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A study of alien invasive plant species in Kottamkara, Kollam District, Kerala

Jisha M S, Sangeetha G*
Assistant Professor, Department of Botany, TKM College of Arts and Science, Kollam, Kerala, India

Abstract
The plant which are introduced as alien, non-indigenous, exotic, non-native to the location but very aggressive causing damage to the other plant species, health of human and economic structure known as invasive plants which leads to biodiversity losses. AIS are a significant problem to our State, since they impact deeply on native biodiversity, productivity and results in landscape level changes. The problem needs crucial attention. In the present study evaluates the risk and diversity of alien invasive species (AIS) to Kottamkara Grama Panchayat, Kollam, Kerala. Based on the field survey, 20 exotic weed species, belonging 11 families were recorded. Among them Asteraceae and Amaranthaceae are the ruling families with 4 species each. The place of origin of the AIS happens to be Tropical America for 6 species, South America for 2 species, North America for 3 species, Asia for 1 species, Tropical Africa for 3 species and West Indies for 1 species. The present study detected the highly aggressive established exotic plant colonies from the study sites. Among this *Tridax procumbens*, *Alternanthera tenella* and *Chromolaena odorata* were the most aggressive colonizers in Kottamkara Grama Panchayat.

Keywords: alien invasive species aggressive colonizers, exotic, floristic diversity, Kottamkara Grama Panchayat

Introduction
Weeds often defined as a plant that grows out of their native place, competitive, tenacious and detrimental. The invasive character of these plants is thought to be because of their ability to replace other species by means of their specific chemical compounds. So, it is material to study their action on nearby plants. AIS are coming out as one of the major menaces to biodiversity conservation. They are evaluated as the second largest threat to global biodiversity loss following habitat destruction. Climatic unevenness, rising trade, travel and tourism have increased the spread of undesirable non-native alien species to conservation areas, making susceptible to the establishment of AIS and are species, native to one region, that have been introduced into an area outside their normal dispersal, either by chance or on purpose and which have settled or invaded their new place, threatening biological diversity, ecosystems and human wellbeing (CBD, 1992) [6].
AIS cause thoughtful ecological instabilities and financial well-being of every habitat and region on the Earth (Boy and Witt, 2013) [2]. Habitat modification by the invasive plants detrimentally affects the biodiversity. Such plants are highly adjustable, aggressive and have high multiplicative capacity. These exotic plant species change native community configuration, reduce species diversity, disturb ecosystem process and thus cause huge financial and ecological disparity (Dogra *et al.*, 2009) [10].
The consecutive mechanism behind the destructive establishment of invasive plants is recognized as allelopathy. Allelopathy is the result of one plant on another plant owing to substances released by them, or the breakdown products of their metabolites. It mentions to the direct or secondary chemical effect of one plant on the germination, growth, or development of neighbouring plant. Allelopathy may contribute to the capability of particular exotic species to become dominant in invaded plant communities (Kanchan and Jayachandra, 1979) [17].
Allelopathy is anticipated to be an important mechanism in the plant invasion method because the absence of co-evolved tolerance of unaffected vegetation to new chemicals produced by the invader could permit these newly arrived species to dominant natural plant communities. Alien Invasive plants have certain biological characters which help them to their victory as attackers in a new habitat. The characters comprise production of large number of easily dispersible light weight seeds, fast growth rate and better competitive resource capture and consumption abilities compared to native plants (Enserink, 1999; Burns, 2006) [11, 3].
The majority of plant species encompassing us are not of Kerala origin, they are really aliens. They occupy a variety of ecosystems, spreads rapidly displace native plants, distressed ecological balance, diminish biodiversity and forms a monoculture. Plant biodiversity of Kerala faces severe threat from 89 AIS which were noted in a survey commission by the Kerala State Biodiversity Board. Of which, 19 presents at high risk; many were found dislocating and eliminating a large number of native species and triggering economic and environmental loss. Around 40 percent of the varieties belonging to Brazil, Trinidad, Costa Rica, Chile and Mexico, were supposed to have reached the State mostly through timber and food grain import (Sankaran 2013) [21]. AIS are a significant problem to our State, since they impact deeply on native biodiversity, productivity and

results in landscape level changes. The problem needs crucial attention. The major aim of the work is to analyse and identify the invasive species of Kottamkara Grama Panchayat of Kollam District, and their threats to our native flora.

