

Less-known leafy vegetable “Lapha” (Malva L.; family Malvaceae) in India and study on genetic resources

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Research Article

Keywords: Exploration, Genetic Resources, Lapha, Wild leafy vegetable,

Posted Date: March 29th, 2023

DOI: <https://doi.org/10.21203/rs.3.rs-2722323/v1>

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Abstract

During survey, exploration and germplasm collection in parts of Eastern India and National Capital Region of Delhi, mainly Haryana state of India, the authors came to know that two species of *Malva* locally known as “lapha” being used as a green leafy vegetable in the surveyed areas. Published literature refers same local name and use of *Malva parviflora*. The critical morphological study of the taxa has delineated two taxa as *Malva parviflora* L and *M. verticillata* L, former is a weed of wastelands whereas the latter is grown as vegetable in some parts of Assam, Bihar and West Bengal. *M. verticillata* is preferred most by locals due to its easy-to-cultivate nature and having high nutritive/therapeutic value, which indicates it's potential to cultivate during the lean period in those areas where few greens are grown. In the present paper, detailed study on botanical characters, range of distribution and method of utilization of both the taxa in the Indian region has been discussed. The current studies further demonstrated that allied species with similar use and taste are identified as a substitute.

Introduction

Wild edible plants (WEPs) have high acceptability among a large section of the population mainly tribals and rural communities ensure food and nutritional security hence constitute a significant part of their diet. Indian region has substantial diversity of about 300 wild species of vegetables (Arora and Pandey, 1996). It is estimated that 1,403 wild plant species belonging to 184 families are consumed across the country (Ray et al. 2020). Assessment of the diversity of wild edible plant resources on the use pattern indicated that the leafy shoots (722 species) and fruits (652 species) are the two most consumable edible plant parts (Ray et al. 2020). Among the list of over 500 wild annuals/perennials reported from India, majority of leafy vegetables belongs to plant families include Amaranthaceae, Araceae, Asteraceae, Chenopodiaceae, Convolvulaceae, Fabaceae, Malvaceae, Nymphaeaceae and Polygonaceae (Pandey et al. 2019). Malvaceae has been listed among the significant wild economic potential families to contribute towards cultivated taxa (de Oliveira et al. 2019; Ray et al. 2020). Genus *Malva* L. that belongs the species occur as weed, used for consumption, aesthetic and therapeutic potential across many parts of the globe. *M. verticillata* was one of the earliest domesticated crops in China and remained under cultivation for well over 2,500 years (Facciola, 1990). In India, its six taxa (including 05 species and 01 variety) namely, *Malva ambigua*, *M. neglecta*, *M. parviflora*, *M. sylvestris* and *M. verticillata* are distributed in the wide range of climatic zones (Pramanick et al. 2020).

Uses of these taxa as pot-herb and fodder (*M. verticillata* and *M. parviflora*), or used as medicinal (*M. pusilla* and *M. sylvestris*) are well known because these are nutritionally rich in calcium, iron and carotene. Ahmedullah and Sanjappa (2008) reported that seeds of *M. parviflora* contain 18% fatty oil and seeds of *M. neglecta* yields 7–8% fatty oil.

M. verticillata is an easily growing species, succeeding in ordinary garden soil. It is often found as a weed in its native range, escaped from cultivation (especially in the form of var. *crispa* L.) in temperate and tropical regions worldwide, and has become an invasive weed in N. America, and is also widespread in

tropical east Africa. Seeds of *M. verticillata* are sweet, astringent, with healing property used in Tibetan medicine, for treatment of renal disorders, the retention of fluids, frequent thirst and diarrhea. The roots are used in treatment of whooping cough; while leaves and stems are said to be digestive and are considered good in the advanced stages of pregnancy. It is sometimes also grown as an ornamental in gardens. The fibre obtained from the stem is supposed to be strong substitute for jute in cordage production.

