



ISSN: 0975-833X

Available online at <http://www.journalera.com>

International Journal of Current Research  
Vol. 13, Issue, 02, pp.16410-16415, February, 2021

DOI: <https://doi.org/10.24941/ijcr.40850.02.2021>

INTERNATIONAL JOURNAL  
OF CURRENT RESEARCH

## RESEARCH ARTICLE

### EXTINCTION OF *LUVUNGA SCANDENS* (ROXB.) BUCH.-HAM. EX WIGHT & ARN. FROM THE ERSTWHILE UNDIVIDED DISTRICT OF BARDHAMAN IN WEST BENGAL, INDIA: A CASE STUDY

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#### ARTICLE INFO

##### Article History:

Received 07<sup>th</sup> November, 2020  
Received in revised form  
15<sup>th</sup> December, 2020  
Accepted 18<sup>th</sup> January, 2021  
Published online 28<sup>th</sup> February, 2021

##### Key Words:

Extinction, Native,  
*Luvungasacandens*, Erstwhile.

#### ABSTRACT

Extinction and invasion are two major crises of the current millennium which are antagonistic to the sustainable development of the phytodiversity of a region. A plant species may become endangered and eventually extinct when death rate exceeds regeneration rate for a prolonged period of time. The reasons may be natural or anthropogenic. However, now-a-days, anthropogenic activities have become globally prominent in causing extinction of many plant species of ecological and economic significance. Many plant species are facing tremendous pressure and are on the verge of extinction - either globally or locally. In the present paper, a humble effort has been made to present a case study establishing localized extinction of a native plant (Roxb.) Buch.-Ham. ex Wight & Arn. from the erstwhile undivided Bardhaman district of West Bengal in India within the last one hundred fifty years only. This study has been concluded with some recommended interventions for the sustainable conservation of the existing phytodiversity of the surveyed region but admitting that all threat assessments should be pooled to provide more data and broaden their scope for monitoring progress towards targets within the framework of the existing Global Strategy for Plant Conservation. Finally, some of the future scopes for research with respect to finding the causes of extinction of the taxon have been suggested.

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Citation: Kaustuv Bhattacharyya. 2021. "Extinction of *Luvunga scandens* (Roxb.) Buch.-Ham. ex Wight & Arn. from the erstwhile undivided district of Bardhaman in West Bengal, India: A Case Study", *International Journal of Current Research*, 13, (02), 16410-16415.

## INTRODUCTION

At the tenth Conference of the Parties to the Convention on Biological Diversity (CBD) it was widely accepted that the proposed 2010 Biodiversity target to significantly reduce the rate of biodiversity loss had not been met (Balmford *et al.*, 2005; Walpole *et al.*, 2009; Butchart *et al.*, 2010; Brummitt *et al.*, 2015). As a consequence, the Parties to the Convention responded by declaring a Decade of Biodiversity and Decision X/2 in particular - which sets out 20 new biodiversity targets (Tittensor *et al.*, 2014). In response to the Convention on Biological Diversity (aka CBD), a plant-specific program called the Global Strategy for Plant Conservation (aka GSPC) (Wyse Jackson and Kennedy, 2009), which was originally adopted in 2002 and renewed and updated in 2010 - has set sixteen targets for the conservation of plant species by the year 2020 (Paton and Lughadha, 2011). Of these sixteen targets, three GSPC targets i.e., Target 2, Target 7 and Target 8 - make specific reference to threatened plant species.

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GSPC Target 2 calls for assessment of the threat status of all known plant species, as far as possible, to guide conservation actions. GSPC Target 7 calls for at least 75% of known threatened plant species to be conserved *in situ* while GSPC Target 8 requires that at least 75% of threatened plant species are held in *ex situ* collections, preferably in the country of origin, with at least 20% available for recovery and restoration programs (Paton and Lughadha, 2011). Clearly gains towards GSPC Target 2 are required before progress towards GSPC Target 7 and GSPC Target 8 can be meaningfully measured and monitored. Hence, threatened species assessments are the central component of GSPC Target 2 (Wyse Jackson and Kennedy, 2009) which can provide an easily understood and qualitative estimate of extinction risk for different species (Possingham *et al.*, 2002). All threatened species assessments generate an evidence-informed assertion on the probability of decline of a particular taxon (Possingham *et al.*, 2002), a principle exemplified by the leading protocol for global evidence-based conservation assessment - the global IUCN Red List of Threatened Species (aka IUCN-RL). The IUCN-RL classifies species on a qualitative scale, as Threatened (Critically Endangered, Endangered, or Vulnerable), not threatened (Near Threatened or Least Concern), extinct (Extinct, Extinct in the Wild), or about which there is

