An assessment of the invasive flora of Amchang Wildlife Sanctuary in the Kamrup District of Assam, India

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Abstract

Invasive alien species are not only harmful both ecologically and economically, but also pose a serious threat to the native flora risking species extinction. However, some invasive species are being used by the people for a variety of purposes like medicine, vegetables, furniture and for meeting their daily livelihood requirements. In this paper, we document a total of 57 invasive species belonging to 49 genera of 22 families with their local names in Assamese, frequency of occurrence, and flowering and fruiting periods from Amchang wildlife sanctuary in Assam. Of these, 24 species are medicinally used and seven species are cooked as vegetables. This information generated from the field work is a manifestation of the contemporary traditional knowledge of people about the plant resources growing around them in the sanctuary.

Key words: Amchang Wildlife Sanctuary, Assam, Invasive plants, medicinal use of plants.

INTRODUCTION

Invasion of natural ecosystems and replacement of native flora by the invasive alien plants is one among the top three threats identified globally by the scientists. India has also highlighted the adverse effects of invasion of flora in a number of studies and has set targets to reduce this menace in future decades (Bhatt *et al.* 2011). The northeastern region of India encompassing eight States, viz., (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura) and northern districts of West Bengal (Darjeeling, Jalpaiguri and Coochbehar) is bestowed with a rich diversity of fauna, flora and microbes. This region constitutes the landscapes of two global hotspots of biodiversity, The Himalaya and Indo-Burma (Myers 2003) and boasts a variety of ecosystems such as tropical lowland forests (Shankar & Tripathi 2017; Shankar 2017, 2019), gregarious sal forests (Shankar 2001; Majumdar *et al.* 2014; Tripathi & Shankar 2014), subtropical pine and oak forests (Upadhyaya 2015), temperate conifer forests and savanna grasslands (Shankar 1991; Shankar *et al.* 1991). Orchidaceae is the largest family of flowering plants in this region and other dominant families are Poaceae, Compositae, Fabaceae, Rubiaceae, and Lamiaceae. The invasion of alien species in the northeastern region of India has emerged as a challenge for the 21st century, despite the fact that its extent has not been quantified and it has not been subjected to scientific study (Shankar *et al.* 2011). Of late, a few studies on invasive plants were undertaken by some workers (Das 2002; Boro & Sarma 2013; Buragohai 2007; Das & Duarah 2013). Recently, a project has been launched by the Ministry of Environment, Forests, and Climate Change, Government of India under the aegis of National Mission on

Himalayan Studies (NMHS) to study and document invasion of habitats in the Himalayan and northeastern region of India. Here, we present the results of a study carried out in the Amchang Wildlife Sanctuary in Kamrup district of Assam to document the diversity of invasive alien plants in the native habitats. We also investigated contemporary traditional knowledge of the people about the medicinal and economic uses of the invasive plants inhabiting in and around the sanctuary.

MATERIALS AND METHODS

Amchang Wildlife Sanctuary in Kamrup district of Assam comprises three reserve forests, viz., Amchang RF (53.18 km²), South Amchang RF (15.5 km²) and Khanapara RF (9.96 km²). Amchang was declared a sanctuary in 2004 with a total area of 78.64 km². This sanctuary lies between 26°06' to 26°13' N latitude and 91°50' to 91°58' E longitude. Geographically, the area is a continuation of the Khasi and Jaintia hills of Meghalaya and forms a part of the Shillong Plateau (Shankar 2019). The Sanctuary is bounded by the river Brahmaputra in the North, by National Highway 37 and Sonapur in the South, by urban agglomeration of Guwahati city in the West and by Digaru Railway Station in the East (Figure 1). The ethnic groups such as Boro, Karbi, Kasari, Garo, Nepalese, Tea tribes and Assamese are residing in the fringe area of the Amchang Wildlife Sanctuary. These local people not only extract many wild plants and other non-timber forest products from the sanctuary as medicine and vegetables for their daily livelihood requirements, but also interact with vegetation in many other ways which paves the way for the spread of the invasive plants.

