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Eragrostis tenella (L.) P. Beauv. Ex Roem & Schult - A Competitive Species to a Noxious Weed Pollutant *P. hysterophorus* (L.)

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ABSTRACT

A noxious weed *Parthenium hysterophorus* (L.) has a global significance due to its hazardous effects on human and animal health by releasing its pollen grains into the atmosphere that cause air pollution. Under the canopy of *Ficus* trees, where a micro climatic conditions are present at Panyam (Vi.), Kurnool dt., Andhra Pradesh, India, the abundance, dominance and growth performance of this aggressive weed in relation to its field associates was investigated. The preliminary analysis of the data obtained in the field by 'quadrate ' method revealed that *P. hysterophorus* is a week competitor and hence it has a low IVI (26.6) in presence of other aggressive species such as *Eragrostis tenella* (38.5), *Justicia glauca* (35.4), *Vernonia cinera* (34.0), *Gomphrena serrata* (33.6), *Antigonon leptopus* (29.9), *Croton bonplandianum* (29.5) and *Euphorbia geniculata* (29.1). *Eragrostis tenella* of the family Poaceae is a very competitive species than *P.hysterophorus.* This species is more useful than *Hyptis suaveolens, Cassia sericea, C.tora, Stylosanthes* sps., etc. which are reported earlier as suppressive plants of *P.hysterphorus,* since it maintains the diversity of habitat by allowing the growth of other species and moreover due to nutritious, prolific number of grains and the plant is eaten by the cattle both fresh and dry. The ability of other species to suppress *P.hysterophorus* is attributed either to allelopathy or to their ability to grow aggressively. The present study revealed that *Parthenium* weed can be more effectively managed by growing this suppressive and competitive plant species. It is an effective and eco-friendly method of weed control.

INTRODUCTION

According to the reports of National herbarium and institutes, *P. hysterphorus* L. commonly called congress weed or carrot weed, is a strong competitor to various other plants and hazardous to human and animal health was introduced into the country around 1810 (Bennet et.al, 1978; Maiti, 1983; Kohli et. al. 2006). The species suppresses the growth of other species by releasing chemicals like phenolic acids, sesquiterpenes (Picman and Picman,1984; Kohli and Batish, 1994) and other residues (Singh et al. 2003) and showing allelopathic effects (Kohli and Rani, 1994; Heirro and Callaway, 2003; Senthil et al. 2005). It altered the native species composition affecting the forest structure and diversity (Kumar and Rohatgi, 1999). But there are earlier efforts to examine the bio-suppression of the distribution of *P. hysterophorus* by other competent species such as *Amaranthus spinosus, Cassia auriculata, C. occidentalis, C. sericea, C. tora, Croton bonplandianum, Hyptis suaveolens* and *Tephrosia purpurea.* In grasslands, this species acts as a weak or poor competitor and dominated by perennial grasses such as *Cymbopogon coloratus* and *Heteropogon contortus* (Reddy, 1986). A list of plant species from different parts of India, with potential competitive abilities for the biological management of *P. hysterophorus* was compiled by Yaduraju et al. (2005). According to that list, *Amaranthus spinosus, Cassia occidentalis, C. auriculata, Croton sparsiflorus, hyptis suaveolens, Sida acuta, Stylosanthes scabra* and *Tephrosia purpurea* were the competitive plants from Andhra Pradesh.

Pankaj Oudhia, the Convenor of the International *Parthenium* Research News Group, said that we should proceed with research on potential agents capable of bio-controlling *Parthenium* in field conditions. *Cassia sericea*, a common leguminous plant is effective as a bioagent by releasing certain biochemicals and adapted in Andhra Pradesh to introduce in *Parthenium* infested areas. The natural process of replacement of *Parthenium* by *Cassia sericea*, is very slow and could take years (Rohini Rangarajan, 2009).

The present study focuses on the role of *Eragrostis tenella* (L.) P.Beauv. exRoem. & Schult (fig. 3 & 4) of Poaceae which is dominated to *P.hysterophorus* (fig.2) under the canopy of huge *Ficus* (fig.1) trees, where a micro-climatic condition appears.

STUDYAREA

The study is carried under the canopy of huge trees of *Ficus benghalensis* and *F. religiosa* grown from 90 years in surroundings of Panyam village and another open place near to it i.e. 1 Km away from the canopy site. This area is characterized by semi-arid conditions, mainly a long dry season followed by a short rainy season due to monsoons.

