



Research article

## Floristic assessment of different habitats of Parvati Aranga wildlife sanctuary and adjacent Tikri forest area, Gonda, Uttar Pradesh, India

Vineet Singh<sup>1\*</sup>, S. K. Srivastava<sup>2</sup> and L. M. Tewari<sup>3</sup>

<sup>1\*</sup>Botanical Survey of India, Central Regional Centre, Allahabad, Uttar Pradesh, India

<sup>2</sup>Botanical Survey of India, Northern Regional Centre, Dehradun, Uttarakhand, India

<sup>3</sup>Department of Botany, DSB Campus, Kumaon University, Nainital, Uttarakhand, India

\*Corresponding Author: [vineet.singh332@gmail.com](mailto:vineet.singh332@gmail.com)

[Accepted: 20 October 2016]

**Abstract:** The Parvati Aranga wildlife sanctuary and adjoining Tikri reserve forest in north-eastern Terai region of Uttar Pradesh with its varied ecological habitats and occurrence of patchy wetlands in form of 'River' and 'Tals' sustains a variety of plant communities. The area also harbours a rich diversity of economical and medicinal plant species, mainly confined to the peripheral region of the forest. A large component of the forest is occupied by diverse forest stands and a number of special habitats portray remarkable vegetational diversity. The present communication reveals that the plant community with special habitat especially in protected and reserve forest area may play a vital role in the future sustenance of the forest vegetation. Rarity and regeneration pattern of the flora is also discussed.

**Keywords:** Plant community - Special habitats - Terai region.

[Cite as: Singh V, Srivastava SK & Tewari LM (2016) Floristic assessment of different habitats of Parvati Aranga wildlife sanctuary and adjacent Tikri forest area, Gonda, Uttar Pradesh, India. *Tropical Plant Research* 3(3): 543–550]

### INTRODUCTION

The comprehension of relationship between plants and environmental factors can be used as an indicator of environment, in this context a number of plants species used as ecological indicators. In a plant community some plants are dominant and found in abundance, these are important markers because they bear full impact of surroundings. In general, plant communities are better indicators than individual plants and are used to determine the types of soil and other conditions of the environment in a given area. Sometimes these also indicate past or future conditions of the environment. Community structure and composition with special habitats immensely affects the plant diversity pattern in any forest area in terms of the sustenance of a particular community.

Forest composition, community structure and diversity pattern are important ecological attributes significantly correlated with prevailing environmental as well as anthropogenic variables (Gairola *et al.* 2008). The region free from anthropogenic disturbances continues to provide a platform for the microhabitats for an array of local floral elements. Wildlife protected areas in India have had a relatively long history of forest management and exploitation as majority of these areas were originally reserved or other categories of government owned forests where focus on management was timber production, meeting the biomass demands of local communities or soil or water conservation (Rodgers & Sawarkar 1988). The special habitats of any forest play a key role for the state of natural or reserve forest in the area and to suggest conservation measures for the concerned elements.

The Terai expanse of eastern Uttar Pradesh is an assortment of human settlement, cultivation fields, natural and semi-natural vegetations comprising of grasslands and forests. In this area most of the primary forests have been substituted by economically and commercially important plants particularly tree species and agricultural fields (Bajpai *et al.* 2012a). This landscape is listed among the important ecoregions of the world, well known

for its unique biodiversity and productivity (Tripathi & Singh 2009). The region is an ecotone between bhabar tract of foot hills of Himalayas and the Gangetic plains (Bajpai *et al.* 2015a). Several authors have dealt with the vegetation of Terai region of the state (Panigrahi *et al.* 1969, Maliya 2007, Bajpai *et al.* 2015a, Kumar *et al.* 2015) and recently some authors also explored the ecological parameters of some forests of the region (Pandey & Shukla 2003, Chauhan *et al.* 2008, Behera *et al.* 2012, Bajpai *et al.* 2012b, Bajpai *et al.* 2015b). However the baseline data related to typical vegetation community of the Parvati Aranga wildlife sanctuary (PAWS) has not been documented yet. Thus, this communication deals with the species composition and indicator taxa with special habitats of PAWS.