Figure 1. Map showing the location of Amchang Wildlife Sanctuary (*source: Anonymous 2019*).

Several rounds of field visits to various parts of the forest areas in Amchang wildlife sanctuary, Assam (North-East India) were carried out in different seasons of the year during 2014-2019. During the surveys, live specimens along with photographs were taken. Plant species were collected and herbarium specimens were prepared (Jain & Rao 1977) and preserved in laboratory for further investigation. The collected specimens were processed, mounted and identified with the aid of available resources (Barooah & Ahmed 2014; Hooker 1872 – 1897; Kanjilal *et al.* 1934, 1936, 1938, 1940; The Plant List 2013) in the BSI herbarium and the NEHU library. The list of invasive species has been prepared following nomenclature of WFO (2019). The nativity of the exotic plants was recorded from the published literature (Das 2002; Boro *et al.* 2013; Khuroo *et al.* 2007; Reddy *et al.* 2008; Sekar 2012). A list of invasive species is tabled with scientific names, local names, habit and nativity.

RESULTS AND DISCUSSION

The field survey carried out in the Amchang Wildlife Sanctuary revealed that a total of 57 invasive species belonging to 49 genera and 22 families of angiosperms constituted the flora of the Sanctuary. Of these, the dicots were represented by 50 species belonging to 43 genera of 19 families and the monocots were represented by seven species belonging to six genera of three families (Table 1). The most dominant family was Compositae with 11 species followed by Solanaceae with six species, Fabaceae with five species, Amaranthaceae with four species and Cleomaceae, Convolvulaceae, Malvaceae and Poaceae with three species each (Table 1). The invasive species recorded from Amchang Wildlife Sanctuary were characterized by prolonged flowering and fruiting periods and some species flowered and fruited throughout the year. The local names of the species as spoken today are given as per the local dialect of the Assamese language. These names are colloquial and may differ from their literary utterances.

Table 1. The diversity of invasive plants in Amchang Wildlife Sanctuary.

Species name with collection number	Flowers & fruits	Local name in Assamese	Nativity	Habit	Occurrence
<i>Ageratum conyzoides</i> (L.) L. [Compositae]; N. Sarma 133898 (ASSAM)	July – January	Gondhowa-bon	Tropical America	Herb	Dominant
<i>Alternanthera philoxeroides</i> (Mart.) Griseb. [Amaranthaceae]; N. Sarma 133866 (ASSAM)	August – November	Pani-khutura	Tropical America	Herb	Dominant
<i>Alternanthera sessilis</i> (L.) R.Br. ex DC. [Amaranthaceae]; N. Sarma 133981 (ASSAM)	July – January	Mat-kaduri	Tropical America	Herb	Dominant
<i>Amaranthus spinosus</i> L. [Amaranthaceae]; N. Sarma 134015 (ASSAM)	July – January	Kata-khutura	America	Herb	Frequent
<i>Argemone mexicana</i> L. [Papaveraceae]; N. Sarma 136580 (ASSAM)	September – January	Sealkata	Central & South America	Herb	Occasional
<i>Bidens pilosa</i> L. [Compositae]; N. Sarma 136516 (ASSAM)	July – December	Deumeubai (Bodo)	Tropical America	Herb	Occasional