insufficient information to categorize (Data Deficient). To be added to the published global IUCN Red List, species need to be evaluated against quantitative thresholds of the following criteria: (1) decline in population size, (2) small geographic range, (3) small population size plus decline, (4) very small population size, or (5) quantitative analysis (Mounce et al. 2018). The current millennium is experiencing a faster rate of extinction and alien species invasion is posing a major threat to the biodiversity of a region (Choudhury & Khan, 2010). Five mass extinctions that occurred in the past 500 million years caused over 50% species extinction (Myers, 1997). However, species are currently exposed into the opening phase of a sixth mass extinction (Myers, 1993) which is predicted to be human impacted (Eldredge, 2008). Unprecedented human impact affected the speciation process creating a major threat to biodiversity which is being severely pressured through the removal of contiguous related biotic habitats (Erwin, 1991).

Plants are extremely important for conservation of biodiversity both from ecological and human economics view point. However, plant diversity is facing tremendous threat mainly because of unsustainable harvesting for their multifarious utilization and habitat degradation as mentioned before. According to the World Conservation and Monitoring Centre (aka WCMC), it is estimated that more than 8000 tree species are endangered worldwide. However, another estimate predicts this between 22 and 47 percent of the world's plants (Graham, 2002). The rate of extinction is also approximated to be very fast and it is estimated that around 1800 populations are being destroyed per hour (16 million annually) in tropical forests alone (Hughes et al., 1997). Extinction of seed plants is occurring at a faster rate than the normal turnover of species. However, the average extinction lag time is thought to be longer for plants than for animals, and thousands of living plant species are thought to be functionally extinct (Cronk, 2016). This is consistent with the rediscovered species having high extinction risk with several being known from only a few surviving individuals. Therefore, globally estimated extinction rate for plants is likely to prove an underestimate of ongoing extinction of plant diversity (Humphreys et al., 2019).

Therefore, one of the most pressing issues of biological research nowadays is to document, explain and project biodiversity changes under increasing human impact and climatic changes (Myer, 2012). An essential drawback for this task is the lack of appropriate data. Species diversity is an important concept and one of the major attributes of a natural community. Floristic inventory and diversity studies help to understand the species composition and diversity status of an area and offer vital information for their conservation (Kochhar, 1998 & 2001). Hence, a basic understanding of the species diversity through periodic plant-inventorisation of a particular region is important for assessing the complexity and sustainability of the entire ecosystem of that region. Now, due to increasing human population over the years, the biotic pressure on regional vegetation of the erstwhile undivided Bardhaman district has been well documented. The uncontrolled burning of ground vegetation, livestock grazing and harvesting of ground vegetation for forage and rapid rate of urbanization are some of the factors responsible for over exploitation of plants globally [Prescott-Allen & Prescott-Allen, 1990]. Erstwhile Bardhaman district has not been an exception!

However, the region has been blessed by the visits of many legendary botanists – starting from Victor Jacquemont (1835), Sir J.D. Hooker (1848), M.P. Edgeworth (1849) and many famous Indian plant Taxonomists. The establishment of the Botany Department of the Burdwan University in Bardhaman town in 1964, along with other related departments, has boosted the floristic studies in this region and numerous contributions on the flora of the erstwhile undivided district of Bardhaman can be traced from the published literature [Mukherjee S.K. & Bhattacharyya P.K. (1970); Ghosh et al. (1971); Adhikary & Chatterjee (1972); Bhattacharyya P.K. (1974, 1978, 1985, 1986); Adhikary (1978); Namhata et al. (1990); Mondal & Mandal (1994); Bhattacharyya Kamal & Mukherjee (1998), Bhattacharyya Kamal & Palit (2000); Das et al. (2004); Hotwani et al. (2005, 2008)]. But these accounts dealt either with the flora of certain specialized groups, families or genera or had been mainly restricted to the Burdwan University campus or, certain microclimatic zones in a very sporadic manner. Very little or no emphasis were given in these documents to map the extinction of plants from the region in modern era. Thus, the extinct plant profile of the region even for the last few hundred years - especially for the angiosperms, has remained unattended so far.

