ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

(A Monthly, Peer Reviewed Online Journal)

Visit: www.ijmrsetm.com

Volume 5, Issue 3, March 2018

Statistical Analysis of Agrobotanical Traits and Seed Output of *Croton bonplandianum* Baill.in developing as Green Carpet to Combat Dust Pollution

Dr Anubhuti Tiwari

Associate Professor, Department of Botany, SRKP Government College Kishangarh (Ajmer), India

ABSTRACT: 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. Establishment and colonization of herbaceous plants in semi-desert area is often a critical stage.. Hence a study was conducted on naturally growing plants of *Croton bonplandiaum*Baill as a 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, were calculated by taking statistical one way ANOVA F test.

KEYWORDS: establishment, agrobotanical traits, survival capacity, dust pollution,green carpet

I. INTRODUCTION

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.Colonisation and subsequent success is quite often a critical stage in the life history of herbaceous plants. The polluting quality of sandy dust is not easily appreciated even by literate persons except those who have got knowledge of biologyAustrheim,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, Chepil, 1949)

Baker (1962) explained these plants as weeds growing very much in place a very special place our cultivated fields, settlements and roadsides. 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). 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) 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- Plant *Croton bonplandianum* Baill.Belonging to Family- Euphorbiaceae is commonly known as Three-leaved caper, in English and Kala bhangra, Jungle Tulsi in Hindi.

ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

(A Monthly, Peer Reviewed Online Journal)

Visit: www.ijmrsetm.com

Volume 5, Issue 3, March 2018

Distribution- Found in waste lands most commonly in agricultural fields, grassy localities, dried up rice fields, swamp, railway track, saline soil of sea coast and along road side. *Croton bonplandianum*Baillis native of South America, it is widely distributed in India specially West Bengal, Bangladesh.

Botanical Description- The plant is an annual, erect and 60 cm long herb. Stem is much branched, diffuse with annual branching which becomes sympodial and is covered with branched, pointed hairs. Leaves are simple, ovate-lanceolate in shape with finely serrated margins, it is crowded towards the top of branches. Leaves are three to five cm long, alternately arranged and petiolate. Inflorescence is a terminal erect spike. Flowers are white in colour, unisexual and borne on three to eight cm long racemes. Staminate flowers with 15-16 stamens in number are arranged above in fascicles with pale white colour and here petaloid whorl of perianth exceeds the outer sepaloid whorl. Pistillate flowers are borne lower on the peduncles. They are solitary with a disc of red colour glands and its petaloid perianth is absent. Ovary hairy with three styles each bifurcated near the stigmatic area. Fruits are deciduous and three-valved oblong capsule with a warty surface.Seeds are small, smooth and albuminous, with a caruncle.

Chemical Constituent and Medicinal Properties- The seed of *Croton bonplandianum*Baillcontain diterpenes, phorbolester, including 12- 0rtho-trideconeoly-phorbol-13-acetate (TPA) and myristoylphorbol- acetate.

*Croton bonplandianum*Baillhas been used in a varied ways by tribal people. Plant oil is used to control scabies, catarrh, bronchitis, asthma, high blood pressure. Its juice is used in curing helminthiasis, toothache and headache (Kapoor *et al*., 1989). Its juice is used in skin problems, wounds and used as antiseptic and antidote. The seed oil is used for the treatment of jaundice, acute constipation, abdominal dropsy, internal abscesses, chologogue and purgative. Extracts of this plant are also known to possess antimicrobial and antitumor activity.

This exotic weed is used as mosquito repellent to control this deadly disease causing agent (Nishanta *et al*., 2002; Chaudhuri, 2007; Bhakat and Sen, 2008 and Maria *et al.*, 2008).A new phytotherapeautic agent is developed from *C. bonplandianum*Baillwhich has mycocidal activity against human pathogenic fungi such as *Trichophyton mentagrophytes*, *Microsporum fulvum*, *Candida albicans* and *Aspergillus flavus* (Mishra *et al*., 2010). Organic soil amendments in the form of chopped shoots of this plant gave significant reductions in the root-knot nematode *Meloidogyne incognita* and the stunt nematode *Tylenchor hynchus* (Alam, 1986).

According to Singh *et al.* (2010) *C. bonplandianum* Baillshows biomagnifications of metals present in fly ash i.e. high level of iron, manganese, copper, zinc, chromium, lead, and cadmium in the contaminated soil and subsequent higher accumulation in plant parts and thus these plants can be considered as accumulator species.

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) × 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 Raunkaiaer (1934).

