

# RISE

Research  
Information  
Series on  
Ecosystems

Vol. 3 No. 5 May 31, 1991

## Reforestation Species

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**Api-api**

*Avicennia officinalis* L.

**Bungalon -puti**

*Avicennia marina* (Forsk.) Vierh.  
var. *alba* (Blume) Bakh.

**Bungalon**

*Avicennia marina* (Forsk.) Vierh.

**Pagatpat**

*Sonneratia alba* J. Sm.

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## FOREWORD

Reforestation of denuded mangrove and open mudflat areas is one of the schemes being implemented by the Department of Environment and Natural Resources to sustain the productivity of the mangrove forests in particular and the coastal areas in general. The planting of mangrove species such as Api-api, Bungalon, Bungalon-puti (family Avicenniaceae) and Pagatpat (family Sonneratiaceae) can greatly stabilize coastal zones, serve as buffer against erosion and build land by sedimentation. Moreover, these species provide a good source of fuelwood and construction materials for coastal community residents. Furthermore, mangrove in general serves as nurseries for many aquatic life.

The Ecosystems Research and Development Bureau recognizes the above importance of mangrove species to coastal inhabitants. Out of the research outputs and literature, we prepared this information material to disseminate knowledge on the 4 mangrove species.

This issue is intended to equip our readers with the basic knowledge of reforesting denuded mangroves using *Avicennia* and *Sonneratia* species. With this handbook, we hope that we can motivate the public to support the rehabilitation of our mangrove areas.



CARLOS C. TOMBOC  
Director

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## **Api-api**

*Avicennia officinalis* L.

## **Bungalon -puti**

*Avicennia marina* (Forsk.) Vierh.  
var. *alba* (Blume) Bakh.

## **Bungalon**

*Avicennia marina* (Forsk.) Vierh.

Compiled by

**Santiago R. Baconguis**

and

**Sofia A. Alaira**



Representative sketches of Api-api flowers, and immature fruits.



## 1. Api-api

1.1 **Common Name:** Api-api

1.2 **Local Name:** Api-api, Miapis (Samar, Leyte and Masbate) Kalapisi mangitit (Zambales) Pipisik (Tayabas, Camarines, Mindoro) Piapi (Iloilo, Capiz and Agusan) Piksik (Mindoro)

1.3 **Scientific Name:** *Avicennia officinalis* L.

1.4 **Family:** Avicenniacea

### 1.5 Morphological Characteristics

1.5.1 *Leaves* - simple; opposite; golden brown beneath; obovate or broadly oblong; narrow at the base; rounded at the apex; 5 to 10 cm long and 2.5 to 5 cm broad; midrib stout and very prominent.

1.5.2 *Inflorescence* - flowers small; no individual stalks, occur in two's together in the axils of the upper leaves or several at the end of the branch; 3 to 7 flowers in each head; corolla is yellow in color; corolla tube is short, cylindrical and has 4 lobes; lobes are 5 mm in length; hairy outside and nearly smooth inside.

1.5.3 *Fruit* - heart-shaped; slightly flattened; capsule is 2.5 to 4.0 cm long and contains single seed.

