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Survival Capacity of *Cassia occidentalisL*. and its Statistical Analysis

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Abstract

*C*olonisation and subsequent success is quite often a critical stage in the life history of herbaceous plants Many plants grow along roadside areas of Jaipur during rainy season and make a green belt helping in reducing soil erosion, reducing dust pollution caused by vehicular smoke and also gives asthetic value to the city. Hence a study was conducted on naturally growing plant *Cassia occidentalis*L.ascoloniser for the barren land. A field study was conducted around three selected sites of suburban area of Jaipur and data was collected. Ecophysiology, agrobotanical traits, seed size-number and reproductive capacity was calculated by taking statistical one way ANOVA F test.

Keywords : ecophysiology, pigment content, reproductive capacity, survival capacity, herbaceous plants.

Introduction

Establishment and colonization of herbaceous plants in semi-desert area is often a critical stage. Baker (1962) explained these plants as weeds growing very much in place a very special place our cultivated fields, settlements and roadsides. In India all sort of stray animals defaecate on roadsides Joshi and Swami (2007). Unfortunately, even children are often seen faecating on roadsides. All this faecal matter which contains harmful microorganisms sooner or later becomes part of sandy soil which gets easily blown into houses and pollutes many eatables and drinkables inside houses. There is also no check on people throwing garbage outside their houses which ultimately become part of the sandy roadsides and other bare areas. These plants are Agrestals (enter agricultural land) and Ruderals (growing in wasteland or along roadsides). The polluting quality of sandy dust is not easily appreciated even by literate persons except those who have got knowledge of biology. Austrheim, et. al. 2005 ecologically, the most stressful condition in the semi-arid region of Rajasthan is drought which is related to scanty rainfall and soil remains sandy for most of the year. The stress causes a reduction in dry matter production rate of all or a part of vegetation, hence, limiting plant biomass by causing its destruction (Grime, 1979)

Weiher*et al.* (1999) indicated that some of the traits important for colonisation and establishment of species are seed size, plant height, specific leaf area and leaf dry weight.). Most of the ecologists believe that ecological traits do have a strong relationship with plant frequencies and that species richness is related to habitat variation, obviously with a low stress level (Grime, 1979). Colonization stratagies efficient dispersal and high survival capacity of offspring in new habitat, besides dispersal itself, depends on reproductive characteristics, such as germination and vegetative spread as well as ecological demands of species are usually considered to determine colonisation success of species during succession (van der Valk 1992). Successful colonisers show following features i.e. annual habit, wide environment tolerance during growth, striking developmental homeostasis, tolerance to grazing, extension of seed germination over a long period, large number

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of progeny, wide dispersal, wide amplitude of modificational plasticity and relatively fast individual development. (Baker, 1958; Stebbins, 1950, 1957 and 1958; Morley, 1960; Grant, 1958; Darlington, 1939 and Ehrendorfer, 1963)

Study Material

Cassia occidentalis L.belongs to familyFabaceaeSub family Caesalpinioidae. Its common names are Coffee Senna, coffeeweed, Negro coffee in English and Kasondi in hindi .

Distribution- *Cassia occidentalis*L is found as annual plant in North (including Haryana), North-West India but as a perennial plant in South India. It is native of South America, including the Amazon. It grows luxuriantly in all available spaces such as neglected gardens, roadsides, near lakes or streams and unused grounds of public buildings (Vashishthaet al., 2009).

Botanical Description- *Cassia occidentalisL* is an annual herb. The stem is furrowed with subglabrous branching. Leaves are 15to20 cm long, with a single sessile gland near its base. Stipules are lanceolate or ovate in shape and caducous. Leaflets are three to five pairs, membranous, glaucous, ovate to lanceolate in shape with short petiolules. Inflorescence is a raceme, corymbose or a terminal panicle. Flowers are pentamerous with short peduncles and yellow in colour. Calyx is nine mm long and divided to the base. Petals are five, bright yellow in colour oblong and obtuse in shape. Stamens are ten with upper three reduced to staminodes. Out of the remaining seven stamens three lower ones are longer than other four. Pods recurved, glabrous, compressed and transversely septate. Seeds are 20 to30 in number, ovoid in shape and acute at one end and rounded at the other. Their diameter is four to six mm, in diameter, hard, smooth, shining and dark olive green in colour.