Species name with collection number	Flowers & fruits	Local name in Assamese	Nativity	Habit	Occurrence
<i>Blumea lacera</i> (Burm.f.) DC. [Compositae]; <i>N. Sarma</i> 136579 (ASSAM)	August – February	Kukur-shuta/Kukur-sunga	Tropical America	Herb	Frequent
<i>Calotropis gigantea</i> (L.) Dryand. [Apocynaceae]; <i>N. Sarma</i> 136373 (ASSAM)	Throughout the year	Akan	Tropical Africa	Shrub	Occasional
<i>Cardamine hirsuta</i> L. [Brassicaceae]; <i>N. Sarma</i> 136578 (ASSAM)	July – February	-	Tropical America	Herb	Occasional
<i>Chenopodium album</i> L. [Amaranthaceae]; <i>N. Sarma</i> 136577 (ASSAM)		Jilmil	Mexico	Herb	Rare
<i>Chromolaena odorata</i> (L.) R.M. King & H. Rob. [Compositae]; <i>N. Sarma</i> 133898 (ASSAM)	December – May	Germani bon	Tropical America	Shrub	Dominant
<i>Cleome gynandra</i> L. [Cleomaceae]; <i>N. Sarma</i> 136576 (ASSAM)	September – December	Bhutmala	Tropical America	Herb	Rare
<i>Cleome rutidosperma</i> DC. [Cleomaceae]; <i>N. Sarma</i> 134062 (ASSAM)	August – November	-	Tropical America	Herb	Occasional
<i>Cleome viscosa</i> L. [Cleomaceae]; <i>N. Sarma</i> 136435 (ASSAM)	August – December	Hurhuria	Tropical America	Herb	Rare
<i>Crotalaria pallida</i> Aiton [Fabaceae]; <i>N. Sarma</i> 134008 (ASSAM)	August – March	Jhun-jhuniya	Tropical America	Herb	Rare
<i>Croton bonplandianus</i> Baill. [Euphorbiaceae]; <i>N. Sarma</i> 136302 (ASSAM)	August – December	Bon-tulsi	Temperate South America	Herb	Rare
<i>Cuscuta reflexa</i> Roxb. [Convolvulaceae]; <i>N. Sarma</i> 134033 (ASSAM)	August – December	Akashi-lata	Mediterranean	Climber	Occasional
<i>Cyperus difformis</i> L. [Cyperaceae]; <i>N. Sarma</i> 136575 (ASSAM)	August – December	-	Tropical America	Herb	Rare
<i>Cyperus iria</i> L. [Cyperaceae]; <i>N. Sarma</i> 136574 (ASSAM)	August – January	-	Tropical America	Herb	Rare
<i>Datura metel</i> L. [Solanaceae]; <i>N. Sarma</i> 136573 (ASSAM)	August – February	Kala-dhatura	Tropical America	Shrub	Rare
<i>Echinochloa colona</i> (L.) Link [Poaceae]; <i>N. Sarma</i> 136572 (ASSAM)	August – March	Binoi-bon	Tropical South America	Herb	Occasional

