Reassessment of the Genus *Salacia* under IUCN Threatened Categories in Sri Lanka

W.I.N.S. Senevirathne¹, P.L. Hettiarachchi², D.M.D. Yakandawala³ and A. Attanayake⁴

¹Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka
²Department of Biological Sciences, Faculty of Applied Sciences, Rajarata University of Sri Lanka, Mihintale, Sri Lanka
³Department of Botany, Faculty of Science, University of Peradeniya, Peradeniya, Sri Lanka
⁴National Botanic Gardens, Peradeniya, Sri Lanka

Abstract: *Salacia* comprises of five species in Sri Lanka *S. acuminatissima*, *S. chinensis*, *S. diandra*, *S. oblonga* and *S. reticulata* while around two hundred species are distributed in tropical countries worldwide. All five species recorded in Sri Lanka are listed under various threatened categories in the National Red List 2012. The present study was carried out to reassess their conservation status based on IUCN threatened categories using preliminary field observations and data in order to contribute to the national red listing with robust data. The species were evaluated based on the criteria B of the IUCN guidelines 2017. The conservation statuses of two *Salacia* species *S. acuminatissima* and *S. chinensis* have remained same as the previous conservation statuses determined at national level as Endangered (EN) and Near threatened (NT) respectively. However, *S. diandra* was upgraded to the category of Critically Endangered (CR). The statuses of *S. oblonga* and *S. reticulata* were downgraded from Endangered (EN) to Near threatened (NT). Conservation statuses obtained using preliminary data and the upgrading the status of a taxon and downgrading of the statuses of two taxa is of prime importance to prioritize conservation of the members of the Genus *Salacia* in globally.

Keywords: *Salacia*; Geographical distribution; Conservation categories.

INTRODUCTION

The genus *Salacia* comprises of nearly 200 species of woody lianas, scandent or erect shrubs distributed in tropical parts of India, Burma, Sri Lanka, Malaysia, Solaman islands, Africa and New World (Wadhwa, 1996). This genus is well-known for its medicinal values to cure high blood sugar, rheumatism, gonorrhea and skin diseases (Paarakh et al., 2008; Arunakumara and Subasinghe, 2010; Chawla et al., 2013; and Musini and Giri, 2015 and Medagama, 2015). During the revision of the Flora, Wadhwa (1996) recognized four species of *Salacia* occurring in Sri Lanka; *S. chinensis* L., *S. diandra* Thw., *S. oblonga* Wall ex Wight & Arn. and *S. reticulata* Wight. However, during the most recent Red listing in 2012, *S. acuminatissima* has also been recorded as a new species occurring in the wet zone of Sri Lanka (Kostermans, 1992). This species has been considered as a synonym of *S. diandra* during the revision of the Flora by Wadhwa (1996). *S. acuminatissima* was first described by Kostermans (1992) based on plants collected from Sinharaja forest reserve. Out of the five species recorded in Sri Lanka, *S. acuminatissima*, *S. diandra*, *S. oblonga* and *S. reticulata* are categorized as endangered species while *S. chinensis* is recorded as a near threatened species in the National Red List 2012 of Sri Lanka (MOE, 2012). The evaluations of threatened status of above plants in the Sri Lanka are conducted based on the available literature, herbarium records, field experience and records of experts. Therefore, the conservation status decided are considered as national conservation status rather than global, as the requirements laid down by the IUCN Redlisting criteria such as population size reduction and population reduction, geographic range in the form of extent of occurrence and area of occupancy, small population size and decline and very small or restricted population are not achieved. Among the plant species belongs to the genus *Salacia* recorded island wide, *S. acuminatissima* and *S. diandra* limited to the wet zone and majority of *S. chinensis* and *S. reticulata* limited to dry zone while *S. oblonga* majority found also in to the wet zone. A mature plant members of *Salacia*, produces large number of seeds per a season (Arunakumara and Subasinghe, 2010). This species is can be regenerated by seed propagation, vegetative propagation using stem cuttings and root cuttings (Arunakumara and Subasinghe, 2010). Although these plant species produce several seeds, germination ability are poor (Arunakumara and Subasinghe, 2010). The genus *Salacia* includes the well-known medicinal plant 'Kothala-himbutu', *S. reticulata*. The plant is widely used in the Ayurvedic system to treat diabetes and obesity (Medagama, 2015). In some instances, the other *Salacia* species, especially *S. chinensis* and *S. oblonga* are also supplemented in the drug stores for treating diabetics (personal communications). During the exploitation of these species for medicinal use the mature plants are cut-down to obtain parts of the stem and also mature branches which directly affects the survival and reproduction of the plant. Therefore, recording

