanka: Conservation Status of the Fauna and Flora. Ministry of Environment, Colombo, Sri Lanka: 476pp.

Perera, P.L.M.M., K.M.G.G. Jayasuriya, A.M.T.A. Gunaratne *et al*. (2019). Conservation attempt of critically endangered mangrove *Lumnitzera littorea* (Jack) Voigt in Madu Ganga Ramsar Site of Sri Lanka; stand composition and seed germination. *Ceylon Journal of Science*, 48(3): 225–234.

Polidoro, B.A., K.E. Carpenter, L. Collins *et al*. (2010). The loss of species: Mangrove extinction risk and geographic areas of global concern. *PlosOne*, 5: e10095.

Prassanna, M.G.M. (2008). Species Composition and Diversity of Maduganga Mangal. *MSc Thesis, Postgraduate Institute of Science, University of Peradeniya, Sri Lanka*: 52pp.

Prassanna, M.G.M. and K.B. Ranawana (2014). *Guide to mangroves of Sri Lanka*, 1st edition. Biodiversity Secretariat, Ministry of Environment & Renewable Energy, Battaramulla: 70pp.

Raju, A.S., R. Kumar, and B. Rajesh (2014). Pollination ecology of *Lumnitzera racemosa*

Willd. (Combretaceae), a non-viviparous mangrove tree. *Taprobanica*, 6(2): 100–109.

Ramachandra, T.V., S.M.D. Chandran, N.V. Joshi *et al*. (2012). Ecology of sacred kan forests in central Western Ghats. *Sahyadri Conservation Series*, 15: 1–103.

Saad, S., M. Taher, D. Susanti *et al*. (2011). Antimicrobial activity of mangrove plant (*Lumnitzera littorea*). *Asia Pacific Journal of Tropical Medicine*, 2011(7): 523–525.

Saenger, P., P. Ragavan, C.R. Sheue *et al*. (2019). Mangrove biogeography of the Indo-Pacific. *In*: Gul, B., B. Böer, M. Khan *et al*. (eds.). Sabkha Ecosystems. *Tasks for Vegetation Science*, 49.

Sameer, A., G.R. Rao, Mesta *et al*. (2007). *Ecological Status of Sharavathi Valley Wildlife Sanctaury*. Center for Ecological Sciences, Indian Institute of Science: 158pp.

Stephens, P.A. and W.J. Sutherland (1999). Consequences of the Allee effect for behavior, ecology and conservation. *Trends in Ecology & Conservation*, 14(10): 401–405.

Su, G., Y. Huang, F. Tan *et al*. (2007). Conservation genetics of *Lumnitzera littorea* (Combretaceae), an endangered mangrove, from the Indo-West Pacific. *Marine biology*, 150(3): 321–328.

Tomlinson, P.B. (1986). *The Botany of Mangroves*. Cambridge University Press, Cambridge: 413pp.

Tomlinson, P.B., J.S. Bunt, R. Primack, and N.C. Duke (1978). *Lumnitzera rosea* (Combretaceae)–Its status and floral morphology. *Journal of the Arnold Arboretum*, 59(4): 342–351.

Zhang, Y., Y. Chen, Y. Zhou *et al*. (2020). Comparative Transcriptome Reveals the Genes' Adaption to Herkogamy of *Lumnitzera littorea* (Jack) Voigt. *Frontiers in Genetics*, 11: 1516.

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