

# Invasive succulents in Southern Western Ghats of Tamil Nadu, India

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**Abstract.** The present article reports a total of 42 invasive succulents identified from Southern Western Ghats. Majority of the species are from Tropical America (14 species), South America (9 species), Southern Africa (3 species) and the rest from other countries. A quick inventory and plant identification networks are needed for early detection of naturalized weed in order to control the spread of invasive plant species.

**Keywords:** Invasive succulents; Diversity; Nativity; Southern Western Ghats.

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## Introduction

Invasive alien species decreases the diversity of native fauna, flora and ecosystem functions negatively and it changes the composition of native populations and communities. (Elton, 1958; Vitousek, 1986). Convention for Biological Diversity (1992) visualize "biological invasion of alien species as the second worst threat after habitat

destruction". Threat to native biodiversity by invasive alien species was greater than environmental pollution and it was assessed as the primary cause of global biodiversity loss (Reddy et al., 2008). On a global scale the potential damage by invasive alien species to native species and ecosystems may be as severe as the impact due to habitat loss and degradation (IUCN 2000).

The human interference with wild habitats like anthropogenic pressure, commercial trading and environmental reasons could lead to invasion to the new areas (Elton, 1982). After successful local establishment, some naturalized species disperse and produce viable offspring in areas distant from the sites of introduction. Their natural distribution and get introduced to the new ecosystem which has thus increased its spread in the new location, displacing the local biota and threatens native biological diversity (Saxena, 1991; Keane and Crawley, 2002).

A disturbance that affects native flora may reduce the uptake of available resources such as light, water and nutrients, making the surplus resource available to alien invasive species and the site vulnerable to invasion (Davis et al., 2012). Biological invasions may be considered as a form of biological pollution and significant component on human-caused global environmental change and one of the major causes of species extinction. Human-induced disturbances also alter soil properties, thereby affecting recruitment of tropical plants that have low dormancy and are intolerant of adverse soil conditions, while creating opportunities for alien species invasions (Colon and Lugo 2006).

The threat to biodiversity due to invasive alien species is considered second only to that of helical destruction. Invasive species causes loss of biodiversity including species extinction as changes in hydrology and ecosystem feraction. For effective managements to invasive species, knowledge about their ecology, morphology, pharmlalogy, reproductive biology, physiology and photochemistry is essential (Raghubanshi et al., 2005)

Worldwide there is a growing catalogue of the potential impacts of invasive species on native species, wildlife habitats, disturbance regimes, and ecosystem services (Pyšek et al., 2011; Simberloff et al., 2013; Foxcroft et al., 2014). According to Raghubanshi

(2005) about 40% of the species in the Indian flora are alien, of which 25% are invasive. Many invasive plant species cause economic and/or environmental damage.

The present study is an attempt to identify the alien invasive species of the Southern Western Ghats of Tamil Nadu. Western Ghats is one of the 33 recognized ecologically sensitive zones in the world. The significance of the Western Ghats is that along with its rich biodiversity, it also supports a rich environment-dependent civilization of several thousand years.

## Materials and methods

Several intensive field trips conducted at different seasons during the year 2016-2018. Plant species were collected in their flowering and fruiting stages and detailed field notes were taken on the spot. The attention was paid on the observation of field characters like habit, habitat, flower colour, fragrance and environmental factors that influence its growth and these are entered in the field note book.

The collected plant specimens were identified with the help of the local floras (Gamble, 1915-1936; Nair and Henry, 1983; Matthew, 1991) and available floras, revisions and monographs. Further, authenticated by referring specimens deposited in Madras Herbarium (MH) of Botanical Survey of India, Southern circle, Coimbatore. All the plant species were preserved as herbarium specimens based on the standard instructions (Jain and Rao, 1976). The voucher specimens are deposited in the Herbarium of Department of Botany, Bharathiar University (BUH) Coimbatore.

The nativity of the species is provided based on Matthew (1969), Maheswari and Paul (1975), Nayar (1977), Sharma (1984), Hajra and Das (1982), Saxena (1991), Pandey and Parmur (1994), Reddy et al. (2000), Reddy and Raju (2002), Reddy and

Reddy (2004), Murthy et al. (2007), Negi and Hajra (2007) and Reddy (2008).

## Result and discussions

The present study was undertaken to appraise the invasive succulent diversity of the Southern Western Ghats. A total of 42 taxa

belonging to 40 genera in 25 families were identified from the study area. Majority are generally found in all kinds of ecosystem like forest, waste lands and road sides. They are listed alphabetically in tabular form followed by Botanical name, name of the family, type of succulents, nativity, life form and habit (Table 1).