## MATERIALS AND METHODS

### *The Study Area, biota and Climate*

The study was conducted in Parvati Aranga wildlife Sanctuary (PAWS) and adjacent Tikri forest area at a  $26^{\circ} 48' - 27^{\circ} N$  longitude and  $81^{\circ} 37' - 82^{\circ} 37' E$  latitude located in Gonda district of north-east Uttar Pradesh (Fig. 1). It is established in 1990, spread over an area of  $10 \text{ km}^2$  of total  $80 \text{ km}^2$  area and remaining  $70 \text{ km}^2$  is of the reserve forest area characterized by typical terai landscape. The sanctuary harbours a rich floral and faunal diversity and is the home for many rare and migratory avifaunas (Singh 2015). The reserve forest is dominated by *Shorea robusta* as climax species along with other tree species *viz.* *Haldina cordifolia* (Roxb.) Ridsdale, *Syzygium cumini* (L.) Skeels, *S. salicifolium* (Wight) J. Graham, *Tectona grandis* L.f., *Acacia catechu* (L.f.) Willd., *Streblus asper* Lour., *Aegle marmelos* (L.) Correa, *Madhuca longifolia* (J. Koenig ex L.) J. F. Macbr., *Barringtonia acutangula* (L.) Gaertn., *Ficus racemosa* L. etc. Understorey species were represented by *Clerodendrum serratum* (L.) Moon, *C. infortunatum* L., *Mallotus philippensis* (Lam.) Muell. Arg., *Glycosmis pentaphylla* (Retz.) DC. and *Carrisa spinarum* L. accompanied with climbers and lianas *viz.* *Ichnocarpus frutescens* (L.) W.T.Aiton, *Tiliacora racemosa* Colebr., *Bauhinia vahlii* Wight & Arn., *Cissampelos pareira* L. var. *hirsuta* (Buch. Ham. ex DC.) Forman, *Cocculus hirsutus* (L.) W. Theob., *Abrus precatorius* L., *Tinospora cordifolia* (Willd.) Hook. f. & Thompson.



**Figure 1.** Location of the study area *i.e.* Parvati Aranga wildlife sanctuary and Tikri forest area, Gonda.

Along with affluent flora the reserve forest is also endowed with many mammalian fauna *viz.* Wild boar (*Sus scrofa*), spotted deer (*Axis axis*), blue bull (*Boselaphus tragocamelus*), Indian porcupine (*Hystrix indica*), Rhesus macaque (*Macaca mulata*) and grey langur (*Semnopithecus ajax*) with many reptilian species *viz.*

Bengal monitor (*Varanus benghalensis*), Indian Cobra (*Naja naja*), Krait (*Bungarus caeruleus*), Rat snake (*Ptyas mucosa*) and Indianpython (*Python molurus*). The wildlife sanctuary consists of a large wetland in form of lake, rich in avifaunal diversity and different species of fishes. The area also harbours many rare, threatened and common native and migratory bird *viz.* Black drongo (*Dicrurus macrocercus*), Green bee eater (*Merops orientalis*), Red-wattled Lapwing (*Vanellus indicus*), Purple swamphen (*Porphyrio porphyrio*), Sarus crane (*Grus antigone*), Pied kingfisher (*Ceryle rudis*), Grey headed fish eagle (*Ichthyophaga ichthyaetus*) and Red vented Bulbul (*Pycnonotus cafer*) along with many other species. The people residing near by the sanctuary and the reserve forest are mainly depend upon the natural resources such as fuel wood, fodder, thatched grass and Non-timber forest products for their livelihood and for sacred rituals (Singh & Srivastava 2014). The area is also rich in many medicinal and economically valuable angiosperms and pteridophytes (Singh & Srivastava 2015).

The climate is typical monsoon type with three different season's *viz.* summer (March–June), Rainy (July–September) and winter (October–February). Mean annual rainfall is about 1240 mm. The driest month is November with 2 mm of rain. The greatest amount of precipitation occurs in July with an average of 356 mm. May is the warmest month of the year; the average temperature is about 34°C during this month. The lowest temperature in the year occurs during January it measures around 15.5°C. The forest of the area have been classified as Eastern Heavy Alluvium plains Sal forest with some part located along the river in swampy areas fall under 4D/SS2- *Barringtonia* swamp forests and 4D/SS2- *Syzygium cumini* swamp low forests (Champion & Seth 1968).

