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# Population structure and Regenaration of *Croton scabiosus* Bedd. (Euphorbiaceae) in dry forests of Southern Eastern Ghats of YSR Kadapa District, Andhra Pradesh, India


## ABSTRACT

In the present study, habitat, population structure and regeneration of *Croton scabiosus* Bedd. has been studied in eleven sites of Southern Eastern Ghats of YSR Kadapa District, Andhra Pradesh, India. The study was conducted by laying 66 quadrates each 5m X 200 m in size. A total of 2571 tree individuals of *Croton scabiosus* trees were recorded in 58 quadrates. It is associated with 54 tree species like *Acacia chundra, Chloroxylon swietenia, Cleistanthus collinus, Gardenia gummifera, Mimosa intsia,* and *Pterocarpus santalinus*. Its population in the natural habitat in the forests of YSR Kadapa district is primarily threatened by forest fires, seed pathogens and very low regeneration.


*Words: Croton scabiosus, Endemic tree, Dry forests, Population structure.*

## INTRODUCTION

In India, the dry tropical forests account for 46% of the total forest cover. These dry forests not only constitute rich species diversity, generate variety of natural resources and also promote livelihood security to local communities [1]. Tropical dry forests occur in climates with highly seasonal rainfall, with a mean annual rain fall of 250- 2000 mm and Potential Evapo-transpiration (PET)>1 [2]. Seasonal rainfall pattern of tropical dry deciduous forests generates abiotic conditions that are more severe and variable than in tropical rain forests. These forests are also under immense anthropogenic pressures like shifting cultivation and illegal cutting trees for fuel wood and overgrazing of livestock [3]. Tropical dry forest ecosystems are threatened due to loss of forest cover and degradation. Habitat loss and fragmentation lead to the formation of small, isolated and scattered populations which are increasingly vulnerable to in breeding depression, high seedling mortality and consequently possible extinction [4]. The distribution of plants is determined by climatic variables like rainfall, temperature, soil conditions, moisture, nutrient availability and competition between plant species for crown and root space as well as human interference [5]. But habitat loss and degradation are leading to forest community changes that are effecting the survival of endemic and threatened species.

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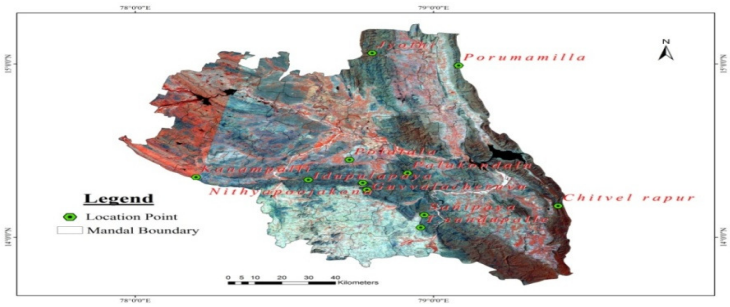
*Croton scabiosus,* a small deciduous tree (Fig.1) of 4-6 m height, belonging to the family Euphorbiaceae is endemic to Southern Eastern Ghats of Andhra Pradesh [6, 7, 8]. Beddome [9] described this species from Nallamalais in Kurnool district. Gamble [10] reported the species in Sanipaya in Kadapa district. Suryanarayana rao and Sreenivasa Rao [11] recorded the species from Penchalakona and Rapur of Nellore district. This species is represented by small populations with scattered distribution in dry deciduous forests of Southern Andhra Pradesh [12]. It is found in Ananthapuramu, Kadapa and Nellore Districts of Southern Andhra Pradesh, India. It is assessed as vulnerable according to IUCN Red list status [13]. This species commonly called as *Yerrichilla* or *Verrichilla* in various localities of its presence in Southern Andhra Pradesh. This plant species is medicinally important, as the seeds are used antidote for snake bite and scorpion sting by the local People [14]. It has a very attractive silvery to golden foliage and can be recommended as an ornamental garden plant [15]. Its populations in the natural habitat in Kadapa forests are primarily threatened by forest fires, fungal infection of seeds and poor germination [14]. As this is an endemic and medicinally important species and its populations are small and declining in the native habitats, studies on regeneration and phytosociological information is necessary for its conservation.