**Table 1.** List of invasive succulent plant species in Tamil Nadu.

	Binomial name	Family	Parts of succulents	Nativity	Life form	Habit
1	<i>Agave americana</i> L.	Asparagaceae	Leaf	Central America, southern North and northern South America	Shrub	Perennial
2	<i>Argemone mexicana</i> L.	Papaveraceae	Stem	South America	Herb	Annual
3	<i>Alternanthera sessilis</i> (L.) DC.	Amaranthaceae	Leaf	Tropical America	Herb	Perennial
4	<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	Amaranthaceae	Stem	South America	Herb	Perennial
5	<i>Amaranthus spinosus</i> L.	Amaranthaceae	Stem	Tropical America	Herb	Annual
6	<i>Anredera cordifolia</i> (Ten.) Steenis	Basellaceae	Leaf	South America	Climber	Perennial
7	<i>Aptenia cordifolia</i> (L. f.) Schwantes	Aizoaceae	Leaf	southern Africa	Herb	Perennial
8	<i>Begonia cucullata</i> Willd.	Begoniaceae	Whole plant	Brazil and Argentina	Herb	Perennial
9	<i>Cardamine hirsuta</i> L.	Brassicaceae	Leaf	Trop. America	Herb	Annual
10	<i>Catharanthus roseus</i> L.	Apocynaceae	Leaf	Trop. America	Herb	Perennial
11	<i>Callisia repens</i> Jacq. L.	Commelinaceae	Leaf	Mexico	Creeping herb	Perennial
12	<i>Cascabela thevetia</i> (L.) Lippold	Apocynaceae	Leaf	Tropical America	Shrub	Perennial
13	<i>Cereus pterogonus</i> Lam.	Cactaceae	Stem	Tropical America	Shrub	Perennial
14	<i>Centella asiatica</i> (L.) Urban	Apiaceae	Leaf	Tropic and Subtropic regions	Creeping herb	Perennial
15	<i>Crassocephalum crepidioides</i> (Benth.) S.Moore	Asteraceae	Stem	Trop. America	Herb	Annual
16	<i>Crassula multicava</i> Lem.	Crassulaceae	Leaf	South Africa	Herb	Perennial
17	<i>Cymbalaria muralis</i> P. Gaertn. B. Mey.& Scherb.	Scrophulariaceae	Leaf	Northern Italy	Climber	Perennial
18	<i>Cylindropuntia ramosissima</i> (Engelm.) F. M. Kunth	Cactaceae	Stem	Northwestern Mexico, and to Baja California and its Islas San Benito	Shrub	Perennial
19	<i>Datura innoxia</i> Mill.	Solanaceae	Stem	Trop. America	Herb	Perennial

Table 1. Continued.

	Binomial name	Family	Parts of succulents	Nativity	Life form	Habit
20	<i>Drymaria cordata</i> Edgew. & Hook.	Caryophyllaceae	Stem	Mexico, C. America	Herb	Annual
21	<i>Eclipta prostrata</i> (L.) Mant.	Asteraceae	Stem	Tropical America	Herb	Annual
22	<i>Emilia sonchifolia</i> (L.) DC.	Asteraceae	Leaf	Trop. America	Herb	Annual
23	<i>Eichhornia crassipes</i> (Mart.) Solms.	Pontederiaceae	Leaf	Tropical and sub-tropical South America	Free-floating herb	Perennial
24	<i>Impatiens balsamina</i> L.	Balsaminaceae	Stem	India, Southeast Asia Southern Africa, Arabia and South East Asia	Herb	Annual
25	<i>Kalachoe delagoensis</i> Ecklon & Zeyh.	Crassulaceae	Leaf and stem	Southern Africa, Arabia and South East Asia	Herb	Perennial
26	<i>Martynia annua</i> L.	Martyniaceae	Stem	Trop. America	Herb	Perennial
27	<i>Mirabilis jalapa</i> L.	Nyctaginaceae	Stem	Tropical America	Herb	Annual
28	<i>Opuntia stricta</i> Haw.	Cactaceae	Stem	Tropical America	Shrub	Perennial
29	<i>Pedaliium murex</i> L.	Pedaliaceae	Leaf and stem	Trop. America	Herb	Perennial
30	<i>Perisicaria capitata</i> (Buch.-Ham. ex D. Don) Gross.	Polygonaceae	Leaf	Southeast Asia	Herb	Perennial
31	<i>Physalis peruviana</i> L.	Solanaceae	Stem	Tropical South America	Herb	Perennial
32	<i>Phytolacca octandra</i> L.	Solanaceae	Stem	Tropical South & Central America	Shrub	Perennial
33	<i>Pilea microphylla</i> (L.) Liebm.	Urticaceae	Leaf	South America	Herb	Annual
34	<i>Portulacca oleracea</i> L.	Portulacaceae	Whole plant	South America	Herb	Annual
35	<i>Sonchus asper</i> (L.) Hill	Asteraceae	Leaf	Africa	Herb	Perennial
36	<i>Silybum marianum</i> (L.) Gaertn.	Asteraceae	Leaf	Mediterranean region (Southern Europe, Western Asia and northern Africa)	Herb	Annual
37	<i>Taraxacum officinale</i> G. H. Weber ex Wiggers	Asteraceae	Leaf	Eurasia	Herb	Perennial
38	<i>Tropaeolum majus</i> L.	Tropaeolaceae	Stem	South America	Herb	Perennial
39	<i>Tradescantia fluminensis</i> Vell.	Commelinaceae	Stem	South America	Creeping herb	Perennial
40	<i>Tradescantia zebrina</i> Heynh. ex Bosse	Commelinaceae	Leaf & Stem	Mexico	Creeping herb	Perennial
41	<i>Trianthema portulacastrum</i> L.	Aizoaceae	Stem	South Africa	Prostrate herb	Annual
42	<i>Vinca minor</i> L.	Apocynaceae	Leaf	Europe, W. Asia	Herb	Perennial

