



RESEARCH PAPER

Natural regeneration of flora in cultivated sandalwood

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Abstract : Sandalwood is now become a component of agro forestry in Karnataka. A field survey was conducted in sandalwood plantation to know the influence of sandalwood and associated cultivation practice on enrichment of plant diversity. Till planting of sandalwood, farmer has followed clean cultivation later allowing the weeds to grow. Sample survey was conducted through grid method. The major biodiversity was contributed by naturally regenerated plant species. Seventeen tree species, ten shrub species, five climbers and forty six herbs, mainly belonging to fabaceae, amaranthaceae and poacea were found in the studied plantation indicating positive association of local flora with sandalwood.

Key Words : Field survey, Sandalwood plantation, Bio diversity, Agro forestry

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INTRODUCTION

Santalum is an important genera of Santalaceae, among the 25 species of this genera, *S. album* (East Indian sandalwood) and *S. spicatum* (Australian sandalwood) are cultivated commercially. Highly valued heart wood of East Indian sandalwood, upon distillation is known to yield essential oil upto 6.36 per cent depending on many factors (Subasinghe *et al.*, 2013), which is rich in santalol (α and β 90%). Though sandal seedlings initially obtain nutrients from its seed reserve, in later stages they are partly dependent on host species for water and nutrients. The tree is naturally seen in dry deciduous tracts of Karnataka and adjoining districts of

Tamil Nadu, Kerala, Maharashtra and Andhra Pradesh. The earlier restrictive policies discouraged legitimate interest in sandal growing and brought the sandalwood to the verge of extinction (Rashkow, 2014). However, after the amendment to the Karnataka Forest Act, 1963 during 2001 the cultivation of sandalwood was liberalized and many enterprising farmers started cultivating the sandalwood. As it require forest like environment, the sandalwood cultivation is not similar to other tree crops and there will be scope for natural bio diversity enhancement with sandalwood. With this background, a survey was taken upto access the medicinal plant diversity in sandalwood ecosystem.

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MATERIAL AND METHODS

The study was carried during March 2018 to March 2020 in pre established sandalwood plantation at Mandalmari village, Kushtagi taluk, Koppal district, Karnataka state. The study plantation is located in Zone-3 (Northern dry zone) of agro climatic zones of Karnataka and at 642 m above mean sea level. Before establishment of sandalwood, the farmer was growing pomegranate following clean cultivation and later sandalwood seedlings planted at 15 feet x 10 feet spacing during 2008. And allowed the self sown plants to grow.. However, the farmer took up annual cleaning by rotavating in between the rows. The plantation was provided with protective irrigation during summer using previously installed drip irrigation system. The perennial plant species present in the plantation were identified and recorded. The annual plant species in the field were recorded using sample grid survey technique (Olsen *et al.*, 1998). Imaginary grids of 10 m X 5 m were marked

in the field in random direction. The plant species present in the grids were sampled and identified. Total five grids were studied to assess the floral biodiversity in the study area. The plant species were identified referring 'Flora of Karnataka' (Saldanha and Ramesh, 1984).

RESULTS AND DISCUSSION

The various medicinal plants regenerated naturally in the sandalwood plantation of study area are tabulated in Table 1. Six different tree species were identified in the sandalwood plantation of which major diversity was contributed by Fabaceae family with.

There were seven shrub species and five climbers recorded in study area. Among the shrubs, curry leaf was planted by farmer, which further dispersed naturally.. All shrubs were of different families except Fabaceae, of which two species were recorded in the study plantation. All the climbers presented in the study plantation were naturally grown and of different families *viz.*, Cucurbitaceae

Table 1 : The list of trees present in sandalwood plantation

Sr. No.	Common name	Botanical name	Family	Habit
1.	Flame of forest	<i>Butea monosperma</i>	Fabaceae	Tree
2.	Thorn mimosa	<i>Acacia nilotica</i>	Fabaceae	Tree
3.	Prosopis	<i>Prosopis juliflora</i>	Fabaceae	Tree
4.	Banni	<i>Acacia ferruginea</i>	Fabaceae	Tree
5.	Neem	<i>Azadirachta indica</i>	Meliaceae	Tree
6.	Simaruba	<i>Simarouba glauca</i>	Simaroubaceae	Tree

Note: F –Planted by farmer; SS – Self sown F and SS – Initially planted by farmer followed by natural dispersal

