A new lepidopteran insect pest discovered on commercially grown *Eucalyptus nitens* in South Africa

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Intensively managed eucalyptus plantations form an important component of the South African forestry industry. In this paper we identify and comment on a wood-boring moth (Lepidoptera: Cossidae) recently discovered damaging *Eucalyptus nitens* trees in plantations growing in the Lothair/Carolina area. Infested wood containing larvae was incubated in emergence chambers for two months. Upon emergence, adult moths were collected and identified as *Coryphodema tristis*. This insect is native to South Africa and is well known as a pest of fruit trees and vines as well as of a few native trees. Its presence on *E. nitens* appears to represent a sudden new host association, which is of significant concern to South African forestry. Research on the biology, phenology, population dynamics and possible hosts of origin in the Lothair/Carolina area is currently under way. The possibility of using natural enemies to reduce the impact of this pest is also being considered.

Introduction

Intensively managed eucalypt plantations form the basis of the forestry industry in South Africa. Of the 1.4 million hectares of plantations in the country, about 700 000 ha are planted to eucalypts. The most important *Eucalyptus* species grown include *E. nitens, E. grandis* and hybrids of these species with each other and, for example *E. urophylla, E. camaldulensis* and *E. dunnii*.[1,2]

Various insect pests are found on *Eucalyptus* in South Africa and some cause serious damage. Perhaps the most damaging in the country has been the eucalyptus snout beetle, *Gonipterus scutellatus* Gyllenhal. Both adults and larvae of this insect feed on the leaves and buds of their hosts and they can cause extensive defoliation of susceptible trees.[3,4] However, when one considers the great number of insect pests known on *Eucalyptus* species in their native range, South African forestry has, thus far, been relatively fortunate in not having been particularly seriously affected by insect pest problems.

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A new pest discovered

During the early part of 2004, very serious damage was noted on *E. nitens* in the Lothair/Carolina area, Mpumalanga province, South Africa. Damage was clearly due to a wood-boring insect that resulted in extensive tunnelling in the wood. It was evident that eggs were laid on the bark of the main stems or branches, and soon after hatching early instar larvae began to feed on the cambium.

As the larvae grew, they tunnelled into the sapwood and hardwood (Fig. 1), making extensive galleries and pushing frass to the outside of the stems, which makes their presence easy to detect (Fig. 2).

The larvae were clearly lepidopteran and all indications based on the juvenile forms were that they were of moths belonging to the family Cossidae. Species-level identification required that adult insects be obtained. Thus, samples of the wood containing larvae were collected from the field and brought to the insectary at the Forestry and Agricultural Biotechnology Institute, University of Pretoria, and placed in emergence chambers to allow adults to develop.

Adult emergence began in the first week of September, eight weeks after logs containing larvae were brought to the insectary, and emergence continued for three weeks. Adult specimens were then submitted to the Transvaal Museum for identification. The moth was subsequently identified as the native *Coryphodema tristis* (Drury) (Lepidoptera: Cossidae).

Coryphodema tristis is well known in South Africa and is most commonly referred to as the quince borer. The moth derives its common name from the quince tree, with which it is closely associated in the western and southwestern Cape. In this region, it is an economically important pest on many fruit trees including quince, grape vines, apples and sugar pears.[5,6] *C. tristis* also feeds on a wide range of native and exotic trees, including species in the families Ulmaceae, Vitaceae, Rosaceae, Scrophulariaceae, Myoporaceae, Malvaceae and Combretaceae.[7] This is, however, the first record of *C. tristis* attacking *Eucalyptus* or any other species of Myrtaceae in South Africa.

Coryphodema tristis on *E. nitens*

Coryphodema tristis was observed only on *E. nitens* and none of the surrounding compartments of other *Eucalyptus* species was affected. *E. nitens* infested with *C. trisits* in the Lothair/Carolina area ranged from 8 to 13 years of age. The infested sites were visited in July, when only the larval stage of *C. tristis* was observed, and in August, when the larval stage was still dominant, but pre-pupae and pupae were also observed. Extensive larval tunnels in the main stems and branches of the trees were observed. Frass, resulting from the tunnelling, accumulated on the tree surrounding the point of entry and on the ground surrounding the tree (Fig. 3), making the presence of the insect quite conspicuous.