During the course of exploration (2014–2016), the various ecological habitats were visited in different seasons of the year and the dominant species growing in different communities, which act as a keystone species with special importance as indicator, have been collected randomly along with their field data, dried, preserved and mounted by following the standard herbarium techniques (Jain & Rao 1977–78). These plant specimens were finally identified with the help of floras (Hooker 1872–1897, Duthie 1903–1929) assisted by matching with herbarium specimens for authentication and deposited in BSA and the correct nomenclature of the plants has been provided after consulting recent floras and website like IPNI and The PLANTLIST. The vegetation of the area was observed under different categories *viz.* top canopy tree species, under-storey, ground flora, lianas and climbers. The relevant information regarding habit, habitat, relative abundance, association, flowering, period, GPS data etc. were collected in the field.

## RESULTS AND DISCUSSION

There are certain plant species which portrays the nature and disposition of habitats commonly referred to as plant indicator. It is found that certain species have one or more specific requirements which may limit their distribution and the occurrence, character and behavior of a plant are thus indicator of the combined effect of all factors prevailing in a habitat. These plant species establish themselves according to their environmental requirement where conditions are favourable. The knowledge of relationship between plants and ecological factors can be used as an indicator of environment. The characteristic species are collectively the best indicators of ecological conditions of the community (Braun-Blanquet 1932). The plants are admittedly a measure of the environment and although the community indicates the nature of the surroundings, only a few key species which are restricted to their habitats are of special importance (Santapau 1958a).

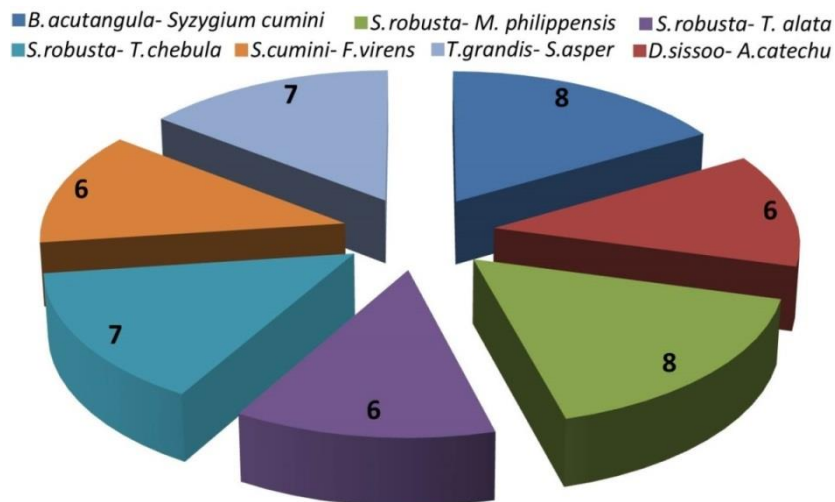
The indicator implication of one group of plants must be inferred and applied to an entirely different group of plants. Generally, forest indicators are herbs or shrubs as compared to trees. In the broad sense, forest indicators are site indicators, but rarely do they suggest more than a portion of the several factors that contribute to site. Some plants indicate the characteristic types of forest and they grow in an area which is not disturbed. *Narenga porphyrocoma* is a grass which binds the soil in which sal (*Shorea robusta*) can be cultivated. *Viola* species in eastern Himalayas is a suitable indicator for plantation of *Cedrus deodara* and *Pinus wallichiana*. If we know that a particular forest grows better in certain area of specific soil the productivity can be increased. Physical or chemical characteristics of soil moisture relationships, aeration or erosion may be indicated by some species.

The nature and composition of flora is manifestation of their cumulative effects of all aspects functioning in a particular habitat. It is usually accepted that a set of species or a whole community is steadier as an indicator than a solitary species and that dominants, particularly of the climax species are more useful indicators than lesser species. Species which are less tolerant to many varying conditions are usually indicators since their

growth requirements are exacting hence, the dominant species from different communities of selected habitats, are of special importance as indicators of the nature of habitat. The vegetation of the area can be broadly classified in to two groups consisting of various types of plant associations, A. Common vegetation and B. Vegetation of special habitats.

#### A. Common Vegetation

The common vegetation of the study area is of moist deciduous type with some evergreen and semi-evergreen tree species. The flora under this category dominates the physiognomy of the forest area by forming different phytoassociations which ultimately leads to a healthy forest in this terai region. Some of the important plant associations (Fig. 2) are discussed below.