M. verticillata var. *verticillata* is considered as a native to eastern Asia to southern Asia, particularly in China. The species has a long history of cultivation and used as a vegetable, salad, and in oldest traditional medicine in south-east Asia, China; and as fodder in Europe. It differs from *M. verticillata* var. *crispa* L. due to its flatter leaf blades and shorter stems; mostly grown by the eastern Asian immigrants as vegetable in home garden. Variety *crispa* however is more widely cultivated as salads and commonly observed as an escape or naturalized species.

Uphof et al. (2001) reported the leaves of *M. sylvestris* are used as substitute for tea and young shoots of *M. verticillata* are consumed as vegetable. Nayar et al, (1994) reported the leaves of *M. sylvestris* eaten as vegetable. Locally called “sonchal” or “swatsal” (*M. sylvestris*) is greatly relished by locals of Kashmir and Himachal Pradesh (Malik et al. 2021). *M. verticillata* var. *verticillata* used as a vegetable in Jammu and Kashmir, Arunachal Pradesh (Pradheep et al. 2014). Seedlings and tender shoots of *M. verticillata* are boiled and pickled in temperate regions (Lin LJ et al. 2009)

The present paper reports information on the potential of the less-known leafy vegetable, *M. verticillata* and *M. parviflora* in the area of study. The study was aimed to document 1) distributional range, cultivation potential and possibly selection of desired types; and 2) confirming use of *M. parviflora* as leafy type through sensory evaluation study. Additionally, comparative study on botanical characters with identification key is also discussed.

Materials And Methods

Multiple field trips and surveys were conducted as per the National exploration plan 2020-21, 2021-22 & 2022-23 during the months of October-November and January-April for collecting germplasm in the parts of Araria, Kishanganj, Madhepura, Saharsa and Supaul districts of Bihar; Cachar (Assam), Uttar Dinajpur districts (West Bengal) and Jhajjar district of Haryana/NCR of Delhi. Local mandi/markets, kitchen gardens and backyards/homesteads were also surveyed thoroughly in the areas of study to know the domestication status and frequency of use. The diversity and distribution of these two taxa across the areas of study and methods of use by the communities were also recorded.

Knowledgeable and elder persons (family /village headman and village Panchayat secretary) were interacted and information on cultivation practices, parts used, market price, vernacular name, methods of selection of species, preparation and consumption was recorded using a structured/ semi-structured questionnaire through recorded information and validated through repeated interaction. Before initiating discussion, prior consent from the informants was taken and the purpose of study was also explained

and subsequently the informants were asked to share their knowledge on the traditional use of taxa. To authenticate information as well as to know the new uses, the recorded data were compared with already published literature/reports/research articles, etc (Wealth of India, CSIR, 1976). The herbarium specimens were deposited in the repository of National Herbarium of Cultivated Plants (NHCP), ICAR-NBPGR, New Delhi after assigning HS number to *M. parviflora*- (HS12606); and *M. verticillata*- (HS25248, 25290). DIVA-GIS software version 7.5, freely downloadable software from www.diva-gis.org was used to generate the potential distribution map.

Results And Discussion

Distribution and site of collection

Arora and Nayar (1984) has reported distribution of three species, among these *M. sylvestris* L. is found in western Himalaya at the altitude of 2400 m, while occurs as a weed in Bihar and Deccan plateau; *M. verticillata* L. grows up to altitude 3000 m in the temperate Himalaya and also found in West Bengal, Assam and Nilgiris. Occurrence of *M. sylvestris* is reported from Kashmir to Kumaon and consumed as pot-herb (Arora and Pandey, 1996).

M. parviflora occurs world-wide including India as a weed; which grows in rich humid and nutrient rich soils with luxuriant leafy growth, softer plant types as compared to plants grown in poorly irrigated land where early maturity and occurrence of rare common features fibrous plants (Hanelt, 2001).

Malva verticillata var. *crispa* is an age old cultigen of Chinese origin, introduced in Japan and elsewhere where its green and red pigmented types are used for soup, garnishing and as pot-herb ((Arora and Prasad, 1976; Arora, 2014). Rana et al. (2012) have reported its occurrence from 700–1000 m in cold arid region of Himalaya, locally preferred for medicinal and food purposes. Pradheep et al. (2019) have also reported its occurrence in Nagaland, being used as leafy types by the tribal.

