

Perception and knowledge of native people on exotic plant species in the Bargarh district of Western Odisha, India: A case study

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Abstract

The present study was based on both bibliographic sources and the survey to the documentation of exotic plants in Bargarh district, western Odisha, India. A total of 75 species belonging to 65 genera and 34 families are reported. Asteraceae family contributes the highest number of species (13), six species were from Amaranthaceae; five species each from Leguminosae and Poaceae; four species of Euphobiaceae; three species each from four families viz. Convolvulaceae, Malvaceae, Onagraceae, and Verbenaceae; two species each from six families *i.e.* Arecaceae, Asclepiadaceae, Capparaceae, Lamiaceae, Portulacaceae, Solanaceae; one species each from rest 19 families. Out of 75 species, a total of 42 species are native to Tropical America; five species are native to Mexico; each of three species to America; each of two species to Africa, Brazil, Europe, the Mediterranean, and South America; each of one species to Australia, Central America, China, Madagascar, Malaysia, North America, Pantropic, Peru, South America (1824), South America (17th cent.), Tropical West Asia, Tropical Africa, Tropical America (Bf1824), Tropical South America, and West Indies. The uses of exotic plants for various purposes as indicated by the native peoples are discussed here. The present study gives complete and efficient documentation of exotic plants in the Bargarh district of Western Odisha that will provide a tool for the maintenance of the local biodiversity. Some plant species such as *Alternanthera sessilis*, *Borassus flabellifer*, *Cassia tora*, *Cleome gynandra*, *Datura metel*, *Gomphressa globosa*, *Sida acuta*, *Zinnia elegans*, etc. may have potential as medicinal plants.

Significance Statement

The present study provides complete and efficient documentation of exotic plants with their use by the natives in the Bargarh district of Western Odisha. This finding will provide a tool for the maintenance of the local biodiversity.

Introduction

As per the ancient Indian literature (Paranjpe 2012; Bhutya 2021; Mishra 1985; Solanki 2018), it is written that all plants on the earth are beneficial for human beings, animals, and other plants. Hence, every plant on the earth is a fortune for the whole living race. However, some plants also show negative impacts on the environment and global biodiversity. Such plants have been the focus of environmentalists due to their undesired impact on the ecosystem. One group of plants under this category is the exotic plants or invasive plants (Kull et al. 2007). In the last few decades, several exotic species have been introduced in India from their native areas either accidentally or deliberately as fodder crops or ornamentals. Some exotic species often cultivated, may provide food, medicine, fuel, or fodder to local communities (Sahu and Ekka 2020; Kohli et al. 2006). Some exotic species are also responsible for the endangerment and extension of native species and have a negative impact on crop production, regeneration of forest plants, grazing of livestock, and human health (Sharma et al. 2005; Richardson et al. 2000). It has been reported that about 50% of the exotic species were ecologically harmful (Zhang and Hizioglu 2010). Various studies have shown that exotic plants have positive economic, social, and ecological contributions (Das and Duarah 2013). In India, investigation has been carried out to identify the exotic species and their impact on the ecosystem and biodiversity (Maheswari and Paul 1975; Matthew 1969; Negi and Hajra 2007; Pandey and Parmer 1994; Raizada 1935; Srivastava et al. 2014; Wagh and Jain 2018; Mallick et al. 2019). In Odisha, studies on exotic plants were carried out by a few authors (Nayak and Satapathy 2015; Mohanty 2018). But no study especially on Bargarh district of Western Odisha was so far carried out to document such exotic species. Therefore, the present study aimed to document the status and versatility of the use of exotic plant species in Bargarh district, Western Odisha, India.

Materials and Methods

Study area

Bargarh district is situated between 20°43' to 21°41' N and 82°39' to 83°58' E (as per the District Statistical Handbook 2020). The district enjoys tropical monsoon with an average rainfall of 1250 mm to 2220 mm per annum. The district covers about 5,737 Sq Km of geographical area. Bargarh district is surrounded by Jharsuguda in the North, Sambalpur in the east, Subarnapur and Bolangir in the south, and Nuapada in the west (Fig. 1).

Data collection

The present study is an attempt to know the documentation of exotic plants in the Bargarh district of Western Odisha. Periodic field surveys were carried out from Mar 2020 to Sept 2021. A total of 46 well-known inhabitants have been surveyed including 20 females and 26 males of Binjhal tribes (Dravidian ethnic group). During the fieldwork, interviews were conducted with the local villagers and the local practitioners involved in herbal medicines. The ages of the participants range from 25 to 85 (Table 1). Periodic collections of plants were made from each locality to collect the exotic plant species. The specimen was dried and pressed in the field and taken to the laboratory and the herbarium was prepared according to customary methods (Sahu et al. 2010; Mohanty 2018). The voucher specimens (No ARS/BGH-07 to ARS/BGH-248) were deposited at the Department of Botany, Vikash Degree College, Bargarh. The surveyed exotic plant species were alphabetically arranged in Table 2, according to their scientific names, family, habit, nativity, and uses. For identification of plants local flora books and published literature was used (Sahu et al. 2021; Saxena and Brahman 1994; Sheikh and Dixit 2017).

Table 1
Demographic characteristics of the healers of
the study area.

Socio-economic variables		Number	%
Gender	Female	20	43.5
	Male	26	56.5
Age (Years)	16–25	2	4.3
	26–35	4	8.7
	36–55	12	26.1
	56–65	17	37.0
	66–75	7	15.2
	76–85	4	8.7

Table 2
List of exotic plant species used by the natives of Bargarh district of Western Odisha.

Botanical Name, Voucher Number, Local Name	Family	Life Form	Habitat	Nativity	Ethnobotanical Uses	No. of paper indexed by Web of Science*: total/chemical composition/biological activity/clinical trial
<i>Acacia nilotica</i> (L.) Willd. ex Delile, ARS/BGH-07, Bamor	Leguminosae	Tree	F	Africa	Young twigs cut in to small pieces and used as tongue cleaner and toothbrush without any toothpaste. Dry wood also used as fuel.	960/41/14/1
<i>Aerva lanata</i> (L.) Juss. ex. Schult., ARS/BGH- 13, Lopang ark	Amaranthaceae	Herb	W	Madagascar	Whole plants are used to cure diabetes.	90/1/0/0
<i>Aeschynomene indica</i> L., ARS/BGH-211, Pensual	Leguminosae	Herb	W	North America	Aerial parts of the plants are used for wound healing, urinary tract infection, and dysentery.	69/0/1/0
<i>Ageratum conyzoides</i> L., ARS/BGH-15, Poksungha	Asteraceae	Herb	W, CF	Trop. America	Leaves juice is applied on wound to stop bleeding.	562/31/9/1
<i>Allium cepa</i> L., ARS/BGH-18, Uel	Alliaceae	Herb	CF, HS	Mediterranean	Bulbs are used as spices and vegetables; young's leaves are cooked and eaten with rice. Bulbs are used for insect bites, sunstroke, and blood purifier.	6,280/108/50/4
<i>Alternanthera sessilis</i> (L.) DC., ARS/BGH- 212, Madaranga	Amaranthaceae	Herb	RB	Trop. America	Root paste is applied to get relief from scorpion bite.	147/2/0/1
<i>Amaranthus spinosus</i> L., ARS/BGH-213, Kanta bhaji	Amaranthaceae	Herb	CF	Trop. America	Young leaves were boiled, cooked and eaten as vegetables by the rural peoples. Fresh leaves juice is applied on eczema.	201/7/3/0

Note: Habitat: A-Aquatic, AR-along roadside, CF- cultivated fields, F-forests, HS-homestead, PR-parasites, W-wastelands.