Table 2 : The list of shrubs and climbers present in sandalwood plantation

Sr. No.	Common name	Botanical name	Family	Mode of introduction
Shrubs				
1.	Yakka	<i>Calotropis gigantea</i>	Asclepiadaceae	SS
2.	Ankole	<i>Alangium salvifolium</i>	Cornaceae	SS
3.	Lakki	<i>Vitex negundo</i>	Lamiaceae	SS
4.	Wild indigo	<i>Teprosia purpurea</i>	Fabaceae	SS
5.	Senna	<i>Senna auriculata</i>	Fabaceae	SS
6.	Curry leaf	<i>Murraya koenigi</i>	Rutaceae	F and SS
7.	Lantana	<i>Lantana camara</i>	Verbenaceae	SS
Climbers				
1.	Indian ipecac	<i>Tylophora asthamatica</i>	Asclepiadaceae	SS
2.	Wild ivy gourd	<i>Coccinia grandis</i>	Cucurbitaceae	SS
3.	Amrutha balli	<i>Tinospora cordifolia</i>	Menispermaceae	SS
4.	Broom creeper	<i>Cocculus hirsutus</i>	Menispermaceae	SS
5.	Balloon climber	<i>Cardiospermum halicacabum</i>	Sapindaceae	SS

Note: F –Planted by farmer SS – Self sown F and SS – Initially planted by farmer followed by natural dispersal

Table 3: The list of annual herbs present in sandalwood plantation				
Sr. No.	Common name	Botanical name	Family	Mode of introduction
1.	Ruellia	<i>Ruellia bicalyculata</i>	Acanthaceae	SS
2.	Kakajangha	<i>Peristrophe bicalyculata</i>	Acanthaceae	SS
3.	Malapudak	<i>Peristrophe roxburghiana</i>	Acanthaceae	SS
4.	Abrojo	<i>Alternanthera spinosa</i>	Amaranthaceae	SS
5.	Prickly chaff flower	<i>Achyranthes aspera</i>	Amaranthaceae	SS
6.	Ox knee	<i>Achyranthes bidentata</i>	Amaranthaceae	SS
7.	Mountain knot grass	<i>Aerva lanata</i>	Amaranthaceae	SS
8.	Silver cockscomb	<i>Celosia argentea</i>	Amaranthaceae	SS
9.	Creeping chaff weed	<i>Alternanthera pungens</i>	Amaranthaceae	SS
10.	Prickly amaranth	<i>Amaranthus spinosus</i>	Amaranthaceae	SS
11.	Green amaranth	<i>Amaranthus viridis</i>	Amaranthaceae	SS
13.	Tridax daisy	<i>Tridax procumbance</i>	Asteraceae	SS
14.	Carrot grass	<i>Parthenium hysteroporus</i>	Asteraceae	SS
15.	Bristly starbur	<i>Acatospermum hispidum</i>	Asteraceae	SS
16.	Latin American fleabane	<i>Erigeron mucronatus</i>	Asteraceae	SS
17.	Indian heliotrope	<i>Heliotropium indicum</i>	Boraginaceae	SS
18.	Stinking cassia	<i>Cassia tora</i>	Caesalpinaceae	SS
19.	Sickle pod	<i>Senna obtusifolia</i>	Caesalpinaceae	SS
20.	Fringed spider flower	<i>Cleome rutidosperma</i>	Cleomaceae	SS
21.	Bengal dayflower	<i>Commelina benghalensis</i>	Commelinaceae	SS
22.	Morning glory	<i>Ipomea obscura</i>	Convolvulaceae	SS
23.	Spiny gourd	<i>Momordica dioca</i>	Cucurbitaceae	SS
24.	Grass like Fimbr	<i>Fimbristylis milliaceae</i>	Cyperaceae	SS
25.	Indian copper leaf	<i>Acalypha indica</i>	Euphorbiaceae	SS
26.	Asthma weed	<i>Euphorbia hirta</i>	Euphorbiaceae	SS
27.	Wild Poinsettia	<i>Euphorbia geniculata</i>	Euphorbiaceae	SS
28.	Bana tulsi	<i>Croton bonplandianum</i>	Euphorbiaceae	SS
29.	American basil	<i>Ocimum americanum</i>	Lamiaceae	SS
30.	Touch me not	<i>Mimosa pudica</i>	Mimosaceae	SS
31.	Broom weed	<i>Malvestrum coromandelianum</i>	Malvaceae	SS
32.	Common wire weed	<i>Sida acuta</i>	Malvaceae	SS
33.	Prickly Fan petals	<i>Sida spinosa</i>	Malvaceae	SS
34.	Purple Shamrock	<i>Oxalis corniculata</i>	Oxalidaceae	SS
35.	Mexican prickly pear	<i>Argemone mexicana</i>	Papaveraceae	SS
36.	Black honey shrub	<i>Phyllanthus reticulatus</i>	Phyllanthaceae	SS
37.	Love grass	<i>Ergrostis chinensis</i>	Poaceae	SS
38.	Black spear grass	<i>Heteropogon contortus</i>	Poaceae	SS
39.	Torpedo grass	<i>Panicum repens</i>	Poaceae	SS
40.	Desho grass	<i>Pennisetum pedicellatum</i>	Poaceae	SS
41.	Mission grass	<i>Pennisetum polystachion</i>	Poaceae	SS
42.	Indian commet grass	<i>Perotis indica</i>	Poaceae	SS
43.	Swollen finger grass	<i>Chloris barbata</i>	Poaceae	SS
44.	Crowfoot grass	<i>Dactylactenium aegyptium</i>	Poaceae	SS
45.	<i>Borreria</i> Sp.	<i>Borreria stricta</i>	Rubiaceae	SS
46.	Wild cape gooseberry	<i>Physalis minima</i>	Solanaceae	SS

