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Medicinal plants for intercropping in plantations

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Abstract
One of the important constraints faced by the medicinal plant sector is depletion of the resource base by unsustainable wild harvesting. Intercropping or multistoried cropping of plants in the plantation crops of Kerala is a suitable proposition for ex situ conservation of shade adapted medicinal plants. The survey conducted on the available economically important shade adapted medicinal plants which were naturally growing under the canopy of plantation crops and home steads of Kerala revealed that there is a rich diversity and listed 37 species. They are are *Adhatoda beddomei*, *Adhatoda vasica*, *Aegle marmelos*, *Aloe vera*, *Alpinia galanga*, *Asparagus racemosus*, *Azadirachta indica*, *Boerhaavia diffusa*, *Cardiospermum halicacabum*, *Curculigo orchioides*, *Chonemorpha fragrans*, *Desmodium gangeticum*, *Embelia ribes*, *Gloriosa superba*, *Holostemma adakodien Indigofera tinctoria*, *Ipomoea mauritiana*, *Kaempferia galangal*, *Kaempferia rotunda*, *Mucuna Pruriens Phyllanthus amarus*, *Piper longum*, *Plumbago rosea*, *Pseudarthria viscidia*, *Rauwolfia serpentine*, *Ricinus communis*, *Sesamum inducum*, *Sida rhombifolia*, *Solanum anguivi*, *Strobilanthes heyneanus*, *Trichosanthes anguina*, *Tylophora indica*, *Vigna radiate*, *Vigna pilosa*, *Vitex negundo*, *Withania somnifera*, *Woodfordia fruticosa*. Of the 22 families and 34 genera in which these 37 species of medicinal plants are recorded, the family fabaceae recorded the maximum species. Family Acanthaceae, Liliaceae and Zingiberaceae also share a large proportion of medicinal plant species. Habit wise analysis of these shade adapted medicinal plants shows herbaceous flora (17 species) is the dominant followed by shrubs (13 species). In the preliminary field experiment, these 37 species of medicinal plants obtained from the botanical survey, were screened for adaptability and shade tolerance by growing them in the interspaces of mature rubber plantations. Studies identified the Following 5 species of medicinal plants to be best suited for intercropping in rubber plantations-*Adhatoda beddomei*, *Adhatoda vasica*, *Alpinia galangal*, *Plumbago rosea and Strobilanthes heyneanus*. They can be successfully and profitably intercropped in rubber plantations. The study also indicated that intercropping did not cause any adverse effect on the yield of dry rubber.

Keywords: medicinal plants, intercropping, plantations

Introduction

Herbal medicine and products have a large global market and it is estimated that it may be as much as $ 1 trillion in the coming few decades. India's share in the present world market is quite small and we need to put our resources together to benefit from the upcoming opportunities because India is one of the 12 mega biodiversity regions, holding approximately 8% of global biodiversity and tropical medicinal plants constitute the bulk of the world's medicinal plants biodiversity.

Medicinal plants are living resources and are exhaustible if over used but sustainable if used with care and wisdom. About 95% of medicinal plants used by the industries are collected from the wild because gathering plant materials from wild is cost effective than cultivation. Over 70% of the plant collections involve destructive harvesting. So one of the important constraints faced by the medicinal plant sector is depletion of the resource base by unsustainable wild harvesting because resource base is the foundation of medicinal plant sector. Increased population coupled with diminishing forest area, progressive demand of raw materials and unrestricted exploitation of crude drugs from natural resources without proper measure of conservation have led to a situation where at least 120 medicinal plant species have been officially classified as endangered (Jain 1987) [1]. Therefore in situ and ex situ conservation efforts, sustainable utilization and commercial production of medicinal plants, need urgent and serious attention in the country. Intercropping of medicinal plants in the plantation crops is a suitable proposition for ex situ conservation of shade adapted medicinal plants.In India, one of the potential areas for growing these plants is the west coast of peninsular India as intercrops in tropical plantation crops (Coconut, rubber etc).

Cultivation of easily marketable agricultural crops as intercrops is possible in the first three years of growth of rubber (Mathew *et al* 1978) [2]. But by the fourth year, the canopy of the trees closes and light penetration is restricted to the extent that agricultural crops cannot be cultivated. The cultivation of shade loving medicinal plants appears a viable proposal from the fourth year onwards. It is in this context that the medicinal plants which are adapted to shade and which are naturally growing under shade in plantations and homesteads of Kerala need be surveyed and evaluated for cultivation as intercrops in plantations. The present study was taken up i) to identify the available economically important shade adapted medicinal plants, which were naturally growing under the canopy of plantation crops and homesteads of Kerala, ii) to screen the selected species of medicinal plants for adaptability and shade tolerance by growing them in the interspaces of mature rubber plantations.