*Visited on 1/15/2021

Botanical Name, Voucher Number, Local Name	Family	Life Form	Habitat	Nativity	Ethnobotanical Uses	No. of paper indexed by Web of Science*: total/chemical composition/biological activity/clinical trial
<i>Argemone mexicana</i> L., ARS/BGH-29, Deng bhejeri	Papaveraceae	Herb	W	S. America (17th cent.)	The leaves are useful in curing cough and cold. The latex is useful in skin diseases, jaundice, and leprosy.	277/3/5/1
<i>Bidens pilosa</i> L., ARS/BGH-214, Bangendu	Asteraceae	Herb	W	Trop. America	Leaves extract is used for the treatment of headache, liver disorders and ear infections.	887/41/14/2
<i>Blumea lacera</i> (Burm.f.) DC., ARS/BGH-215, Kukur Sunga	Asteraceae	Herb	W	Trop. America	Whole plant extracts are used by the native to get relief from liver disorder.	27/2/0/0
<i>Borassus flabellifer</i> L., ARS/BGH-40, Tal	Arecaceae	Tree	W, HS	Trop. America	Fruit juice jaggery given two times per a day to cure asthma.	207/4/2/0
<i>Calotropis gigantea</i> (L.) W.T.Aiton, ARS/BGH-216, Dhob Arakh	Asclepiadaceae	Shrub	W	Trop. America	Flowers were also used for worship purpose by the native of the district.	373/5/4/0
<i>Calotropis procera</i> W.T.Aiton, ARS/BGH- 48, Arakh	Asclepiadaceae	Shrub	W	Trop. America	Flowers were also used for worship purpose by the native of the district.	934/24/7/1
<i>Cardiospermum</i> <i>halicacabum</i> L., ARS/BGH-217, Fatka	Sapindaceae	Herb	W	Trop. America	The leaves extract is used to cure earache by the native.	97/3/1/0
<i>Carica papaya</i> L., ARS/BGH-52, Amrutbhanda	Caricaceae	Tree	CF, HS	Mexico	Fruits are used for improving digestion and liver health. Ripen fruits are eaten as fresh. Leaves extract is used the platelet level in bloods.	3,226/43/10/6

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*Visited on 1/15/2021

Botanical Name, Voucher Number, Local Name	Family	Life Form	Habitat	Nativity	Ethnobotanical Uses	No. of paper indexed by Web of Science*: total/chemical composition/biological activity/clinical trial
<i>Cassia fistula</i> L., ARS/BGH-54, Sunari	Leguminosae	Tree	W, AR	Pantropic	10 gm of unripe fruit pulp is crushed and cooked in 100 ml of Mustard oil and filtered it, two to three drops of the filtered oil is given in the ear to cure earache. For its beautiful flowers, people used as an ornamental plant also.	447/11/4/4
<i>Cassia tora</i> L., ARS/BGH-55, San chakunda	Leguminosae	Herb	W	S. America (1824)	Root extract is used to get relief from scorpion sting; seed extract is used to cure various skin diseases.	304/0/2/1
<i>Catharanthus roseus</i> (L.) G.Don, ARS/BGH- 56, Baramasi	Apocynaceae	Herb	CF, HS	West Indies	Plants are used as ornamental purpose. Leaves extract is used to cure blood dysentery, diabetes and root extract is used to cure fever. Flowers are used for worshipping purpose.	3,567/12/33/2
<i>Celosia argentea</i> L., ARS/BGH-59, Sirel	Amaranthaceae	Herb	W	Trop. America	Leaves are cooked as vegetables.	227/1/3/0
<i>Chenopodium album</i> L., ARS/BGH-218, Bathua	Chenopodiaceae	Herb	CF	Europe	Leaves are cooked as vegetables.	2,297/27/10/0
<i>Chloris barbata</i> Sw., ARS/BGH-219, Phuleri lata	Poaceae	Herb	W	Trop. America	Juice from the whole plants is used to cure skin disorders, and diabetics.	38/1/0/0
<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob., ARS/BGH-220, Pokasungha	Asteraceae	Herb	W	Trop. America	The leaves extract is used to cure wound healing.	700/29/3/0

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Botanical Name, Voucher Number, Local Name	Family	Life Form	Habitat	Nativity	Ethnobotanical Uses	No. of paper indexed by Web of Science*: total/chemical composition/biological activity/clinical trial
<i>Cleome gynandra</i> L., ARS/BGH-68, Hulhul	Capparaceae	Herb	W, AR	Trop. America	The leaves juice is used for the treatment of insect bites and wound.	136/1/0/0
<i>Cleome viscosa</i> L., ARS/BGH-221, Bansurso	Capparaceae	Herb	W, AR	Trop. America	The leaves extract is used to cure wound and to treat herpes infections.	149/2/2/0
<i>Cuscuta reflexa</i> Roxb., ARS/BGH-79, Nirmuli	Convulvaceae	Climber	P	Mediterranean	The whole plant extract is used to cure from jaundice.	246/2/1/1
<i>Cynodon dactylon</i> (L.) Pers., ARS/BGH-81, Dub	Poaceae	Herb	W	Trop. America	Leaves were used for blood clotting. Leaves were also used for worship purpose by the native of the district.	3,056/50/8/0
<i>Datura metel</i> L., ARS/BGH-222, Dudura	Solanaceae	Shrub	W, HS	Trop. America	Flowers were also used for worship purpose by the native of the district. The plants are also externally used to cure skin diseases and wound healing.	254/2/0/0
<i>Duranta repens</i> L., ARS/BGH-223, Bilatikanta	Verbenaceae	Shrub	W, HS	America	It is used as insect repellent plant.	54/2/1/0
<i>Echinochloa colona</i> (L.) Link, ARS/BGH- 224, Jhipa	Poaceae	Herb	CF, RB	Trop. America	The whole plants are used as fodder by the grazing animals.	261/4/0/0
<i>Eclipta prostrata</i> L., ARS/BGH-93, Bhurangaraj	Asteraceae	Herb	AR, HS, CF	Trop. America (Bf1824)	The plant extracts are used for the treatments of wounds, hair loss prevention.	292/3/5/1