Chemical Composition- The main plant chemicals in *C. occidentalis*L are achrosine, emodin, anthraquinones, anthrones, apigenin, sitosterols, tannins and xanthones(Yadav*et al.*, 2010).

Medicinal Properties- It is used as a broad spectrum internal and external antimicrobial to treat bacterial and fungal infections.Leaf extracts have antibacterial, antimalarial, antimutagenic, antiplasmodial,anticarcinogenic andhepatoprotective activity(Jafri*et al.*, 1999; Jain *et al.*, 1998 and Hammer, 1999). Plant is used to treat jaundice, hepatitis, cirrhosis, detoxification, bile stimulant etc. It is also used as a cellular protector and preventative to cell damage in different organs like liver and kidney. Plant is used in treatment for intestinal worms, internal parasites, skin parasites, abscesses, insect bites, scorpion sting, constipation, diabetes, oedema, fever, menstrual problems, tuberculosis, diuretic anemic, inflammation, rheumatism, ringworm, scabies, skin diseases, snakebite, and wounds (Saganuwan and Gulumbe 2006 and Sharma *et al.*, 2000).People use it as a tonic for general weakness and illness.

Study Site and Methodology

This study site is natural population of plants growing along roadsides and open land in suburban areas of Jaipur at three sites of different localities were selected for experimental study for statistical analysis of pigment content chlorophyll a, chlorophyll b and carotenoids using Arnon (1949) method 50 readings of plant height, number of branches per plant, total number of fruits per plant, total number of seeds per plant were studied as per the methods given by Misra (1968) and Pandeya, Puri and Singh (1968).Mature seeds were collected carefully before they were shed, if the dispersal is quick, the fruits as well as plants were tied with a cloth to trap the seeds to avoid contamination and mixing with other plant material. The collected seeds were used for calculating seed germination percentage, average seed output and reproductive capacity. Average seed output of plants containing more than one seed was calculated as given by Salisbury (1942).

Average seed output = Number of seeds per fruit (mean) \times number of fruits per plant (mean) \pm standard error of means

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Community structure of an area is expressed by measuring its frequency using Quadrat method given by Oosting (1958). Twenty quadrats (1mx1m) were placed at each site for calculation of frequency class given by Raunkaiaer (1934).

Frequency % = $\frac{\text{Number of quadrats in which species occurred}}{\text{Total number of quadrats studies}} \times 100$

Reproductive capacity = $\frac{\text{Average seed output } \times \text{Seed germination}\%}{100}$

Observations and Results

The Agrobotanical characters as plant height, number of branches per plant, number of fruits per plant were recorded in Table 1. Plant height(cm) of *Cassia occidentalis*L the plant height (cm) is 135.3 ± 47.96 at site B and 120.9 ± 48.32 at site C with one way ANOVA F ratio 0.2001*. The number of branches per plant in cassia occidentalis highest at site A 7.72 ± 0.23 and one way ANOVA F ratio is 2.0424*. Number of leaves per plant of *Cassia occidental L*was highest 725.96 ± 60.37 at site C with one way ANOVA F ratio 1.4822*. Leaf Area (mm) in *Cassia occidentalis*L was 237 ± 24.10 (highest) at site A with ANOVA F ratio 1.4822* The number of fruits per plant in *Cassia occidentalis*L was highest 171.12 ± 19.59 at site C with one way ANOVA F ratio 1.2063*.

The data of seed characterslike number of seeds/plant, average seed output, seed germination percentage, reproductive capacity and frequency are recorded in Table 2. The seed germination percentagerecorded in *Cassia occidentalis L*was 58% at site A (highest) with one way ANOVA F ratio at 11.2941. The statistical analysis showed that there was no significant difference between and among all the three sites. Flowering and Fruiting is dependent upon the vegetative growth and on the availability and proper balance of mineral nutrients. More vegetative growth affects the reproductive growth of a plant.

The number of seeds per fruit of *Cassia occidentalis*L the number of seeds per fruit is highest 35.6 ± 2.24 at site B with one way ANOVA F ratio 2.9042*. Average seed output was 5812.05 at site B(highest) of Cassia occidentalisL and reproductive capacity of Cassia occidentalisL is 3196.6 is highest at site B. All the three sites comes under Frequency class E.

