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Mahesh V Gokhale
a) Department of Botany, K. B. P. College, Urun -slampur, Dist.- Sangli - 415 409, (MS - India)
b) Abhivyakti Academy for Research, Education and Awareness, Kolhapur (AAREA), 1039/3/4 A- Suprabhat Colony, New Washi Naka, Kolhapur, 416 011, (MS-India)

Live Fencings in Sindhudurga District of Maharashtra State (India): A Traditional Mean of Plant Resource Maintenance

Mahesh V Gokhale

Abstract

In Konkan region of Maharashtra State of India the privately owned lands are demarcated by fences either of Jambha stones or by cultivation of living plant species. Fences made up of these plants are unique ecological entities. These fences have received own identity due to species composition and ecological processes going on among them. Species are used for specific purposes. Few introduced plants are observed; otherwise all the species are native. Some of the plants are used as stumps or poles; some are binders-wire ropes- runners. Some thorny species are used for protection from cattle. *Carissa*, *Ixora*, *Plumeria*, *Euphorbia*, *Jatropha* are common species used in the fences. Live fences are the most preferred sites for maintenance of medicinally important and other useful species. These plants are pruned and trained yearly to maintain shape of fencing. The present paper reports a survey of fencing plant species in Sindhudurga District of Maharashtra. Frequency of the species is calculated.

Keywords: Live Fencings, Sindhudurga District, Plant Resource Maintenance

Introduction

Since long back, local inhabitants of Konkan region of Maharashtra are practicing the protection of privately owned lands by producing fences of live plant species. Most of the time, these appear to be natural. The shapes, height of fences are maintained by the inhabitants. Some plants are specifically cultivated while most of the species are growing naturally. The shape and size of all the fencing species is maintained by land owners. Land owners consider the fences as good sites for maintenance of medicinal as well as other important species. Present paper reports a survey of plant species occurring in the fences in the villages of eight different Tahsils of Sindhudurga districts of Maharashtra. Total 200 Fencings were surveyed from different ecological conditions.

Material and Methods

Survey of plant species occurring along the fences was carried out in the villages of Sindhudurga District of Maharashtra (India) during 2005 to 2012. Following villages were visited. Fences were located and species were documented. Species were confirmed using standard literature (Cooke, 1901; Kulkarni, 1988) [3]. The areas represent different ecological conditions like human habitations, road sides, agricultural fields, horticultural fields, hilly slopes, plateaus, wastelands, forest outskirts etc. Fences more than 20 meters in length were considered for present survey. Total 200 fences were surveyed. Frequency of species is calculated by considering a single fencing as sample unit, using following formula.

$$\text{Frequency (\%)} = \frac{\text{No. of fences in which species occur}}{\text{Total number of fences studied}} \times 100$$

Correspondence

Mahesh V Gokhale

a) Department of Botany, K. B. P. College, Urun -slampur, Dist.- Sangli - 415 409, (MS - India)
b) Abhivyakti Academy for Research, Education and Awareness, Kolhapur (AAREA), 1039/3/4 A- Suprabhat Colony, New Washi Naka, Kolhapur, 416 011, (MS-India)

Tahsil wise micro-geographic areas screened for fences species.