**Figure 2.** Number of important plant associates in general vegetation community.

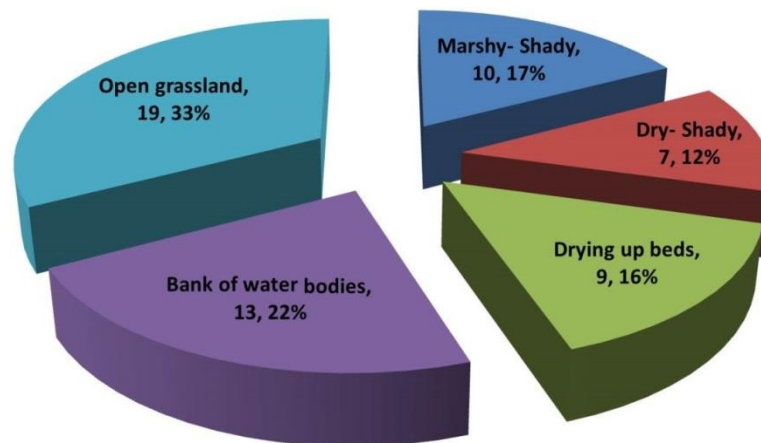
- Shorea robusta - Mallotus philippensis* community: Under this category the other associates are *Bridelia retusa* (L.) A.Juss., *Carrisa spinarum* L., *Rothea serrata* (L.) Steane & Mabb., *Clerodendrum infortunatum* L., *Curculigo orchioides* Gaertn., *Ceriscoides turgida* (Roxb.) Tirveng., *Glycosmis pentaphylla* (Retz.) DC. and *Haldina cordifolia* (Roxb.) Ridsdale.
- Shorea robusta - Terminalia chebula* Community: The other important associates are *Aegle marmelos* (L.) Correa, *Desmodium gangeticum* (L.) DC., *Phyllodium pulchellum* (L.) Desv., *Diospyros montana* Roxb., *Bauhinia vahlii* Wight & Arn., *Tiliacora racemosa* Colebr. and *Oplismenus compositus* (L.) P. Beauv.
- Tectona grandis - Steblus asper* community: The other important co-existing species are *Abrus precatorius* L., *Alangium salvifolium* (L.f.) Wangerin, *Cissampelos pareira* L. var. *hirsuta* (Buch.-Ham. ex DC.) Forman, *Dioscorea bulbifera* L., *Cocculus hirsutus* (L.) W. Theob., *Clerodendrum infortunatum* L. and *Elephantopus scaber* L.
- Shorea robusta - Terminalia alata* community: The other phytoassociates are *Abutilon indicum* (L.) Sweet, *Oroxylum indicum* (L.) Kurz., *Ailanthus excelsa* Roxb., *Sida cordata* (Burm.f.) Borss. Waalk., *Madhuca longifolia* (J. Koenig. ex. L.) J.F.Macbr. and *Chrysopogon zizanoides* (L.) Roberty.
- Dalbergia sissoo - Acacia catechu* community: The other phytoassociates are *Ailanthus excelsa* Roxb., *Albizia procera* (Roxb.) Benth., *Ampelocissus latifolia* (Roxb.) Planch., *Kydia calycina* Roxb., *Abrus precatorius* L. and *Cardiospermum halicacabum* L.
- Barringtonia acutangula - Syzygium* spp. association: In this type of association there may be individual stands of these species or mixed stands at some places. *Syzygium cumini* (L.) Skeels and *S. salicifolium* (Wight) J. Graham. are two important species of syzygium in the study area. The other associates are *Calamus tenuis* Roxb., *Saccharum spontaneum* L., *Oxystelma secamone* K. Schum., *Tiliacora racemosa* Colebr., *Smilax zeylanica* L., *Helminthostachys zeylanica* (L.) Hook., and *Lygodium flexuosum* (L.) Sw.
- Syzygium* spp. - *Ficus* spp. association: Mainly consists of *Syzygium cumini* (L.) Skeels and *S. salicifolium* (Wight) J. Graham. of *Syzygium* and *Ficus racemosa* L., *F. heterophylla* L.f. and *F. virens* Aiton. Other phytoassociates are *Pongamia pinnata* (L.) Pierre, *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn. and *Vitex negundo* L.