Table 1: Showing Variation in Agrobotanical Traits of Cassia occidentalis from all the Three Sites (values are mean of 50 readings).

Parameters	Site A	Site B	Site C
	(mean±SD)	(mean±SD)	(mean±SD)
Plant Height(cm)	126.2±50.21	135.3±47.96	120.9±48.32
No. of Branches/Plant	7.72±0.23	7.14±0.34	7.26±0.51
No. of Leaves/Plant	725.96±60.37	686.52±119.41	692.8±22.82
Leaf Area(mm)	237±24.10	225±22.91	218±24
No. of Fruits/Plant	155.27±13.36	163.26±7.88	171.12±19.59

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NS= Not Significant *= Significant

Analysis of variance: one way ANOVA

F- ratio: i. Plant height =0.2001* ii. Branches /plant =2.5424* iii .Leaves/plant =0.2924* iv. Leaf area =1.4822* v.Fruit/plant=1.2063*

 Table 2: Showing Variation in Seed Characters and Reproductive Capacity of Cassia occidentalisfrom all the Three Sites (values are mean of 50 readings).

Parameters	Site A	Site B	Site C
	(mean±SD)	(mean±SD)	(mean±SD)
Seed Length(mm)	3.6±0.44	3.5±0.38	3.5±0.39
Seed Width (mm)	2.53±0.44	2.6±0.42	2.52±0.33
Number of Seeds/Fruit	35.4±2.24	35.6±2.24	32.2±2.22
Average Seed Output	5496.55	5812.05	5510.06
Seed Germination (%)	58	57	55
Reproductive Capacity	3187.9	3196.6	2920.3
Frequency Class	Е	Е	Е

NS= Not significant *= Significant

Analysis of variance:

F- ratio:

i. Number of Seeds/Fruit =2.9042*ii. Seed Germination =11.2941^{NS}

Discussion and Result

*I*ndustrialization and Urbanization of cities especially metropolitan cities are facing fast growth in automobile number which is the major cause of dust pollution. These dust when blown carries with it large amount of pollutant into our houses and are cause of many air born diseases. Hence, covering the roadsides by vegetation is the need of hour. Keeping in view the persistent dust pollution caused by automobiles, to reduce it some field and laboratory experiments were conducted to study the colonising capacity of *Cassia occidentalis*

Agrobotanical Traits -Life history traits such as growth rate, reproductive capacity and phenotypic plasticity are all subject to selection pressure and are influenced by soil moisture and nutrients, herbivory, competition and pollutants etc. (Bradshaw,1965; and Stearns and Hoekstra, 2005). A careful study of data indicated that among Agrobotanical traits (Vadivel and Janardhanan, 2002 and Sridhar and Bhat, 2007) plant height in *Cassia occidentalis* differed greatly among the three sites. As the reproductive capacity and survival of plants depends more on size rather than the age it is better to classify the life history of a plant by stages (size) rather than the age(Kirpatrick, 1984).

Seed Size and Seed Number- Seed size seems to be an important character in plant fitness. SSNT explaining the relation of seed size and seed number. Both seed size and number are regarded as ecologically important life-history traits and provide increased fitness in various environments (Westoby*et al.*, 1996). Bowers *et al.*, (2004), explained that larger seeds have greater recruitment, greater percent germination or emergence success as compared to smaller seeds. Relatively low seed number was sufficient for maximal fruit set. Seeds are well known to be a rich source of plant growth regulators (Hedden and Hoad, 1985). These findings agree with our observations that in *Cassia occidentalis* have low seed number hence the fruit set is high to very high.

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Frequency- Mitchley and Grubb (1986) found positive correlation between seed size and abundance. This finding is similar to our observations that *Cassia occidentalis* belong to Frequency Class 'E'. is the common and abundant plant and could be a good coloniser.

Reproductive Capacity-Reproductive capacity of a plant is another critical aspect of plant reproduction. According to Salisbury (1942) reproductive capacity of many plants is extremely great and there are large differences between species, these differences is due to selective pressures (Harper and White 1974)

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