Materials and Methods

A botanical survey was conducted mainly in central zone of Kerala to identify the available economically important shade adapted medicinal plants, which were naturally growing under the canopy of plantation crops and homesteads of Kerala.

In the preliminary field experiment, 37 species of medicinal plants, obtained from the botanical survey, were screened for adaptability and shade tolerance by growing them in the interspaces of mature rubber plantations.

Second set of experiment was carried out in a stand of clone RRII 105 and was aimed to find out the growth performance, production of economic part and impact of intercropping on latex yield with respect to the five species of medicinal plants which are identified to be best suited for intercropping in rubber plantations, from the first set of field experiments. These species were planted in the month of June-July when there was heavy rain (which is the best condition for planting).

Tender vegetative cuttings of *A. vasica, A. beddomei and S. heyneanus;* stem cuttings with at least 3 nodes of *P. rosea* and rhizome with bud of *A.galanga* were obtained from the source bushes established in CES and were used for planting. The interspace between the rows of rubber with a width of 1.5 to 2.0 M have been selected for planting. The area was subjected to slash weeding and four or five strips of 10 cm width were strip weeded. The distance between the strips were 45 cm for *S. heynianus* and 30 cm for all other species. In these strips, planting of cuttings was done with 45 cm gap in between plants of *S.heynianus* and 30 cm gap between other species. This pattern of planting resulted in 4 rows of *S.heyneanus* in between 2 rows of rubber at the rate of 16,000 cuttings per ha and 5 rows for other species at the rate of 30,000 cuttings per hectare. All cultural practices were as per the package of practices recommendation for rubber trees. Data on economic yield of the medicinal plants was collected by harvesting. Economic parts were separated and air dried to measure the air dry weight as only air dried parts are marketed. But in the case of *P.rosea*, only fresh root weight was recorded since only fresh root are marketed. Yield of rubber was collected in all experimental plots before and after intercropping.

Results and Discussion

The botanical survey conducted on the available economically important shade adapted medicinal plants, which were naturally growing under the canopy of plantation crops and homesteads of Kerala revealed that there is a rich diversity and listed 37 species. They are1 *Adhatoda beddomei* C.B Clarke [Cheriyaadalodakam], 2 *Adhatoda vasica* Nees [Valiyaadalodakam] 3 *Aegle marmelos* (Linn) Corr [Koovalam],4 *Aloe vera* Mill[Kattarvazha], 5 *Alpinia galanga* Sw[Aratha], 6 *Asparagus racemosus* Willd [Sathavari], 7 *Azadirachta indica* A. Juss [Aryavep], 8 *Boerhaavia diffusa* Linn [Thazhuthama], *9 Cardiospermum halicacabum* Linn [Valliuzhinga], 10 *Curculigo orchioides* Linn [Nilappana],11*Chonemorpha fragrans* [Perumkarumba], 12 *Desmodium gangeticum* (Linn) Dc [Orila],13 *Embelia ribes* Burm F[Veezhalari], 14 *Gloriosa superba* Linn[Menthonni], 15 *Holostemma adakodien* Schultes [Adapathiyan], 16 *Indigofera tinctoria* Linn [Neelayamari], 17 *Ipomea mauritiana* Jacq [Paalmuthuk], 18 *Kaempferia galanga* Linn [Kacholam], *19 Kaempferia rotunda* Linn [Chenganer kizhagu], 20 *Mucuna Pruriens* (Linn) Dc [Naaykkurunna], 21*Phyllanthus amarus* Schum and Thunn [Kiezharnelli],22 *Piper longum* Linn [Thippali], 23 *Plumbago rosea* Linn [Chumala Koduvelli], 24 *Pseudarthria viscidia* (Linn) Wight & Arn [Moovilla], 25 *Rauwolfia serpentina* (Linn) Benth [Sarppagandhi], 26 *Ricinus communis* Linn [Aavanakku], 27 *Sesamum inducum* Linn [Ellu], 28 *Sida rhombifolia* Spp. Retusa Linn[Kurumthotti], 29 *Solanum anguivi* Lam [Chunda], 30 *Strobilanthes heyneanus* Nees [Karimkurinji], 31 *Trichosanthes anguina* Linn [Padavalam], 32 *Tylophora indica* (Burm) Merill [Vallippala], 33 *Vigna radiata* var sublobata (Linn) Wilczek [Kattuzhunnu], 34 *Vigna pilosa* [Kattupayar], 35 *Vitex negundo* Linn [Karinochy], *36 Withania somnifera* (Linn) Dunal [Amukkirum], 37 *Woodfordia fruticosa* (Linn) Kurz (Thathiri).Of the 22 families and 34 genera in which these 37 species of medicinal plants are recorded, the family fabaceae recorded the maximum species. Family Acanthaceae, Liliaceae and Zingiberaceae also share a large proportion of medicinal plant species. Habit wise analysis of these shade adapted medicinal plants shows herbaceous flora (17 species) is the dominant followed by shrubs (13 species) [Table 1].