Study area




YSR Kadapa district is lies between $13^0 43^l$ and $15^0 14^l$ North latitude and $77^0 55^l$ and $79^0 29^l$ East longitude. The total geographical area of the district is 15,379 $km^2$ in which forest area is 5,050 $Km^2$, with 32.87% of the district area. Kadapa district day temperature reaches maximum $46^0$C in the month of May and minimum $17^0$C in December. Average Rain fall is 700mm.The present study was undertaken in dry deciduous forests of Kadapa district in 11 places (Fig. **5**) namely Idupulapaya, Palakondalu, Nithyapooja kona, Porumamilla, Jyothi, Kanampalli (Pulivendula), Sundupalli, Sanipaya, Polathala, Guvvalacheru and Chitvel –Rapur hills. These 11 locations were identified based on forest vegetation of *C.scabiosus* species distribution. The study was carried out at each location to assess the density of population and regeneration status of the tree species. All the study sites

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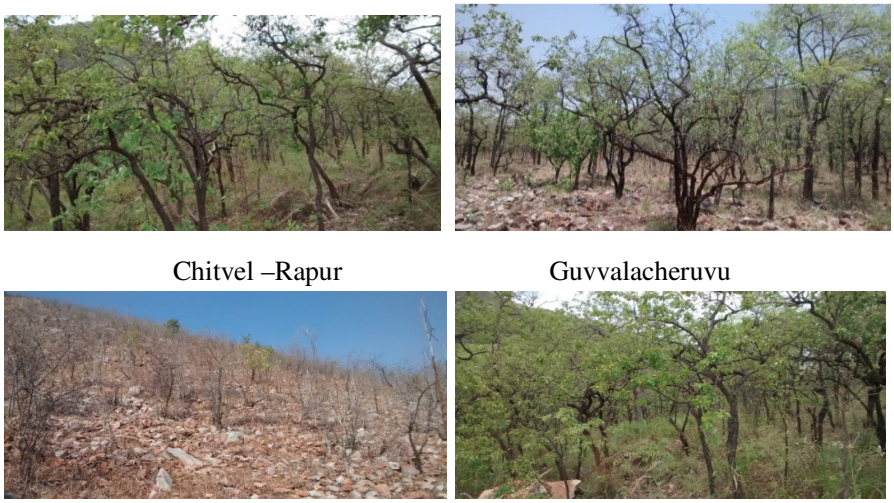
comprise of dry deciduous forests except in Palakondalu and Pulivendula hills where Scrub forest is met with.



Chitvel –Rapur Guvvalacheruvu

Palakondalu Sanipaya

Fig .1 *Croton scabiosus* Tree Population in Chitvel-Rapur, Guvvalacheruvu, Palakondalu and Sanipaya forests

Data collection and analysis

A total of 66 belt transects with 5 X 200 m, size were laid to totaling 6.6 ha. In each site, 6 belt transects were laid and inventoried all trees which are associated with *Croton scabiosus.* All trees ≥10 cm gbh (girth at 1.37m height) were inventoried and specifically recorded. Diameters of all trees greater than 30cm gbh and height of trees from all diameters classes in the sample plots were measured and number of individual trees was counted. In the regeneration plots the number of *Croton* seedlings (below 10 cm height) and saplings (1m height) encountered were counted. Analysis was carried out based on gbh class distribution, height of the trees and regeneration status. The population structure of the species is depicted using frequency histogram of diameter classes, height and numbers of regeneration count. In each study site along with *Croton scabiosus* associated trees were also recorded.

