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FOREST INSECT PESTS OF PAPUA NEW GUINEA
1. UNDER-BARK BORERS OF KAMARERE AND TERMINALIAS-AGRILUS BEETLES

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INTRODUCTION

Within the Papua New Guinea Department of Forests great emphasis is being given to the establishment of tree plantations mainly as a means of replacing the timber removed by logging operations. Entomology has an important part to play in the management of these plantations. Usually the plantation has only one kind of tree. Therefore a large source of food is readily available for any insect that can use it. For this reason insects are often important as pests in tree plantations. On the other hand in the natural rain forest, many different kinds of trees occur together in the same area. The food sources for different insects are more spread out and the insects are less likely to become pests.

At present the two trees most widely grown in forest plantations in the wet lowlands of Papua New Guinea are kamarere *(Eucalyptus deglupta)* and swamp talis *(Terminalia brassii)*. Both these suffer attack by larvae (grubs) of *Agrilus* beetles. These larvae live beneath the bark of the growing tree.

DESCRIPTION

Agrilus beetles are known as jewel beetles in Australia. There are many species (kinds) of *Agrilus* in this country. The adults of all species are small (0.5 cm to 1.5 cm long), and shiny green or blue, with orange or silver spots on the back. Two species are important as forest pests in Papua New Guinea. *Agrilus opulentus* attacks kamarere, and *A. viridissimus* attacks swamp talis. The two species of *Agrilus* beetles look quite similar, but they can be easily distinguished because *A. opulentus* has a pair of orange spots on the sides of the first segment after the head. *A. viridissimus* does not have these spots. (See Figure 1.)

The larvae (grubs) of all *Agrilus* species are similar, and easy to recognise. They are white, 2.5-3 cm long and have a swelling immediately behind the head. The rest of the body is very narrow.

BIOLOGY

Eggs are laid, usually singly, in cracks in the bark of the host tree - either on a fallen tree trunk, or the trunk of the growing tree. Long white larvae hatch from the eggs. These larvae feed on the living cambium (growing tissue in wood) beneath the bark. When feeding has finished the larvae tunnel into the wood underneath the bark where they construct a long chamber parallel to the length of the stem and then change into pupae (the resting stage). The pupae eventually change into young adults. The adults then tunnel to the surface and emerge by a ᗢ - shaped hole as shown in the diagram (Figure 2).

Young adults must feed before they can mate, and before the females can lay eggs. They eat the new foliage (leaves) of the preferred tree hosts. Young beetles of both *A. opulentus* and *A. viridissimus* are often found feeding on young regenerating shoots in logged forest.

The time taken to complete the life cycle depends on the condition of the tree attacked. Development takes place most