*Corresponding Author’s Email: nirodha.sewwandi@gmail.com

https://orcid.org/0000-0002-8811-2714

This article is published under the Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.
existing populations in different bioclimatic regions with their abundance has become a timely need to conserve these taxa for sustainable use in the future. A study carried out with field visits covering the entire island provides firsthand information in acquiring the information on the habitats and threats for the existing populations. Further the collected data would contribute can be used to update the information for future Red-listing processes. The National Red List 2012 (MOE, 2012) of Sri Lanka is the current working document which includes the IUCN conservation status of many taxonomic groups, including Angiosperms, Gymnosperms, Pteridophytes, Invertebrates, Amphibians, Reptiles, Birds, Fish and Mammals. The National Red listing document provides baseline information obligatory for the preparation of species profiles of threatened taxa, a basis for prioritizing conservation efforts and data necessary for the compiling and implementation of recovery plans. Further it also provides details of information gaps regarding specific taxa and geographic areas and allows for objective prioritization of funding for conservation-oriented research (MOE, 2012). Further, the conservation status of species has been used globally to guide conservation responses, direct conservation policies and legislation, plan protected area networks and prioritize sites to be protected (Possingham et al., 2002). Therefore, the objective of the study was to conduct an eco-geographical survey to record all Salacia species in Sri Lanka in order to reassess the IUCN threatened categories of genus Salacia.

MATERIAL AND METHODS

The study was conducted from the January 2016 to December 2018 for a period of two years. Salacia species were collected from all possible locations in Sri Lanka (Figure 1 and Table 1), covering all major climatic zones of the country. This included all the administrative provinces of the country.

The plants were identified using the National Herbarium, Royal Botanic Gardens Peradeniya and literature (Flora of Ceylon, Wadhwa B.M., 1996 and Reinwardtia, Kostermans A.J.G.H). All the locations were recorded using a Global Positioning System (Garmin Etrex 10, USA). Possible causes of threats for each subpopulation were recorded at all locations. A visual estimation of the subpopulation for each location was also recorded.

Figure 1: Geographical distribution of Salacia species recorded during the study in Sri Lanka.
Table 1: Geographical distribution of the genus *Salacia* species recorded in Sri Lanka.

