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Managing Agarwood producing species in natural forest and in plantations

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In India Agarwood naturally grows only in North East Region

Use of Agarwood tree during Medieval Era

Agarwood Tree - Brief Information

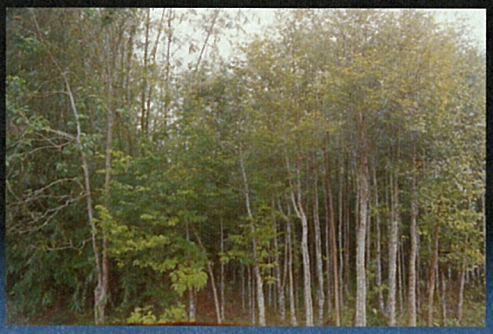
- Local name: Sanchi, Agaru or Agar
- Scientific name: *Aquilaria malaccensis Lamk*, syn. *A. agallocha* of Thymelaeaceae family
- It is a large evergreen tree growing up to 40 m tall and 1.5-2.5 m in diameter.
- Grow in mixed forest habitat at altitudes up to 1000 m above sea level.
- Agarwood tree is belief to be originated in Assam, India
- Naturally found in the foothills of NE India
- Product of commercial interest: Agar wood & Agar oil.
- In South East Asia agarwood is regarded as the Wood of the God & the oil as Liquid Gold.

Soil and climate

- Prefers warm and high humid, sub-tropical climate with rainfall 1800 - 3500 mm
- Grows on a wide range of soils including poor sandy soils.
- Well-drained deep sandy loam to loam rich in organic matter, marginal soils, shallow soils over rocky beds.
- Prefers acidic soil reaction. The mycorhiza & other beneficial fungi being soil borne requires acid soils for their population build up.
- Agar tree is sun-loving & rarely found in deep forest.
- Produces good quality agar oil / agarwood when grown on south slope of hill / hillock receiving high amount of sunshine.
- Grow in borders of forest, scrub jungle & in homestead.

A view of Homestead Agarwood plantation in Assam

Natural dense population



Organized Agarwood Plantation in Assam

Agarwood as shade trees in Tea Gardens

Why the concept of plantation came so late despite being so valuable?

- In natural population only 20-30% tree is infected and takes longer time to make a tree harvestable.
- The maximum yield is obtained after 50 years of infection.
- The uninfected trees yield very negligible products of inferior quality.
- No timber value
- Longer gestation period- min. 10 years.

Why natural population so drastically reduced?

- Destruction of forest.
- Unscientific exploration *i.e.* random felling.
- Agar trees become valuable only when it falls sick or ceases to grow or died. So the economic exploration if done properly should not hamper eco-balance.
- Major assault came with the emergence of petro-dollars in Middle East.
- Doves are very fond of Agar seeds -- in natural stand this is another reason of low regeneration.

Prospects of commercial plantation

The mystery of agar oil/ agarwood formation is evolving with success.

- Artificial culturing of causal fungus and their successful inoculation has increased the infection rate and shortened the bio-transformation time.
- 90% of the trees in a population can be converted for economic harvest now.

Propagation

- Propagation is done normally by seeds.
- Time of Seed collection during July – August
- No. of seeds per kg- 1500
- Seed viability-With capsule about 32 days and after shelling-1 week
- Average Germination in farmers field-40-60 %

Invitro micro-propagation also getting popularity in India

Propagation

- Sowing method-Sowing in mother beds, and after 20-25 days transferred them to poly bags.
- Sand media with organic compost
- Germination continues up to 52 days
- Highest germination obtained in experimental field 88.89(%).

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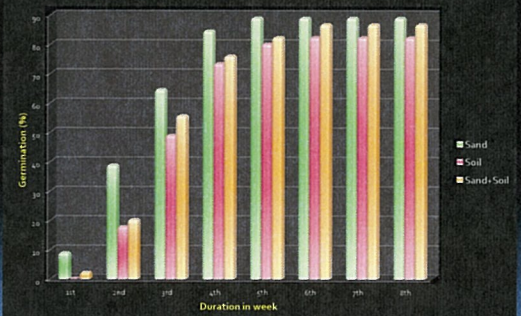
Germination studies on the seeds of *Aquilaria malaccensis* LAMK. -A potential crop for fragrance industry