The preliminary field experiment where these 37 species of medicinal plants were screened for shade adaptability by growing them in the interspaces of mature rubber plantations identified the following five species of medicinal plants to be best suited for intercropping in rubber plantations.

1. *Adhatoda beddomei* C.B.Clarke (Vernacular name: Cheriya adalodakom)
2. A large shrub with entire leaves and small flowers in short heads; known for its bronchodilatory and antispasmodic properties.
3. *Adhatoda vasica* Nees (Vernacular name: Valiya adalodakom) A dense shrub with a foetid cent having entire leaves and white flowers with the throat barred with yellow. It acts as bronchodilatory and antispasmodic.
4. *Alpinia galanga* Sw (Vernacular name: Aratha) A perennial herb with fleshy rhizome and greenish white flowers with lip veined with red. The rhizomes has diuretic, carminative and expectorant properties.
5. *Plumbago rosea* Linn.(Vernacular name: Chumala koduveli) A perennial undershrub with alternate, ovate leaves and petiole often auricled at the base, with bright red flowers. It is widely used for the cure of leprosy, anemia,diabetes,diabetes, diarrhoea,dyspepsia and leucoderma.
6. *Strobilanthes heyneanus* Nees (vernacular name: Karimkurunji)

A small perennial shrub reaching 3 ft in height with opposite, lineolate leaves with serrate margin and pale blue flowers. It is used against neurological disorders, glandular swellings, skin diseases etc.

Many other species like *Kaempferia rotunda*, *Kaempferia galanga*, *Asparagus racemosus* etc also showed good growth but large scale commercial cultivation is difficult with them.

Further studies on the intercropping of the above five species which are suitable for cultivation under rubber plantation in a stand of clone RRII 105 showed that intercropping of these medicinal plant did not cause any

significant change in the yield performance of the rubber clones. Yield of economic parts of *S. heyneanus, A. vasica and A.beddomei* at 30 months after planting was 5.3, 4.2 and 1.1 tonnes per hectare rubber area respectively whereas yield of *P. rosea* and *A. galanga* at 18 months after planting was 1.4 and 2.2 tonnes per hecture rubber area respectively.

Conclusion

The botanical survey listed 37 species of economically important shade adapted medicinal plants naturally growing under the canopy of different plantation crops and homesteads of Kerala which are suitable for intercropping in plantations. The propagation methods of these species have been broughtout.

Five species of medicinal plants were found to be best suited for intercropping in rubber plantations from the preliminary studies conducted by intercropping 48 species of medicinal plants in rubber plantations. They are *A. vasica, A. beddomei, A. galanga, P. rosea* and *S. heyneanus*. These medicinal plants will have to undergo active growth for at least 2 years to produce substantial economic yield. The study also indicates that intercropping does not need any additional manuring than recommended for *H. brasiliensis* and did not cause any adverse effect on the yield of dry rubber.

Among these 3 species, 7 species have been assigned threatened category with Red list status of Endangered (*Rauwolfia serpentina, Holostemma ada-kodien*), vulnerable (*Chenomorpha fragrans, Gloriosa superba, Psuedarthria viscida* and Near Threatened (*Embelia ribes, Piper longum*). (Ravi Kumar *et al* 2005). *Rauwolfia serpentina* and *Gloriosa superba* are present in the list of banned species from Export by the Ministry of Commerce (Vide notification No.47 (PN) 92 – 97 dated 30 March 1994. Among these 37 species, 10 species (*Aegle marmelos, Indigofera tinctoria, Holostemma ada-kodien, Mucuna pruriens, Aloe vera, kaempferia galanga, Asparagus racemosus, Alpinia galanga Ipomoea mauritiana* and *Adhatoda beddomei*) are present in the recommendation list of medicinal plants for large-scale cultivation in India by the National Medicinal Plant Board.

To address the need for conservation of native medicinal plant species of India, we need to cultivate them. The medicinal plants studied can be successfully and profitably intercropped in rubber plantations. Intercropping system of medicinal plants in plantation crops is a very good approach to sustainable medicinal plant management, conservation and ecorestoration. It is also a potential income-augmenting source for small growers. Intercropping of medicinal plants in plantations is an ecotechnology for conservation of medicinal plants.

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