| Sample ID | Species name       | Climatic zone | Administrative district | DSD division | Habitat                                      |
|-----------|--------------------|---------------|-------------------------|--------------|----------------------------------------------|
| SBRA14    | *Salacia* accuminatissima | Intermediate | Rathnapura              | Panawagama   | Buffer zone of tank                          |
| CEKA04    | *Salacia* accuminatissima | Wet          | Kandy                   | Hantana      | Wet evergreen forest interior                |
| WPCO03    | *Salacia* accuminatissima | Wet          | Colombo                 | Kaluaggala   | Wet evergreen forest interior                |
| SUMA08    | *Salacia* accuminatissima | Wet          | Matara                  | Buthkanda    | Wet evergreen forest interior                |
| NCAN07    | *Salacia* chinensis   | Dry           | Anuradhapura            | Ritigala     | Dry mixed evergreen forest interior          |
| NCAN16    | *Salacia* chinensis   | Dry           | Anuradhapura            | Katupotha    | Secondary forest patch in urban area         |
| UVMO03    | *Salacia* chinensis   | Intermediate | Monaragala              | Buduruwagala | Secondary forest interior                    |
| UVMO05    | *Salacia* chinensis   | Intermediate | Monaragala              | Buttala      | Buffer zone of tank                          |
| SBRA12    | *Salacia* chinensis   | Intermediate | Rathnapura              | Ihala Galagama | Intermediate forest interior                |
| SBRA17    | *Salacia* chinensis   | Wet           | Rathnapura              | Badulu dena  | Buffer zone of tank                          |
| SBRA18    | *Salacia* chinensis   | Wet           | Rathnapura              | Kottegoda    | Secondary forest patch in urban area         |
| NWKU01    | *Salacia* chinensis   | Intermediate | Kurunegala              | Dolukanda    | Intermediate forest interior                |
| NCAN20    | *Salacia* chinensis   | Dry           | Anuradhapura            | Wilpattu     | Buffer zone of tank                          |
| ESAM01    | *Salacia* chinensis   | Dry           | Ampara                  | Lahugala     | Buffer zone of tank                          |
| NCAN09    | *Salacia* chinensis   | Dry           | Anuradhapura            | Galkulama    | Abandoned paddy land near tank               |
| NCAN10    | *Salacia* chinensis   | Dry           | Anuradhapura            | Galkulama    | Buffer zone of tank                          |
| NCAN13    | *Salacia* chinensis   | Dry           | Anuradhapura            | Horowpethana | Secondary forest patch                       |
| NCAN15    | *Salacia* chinensis   | Dry           | Anuradhapura            | Rambewa      | Buffer zone of tank                          |
| NCAN19    | *Salacia* chinensis   | Dry           | Anuradhapura            | Mihintale    | Buffer zone of tank                          |
| NWKU07    | *Salacia* chinensis   | Intermediate | Kurunegala              | Aran kale    | Intermediate forest interior                 |
| NOFJ02    | *Salacia* chinensis   | Dry           | Jaffna                  | Varani       | Urbanized area                               |
| NOKL01    | *Salacia* chinensis   | Dry           | Kilinochchi             | Paranathana  | Secondary forest patch                       |
| NOKL03    | *Salacia* chinensis   | Dry           | Kilinochchi             | Kokawil      | Secondary forest patch                       |
| NOKL04    | *Salacia* chinensis   | Dry           | Kilinochchi             | Manikulama   | Secondary forest patch                       |
| ESAM02    | *Salacia* chinensis   | Dry           | Ampara                  | Wadinagala   | Dry mixed evergreen forest interior          |
| ESAM03    | *Salacia* chinensis   | Dry           | Ampara                  | Wadinagala   | Urbanized area                               |
| SUGA01    | *Salacia* diandra     | Wet           | Galle                   | Kalubowitiya | Wet evergreen forest interior                |
| SUMA04    | *Salacia* diandra     | Wet           | Matara                  | Neluwa       | Wet evergreen forest interior                |
| SBRA20    | *Salacia* oblonga     | Wet           | Rathnapura              | Wathurawa    | Wet evergreen forest interior                |
| SUGA07    | *Salacia* oblonga     | Wet           | Galle                   | Radagoda     | Urbanized area                               |
| SUMA10    | *Salacia* oblonga     | Wet           | Matara                  | Viharahena   | Wet evergreen forest interior                |
| UVMO01    | *Salacia* oblonga     | Intermediate | Monaragala              | Maligawila   | Secondary forest interior                    |
| UVMO02    | *Salacia* oblonga     | Dry           | Monaragala              | Kumbukkan oya | Along the river banks                        |
| SBRA03    | *Salacia* oblonga     | Intermediate | Rathnapura              | Belihuloya   | Intermediate forest interior                 |
| SBRA04    | *Salacia* oblonga     | Intermediate | Rathnapura              | Karagastalawa | Urbanized area             |
| SBRA16    | *Salacia* oblonga     | Intermediate | Rathnapura              | Karagastalawa | Urbanized area             |
| NWKU06    | *Salacia* oblonga     | Intermediate | Kurunegala              | Kumbukewa    | Intermediate forest interior                 |
| CEKA01    | *Salacia* oblonga     | Wet           | Kandy                   | Nilamba      | Wet evergreen forest interior                |
| CEKA02    | *Salacia* oblonga     | Wet           | Kandy                   | Galaha       | Wet evergreen forest interior                |
| WPCO01    | *Salacia* oblonga     | Wet           | Colombo                 | Labugama     | Wet evergreen forest interior                |
| WPCO04    | *Salacia* oblonga     | Wet           | Colombo                 | Kakkutudeniya | Wet evergreen forest interior                |
| SBRA10    | *Salacia* oblonga     | Wet           | Rathnapura              | Karawita     | Wet evergreen forest interior                |
| SBRA13    | *Salacia* oblonga     | Intermediate | Rathnapura              | Karape       | Buffer zone of tank                          |
The potential distribution maps for each species were developed by plotting the GPS locations on a map of Sri Lanka using the software ArcGIS 10.4 (ESRI, 2017) and the extent of occurrence (EOO); “the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy” (IUCN 2012 and 2017); of each species were determined based on the convex hull (the smallest polygon in which no internal angle exceeds 180 degrees and which contains all the sites of occurrence) and the area of occupancy (AOO); “the area of suitable habitat currently occupied by the taxon”; were calculated using a 2 x 2km² grid on the map. The conservation statuses of the five Salacia species were evaluated with the available data strictly adhering to the recommended guidelines of the IUCN (IUCN, 2017).