Note: F –Planted by farmer SS – Self sown

(*Coccinia grandis*), Asclepiadaceae (*Tylophora asthamatica*), Menispermaceae (*Tinospora cordifolia* and *Cocculus hirsutus*) and Sapindaceae (*Cardiospermum halicacabum*).

The herb biodiversity was rich in the study plantation with forty six species belonging to various botanical families. Most of the species listed are common weeds of dry land ecosystem. The maximum biodiversity was contributed by Amaranthaceae and Poaceae. Eight species of each of these families were recorded in study plantation. The family Euphorbiaceae registered four entries in the plantation which was equal to the biodiversity contribution by Asteraceae. Three species were registered from Acanthaceae and Malvaceae while, two species were from Caesalpinaceae, one from each of Asphodelaceae, Boraginaceae, Cleomaceae, Commelinaceae, Convolvulaceae, Cucurbitaceae, Cyperaceae, Lamiaceae, Mimosaceae, Oxalidaceae, Papaveraceae, Phyllanthaceae, Rubiaceae and Solanaceae.

Even though sandalwood plantation was established in standing pomegranate orchard, the study location exhibited appreciable floral biodiversity with seventy seven plant species, of which seventeen were trees, ten were shrubs, four were climbers and forty six species were herbs. Such a varied biodiversity can be attributed to the minimum cultivation followed by the farmer, which provide equal opportunity for the plants to establish and multiply. High degree of species diversity associated with sandalwood is also reported by Durairaj and Kamaraj (2013) from Manmalai reserve forest.

The major contribution to biodiversity is from Fabaceae, Amaranthaceae and Poaceae. The members of these families are very common inhabitants of arid zones of Karnataka. They are also common weeds of dry land ecosystem. The maximum introduction of species by farmer is among trees as few were pre established before planting of sandalwood. However, the trees like teak, mahogany were planted by the farmer in view of alternate income generation. The self dispersal of most of the plant species can be attributed to the bird attracting sandalwood fruits produced in enormous quantity in early monsoon months (Ratnanigrum and Indrioko, 2014). The birds are attracted from far away locations due to fruit

availability apart from other fruit eating and bird hunting animals in the area. Hence, there could be influence of sandalwood itself on associated biodiversity. Apart from sandalwood, the trees, climbers and shrubs also provide fruits for birds and stray animals.

Summary and Conclusion:

Seventeen different tree species, ten shrub species, five climbers and forty six herbs were found in the sandalwood plantation mainly belonging to fabaceae, amaranthaceae and poacea. The major biodiversity was contributed by naturally regenerated plant species. Hence, it can be concluded that, cultivating sandalwood can aid in increasing the local plant diversity.

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REFERENCES

- Anonymous (1972). *Santalum*. In: *Wealth of India*. Raw Materials Rh-SO-9. Pub: Publication and Information Directorate, CSIR, New-Delhi, India, pp. 208-224.
- Durairaj, P. and Kamaraj, M. (2013).** Assessment and conservation strategies for *Santalum album* in manmalai rf of thuraiyur range at Tiruchirappalli district. *International J. Humanities, Arts, Medicine & Sciences*, **1**(1): 1-12.
- Olsen, A., Stevens, D. and White, D. (1998).** Application of global grids in environmental sampling. In: *Computing Science and Statistics (Proceedings of the 30th symposium on the interface, computing science and statistics*. Mineapolis, Minnesota, May 13-16. Interface Foundation of North America, Fairfax Station, Virginia), Ed: S. Weisberg, **30**: 279-284.
- Rashkow, E. D. (2014).** Perfumed the axe that laid it low: The endangerment of sandalwood in southern India. *Indian Economic Social History Review*, **51**: 41.
- Ratnaningrum, Y. W. N. and Indrioko, S. (2014).** Response of flowering and seed production of sandalwood (*Santalum album L.*) to climate changes, In: *Procedia Environmental Sciences*, **28**: 665 – 675.
- Saldanha, C. J. and Ramesh, S. R. (1984).** *Flora of Karnataka*. Oxford and IBH, New Delhi, India.

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