Materials and Method

In the present investigation, Alien Invasive plants of Kottamkara Grama Panchayat of Kollam District were collected and identified during the period of 2017-2020. Kottamkara Grama Panchayat consists of 21 wards. A total of 210 point observations were made that is each ward with 10 point observations. At each location, information was collected on the AIS and its impacts. Field survey, individual interviews and literature review were conducted for the collection of data. Plant samples were collected for herbarium and future study. Herbarium specimens are deposited in TKM college of Arts and Science, Kollam. Plant photographs were also taken from their natural habitat including agriculture field, settlement areas and roadsides. The GPS coordinates of each ward of Kottamkara Grama Panchayat was recorded and mapped.

Results and Discussion

Kottamkara Grama Panchayat, Kollam consists of 21 wards (Fig. 1). A total of 20 AIS were identified in the Kottamkara Grama Panchayat (Table 1).

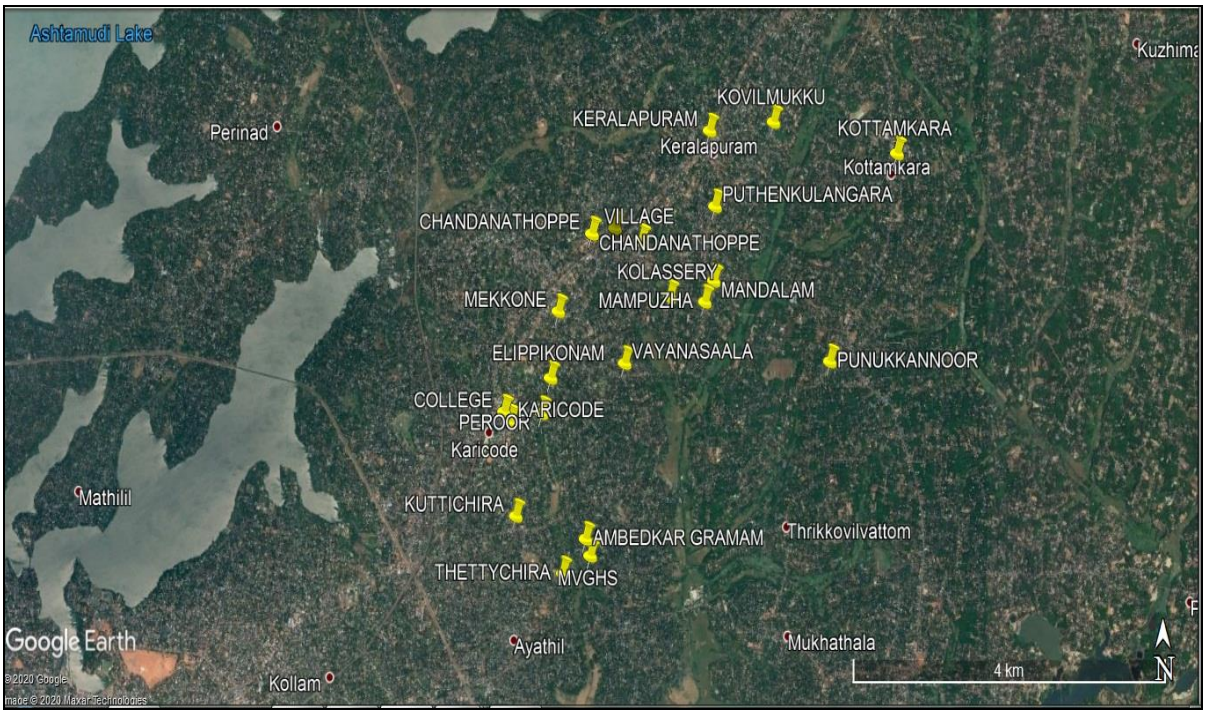

Fig 1: Map of Kottamkara Grama Panchayat

Table 1: Alien Invasive Plants of Kottamkara Grama Panchayat of Kollam District, Kerala