Tahsil	Village	No. of fences studied for species composition	Ecological conditions of area
Malvan	Achara	14	Coastal, coastal inland, forest outskirts
	Chindar	10	Agriculture, inhabitations
	Trimbak	10	Agriculture, inhabitations
	Malvan	10	Coastal, coastal inland
	Nerurpar	8	Wet places, agriculture
	Hadi	6	Plateau, agriculture, rocky plateau
	Kandalgaon	8	Coastal, inland
Deogad	Deogad	6	Rock plateau
	Mutat	9	Hilly slope, agriculture, forest outskirts
	Mithbaon	7	Agriculture, inhabitations
	Hindale	7	Horticultural farms
	Munage	6	Inhabitutions, Hilly slopes
Kankavali	Kankavai	6	Roadside, urbanized areas
	Harkul	3	Foot hills of Sahyadri
	Phonda	7	Foot hills of Sahyadri
	Belane	3	Plateau
Kudal	Kudal	7	Inhabitutions
	Pinguli	3	Agriculture, Inhabitutions
	Mhapan	5	Wet places, Agriculture
Dodamarg	Dodamarg	3	Foothills of Sahyadri
	Banda	3	Roadside, Agriculture, forest outskirts
Sawantwadi	Sawantwadi	7	Roadside, Inhabitutions, forest outskirts
	Majagaon	3	Roadside, Inhabitutions
Vengurla	Vengurla	5	Coastal inland
	Dabholi	9	Inhabitutions, hilly slopes
	Nivati	7	Coastal inland
	Khavane	7	Close to estuaries
Vaibhavwadi	Vaibhawadi	9	Foot hill of Sahyadri
	Sangulwadi	5	Agriculture, Horticulture, forest outskirts
	Karul	7	Roadside, Inhabitutions, forest outskirts

Results and Discussion

Demarcation of privately owned lands by fences of live plant species is characteristics feature of Konkan region of Maharashtra. It is one of the historical features of the region. The live fences are maintained since long back. These are purely made up of wild native plant species. Some of the plants are purposely maintained while some introduced plants are cultivated along the fences. Bamboo sticks are widely used to tie these plants collectively, to maintain compact structure of fences.

Fences in this region have two systems vertical and running or horizontal systems. Vertical systems are mainly made up of

live trees, shrubs and stumps as well as poles of some specific plants. These plant species are selected in such a way that their stumps can be vegetatively grown and maintained alive. Vertical system provides basic support to the fences. These stumps are irrigated during dry months to keep them alive at initial stage. The plant species which are used as stumps or poles in vertical system are recorded in Table 1. *Jatropha curcas*, *Plumeria alba*, *Bombax ceiba*, *Erythrina indica* are very commonly used as stumps. Recently species like *Casuarina*, *Leucaena* are purposefully cultivated along the fences. Now these are started to grow as escape species. These plants are kept stunted by frequent chopping.

Table 1: Species used as stumps / poles in fences

Sr. No.	Species	Frequency (%)
1.	<i>Jatropha curcas</i> L.	42
2.	<i>Jatropha gossypifolia</i> L.	09
3.	<i>Macaranga peltata</i> (Roxb.)	37
4.	<i>Sapium insigne</i> (Royle, Benth)	64
5.	<i>Casuarina equisetifolia</i> J.R. and G. Forst	12
6.	<i>Bombax ceiba</i> Burm.F.	40
7.	<i>Spondias pinnata</i> (L.F.) Kur	18
8.	<i>Erythrina indica</i> Lamk.	39
9.	<i>Eugenia corymbosa</i> Lamk.	27
10.	<i>Plumeria alba</i> L.	46
11.	<i>Tectona grandis</i> L.F.	20
12.	<i>Leucaena leucocephala</i> (Lam) dewit.	24

Lengthwise or horizontal continuity of fences is maintained mainly by climbers and lianas. These species provide necessary support as they are woody with perennial life cycle.

Among these *Cryptolepis*, *Tinospora*, *Derris* is common in occurrence along the fences. Some of the scandent and straggling shrubs are also used (Table 2).