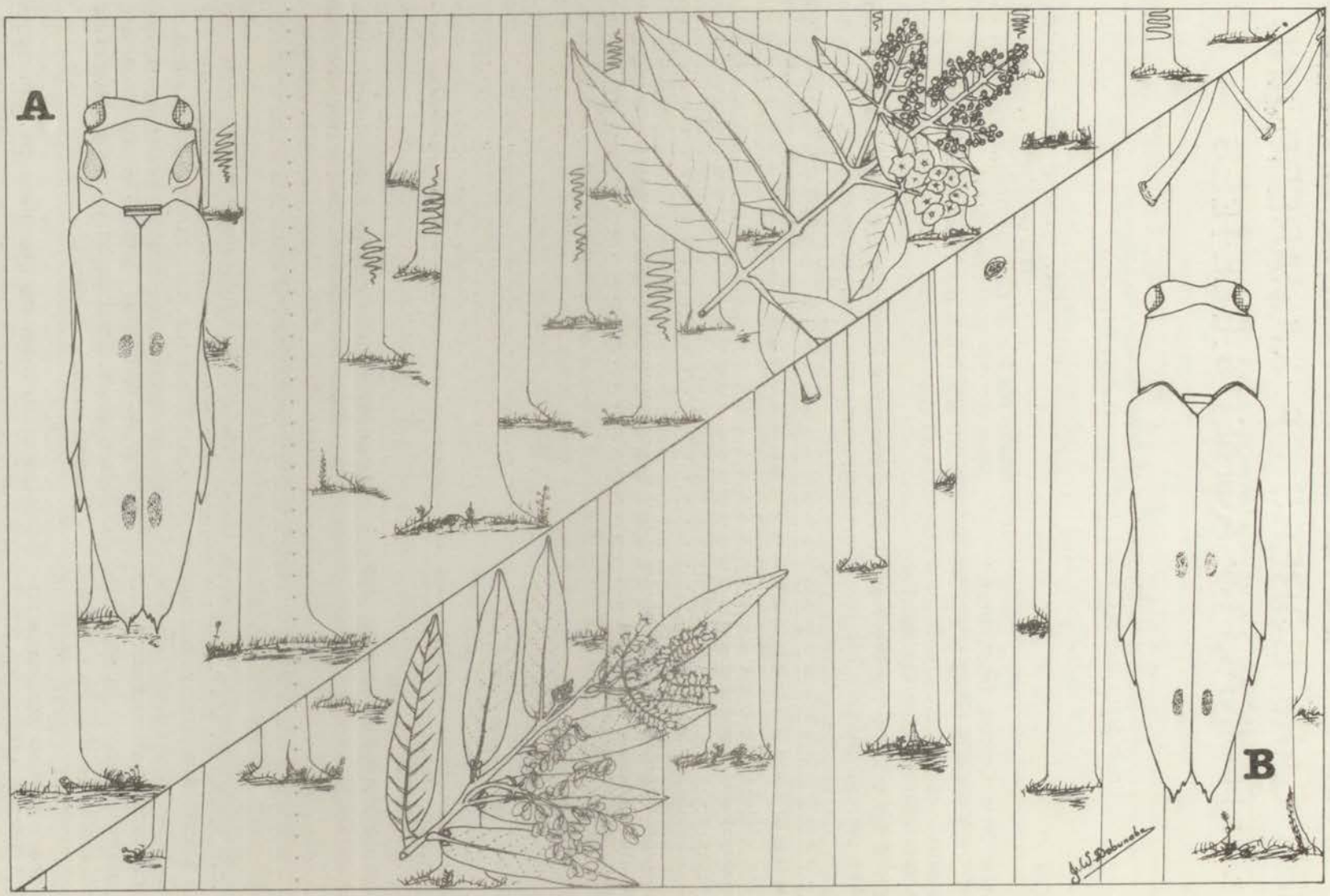

Figure 1. **A.** *An adult female beetle of* Agrilus opulentus *with its main plantation host tree, kamarere.*
B. *An adult female beetle of* Agrilus viridissimus *with its main plantation host tree* Terminalia brassii.
Note that the tunnels made by Agrilus *grubs are easy to see on the thin-barked kamarere. However on Terminalia, there are no obvious signs of attack.*