Germplasm conserved in National gene bank and Grid map generated through DIVA-GIS for floristic study of *M. verticillata*, indicated that this species is mainly confined to north eastern, Indo-gangetic plains and western Himalayan region of India. Whereas *M. parviflora* is distributed (grid maps) in Central, West and South India.

Sensory evaluation: a tool to identify food value

Interaction with local people (42) and vendors (5) has confirmed that the knowledge on method of use of leaves and preparation of dish might have inherited from traditional culture, which the ancestor hold since long past.

It has been observed that use and taste of many wild edible species have prompted locals to switch over to newer plant based products. Such kind of trial and error practice have been commonly observed in several cases during study on wild taxa (Pandey et al. 2019). *M. verticillata*, locally known as “lapha” in Bihar and West Bengal is grown in kitchen garden and also sold in the local markets (Fig. 2). Due to

morphological resemblance of *M. parviflora* with *M. verticillata* as well as similarity in taste and use (only when used as salad and vegetable), migrants from Bihar used to harvest the same from wild for consumption, sale in the markets of Delhi (Fig. 2).

For sensory evaluation, harvested leaves of 15, 30 and 45 days old plants were subjected to assessment at different stages as salad (15–20 days old; mild soft with crunchy taste), vegetable (20–30 days old; mucilaginous taste after cooking) and full maturity stage (30–45 days old; fibrous, rough feel). At salad stage, 90 per cent participants compared the taste either with common spinach (*Spinacea oleracea/Beta vulgaris* var. *benghalense*) or with leafy choulai (*Amaranthus tricolor*) and scored its high acceptability. While at vegetable stage, 99 per cent of the participants accepted the taste like *choulai* but only one per cent did not like it because they compared it with common choulai having crunchiness and mild sour taste (after cooking for mucilage), but remaining identified it as intermediate of desi palak and choulai or poi (*Basella rubra*). As compared to raw leaves, 90 per cent accepted the cooked form and only 10 per cent favoured for its potential use if added with some value. Comparative study of morphological characters of *Malva* species and organoleptic test carried out, revealed that it is closer to cultivated taxa (*M. verticillata*) at young stage.

Botany, cultivation and use

M. parviflora generally annual herb, ascending or prostrate and procumbent, spreading 90 cm high; stems branched at base, pubescent with scattered patent simple and stellate hairs, ultimately glabrescent where as *M. verticillata* is annual or perennial herb grows upto 30–150 cm high; stems slender with simple and stellate hairs, ultimately glabrescent. In the former, leaves are round to broadly reniform and unlobed, stipules persistent and orbicular, cordate at base, stipules slightly falcate, papery lanceolate to ovate in the later. Peduncle to spike length is thrice the length in *M. verticillata* while compared to *M. parviflora*. Pale lilac- whitish with lavender-pink in *M. parviflora* and white and slightly pinkish in the tip region. Corolla is reticulate veined in the former and densely stellate pubescent, free nearly to the middle in later.

M. parviflora is considered as weed, cooked as greens in many parts of the world. Critical scrutiny of literature revealed that the common name 'lapha' was also denoted to many other species of *Malva*. There is no published record of cultivation and consumption of 'lapha' as well as sale in market in India (Ambasta et al. 1986; Arora and Prasad 1976; Zeven and de Wet 1982), except, Arora and Pandey (1996) who have mentioned the use of this species as leafy vegetable in India.

Key to species (cultivated) of *Malva* in India

Stem erect and mericarps gently or slightly reticulated with pale lilac to whitish with lavender-pink tips petals in case of *M. verticillata* and with pink-purple petals in *M. sylvestris* whereas prostrate-procumbent stem and extremely reticulate with slight winged projections mericarps were observed in *M. parviflora*.