During the present study, assessing the threat statuses of Salacia species was carried out based on criteria B, which considers only the current AOO and EOO data together with two of the three given conditions: (a) Severely fragmented OR number of locations and (b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals since data and information for other criteria were not available.

| Species                  | Water Availability | Location          | Buffer/Tank Zone         |
|--------------------------|--------------------|-------------------|--------------------------|
| Salacia oblonga          | Wet                | Colombo           | Urbanized area           |
| Salacia reticulata       | Wet                | Galle             | Hinidumana kanda         |
| Salacia oblonga          | Wet                | Galle             | Kinna Wewa              |
| Salacia oblonga          | Wet                | Matara            | Diyaduwa - North        |
| Salacia oblonga          | Wet                | Matara            | Ilukwatta               |
| Salacia oblonga          | Wet                | Galle             | Napal Kanda             |
| Salacia reticulata       | Intermediate      | Rathnapura        | Intermediate forest     |
| Salacia oblonga          | Wet                | Galle             | Palawela                |
| Salacia reticulata       | Intermediate      | Kurunegala        | Siradunna               |
| Salacia reticulata       | Intermediate      | Kurunegala        | Kumbuk gate             |
| Salacia reticulata       | Intermediate      | Kurunegala        | Kumbuk wewa             |
| Salacia reticulata       | Wet                | Galle             | Nagal Kanda             |
| Salacia reticulata       | Wet                | Matara            | Panal Kanda             |
| Salacia reticulata       | Wet                | Matara            | Ihala Galagama          |
| Salacia reticulata       | Wet                | Colombo           | Iluk owa                |
| Salacia reticulata       | Dry                | Anuradhapura      | Horowpathana            |
| Salacia reticulata       | Dry                | Anuradhapura      | Horowpathana            |
| Salacia reticulata       | Dry                | Anuradhapura      | Ritigala                |
| Salacia reticulata       | Dry                | Anuradhapura      | Katupotha               |
| Salacia reticulata       | Dry                | Anuradhapura      | Mamakkattiyawa          |
| Salacia reticulata       | Dry                | Anuradhapura      | Kabithigollawa          |
| Salacia reticulata       | Intermediate      | Monaragala        | Buduruwagala            |
| Salacia reticulata       | Arid               | Hambantota        | Mabunagala              |
| Salacia reticulata       | Arid               | Hambantota        | Sooriya wewa            |
| Salacia reticulata       | Arid               | Hambantota        | Aluthganga aara         |
| Salacia reticulata       | Arid               | Hambantota        | Aluthganga aara         |
| Salacia reticulata       | Arid               | Hambantota        | Tissamaharama           |
| Salacia reticulata       | Intermediate      | Rathnapura        | Seelagama               |
| Salacia reticulata       | Wet                | Rathnapura        | Karawita                |
| Salacia reticulata       | Intermediate      | Kurunegala        | Hunupola                |
| Salacia reticulata       | Wet                | Kandy             | Galaha                  |
| Salacia reticulata       | Wet                | Matara            | Gongala                 |
| Salacia reticulata       | Wet                | Matara            | Wiharahena              |
| Salacia reticulata       | Dry                | Jaffna            | Poorerin                |
| Salacia reticulata       | Wet                | Matara            | Poorerin                |

The conservation statuses of the five Salacia species were evaluated with the available data strictly adhering to the recommended guidelines of the IUCN (IUCN, 2017).
RESULTS AND DISCUSSION

In the island-wide field collection, 82 distinct populations of Salacia species have been recorded, which were distributed across 13 administrative districts i.e. Anuradhapura, Hambantota, Galle, Matara, Monaragala, Kandy, Kurunegala, Puttalama, Colombo, Jaffna, Kilinochchi, Ampara and Rathnapura representing all major climatic zones.