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

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

ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

(A Monthly, Peer Reviewed Online Journal)

Visit: www.ijmrsetm.com

Volume 5, Issue 3, March 2018

Observations

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 *Croton bonplandianum* Baillis highest at site A 125±46.87 and lowest 111.5±43.23 at site C with one way ANOVA F ratio0.2191*. The number of branches per plant in *Croton bonplandianum Baill* was highest at site B 26.29±1.71 and lowest at site C 20.91±3.30with one way ANOVA and the F ratio is 2.4216* . Number of leaves per plant of *Croton bonplandianum* Baill is highest at site A 714±192.44 with one way ANOVA F ratio 4.092*. Leaf Area (mm)was highest at site A with 295±118.01 and lowest at site B 260±138.41 with ANOVA F ratio 0.2004* The number of fruits per plant of *Croton bonplandianum* Baill is highest at site B 546.32±112.10 with one way ANOVA F ratio 0.1172* (Table 1)

The data of seed characterslike seed size and number of seeds/plant, average seed output, seed germination percentage, reproductive capacity and frequency are recorded in (Table2)Seed length(mm) was 2.3±0.19(highest) at site A with one way ANOVA F ratio 1.0125* and seed width(mm) 1.38±0.15 (highest) at site B with one way ANOVA F ratio 0.9087* The seed germination percentage was recorded in *Croton bonplandianum* Baill at 71% at site B(highest) one way ANOVA F ratio 8.8539*. 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. Our observations show a strongly negative correlation between vegetative growth and reproductive growth in *Croton bonplandianum* Baill .The number of seeds per fruit of *Croton bonplandianum* Baill is highest at site A 2.8±0.4 with one way ANOVA F ratio 0.25* Average seed output was 812.94 at site C(highest) of *Croton bonplandianum* Baill and reproductive capacity of *Croton bonplandianum* Baillhighest at site B 577.18 on the. All the three sites comes under Frequency class E.

Table 1: Showing Variation in Agrobotanical Traits of *Croton bonplandianum*Baillfrom all the Three Sites(values are mean of 50 readings)

Parameters	**Site A (mean±SD)**	**Site B (mean±SD)**	**Site C (mean±SD)**
Plant Height(cm)	52.7±9.93	56.7±11.10	49.7±10.48
No. of Branches/Plant	51.39±4.46	48.54±4.39	49.56±3.21
No. of Leaves/Plant	459.28±110.30	431.06±35.16	429.4±28.28
Leaf Area(mm)	28±13.16	30±13.33	27±14.18
No. of Fruits/Plant	246.54±42.75	262.68±38.74	270.98±16.88

NS= Not Significant *= Significant

Analysis of variance:

F- ratio:

i. Plant height =1.1553*
ii. Branches /plant =0.6321*
iii. Leaves/plant =0.2978*
iv. Leaf area =0.1268*
v. Fruit/plant=0.5128*

ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

(A Monthly, Peer Reviewed Online Journal)

Visit: www.ijmrsetm.com

Volume 5, Issue 3, March 2018

Table 2: Showing Variation in Seed Characters and Reproductive Capacity of *Croton bonplandianum*Baillfrom 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)	2.3±0.19	2.18±0.22	2.24±0.15
Seed Width(mm)	1.3±0.13	1.38±0.15	1.28±0.11
Number of Seeds/Fruit	2.8±0.4	2.6±0.48	2.6±0.48
Average Seed Output	739.62	788.04	812.94
Seed Germination (%)	68	71	71
Reproductive Capacity	502.94	559.5	577.18
Frequency Class	E	E	E

NS= Not significant * = Significant

Analysis of variance:
F- ratio:

i. Seed Length =1.0125*
ii. Seed Width=0.9087*
iii. Number of Seeds/Fruit =0.25*
iv. Seed Germination =8.8539 ^{NS}

II. 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.

Agrobotanical Traits -A careful study of data indicated that among Agrobotanical traits (Vadivel and Janardhanan, 2002 and Sridhar and Bhat, 2007) plant height in ***Croton bonplandianumBaill***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).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.(Austrheim et. al 2005 Bradshaw,1965)
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)

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 ***Croton bonplandianum*Baill** have low seed number hence the fruit set is high to very high.

Frequency- Mitchley and Grubb (1986) found positive correlation between seed size and abundance. This finding is similar to our observations that ***Croton bonplandianum*Baill**belong to Frequency Class 'E'. is the common and abundant plant and could be a good colonizer.. Hence we can recommend *Croton bonplandianum* Baill to be distributed for plantation to cover the barren roadside areas of all the three sites of Jaipur. This will help to reduce soil erosion, noise pollution, dust pollution caused by vehicles along roadsides and will help to enhance the greenery of the area.Keeping in view the persistent dust pollution caused by automobiles, and to reduce it to some extant covering the roadsides by ***Croton bonplandianumBaill*** vegetation is the need of hour.