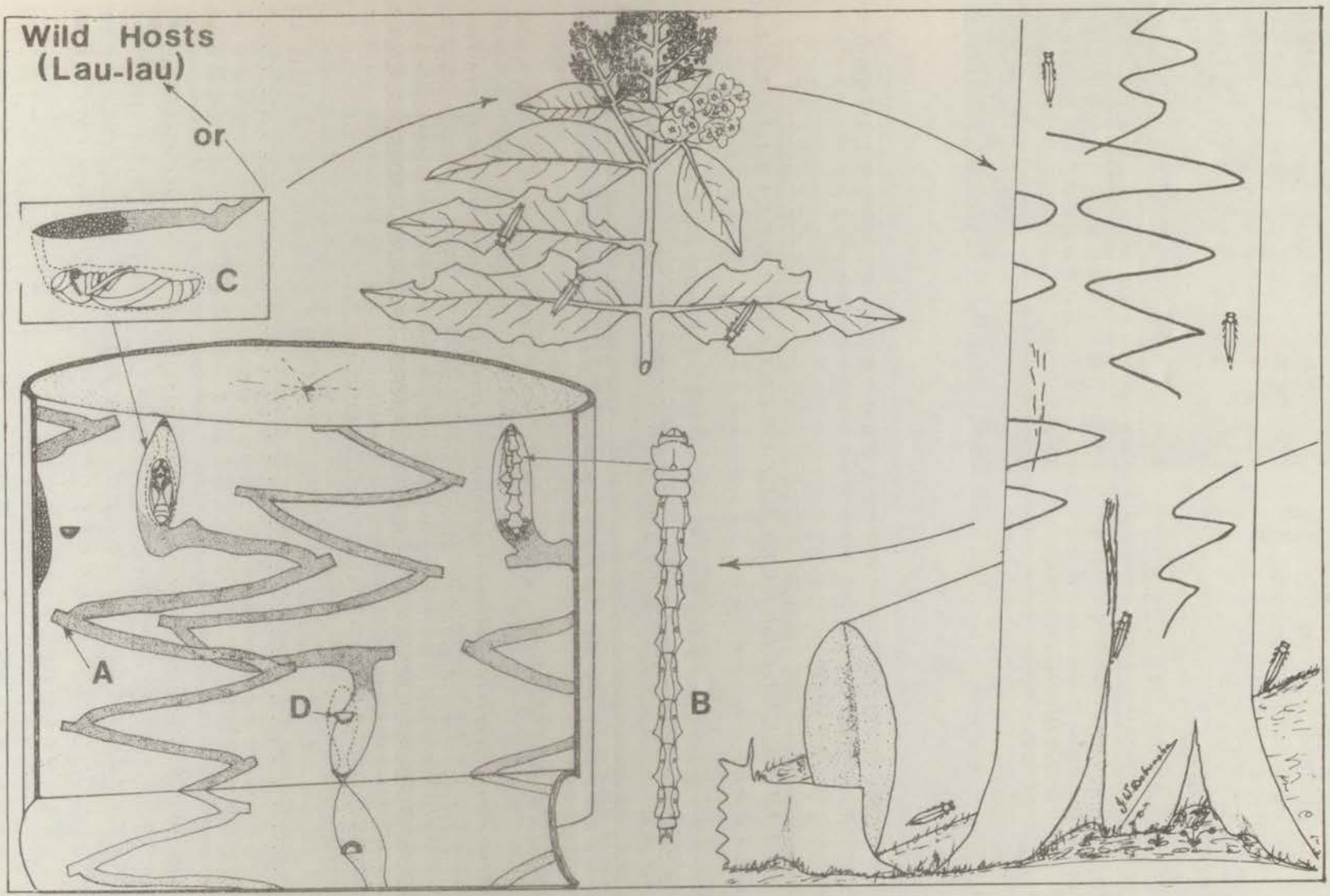

Figure 2. *Details of the life cycle of* Agrilus opulentus *in a plantation of* Eucalyptus deglupta *in the Trans-Gogol. Note the distinctive nature of the under-bark galleries (**A**), the larva (**B**), pupa (**C**) and emergence holes (**D**). Note that on the felled tree, the chambers made by the beetle are not visible.*

rapidly in felled, and near-dying trees with a main trunk about 30 cm diameter. The adults of *A. opulentus* emerge 6 to 7 weeks after felling, when the eggs were laid. The adults of *A. viridissimus* take a little longer to emerge. In trees with a larger diameter trunk the life history may take up to 3 times longer, while in standing, living trees the life history takes at least 9 - 12 months.

WILD HOST TREES

In natural forest *A. opulentus* attacks only trees of the plant family Myrtaceae. This is the family to which kamarere belongs. In Papua New Guinea the most common wild hosts are species of lau lau *(Syzygium)*. On New Britain, kamarere grows wild and is also attacked. In contrast *A. viridissimus* has been found only in the many kinds of wild talis that occur in Papua New Guinea, all of which belong to the family Combretaceae.