METHODOLOGY

Phytosociological studies are conducted under the shade of large trees of *Ficus* and in open place surrounding the canopy by using quadrate method to determine the type of vegetation grown. The number of quadrates and size of the quadrate that have to use to study were determined by using a simple 'Species-area curve' method. The list of plant species was made. Then the numbers of individuals of each species present in all quadrates were counted. Plants are identified with the help of local floras. By using this data, abundance and relative abundance; density and relative density; frequency and relative frequency were calculated for each species by using the following formulas –

$$\text{Abundance} = \frac{\text{Total no. of individuals of the species}}{\text{Total no. of quadrats in which the species occurred}}$$

$$\text{Relative abundance} = \frac{\text{Abundance of a species}}{\text{Total abundance of all species}} \times 100$$

$$\text{Density} = \frac{\text{Total no. of individuals of a species}}{\text{Total no. of quadrates}}$$

$$\text{Relative density} = \frac{\text{Density of a species}}{\text{Total density of all species}} \times 100$$

$$\text{Frequency} = \frac{\text{Total no. of quadrats in which sps. Observed}}{\text{Total no. of quadrates}} \times 100$$

$$\text{Relative frequency} = \frac{\text{Frequency of a species}}{\text{Total frequency of all species}} \times 100$$

On basis of the above data IVI of each species is calculated by using the formula –

IVI = R.A. + R.D. + R.F.

And all the values are tabulated according to the decline order for both the study sites in table 1 and 2. IVI of the species indicates the dominance of each species in the study area.

RESULTS

The study revealed presence of 24 species under the canopy of trees and 12 species in open place. Among 24 species of under canopy, 8 species had highest IVI, than *Parthenium hysterophorus* which IVI is 26.6. Among the 8 species, *Eragrostis tenella* (L.) Beauv ex. Roem and Schult of the family Poaceae had the highest IVI 38.5 and dominated the area whereas in open place *P. hysterphorus* had the IVI 42.1 and it was predominated. This indicates that the spread of *P. hysterophorus* under the canopy where *E. tenella* and other its associates are present is highly reduced.

Table – 1.List of plant species collected from under canopy of trees and their IVI values

S.No.	Name of the Plant species & Family	IVI
1.	*Eragrostis tenella* (L.) Beauv. ex. Roem & Schult Family: Poaceae	38.5
2.	*Justicia glauca* Rottl. Family: Acanthaceae	35.4
3.	*Vernonia cinera* (L.) Less. Family: Asteraceae	34.0
4.	*Gomphrena serrata* L. Family: Amaranthaceae	33.6
5.	*Antigonon leptopus* Hook. & Arn. Family: Polygonaceae	29.9
6.	*Croton bonplandianum* Baillon Family: Euphorbiaceae	29.5
7.	*Euphorbia geniculata* Ort. Nov. Rar Pl. Hort. Martr Family: Euphorbiaceae	29.1
8.	*Asystacia gangetica* (L.) T. And in Thw. Family: Acanthaceae	27.7
9.	*Parthenium hysterophorus* L. Family: Asteraceae	26.6
10.	*Commelina benghalensis* L. Family: Commelinaceae	25.0

11.	*Aerva lanata* (L.) Juss. Ex Schult Family: Amaranthaceae	24.9
12.	*Acalypha indica* L. Family: Euphorbiaceae	24.1
13.	*Boerhavia erecta* L. Family: Nyctaginaceae	24.1
14.	*Clitoria ternatea* L. Family: Fabaceae	24.1
15.	*Malvastrum coromandelianum* (L.) Garcke Family: Malvaceae	21.8
16.	*Ecbolium viride* (Forsk) Family: Acanthaceae	21.4
17.	*Coccinia grandis* (L.) voigh	15.8
18.	*Plumbago zeylanica* L. Family: Plumbaginaceae	14.8
19.	*Abutilon indicum* (L.) Sweet Family: Malvaceae	14.0
20.	*Ipomea sepiaria* J. Koenig ex Roxb. Family: Convolvulaceae	13.5
21.	*Boerhavia diffusa* L. Family: Nyctaginaceae	11.9
22.	*Basella alba* L. Family: Basallaceae	09.3
23.	*Alternanthera tenella* Colla Family: Amaranthaceae	08.4
24.	*Calotropis gigantean* (L.) R.Br. Family: Asclepiadaceae	05.9