Table 2: Species used as runner or wire ropes in fences

Sr. No.	Species	Frequency (%)
1.	<i>Trichosanthes tricupsidata</i> Lour.	05
2.	<i>Jasminum malabaricum</i> wight.	09
3.	<i>Wattakaka volubilis</i> (L.F.) staph.	03
4.	<i>Cryptolepis buchanani</i> Roem and Schult	58
5.	<i>Strychnos wallichiana</i> steud.	01
6.	<i>Cyclea peltata</i> (Lamk.) Hook F.	62
7.	<i>Tinospora cordifolia</i> (Willd.) Miers	16
8.	<i>Tinospora sinensis</i> (Lour.) Merr.	19
9.	<i>Hiptage benghalensis</i> (L.) Kurz.	01
10.	<i>Cayratia 53Iujube531h</i> (Roxb.)	07
11.	<i>Cayratia 53Iujube531hyl</i> (L.)	09
12.	<i>Allophylus cobbe</i> (L.)	01
13.	<i>Abrus precatorius</i> L.	18
14.	<i>Derris scandens</i> (Roxb.) Benth	35
15.	<i>Mucuna pruriens</i> (L.) DC.	21
16.	<i>Calycopteris floribunda</i> (Roxb.) Poir.	29
17.	<i>Bridelia stipularis</i> Blume, Bijdr	03
18.	<i>Embelia robusta</i> Roxb.	09
19.	<i>Daemia extensa</i> R. Br.	04
20.	<i>Ipomoea 53Iujube531</i> For Sk	10
21.	<i>Ipomoea pes-tigridis</i> Linn	13
22.	<i>Argyria speciosa</i> sweet	07
23.	<i>Ipomoea quamoclit</i> Linn.	20
24.	<i>Canavalia ensiformis</i> DC.	03

Live fences are not only for demarcation of lands but these are the important provisions to protect areas from grazing animals. Therefore, to create the fences impenetrable, thorny plants are used. One of the common and purposefully used species is *Euphorbia antiquorum*. In addition to this some other species are also used (Table 3).

Table 3: Thorny species used in fences

Sr. No.	Species	Frequency (%)
1.	<i>Carissa carandas</i> Linn	72
2.	<i>Ziziphus rugosa</i> Lamk.	21
3.	<i>Caesalpinia bonduc</i> L.) Roxb.	03
4.	<i>Caesalpinia crista</i> (L.)	05
5.	<i>Euphorbia antiquorum</i> L.	63
6.	<i>Dalbergia 53Iujube531hyll</i> Nimmo	16
7.	<i>Acacia concinna</i> DC.	38

To make the fences more thick and impenetrable; cuttings of thorny plants, climbers as well as stumps / poles are collected from nearby forests, other vegetation patches and even from existing old and thick fences. These cuttings collectively called as 'Bela' in vernacular language ie Malvani (subsidiary of Marathi language).

Fences provide good ecological sites for germination of different species. Among these, trees are very important. Tree species germinate, establish and at sapling stage provide stumps or poles in vertical system. Generally the tree species are allowed to grow further. The trees recorded in fences are depicted in Table 4.