### Aquatic flora

The common habitations of the hydrophyte are ‘tals’, ‘nalas’ and other water reservoir with low-lying areas. Most of the ‘tals’ and the Parvatiaranga lakes in the area hold water throughout the year, only a few smaller and less deeper ones may dry up during summer season. During rainy season these get filled with water as a part of Saryu river flood area. As the flood water recedes, these water bodies get roofed with a number of hydrophytes viz. *Eichhornia crassipes* (Mart.) Solms, *Hygroryza aristata* (Retz.) Nees ex Wight & Arn., *Pistia stratiotes* L. & *Spirodela polyrrhiza* (L.) Schleid., *Ceratophyllum demersum* L., *Hydrilla verticillata* (L.f.) Royle, *Najas graminea* Delile, *Nechamandra alternifolia* (Roxb. ex Wight) Thwaites, *Ottelia alismoides* (L.) Pers., *Potamogeton crispus* L., *Nelumbo mucifera* Gaertn., *Nymphaea nouchali* Burm.f., *Nymphoides indica* (L.) Kuntze., *Ipomoea aquatica* Forssk., *Ludwigia adscendens* (L.) Hara, *Bacopa monnieri* (L.) Wettst., *Hygrophila auriculata* (Schumach.) Heine, *Phragmites karka* (Retz.) Trin. ex Steud., *Ranunculus sceleratus* L., *Rumex dentatus* L., *Typha angustifolia* L. and *Veronica anagallis-aquatica* L.

### B. Vegetation of Special Habitats

The study area is also harbours a rich population of flora with special habitats. There are almost 5 categories (Fig. 3) of special habitats have been observed along with aquatic flora under which the species from the unique and characteristic phytoassociation forms the habitat conditions.



**Figure 3.** Frequency and percentage of vegetation of special habitats.

1. On marshy shady conditions: Under this situation the following phytoassociates are growing together viz. *Bacopa monnieri* (L.) Wettst., *Centella asiatica* (L.) Urb., *Oldenlandia corymbosa* L., *Laphangium luteoalbum* (L.) Tzvelev., *Ceratopteris thalictroides* (L.) Brongn., *Pycneus pumilus* (L.) Nees, *Peperomia pellucida* (L.) Kunth, *Ranunculus muricatus* L. and *R. scleratoides* Perfil. ex Ovczinn.
2. On dry shady situations: In these conditions scattered poulation of *Abutilon indicum* (L.) Sweet, *Desmodium gangeticum* (L.) DC., *Phyllodium pulchellum* (L.) Desv., *Lea indica* (Burm.f.) Merr., *Scoparia dulcis* L., *Aerva sanguinolenta* (L.) Blume and *Ageratum conyzoides* (L.) L. associations.
3. On drying up beds: In such areas plant species forming large clumps and patches under these associates viz. *Coldenia procumbens* L., *Glinus lotoides* L., *Grangea maderaspatana* (L.) Poir., *Heliotropium supinum* L., *Polycarpon prostratum* (Forssk.) Aschers & Schweinf., *Polygonum plebeium* R. Br., *Rumex dentatus* L. and *Sphaeranthus indicus* L.
4. On the bank of water bodies: The following important plants and their associates are observed under this situation viz. *Ammannia baccifera* L., *Lippia javanica* (Burm.f.) Spreng., *Chrysopogon zizanioides* (L.) Roberty, *Arundo donax* L., *Typha domingensis* Pers., *Persicaria lapathifolia* (L.) Delarbre species. There are also some woody species found along the water bodies in the forest area viz. *Barringtonia acutangula* (L.) Gaertn., *Syzygium cumini* (L.) Skeels, *S. salicifolium* (Wight) J. Graham and *Pongamia pinnata* (L.) Pierre along with other associates like *Oxystelma secamone* K. Schum., *Tiliacora racemosa* Colebr. and *Vitex negundo* L.
5. On open situations: These conditions support a rich wealth of grasslend flora with some woody species viz. *Alangium salvifolium* (L.f.) Wang subsp. *decapetalum* (Lam.) Wang, *Alysicarpus monilifer* (L.) DC., *Apluda mutica* L., *Biophytum sensitivum* (L.) DC., *Boerhavia diffusa* L., *Bothriochloa pertusa* (L.) A. Camus, *Carissa spinarum* L., *Chrozophora rotleri* A. Juss. Dalz., *Clerodendrum infortunatum* L., *Cynodon dactylon* (L.) Pers.,

*Imperata cylindrica* (L.) Raeusch., *Indigofera linifolia* (L.f.) Retz., *Solanum virginianum* L., *Urena lobata* L., *Chrysopogon zizanioides* (L.) Nash, *Woodfordia fruticosa* (L.) Kurz and *Ziziphus nummularia* (Burm.f.) Wight & Arn.