Sl. No	Scientific Name	Family	Common name	Habit
1	*Alternanthera brasiliana* (L.) Kuntze	Amaranthaceae	Joyweed	Shrub
2	*Alternanthera tenella* Colla	Amaranthaceae		Herb
3	*Amaranthus spinosus* L.	Amaranthaceae	Prickly amaranth	Herb
4	*Centrosema molle* Benth.	Fabaceae	Butterfly pea	Herb
5	*Chromolaena odorata* (L.) R.M.King & H.Rob.	Asteraceae	Siam weed	Herb
6	*Cuscuta reflexa* Roxb.	Cuscutuceae	Dodder, sky creeper	Herb
7	*Gomphrena celosioides* Mart.	Amaranthaceae	Water globehead	Herb
8	*Ipomoea carnea* Jacq.	Convolvulaceae	Bush morning glory	Shrub
9	*Mikania micrantha* Kunth	Asteraceae	Mile-a-Minute weed	Climber
10	*Mimosa diplotricha* Sauvalle	Mimosaceae	Giant sensitive plant	Shrub
11	*Mimosa pudica* L.	Mimosaceae	Touch-me not	Herb
12	*Pennisetum pedicellatum* Trin.	Poaceae	Kyasuwa grass	Herb
13	*Quisqualis indica* L.	Combretaceae	Burma creeper	Shrub
14	*Senna alata* (L.) Roxb.	Caesalpiniaceae	Candle bush	Shrub/tree
15	*Senna occidentalis* (L.) Link	Caesalpiniaceae	Coffee-senna	Shrub
16.	*Sesamum radiatum* Schumach. & Thonn.	Pedaliaceae	Wild beriseed	Herb
17.	*Sphagneticola trilobata* (L.) Pruski	Asteraceae	Singapore daisy	Herb

18.	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae	Synedrella	Herb
19	*Tridax procumbens* L.	Asteraceae	Coat button	Herb
20	*Turnera subulata* Sm.	Turneraceae	West Indian holly	Shrub

1. *Alternanthera brasiliana* (L.) Kuntze
Family: Amaranthaccae
Common Name: Joseph coat, copperleaf calico plant, blood leaf, Joy weed and parrot lead
Nativity: Central and south American southern Mexico Carribbean and south America

It is an erect, spreading subshrub up to 2 m tall. It was introduced as an ornamental plant. The plant is competent to establish in particular area within a short time period and is grown for its dark purple leaves. The stem is erect and red or purple in colour. Leaves are simple, entire, opposite, decussate, lanceolate and purple in color. Inflorescence is terminal or axillary, have peduncle, white globose cluster, tepals lanceolate, apex acuminate, stamens 5, utricles included within tepals, seeds ovoid-oblong.
Uses: It is frequently collected from the forest for regional use as food and medicine. It is used as analgesic and anti-inflammatory in traditional medicine (Attaugwu and Uvere, 2017) [1]. According to this survey, *Alternanthera brasiliana* was widely distributed in Peroor, Mampuzha Mekkone, Ambedkar gramam, Kolassery, Kovil mukku in Kottamkara Grama Panchayat.

2. *Alternanthera tenella* Colla
Family: Amaranthaceae
Common name: Joy weed
Nativity: Tropical America

Alternanthera tenella is an evergreen perennial herb. The plant spreading like a dense mat over the soil surface and it grows in abandoned areas, road sides, agricultural lands *etc*. Leaves are opposite, upper surface pubescent, elliptic-oblong, sub-sessile. Flowers are axillary, spikes, white, globose, bracts and bracteolates. 5 Tepals, 5 Fertile stamens, anther longer than filaments, ovoid ovary, style short, seed brown in color.
Uses: The leaves are cooked consumed locally. The plant grown as a ground cover, they form a dense mat over the soil so, prevent soil erosion (Guerra *et al*.,2003) [14]. In the present study this plant was widely distributed in Ambedkar Gramam, Chandanthope, Mekkone, Mampuzha and Peroor.

3. *Amaranthus spinosus* L.
Family: Amaranthaceae
Common Name: Spiny amaranth, prickly amaranth
Nativity: Tropical America

It is an erect, branched annual or perennial herb, introduced to warmer parts of the world for its therapeutic properties. It grows abundantly in abandoned areas and roadsides. The plant is a harmful invader which replaces native flora. The plant grows up to 1 m in height. Upright profusely branched herb with pointed spines. Leaves are simple, alternate, ovate or elliptical. Flowers whites, 5 tepals, 5 stamens, anthers sagittate. Female flowers 1-2 mm across, tepals 5, oblong, ovary one celled, ovules solitary. Seeds tiny, black and glowing.
Uses: It is edible for humans and used as forage for cattles. It is rich in protein, vitamin A, iron *etc*. The leaves can be cooked and consumed like spinach. Spiny amaranth is also used in traditional medicine.It is used for treating bleeding ulcers and diarrhea (Dinesh *et al*., 2014) [9]. In the present study, *Amaranthus spinosus* was widely distributed in Kuttichira, Peroor, Mammood, Ambedkar grammam, Mampuzha in Kottamkara Grama Panchayat.