S.C. Nath, J. Kalita and N. Saikia

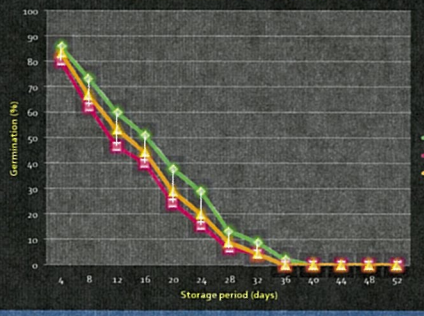
ABSTRACT

Germination, dormancy and viability of the seeds of ***Aquilaria malaccensis*** *Lamk. have been studied. The fresh and mature seeds when sown immediately after collection in sand media exhibit highest percentage (88.89%) of germination indicating a dormancy period up to 6 weeks even when the nursery beds are provided with proper shading and regular watering. With the increase of storage period, the seeds however, start losing their viability.*

Percentage of Germination of *A. malaccensis* seeds under different bed media



Percentage of Germination of *A. malaccensis* seeds at different storage periods



Species that are being commercially exploited

i) *Aquilaria agallocha*
ii) *A. malaccensis*
iii) *A. khasiana*
iv) *A. sinensis*
v) *A. crassna*
vi) *A. bancana*
vii) *Aquilaria beccariana*
viii) *A. cumingiana*
ix) *A. filaria*
x) *A. microcarpa*
xi) *A. hirta*
xii) *A. ovata*

Out of these *A. agallocha syn. name A. malaccensis* is most exalted species

Variety

- No identified variety so far, but two distinct type can be identified in field
- *Jati sanchi* -Desired type which gets infected frequently and yields oil/agaru in due course of time
- *Bhola sanchi* -Fast growing but infection is very poor, not preferred by growers.

Intercropping

- Intercropping with Medicinal and aromatic plants like *Rauvolfia serpentine, Homalomena aromatica, Kaempferia galanga, Asparagus racemosus*, patchouli etc.
- Ginger and turmeric and seasonal vegetables in early 2-3 years

Agarwood Plantation intercropping with Lemon grass

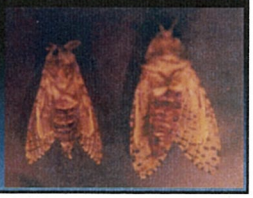
Patchouli intercropping under Agar plantation at farmers field

Turmeric intercropping under Agar plantation at farmers field

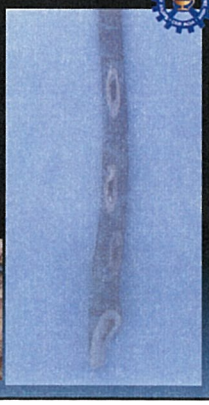
Agarwood tree planted as shade tree in tea plantations

Formation of Agar oil and agaru and scope of manipulation

- Agar oil & agaru are regarded as a pathological products
- Wood borer-*Zeuzera conferta* make zig-zag tunnels
- Borer infestation followed by fungal infection
- The fungi identified as *Botryodiploidia theobromae, Mucor heimalis* and *Fusarium solani*