#### Parasitic and Epiphytic associations

Along with general floral association some unique association in form of parasitic and epiphytic are also found in the area:

1. *Cuscuta reflexa* Roxb. found on a variety of host plants viz. *Streblus asper* Lour., *Glycosmis pentaphylla* Retz. DC., *Ipomoea fistulosa* Mart. ex Choisy, *Vitex negundo* L. and on *Ziziphus* spp.
2. *Dendrophthoe falcata* (L.f.) Ettingsh. on *Bombax ceiba* L., *Butea monosperma* (Lam.) Taub., *Mangifera indica* L., *Dalbergia sissoo* DC., *Syzygium cumini* (L.) Skeels at some places on *Tectona grandis* L.f. .
3. *Vanda tessellata* (Roxb.) Hook. ex G. Don mainly growing as an epiphytes on *Madhuca longifolia* (J. Koenig ex L.) J.F. Macbr., *Tectona grandis* L.f. and on *Shorea robusta* Gaertn. (Fig. 4).



**Figure 4.** Epiphytic association of *Vanda tessellata* (Roxb.) Hook. ex G. Don on *Madhuca longifolia* (J. Koenig ex L.) J.F. Macbr.

#### Pattern of rareness and regeneration potential in the study area

Rarity and regeneration of plant species in any forest area plays a significant role in maintenance of a healthy forest. *Plumbago zeylanica* L., *Oroxylum indicum* (L.) Kurz., *Hymenodictyon orixense* (Roxb.) Mabb., *Clerodendrum indicum* (L.) Kuntze, *Gloriosa superba* L., *Terminalia chebula* Retz., *Helicteres isora* L., *Bauhinia vahlii* Wight & Arn., *Bacopa monnieri* (L.) Wettst., *Leea alata* Edgew., *Habenaria plantaginea* Lindl., *Tylophora indica* (Burm.f.) Merr., *Cheilocostus speciosus* (J. Koenig) C. D. Specht, *Holarrhena pubescens* Wall. ex G. Don, *Heminthostachys zeylanica* were considered most rare plant species found during collection and survey of the area (Table. 1). There are also some common species occurs frequently in the entire area due to their capacity to produce seedling rapidly viz. *Bridelia retusa* (L.) A. Juss., *Mallotus philippensis* (Lam.) Mull. Arg., *Mitragyna parvifolia* (Roxb.) Korth., *Terminalia alata* Wall., *Rothea serrata* (L.) Steane & Mabb., *Clerodendrum infortunatum* L., *Cayratia trifolia* (L.) Domin, *Cissampelos pareira* L., *Ichnocarpus frutescens* (L.) W. T. Aiton, *Elephantopus scaber* L. and *Lygodium flexuosum* (L.) Sw (Table. 2). Certain rhizomatous species like *Curculigo orchiioides* Gaertn., *Typhonium trilobatum* (L.) Schott, *Helminthostachys zeylanica* (L.) Hook. and *Gloriosa superba* L. growing even in highly stochastic environment. This type of rarity and regeneration among various species are indicative of their ability to reproduce and establish efficiently in frequently distributed environment (Shukla 2009).

**Table 1.** Rare species occurring in the study area.

Name of the species	Family	Habit	Phenology
<i>Bacopa monnieri</i> (L.) Wettst	Plantaginaceae	Herbs	July–March
<i>Bauhinia vahlii</i> Wight & Arn.	Leguminosae	Lianas	Sept.–Jan.
<i>Clerodendrum indicum</i> (L.) Kuntze	Verbenaceae	Shrubs	April–Dec.
<i>Cheilocostus speciosus</i> (J. Koenig) C.D. Specht	Costaceae	Shrubs	Aug.–Jan.
<i>Gloriosa superba</i> L.	Liliaceae	Climbers	July–Nov.
<i>Habenaria plantaginea</i> Lindl.	Orchidaceae	Herbs	Aug.–Nov.
<i>Helminthostachys zeylanica</i> (L.) Hook.	Ophioglossaceae	Herbs	Oct.–Jan.
<i>Holarrhena pubescens</i> Wall. ex G.Don	Apocynaceae	Large Shrubs	May–Feb.
<i>Hymenodictyon orixense</i> (Roxb.) Mabb.	Rubiaceae	Trees	July–Feb.
<i>Leea alata</i> Edgew.	Vitaceae	Shrubs	June–Sept.
<i>Oroxylum indicum</i> (L.) Kurz.	Bignoniaceae	Trees	June–March
<i>Passiflora foetida</i> L.	Passifloraceae	Climbers	Nov.–Jan.
<i>Plumbago zeylanica</i> L.	Plumbaginaceae	Shrubs	Aug.–Oct.
<i>Schleichera oleosa</i> (Lour.) Merr.	Sapindaceae	Trees	April–Aug.
<i>Strychnos nux-vomica</i> L.	Loganiaceae	Trees	March–Feb.
<i>Terminalia chebula</i> Retz.	Combretaceae	Trees	March–Oct.
<i>Tylophora indica</i> (Burm.f.) Merr.	Apocynaceae	Climbers	May–Sept.