According to the results, all S. acuminatissima were recorded in the wet and intermediate climatic zones while majority of S. chinensis were recorded in the dry and intermediate zones with very few records in wet zone. S. diandra is restricted to the wet zone while all the S. oblonga were recorded from the wet and intermediate zones except one population from Monaragala, Kumbukkan Oya area. Although majority of S. reticulata were recorded from the dry and intermediate zones few individuals were also recorded from the wet zone. According to the above data S. chinensis and S. reticulata are more adapted to the dry and intermediate climatic zones while S. acuminatissima, S. diandra and S. oblonga are more adapted to the wet and intermediate climatic zones. Among those 82 distinct populations recorded in the present study, 69 were new records indicating that 84% of the populations are new records for the genus Salacia (Table 2).

Remaining 13 distinct populations out of 82 have been recorded in Revised Handbook to the Flora of Ceylon and herbarium specimens deposited at the National Herbarium, Royal Botanic Gardens, Peradeniya.

Table 2: Comparison of the distinct populations of Salacia species recorded during the present study with past records.

| Species          | Number of recorded distinct populations | Number of newly recorded distinct populations | Percentage of newly recorded distinct populations |
|------------------|-----------------------------------------|-----------------------------------------------|-------------------------------------------------|
| S. acuminatissima| 4                                       | 3                                             | 75%                                              |
| S. chinensis     | 23                                      | 17                                            | 74%                                              |
| S. diandra       | 2                                       | 1                                             | 50%                                              |
| S. oblonga       | 36                                      | 32                                            | 89%                                              |
| S. reticulata    | 19                                      | 16                                            | 84%                                              |

Table 3: Habitats of the members of the genus Salacia.

| Plant species | Disturbed forest | Natural Forest | Associates with water reserves | Urbanized area | Human inhabited area |
|---------------|------------------|----------------|-------------------------------|---------------|---------------------|
| S. acuminatissima | -                | 3              | 1                             | -             | -                   |
| S. chinensis    | 5                | 5              | 7                             | 4             | 1                   |
| S. diandra      | -                | 2              | -                             | -             | -                   |
| S. oblonga      | 4                | 19             | 3                             | 8             | 1                   |
| S. reticulata   | 1                | 9              | 6                             | 3             | -                   |

Table 4: IUCN recommended EOO and AOO values for species categorization.

|                        | Critically Endangered (CR) | Endangered (EN) | Vulnerable (VU) |
|------------------------|----------------------------|-----------------|-----------------|
| EOO value              | < 100 km²                  | < 5000 km²      | < 20000 km²     |
| AOO value              | < 10 km²                   | < 500 km²       | < 2000 km²      |

According to the habitats, most of the Salacia species recorded during the present study were recorded from the interior of natural forests. Although majority existed in the natural forests, these species were also recorded in disturbed, urbanized and cultivated areas in fewer numbers (Table 3).

The Table 4 gives the IUCN recommended EOO and AOO values for species categorization (IUCN 2017) while the Figure 2 illustrates the distribution maps with the polygons used for the EOO estimations and Table 5 gives the estimated EOO values and AOO values for the genus Salacia.

Among 82 distinct populations encountered during the study majority of them were not under any specific threat except few populations of S. chinensis, S. oblonga and S. reticulata that were recorded in human inhabited areas, urbanized areas and associate with water reservoirs. The threat that was observed for these three species with high medicinal value is the harvesting of mature branches. However, this cropping does not affect the mature individuals as they always resprout with the rains. The term ‘severely fragmented’ has been used according to the guidelines given by IUCN 2017. For deciding whether there is a severe fragmentation, number of locations and the distribution of area of occupancy (detailed maps of occupied habitat) have been used. According to the IUCN 2017, a taxon can be considered to be severely fragmented if most (> 50%) of it is total area of occupancy is in habitat patches that are separated from other habitat patches by a large distance.
Based on the EOO (B1) and AOO (B2) values of the five *Salacia* species, *S. diandra* is the rarest species (EOO = 55.01 km$^2$ and AOO = 7.99 km$^2$) which is confined to two populations recorded in Galle and Matara districts. According to Criterion B, based on geographic range, with only 55.01 km$^2$ of the extent of occurrence and 7.99 km$^2$ of area of occupancy, this species qualifies for Critically Endangered (CR) category under the thresholds for both B1 and B2 (for this species polygon was not prepared and EOO and AOO were estimated using standard method due to restriction of two populations). Further, the current population of *S. diandra* is clearly fragmented into small patches of less than 100 m$^2$ and it can be projected the declining of population. Thus this species qualifies for Critically Endangered (CR) under the both B1a, B1b and B2a and B2b.