4. *Centrosema molle* Benth.
Family: Fabaceae
Common name: Butterfly-pea
Nativity: Indonesia and Malaysia

It is a perennial climbing herb, introduced for nitrogen fixing ground cover in plantations. It is common in cultivated fields, plantations, roadsides *etc.* It has a well-developed root system. Perennial twiner, leaves trifoliate, leaflets ovate or elliptic, pubescent, petiole long, stipules persistent. Inflorescence axillary raceme with papilionate flowers. Companulate calyx, 2 lipped lilac Corolla, papilionate. Stamens 9+1. Pods linear with15 -17 seeded. Seeds oblong.
Uses: It is a forage plant, supplement protein for cattle. The plant is used as ground cover, and a green manure. The plant fixes atmospheric nitrogen (Deepa *et al*., 2016) [8]. According to the survey the plant was commonly seen in Keralapuram, Mamoodu, Ambedkar Gramam, Mampuzha in Kottamkara Grama Panchayat.

5. *Chromolaena odorata* (L.) King & H.Rob.
Family: Asteraceae

Common Name: Siam weed
Nativity: Northern America

It is a fast spreading erect perennial herb and is considered as the world harmful and aggressive weed. It can grow on waste lands, roadsides, cultivated areas, forest, plantation areas *etc.* The plant affects the growth of several native floras due to its allelopathic and aggressive nature. The plant is glandular, hairy scandent shrubs. Leaves are opposite, margin serrated, long ovate with acute apex. When crushed it produce a pungent smell. Terminal Head inflorescence, bracts 3-5 seriate, ovate. Flowers many, small flowers, similar, bisexual, corolla 5 mm long, tubular, 5-lobed. Achene's black, numerous pappus.
Uses: Traditionally the leaves are used for wound healing, it also has anti-inflammatory, analgesic, antipyretic activities *etc* (Sankaran, 2013) [21]. According to this survey, the plant was widely distributed on Chandanathoppe, Mampuzha, Peroor, Ambedkar Gramam, Mekkone *etc.* in Kottamkara Grama Panchayat.

6. *Cuscuta reflexa* Roxb.
Family: Cuscutaceae
Common name: Sky creeper
Nativity: Mediterranean

This is a parasitic leafless plant with succulent vine that grows over host plants. Within a short period of time this can produce numerous branches which can cover the whole host plant within a short period and completely destroy the host plant. It prefers wet soil for profuse growth. Leaves reduced to scales. Inflorescence is lateral raceme with sessile flowers, white or creamy, tubular, calyx cupular. Corolla with 5 obtuse lobes, ovary conical, stigma acute, Succulent globose capsule. Seeds are long and black.
Uses: The plant is used in traditional medicine for the treatment of fever, rheumatism, headache etc (Sankaran, 2013) [21]. From this survey the plant was widely occupied in Ambedkar Gramam, Chandanathope, Mekkone, Mampuzha, and Peroor.

7. *Gomphrena celosioides* Mart.
Family: Amaranthaceae
Common Name: Water globe head
Nativity: Argentina, Bolivia

Gomphrena celosioides is a herbaceous prostrate annual or perennial plant. It is common weed in dry open places, generally seen on roadsides, open areas and agricultural fields. The plant has worldwide occurrence throughout tropics and sub-tropics. Prostrate herbs, hairy branches, leaves opposite, elliptical, apex acute, hairy petioles. Spike terminal or axillary, bracts scarious, bracteoles 2, ovate, tepals 5, lanceolate, bifid stigma, ovary superior, 5 stamens.
Uses: Traditionally the plant is used for malarial fever, diarrhea, bronchial infections *etc* (Deepa *et al*., 2016) [8]. In this study, this plant was distributed on Vayanasala, Mandalam, Mampuzha and Kottamkara in Kottamkara Grama Panchayat.