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Botanical Name, Voucher Number, Local Name	Family	Life Form	Habitat	Nativity	Ethnobotanical Uses	No. of paper indexed by Web of Science*: total/chemical composition/biological activity/clinical trial
<i>Eichhornia crassipes</i> (Mart.) Solm., ARS/BGH-225, Bilatidala	Pontederiaceae	Herb	A	Trop. America	Root paste extract is used with oil to get relief from back pain.	2,315/40/4/0
<i>Eucalyptus citriodora</i> Hook., ARS/BGH-97, Eucalyptus	Myrtaceae	Tree	AR, CF	Australia	Leaves were used to cure asthma, cod, and diabetes. Wood is also used as fuel.	341/68/6/0
<i>Euphorbia heterophylla</i> L., ARS/BGH-100, Bad Dudhini	Euphorbiaceae	Herb	CF	Trop. America	Plants were grown for ornamental purposes.	282/2/4/0
<i>Euphorbia hirta</i> L., ARS/BGH-101, Dudhini	Euphorbiaceae	Herb	CF, W	Trop. America	Whole plant is used to cure abdominal pain, asthma, dysentery, and skin diseases.	316/5/5/3
<i>Evolvulus nummularius</i> L., ARS/BGH-102, Bichamalia	Convolvulaceae	Herb	W, CF	Trop. America	Used as fodder. The whole plant is used as a medicine to cure burns, cuts, scorpion stings.	11/0/0/0
<i>Gomphrena celosioides</i> Mart., ARS/BGH-226, Hiragol	Amaranthaceae	Herb	CF, AR	S. America	Whole plant is used by the native for the treatment of Urinary Tract Infection.	21/0/3/0
<i>Gomphrena globosa</i> L., ARS/BGH-227, Supari phul	Amaranthaceae	Herb	HS	America	Plants were grown for ornamental purposes.	131/2/0/0
<i>Heliotropium indicum</i> L., ARS/BGH-113, Hatisundh	Boraginaceae	Herb	W, F	S. America	Root is used to overcome iron deficiency during pregnant by the native.	70/2/0/0
<i>Hibiscus rosa-sinensis</i> L., ARS/BGH- 115, Mandar	Malvaceae	Shrub	HS	China	Flowers are used for worshipping.	518/9/3/1
<i>Hyptis suaveolens</i> (L.) Poit., ARS/BGH-228, Ganga tulsī	Lamiaceae	Herb	AR	Trop. America	Root extract are taken orally in the early morning in empty stomach to constipation.	235/41/7/0
Note: Habitat: A-Aquatic, AR-along roadside, CF- cultivated fields, F-forests, HS-homestead, PR-parasites, W-wastelands.						
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Botanical Name, Voucher Number, Local Name	Family	Life Form	Habitat	Nativity	Ethnobotanical Uses	No. of paper indexed by Web of Science*: total/chemical composition/biological activity/clinical trial
<i>Ipomoea batatas</i> (L.), Lam., ARS/BGH-229, Kanda	Convolvulaceae	Climber	CF, HS	Trop. America	Adventitious roots are boiled and eaten. The green leaves are used as leafy vegetables.	3,165/47/12/6
<i>Jatropha gossypifolia</i> L., ARS/BGH-121, Baigaba	Euphorbiaceae	Shrub	AR, CF	Brazil	Bark and leaves extracts are used to cure stomach ache, and also used as blood purifier.	119/1/2/0
<i>Lantana camara</i> L., ARS/BGH-122, Naguari	Verbenaceae	Shrub	F, AR	Trop. America	Leaves are used to cure malaria.	1.411/96/13/0
<i>Ludwigia adscendens</i> (L.) H.Hara, ARS/BGH- 230, Pengali	Onagraceae	Herb	RB	Trop. America	It has soil binding properties.	458/4/0/0
<i>Ludwigia octovalvis</i> (Jacq.) P.H.Raven, ARS/BGH-231, Bheinkura	Onagraceae	Herb	RB	Trop. America	It has soil binding properties. Fresh leaf juice is applied to get relief from eye infection.	
<i>Ludwigia perennis</i> L., ARS/BGH-232, Latkara	Onagraceae	Herb	RB	Trop. America	It has soil binding properties. Plants is boiled in mustard oil and applied on body to bring down fever.	
<i>Melochia corchorifolia</i> L., ARS/BGH-233, Telpuri	Sterculiaceae	Herb	W	Trop. America	Root paste is used to get relief from headache.	21/0/0/0
<i>Mimosa pudica</i> L., ARS/BGH-131, Lajkuli	Mimosaceae	Herb	F	Brazil	Root paste is useful in urinary disorder.	676/9/5/1
<i>Mirabilis jalapa</i> L., ARS/BGH-133, Belbudia	Nyctaginaceae	Herb	W, HS	Peru	Leaves and flowers are used to cure earache, and skin allergies. It is also used as ornamental plant.	218/5/4/0

