

Seed Size / Number Tradeoff (SSNT) in *Daturastramonium L.*

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ABSTRACT

A study was conducted on naturally growing plant *Daturastramonium L.* as coloniser 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. Colonization and establishment of herbaceous plants in semi-desert area is often a critical stage. 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 aesthetic value to the city..

Keywords : Seed size, seed number, colonisation,, average seed output, reproductive capacity

Introduction

The plants growing as weeds are very much in place a very special place our cultivated fields, settlements and roadsides Baker (1962). In the 5th decade of the 20th century Austrheim *et al.* (2005) pointed out a very important characteristic of colonising species which refers to the introduction and colonisation of certain species into previously uninhabited areas into a country from a foreign country with unusual success in the new physical/biological environment designated as genetic revolution. According to him 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, Chapil, 1949) 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. Colonization strategies 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). Some of the traits important for colonisation and establishment of species are seed size, plant height, specific leaf area and leaf dry weight Weiher *et al.* (1999). 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) 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 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

*Daturastramonium*L belongs to family Solanaceae iscommonly called as Jimson weed, Angel's Trumpet, Devil's trumpet, Jamestown weed, Loco weed, Moonflower, Thorn-apple, Mad apple in English , Dhatura in Hindi.

Distribution-*Daturastramonium L* is found throughout the warm temperate parts of the world. In India *D. stramonium* is common in North Western Himalayas, Central and Western India (Braun *et al.*, 1991). It is usually found growing in disturbed areas, waste lands, burn yards, along road sides, rail tracks, rocky open areas, scrub vegetation and grassland.

Botanical Description - The plant is annual or short-lived perennial erect herb up to 2.0 m tall. It grows in winters and flowering and fruiting occurs till late March. Stem is pseudo- dichotomously branched. It is sparsely hairy to glabrous with purple in colour. Leaves are alternate, simple, minutely hairy. The leaf blade is rhombic to ovate with coarsely doubly lobed margins and acute apex. Inflorescence is axillary with pentamerous flowers. Calyx is angular with five longitudinal ribs while corolla is trumpet-shaped, six to eight cm long and white in colour. The stamens are five in number and arranged adnate to the corolla tube. Filaments are short and thick with three to four mm long anthers. Ovary is superior with slender, 3.5–7.0 cm long style and two lobed stigma. Fruit is egg shaped and many seeded capsule with four valves and rigid spines. Seeds are kidney shaped and flattened with dark brown to black in colour.

Chemical Composition and Medicinal Importance -The concentration of total alkaloids in the leaves of *D. stramonium L* is 0.2–0.5%, hyoscyamine being the major compound and scopolamine (hyoscine), apoatropine, tropine, belladonnine and hyoscyamine compounds occur in minor quantity (Berkovet *et al.*, 2006). Zagari (1992) reported that *D. stramoniumL* is very useful in curing asthma, cough, tuberculosis and bronchitis by smoking 'asthma cigarettes' made of the dried leaves, roots or flowers. *Datura* fruit is a specific remedy for phlegmatic and bilious types of malarial fever. This herb is also a valuable remedy for heart disorders, as it relieves cardiac pains, distress, palpitations and aortic disorders (Berne and Levy, 1998 and Heath *et al.*, 1999).

A decoction of leaves is given as a sedative to mental and schizophrenic patients and in treating Parkinson's disease. The herb is highly beneficial in halting the secretion of the breast milk in case of the unfortunate death of a newly born baby. Along with this *Datura* is useful in curing the impotency and promotes health and vigour and absolute fitness of the body (Monseeset *et al.*, 2001). The leaves are applied as a dressing to cure rheumatic pain, swellings, patchy baldness, wounds, gout, burns, ingrown toe-nails, fungal infections, tumours, ulcers and piles (Spring, 1989). The flowers and seeds of *D. stramoniumL* are hallucinogenic and known to have poisonous effects like raving, insensibility and even death. Food and Drug Administration (FDA) has determined it to be unfit for human consumption.

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 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) × number of fruits per plant (mean)
± standard error of means

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 Raunkiaer (1934).

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

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

Observations

The data of seed characters like seed size and number of seeds/plant, average seed output, seed germination percentage, reproductive capacity and frequency are recorded in (Table 1). Seed length(mm) was 1.36±0.15(highest) at site A with one way ANOVA F ratio 1.6058* and seed width(mm) 0.69±0.15 (highest) at site B with one way ANOVA F ratio 1.0385* The seed germination percentage was recorded in *Daturastranomium L* at 70% at site A (highest) one way ANOVA F ratio 15.0815NS 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 *Daturastranomium L* is highest at site C 476.4±16.92 with one way ANOVA F ratio 0.1527* Average seed output was 38242.2 at site C (highest) of *DaturastranomiumL* and reproductive capacity is highest at site C 25622.27 on all the three sites. *DaturastranomiumL* belong to Frequency Class 'E' and is common and abundant plant and could be a good coloniser

Table 1: Showing Variation in Seed Characters and Reproductive Capacity of *Daturastramonium* from all the Three Sites (values are mean of 50 readings).

Parameters	Site A (mean±SD)	Site B (mean±SD)	Site C (mean±SD)
Seed Length(mm)	1.22±0.19	1.34±0.22	1.36±0.15
Seed Width(mm)	0.61±0.13	0.69±0.15	0.62±0.11
Number of Seeds/Fruit	433±33.26	423.8±56.46	476.4±16.92
Average Seed Output	36423.96	35624.63	38242.2
Seed Germination (%)	70	67	67
Reproductive Capacity	25496.77	23868.5	25622.27
Frequency Class	C	C	C

NS= Not significant * = Significant

Analysis of variance:

F-ratio:

- i. Seed Length =1.6058*

- ii. Seed Width=1.0385*
- iii. Number of Seeds/Fruit =0.1527*
- iv. Seed Germination =15.0815^{NS}

Discussion and Result

Industrialization 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 reproductive and colonising capacity of

Seed Size and Seed Number- Since, environmentt resources necessary to reproduce are limited hence, plant experience a tradeoff involving allocation of energy to dispersal(higher seed number) or offspring survival (higher seed size)the so called seed size/number trade off (SSNT) gives rise to a competition-colonization trade-off for annual plants . Both seed size and number are regarded as ecologically important life-history traits and provide increased fitness in various environments (Stamp, 1990 and Saeed and Shaukat, 2000).

Seed size seems to be an important character in plant fitness. SSNT explaining the relation of seed size and seed number (Aiken and Springer., 1995). 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).

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) These findings agree with our observations that in *Daturastranomium* have high average seed output and greater reproductive capacity.

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

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