Species name with collection number	Flowers & fruits	Local name in Assamese	Nativity	Habit	Occurrence
<i>Eclipta prostrata</i> (L.) L. [Compositae]; <i>N. Sarma</i> 136571 (ASSAM)	June – March	Keharaj	Tropical America	Herb	Rare
<i>Eichhornia crassipes</i> (Mart.) Solms [Pontederiaceae]; <i>N. Sarma</i> 136570 (ASSAM)	August – December	Pani meteka	Tropical America	Aquatic herb	Frequent
<i>Euphorbia hirta</i> L. [Euphorbiaceae]; <i>N. Sarma</i> 136569 (ASSAM)	August-December	Gakhirati bon	Tropical America	Herb	Rare
<i>Evolvulus nummularius</i> (L.) L. [Convolvulaceae]; <i>N. Sarma</i> 136347 (ASSAM)	October – February	Bhui- ankra	Tropical America	Herb	Occasional
<i>Galinsoga parviflora</i> Cav. [Compositae]; <i>N. Sarma</i> 136568 (ASSAM)	August – January	Potato weed (E)	Tropical America	Herb	Rare
<i>Hyptis suaveolens</i> (L.) Poit. [Lamiaceae]; <i>N. Sarma</i> 134016 (ASSAM)	August – March	Ukma	Tropical America	Herb	Rare
<i>Impatiens balsamina</i> L. [Balsaminaceae]; <i>N. Sarma</i> 136567 (ASSAM)	July – January	Keruphul	Tropical America	Herb	Occasional
<i>Imperata cylindrica</i> (L.) Raeusch. [Poaceae]; <i>N. Sarma</i> 134086 (ASSAM)	July–December	Ulu-bon	Tropical America	Herb	Rare
<i>Ipomoea hederifolia</i> L. [Convolvulaceae]; <i>N. Sarma</i> 134063 (ASSAM)	August – December	-	Tropical America	Climber	Rare
<i>Lantana camara</i> L. [Verbenaceae]; <i>N. Sarma</i> 133991 (ASSAM)	Througho ut the year	Goo-phul	Tropical America	Shrub	Dominant
<i>Ludwigia octovalvis</i> (Jacq.) P.H. Raven [Onagraceae]; <i>N. Sarma</i> 133809 (ASSAM)	July–December	Bon-jalakia	Tropical Africa	Herb	Frequent
<i>Mikania micrantha</i> Kunth [Compositae]; <i>N. Sarma</i> 133839 (ASSAM)	December - April	Gahori-lata	Tropical America	Climber	Dominant
<i>Mimosa pudica</i> L. [Fabaceae]; <i>N. Sarma</i> 136434 (ASSAM)	July - February	Lajukilota	Brazil	Herb	Frequent
<i>Monochoria vaginalis</i> (Burm.f.) C.Presl [Pontederiaceae]; <i>N. Sarma</i> 134025 (ASSAM)	August – December	Bhat meteka	Tropical America	Aquatic herb	Occasional
<i>Nicotiana plumbaginifolia</i> Viv. [Solanaceae]; <i>N. Sarma</i> 136566 (ASSAM)	December - April	Ulu-lai/ dhopat	Tropical America	Herb	Rare
<i>Ocimum americanum</i> L. [Lamiaceae]; <i>N. Sarma</i> 133988 (ASSAM)	August – January	Bon-tulsi	Tropical America	Shrub	Rare
<i>Oxalis corniculata</i> L. [Oxalidaceae]; <i>N. Sarma</i> 136483 (ASSAM)	August – December	Saru-tengesi	Europe	Herb	Occasional

Species name with collection number	Flowers & fruits	Local name in Assamese	Nativity	Habit	Occurrence