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<i>Ocimum canum</i> Sims, ARS/BGH-234, Bantulsi	Lamiaceae	Herb	W	Trop. America	Plant extract is used to lowering the blood glucose level.	82/23/3/1
<i>Opuntia stricta</i> (Haw.) Haw., ARS/BGH-149, Nagpheni	Cactaceae	Shrub	W	Trop. America	Phylloclade is used to cure swelling of joints.	169/13/1/1
<i>Oxalis corniculata</i> L., ARS/BGH-235, Kumaree	Oxalidaceae	Herb	CF, HS	Europe	Leaves are cooked as vegetables by the native.	149/4/2/0
<i>Parthenium hysterophorus</i> L., ARS/BGH-236, Gajar ghas	Asteraceae	Herb	W, AR	Trop. America	Plant extract is used as insecticide.	1,004/14/5/0
<i>Phoenix sylvestris</i> (L.) Roxb., ARS/BGH-153, Khajur	Arecaceae	Tree	F	Trop. America	Main riches of leaf are used as toothbrush and tongue cleaner. Ripen fruits are edible. During summer, the juice extract from the young leaves were used to drinks by the native. The dry Leaves were used as fuel.	53/1/0/0
<i>Phyla nodiflora</i> (L.) Greene, ARS/BGH-154, Langali ghas	Verbenaceae	Herb	W	Trop. America	Leaf paste is used to treat knee pain and boils.	45/0/0/0
<i>Pistia stratiotes</i> L., ARS/BGH-157, Borajhanj	Araceae	Herb	A	Trop. America	Leaves were used to cure diabetes, blood in urine, and anemia.	706/7/2/0
<i>Portulaca oleracea</i> L., ARS/BGH-237, Nuni sag	Portulacaceae	Herb	W, HS	Trop. S. America	Leaves are used as vegetables. Leaf juice is used to improve digestion power.	1,206/66/9/14
<i>Portulaca quadrifida</i> L., ARS/BGH-238, Duldulia	Portulacaceae	Herb	W	Trop. America	Leaf extract is given in dysentery. Leaves are used as vegetables.	12/0/0/0
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<i>Quisqualis indica</i> L., ARS/BGH-166, Madhumalti	Combretaceae	Climber	HS	Malyasia	Seeds were used to expelling the worms. Plants were grown for ornamental purposes.	44/0/1/1
<i>Rhoeo discolor</i> (L'Hér.)HanceinWal., ARS/BGH-239	Commelinaceae	Herb	HS	Central America	Plants were grown for ornamental purposes.	33/0/1/0
<i>Ricinus communis</i> L., ARS/BGH-240, Jada	Euphorbiaceae	Shrub	CF, AR	Africa	Oil is used for the skin irritations. Oil is also used as lubricant.	4,316/77/53/7
<i>Ruellia tuberosa</i> L., ARS/BGH-241, Meadow ghas	Acanthaceae	Herb	AR, HS	Trop. America	Seed extract is used in pneumonia.	49/1/0/0
<i>Saccharum spontaneum</i> L., ARS/BGH-242, Kais	Poaceae	Herb	RB	T. West Asia	Stem paste is used in jaundice. Leaves are used for traditional rope making.	426/5/2/0
<i>Scoparia dulcis</i> L., ARS/BGH-176, Bangangai	Scrophulariaceae	Herb	W	Trop. America	Leaves were used for the treatment of sore throat.	245/5/1/2
<i>Sida acuta</i> Burm.f., ARS/BGH-179, Bajarmuli	Malvaceae	Herb	W	Trop. America	Stem is used as tooth brush and tongue cleaner.	111/1/1/0
<i>Solanum nigrum</i> L., ARS/BGH-243, Nunnunia	Solanaceae	Herb	CF, W	Trop. America	Leaf extract is used in typhoid fever.	1,467/13/9/1
<i>Tagetes erecta</i> L., ARS/BGH-188, Haldia ganja	Asteraceae	Herb	CF, HS	Mexico	Plants were grown as ornamental purpose. Flowers also used for worshipping purpose and decoration by the native of the district. These plants were planted as insect repellent plants in crop fields.	735/20/6/0

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<i>Tagetes patula</i> L., ARS/BGH-189, Lal ganja	Asteraceae	Herb	CF, HS	Mexico	Plants were grown as ornamental purpose. Flowers also used for worshipping and decoration by the native of the district. These plants are Planted as insect repellent plants in crop fields.	509/22/5/0
<i>Tamarindus indica</i> L., ARS/BGH-190, Tentel	Leguminosae	Tree	HS	Trop. America	Both the unripe and ripen fruits can be eaten fresh. Young twigs cut in to small pieces and used as tongue cleaner and toothbrush without any toothpaste.	818/22/6/2
<i>Tridax procumbens</i> L., ARS/BGH-199, Bisalyakarani	Asteraceae	Herb	CF, AR	Mexico	Leaf extract is used to stop bleeding.	250/6/4/0
<i>Urena lobata</i> L., ARS/BGH-244, Khet kapasia	Malvaceae	Herb	W	Trop. Africa	Stem fiber is used for making rope.	70/2/0/0
<i>Vernonia cinerea</i> (L.) Less., ARS/BGH-245, Sahadebi	Asteraceae	Herb	W	S. America	Whole plant extracts are used to cure liver disorder, urine infection, fever, sleep disorder.	137/3/0/1
<i>Xanthium indicum</i> J. Koenig ex Roxb., ARS/BGH-246, Gokhru	Asteraceae	Herb	AR, RB	Trop. America	Fruits can be used for the treatment of fungal infection and insect bites.	7/1/0/0
<i>Xanthium strumarium</i> L., ARS/BGH-206, Chotghokhuru	Asteraceae	Herb	AR, RB	Trop. America	Leaf extract is used in earache.	742/16/9/0
<i>Zinnia elegans</i> Jacq., ARS/BGH-247, Jinia	Asteraceae	Herb	HS	Mexico	Plants were grown for ornamental purposes.	526/4/1/0

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<i>Zea mays</i> L., ARS/BGH-248, Maka	Poaceae	Herb	CF, HS	America	The corns are used as food for human and livestock.	44,019/500/134/4
Note: Habitat: A-Aquatic, AR-along roadside, CF- cultivated fields, F-forests, HS-homestead, PR-parasites, W-wastelands.						
*Visited on 1/15/2021						

Results

In this present study, a total of 75 species belonging to 65 genera and 34 families are reported. The exotic species were found to be used as food, fodder, fuel, vegetable, ornamental, medicine, noxious, etc. by the native of Bargarh district (Table 2, Fig. 2). Out of 34 families, Asteraceae family contributes 13 numbers of species; *i.e.* highest in number, six species from Amaranthaceae; five species each from Leguminosae and Poaceae; four species of Eupobiaceae; three species each from four families viz. Convolvulaceae, Malvaceae, Onagraceae, and Verbenaceae; two species each from six families *i.e.* Arecaceae, Asclepiadaceae, Capparaceae, Lamiaceae, Portulacaceae, and Solanaceae; one species each from rest 19 families (Acanthaceae, Alliaceae, Apocynaceae, Araceae, Boraginaceae, Cactaceae, Caricaceae, Chenopodiaceae, Combretaceae, Commelinaceae, Mimosaceae, Myrtaceae, Nyctaginaceae, Oxalidaceae, Papaveraceae, Pontederiaceae, Sapindaceae, Scrophulariaceae, and Sterculiaceae) (Table 2, Fig. 3). A total of 30 species (40%) have been reported as perennials and 45 species (60%) as annual. Out of the 75 exotic plant species, 56 (75%) species were herbs; nine (12%) species were shrubs; seven (9%) species were trees; and 3 (4%) species were climbers respectively (Fig. 4). Results show the diversity of exotic plant species in different habitats (Table 3). Among these habitats, the diversity of exotic plants was highest in the wasteland (75 spp.), followed by 21 species contributed each from both the cultivated field and homestead, roadside (14 spp.), forest (5 spp.), aquatic (2 spp.) and parasite (1 spp.). The nativity of 75 exotic species belongs to 23 different countries. Among these the maximum percentage is from Tropical America (56%), followed by Mexico (7%), America (4%), and countries like Brazil, Europe, the Mediterranean, S. America, and Africa contribute 3% each. The remaining 15 countries contributed 1% each (Table 4, Fig. 5). All the exotic species played a crucial role in the life of human beings. A total of 51 species were used as medicines, 25 species were used as ornamental, 10 species were simultaneously used as noxious, fuel, and vegetable; three species were soil binders; the use of two species was not known; and one species was used as fiber. A few species were also used for multiple purposes.