Sometimes woodpecker took out the borer insect - a hindrance in agaru formation

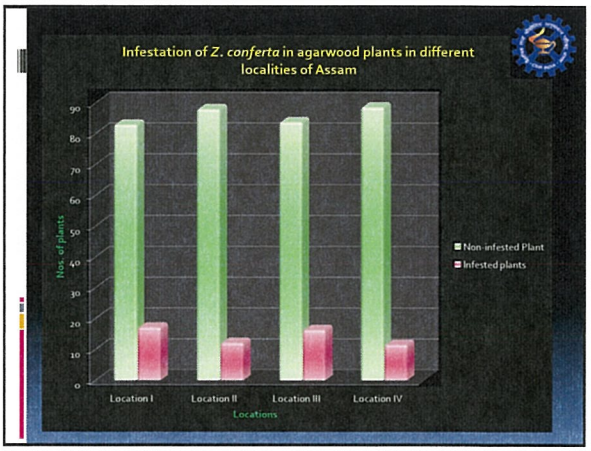


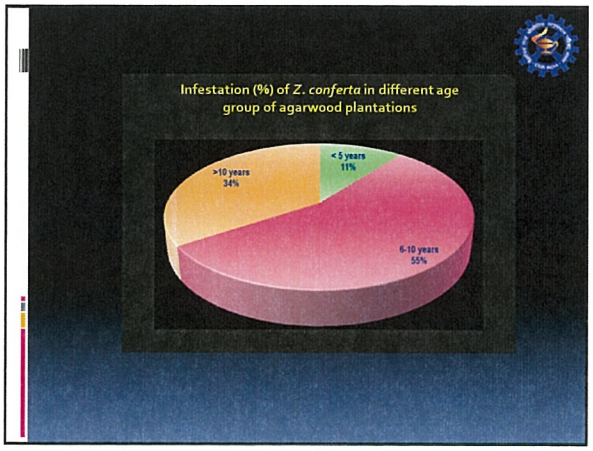
Ants are also fond of the borer

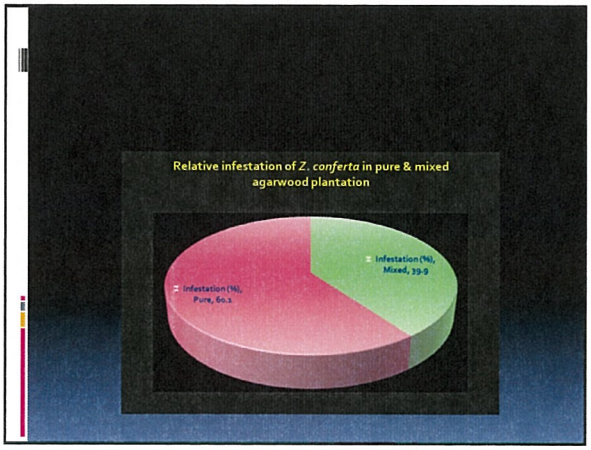
Inside tunneling – a site for fungal infection

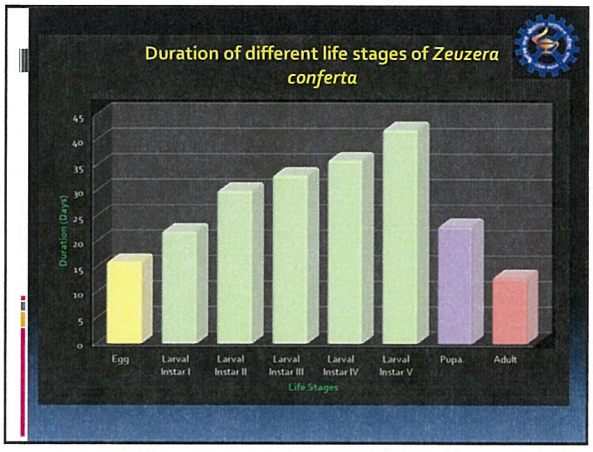
Bio-ecology of *Zeuzera conferta* on Agarwood plantations

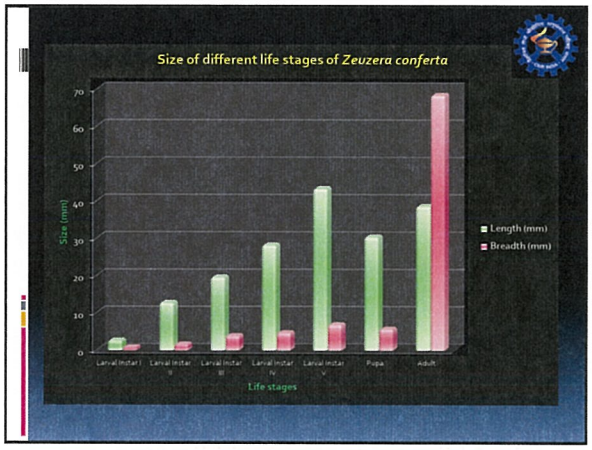
- One generation in a year
- In Jorhat district of Assam average infestation percentage of *Zeuzera conferta* is 14.25.
- Maximum infestation of plants with age of 6-10 years (60.70%).
- Infestation at pure agarwood plantation (60.105) is higher than mixed plantation (39.90%) with other trees.
- The insect remain active and continue feeding during March to November, when temperature & humidity become high.
- Hibernate (diapauses) during December to February.