'Lapha'- a potential vegetable genetic resource

In India, *M. verticillata* primarily occurs in wild, however, some peoples are also cultivating it in kitchen garden for household consumption mainly in parts of Araria, Kishanganj and Sapaul districts of Bihar state (NGB Database, 2022). Sowing of 'Lapha' in Bihar is mainly done in the end of September and beginning of October while first picking/harvesting of leaves is done from one month old plant for supply in the local markets. Like most of the wild edible plants, selling of "lapha" in local markets is also done directly by vendors (Fig. 2). As per interaction with the sellers/retailers, now at present almost a threefold increase has been observed in price from last three decades. Currently, cost of one kg fresh leaves is 70 INR in markets of towns and cities of area surveyed whereas, in other areas, costs recorded was \$1.4–2.8 (40–50 INR). Seeds were selling @ 150–200 INR per kg in local market. Lucrative prices of the produce were obtained during the beginning (first fortnight of February) and end of harvest season.

Young shoots and leaves of *M. parviflora* locally known as "firki" in the parts of Haryana (Badli in Jhajjar district) are fed to mulching animals. In local market of JJ Colony, Inderpuri, Central Delhi "lapha" was being sold only by residents from Bihar as a substitute considering it the same leafy vegetable which is growing in Bihar. Some consumers are considering it as a newer cultivar of lapha hence purchasing from the market. It was also observed that a lady vendor from Mujjafarpur, Bihar harvested its leaves from wheat fields of IARI, New Delhi and sold @ 20–30 INR per kg.

Conclusions

High storage life, no pest damage, easiness-to-propagate through seeds, adoption by locals as leafy vegetable as well as having therapeutic value make "lapha" a remunerative potential crop in parts of Bihar and West Bengal. Developing package of good cultivation practices, selection of desired genotypes for developing varieties, adding value, validating its medicinal properties and its popularization at large scale are some of the challenges for the researchers and breeders. Collecting germplasm from diverse areas/habitats (field/homestead/wild) and evaluating them for desired traits can be taken into consideration as future research priorities.

Keeping in view the economic importance of 'lapha' and better adaptability to drought conditions especially when there is limited supply of leafy vegetables in the early summer season; emphasis needs to be given on the followings:

- Fine grid survey, collection and conservation of germplasm from areas of occurrence (Delhi, Haryana, Rajasthan) of both the types/species
- Evaluation for nutritional, biotic (diseases) and abiotic (drought resistance) traits
- value addition
- Package and practices of cultivation

In the present paper findings are presented based on availability of limited quantity of material and area of study and thus need further investigation on taxonomic identity using large sample size. To best of our

knowledge, '*lapha*' is neither seen under cultivation in the area mentioned above nor reported from the neighboring areas of the country.

Declarations

Acknowledgements Authors express their sincere thanks to the Director, ICAR-NBPGR, New Delhi and Head, Division of Plant Exploration and Germplasm Collection, ICAR-NBPGR, New Delhi for allowing the team to undertake explorations and preliminary study. Sincere thanks are also due to the local people for surveys and for sharing their ethno-botanical knowledge and use practices, particularly in Issapur village (Delhi), Kishanganj and Saharsa (Bihar). The help provided by the curators of various herbaria for sharing the facility and Ms. Rita Gupta for all help.

Compliance with ethical standards

Conflict of interest: the authors declare that they have no conflict of interest on the content of manuscript and study undertaken.

Research involving human participants and informed consent: a clear expression of consent was obtained from the farmers/ informants who participated in discussion and provided feedback on elaborating the purpose of research study; they provided information on undertaking data on knowledge resource.

Funding: Study was conducted by using the institutional funding resources from ICAR-NBPGR, New Delhi.

