



## **IMPACT OF NOXIOUS WEEDS ON THE GROWTH OF INDIGENOUS FLORA OF SACRED GROVES OF KANYAKUMARI DISTRICT, SOUTHERN WESTERN GHATS**

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### **ABSTRACT**

Invasive alien plants create a serious threat to native biodiversity as well as human health. Studies carried out in the sacred groves of the Kanyakumari district, southern end of India. revealed that there are 94 invasive alien plants. The present exploration was concentrated on the 10 noxious weeds and their harmful activity on the biodiversity. *Ageratum conyzoides*, *Amaranthus spinosus*, *Antigonon leptopus*, *Argemone mexicana*, *Axonopus compressus*, *Centrosema pubescens*, *Chromolaena odorata*, *Echinochloa crus-galli*, *Lantana camara* and *Mimosa pudica*. were considered to be a nastiest invader creating harmful effects on biodiversity of the study area. Eradication of these weeds should be done immediately in order to conserve the biodiversity and sacred groves for the betterment of human health.

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## **INTRODUCTION**

Developing countries have become potential sources for receiving invasive alien species to and from other countries of the world due to fast economic globalization, trade, travel, and transport (Khuroo *et al.*, 2012). ) They can widely distributed among the all habitat as well as diverse ecosystem throughout the world (Aravindhan and Rajendran, 2014) and therefore they are considered as one of the severe threat to the biodiversity after the habitat destruction (Hobbs and Humphries, 1995). The International Union for Conservation of Nature and Natural Resources (IUCN) defines “alien invasive species” as an alien species which becomes established in natural or seminatural ecosystems or habitat as agent of change and threatens native biological diversity (Srivastava *et al.*, 2014).

Invasive alien plant species has gained the global interest of ecologists, biological conservationist, forestry planners, natural resource managers and social development planners due to their devastating impact on biodiversity and ecosystem functioning. The resulting impact can be termed disastrous as they are ultimately threatening the environmental integrity and most concerning the food security of mankind.

They also have large detrimental economic impacts on human enterprises such as fisheries, agriculture, grazing and forestry (Kannan *et al.*, 2013).

India is a mega diverse nation with trade, travel and transport hence facing severe threat of plant invasions (Sharma *et al.*, 2005). These invasive alien plants affect native biota in a direct or indirect way and about 18% of the Indian flora constitutes alien plants (Nayar, 1997). Numerous studies have been conducted to explore the exotic floristic composition of various regions of the India (Mcdougall *et al.*, 2011; Khuroo *et al.*, 2012; Boro and Sarma, 2013; Das, 2013; Surendra *et al.*, 2013; Udaykumar *et al.*, 2014; Debnath *et al.*, 2015; Vyankatrao, 2017; Pepsi *et al.*, 2018).

The sacred forests are the last remnants of the native vegetation of the region protected by the villagers of that region (Karthik *et al.*, 2015). Sacred groves are the ancient means of in situ conservation of genetic diversity and are conserved through social, cultural and environmental values since time immemorial (Sasikala *et al.*, 2014). It act as pristine patches of native biodiversity that are preserved in their original state over centuries due to religious beliefs, taboos and customs which have been followed from generations to generations (Subramanian *et al.*, 2016). Invasion of exotic weeds into these groves has become a serious problem in the ecological functions. Local biodiversity of these groves are being depleted and further threatened by the domination of exotic weeds (Swamy *et al.*, 2003).

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Kanyakumari district, foothills of Western Ghats were spotted with dense patches of vegetation known as sacred groves. These groves are known as “Kaavu” or “Iyarkaikovilkal” by the local people of the district. Though these groves are well protected, intrusion of exotic species was increased recently due to various anthropogenic activities and seed dispersal by biotic and abiotic components and they were comparatively low when compared with other protected ecosystems (Pepsi *et al.*, 2018). The study carried out by Pepsi *et al.*, 2018 identified 94 exotic plants from 289 sacred groves of the district. Among these 94 invasive plants, 10 were considered to be the nastiest. The present study aims to document the harmful activities of these 10 noxious weeds and its effects on the environment.