Table – 2. List of plant species collected from open places and their IVI values

S.No.	Name of the plant species	IVI
1.	*Parthenium hysterophorus* L. Family: Asteraceae	42.1
2.	*Euphorbia geniculata* Ort. Nov. Rar. Pl. Hort. Martr. Family: Euphorbiaceae	36.8
3.	Seedlings of *Azadirachta indica* D. Juss Family: Meliaceae	28.7
4.	Seedlings of *Albizzia lebbeck* (L.) Benth Family: Mimosaceae	23.6
5.	Seedlings of *Tamarindus indica* L. Family: Caesalpiniaceae	18.9
6.	*Euphorbia hirta* L. Family: Euphorbiaceae	18.8
7.	*Sida cordifolia* L. Family: Malvaceae	17.6
8.	*Tephrosia purpurea* (L.) Pers. Family: Fabaceae	16.9
9.	*Cadabafruiticosa*L. Family: Capparidaceae	14.3

10.	*Abutilon indicum* (L.) Sweet Family: Malvaceae	13.6
11.	*Tridax procumbens* L. Family: Asteraceae	12.4
12.	*Tribulus terrestris* L. Zygophyllaceae	11.7

DISCUSSION

Parthenium weed is a prolific seeder and the seeds can be dispersed by wind, livestock and other animals in the hair or mud attached to their bodies (Chamberlain & Gittens, 2003) and spreads rapidly. In recent past, introduction of competitive species can be used to control *Parthenium* (Singh, 1983 and Mahadevappa and Ramaiah, 1988).*Cassia sericea* and other competitive, harmless plants replace the weed without causing harm to the crop. Recently Asha Kumari, J et al. (2010) reported that *Hyptis suaveolens* had stronger impact on *Parthenium* than *C. sericea* in Prakasam and Kurnool districts. They reported that the canopy thickness seems to be a function of leaf area index, phyllotaxy, form and size of leaves and branching and *H. suaveolens* had the highest canopy thickness than *Parthenium* which leads to domination and inhibits or eliminate the other species.

Eragrostis tenella, a densely tufted annual grass with variable size is a prolific seed producer. As per the literature one individual produces 1,40,000 seeds and it is a very competitive species with a rapid growth rate and fast production of erect tillers and leaves. The species grows under trees achieves greatest height and more spread due to seed output in full sunlight. Over grazed fields show the greatest reproductive capacity. The seed is light and falls free from the spikelet and so more by the wind. This plant is eaten by cattle both fresh and dry and the grain is also nutritious (Sant, H.R. 1966). Moreover, this plant does not have thick canopy because of their narrower leaves and allow the light though they grow at fast than the other species. It is supported by the presence of other associated species that had higher IVI than *Parthenium.*The suppression of *Parthenium* in presence of this species is attributed to either allelopathy or to aggressive spread of the species due to its prolific seed formation.

Some studies carried out in the recent years reveal that allelopathy can play a major role in controlling the spread and growth of *Parthenium*. Aqueous extracts of allelopathic grasses significantly suppressed the germination and growth of *Parthenium* weed (Javaid & Anjuman,

2006). Similarly, Shafique et al., (2005) showed that aqueous extracts of allelopathic trees viz., *Azadirachta indica* (L.) A. Juss., *Ficus bengalensis* L., *Melia azadarach* L., *Mangifera indica* L., and *Syzygium cumini* (L.) Skeels significantly reduced the germination and early seedling growth of *Parthenium*. Thus, the suppression of *P. hysterophorus* may also be due to the litter formed by the leaf fall of *Ficus* trees. In order to confirm further experiments regarding allelopathic effects of *E. tenella* and organic litter collected under the canopy of *Ficus* trees are required. The process of allelopathy is an ecological approach.

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***Fig.1 - Ficus bengalensis* Tree Under which shade the study conducted.**

***Fig.2- Parthenium hysterophorus L.* A noxious weed pollutant.**

Fig.3 & 4 - *Eragrostis tenella (L.)P.Beauv. ex Roem* & *Schult.* – A competitive species