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Figures

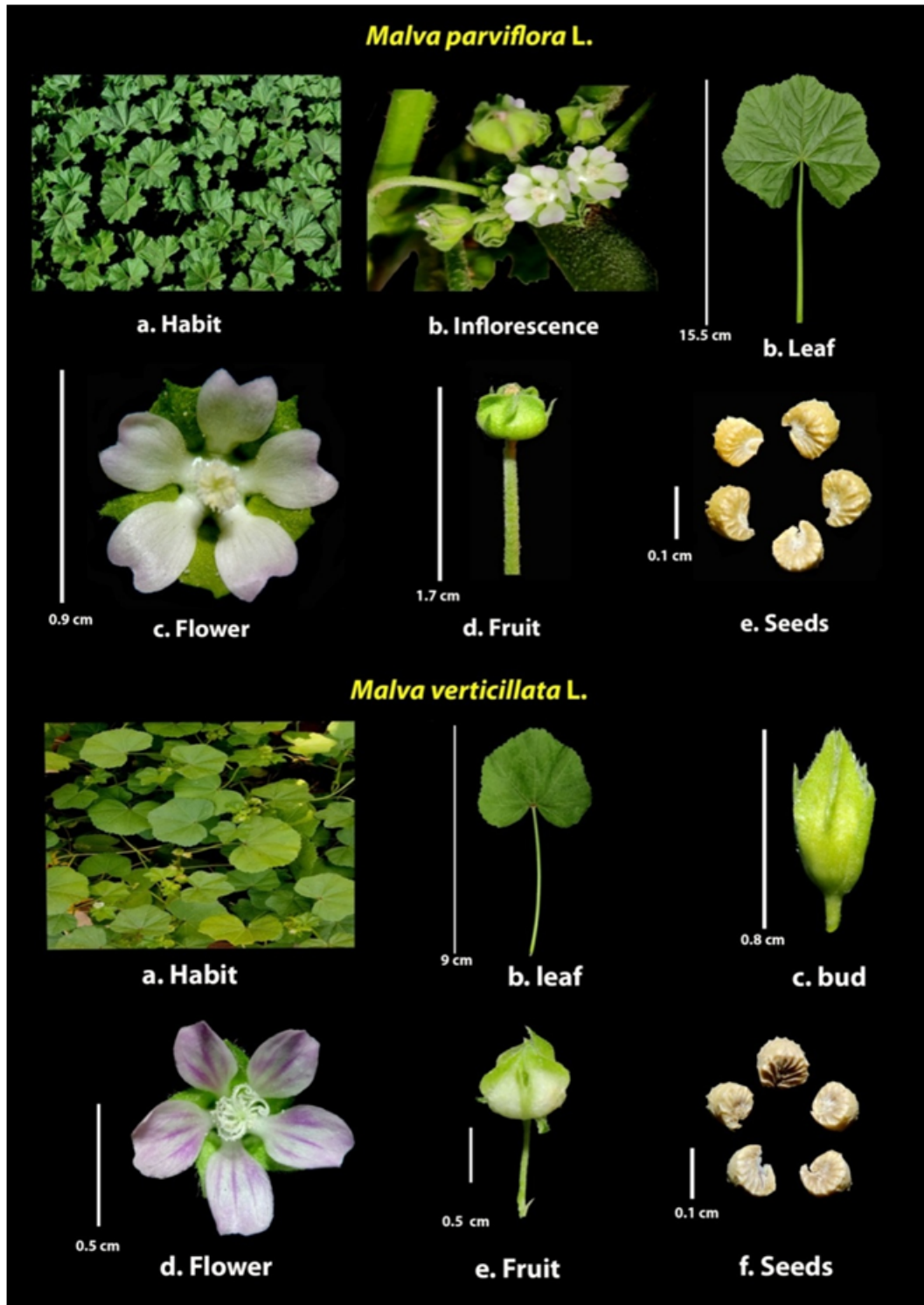


Figure 1

Botanical features of *Malva verticillata* L. and *M. parviflora* L.



Figure 2

(A&B) Selling and growing of *Malva verticillata* in Kishanganj, Bihar; 2 (C) Selling of *M. parviflora* in the local market of Inderpuri, Central Delhi 2(D) *M. parviflora* growing luxuriantly in the farm fields.