## MATERIALS AND METHODS

### Study area

Kanyakumari District is the southernmost district of Tamilnadu. The district lies between 77° 15' and 77° 36' of the eastern longitudes and 8° 03' and 8° 35' of the northern latitudes. Kanyakumari spreads 1,684 km<sup>2</sup> and has almost all ecosystems such as forests, wetlands, freshwater resources, marine areas and the hills. Topographically, it has prominent natural features such as richly varied and crowded vegetation, majestic undulating hills with surrounding plains, colorful seashores and plantations which make splendid landscapes (Kiruba *et al.*, 2006). The climate of the district is warm and humid. The soil of district is broadly classified into two major groups namely, red and alluvial soils. Red soil is further classified into red loam and sandy soils. Alluvial soil is divided into coastal and river alluvial soils. The black colour of the forest soil is mainly due to high contents of humus and minerals.

### Data Collection

An extensive field survey was undertaken to inventory the sacred groves of Kanyakumari district during the study period (October 2014 – September 2016). Field surveys were carried out by visiting the sacred grove and documenting the exotic plants. Exotic plant species were identified and confirmed by using regional floras of Gamble and Fischer (1915 - 1936), Matthew (1999) and Nayar *et al.* (2014). Citations of the plants were obtained from the database the plant list (IPNI) (<http://www.ipni.org>). All the preserved voucher specimens were deposited at Department of Botany and Research centre, Nesamony Memorial Christian College, Marthandam. From the recorded plants noxious plants were elucidated based on their harmful impact on biodiversity

## RESULTS AND DISCUSSION

A total of 614 plants were identified from 289 sacred groves of the district (Pepsi, 2017). Among these 614 plant taxa, 94 exotic plants were identified in which 10 of them were the noxious weeds affecting the environment and human health. Nayar (1997) reported 18% of the Indian flora constitutes alien plants but in the present study only 15% of exotic taxa were enlisted and it was proved that exotic plants invade even the protected areas. It may be due to anthropogenic activities and seed dispersal capacities. Out of 94 plant species recorded, 85 were dicotyledons (35 polypetalae, 33 gamopetalae and 17 monoclamydeae) and 9 were monocotyledons (Table 2). These belonged to 78 genera and 39 families. The present

work was closely correlated and most of the alien species studied were also reported by the number of workers in various ecosystems of India (Gyan *et al.*, 2005; Reddy, 2008; Sekar, 2012; Srivastava *et al.*, 2014; Debnath *et al.*, 2015).

Noxious weeds belonged to 8 dicotyledons (4 polypetalae, 3 Gamopetalae and 1 monoclamydeae) and 2 monocotyledons with 7 families, 10 Genus and Species each. Of these 10 noxious exotic plants 7 were herbs, 2 climbers and 1 Shrub.

### *Ageratum conyzoides* (L.) L

*Ageratum conyzoides* (Compositae) is an erect, herbaceous annual, stems are covered with fine white hairs, leaves are opposite, pubescent with long petioles and include glandular trichomes. The inflorescence contains 30- 50 pink flowers arranged as a corymb and are self incompatible. The fruit is an achene with an aristate pappus and is easily dispersed by wind (Idu, 2014). This plant was native to Tropical America and has the potential to naturalize in several countries because of its high regenerative and reproductive potential, producing large number of light weighted seeds for easy dissemination by wind (Kohli *et al.*, 2012). This plant produces allelopathic effects (Idu, 2014) on the nearby plants by dispersing chemicals into the soil that may inhibit neighboring plant growth, nutrient uptake, or germination (Inderjit and Dakshini, 1995; Inderjit, 1996; Abhilasha *et al.*, 2008).

### *Amaranthus spinosus* L

*Amaranthus spinosus* (Amaranthaceae) are erect, monoecious perennial, stem are terete or obtusely angular, glabrous or slightly pubescent and branched, leaves alternate and are simple without stipules, inflorescence are terminal and axillary spike-like, spiny-tipped tepals, the fruit is ovoid shaped (Kumar *et al.*, 2014). It is a native species of Tropical America introduced to several countries and become naturalized in almost all states. It is a cosmopolitan weed producing thousands of seeds per plant and has the capacity to get dispersed by wind, water and animals and colonizes the other habitat vigorously. This plant affects the germination of the other plants.