In this context, the present case study has been conducted to assess the present extinction threat status of the medicinally important (Khare, 2008) plant *Luvunga scandens* (Roxb.) Buch.-Ham. ex Wight & Arn. (Bengali: *Lavanga-lata*) from the erstwhile undivided district of Bardhaman as per the IUCN Red List Categories as this plant was last documented from this region only about hundred fifty years back! This can be ascertained from the 'GLOSSARY OF INDIAN TERMS' [pages: 377 - 383] of the very famous book '*Govinda Samanta or The History of a Bengal Raiyat*' (later renamed as '*Bengal Peasant Life*') written by the Rev. Lal Behari Day (1874) where he enumerated thirty-five different plant species along with this taxon. Though, one can also find the mention of this medicinal plant even in the Third Song of the Part One of *Gita Govinda* (Sanskrit: *G tagovinda*) composed by the Hindu poet Jayadeva (as mentioned by Tripathy & Tripathy, 2006) who was attached to the Bengali court of King Lakshmana Sena during the late 12<sup>th</sup> century AD! However, in recent times, the plant has been reported only from the 24 - Parganas (Sunderbans) in West Bengal (Botanical Survey of India, 1997). In this backdrop, the following objectives were fixed for conducting the present study.

## OBJECTIVES

The principal objectives behind this entire study were

- To scan for the plants described in Rev Lal Behari Day's *Bengal Peasant's Life* for their present-day existence in the erstwhile undivided Bardhaman district with special reference to *Luvunga scandens*;
- To suggest some management strategies for conservation of phytodiversity of the district; and
- To discuss some future scopes of research for sustainable development of the plant wealth of the district.

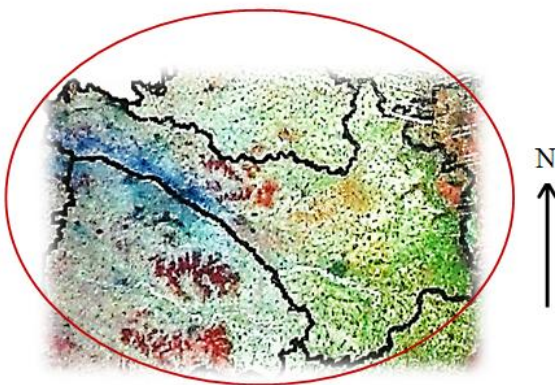
## MATERIALS AND METHODS

Here, a hitherto unpublished case study regarding the Threat Assessment of *Luvunga scandens* in the erstwhile undivided

district of Bardhaman as per the IUCN Red List Categories has been documented based on relevant literature review being complemented by the frequent field surveys by the author from 2011 to 2016.

### Study Sites

The erstwhile undivided Bardhaman district extended from 23°53' to 22°56' North latitudes and from 88°25' to 86°48' East longitudes. The maximum length of the district, from east to west was 208 kms, while the maximum breadth from north to south was 112 kms. Average altitude of the undivided district was 40 m. / 131 ft. above the sea-level. Thus, in shape, the referred geopolitical area – resembled a hammer. There existed a wide temperature range from 4°C to 49°C in the region throughout the year. Different types of soil could be encountered in different topographical, biological and hydrological as well as geological conditions within the district.



**Figure 1. A GIS map of the erstwhile undivided district of Bardhaman [source: Forest Department, Govt. of West Bengal]**