*Salacia chinensis* is also a rare species that is confined to the four populations in wet zone (EOO = 3,649.89 km$^2$ and AOO = 15.99 km$^2$). According to Criterion B, based on geographic range, with 3649.89 km$^2$ of the extent of occurrence and 15.99 km$^2$ of area of occupancy, this species qualifies for Endangered (EN) category under the thresholds for both B1 and B2. Further, the populations of *S. oblonga* are not clearly fragmented into small patches and could not be projected to declining of population. Thus this species qualifies for Near threatened (NT) category under B2 and B2b.

*Salacia chinensis* is the most common species belonging to the genus *Salacia* in Sri Lanka and has a wide range of population distribution with 29,703.6 km$^2$ of the extent of occurrence and 85.96 km$^2$ of area of occupancy. According to the EOO value this species not qualifies for Vulnerable or any above conservation level and according to the AOO value qualifies for Endangered (EN) category under the thresholds for both B1 and B2. Although populations of *S. chinensis* are widely distributed, there is a probability for declining of population due to high medicinal demand in the local market. Therefore, this species qualifies for Near threatened (NT) category under B2 and B2b.

*Salacia reticulata*, commercially the most important species that belongs to the genus *Salacia* occupies an area of 22,899.5 km$^2$ of the extent of occurrence and 72.33 km$^2$ of area of occupancy according to the criterion B, based on geographic range. This species qualifies for Near Threatened (NT) category under the thresholds for both B1 and qualifies for Endangered (EN) category under the

| Species          | EOO value (km$^2$) | AOO value (km$^2$) |
|------------------|--------------------|--------------------|
| *S. acuminatissima* | 3,649.89           | 15.99              |
| *S. chinensis*    | 29,703.60          | 85.97              |
| *S. diandra*      | 55.01              | 7.99               |
| *S. oblonga*      | 12,322.00          | 119.11             |
| *S. reticulata*   | 22,899.50          | 72.33              |

Figure 2: The distribution maps with the polygons used for the EOO estimations for four *Salacia* species except *S. diandra*. 

Conservation of *S. acuminatissima* and *S. diandra* has become a critically important factor not only because they are EN and CR respectively, but also as these two species are restricted to limited areas of undisturbed forests in the wet zone of the country. 

Another *Salacia* species, *S. oblonga* has a wider population distribution than *S. acuminatissima* and *S. diandra* with a 12,322 km$^2$ of the extent of occurrence and 119.11 km$^2$ of area of occupancy. According to the EOO value this species qualifies for vulnerable (VU) category and according to the AOO value qualifies for Endangered (EN) category under the thresholds for both B1 and B2. Further, the populations of *S. oblonga* are not clearly fragmented into small patches and could not be projected to declining of population. Thus this species qualifies for Near threatened (NT) category under B2 and B2b.

*Salacia reticulata* is commercially the most important species that belongs to the genus *Salacia* occupies an area of 22,899.5 km$^2$ of the extent of occurrence and 72.33 km$^2$ of area of occupancy according to the criterion B, based on geographic range. This species qualifies for Near Threatened (NT) category under the thresholds for both B1 and qualifies for Endangered (EN) category under the
threshold of B2. *Salacia reticulata* can be projected as declining because people tend to harvest this due to high medicinal value for their economic benefits. According to that this species qualifies for near threatened (NT) under the B2 and B2b. Table 6 indicates the proposed conservation statuses of species belongs to genus *Salacia* while comparing the conservation status according to the National Redlist of 2012 Sri Lanka.