Table 3
Diversity of exotic ethnobotanical plants at different habitats in the study sites.

Habit	Herbs (56)	Shrubs (9)	Trees (7)	Climbers (3)	Total (75)
Aquatic	2	0	0	0	2
Along road side	9	3	2	0	14
Cultivated field	16	2	2	1	21
Forest	2	1	2	0	5
Homestead	13	3	3	2	21
Parasites	0	0	0	1	1
Wasteland	28	5	2	0	35

Table 4
Regions of Nativity of exotic plant species in the Bargarh district of Odisha.

Region of Nativity	No. of Species	Contribution percentage
Africa	2	3
America	3	4
Australia	1	1
Brazil	2	3
Central America	1	1
China	1	1
Europe	2	3
Madagascar	1	1
Malya	1	1
Mediterranean	2	3
Mexico	5	7
North America	1	1
Pantropic	1	1
Peru	1	1
S. America	2	3
S. America (1824)	1	1
S. America (17th cent.)	1	1
T. West Asia	1	1
Trop. Africa	1	1
Trop. America	42	56
Trop. America (Bf1824)	1	1
Trop. S. America	1	1
West Indies	1	1

Discussion

In this present manuscript, we report a total of 75 exotic plant species (65 genera) come under 34 families from the Bargarh district of Western Odisha. All the species recorded in the present study have also been reported as exotic plant species in other parts of the world. Many of these exotic species have the potential to dominate the habitat and cause disturbance and damage to the native vegetation. It is difficult to find out the history and the period of time of introduction of these species. Various authors have classified these exotic species into naturalized and noxious species (Singh and Misri 1994; Singh et al. 2010; Reshi et al. 2017).

Few reports also provide evidence that exotic species become noxious after naturalized. A total of nine (*Ageratum conyzoides* L., *Argemone Mexicana* L., *Blumea lacera* (Burm. f.) DC., *Cassia tora* L., *Hyptis suaveolens* (L.) Poit., *Lantana camara* L., *Parthenium hysterophrus* L., *Xanthium indicum* L., and *Xanthium strumarium* L.), noxious species were found in this study site. Similar kinds of noxious plants were also reported in Sambalpur district of Odisha. From the taxonomical study, the family Asteraceae was found as dominant family. Similar kinds of results were also reported by various authors (Sahu and Ekka 2020; Srivastava et al. 2014; Wagh and Jain 2018; Nayak and Satapathy 2015; Reshi et al. 2017). Further, plants of Asteraceae have minute seeds that help the species

faster dispersing to a new area through wind, air, and water. Hence exotic species become a serious barrier to the natural regeneration of native vegetation, and sustainable use of biodiversity (Singh et al. 2010). Most of the exotic species in this region are from the tropical America. Similar kinds of results were also reported from Sagar district, Madhya Pradesh by Reshi et al. 2017; from Sambalpur district by Sahu and Ekka 2020.

Several species of plants presented in Table 2 (*Allium cepa*, *Carica papaya*, *Ipomoea batatas*, *Ricinus communis*, *Zea mays*, etc), are well known as food plants, they have a long tradition of use in folk medicine, their composition and effects have been rather well documented. Our studies to date with some medicinal plants in Europe and Asia have shown that the historical ethnopharmacological experience of the local population with the use of healing plants can sometimes be confirmed by analysis of their phytochemical and biological activity (Nguyen et al. 2018; Tran et al. 2019; Raal et al. 2015). More specifically, further research should focus on those plants that have been referenced more than a hundred times in the WoS database, but for which very little data have been published to date on chemical composition and biological activity, such as *Alternanthera sessilis*, *Borassus flabellifer*, *Cassia tora*, *Cleome gynandra*, *Datura metel*, *Gomphressa globosa*, *Sida acuta*, *Zinnia elegans*, etc. Also, there is available less than 50 scientific papers on Web of Science about such species as *Blumea lacera*, *Chloris barbata*, *Evolvulus nummularius*, *Gomphrena celosioides*, *Melochia corchorifolia*, *Phylla nodiflora*, *Quisqualis indica*, *Rhoeo discolor*, *Ruellia tuberosa*, and *Xanthium indicum*.

Conclusions

For the first time, an attempt has been made to document 75 exotic plant species belonging to 65 genera and 34 families from the Bargarh district of Western Odisha. The findings of the present report may help to understand the presence, distribution, and reproduction of exotic species in the Bargarh district. Further, this report will give a superior way to plan for the early detection of exotic species and help environmentalists, taxonomists, agriculturalists, and others to monitor such exotic species. The advantage of the present report is that out of 75 exotic species, a total of 51 species have a crucial role in medical purposes.

Declarations

Acknowledgment

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Conflict of Interest

The authors declared that there is no conflict of interest.

Authors' Contributions

The concepts, survey, data analysis, and writing of the article have been contributed by Dr. Alok Ranjan Sahu. Dr. Ain Raal analyzed the level of scientific research of the plants covered in this paper based on the databases Google Scholar, WoS, and Scopus. He helped to design the structure of the article, as well as to analyze and describe the results and to finalize the manuscript. Both authors have read and approved the final manuscript.

References

1. Bhutya RK (2021) Medicinal plants of India. **Om Publications**.
2. Das K, Duarah P (2013) Invasive alien plant species in the roadside areas of Jorhat, Assam: their harmful effects and beneficial uses. *J. Eng. Res. Appl.* 3(5):353-358. https://www.ijera.com/papers/Vol3_issue5/BL35353358.pdf.
3. Kohli RK, Batish DR, Singh HP, Dogra KS (2006) Status, invasiveness and environmental threats of three tropical American invasive weeds (*Parthenium hysterophorus* L., *Ageratum conyzoides* L., *Lantana camara* L.) in India. *Biol. Invasions* 8:1501-1510. 10.1007/s10530-005-5842-1.
4. Kull CA, Tassin J, Rangan H (2007) Multifunctional, scrubby, and invasive forests? Wattles in the highlands of Madagascar. *Mt. Res. Dev.* 27(3): 224-231. <https://doi.org/10.1659/mrd.0864>.