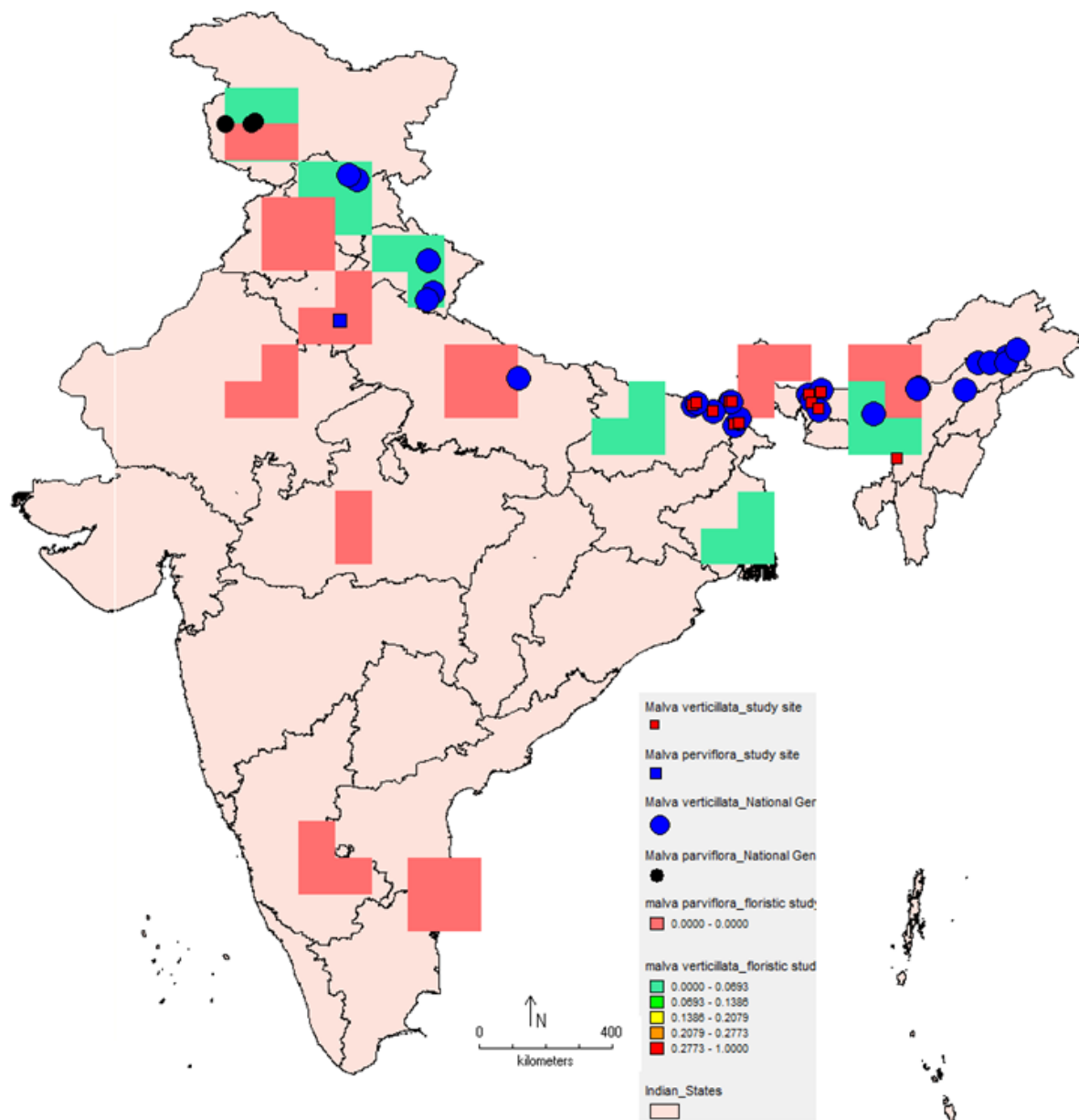


Figure 3

Distribution of *M. verticillata* and *M. parviflora* in India; gene bank accessions (shown by blue circle- *M. verticillata*; black circle- *M. parviflora*); study site (shown by red and blue rectangle) and floristic study (Pink and green rectangles grids)