### *Antigonon leptopus* Hook. & Arn

*Antigonon leptopus* (Polygonaceae) commonly known as Coral Vine is a climber with woody base and tuberous root, stem angled, slightly thickened at the node, finely pubescent, leaves alternate, cordate-ovate, entire or undulate, with prominent reticulate vine, flowers are small, showy, numerous on axillary and terminal racemes which terminate into tendrils, perianth segments, oblong-lanceolate, stamens are 8, filaments basally connate into short ring, style 3, stigma capitate. Fruits are Achene, Seeds with deep longitudinal grooves (Sathi and Habibur, 2013). This plant thrives well in places where they invade and it was an introduced species in many countries from Tropical America as an ornamental plant and now get naturalized in most parts of India as a weed.

### *Argemone mexicana* L

*Argemone Mexicana* (Papaveraceae) is an annual herb, up to 150 cm tall with a slightly branched taproot, stem is erect, branched, usually prickly, pale bluish-green, leaves are alternate, without petioles, more or less sheathing the stem, spiny margins, greyish white veins are conspicuous on the bluish green upper surface of the leaves (Dash and Murthy, 2011). It is native to South America and can produce seed at

an average of 60 to 90 capsules per plant with 300 to 400 seeds in each capsule. Seeds are dormant when shed and after ripening for several weeks or months (Karlsson *et al.*, 2003). The seeds contain 22-36% of pale yellow non-edible oil, called argemone oil or katkar oil, which contains the toxic alkaloids sanguinarine and dihydrosanguinarine. Toxic oil from seed causes lethal dropsy when used with mustard oil for cooking. The plant has allelopathic effects on germination and seedling vigour of wheat, mustard, sorghum etc (Das and Durah, 2013).

#### ***Axonopus compressus* (Sw.) P.Beauv**

*Axonopus compressus* (Poaceae) commonly known as carpet grass has a creeping stem which roots at the nodes. It is a perennial, stoloniferous, short-spreading grass, culms ascendent, 20-50 cm tall, solid, and laterally compressed, leaf sheath is fine and hairy along the outer margin; the nodes densely pubescent, ligule very short, fringed with short hairs, the leaf blade is lanceolate, flat, base broadly rounded, margin ciliate, apex obtuse, there are usually 2-4 inflorescences arising from the uppermost leaf axil (Henderson, 1959), Spikelets green, elliptical, pointed, flattened, shortly-stalked, caryopsis is elliptical. The native of the plant is North America and invaded the other countries with the help of its light weighed seeds. This noxious plant litter might interfere allelopathically with its neighboring species. However, the allelopathic effects depend on weed species and soil characteristics. The allelopathic action also may not persist for a considerable period of time (Samedani *et al.*, 2013).

#### ***Centrosema pubescens* Benth**

*Centrosema pubescens* (Leguminosae) is a perennial climber. Stems grow and branch rapidly, producing a dense mass of branches and leaves on the soil. Leaves are trifoliate, dark-green and glabrous above but whitish and densely tomentose below. Flowers are generally pale violet with darker violet veins, born in axillary raceme. Fruit is a flat, long, dark brown pod containing up to 20 seeds. Seeds are spherical, dark brown when ripe. *Centrosema pubescens* is an exotic weed from Tropical America and established well in most parts of study area inhabiting the place of native plants.