5. Maheswari JK, Paul SR (1975) The alien flora of Ranchi. J. Bombay Nat. Hist. Soc. 72:158-188.
6. Mallick SC, Ekka NJ, Kumar S, Sahu SC (2019) Invasive Alien Flora in and around an Urban Area of India, Diversity and Ecology of Invasive Plants, In: Intech Open, Sahu SC, Kumar S. <https://doi.org/10.5772/intechopen.88725>.
7. Matthew KM (1969) Alien flora of Kodai Kanal and Palni Hills. Rec. Bot. Surv. India 20:1-241.
8. Mishra L (1985) Anubhut yogamala and sahaja chikishya. Raj Edition. Springer-Verlag.
9. Mohanty CR (2018) Textbook of Plant Systematics. Kalyani Publisher.
10. Nayak SK, Satapathy KB (2015) Diversity, uses and origin of invasive alien plants in Dhenkanal district of Odisha, India. Int. Res. J. Biol. Sci. 4:21-27. <http://www.isca.me/IJBS/Archive/v4/i2/4.ISCA-IRJBS-2014-223.pdf>.
11. Negi PS, Hajra PK (2007) Alien flora of Doon Valley, Northwest Himalaya. Curr. Sci. 92:968-978. <https://www.jstor.org/stable/24097678>.
12. Nguyen HT, Ho DV, Nguyen PDQ, Vo HQ, Do TT, Raal A (2018) Cytotoxic evaluation of compounds isolated from the aerial parts of *Hedyotis pilulifera* and methanol extract of *Inonotus obliquus*. Nat. Prod. Commun. 13:939-941. <https://doi.org/10.1177/1934578X1801300805>.
13. Pandey RP, Parmar PJ (1994) The exotic flora of Rajasthan. J. Econ. Taxon. Bot. 18:105-121. <https://oa.mg/work/2903332266>.
14. Paranjpe P (2012) Indian medicinal plants: Forgotten healers. Chaukhamba Sanskrit Pratishthan.
15. Raal A, Nguyen TH, Ho VD, Do TT (2015) Selective cytotoxic action of Scots pine (*Pinus sylvestris* L.) needles extract in human cancer cell lines. Pharmacogn. Mag. 11:290-295. <https://doi.org/10.4103/0973-1296.166052>.
16. Raizada MB (1935) Recently introduced or otherwise imperfectly known plants from the upper Gangetic plain. J. Indian Bot. Soc. 14:339-348.
17. Reshi MI, Chadhar BL, Khare PK (2017) Alien invasive plants of central Indian tropical dry deciduous forests of Sagar district, Madhya Pradesh, India. Indian For. 143:157-164.
18. Richardson DM, Pysek P, Rejmanek M, Barbour MG, Dane PF, West CJ (2000) Naturalization and invasion of alien plants: concepts and definitions. Divers. Distrib. 6:93-107. <http://www.blackwell-science.com/ddi>.
19. Sahu AR, Ekka NJ (2020) Checklist of exotic herbs used by the peoples of Sambalpur district of Odisha, India. Int. J. Pharm. Res. Appl. 5:665-672. <https://doi.org/10.35629/7781-0502665672>.
20. Sahu AR, Behera N, Mishra SP (2010) Use of ethnomedicinal plants by natives of Bargarh District of Orissa, India. Ethnobot. Leaflet. 14:889-910.
21. Sahu AR, Sahu M, Raal A (2021) An Ethnobotanical Study on Native Plants of Bargarh of Western Odisha, India in relieving Urogenital ailments. Ethnobot. Res. Appl. 21:29. <http://dx.doi.org/10.32859/era.21.29.1-11>.
22. Saxena HO, Brahmam M (1994) The Flora of Orissa, Regional Research Laboratory Bhubaneswar, Orissa, India and Orissa Forest Development Corporation Ltd., Bhubaneswar.
23. Sharma GP, Singh JS, Raghubanshi AS (2005) Plant invasions: emerging trends and future implications. Curr. Sci. 88:726-734. <https://www.researchgate.net/publication/225039760>.
24. Sharma PV (2004) Classical uses of medicinal plant. Chaukhambha Visvabharati.
25. Sheikh DK, Dixit AK (2017) Occurrence of invasive plant in three phytogeographical region of Bilaspur district of Chhattisgarh. Ann. Plant Sci. 6(12):1872-1878. <https://doi.org/10.21746/aps.2017.6.12.13>.
26. Singh G, Misri B (1974) Some exotic ornamentals of Kashmir. Indian J. Hortic. 31:834.
27. Singh KP, Shukla AN, Singh JS (2010) State-level inventory of invasive alien plants, their source regions and use potential. Curr. Sci. 99(1):107-114. <https://www.jstor.org/stable/24108357>.
28. Solanki HA (2018) Checklist of invasive plants of Gujarat and some most indious plants of Gujarat, their hazards, its management and public perspective. Life Sci. Leaflet. 100:72-89. <https://www.researchgate.net/publication/326200532>.
29. Srivastava S, Dvivedi A, Shukla RP (2014) Invasive alien species of terrestrial vegetation of north-eastern Uttar Pradesh. Int. J. For. Res. 959875. <https://doi.org/10.1155/2014/959875>.
30. Tran LTT, Ho DV, Le DV, Phan KV, Nguyen HT, Raal A (2019) Apoptosis-inducing effect of pogostemin A isolated from the aerial parts of *Pogostemon auricularius* against the humal lung cancer cells. J. Biol. Active Prod. Nature 9: 320-327. <https://doi.org/10.1080/22311866.2019.1687334>.

31. Wagh VV, Jain AK (2018) Status of ethnobotanical invasive plants in western Madhya Pradesh, India. *S. Afr. J. Bot.* 114:171-180. <https://doi.org/10.1016/j.sajb.2017.11.008>.
32. Wagh VV, Jain AK (2015) Invasive alien flora of Jhabua district, Madhya Pradesh, India. *Int. J. Biodivers. Conserv.* 7:227-237. <https://doi.org/10.5897/IJBC2015.0833>.
33. Zhang D, Hizirolu S (2010) Impact assessment and utilization of Eastern Redcedar. *Am. J. Appl. Sci.* 7:1032-1037. <https://doi.org/10.3844/ajassp.2010.1032.1037>.