In the rain forest both the insects are found particularly breeding in trees that have been damaged in some way, for example trees blown down by winds, exposed to standing floods, or earthquakes, or felled by man. They have also been found in living trees, especially very large trees dying of old age, wild trees hit by drought, and secondary forest which has been logged or converted to gardens or farms.

AGRILUS IN FOREST PLANTATIONS

When *Agrilus* larvae attack plantation trees they may ring-bark the trees. This results in a disturbance of the movement of water, and food materials within the tree. Symptoms of attack are most easily seen in kamarere. The bark of kamarere is thin and the zig-zag tunnels made by the *Agrilus* larvae are easy to see on the surface. These tunnels are so clear that the pest has been given the name 'varicose vein borer'. It should be remembered however that these tunnels are from old attacks. Where active live grubs occur there are usually no visible tunnels. Another symptom often visible is the presence of epicormic shoots (developing from the trunk) particularly in the lower stem in kamarere. In swamp talis these effects are not usually evident because the bark is much thicker.

Close up of a 6-year-old kamarere tree, showing raised surface tunnels caused by Agrilus opulentus *(Trans-Gogol, Madang).*

Studies have shown that in plantations, attack by these insects is heaviest on small diameter trees which are not growing well. Site also has an effect. Kamarere is particularly susceptible to attack by *A. opulentus* on badly drained soils. Swamp talis is attacked by *A. viridissimus* especially when soils dry out rapidly. Kamarere suffers much more on mainland Papua New Guinea (e.g. Trans-Gogol, Madang), than on the Islands (e.g. Keravat, New Britain). This is shown in the histograms in Figure 3. Soil differences may be a reason but this is not yet known.

The major effect of these insects is to reduce the amount of annual growth of the trees. One author claims that millions of kina have been lost in mainland plantations of kamarere because of *A. opulentus*. However it is not easy to calculate losses due to *Agrilus* damage alone because other factors are also involved; for example site, tree variety, and incidence of disease, particularly heart rot.