Succulence is an adaptive strategy that allows plants to remain active diversity seasonal water storage. Succulence is a matter of degree and its expression in enviornmentaly modified

in many taxa. They are combination of morphological/anatomical/consideratio ns, ecological condition and physiological aspects (Eggli and Nyffeler, 2009).

The present study found that Asteraceae is the most specios family (6 species) followed by Amaranthaceae, Apocynaceae, Solanaceae, Commelinaceae and Cactaceae (each have 3 species), Crassulaceae and

Aizoaceae (each have 2 species) and others have single species respectively (Figure 1). The preleminance of Asteraceae species in invading category shows the high impact of neotropical flora on Indian region (Reddy, 2008).

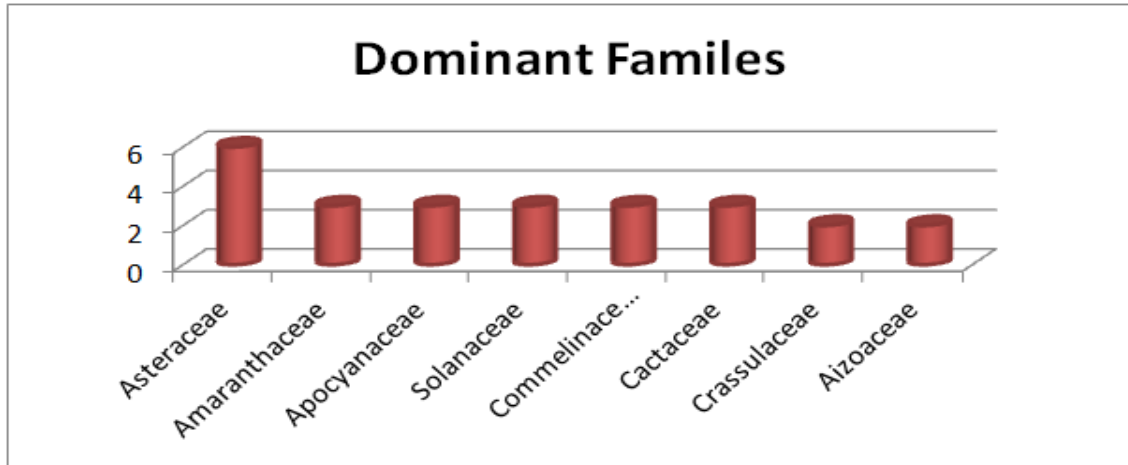


Figure 1. Distribution of invasive succulent taxa of various families in the study area.

The total life forms of the invasive succulent diversity reveals that, herbs are dominant form in which 34 species. It consist of erect herbs (28), creeping herbs (4) prostrate herb (1) and floating herb (1) followed by shrubs with 6 species and climbers have 2

species respectively (Figure 2). All these species reported here were reported as weeds in differ countries or as invasive alien plants in most of the regions. The diversity of their architecture has made them horticultural "Collectibles" form a very early time onwards (Rowley, 1997).