1.5.4 *Seed* - Viviparous

## 2. Bungalon-puti

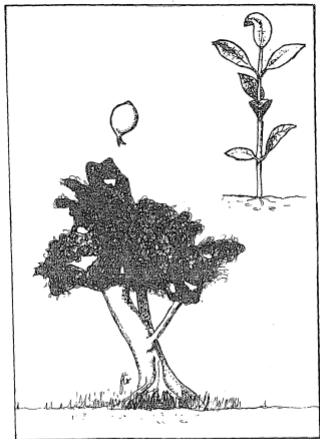
2.1 **Common Name:** Bungalon-puti

2.2 **Local Name:** Api-api, Piapi

- 2.3 **Scientific Name:** *Avicennia marina* (Forsk.) Vierh.  
*var. alba* (Blume) Bakh.
- 2.4 **Family:** Avicenniacea
- 2.5 **Morphological Characteristics**
- 2.5.1 *Leaves* - simple; opposite; golden brown beneath; oblong to oblong-elliptic with acute or rarely sub-obtuse apex; 5 to 7 cm long and 2.5 to 5 cm broad; midrib prominent.
- 2.5.2 *Inflorescence* - flowers without individual stalks grow either in small heads or spikes; inflorescence elongated and spicate or sub-spicate; style usually very short or sub-obsolete; stigma sessile; corolla limb mostly glabrous on the upper (inner) surface.
- 2.5.3 *Fruit* - obliquely conic or narrowly oblong to obversely spatulate; laterally compressed, not beaked.
- 2.5.4 *Seed* - Viviparous

### 3. **Bungalon**

- 3.1 **Common Name:** Bungalon
- 3.2 **Local Name:** Bungalon, Piapi
- 3.3 **Other Name:** Grey mangrove (Australia)
- 3.4 **Scientific Name:** *Avicennia marina* (Forsk.) Vierh.
- 3.5 **Family:** Avicenniacea



Representative sketches of Bungalow tree, and fruit.

### 3.6 Morphological Characteristics

3.6.1 *Leaves* - simple; golden brown beneath; often rather abruptly acute at the apex.

3.6.2 *Petioles* - generally shorter, (0.03 to 1.4 cm long)

3.6.3 *Inflorescence* - mostly solitary in each axil.

3.6.4 *Fruit* - heart-shaped; slightly flattened, usually beaked when young; capsule 1 to 2 cm long; contains one single seed which completely fills the lower part of the capsule.

#### 4. Description (for the 3 species)\*

Api-api, Bungalon-puti and Bungalon are trees of the outer swamp all belonging to the family Avicenniaceae. They are mangrove tree species that could be distinguished most readily from other trees in the swamp because of the color of their leaves. They are branchy, characterized by their extra forking form and crowns that form an open-grown oval shape with luxuriant leaves, dull green in color.

These species have prominent pneumatophores, a special kind of root that grow vertically up into the air. The wood is hard, heavy and brittle but difficult to split, having an exceedingly crossed grain. Its bark is usually gray in color, smooth and finely checked with small cracks.

The 3 species of *Avicennia* possess distinguishing characteristics. Api-api is a medium-sized tree with commonly developed aerial stilt roots, while Bungalon-puti is a medium to large tree, often branchy near the base of the trunk with aerial pointed pneumatophores. Bungalon, on the other hand, is a small tree, also with aerial pointed pneumatophores. Basically, the difference of these species could be seen in the morphology of their leaves and inflorescence.

Moreover, among other trees, *Avicennia* is a dominant to co-dominant species

\* Henceforth, all the discussions will pertain to all or any of the 3 *Avicennia* species as maybe indicated.

## 5. Uses

The seeds and roots of *Avicennia officinalis* are heated and then wrapped in a cloth and placed on the boil to induce eruption and suppuration. To cure ulcer, the seeds are boiled and the water from where they are boiled are taken. Cooked seeds are edible. The bark's decoction serves as astringent. The resinous substance is claimed to be helpful for birth control purposes; and the ointment made from the seed is useful for relieving small pox ulcerations.

The wood is locally used for rice mortars and is famous in some regions in the Philippines as fuelwood, particularly for smoking fish. It could also be made into small cabinets because of its peculiar color and attractive grains.

In many areas of the Philippines, *Avicennia* species are used as forage for livestock (i.e. cattle, goats, etc). It was reported that *Avicennia* leaves, especially *A. marina*, are more nutritious than the queen of forages - alfalfa. In Baclaran and Manila-Cavite Coastal Road areas, the branches of *Avicennia* are fashioned into expensive Christmas trees.

In Madras, the ashes from the wood are used for washing clothes.