8. *Ipomoea carnea* Jacq.
Family: Convolvulaceae
Common Name: bush morning glory
Nativity: North America

Ipomoea carnea is grown as an ornamental and occurs as a weed along marshy areas, roadsides and agricultural lands *etc.* The flower is very appealing with pinkish white colour. It can invade all areas and replace the native flora. Upright or ascending shrubs. Leaves heart-shaped, light green, lanceolate, apex acuminate, base cordate. Cymose inflorescence, axillary or sub terminal in position, corolla pale pink, seeds hairy.
Uses: The stem of *I. carnea* can be used for producing paper. In traditional medicine the plant has been used as laxative, treatment for skin diseases, leukoderma *etc* (Sankaran, 2013) [21]. In the present survey, *I. carnea* was widely distributed on Mampuzha, Mekkone, Peroor *etc* in Kottamkara Grama Panchayat.

9. *Mikania micrantha* Kunth.
Family: Asteraceae
Common name: Mile-a minute weed
Nativity: North, Central and South America

Mikania is a vigorously growing perennial climber and it is introduced In India as a ground cover for tea plantations. According to Global Invasive Species Database *Mikania* is considered as world's worst invader. The plant generally invades moist and fertile areas and also it grows on sandy loams, abandoned areas, cultivated lands, roadsides *etc.* The plant prefers full sun light. So, it can get sun light by climbing over the plants, forms dense mat over other plants, this will reduce the growth and yield of native flora and crop plants.

Perennial climber, stem covered with short stiff hairs, leaves opposite, heart shaped base, acute apex, ovate. Petiole is long. Head or capitulum inflorescent, bisexual flowers, corolla tubular, 5 lobed and white. Anthers linear, achenes is black, hairy with pappus.
Uses: The plant is used as ground cover, food shortage during summer cattle's consume this as fodder. Leaf juice exhibits wound healing activity (Deepa *et al*., 2016) [8]. From the survey the plant was widely distributed in Mamood, Keralapuram, Chandanathope and Peroor in Kottamkara Grama Panchayat.

10. *Mimosa diplotricha* C. Wright ex Sauvalle
Family: Mimosaceae
Common Name: Giant sensitive plant
Nativity: Tropical America

Mimosa diplotricha is a leguminous rambling or upright shrub commonly known as giant sensitive plant, reaching height of around 3m. In Kerala there are two varieties are reported, one is spiny and other is spineless. The spiny one is the most common plant in Kerala. The weeds invade best in places like plantations, crop lands, road sides, railway track *etc.* Global Invasive Species Database cited this as one among 100 of the world's worst invaders. Whole parts of these plants are toxic to animals when consumed. Rambling shrub, hairy stem, small prickles, profusely branched roots with root nodules, leaves are bipinnate, green, and long, alternately arranged on stem, leaflets oblong, glabrous and highly sensitive to touch. Head up to 1.8 mm across, peduncled, terminal raceme with numerous flowers. Stamens 10, clustered pods, seeds flat, ovate and light brown.
Uses: As a cover crop in plantations, to control soil erosion and act as good green manure (Sankaran, 2013) [21]. In this present survey, *Mimosa diplotricha* was widely distributed over Mekkone, Kuttichira, Keralapuram, Chandadathoe, Mamood, Peroor, Ambedkar Gramam in Kottamkara Grama Panchayat.

11. *Mimosa pudica* L.
Family: Mimosaceae
Common Name: Touch –me-note-plant
Nativity: South America

Minosa pudica is a prickly, creeping long lived annual or perennial herbaceous plant or small shrub. It is generally grows in agricultural feeds, plantations, riversides *etc.* Consuming the plant is reported to be toxic to animals. It is a sensitive plant. The stem is straight in young plants, but becomes creeping with age. Spreading herb, stem branched, prickly. Leaves are bipinnate compound, alternate on stem, palmately arranged, leaflets up to 20 pairs, sensitive to touch. Inflorescence globose heads. Calyx small, 4 lobed, petals 4 stamens 4, pink filaments, ovary pubescent, linear, 3-5 jointed pod seeds ovoid long.
Uses: It has been planted as a cover crop and for erosion control. It has several uses in traditional medicines like curing of arthritis, bleeding, tooth ache *etc.* It has been included in the Global Invasive Species Data Base (Deepa *et al*., 2016) [8]. In this survey, this plant (*Mimosa pudica*) was widely distributed in Peroor, Karicode, Mamoodu, Chandanathopu, Kuttichira, Keralapuram, Mampuzha, Punukkannoor, Kovilmukku, Kottamkar, MVGHS, Ambekkar Gramam, Mekone in Kottamkara Grama Panchayat. The prevention their invasive species is no longer possible. Controlling the weed before its seeds will reduce feature problems. Constant follow-up work is required for sustainable Management.