<i>Parthenium hysterophorus</i> L. [Compositae]; <i>N. Sarma</i> 136407 (ASSAM)	July – February	Gajar ghass	Tropical North America	Herb	Dominant
<i>Passiflora foetida</i> L. [Passifloraceae]; <i>N. Sarma</i> 136441 (ASSAM)	June – December	Junuka phul	Tropical South America	Climber	Rare
<i>Peperomia pellucida</i> (L.) Kunth [Piperaceae]; <i>N. Sarma</i> 136587 (ASSAM)	July– December	Pononua	Tropical South America	Herb	Occasional
<i>Physalis minima</i> L. [Solanaceae]; <i>N. Sarma</i> 136565 (ASSAM)	July – January	Kapalfuta	Tropical America	Herb	Rare
<i>Saccharum spontaneum</i> L. [Poaceae]; <i>N. Sarma</i> 136513 (ASSAM)	August – December	Kahua-bon	Tropical West Asia	Herb	Rare
<i>Scoparia dulcis</i> L. [Plantaginaceae]; <i>N. Sarma</i> 136446 (ASSAM)	July – December	Seni bon	Tropical America	Herb	Frequent
<i>Senna alata</i> (L.) Roxb. [Fabaceae]; <i>N. Sarma</i> 133907 (ASSAM)	May – December	Khor-goch	West indies	Shrub	Occasional
<i>Senna occidentalis</i> (L.) Link [Fabaceae]; <i>N. Sarma</i> 136564 (ASSAM)	July – December	Hantthenga	Tropical South America	Herb	Rare
<i>Senna tora</i> (L.) Roxb. [Fabaceae]; <i>N. Sarma</i> 136563 (ASSAM)	August – December	Medeluwa	Tropical S America	Herb	Rare
<i>Sida acuta</i> Burm.f. [Malvaceae]; <i>N. Sarma</i> 133806 (ASSAM)	July – December	Boriala	Tropical America	Herb	Occasional
<i>Solanum americanum</i> Mill. [Solanaceae]; <i>N. Sarma</i> 136561 (ASSAM)	June – December	Laskosi/ koisi	Tropical America	Herb	Rare
<i>Solanum torvum</i> Sw.[Solanaceae]; <i>N. Sarma</i> 136339 (ASSAM)	October – March	Hati bhekuri	West Indies	Shrub	Rare
<i>Solanum viarum</i> Dunal [Solanaceae]; <i>N. Sarma</i> 136560 (ASSAM)	August – February	-	Tropical America	Herb	Rare
<i>Stachytarpheta jamaicensis</i> (L.) Vahl [Verbenaceae]; <i>N. Sarma</i> 133889 (ASSAM)	Mainly in rainy season	-	Tropical America	Herb	Rare
<i>Synedrella nodiflora</i> (L.) Gaertn. [Compositae]; <i>N. Sarma</i> 133830 (ASSAM)	August – January	Suhani ban	West Indies	Herb	Rare
<i>Tridax procumbens</i> (L.) L. [Compositae]; <i>N. Sarma</i> 134087 (ASSAM)	Through out the year	Mexican Daisy(E)	Tropical Central America	Herb	Frequent
<i>Triumfetta rhomboidea</i> Jacq. [Malvaceae]; <i>N. Sarma</i> 136559 (ASSAM)	June – December	Agora	Tropical America	Herb	Rare
<i>Urena lobata</i> L. [Malvaceae]; <i>N. Sarma</i> 133832 (ASSAM)	July – December	Honborolua	Tropical Africa	Shrub (annual)	Rare
<i>Xanthium strumarium</i> L. [Compositae]; <i>N. Sarma</i> 136558 (ASSAM)	August – March	Aagora-kata	Tropical America	Herb	Rare