Results and Discussion

A total of 1068 *Croton scabiosus* trees (≥10 gbh),1277 saplings and 226 seedlings in 6.6 ha area, with a range of 61-100 individuals in each belt transects were recorded. Out of these 1068 trees 333 individuals are with 10-20cm gbh,532 are with 21-30cm gbh and 203 are with 31-40cm gbh. The gbh class distribution showed that 12.95% of 10-20 gbh class, 20.7% of 21-30 gbh class and 7.9% of 31-40 gbh class. (Fig **-2**).The saplings are 49.7% and seedlings are 8.8%.The height class distribution revealed that 49.7% trees i.e saplings are below 2m

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height,791 trees are 2-3m height(30.76%) 222 trees are 4-5m height(8.63%) and only 55 trees are 6-8m height (0.02%) (Fig. **3**). Regenaration of *Croton scabiosus* is poor in all the sites studied. The regeneration distribution shows that the saplings are 49.7% and seedlings are 8.8%. Highest regeneration status(19.16%) is seen in Sundupalli forest and lowest regeneration is in Porumamilla and Pulivendula forests. The poor regeneration may be due to rocky habitat (Fig. **4**). The total basal area value is 7.74m$^2$/ha with a range of 25% - 75% and the average height is 3m. *Croton scabiosus* tree height and the calculated basal area showed a marked strong relationship. The detailed analysis among the quadrates reveals that seedlings are present in only 35 quadrates out of all the 11 localities studied. Highest percentage of seedlings growth occurred in Sundupalli. This may be due to good soil and climatic condition favourable for growth and almost no human interference and the lowest seedling growth on rocky habitats of Pulivendula ghats and Porumamilla. Out of the 11 forest areas studied more population of *Croton scabiosus* was found in Palakondalu and Sanipaya but in these areas the trees and saplings are more and the number of seedlings are very low. This may be due to recurrent forest fires and anthropogenic distrubences. Eventhough in Sundupalli the seedling growth is high but due to forest fires they are not able to grow into saplings and trees. In the rocky hilly areas of Porumamilla and Pulivendula ghat area even though the percentage of trees are more the regeneration of seeds is low as the hills are rocky and lack of adequate soil for germination of seeds. The overall regeneration of *Croton scabiosus* in different forests studied showed that contribution of saplings to the population was highest followed by that of trees and seedlings. The availability of high number in <30 cm gbh category indicates that the prevalent disturbance condition and harsh environmental conditions have a role in gbh increment among the tree individuals. The high number of 21-30 cm girth individuals indicates the prevailing disturbances are providing a threshold to the girth increment for the tree.

The inventory also included a total of 54 tree species (Table -1) belonging to 39 genera and 21 families. Fabaceae is the dominant family represented by six species, Moraceae family with four species and Rubiaceae with three species are the other dominant families. The other families are represented by either two or one species. *C.scabiosus* is commonly associated (Table -2) with *Acacia chundra, Boswellia serrata, Cassia fistula, Dalbergia lanceolaria, Dalbergia latifolia, Diospyros chloroxylon, Diospyros melanoxylon, Ficus mollis, Ficus religiosa, Ficus virens, Gardenia gummifera, Gardenia resinifera, Gardenia latifolia, Grewia hirsuta, Grewia tiliifolia, Ochna obtusata, Premna tomentosa,*

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*Premna latifolia, Pterocarpus santalinus, Strychnos nux-vomica, Strychnos potatorum, Wrightia tinctoria* etc. *C. scabiosus* formed the dominant tree species followed by *Anogeissus latifolia, Wrightia tinctoria, Grewia hirsuta, Gardinia resinifera, Buchanania axillaris* and *Ochna obtusata.* In the forests of Porumamilla and Chitvel – Rapur *Croton scabiosus* is associated with *Limonia acidissima, Radermarchera xylocarpa* and *Ficus virens.* It is followed by *Clistanthus collinus, Mimosa intsia, Ochna obtusata* and *Peterocarpus santalinus. Croton scabiosus* is associated with *Ochna obtusata, Acacia chundra* and *Buchanania axillaris* in the forested hilly area of Palakondalu. The *Croton scabiosus* tree usually occurs in lower canopy and the upper canopy is dominated by *Pterocarpus santalinus, Terminalia alata, Anogeissus latifolia, Gardenia gummifera, Gardenia resinifera, Cleistanthus collinus, Wrightia tinctoria* and *Mimosa intsia* Variation in population structure of *Croton scabiosus* in different forests may be partly attributed to the differences in the prevailing micro environmental factors.