12. *Pennisetun pedicellatum* Trin.
Family: Poaceae
Common Name: Deshograss
Nativity: Tropical Africa

P. pedicellatum is an annual plant introduced as a fodder grass in Asia however they became invasive in the long stretch. It can grow fast in fertile soil and can endure acidic and alkaline conditions. The aggressive plant can multiply and replace native flora. Herbaceous annual, culms, upright, tufted. Leaves linear- lanceolate hairy, membranous ligules, Inflorescence panicle, spike shaped, cottony white. Rachis finely pubescent, involucre encircling spikelets. Spikelets lanceolate. Lower and upper glumes are ovate-lanceolatus. Lower floret male, upper floret bisexual. First lemma ovate, 3 lobed at top and 5 nerved. Palea very small, stamens 3, anthers long and yellow in color. Second lemma elliptic, glowing, 5 nerved. Palea elliptic, leathery. Stamens 3, Ovary oblong, styles 1-2 mm length, stigma cream coloured.
Uses: The plant is used as a fodder. It helps to prevent soil erosion (Deepa *et al*., 2016) [8]. According to this survey, this plant (*Pennisetum pedicellatum*) was widely distuributed on Peroor, Mamoodu in Kottamkara Grama Panchayat.

13. *Quisqualis indica* L.
Family: Combretaceae
Common Name: Rangoon creeper
Nativity: Tropical Africa

It is shrubby liana with aromatic flowers. It is commonly used as a garden plant, but now become an aggressive invader. It grows on roadsides, open areas *etc.* Twining climber up to 6m in length, cylindrical numerous branches from the base, leaves opposite to sub opposite, elliptical to oblong, the apex acuminate, the base rounded, the margins entire. Flowers sessile or sub sessile in terminal spikes up to 7 cm long. Flowers are tubular, attractive, first white, then becoming red to white. Receptacles 4-8 cm long, tubular, sepals 5, green, triangular, petals 5, stamens 10, exserted.
Uses: It has been extensively cultivated for medicinal and ornamental uses in all tropical region of the world (Sankaran, 2013) [21]. According to our survey, this plant is widely distributed on Keralapuram, Mamoodu in Kottamkara Grama Panchayat.

14. *Senna alata* (L.) Roxb.
Family: Caesalpiniaceae
Common name: Candle bush
Nativity: Tropical America

Senna alata is an ornamental shrub or sub-tree. The plant can grow profusely in roadsides, muddy area and unoccupied areas. They prefer wet soil types. Upright shrub. Leaves are compound, leaflets 6-12 pairs, oblong and apex rounded. Inflorescence is a spicate raceme which is axillary or terminal, flowers are dazzling yellow in appearance, pedicels long. Petaloid yellow bracts are present. Sepals yellow. Petals yellow. Stamens 10, Fruit is a pod.
Uses: Ringworm bush is commonly used as a traditional medicine, especially used for its laxative effect and its effective medication of several skin conditions, including ringworm (Griffith and Sultan, 2005) [13]. From the present survey, *Senna alata* was generally grown in Ambedkar Gramam and Karikode in Kottamkara Grama Panchayat.

15. *Senna occidentalis* (L.) Link
Family: Fabaceae
Common Name: Coffee senna
Nativity: Tropical West Africa

It is a slender erect and short-lived perennial shrub, distinguished by unpleasant smell. The plant generally inhabits vacant lands, road sides and disturbed habitats. It grows as a weed in cultivated lands and plantations. The leaves and seeds are toxic to animals. Upright subshrubs, stems reddish, upright, 4-angled when young, becoming rounded with age. Compound leaves consist of 3-6 pairs of leaflets, apex acute, rachis long with a sessile, semi-circular gland at the base, stipulate. Inflorescence in terminal and axillary racemes, sepals 5. Petals 5, yellow in colour.10 unequal stamens of which 7 are fertile, fruit is a pod.
Uses: The plant parts are used as vegetables. Dried seeds are traditionally used in spite of coffee powder (Deepa *et al*., 2016) [8]. The *senna occidentalis* widely distributed in Chanthanathope, Mampuzha, Peroor in Kottamkara Grama Panchayat.