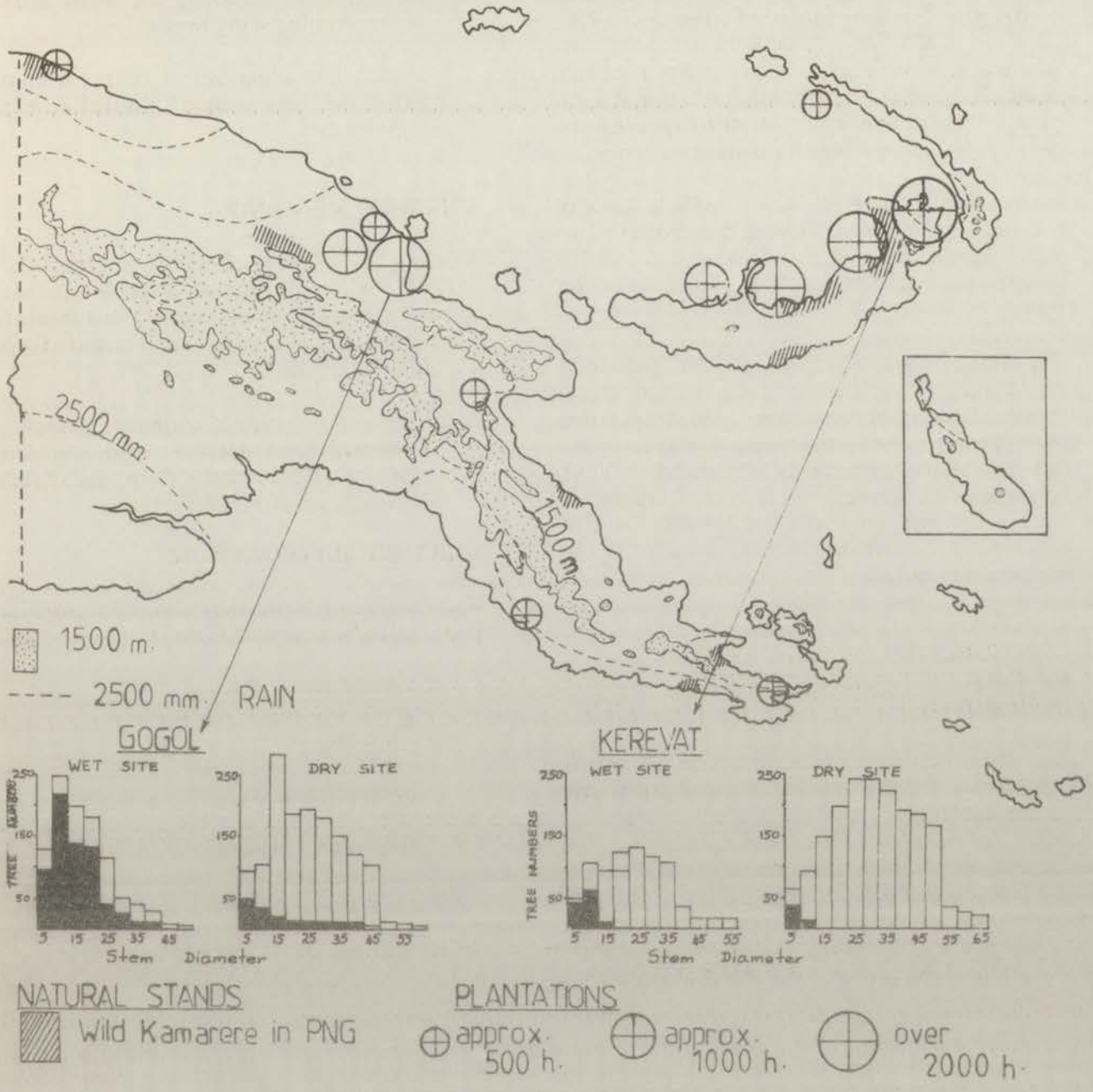

Figure 3. *This map shows where* Agrilus opulentus *is found in Papua New Guinea, i.e., in areas below 1500 m and where the rainfall is more than 2500 mm per year. The map also shows where natural stands of kamarere occur, and the main and potential plantations of this tree.*

The histograms show the level of infestation of A. opulentus *in kamarere on mainland Papua New Guinea (Trans-Gogol) and on the islands (Keravat, E.N.B.P.). The level is much higher on the mainland.*

Agrilus opulentus and *A. viridissimus* also contribute to the death of trees. In Lae City in 1985 large numbers of adult *A. viridissimus* emerged from many recently dead ornamental *Terminalia catappa* (beach talis). Elsewhere, other *Agrilus* species are definitely blamed for the deaths of trees.

In the Philippines, in the 1970's a closely related *Agrilus* was causing the deaths of so many kamarere trees that kamarere is no longer used there as a major plantation tree.

Today in Papua New Guinea the incidence of attack by *Agrilus* species is increasing. In the Trans-Gogol before 1980 only trees over 4 years were attacked. Today 2-year-old trees are commonly attacked. What happened to kamarere in the Philippines could also happen in Papua New Guinea in the not too distant future, and it could happen suddenly.

CONTROLS RECOMMENDED TO MINIMISE ATTACK BY *AGRILUS OPULENTUS*

1. Use only seed of Philippine varieties known from trials to show *Agrilus* resistance.
2. Do not plant kamarere in badly drained alluvial soils.
3. Remove, by felling, all small diameter suppressed kamarere from plantations.
4. Remove, by felling, all wild lau lau from neighbouring areas.
5. Reduce tending to a bare minimum after the first year of plantation establishment.

FURTHER READING

Cortez, F. (1985). Preliminary results on effect and extent of *Agrilus* infestation in the Trans-Gogol Reforestation Project. Forest Department Report (unpublished)

Mercer, C. (1985). *Agrilus* attack on *Terminalia catappa* around the University of Technology Campus. *Klinkii*, 3, No. 1, pp 103-106.

FURTHER INFORMATION

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