Table -1 Associated Tree Species with *Croton scabiosus*

| SI.No | Tree Species | Family |
|---|---|---|
| 1 | *Acacia caesia* (L.) Willd. | Mimosaceae |
| 2 | *Acacia chundra* (Rottler) Willd. | Mimosaceae |
| 3 | *Aegle marmelos* (L.) Correa | Rutaceae |
| 4 | *Albizia amara* (Roxb.) B.Boivin | Mimosaceae |
| 5 | *Anogeissus latifolia* (Roxb. ex DC.) | Combretaceae |
| 6 | *Atalantia monophylla* DC. | Rutaceae |
| 7 | *Bauhinia racemosa* Lam. | Fabaceae |
| 8 | *Boswellia ovalifoliolata* N.P.Balakar. & A.N.Henry | Burseraceae |
| 9 | *Boswellia serrata* Roxb.ex Colebr. | Burseraceae |
| 10 | *Bridelia montana* (Roxb.) Willd. | Euphorbiaceae |
| 11 | *Buchanania axillaris* (Desr.) Ramam. | Anacardiaceae |
| 12 | *Cassia fistula* L. | Caesalpiniaceae |
| 13 | *Cassine glauca* (Rottb.) Kuntze | Celastraceae |
| 14 | *Ceiba pentandra* (L.) Gaertn. | Bombacaceae |
| 15 | *Cleistanthus collinus* (Roxb.) Benth. | Euphorbiaceae |
| 16 | *Chloroxylon swietiana* DC. | Rutaceae |
| 17 | *Cochlospermum religiosum* (L.) Alston | Cochlospermaceae |
| 18 | *Commiphora caudata* (Wight&Arn.) Engl. | Burseraceae |
| 19 | *Dalbergia lanceolaria* L.f. | Fabaceae |
| 20 | *Dalbargia latifolia* Roxb. | Fabaceae |
| 21 | *Deccania pubescens* (Roth) Tirveng. | Rubiaceae |
| 22 | *Diospyros chloroxylon* Roxb. | Ebenaceae |
| 23 | *Diospyros melanoxylon* Roxb. | Ebenaceae |
| 24 | *Dolichondrone atrovirens* (Roth) K.Schum. | Bignoniaceae |
| 25 | *Erythroxylum monogynum* Roxb. | Erythroxylaceae |
| 26 | *Ficus benghalensis* L. | Moraceae |
| 27 | *Ficus mollis* Vahl | Moraceae |
| 28 | *Ficus religiosa* L. | Moraceae |

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|---|---|---|
| 29 | *Ficus virens* Aiton | Moraceae |
| 30 | *Gardenia gummifera* L.f. | Rubiaceae |
| 31 | *Gardenia resinifera* Roth | Rubiaceae |
| 32 | *Grewia flavescens* Juss. | Tiliaceae |
| 33 | *Grewia hirsuta* Vahl | Tiliaceae |
| 34 | *Grewia tiliifolia* Vahl | Tiliaceae |
| 35 | *Hardwickia binata* Roxb. | Caesalpiniaceae |
| 36 | *Lannea coromandelica* (Houtt.) Merr. | Rutaceae |
| 37 | *Mimosa intsia* L. | Mimosaceae |
| 38 | *Madhuca longifolia* (J.Kong ex L.) J.F.Macbr. | Sapotaceae |
| 39 | *Naringi crenulata* (Roxb.) Nicolson | Rutaceae |
| 40 | *Ochna obtusata* DC. | Ochnaceae |
| 41 | *Phyllanthus emblica* L. | Euphorbiaceae |
| 42 | *Polyalthia cerasoides* (Roxb.) Bedd. | Annonaceae |
| 43 | *Premna latifolia* Roxb. | Verbenaceae |
| 44 | *Premna tomentosa* Willd. | Verbenaceae |
| 45 | *Pterocarpus santalinus* L.f. | Fabaceae |
| 46 | *Radermarchera xylocarpa* (Roxb.) Roxb. ex K. Schum. | Bignoniaceae |
| 47 | *Santalum album* L. | Santalaceae |
| 48 | *Strychnos nux-vomica* L. | Loganiaceae |
| 49 | *Strychnus potatorum* L. | Loganiaceae |
| 50 | *Syzigium alternifolium* (Wight) Walp | Myrtaceae |
| 51 | *Terminalia bellirica* (Gaertn.) Roxb. | Combretaceae |
| 52 | *Terminalia chebula* Retz. | Combretaceae |
| 53 | *Terminalia tomentosa* Wight&Arn. | Combretaceae |
| 54 | *Wrightia tinctoria* R.Br. | Apocynaceae |