16. *Sesamum radiatum* Schum. & Thonn.
Family: Pedaliaceae
Common Name: Wild bercisea
Nativity: Tropical West Africa

Seasamum radiatum is an aggressive alien species. The stem produces a bad smell when bruised. Upright, annual, mucilaginous plant growing up to 150cm, hairy stem. Leaves are variously lobed, both surface with hairs, lanceolate to oval in shape and serrated. Flowers are axillary, purple in color, 5 lobed calyx, didynamous stamens, 2 lobed stigmas with many ovules. Fruits are capsules. Seeds small, compressed, brown in color.
Uses: People of Africa consumed its leaves as fresh and cooked. The leaves produce mucilage when cooked. The shoots are also used in soups and porridge. The leaves are used curatively as laxative and remedy to scorpion venom. The plant is used to treat sprains. It can grow on poor, rocky soils and it flowers even through drought conditions (Griffith and Sultan, 2005) [13]. The species was widely distributed in Peroor, Mamoodu, Mampuzha in Kottamkara Grama Panchayat.

17. *Sphagneticola trilobata* (L.) Pruski
Family: Asteraceae
Common Name: Syngapore daisy
Nativity: Tropics of Central America

Sphagneticola trilobata usually known as the creeping-oxeye, Singapore daisy, Wedelia *etc.* It is a plant in the Heliantheae tribe of the Asteraceae family. It is produced as a thick ground covering creeper. The ground cover just acts like a mat and inhibit sunlight to other small herbs beneath the mat. It is generally cultivated as an ornamental perennial herb. The plant competes with our crop plants for fertilizer, water and sunlight, this will

cause the reduction in yield. It has extensive ecological tolerance range, but grows best in luminous areas with well-drained, moist soil. It is a perennial, prostrate herb, rooting at nodal region with rounded stems. Leaves fleshy, hairy, 3 lobed with serrated margins, have acute apex and are opposite decussate. Inflorescence are bright yellow capitulum. Each head with 8-13 ray florets. Central tubular disc florets. Syngenecious anthers, style marginally pubescent, achenes black and crowded with pappus hairs.
Uses: It is used as ground cover plant for warm locations, an ornamental plant, the leaves are used as remedy for cough and cold (Cremer, 2003) [7]. During the present survey, the plant was widely distributed in Ambedkar Gramam, Keralapuram, Karicode in Kottamkara Grama Panchayat.

18. *Synedrella nodiflora*
Family: Asteraceae
Common name: Syndrella
Local name: Mudianpacha
Nativity: West Indies

Synedrella nodiflora is an upright branched herb, well adapted in many countries. It is possibly found in every tropical and subtropical country in situations which promote its growth. It is commonly seen in abandoned lands, along roadsides and in crop lands. The plant prefers moist fertile soil and shady places under the plantation crops. It can adapt splendidly to a variety of environmental conditions. Propagation is mainly through seeds. Upright herbs with hairy stem. Leaves are opposite contained 3 main veins and have serrated leaf margin, short pubescent petiole. Capitulum or head inflorescence, flowers yellow. Outer row of flowers ligulate, female. Disc flowers are bisexual. Ovary 3mm long. Fruits cypsela.
Uses: The species used as a crop cover and prevent soil erosion. It has wound healing activity (Deepa *et al*., 2016) [8]. The present survey, *syndrella nodiflora* was widely distributed Mekkone, Mampuzha, Kottamkara, Mamoode, Keralapuram, and Kuttichira.