Table 4: Tree species occur in the fences

Sr. No.	Species	Frequency (%)
1.	<i>Mimusops elengi</i> L.	05
2.	<i>Gmelina arborea</i> Roxb.	10
3.	<i>Tectona grandis</i> L.F.	27
4.	<i>Bridelia retusa</i> (L.) spreng.	38
5.	<i>Phyllanthus emblica</i> L.	14
6.	<i>Artocarpus 53Iujube531hyllous</i> Lamk.	31
7.	<i>Eugenia jambolana</i> Lamk.	27
8.	<i>Barringtonia acutangula</i> (L.) Gaerth.	07
9.	<i>Careya arborea</i> Roxb.	39
10.	<i>Thespesia populnea</i> (L.) Soland.	09
11.	<i>Annona squamosa</i> L.	05
12.	<i>Firmiana colorata</i> (Roxb.) R. Br.	03
13.	<i>Calophyllum inophyllum</i> L.	05
14.	<i>Zanthoxylum rhetsa</i> (Roxb.) DC	08
15.	<i>Garcinia indica</i> Choicy	13
16.	<i>Sapindus laurifolius</i> Vahl.	05
17.	<i>Mammea suriga</i> Kosterm	04
18.	<i>Anacardium occidentale</i> L.	27
19.	<i>Lannea coromandelica</i> (Houtt.) Merr.	15
20.	<i>Mangifera indica</i> L.	57
21.	<i>Pongamia pinnata</i> (L.) Pierre	09
22.	<i>Cynometra iripa</i> Kostel	01
23.	<i>Acacia chundra</i> (Rottl.) wild.	23
24.	<i>Lucaena leucocephala</i> (Lamk.)	11
25.	<i>Terminalia bellirica</i> (Gaerth.) Roxb.	09
26.	<i>Terminalia chebula</i> Retz.	07
27.	<i>Terminalia paniculata</i> Roth. Nov.	14
28.	<i>Randia dumetorum</i> Linn. Sans.	12
29.	<i>Butea monosperma</i> (Lam.) Taub	03
30.	<i>Cassia fistula</i> L.	10
31.	<i>Santalum album</i> Linn.	04
32.	<i>Ficus asperrima</i> Roxb.	20
33.	<i>Caryota urens</i> Linn,	31
34.	<i>Cerbera odollam</i> Gaerth	01
35.	<i>Polyalthia longifolia</i> Benth	03
36.	<i>Hibiscus tiliaceus</i> Linn	01
37.	<i>Bombax ceiba</i> L.	15
38.	<i>Pterospermum suberifolium</i> Lam.	01
39.	<i>Grewia tiliacefolia</i> Vahl.	04
40.	<i>Carallia brachiata</i> (Lour.) Merr	18
41.	<i>Zizyphus 53Iujube</i> Lamk.	04
42.	<i>Dolichandrone spathacea</i> (L.f) K. Schum	01

To create the fences more dense and thick some shrubs are either maintained from natural regeneration or planted purposefully. Due to comparatively fast growth and less height, the canopy of these shrubs provides impenetrable nature to the fences. These species are documented in Table 5.

Table 5: Shrub species occurring along the fences.

Sr. No.	Species	Frequency (%)
1.	<i>Melastoma malabathricum</i> L.	03
2.	<i>Memecylon umbellatum</i> Burm.	30
3.	<i>Woodfordia fruticosa</i> (L.) Kurz.	41
4.	<i>Lawsonia inermis</i> L.	15
5.	<i>Ixora coccinea</i> L.	44
6.	<i>Morinda pubescens</i> Sm.	18
7.	<i>Plumbago zeylanica</i> L.	06
8.	<i>Holarrhoena antidysenterica</i> (Roth) A. DC.	38
9.	<i>Adhatoda zeylanica</i> Medic.	32
10.	<i>Barleria prionitis</i> L.	14
11.	<i>Clerodendrum inerme</i> (L.) Gaerth	08
12.	<i>Lantana camara</i> L.	51
13.	<i>Vitex negundo</i> L.	17
14.	<i>Vitex trifoliata</i> L.	08
15.	<i>Hibiscus rosasinensis</i> L.	09
16.	<i>Colubrina asiatica</i> (L.) Brough.	03
17.	<i>Bauhinia tomentosa</i> L.	08
18.	<i>Agrostistachys indica</i> Dalz.	06
19.	<i>Ficus arnottiana</i> Mia	04
20.	<i>Helicteres isora</i> Linn.	16

In the live fences some plants appear seasonally, mostly during rainy season. These include ephemerals, herbs and few seasonal climbers. These plants have no direct role in fencing structure. Due to protection against grazing, these plants can establish along the fences. Typical yearly recruitment of these species is observed along the fences. After rainy season all these species are cleared from both the sides of fences by land owners. Fences provide mechanical support as well as protection. They also provide better grounds for germination

and establishment of colonizing plant species. *Smilax Gloriosa* are some of the examples. Sides along the fences also provide good ecological conditions for establishment of weed species (Table 6). Many times it is observed that these species are not occurring in the region as isolated individuals but these are present along the fences in considerable number. These species successfully complete lifecycle and regenerate along the fences, indicating these are habitable sites or good niches for them.