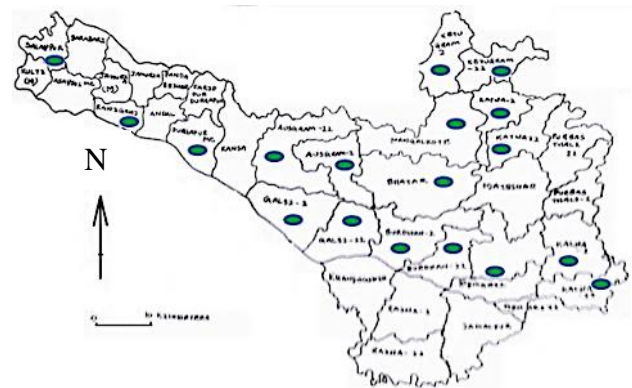
On the basis of the review of the published literature related to the phytodiversity of the district of Bardhaman, as mentioned before, along with the consideration of the Remote Sensing studies [Gupta *et al* (2007)] - field surveys were conducted in the region. Considering the Remote Sensing image of the erstwhile undivided Bardhaman district, available to the author [vide the encircled portion in the Figure – 1], along with the critical review of the relevant literature cited before - 18 blocks were purposively selected [vide Figure -2] out of the 31 blocks of the then undivided district. Those blocks were Ausgram - I, Ausgram - II, Bhatar, Burdwan - I, Burdwan-II, Durgapur, Galsi-I, Galsi-II, Kalna –I, Kalna –II, Katwa-I, Katwa-II, Ketugram-I, Ketugram-II, Memari, Mongalkote, Raniganj and Salanpur.


### Field survey methods for Rapid Threat Assessment

Routine procedures were followed for conducting the field surveys necessary for the study. Several excursions were undertaken to cover the study sites indifferent seasons so as to collect relevant data from the field. After developing a good rapport with the native people of the district - gathering necessary information from them was easier.

Rapid Assessment of Threat to the medicinal plant *L. scandens* for the localized region was done as to its degree of endangerment based on the estimates of the threats to its population assessed according to the IUCN Red List Criteria. Specialists like Plant Taxonomists, Scientists from the Botanical Survey of India and Forest Officials were also approached for their independent rapid threat assessment of

this particular plant species at the erstwhile undivided Bardhaman district and to validate the finding from this study.



**Figure – 2. A map of the Bardhaman district showing the different study sites marked as** 

### Plant characterization

The taxon of interest i.e., *Luvunga scandens* as mentioned in the book *Bengal Peasant's Life* by Rev. Lal Behari Day (1874) as 'Lavanga-lata' [= *Limonia scandens* i.e., the then recognized scientific name for the plant], was characterised with the help of available literature like – different published floras [Hooker (1872 – 1907, 1907); Prain (1903)] and was later confirmed in the Central National Herbarium i.e., CNH of the Botanical Survey of India at Howrah (CAL). While dealing with the nomenclature of the plant specimen – significant help has been obtained from the official websites of International Plant Name Index as <http://www.ipni.org/> - and The Plant List [Version 1.1] as <http://www.theplantlist.org/> - for determination of the validity of the plant name. Correct name has been checked for the plant from Bennet (1987) and also from Mabberley's Plant Book [Mabberley (2008)]. Author citation for the plant has also been confirmed by consulting Author of Plant Names [Brummitt R.K. & Powell C.E. (1992)]. Major changes made to the Rules for nomenclature of angiosperms at the International Botanical Congress in Melbourne, Australia (McNeill & Turland, 2011) and also at the International Botanical Congress in Shenzhen, China (Turland, 2019) have also been considered.

### RESULTS AND DISCUSSION

The extensive and intensive floristic surveys already conducted for the region as put forward so far in different related literature, in turn, has pointed out the gradual changes of the plant wealth there. Considering the reviewed literature, after conducting this case study, it is being asserted here that as per the IUCN Red List Categories, at present *Luvunga scandens* has become an Extinct plant from the geopolitically demarcated region of the erstwhile undivided district of Bardhaman. But the plant is presently being considered as a Critically Endangered plant under the Threatened category in the global context while being distributed only in India, Laos, Vietnam and Thailand. From the database of the Foundation for Revitalisation of Local Health Traditions Trust i.e., FRLHT, Bangalore- it has been found that within India, *L. scandens* has been recorded in the evergreen forests up to 1500 m. in Assam and Meghalaya. However, during the present case study, all the other plants as enlisted from the same region by

Rev. Lal Behari Day in his book *Bengal Peasant's Life* have been found to be existing naturally in the surveyed region.