#### ***Chromolaena odorata* (L.) King and Rob**

*Chromolaena odorata* (Compositae) is an herbaceous perennial, stems are brown and woody near the base; tips and young shoots are green and succulent. The root system is fibrous and does not penetrate beyond 20-30cm in most soils. Leaves opposite, flaccid-membranous, velvety-pubescent, deltoid-ovate, acute, 3-nerved and entire in youngest leaves. The flower heads are borne in terminal corymbs. The seeds of Siam weed are small (3-5mm long, ~1mm wide (Chakraborty *et al.*, 2011). The studies made by Hu and Zhang, 2013 suggested aqueous extracts of *C. odorata* leaves and roots can suppress the seed germination as well as root and shoot length growths of most herbaceous species. *Chromolaena odorata*, for example, is a pithy plant, so it is a fire hazard during the dry season, but it sprouts readily at the onset of the rainy season because the stubble remains in the ground. In addition, it has allelopathic capabilities, which add further to its dominance over native vegetation (Cruz *et al.* 2006).

#### ***Echinochloa crus-galli* (L.) P.Beauv**

*Echinochloa crus-galli* (Poaceae) is an annual grass, culms 30-200 cm, Sheaths glabrous, ligules absent, Spikelets 2.5-4 mm

long, 1.1-2.3 mm wide, disarticulating at maturity. Upper glumes about as long as the spikelets; lower florets sterile; lower lemmas unawned to awned, sometimes varying within a branch, awns to 50 mm; anthers 0.5-1 mm. Caryopses 1.3-2.2 mm long, 1-1.8 mm wide, ovoid or oblong, brownish (Michael, 2003). This grass belongs to South America and now become flourished in every parts of India and regarded as a weed because once they invade they occupy the entire habitat thus it affects the growth of other plants.

#### ***Lantana camara* L**

*Lantana camara* (Verbenaceae) commonly known as Lantana, native to Tropical America is considered as the worst invader of most parts of India including the study area. *Lantana camara*, also known as wild sage, is a thorny multi-stemmed, deciduous shrub with an average height of 2m (6ft). Stems are square in outline, covered with bristly hairs when green, often armed or with scattered small prickles. It possesses a strong root system. The roots even after repeated cuttings give new flush of shoots. Leaves are opposite, simple, with long petioles, oval blades which are rough and hairy and have blunt toothed margins. The leaves of this plant have a strong aroma. Its flowers are small, multi-colored, in stalked, dense in flat-topped clusters with a corolla having narrow tube with four short spreading lobes. These flowers occurs in cluster which includes white-pink-lavendar or yellow-orange-red mix. Berries of *Lantana camara* are round, fleshy, 2-seeded drupe with initially green in color and turning purple and finally to blue-black color (Chatterjee, 2015). Seeds germination is easy and faster in *Lantana camara*. It increases water runoff thereby increases soil erosion. This plant also consists of phenolic compounds to inhibit the germination and growth of the native plants.

#### ***Mimosa pudica* L**

*Mimosa pudica* (Leguminosae) was native to Brazil and it was considered to be noxious plants. It was an semi-prostrate herb. Cylindrical taproot upto 2 cm thick. Stem cylindrical, up to 2.5 cm in diameter; sparsely prickly, covered with long, weak bristles. Digitately compound with one or two pairs of sessile, hairy pinnae, alternate, petiolate, stipulate, linear lanceolate; leaflets 10-20 pairs, sessile, obliquely narrow or linear oblong; obliquely rounded at base, acute, nearly glabrous; yellowish green. Pink, in globose head, peduncles prickly; Lomentum, simple, dry, 1-1.6-cm long, 0.4-0.5-cm broad, with indehiscent segments and persistent sutures. Compressed, oval-elliptic, brown to gray, 0-0.3-cm long, 2.5-mm broad, having a central ring on each surface. This plant shows harmful effect on crop production, native vegetation and also effects on livestock grazing.

## **CONCLUSION**

Sacred groves are the treasure house of threatened plants and supports indigenous flora. These native plants of these valuable groves are on the risk of extinction because of the invasion of the alien species. They cause severe impacts on biodiversity and ecosystem services and they are the serious hindrance to the conservation with significant undesirable impacts on the ecosystems. They can be eradicated largely by physical, chemical, biological and cultural methods (mulching). Researches should be carried out to eradicate these exotic plants and to create awareness about these alien plants to the common man. So that planting of these alien plants

should be largely minimized from the sacred lands and its environs.

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