ISSN: 2395-7639

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

(A Monthly, Peer Reviewed Online Journal)

Visit: www.ijmrsetm.com

Volume 5, Issue 3, March 2018

REFERENCES

1. Arnon, D.I. 1949. Copper enzymes in isolated chloroplast polyphenol oxidase in *Beta vulgaris.* Plant physiol. 24: 1-15.
2. Austrheim, G., Evju, M. and Mysterud, A. 2005. Herb abundance and life history traits in two contrasting alpine habitats in southern Norway. Plant Ecol. 179: 217-229.
3. Bowers, J.E., Turner, R.M. and Burgess, T.L. 2004. Temporal and spatial patterns in emergence and early survival of perennial plants in the Sonoran Desert. Plant Ecol. 172:107–119.
4. Bradshaw, A. D. 1987a . Functional Ecology = Comparative Ecology? Functional Ecology 1: 71-71.
5. Bullock, J.M. 2000. Gaps and seedling colonization. In : Fenner M. (ed.), Seeds : The Ecology of Regeneration in Plant Communities. CABI Publishing, Wallingford. pp. 375-396.
6. Baker, H.G. 1958. Studies in reproduction biology of West African Rubiaceae. Jour. West Afr. Sci. Assoc.4: 9-24.
7. Chopra, R.N., Nayar, S.L. and Chopra, I.C. 1986. Glossary of Indian Medicinal Plants. Reprint Edition, Publication and Information Directorate, Council of Scientific and Industrial Research, New Delhi.
8. Elizabeth, P.H. 2005. Phytoremediation. Ann. Rev. Plant Biol .56: 15–39.
9. Eriksson, O. 1997. Colonization dynamics and relative abundance of three plant species *Antennaria dioca, Hieracium pilosella and Hypochoeris maculata* in semi natural grasslands. Ecography 20: 559–568.
10. Eriksson, O. and Jakobsson, A. 1998. Abundance, distribution and life histories of grassland plants: a comparative study of 81 species. Jour. Ecol. 86: 922-933.
11. Grime, J.P. 1979. Plant Strategies and Vegetation Process. John Wiley and Sons, Chichester.
12. Gross, K. L. and Werner, P.A. 1982. Colonizing abilities of "biennial" plant species in relation to ground cover: implications for their distributions in a successional sere. Ecology 63: 921–931.
13. Harper, J.L. and J. White. 1974. Demography of plants. Ann. Rev. Ecol. Syst. 5: 419-463.
14. Jakobsson, A. and Eriksson, O. 2000. A comparative study of seed number, seed size, seedling size and recruitment in grassland plants. Oikos 88: 494–502.
15. Joshi, P.C. and Swami, A. 2009.Air pollution induced changes in the photosynthetic pigments of selected plant species. Jour. Environ. Biol. 30: 295-298.
16. Kirkpatrick, M. 1984. Demographic models based on size, not age, for organisms with indeterminate growth. Ecology 65:1874-1884.
17. Kirtikar, K.R. and Basu, B.D. 1980. Indian Medicinal Plants. Lalit Mohan Basu, Allahabad, India. 3:1774-1777.
18. Leishman, M. 1999. How well do plant traits correlate with establishment ability? Evidence from a study of 16 calcareous grassland species. New Phytol. 141: 487-496.
19. Leishman, M.R. 2001. Does the seed size/number trade-off model determine plant community structure? An assessment of the model mechanisms and their generality. Oikos 93: 294–302.
20. Misra, R. 1968. Ecology Work Book,Calcutta, Bombay, New Delhi.
21. Mitchley, J. and Grubb, P. J. 1986. Control of relative abundance of perennials in chalk grassland in southern England. Jour. Ecol. 74: 1139–1166.
22. Oosting, H.J. 1958. The Study of Plant Communities. 2 edition. W.H. Freeman and Co., San Francisco. pp 440.
23. Pandeya, S.C., Puri,G.S. and Singh,J.S.1968. Research Methods in Plant Ecology. Bombay-Calcutta-NewDelhi-Madras-Lucknow-Bangalore- London – NewYork
24. Raunkiaer, C. 1934. The Life Forms of Plants and Statistical Plant Geography. Clarendon Press, Oxford, England.
25. Salisbury, E. J. 1942. The Reproductive Capacity of Plants. G.Bell and Sons Ltd., London. pp 244.
26. Schaal, B.A. 1980. Reproductive capacity and seed size in *Lupines texensis.* Amer. Jour. Bot. 67: 703-709.
27. van der Valk, A. 1992. Establishment, colonization and persistence. In: Glenn-Lewin D.C., Peet, R.K. and Veblen, T.T. eds, Plant succession: Theory and prediction. Champman and Hall, London, UK. pp. 60-102.
28. Weiher, E. der Werf, A., Thompson, K., Roderick, M., Gamier, E. and Eriksson, O. 1999. Challenging Theophrastus : a common core list of plant traits for functional ecology. Jour. Veg. Sci. 10: 609-620.
29. Westoby, M.E., Jurado, E. and Lord, J. 1996. Comparative ecology of seed size. Trends Ecol. Evol. 7: 368-3