Ecologically, mangroves are important for a number of reasons;

- they are a major producer of organic material and may have a special role in supporting estuarine fisheries (finfish, crustaceans and shellfish)
- they are involved in nutrient cycling
- they help reduce water pollution and stabilize sediments
- they provide shelter, refuge and food for many forms of wildlife

- they help prevent bank erosion and provide protection from storm surge
- they act as visual screens along industrial fore-shores, improving the amenity of the waterway
- mangrove habitats act as important nursery areas for many economically important (commercial and angling) fish species.

## 6. Distribution

Api-api (*Avicennia officinalis*) grows well throughout the Philippines: in India, Southern China, Taiwan and throughout Malaysia.

Bungalon-puti (*A. alba*) abounds in Philippine coastal areas specifically Mindanao (Misamis, Lanao, Surigao, Cotabato); overseas in India, Southeast Asia, particularly Polynesia.

Bungalon (*A. marina*) can be found in the Philippines, in Malaysia, Borneo, Celebes, Talaud, Mollucas and Papua New Guinea.

## 7. Site Requirements

*Avicennia* spp. grow not only in deep mud in mangrove swamps but also in the upper stretches of the tidal streams.

The three (3) species of *Avicennia* have specific soil requirements. Api-api grows best in the inland along river-banks on firm mud. It also develops better in shaded condition than in open areas. This species is also found growing along exposed coral reef and can adapt in soil under varying pH and density values. Furthermore, seedlings which underwent extreme waterlogging (i.e., total immersion) but have survived could grow into healthy trees.

Bungalon-puti is adaptable to highly saline (seaward), fairly saline (central) and negligibly saline (landward) fringes. Bungalon grows along muddy portions of the seashores or along banks of the river mouths. Bungalon grows in substrates ranging from gravel to fine mud or clay and in areas of sandy mud. This species also prefers salinities close to sea water.

## 8. Propagation

*Avicennia* could be propagated by seeds and wildlings. The following are the steps in propagating *Avicennia* species:

- 8.1 Collect mature *Avicennia* seeds. The seeds are mature when their seedcoats split.
- 8.2 The seeds must be cleaned and sorted out prior to planting.
- 8.3 Sow the seeds in seedbeds or directly pot them in mangrove soil 1 to 2 cm deep. However, in areas where wave and tidal actions occur, this depth is not advisable since the seeds might be dislodged.
- 8.4 As for the potted seeds, place them under a partially shaded area.
- 8.5 Api-api germinates 10 days after sowing; Bungalon, 6 days.
- 8.6 Wildlings chosen for transplanting should be about 0.5 m high with a straight trunk. They should be no more than 18 months old and must have 6 to 10 leaves and no peg root development. Wildlings are earthballed to minimize root damage.
- 8.7 Wildlings should be potted and placed under a shaded area for hardening purposes. One to 2 months after hardening, the wildlings are ready for transplanting.

## 9. Seed Technology

### 9.1 *Collection*

- a. Seeds are collected during the months of June to mid-August.
- b. Collect seeds from phenotypically superior mother trees.
- c. Mature seeds are collected by climbing the mother tree or by reaching out to the underneath canopy.
- d. Wildlings/seed germinants are collected from large, mature stands where natural seeding occurs.

### 9.2 *Handling and Transport*

During the collection of wildlings to be potted, the earth plugs should be kept moist prior to transporting by placing them in containers such as plastic bags or wooden boxes to protect them from direct sunlight and wind. This process is also carried out during planting period. It is also recommended that planting must not be done during summer to prevent the seedlings from drying.

### 9.3 *Germination*

Reports show that seeds germinate even without chemical treatments to hasten germination. Oftentimes, the seeds germinate before they fall.

## 10. Plantation Establishment

### 10.1 *Site Preparation*

- a. The area must be clear of undesirable vegetation (e.g. weeds, debris, shrubs and other dead trees).
- b. In the presence of crab holes, they must be filled with soil to make the area level.