**Table 2.** Most common species occurring in the study area.

Name of the species	Family	Habit	Phenology
<i>Aerva sanguinolenta</i> (L.) Blume	Amaranthaceae	Herbs	July–April
<i>Bridelia retusa</i> (L.) A.Juss.	Phyllanthaceae	Trees	July–March
<i>Cayratia trifolia</i> (L.) Domin	Vitaceae	Climbers	Aug.–Nov.
<i>Cissampelos pareira</i> L.	Menispermaceae	Climbers	June–Dec.
<i>Rotheca serrata</i> (L.) Steane	Lamiaceae	Shrubs	Aug.–Oct.
<i>Clerodendrum infortunatum</i> L.	Lamiaceae	Shrubs	March–June
<i>Phyllodium pulchellum</i> (L.) Desv.	Leguminosae	Shrubs	Aug. –April
<i>Dioscorea bulbifera</i> L.	Dioscoreaceae	Climbers	June–Nov.
<i>Elephantopus scaber</i> L.	Asteraceae	Herbs	Jan.–March
<i>Glycosmis pentaphylla</i> (Retz.) DC.	Rutaceae	Shrubs	Dec.–March
<i>Hemidesmus indicus</i> (L.) R.Br. ex Schult.	Apocynaceae	Climbers	Aug.–Jan.
<i>Holoptelea integrifolia</i> Planch.	Ulmaceae	Trees	Dec.–April
<i>Ichnocarpus frutescens</i> (L.) W.T. Aiton	Apocynaceae	Climbers	July–Feb.
<i>Mallotus philippensis</i> (Lam.) Mull. Arg.	Euphorbiaceae	Small trees	Oct.–May
<i>Mitragyna parviflora</i> (Roxb.) Korth.	Rubiaceae	Trees	Sept.–Jan.
<i>Streblus asper</i> Lour.	Moraceae	Trees	May–Sept.
<i>Terminalia alata</i> Wall.	Combretaceae	Trees	April–Nov.

An extensive ecological and floristic study has been conducted in the north-eastern terai region of the Uttar Pradesh with respect to the floral diversity and documentation of vegetational phytosociology. The present communication reveals that the plant community with special habitat specially in protected and reserve forest area may plays a vital role in the future sustenance of the forest vegetation. The area also harbours a rich diversity of economical and medicinal plant species, mainly confined to the peripheral region of the forests. There is need of continued monitoring of various ecological parameters with the help of more accurate and sophisticated ecological tools for the betterment of the plant community of the study area.

#### ACKNOWLEDGEMENTS

The authors are thankful to Director, Botanical Survey of India, Kolkata and Scientist- ‘E’ and Head of Office, BSI, CRC, Allahabad for facilities and encouragement. The authors are also grateful to Range Officers and field staffs of Parvati Aranga Wildlife Sanctuary and Tikri reserve forest, Gonda for providing necessary help during field exploration. The authors are thankful to the Head, Department of Botany, D.S.B. campus,

Kumaon University, Nainital for valuable suggestions.