Table 6: Species colonize naturally along the fences.

Sr. No.	Species	Frequency (%)
1.	<i>Synedrella nodiflora</i> (L.) Gaerth.	09
2.	<i>Andrographis paniculata</i> (Brum. F.) wall	08
3.	<i>Barleria cristata</i> L.	18
4.	<i>Achyranthes aspera</i> L.	31
5.	<i>Costus specioia</i> (Koenig) Smith	09
6.	<i>Curculigo orchiooides</i> Gaerth	72
7.	<i>Dioscorea bulbifera</i> L.	81
8.	<i>Dioscorea pentaphylla</i> L.	30
9.	<i>Gloriosa superba</i> Linn.	23
10.	<i>Smilax zeylanica</i> L.	36
11.	<i>Pothos scandens</i> L.	03
12.	<i>Acacia auriculiformis</i> A. Cunn. ex Benth.	24
13.	<i>Ensete superbum</i> Roxb.	28
14.	<i>Vigna vexillata</i> (L.)	36
15.	<i>Passiflora foetida</i> L.	03
16.	<i>Luffa acutangula</i> (L.) Roxb. var <i>amara</i> (Roxb.)	07
17.	<i>Hemidesmus indicus</i> (L.) R. Br.	60
18.	<i>Crinum latifolium</i> Linn.	04
19.	<i>Vernonia cinerea</i> Less.	12
20.	<i>Tridax procumbens</i> Linn.,	28
21.	<i>Celosia argentea</i> Linn.	21
22.	<i>Sida acuta</i> Burm.	12
23.	<i>Sida rhombifolia</i> var. <i>retusa</i> masters	23
24.	<i>Sida cordifolia</i> Linn.	27
25.	<i>Cucumis trigonus</i> Roxb.	55
26.	<i>Leea macrophylla</i> Roxb.	08
27.	<i>Mimosa pudica</i> Linn.	17

Though the species in the fences are native and appearing natural; basically as a structure, fences are man engineered and maintained since long back allowing the plant to be naturalized. The fences are maintained yearly. Generally,

these are cut after rainy season; because due to heavy rain, fencing species grow rapidly and allow colonizing species to colonize throughout the lengths. To maintain the flat, vertically straight structure irregularly grown plants are cut

and the branches are overlapped and tied using wire ropes, bamboo sticks or stumps of fencing plants.

Mostly the fences are maintained up to the height of 3 to 6 feet. Very few plants, especially the timber trees and the species of other interest are allowed to grow above this height. The side branches of these trees are cut mostly at alternate year and used as stumps or poles in vertical support system of fences. All other plants are chopped which give copice in the next year. These are used as stumps or poles. Due to yearly chopping morphology of plants varies. Boles of some plants are irregularly grown, some plants remain stunted. Due to repeated production of copice, natural canopy architecture and morphology is not observed. It may create some problems in identification of species.

As protective sites, some of the species of interest are maintained along the fences (Table 7). These species do not require much care or maintenance. These species are readily available on requirement. These include many medicinal and ornamental plants. Not only the maintained species but all natural species also used for various purposes. Thus, fences provide number of ethno-botanical dimensions. According to local inhabitants medicinal plants along the fences are good in medicinal properties. It may possibly due to natural ecological conditions as well as frequent chopping, creating stressful conditions which may favor accumulation of active principles in the form of secondary metabolites. Plants like *Azadirachta indica*, which are not native, are also maintained along the fences.