## DISCUSSION AND CONCLUSION

### *Importance of the present study*

Under extensive disturbance - species diversity normally declines, but moderate disturbance can enhance or reduce it depending on the spatial scale and types of species. Hence, understanding the relationship between disturbance and species diversity is fundamental during the setting of a platform regarding future research for sustainable development policy of any region. An increasing interest in understanding the community structure and ecosystem stability has given rise to the need to prepare plant inventories of regions as it has been found that vegetation plays a key role in regulating climate, conserving biodiversity and providing livelihood to the people of a particular region. The land of erstwhile undivided Bardhaman district has given shelter to the cosmopolitan and comparatively younger (in other words, comparatively more evolved) plant species. The entry of several migrant species from surrounding countries and/or regions, and their naturalisation has added richness to the flora and vegetation of the region. However, extinctions of plant species are also happening in this region – perhaps in an alarming rate! This phenomenon, observed and ascertained through this case study, has some greater implications e.g., it sheds light on the pressure of extinction on the existing plant species of the region that are directly dependent on the floristic composition there. It is presumed that changes in the landscape, distribution of water and mineral resources, slopes, soil types etc. may be having this corrosive effect on the phytodiversity of the region though further in-depth studies are required to confirm this presumption. Hence, the result of the present study is believed to initiate awareness both among the academicians as well as common people that can be helpful in ensuring biodiversity conservation and usher future researches for sustainable development of the phytodiversity of the region.

### *Suggested management strategies for conservation of the phytodiversity of the erstwhile undivided district of Bardhaman*

Ecological factors like - soil types, heterogeneity in resources, slopes etc. affect the sustenance and diversity of the plant species of any region. Again, rapid rate of urbanization, along with population explosion, is a serious threat to the conservation of plant species of any region. Hence, a clear understanding of the ecological and economic values of each of the plant species is essential. On the other hand, growth of invasive species adversely affect the growth of desirable plants for which integrated control processes are sought. But, conservation of plant communities cannot be a mutually exclusive phenomenon as the conservation of the regional fauna demands equal weightage. Thus, a PPP [i.e., Private-public partnership] model for conservation of the entire biodiversity of a region might become the best solution to the problem of plant species extinction over the temporal scale of an area. Finally, some management strategies to protect the plant wealth of the region may be suggested, which, if implemented properly, may aid in the strategic planning for survival and sustainable development of the existing

phytodiversity as well as the inhabitants of that region [Ines L. Lopez-Doriga, 2011; Xu *et al.*, 2004].

In this noble motto, drawings of at least traditionally useful and over-exploited plant species, at their seedling stages, may become very useful for common people for their desired discrimination at the field level from apparently similar unwanted plants and/or weeds. The more these drawings and associated short descriptions are realisable by the common people - the more will be their involvement in the conservation of these species. Apart from these, periodic surveys of gross phytodiversity of the region using GIS techniques may turn out to be an important tool for sustainable plant conservation there. Interestingly, most people can name a mammal or bird that has become extinct in recent centuries, but few can name a recently extinct plant. Many plant species have become extinct, at a higher rate than background extinction, but almost as many have been erroneously declared extinct and then been rediscovered. However, it has been documented that reports of extinction on islands, in the tropics and of shrubs, trees or species with narrow ranges are least likely to be refuted by rediscovery (Humphreys *et al.*, 2019). Plant extinctions endanger other organisms, ecosystems and human well-being, and must be understood for effective conservation planning leading to sustainable development in future.

Finally, if not acted upon at once, the somewhat unique phytodiversity of the erstwhile undivided district of Bardhaman will be decreased further. This will surely have imminent adverse effects in the phytodiversities of the adjoining districts of West Bengal as well. Therefore, unless urgent actions are taken to reverse current trends, a wide range of services derived from ecosystems, underpinned by biodiversity, could rapidly be lost. While the harshest impacts will fall on the poor, thereby undermining efforts to achieve the United Nations Sustainable Development Goals (aka SDGs), no-one will be immune from the impacts of the loss of this biodiversity.

## ACKNOWLEDGEMENTS

The author is grateful to the native people of the erstwhile undivided district of Bardhaman for providing all the necessary helps along with all the authors whose published literature were instrumental in providing the relevant data to conduct this study. The author also gratefully acknowledges the help rendered by Prof. (Dr.) Amit Kumar Bhattacharjee, an eminent scholar of Sanskrit who is presently shouldering the responsibility of the Controller of Examinations, The West Bengal University of Teachers' Training, Education Planning and Administration, for providing the relevant reference from the *Gita Govinda* amidst his very busy schedule.

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