## REFERENCES

- Bajpai O, Kumar A, Srivastava AK, Kushwaha AK, Pandey J & Chaudhary LB (2015a) Trees species of the Himalayan Terai region of Uttar Pradesh, India: a Checklist. *Checklist* 11(4): 1–15.
- Bajpai O, Kushwaha AK, Srivastava AK, Pandey J & Chaudhary LB (2015b) Phytosociological status of a monotypic genus *Indopiptadenia*: A Near Threatened Tree from the Terai-Bhabar Region of Central Himalaya. *Research Journal of Forestry* 9(2): 35–47.
- Bajpai O, Kumar A, Mishra AK, Sahu N, Pandey J, Behera SK & Chaudhary LB (2012b) Recongregation of tree species of Katarniaghat Wildlife Sanctuary, Uttar Pradesh, India. *Journal of Biodiversity and Environmental Sciences* 2: 24–40.
- Bajpai O, Kumar A, Mishra AK, Sahu N, Behera SK & Chaudhary LB (2012a) Phenological study of two dominant tree species in tropical moist deciduous forest from the Northern India. *International Journal of Botany* 8: 66–72.
- Behera SK, Mishra AK, Sahu N, Kumar A, Singh N, Kumar A, Bajpai O, Chaudhary LB, Khare PB & Tuli R (2012) The study of microclimate in response to different plant community association in tropical moist deciduous forest from northern India. *Biodiversity and Conservation* 21(5): 1159–1176.
- Braun-Blanquet J (1932) *Plant Sociology- The Study of plant communities*, London.
- Champion HG & Seth SK (1968) *A revised survey of the forest Types of India*. Manager of Publication, Govt. of India, New Delhi.
- Chauhan DS, Dhanai CS, Singh B, Chauhan S, Todaria NP & Khalid MA (2008) Regeneration and tree diversity in natural and planted forests in a Terai- Bhabhar forest in Katarniaghat wildlife sanctuary, India. *Tropical Ecology* 49: 53–67.
- Duthie JF (1903–1929) *Flora of Upper Gangetic Plain and Adjacent Siwalik and Sub-Himalayan Tracts*. Vols 1-3. Rep. 1994. Bishen Singh Mahendra Pal Singh, Dehradun.
- Gairola S, Rawal RS & Todaria NP (2008) Forest vegetation pattern along an altitudinal gradient in sub-alpine zone of West Himalaya, India. *African of Plant Science* 2(6): 42–48.
- Hooker JD (1872–1897) *The Flora of British India*. Bishensingh Mahendra Pal Singh, Dehradun India.
- Jain SK & Rao RR (1978) *A Handbook of Field and Herbarium Methods*. Today and Tomorrow 's Pub. New Delhi.
- Kumar A, Bajpai O, Mishra AK, Sahu N, Behera SK, Bargali SS & Chaudhary LB (2015) A checklist of the flowering plants of Katarniaghat Wildlife Sanctuary, Uttar Pradesh, India. *Journal of Threatened Taxa* 7(7): 7309–3408.
- Maliya SD (2007) Rare species of Katarniyaghat Wildlife sanctuary District Bahraich, Uttar Pradesh, India. *Indian Forester* 133(8): 1052–1056.
- Pandey SK & Shukla RP (2003) Plant diversity in managed sal (*Shorea robusta* Gaertn.) forests of Gorakhpur, India: species composition, regeneration and conservation. *Biodiversity and Conservation* 12: 2295–2319.
- Panigrahi G Singh AN Mishra OP (1969) Contribution to the botany of the terai forest of the Bahraich District of Uttar Pradesh. *Bulletin of the Botanical Survey of India* 11(1&2): 89–114
- Rodgers WA & Sawarkar VB (1988) Vegetation management in Wildlife Protected Areas in India. *Aspects of Applied Biology* 16: 407–422.
- Santapau H (1958a) Floriistic study in India. *Mem. Indian Botanical Society* 1: 117–121
- Shukla RP (2009) Patterns of plant species diversity across Terai landscape in north-eastern Uttar Pradesh, India. *Tropical Ecology* 50(1): 111–123.
- Singh V & Srivastava SK (2014) Utilization of Wild Plants during *Tinchhath* festival in eastern Uttar Pradesh. *Ethnobotany* 26(1&2): 101–103.
- Singh V & Srivastava SK (2015) A note on occurrence and copious growth of *Helminthostachys zeylanica* (L.) Hook. (Ophioglossaceae) in Tikri forest in Terai region, Uttar Pradesh. *Phytotaxonomy* 15: 15–16.
- Singh V (2015) Rare Sighting of Nearly Threatened Grey-Headed Fish-Eagle *Ichthyophaga Ichthyæetus* (Horsfield, 1821) From Tikri Reserve Forest of Eastern Uttar Pradesh, India. *Indian Forester* 141(10): 1104–1105.