- c. After clearing the area, holes of similar size with that of the pot are dug for added compaction.

## 10.2 *Planting*

- a. The spacing for planting depends on the purpose of the plantation. If the species are planted for fuelwood purposes, a 4 x 4 m spacing is recommended. Otherwise, a 2 x 2 m spacing is normally practiced.
- b. Potted seedlings/widlings are buried into the mud or holes previously prepared at a depth of 6 cm. The plastic bags must be removed.
- c. The planting holes must be thoroughly filled with soil to protect the seedlings from toppling down.
- d. Best results are achieved by planting seedlings in close clumps. Clumping offers the central plants additional protection.

## 10.3 *Maintenance and Protection*

The newly planted plantation should be regularly visited to monitor the growth of the seedlings. The cleanliness of the plantation should be maintained by removing weeds that might hamper the growth of the new stands.

Additional protection may be provided by establishing temporary fence/stakes or by piling rocks around the seedlings to prevent algae, flotsam and jetsam from entangling with the seedlings by receding tides.

Furthermore, depending on the degree of exposure to wave action, each seedling should be tied to a stake using any material so that it remains in its upright position.

Dead seedlings should be replaced to maintain the spacing of the plantation through replanting. The establishment of warning signs in the plantation could also help against vandals.

Moreover, the occurrence of pests and diseases must be monitored regularly and control measures be applied immediately.

Fresh wounds or cuts on the branches/trunks should be painted with ordinary paint or coal tar to prevent the entry of infectious microorganisms that could cause wood decay. Microorganisms are easily transmitted by air and easily thrive in open wounds or cuts.

## 11. Pests

### 11.1 *Scurgula*, Family Loranthaceae

The most common plant parasite attacking *Avicennia officinalis* is the *Scurgula* (mistletoe). The plant parasite has been identified based on the survey report of the Mangrove Experimental Forest, Palsabangon, Pagbilao, Quezon. The parasite prefers *Avicennia alba* as host, infesting usually the top-most portion of the tree canopy. However, infestations occurred only in the sheltered and interior portions of the mangrove swamp but not in areas directly facing the sea.

Trees with diameter at breast height (dbh) ranging from 16 to 30 cm and 11 to 20 m height classes were the preferred hosts. Parasites in *Avicennia alba* affect a generally larger area in leaf length and width, gell formation and branch/twigs systems than those infesting *A. officinalis*. Leaf change and turnover is fast with peak leaf counts occurring between the fourth week of March to first week of April to last week of May. A life span of about 4 months and an average width increment of 0.06 to 1.98 mm/week and average length increment of 0.01 to 1.97 mm/week were also observed.

## 11.2 Tortricid Moth - *Lepidoptera*

In 1989, Miapi (*Avicennia* sp.) in Palaypay, Leyte was defoliated. About 60 ha of a 400 ha of the mangrove area was affected. Some trees were already found dead during the field survey on October 6, 1989.

The tortricid moth larvae was described to be 10 x 1 mm. It has a reddish-brown head with brown abdomen. Younger larvae have pale yellow head and pinkish abdomen. All instars have their body surface sparsely covered with setae ("hair") and each segment has 4 minute black spots dorsally located.

The larvae feed on the undersurface of the leaves and may join damaged leaves with their silk.

## 12. References

- Anonymous, N.D. A Guide to Mangrove Transplanting. State Pollution Control Commission. Division of Fisheries, Department of Agriculture - NSW.
- Brown, W.H. and Fischer, A.F. 1920. Philippine Mangrove Swamps. Minor products of Philippine Forests. Bureau of Printing, Manila.
- Encendencia, E.M. 1979. Featuring the Twins of Mangrove Swamps. *Canopy International*, 7(5):11. May 1979.
- Encendencia, E.M. 1978. The Miracle Tree of the Mangrove Swamps. *Canopy International*, 4(8):13. August 1978.
- Fernando, E.S. and J.V. Pancho, 1980. Mangrove Trees in Philippines. *Sylvatrop*, The Phil. Forest Research Journal. 5 (1): 35-54
- Sumalde, A. C. 1989. A Report on the Pest Infestation of *Avicennia* sp. in Palaypay, Leyte, Leyte. 2 pp.