Cossid moths

Members of the family Cossidae have a worldwide distribution, and they are represented by several genera and species. In South Africa, the family is represented by over 100 species.[8–10] Cossid larvae are known to infest several families of hardwood species including timber trees,[11] orchard trees and garden shrubs.[5,7]

Coryphodema tristis adults in South Africa have rudimentary mouthparts, they do not feed and they live for a maximum of six days, during which they lay eggs. One female can lay from 104 to 316 eggs. The adult moths are rarely seen, owing to their inconspicuous dull colour (Fig. 4) and the brief duration of the adult stage. The wing expansion of both sexes varies from 4 to 7 cm, depending on the size of the branch or stem in which the larva has fed.[5]

The larvae of *C. tristis* are a transparent, whitish colour with two reddish, rather broadly separated, irregular lines extending along the middle of the back from the 2nd to the 12th body segment (Fig. 5). An indistinct broad line extends along the middle line of the back between the two reddish lines from the 2nd to the 6th body segment. Laterally, there are obscure, small, irregular broken reddish markings on the body. The head is broader than the rest of the body and brown in colour, with darker brown eyes and jaws.[5] The fully-grown larvae range in size from 2–4 cm, depending on the size of the stems on which they have fed.

The biology of cossids is variable, but most species take 1–3 years to complete their life cycle. Petty[5] studied the biology of *C. tristis* and showed that the insect takes two years to complete its life cycle. The greater part of its life history (up to eighteen months) is spent in its larval stage. In the Western Cape province, the emergence of adults occurs from October

to mid-December. This is not very different from our observations of the insect on *Eucalyptus.* On infested *E. nitens* trees in Lothair/Carolina, the insect was in its larval stage in July, when it was first observed, and adult emergence began in the insectary in September. Further observation in October in the field revealed that all stages could be found at this time of the year. We observed early to late instar larvae, pupae as well as evidence of recent adult emergence such as pupal cases protruding out of the emergence holes on the trees (Fig. 6). Adults were not seen.

Future prospects

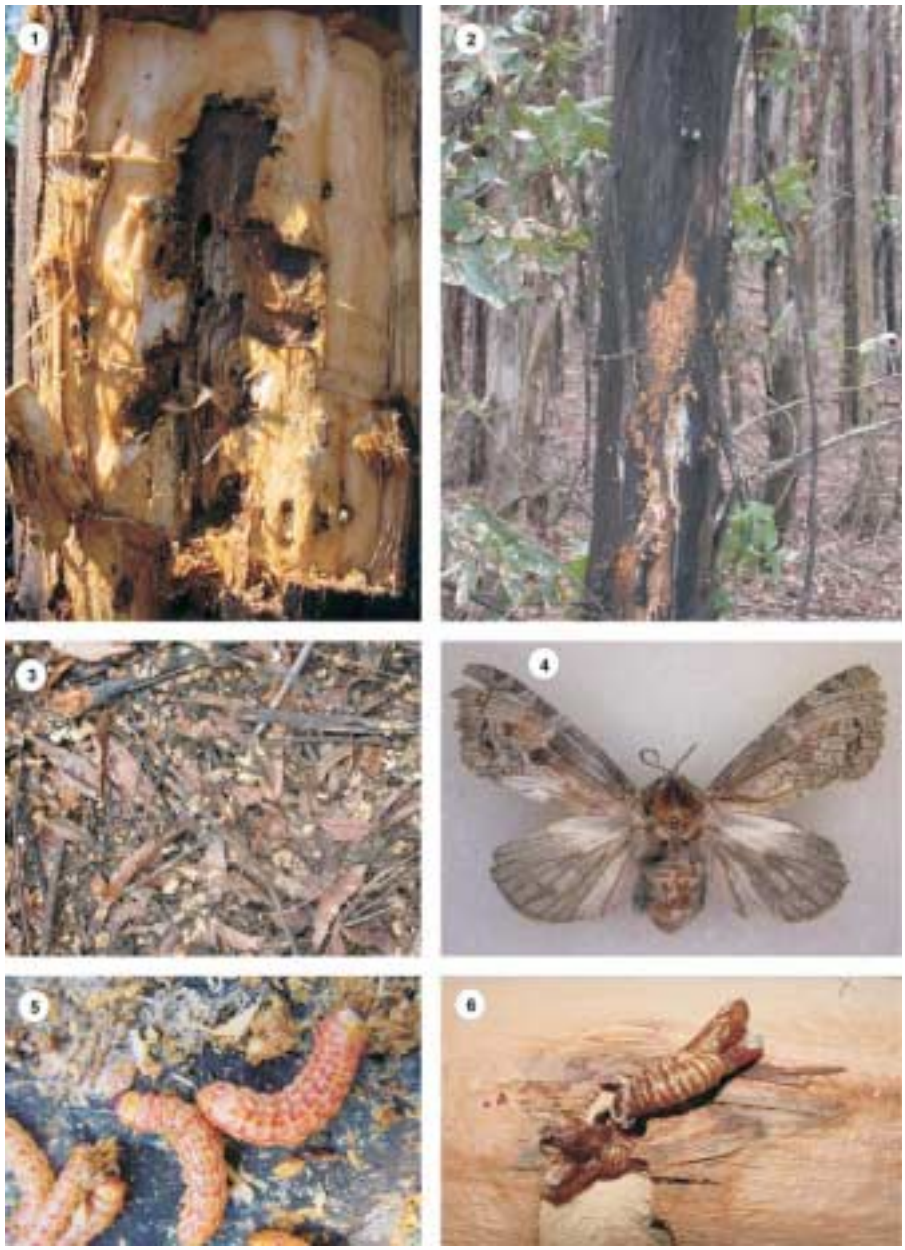
At this stage, there are several questions requiring answers in order to manage this new *Eucalyptus* pest in South Africa. The factors surrounding the sudden new host association of the moth with a plantation *Eucalyptus* are unknown. In Chile, where *Eucalyptus* is planted as an exotic in plantations, the native cossid moth *Chilecomadia valdiviana* feeds naturally on *Salix chilensis* and other native forest trees. In that situation, it has also acquired a new host association with *E. nitens* and a few other commercially grown *Eucalyptus* species.[12]