19. *Tridax procumbens* L.
Family: Asteraceae
Common name: Coat-button
Nativity: Tropical America

Tridax procumbens is a herbaceous, semi prostrate, perennial plant broadly distributed and adapted in the tropics and subtropics. It is common in dry, sunny locations like road side, lawns and dunes. The noxious weed is widely distributed in the Kollam district. Procumbent herbs. Leaves are opposite, ovate, slightly succulent, margin serrate, hairy, pinnately nerved and pubescent. Terminal and axial head inflorescence with solitary head, outer bracts smallest, foliaceous, green; two types of flowers, outer ligulate female ray florets and central bisexual numerous disc florets. Ray florets 5-6 in numbers, 3-4 lobed. Disc florets are erect, bright yellow and 5 lobed. Inferior, bicarpellary, syncarpous and unilocular ovary. Stamens 5, epipetalous and syngenesious. Fruit cypsela, thickly covered with hairs, non-endospermous seeds.
Uses: The plant has been used as a cover crop, helps in soil retention, it is used as traditional medicine for its wound healing activity, insect repellant activity (Deepa *et al*., 2016) [8]. The present study investigated that *T. procumbens* was widely distributed on Mekkone, Mampuzha, Kottamkara, Mamoodu, Keralapuram, Chanthanathoppu and Kuttichira.

20. *Turnera subulata* Sm.
Family: Passifloraceae
Common name: white buttercup
Nativity: Tropical America

It is a flowering plant in the passion fruit family. It is generally growing along roadsides, unused and neglected areas. It also replaces native flora. Perennial subshrub with thick woody base. Leaves simple, alternate slightly ovate, stipules tiny, margins serrated. Flowers produced in leaf axils, bisexual, pentamerous, calyx tube small, 5 lobed, petal 5, cream and yellow with dark purple at the center. Stamens 5. Fruit capsule with many seeds.
Uses: The plant is used in traditional medicine for the treatment of skin diseases and respiratory disorders (Cremer, 2003) [7]. According to the survey the plant was widely distributed in Ambedkar Gramam, Chandanathope, Mekkone, Mampuzha and Peroor in Kottamkara Grama Panchayat.

Conclusions
The present study has identified 20 AIS in the Kottamkara Grama Panchayat. Among the 20 AIS observed *Alternanthera tenella, Tridax procumbens* and *Chromolaena odorata* were most common in the study area. It has the highest cover in the Panchayat, near settlement where human disturbances were high. Based on the survey *Chromolaena odorata* was found to be the most problematic AIS. Rapid establishment of this plant homogenizing the area and replaces the native flora. Beside *Chromolaena odorata, Alternanthera tenella* and *Tridax procumbens* were the other two AIS found with high density. The spread of *Chromolaena odorata* is

complex and is menacing both the natural biological richness and livelihood of residents. It is poisonous to cattle and can also cause allergic reactions (Lalith, 2009) [19]. Sekar (2012) [22] stated that *Alternanthera* is among the genera with the highest number of AIS species.

Launching of the species to the new place can either be unintentional or international (Enserink, 1999) [11]. Unintentional launching happens by way of hitchhiking of the plant (Hughes, 2003) [15], plant parts (Usher *et al.*, 1988) [25], fodder (Panetta and Scanlan, 1995) [20] or attached to vehicles (Carlton and Ruiz, 2005) [5]. International placement of new species is made for variety of purposes like agriculture, forestry, horticulture and aesthetic purposes (Cremer, 2003) [7]. Most of the AIS produce enormous amount of seeds, which are very minute so they can be carried away to long distances by wind and water (Khare, 1980) [18]. This ability of AIS helps them to flourish well in the introduced places. Most of the AIS can thrive abandoned and unfertilized habitats (Funk and Vitousek, 2007) [12]. Most of the invasive plants exhibit the phenomenon of allelopathy which do not allow the native plants from establishing in its neighbourhood (Callaway and Aschehoug, 2000) [4]. The phenotypic plasticity shown by AIS help them to adapt to a variety of habitats like *Mimosa diplotricha* var. *dipoltricha* which remains a shrub in the open land but becomes a climber when the trees are close (Griffith and Sultan, 2005, Hulme, 2008) [16]. Most of the AIS have both sexual and vegetative reproduction making them open to spread all through the year (Silvertown, 2008). The rapid establishment of AIS needs instant consideration and continuous monitoring. Once it is established, eradication may be dreadful and ecological damage is irreparable (Shrine *et al*., 2000) [23]. AIS has the ability to change the structure and function of an area. It may lead to habitat destruction and loss of diversity of species. The rapid growth of *Chromolaena odorata*, *Alternanthera tenella* and *Tridax procumbens* in the study area has started replacing the native plants.

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