**Pagatpat**  
*Sonneratia alba* J. Sm.

Compiled by

**Santiago R. Baconguis**

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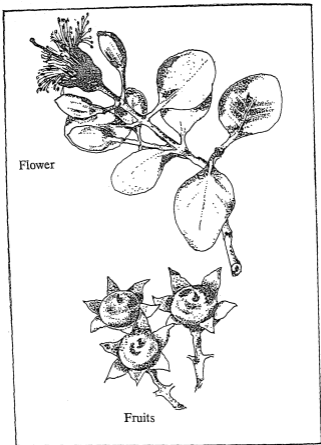
**Florita E. Siapno**

1. **Common Name:** Pagatpat
2. **Local Names :** Pagatpat (Cebu, Camarines, Tayabas, Cagayan, Samar, Agusan, Basilan, Zambales, Cotabato, Palawan, Mindoro, Zamboanga, Panay, Guimaras Island, Negros, Leyte, Bataan, Lanao); Bunayon (Dinagat Island); Patpat (Butuan); Lukabban, Illukabban, Lukabbaan (Cagayan); Pirara and Palalan (Cotabato); Bungalon (Masbate and San Juan, Batangas)
3. **Scientific Name:** *Sonneratia alba* J. Sm.
4. **Family:** Sonneratiaceae
5. **Description**

Pagatpat belongs to the plant group generally called the "front liner" species which include Bungalon, Api-api, Bakauan babae, Saging-saging, Tinduk-tindukan and Gapas-gapas. It thrives on the seaward zone which is the portion of the swamp daily affected by tidal inundation including neap tides. It is a true mangrove species and grows on soils ranging from sandy to sandy-loam, mudflat or corraline type.

Pagatpat is a small-sized tree that grows to a height of 2 to 5 m and a diameter of 3 to 30 cm. It is distinguished by the swollen basal portion of the trunk, at least when young. The aerial roots are distinctly larger than *Sonneratia caseolaris* which may reach about 60 cm in length. However, in some places along riverbanks where it grows in soft mud, much longer air roots are produced reaching more than 2 m.

This species has hard, rounded fruits, depressed at the apex, 3 to 4 cm in diameter and surrounded nearly to the middle by the calyx tube, the lobes of which are still present when the fruit is mature. The fruit contains many seeds. The leaves are elliptic-oblong with no prominent veins, thick, leathery and rounded at the apex. Two or three flower buds



Representative sketches of Pagatpat leaf pattern, flower and fruits.

are usually found together in the inflorescence stalk. The flowers have red petals, in contrast with the greenish or yellowish white surface of the sepals.

The species in plantation can grow with an annual diameter increment of 1.92 cm and height increment of 0.97 m in low saline areas ( $\leq 16$  ppt). In higher saline areas ( $\leq 25$  ppt), it grows slower (about 1.7 cm in annual diameter increment). In plantations, it forms a straight bole due to the effect of uniform spacing. However, in sparse natural stands, it forms into a small, branchy tree.

## 6. Uses

The wood is used for firewood, charcoal, piles, posts, poles, railroad ties, paving blocks; for ship, bridge and wharf construction; doors; siding; sheathing; ceiling, flooring and all kinds of interior finish; ship planking and decking; furniture and cabinet works; and musical instruments. The wood contains a small amount of salt, making the use of copper nails and screws necessary in construction.

The air roots are used as floats for fishnets and being corky in nature, they are employed in the manufacture of inner soles of shoes and can be used as substitute for cork and pith.

Like any other mangrove species, pagatpat can also stabilize the coastal zones by reducing typhoon and storm wind damage, and by preventing erosion. In many areas of the Philippines like Cebu, Siquijor and Bohol, the leaves are used as forage for livestock during summer months when grasses are very limited.