The frequency of occurrence of species showed that the most species were of rare occurrence (29 species) followed by occasional (14 species), frequent (7 species) and dominant (7 species) occurrences (Table 1). The dominant species included: *Ageratum conyzoides*, *Alternanthera philoxeroides*, *Alternanthera sessilis*, *Chromolaena odorata*, *Lantana camara*, *Mikania micrantha* and *Parthenium hysterophorus*. The habit of the species showed that the most species were herbs (42 species) followed by shrubs (8 species) and undershrub (1 species), and four climbers (*Cuscuta reflexa*, *Ipomoea hederifolia*, *Mikania micrantha* and *Passiflora foetida*) besides two aquatic herbs (*Eichhornia crassipes* and *Monochoria vaginalis*) (Table 1). Most of the invasive species were from North and South America (48 species), Tropical Africa (3 species, *Calotropis gigantea*, *Ludwigia octovalvis*, *Urena lobata*), West Indies (3 species, *Senna*

Table 2. A list of invasive plants used as local medicine by the local people in Amchang Wildlife Sanctuary.

Species name	Parts used	Purpose
<i>Ageratum conyzoides</i>	Leaf	Fresh leaf juice applied in cuts
<i>Alternanthera sessilis</i>	Tender shoots	Tender shoots are eaten for curing dysentery
<i>Amaranthus spinosus</i>	Whole plant	The paste of whole plant is applied on eczema
<i>Argemone mexicana</i>	Leaf	Leaves applied locally in skin disease
<i>Chromolaena odorata</i>	Leaf	Leaf paste is applied locally in toothache
<i>Croton bonplandianus</i>	Leaf	Leaf extract is used in cataract eye
<i>Cuscuta reflexa</i>	Stem	Extracted juice is given to cure jaundice
<i>Datura metel</i>	Leaf	Fresh leaves are boiled in coconut oil and the oil is externally applied as an antiseptic
<i>Eclipta prostrata</i>	Leaf	Extract mix with oil for hair growth
<i>Euphorbia hirta</i>	Leaf	Leaf paste is used in wounds and poisonous bites
<i>Evolvulus nummularius</i>	Leaf, Stem	Plant paste applied externally to reduce tonsillitis pain
<i>Lantana camara</i>	Leaf	Leaf paste is used in various skin diseases and also to stop bleeding
<i>Mikania micrantha</i>	Leaves	The crushed leaves are used in minor cuts
<i>Mimosa pudica</i>	Root	Root paste is applied on septic ulcer for quick healing
<i>Monochoria vaginalis</i>	Rhizome	Rhizome is eaten regularly while empty stomach to cure asthmatic trouble
<i>Ocimum americanum</i>	Leaf	Leaf paste is externally applied to treat itching
<i>Oxalis corniculata</i>	Leaf	Leaf juice is applied to cure scabies
<i>Peperomia pellucida</i>	Leaf, Stem	Plant paste externally to reduce pimple and white spots of the body
<i>Senna alata</i>	Leaf	Leaf juice is applied on ringworm
<i>Senna occidentalis</i>	Leaf	Leaf powder is made into a paste applied to cure skin diseases
<i>Senna tora</i>	Leaf	Leaf paste is applied on scabies and ringworm
<i>Sida acuta</i>	Leaf	The leaf paste is layered on the boils
<i>Tridax procumbens</i>	Leaf	The leaf paste is used in cellulites
<i>Urena lobata</i>	Seed	Seeds are crushed into a paste and applied on scabies and ringworm

alata, *Solanum torvum*, *Synedrella nodiflora*), Europe (1 species, *Oxalis corniculata*), Tropical West Asia (1 species, *Saccharum spontaneum*) and Mediterranean (1 species, *Cuscuta reflexa*).

The local inhabitants in and around the sanctuary have learned the use of a number of these species for curing various ailments. In most cases the leaf of the plant is used and in

Table 3. A list of invasive plants used as vegetable by the local people in Amchang Wildlife Sanctuary.

Species name	Parts used	Mode of use
<i>Alternanthera philoxeroides</i>	Tender shoot	Leaves cooked as vegetable
<i>Alternanthera sessilis</i>	Tender shoot	Leaves cooked as vegetable
<i>Amaranthus spinosus</i>	Tender shoots and leaves	Stem and leaves cooked as vegetable
<i>Bidens pilosa</i>	Leaves	Young leaves and shoots cooked as vegetable
<i>Chenopodium album</i>	Young shoot/ Leaves	Tender shoots fried and eaten
<i>Euphorbia hirta</i>	Young shoots and leaves	Young shoots and leaves are used as mixed vegetable
<i>Oxalis corniculata</i>	Leaves/ Stem	Young shoots and leaves are used as vegetable

some cases stem, tender shoots, roots, rhizome and seeds are used. Most of the applications are of the leaf paste or leaf juice for curing skin related diseases followed by the cure of stomach related ailments (such as dysentery), fever, pain and antidote to poison (Table 2).

A variety of species are also used as vegetable by the local inhabitants in and around Amchang wildlife sanctuary. In most cases the leaf of the plant or tender shoot is used as vegetable (Table 3). These are used raw or boiled or fried in isolation or in mix with other vegetables such as potato and onion. The local people believe that the use of some of these plants as vegetable also renders medicinal efficacy in improving their immunity.

CONCLUSIONS

In Amchang Wildlife Sanctuary, a large number of invasive plant species occur in local flora. The invasive species grow quickly and germinate in wide range of physical conditions. These perennial species can flower in large quantities, produce many seeds, and disperse seeds effectively to occupy newer habitats. Our observations in Amchang Wildlife Sanctuary have shown that an invasion of *Parthenium hysterophorus* was seen from 2014 onwards and this species spread in a few months' time in considerable area. The native aquatic species were rapidly replaced by the exponentially growing *Eichhornia crassipes* and *Lantana camara* as dense thickets. *Mikania micrantha* has grown to the level of menace on the branches of trees and shrubs. The rapid proliferation of invasive species in roadsides under the forest canopy not only poses a threat to the forest flora and community composition, but also alters biomass and nutrient dynamics of the ecosystem. The presence of the recorded invasive plants in this study poses a serious challenge for their control in Amchang Wildlife Sanctuary.

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