Table 2. Associated Trees with *Croton scabiosus* in different forests of Kadapa districts

| Forest area | Elevation | Forest type | Associated Trees |
|---|---|---|---|
| Chitvel - Rapur | 261-510m | Dry forest | *Limonia acidissima, Radermarchera xylocarpa, Ficus virens, Mimosa intsia* etc. |
| Idupulapaya | 275m-598m | Dry deciduous forest | *Anogeissus latifolia, Dolichondrone atrovirens, Grewia hirsuta, Gardenia resinifera, Hardwickia binata* etc. |
| Guvvalachervu | 467m-519m | Dry deciduous forest | *Chloroxylon swietenia, Gardenia gummifera, Gardenia resinifera, Pterocarpus santalinus, Ochna obtusata* |
| Nithyapooja kona | 407m-597m | Dry deciduous forest | *Boswellia serrata, Ceiba pentandra, Cleistanthus collinus, Cochlospermum religiosum, Deccania pubescens, Cleistanthus collinus* etc. |
| Palakondalu | 155m-328m | Scrub | *Cleistanthus collinus, Gardenia gummifera, Gardenia latifolia, Pterocarpus santalinus, Mimosa intsia, Ochna obtusata, Buchanania axillaris.* |
| Polathala | 215m-368m | Dry deciduous for- | *Acacia chundra, Bridelia montana,* |

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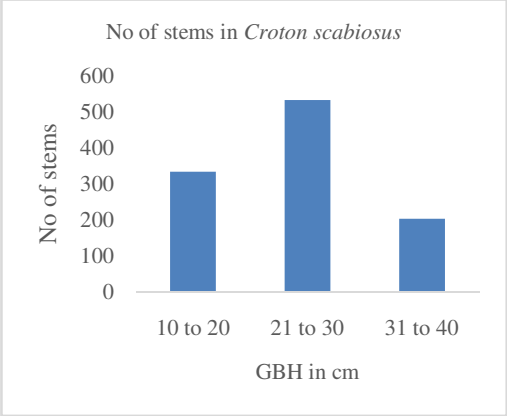
| | | | |
|---|---|---|---|
| | | est | *Diospyros chloroxylon* etc. |
| Porumamilla | 478m-592m | Dry deciduous forest | *Atalantia monophylla, Cassia fistula, Diospyrus melanoxylon, Phyllanthus emblica* |
| Kanam Palli | 268m-462m | Rocky habitat | *Anogeissus latifolia, Gardenia gummifera,Wrightia tinctoria* etc. |
| Sanipaya | 205m-706m | Dry deciduous forest | *Anogeissus latifolia, Aegle marmelos, Hardwickia binata etc.* |
| Sundupalli | 208m-515m | Dry deciduous forest | *Anogeissus latifolia, Albizia amara, Bauhinia racemosa etc.* |
| Joythi | 392m-635m | Dry deciduous forest | *Croton scabiosus* is not found |