Table 7: Species maintained by inhabitants along the fences

Sr. No.	Species	Frequency (%)
1.	<i>Momordica dioica</i> Roxb. ex willd.	05
2.	<i>Rauvolfia serpentina</i> (L.) Benth.	22
3.	<i>Clerodendrum serratum</i> (L.) Moon.	18
4.	<i>Asparagus racemosus</i> willd.	09
5.	<i>Drimia indica</i> (Roxb.)	09
6.	<i>Azadirachta indica</i> A. Juss.	05
7.	<i>Aegle marmelos</i> (L.) Corr. Serr.	12
8.	<i>Petalidium barlerioides</i> Nees.	20
9.	<i>Crossandra undulatifolia</i> Salisb.	14
10.	<i>Lygodium flexuosum</i>	09
11.	<i>Murraya koenigii</i> (L.) Spreng.	13
12.	<i>Cestrum nocturnum</i> L.	18
13.	<i>Artobotrys odoratissimus</i> R. Br.	09
14.	<i>Bougainvillea spectabilis</i> willd.	15
15.	<i>Prosopis cineraria</i> L.	05
16.	<i>Kaempferia rotunda</i> Linn.	05
17.	<i>Alpinia galanga</i> Swartz	12
18.	<i>Jasminum sambac</i> (L.) Aiton	12
19.	<i>Jasminum pubescens</i> willd.	18
20.	<i>Coccinia indica</i> wight and Arn.	08

During rainy season species of *Selaginella*, *Ophioglossum*, *Lygodium* etc. grow very commonly along the fences. Some of the *Selaginella* individuals may attain considerable height (up to 1feet). Parasitic plants like *Cuscuta*, *Loranthus*, *Viscum* also grow on the fencing species (Table 8). As fencing species are regularly chopped, they may dry and die. These stumps are readily attacked by wood rotting fungi like *Polyporus*, *Peniophora*, *Flavodon*, *Hexagonia*, *Ganoderma*, *Microporus*, *Pleurotus* etc. It indicates that the fences can provide good ecological traps to these species.

Table 8: Parasitic angiosperms occurring on fencing species

Sr. No.	Species	Frequency (%)
1.	<i>Loranthus longiflorus</i> Desrousse	05
2.	<i>Viscum capitellatum</i> Sm.	07
3.	<i>Viscum oreintale</i> Willd.	01
4.	<i>Cuscuta reflexa</i> Roxb.	58
5.	<i>Cassytha filliformis</i>	05

Due to stout perennial support in the form of above ground live plants and their underground root system, fences facilitate accretion and soil binding process. Litter from fencing plants accumulates at the base making soil fertile. All these processes results in mulching thereby level elevation at the base of fences. Dead woody plant parts are readily attacked by ants adding to the soil formation. Earthworm species also accumulate along the fences facilitating organic matter transformation. Loosening of soils favors residence of burrowing animals, rodents and snakes. Thus thick fences are able to initiate and stabilize the ecological processes in the form of soil binding, organic matter transformation, food chains and food webs.

Fencing plants attract birds as well as butterflies. Number of insects and ants are also recorded on these plant species. Fencings can be considered as promising sites to locate the seedlings of species which are dispersed by birds. *Ensete superbum* is one of the good examples of species of which the seeds are dispersed by birds. Moreover, germination enhancement is observed as the seeds are passed through digestive tracks of birds (Gokhale *et al.* 2010) [2]. Therefore, crowding of seedlings of *E. superbum* is observed along the fences during rainy season.

It is to be noted here that, in Sindudurga District of Maharashtra human settlements are spread over a larger areas in the form of isolated houses. Therefore, fences around them provide good sites for maintenance rather conservation of some important wild species.

Live fencing has number of facets. It has a major role in protection, secondly it play role in ethno botany and ethno medicines. Though it is the age old practice in India, the research reports on the live fencing are hardly available. Whatever reports are available, they focus the ethno botany and traditional uses (Jadeja *et al.* 2007 and Borkataki *et al.*, 2008) [4, 5]. Only one report from Kasaragod district from Kerala State of India enlists the bio-fencing species with their families, local name, habit, role and the condition of plant material in fencing (Subrahmanyam and Raveendran, 2010) [6]. The present paper reports the structural and functional organization of live fencing in Sindhudurga district of Maharashtra, India. Further ecological processes related to live fencing are under study.

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