## 7. Distribution

The species is widely distributed in the Philippines.

## 8. Site Requirements

This species thrives on the outer part of swamps and often occurs even on exposed reefs. Pagatpat grows best in sandy to sandy-loam soil, mudflats or corraline. It also grows on soft mud along riverbanks.

## 9. Seed Technology

### 9.1 *Seed Collection*

The mature fruits of Pagatpat are collected from superior mother trees from May to July. It is best to collect mature fruits when they are still attached to the mother tree. Maturity can be recognized by the change in color of the outer covering of the fruits from green to brown. The fruits should be cleaned and sorted out prior to soaking in tap water.

### 9.2 *Germination*

Pagatpat seeds are difficult to germinate. In natural stands, wildlings are scarce and hard to find.

The technique (Melana, 1982) in germinating pagatpat seeds include:

- a. Soaking of ripe pagatpat fruits in tap water for 7 days, and
- b. Washing the fleshy fruits, macerating them by hand to separate the seeds, and sowing them in depressed and flooded seedbeds using water-logged mangrove soil as germination medium. This technique can give 59% germination in 34 days.

### 9.3 *Handling and Transport*

The following are the steps in handling and transporting pagatpat fruits/seeds and wildlings:



- a. Avoid exposure of fruits/seeds to direct sunlight to prevent excessive loss of seed moisture.
- b. Retain the pericarp (brown cap-like structure enclosing the plumule) which provides protection to the young shoot during handling and transport.
- c. Place the seeds in sacks for easier handling.

If wildlings are available for potting, the following steps are recommended:

- a. Collect wildlings to be potted.
- b. Keep the earth plugs moist prior to transporting. Place the wildlings in containers such as plastic bags or wooden boxes and protect them from direct sunlight and wind.

It is recommended that planting should not be done during summer season to prevent the seedlings from drying due to too much exposure to sunlight.

#### 10. Propagation

The following steps are recommended in propagating pagatpat seeds:

- a. Germinate the seeds by following the above-mentioned technique.
- b. Allow the seeds to grow in seedbeds or pot them.
- c. Place them under a partially shaded area.
- d. In case of wildlings, they should not be more than 0.5 m high, with straight trunk.
- e. Wildlings for potting should have 6 to 10 leaves and should be placed under the shade for hardening purposes.

## 11. Plantation Establishment

### 11.1 Site Preparation

- a. Clear the planting site of debris such as drift-woods, leaves, shrubs and other unwanted vegetation. Remove floating debris brought in by tidal inundation which may cause mechanical injury to young plants.
- b. Divide the area into compartments of manageable size. This will provide ease in planting, maintenance and monitoring activities. A space of 3-5 m between compartments should be provided for human passage and 10 m for passage of banca.
- c. Establish a temporary fence or put stakes around the periphery of the plantation area to serve as boundary and at the same time provide protection.

### 11.2 Planting

Planting spots should be established with the necessary spacing using planting bars or stakes. A spacing of 1 x 1 m and 2 x 2 m is followed for establishing a plantation for poles/piles and fuelwood purposes, respectively. In the absence of potted seedlings, wildlings could be potted and transplanted after 1-2 months of hardening. Pot wildlings of 10-20 cm in height by earth balling to minimize root damage. In outplanting, dig holes with size similar to that of the pot for added compaction.

## 12. Maintenance and Protection

- a. Establish a temporary fence or put stakes around the periphery of the plantation to provide protection to the newly planted seedlings.

- b. Visit the plantation regularly. Maintain cleanliness by removing debris brought in by tidal inundation as they may cause mechanical injury.
- c. Replace dead seedlings by replanting.
- d. Conduct thinning to avoid overcrowding.
- e. Monitor any occurrence of pest and diseases to prevent any outbreak of infestation.