Table 6: Conservation statuses proposed according to the EOO, AOO and current conservation status according to National Red List 2012 in Sri Lanka for the genus *Salacia*.

| Species          | Conservation Status According to EOO | Conservation Status According to AOO | Proposed final Conservation Status | Conservation Status (National Red List Sri Lanka 2012) |
|------------------|--------------------------------------|--------------------------------------|-----------------------------------|-----------------------------------------------------|
| *S. acuminatissima* | EN                                   | EN                                   | EN                                | EN                                                  |
| *S. chinensis*    | NT                                   | EN                                   | NT                                | NT                                                  |
| *S. diandra*      | CR                                   | CR                                   | CR                                | EN                                                  |
| *S. oblonga*      | VU                                   | EN                                   | NT                                | EN                                                  |
| *S. reticulata*   | NT                                   | EN                                   | NT                                | EN                                                  |

Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened NT

Plate 1: A, B, C – Ripen fruit, inflorescence and well established population of *S. chinensis*, D, E and F – Habit of *S. reticulata* and inflorescence, G and H – Branches without fruits and with fruits of *S. oblonga*.
CONCLUSION

According to the present evaluation of the IUCN Red Data status, out of five Salacia species recorded in Sri Lanka, conservation statuses of two Salacia species namely S. acuminatissima and S. chinensis have remained same as the previous conservation categories determined at national level (National red list 2012 of Sri Lanka) as Endangered (EN) and Near threatened (NT) respectively while S. diandra was upgraded to the category Critically Endangered (CR). The conservation statuses of other two Salacia species S. oblonga and S. reticulata were downgraded from Endangered (EN) to Near threatened (NT). The upgrading and downgrading of category is the result of new information about the geographical distribution of populations. The upgrading of S. diandra conservation status and downgrading of S. oblonga and S. reticulata conservation statuses are important outcome of the present study.

ACKNOWLEDGEMENT

Financial assistance of the Rajarata University research grant is greatly appreciated. Dr. H. K. Kadupitiya, Natural Resource Management Center, Peradeniya and Mrs. M. J. P. T. M. Jayasekara are appreciated for the guidance to prepare maps using Arc GIS software. Staff members of Botany and Zoology laboratories, Department of Biological sciences, Faculty of Applied Sciences, Rajarata University of Sri Lanka and staff members of Research laboratory, Department of Botany, Faculty of Science, University of Peradeniya are appreciated for continuous support given throughout the study. Staff members of National Herbarium, Royal Botanic Gardens, Peradeniya are also appreciated for their support. Family members are appreciated for giving support in field collection.

REFERENCES

Arunakumara, K.K.I.U. and Subasinghe, S. (2010) Salacia reticulate Wight: A review of Botany, Phytochemistry and Pharmacology. Tropical agricultural Research and Extension 13(2): 41-47.

Chawla A., Singh S. and Sharma A.K. (2013) Salacia oblonga Wall: A review on its Pharmacognostic, Phytochemical and Pharmacological aspects. International Journal of Research in Pharmaceutical and Biomedical Sciences 4(4): 1215-1228.

IUCN Standards and Petitions Subcommittee, 2017. Guidelines for using the IUCN Red List Categories and Criteria. Version 13. Prepared by the Standards and Petitions Subcommittee.

IUCN Standards and Petitions Subcommittee, 2012. Guidelines for using the IUCN Red List Categories and Criteria. Version 3.1. Prepared by the Standards and Petitions Subcommittee.

Kostermans, A.J.G.H. (1992), Salacia acuminatissima kosterm., spec. Nov. (celastr) from Sri Lanka, Reinwardtia, A journal on Taxonomic Botany Plant Sociology and Economy, Vol. 11, Part 1, pp. 53

Medagama, A.B. (2015) Salacia reticulata (Kothala himbutu) revisited; a missed opportunity to treat diabetes and obesity, Nutrition Journal.14:21.

MOE (2012). The National Red List 2012 of Sri Lanka. Conservation status of the Fauna and Flora, Ministry of Environment, Colombo, Sri Lanka 236 pp.

Musini, A. and Giri, A. (2015) Salacia. oblonga Wall.: An endangered plant of immense pharmaceutical value. Journal of Chemical and Pharmaceutical research 7(5): 1125-1129.

Paarkh, P.M., Patil, L.J. and Thanga, S.A. (2008) Genus Salacia: A comprehensive review. Journal of Natural remedies 8(2): 116-131.

Possingham, H.P., Andelman, S.J., Burgman, M.A., Medellin, R.A., Master, L.L., and David, A.K., (2002) Limits to The Use of Threatened Species Lists, Trends in Ecology and Evolution 17(11): 503-507.

Wadhwa, B.M. (1996) Hippocraeteaece In:Dassanayake M.D., W.D. Clayton (eds.) A Revised Handbook to the Flora of Ceylon, Amerind Publishing, New Delhi. 10:58pp.