Figures

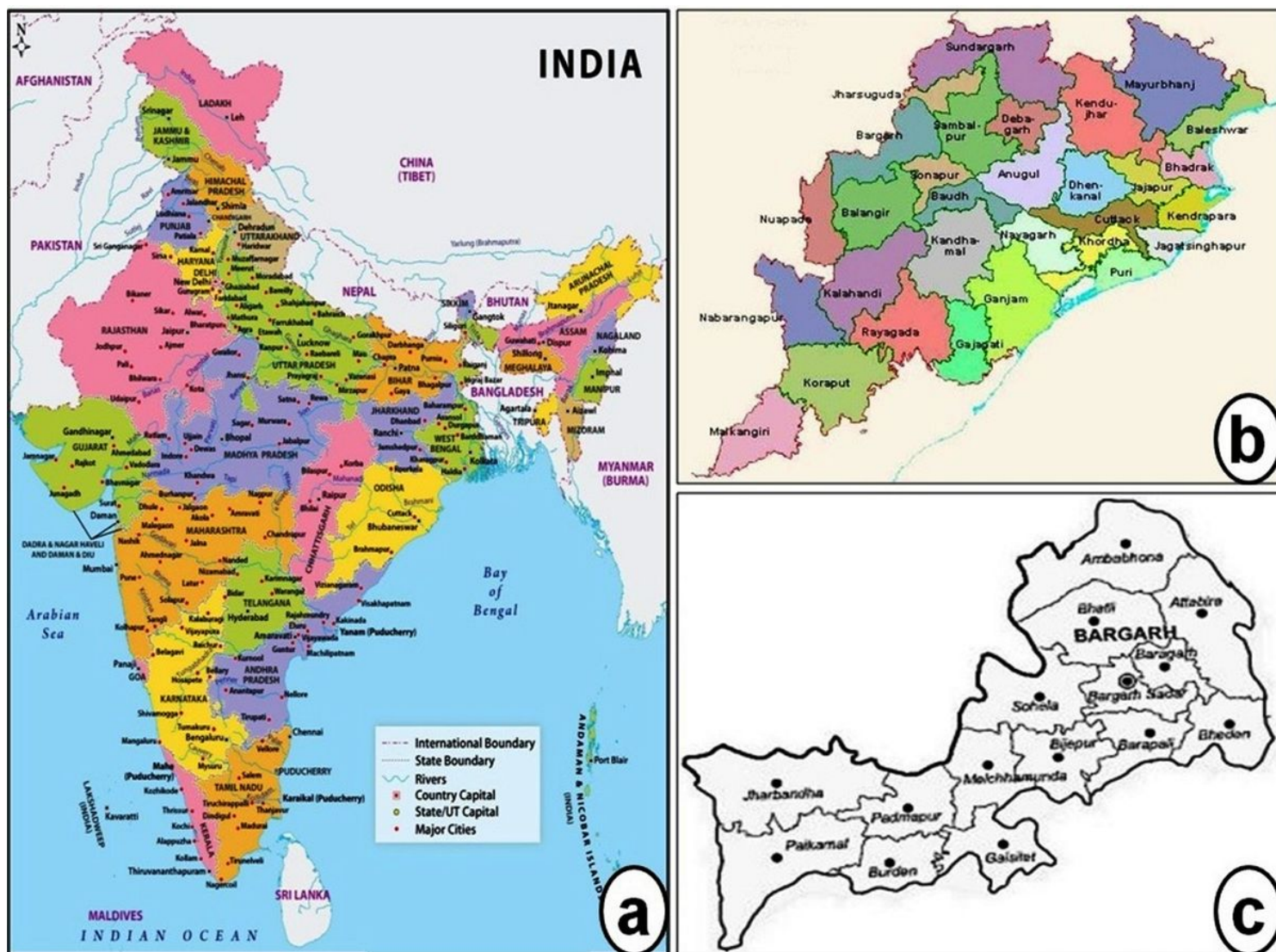


Figure 1

Map of India (a), map of Odisha (b) and map of Bargarh district (c).



Figure 2

Photographs of *Acacia nilotica* L. (a), *Aerva lanata* (L.) Juss. ex. Schult. (b), *Argemone mexicana* L. (c), *Carica papaya* L. (d), *Cynodon dactylon* (L.) Pers. (e), *Eucalyptus citriodora* Hook. (f), *Lantana camara* L. (g), *Mimosa pudica* L. (h), *Phoenix sylvestris* (L.) Roxb. (i), *Sida acuta* Burm.f. (j), *Tridax procumbens* L. (k), and *Zea mays* L. (l).

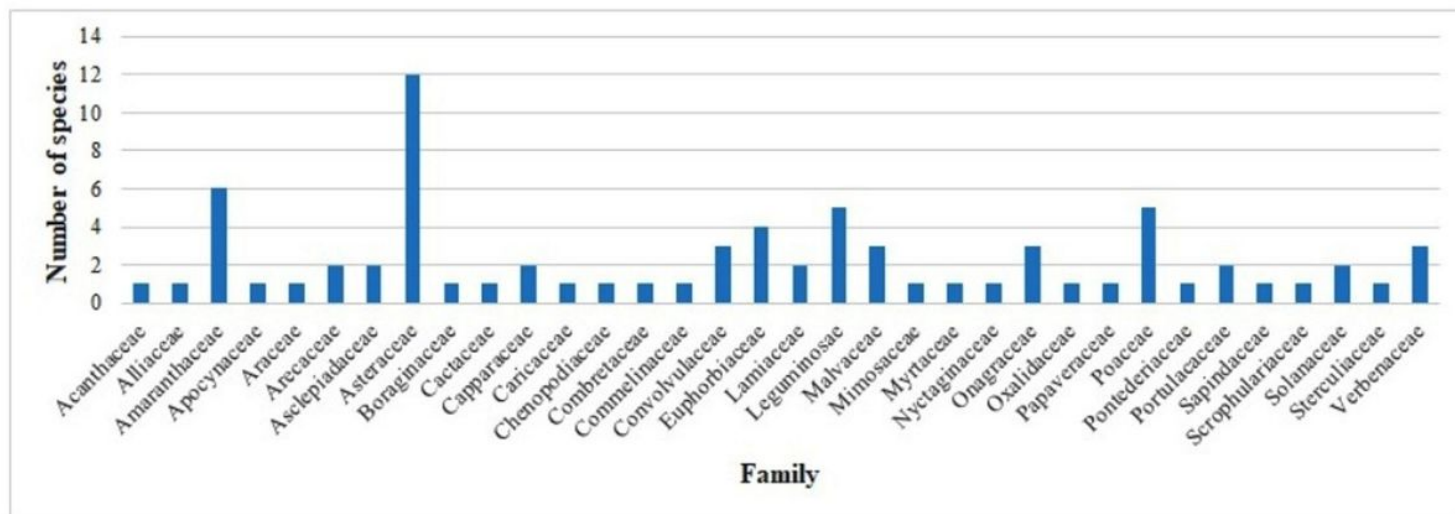


Figure 3

Family wise distribution of exotic plant species of the Bargarh district of Odisha.