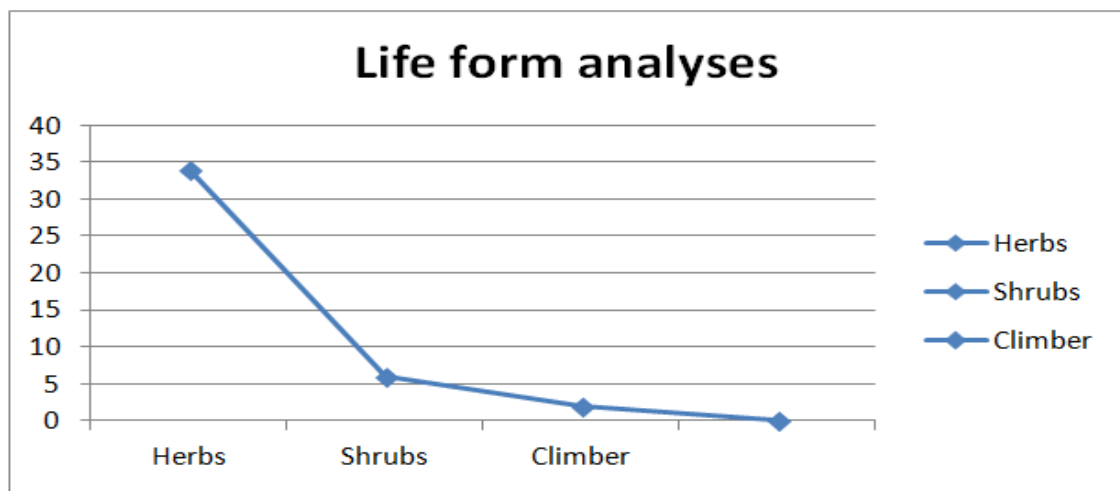
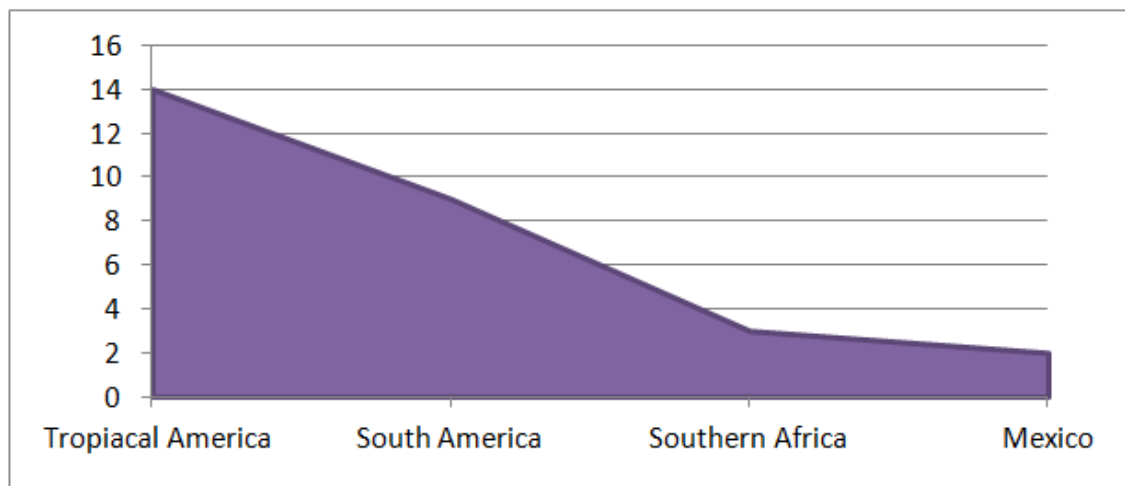


Figure 2. Life form analyses in the study area.

On the basis of the nativity of the species, a total of 18 different geographical regions were recorded in the present study. In that, about 14 species are native to Tropical America, 9 species are native to South America, 3 species are native to Southern Africa, 2 species are native to Mexico and others have single species in single regions

respectively. Almost 80% of the invasive alien plant species were introduced from Neotropics (Figure 3). It clearly indicates that succulence occurs in the subtropics, in a lesser extent, in the tropics and comparatively few representatives are found in temperate and temperate-cool climatic zones (Eggle and Nyffeler, 2009).



**Figure 3.** Contribution of different geographical regions to the invasive succulents of study area.

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### Conflicts of interest

Authors declare that they have no conflict of interests.

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