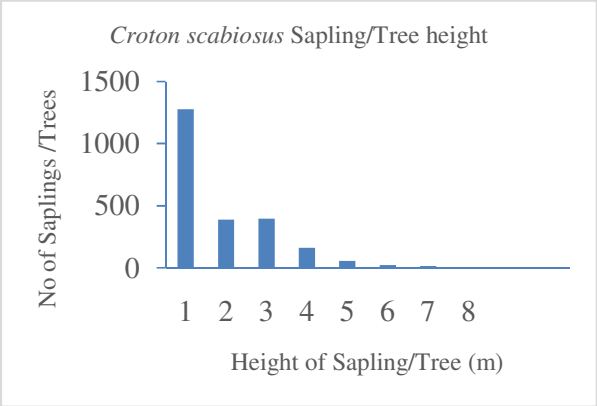




Fig-**2** Fig **-3**

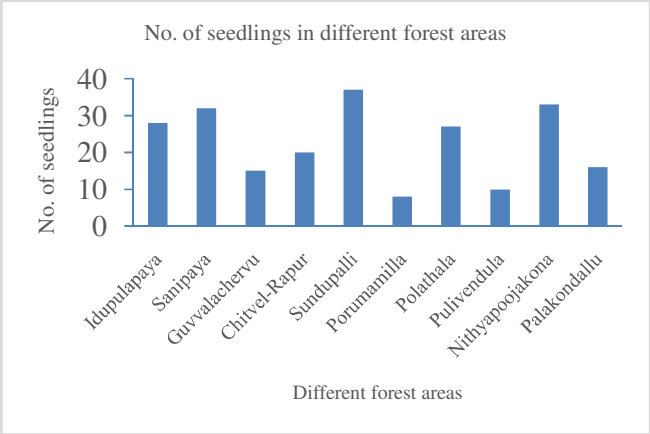



Fig -**4**

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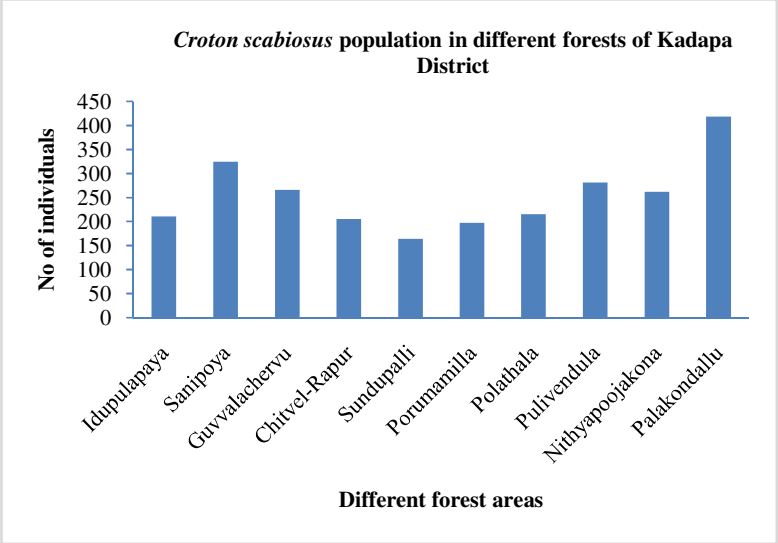


Fig -**5**

Conclusion

*Croton scabiosus* is an endemic tree species confined to small geographical area of southern Eastern Ghats of Andhra Pradesh and categorized as rare or threatened species [6]. In the present study it is recorded in all the areas studied except in Joythi forest and this species is associated with 54 tree species in various dry forests of Kadapa district. *Croton scabiosus* was observed in 58 quadrates out of 66 belt transects laid with a range of 61 – 100 individuals in 5 x 200m quadrate featuring a uniform distribution in all the studied areas. In all the studied areas it was found between the elevation of 208m – 706m. It was usually observed in low to middle foot hills along with *Cleistanthus collinus, Mimosa intsia*, *Pterocarpus santalinus* and *Anogeissus latifolia* indicating preference of dry conditions for the *Croton scabiosus* tree. The regeneration status of *Croton scabiosus* in different forests of Kadapa district is very low. The establishment, survival and growth of seedling is governed by several biotic and abiotic factors. Recurring forest fires and nutrient poor rocky habitat are the main abiotic factors which cause poor regeneration. Flower and fruit predation by beetles and fungal infestation of fruit and seeds, poor germination and anthropogenic disturbances are the important limiting factors for the recruitment and population expansion. Our findings indicate that if anthropogenic pressure, forest fires continue to operate, future perpetuation of *Croton scabiosus* in the forest may be threatened. Hence proper conservation measures have to formulated to protect the species, taking into account its medicinal and economic values. Awareness programmes regarding the importance of forests controlling forest fires and

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motivating the village people towards sustainable harvesting of forest products may help minimize the pressure on this species.

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