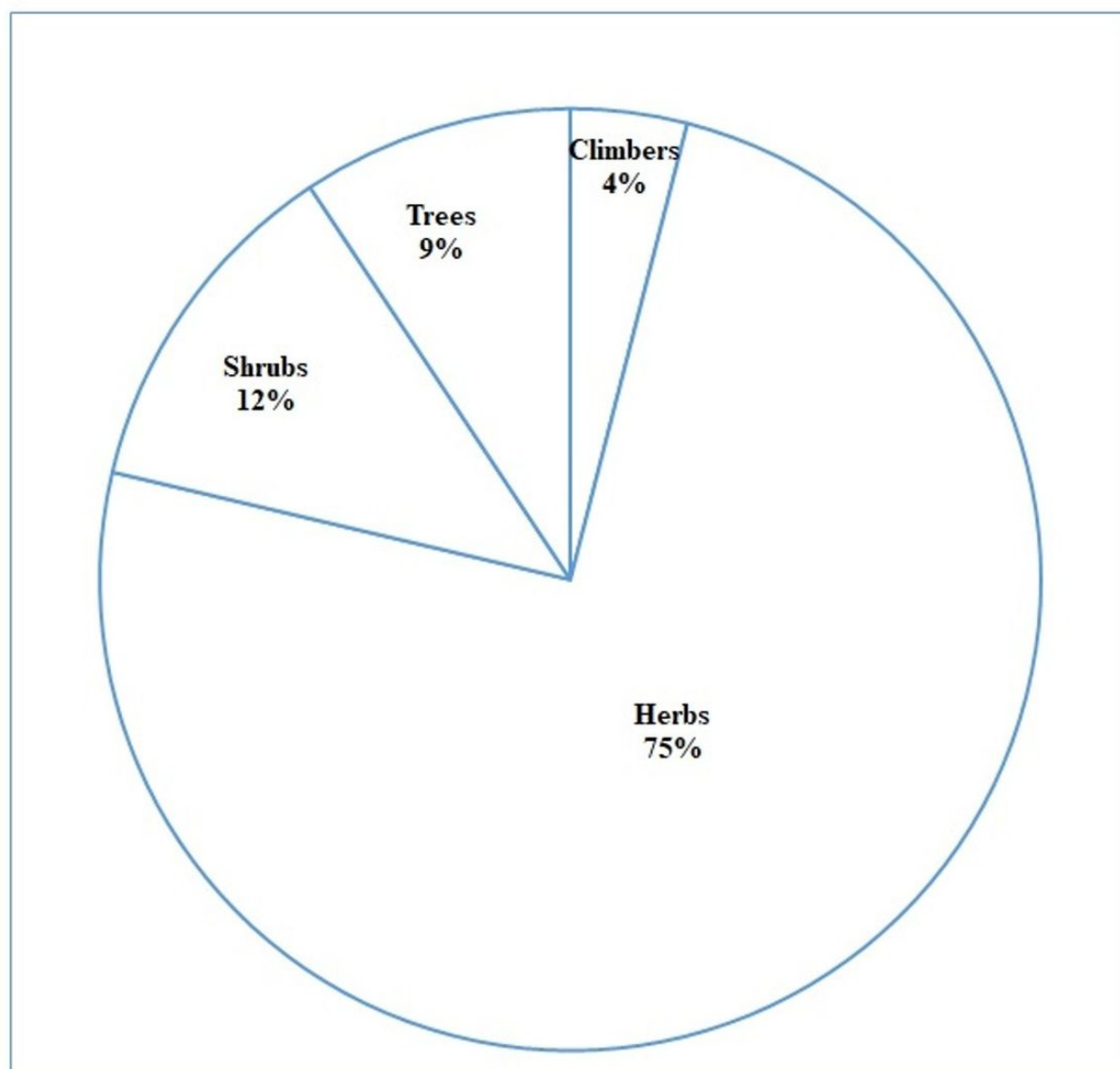


Figure 4

Habit of exotic plant species in the Bargarh district of Odisha.

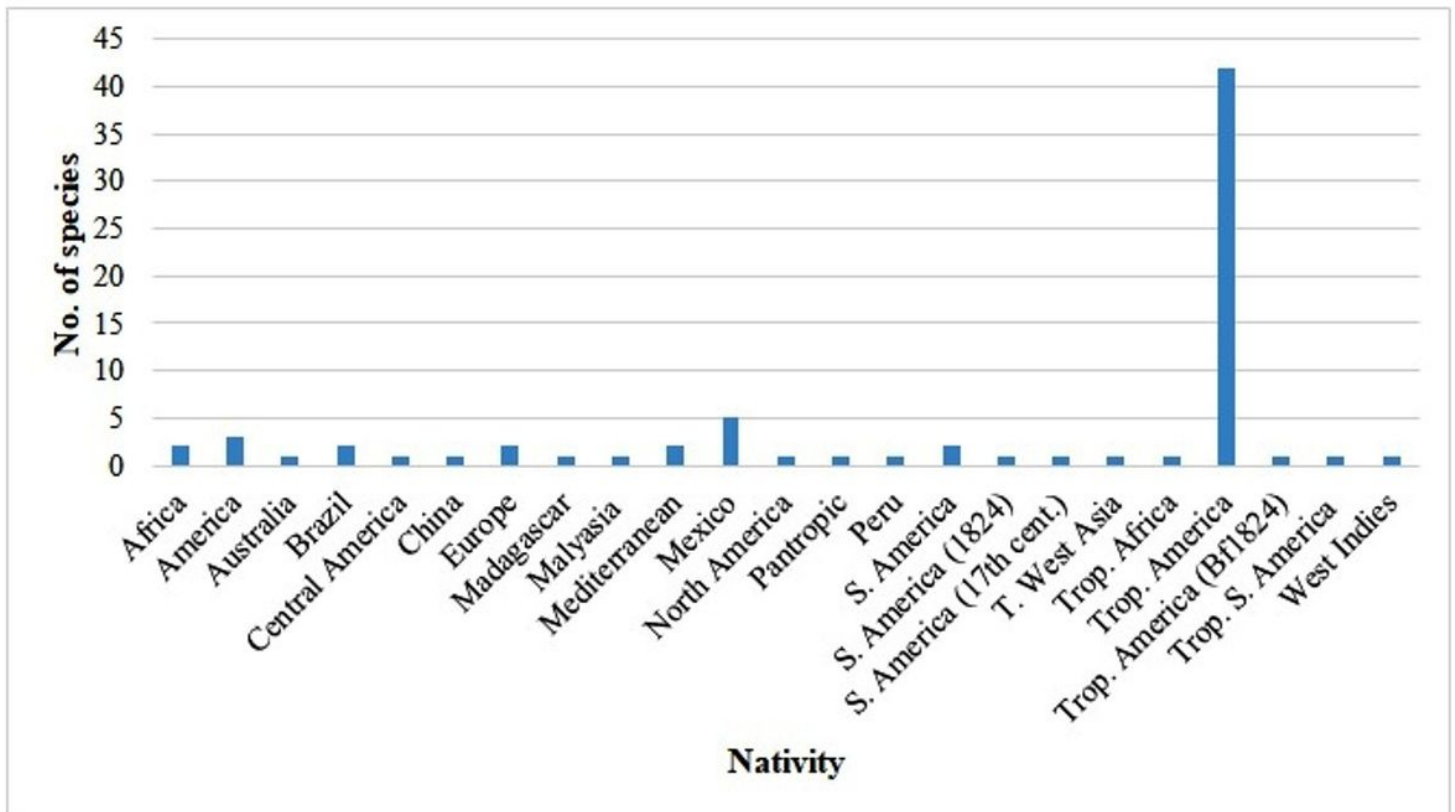


Figure 5

Regional distribution of exotic plants in different countries.