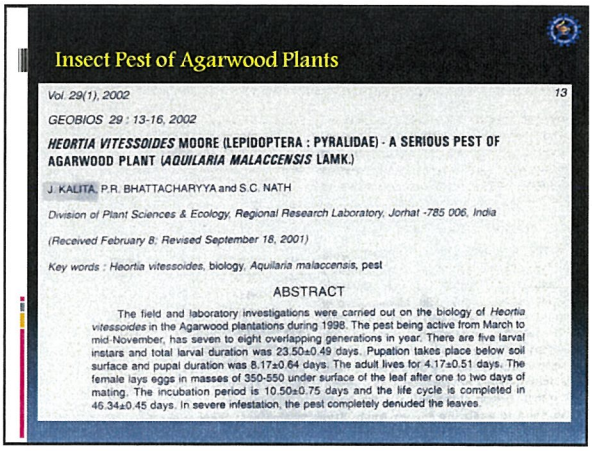

Infestation of Z. conferta in agarwood plants in different localities of Assam
Nos. of plants
0
10
20
30
40
50
60
70
80
90
Location I
Location II
Location III
Location IV
Locations
Non-infested Plant
Infested plants











Insect Pest of Agarwood Plants

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HEORTIA VITESSOIDES MOORE (LEPIDOPTERA : PYRALIDAE) - A SERIOUS PEST OF AGARWOOD PLANT (AQUILARIA MALACCENSIS LAMK.)

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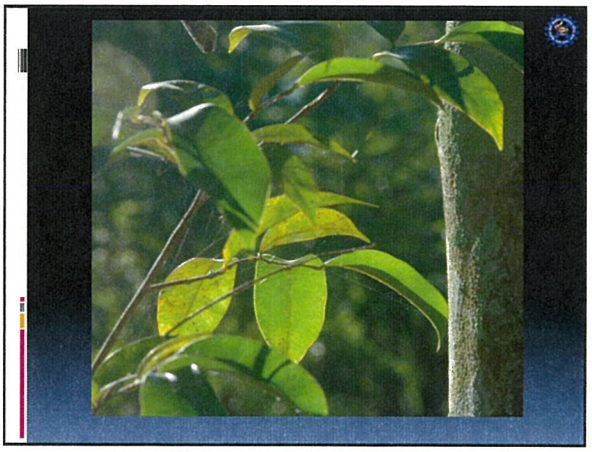
Key words : Heortia vitessoides, biology, *Aquilaria malaccensis*, pest

ABSTRACT

The field and laboratory investigations were carried out on the biology of *Heortia vitessoides* in the Agarwood plantations during 1998. The pest being active from March to mid-November, has seven to eight overlapping generations in year. There are five larval instars and total larval duration was 23.50±0.49 days. Pupation takes place below soil surface and pupal duration was 8.17±0.64 days. The adult lives for 4.17±0.51 days. The female lays eggs in masses of 350-550 under surface of the leaf after one to two days of mating. The incubation period is 10.50±0.75 days and the life cycle is completed in 46.34±0.45 days. In severe infestation, the pest completely denuded the leaves.



Future scope

- Quality that produce in NE part of India is unmatchable and considered nature's gift
- To promote -- popularize as plantation crop and/or mixed plantation under orchards
- Planting agarwood for wasteland utilization as high value plantation crops.
- To remove prohibitory regulations for commercial exploitation and categorize it under agro-base cottage industry

Future scope

- Encourage mass plantation wherever possible to make the future industry viable in an area
- Improve distillation/extraction and make value addition
- Technological development covering identification and development of elite var. and mass propagation by tissue culture etc.
- Biotransformation of wood in quickest possible time. The available techniques can increase the efficacy about 10 times.

Future scope in Assam *(contd.)*

- To develop technique for harvesting *i.e.* only the infected trees – training to collector, growers
- Explore commercial utilization of byproducts-spent dust and Boya (low grade) oil
- Explore its medicinal, cosmetic and other economic values for its wider market.

Future scope in Assam *(contd.)*

- Make economically viable & attractive by adopting intercropping with other MAPs, standard for vanilla.
- Liberalization of trade and inceptive in export of processed agar products.