### 13. Pests

Natural stands of mangrove species are rarely severely affected by pests and diseases. However, disruption of the existing ecological balance could create conditions favorable for an outbreak. This is one reason why planted mangrove species are commonly affected by destructive organisms. In most degraded areas, reforestation fails due to high mortality rate. Protection measures are therefore necessary to attain the highest possible survival of planted mangrove species.

In plantation areas in Thailand, the species is attacked by insect defoliators (scale insects, leaf folders and leaf chewers), crustaceans (barnacles and crabs) and annelids. Damage ranges from insignificant (leaf folders and leaf chewers) to severe (annelids).

- 13.1 *Cleora injectaria* (Walker) [(Lepidoptera: Pyralidae); and *Boeotarcha aff. martinatis* (Walker)]. These have been observed infecting seedlings in plantation areas. Their larvae are surface grazers on foliage.

**Control:** May be controlled by handpicking, spraying of mild insecticide or biological control using *Bacillus thuringiensis*.

13.2 Epipaschiine moth - *Heminomistis flagellaris* (Hampson).

This is known to be a major pest of *Sonneratia* in some parts of Southeast Asia. Males have pectinate antennae with a remarkable clubshaped process from the antennae base which curves backwards over the thorax. The larvae of this epipaschiine moth are gregarious in tangles of dead leaves high in the foliage, and massive outbreak can occur in which trees can be defoliated.

**Control:** May be controlled by handpicking, spraying of mild insecticide, or by biological control using *Bacillus thuringiensis*.

13.3 *Taurometopa pyrometalla* (Meyrick).

This colorful moth was originally described in Thailand and many times has been collected in mangroves all over Southeast Asia. The larvae feed on the newly opened leaf buds of *Sonneratia*. The most distinctive feature is the prominent head and enlarged eyes of the male. Males occasionally form small gregarious assemblages beneath the leaves of the host plant.

**Control:** May be controlled by handpicking, spraying of mild insecticide or by biological control using *Bacillus thuringiensis*.

13.4 *Cryptorhynchinae* sp. indet. (Curculionidae), *Platypus linearis* (Platypodidae) and *Progenius bidentatus* (Scolytidae).

*P. bidentatus* species constructs circumferential galleries that render the pole susceptible to transverse fracture.

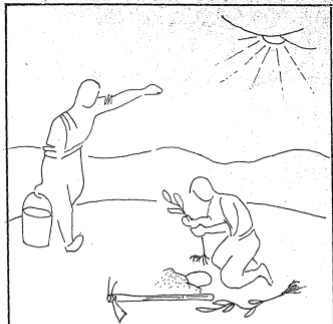
**Control:** Storing timber in freshwater ponds may reduce damage. Barrier spraying with insecticide is effective but could be very costly.

#### 14. References

- Brown, W.H. and A.F. Fisher. 1918. Philippine Mangrove Swamps. Department of Agriculture and Natural Resources, Bureau of Forestry. Bulletin No. 17.
- Melana, E. and D. Melana, 1982. Germination of Pagatpat (Unpublished). Terminal Report.
- Murphy, D. H. and W. Meepol. 1990. Timber beetles of the Ranong mangrove forest. Mangrove Ecosystems Occasional Papers No. 7. p. 5-7.
- Murphy, D. H. 1990. The Recognition of Some Insects Associated with Mangroves in Thailand. Mangrove Ecosystems Occasional Papers No. 7. p. 15-23.
- Rau, M. T. and Murphy, D. H. 1990. Herbivore Attack on Mangrove Plants at Ranong. Mangrove Ecosystems Occasional Papers No. 7. p. 25-36.
- Yao, C.E. 1986. Mangrove Reforestation in Central Visayas. Canopy International. Vol. 12 No. 2.

### **Acknowledgement**

The authors would like to thank Ms. Fe Ociones for the illustrations.



It was God who made the plant grow.

- 1 Cor. 3:6

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Entered as Second Class Mail at the College Post Office, Laguna  
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