As yet, we can only speculate on the reason why *C. tristis* has infested *E. nitens.* Considering the large number of infested trees, it is unlikely that the oviposition of *C. tristis* on *E. nitens* is merely by chance. It is more probable that *C. tristis* was specifically attracted to *E. nitens.* The infested sites were generally compartments of stressed trees, which suggests that the moths could possibly have been attracted by kairomones or other stress signals. Whatever the cue, the surrounding compartments of different eucalypt species did not share this, as none of these compartments was infested with *C. tristis.*

The 'enemy-free space' hypothesis[13] could also explain the newly acquired oviposition behaviour of *C. tristis.* Here, association with new hosts by phytophagous insects may have its origin based in part in securing enemy-free space.[14,15] Regardless of whether natural enemies influenced the new host association, the high infestation of *C. tristis* on *E. nitens* does suggest that natural enemies are currently absent or in low numbers. The identity and populations of the natural enemies must still be investigated before their possible role in this dramatic new host association is known.

The new host association of *C. tristis* with *Eucalyptus* species has potentially serious consequences for the forestry industry. From the industry's perspective, this 'new' pest needs to be managed to mitigate the loss that it causes. In countries such as Australia, the United States and Italy, where some cossid species have been known as serious pests of forest and commercial fruit trees, pheromone trapping is used for monitoring and timing of insecticide applications.[16–18] The entomophagous nematodes, *Steinernema feltiae* and *S. bibionis,* have also been used to suppress populations of the cossid *Prionoxystus robinae,* which is the most damaging borer of oak timber in the United States.[19]

Clearly, the losses to *E. nitens* observed in the Lothair/Carolina area are economically significant and should be viewed with concern. A crucial question is to what extent the next generations of *C. tristis* will infest *E. nitens,* and whether these large, emerging populations of *C. tristis* in the plantations might result in the insect ovipositing on more healthy *E. nitens* and even other *Eucalyptus* species. A better understanding of the biology, phenology and population dynamics of the insect and its natural enemies on its native hosts as well as its new host is clearly required. Pest management techniques have been developed under agricultural conditions in the Cape.[20,21] The development of techniques for monitoring and management of populations that are applicable under South African forestry conditions is needed.



Figs 1–6. **1**, Tunnels made by *Coryphodema tristis* larvae; **2**, frass, from *C. tristis* tunnelling, pushed out the tree; **3**, frass from *C. tristis* on the forest floor; **4**, *C. tristis* adult; **5**, *C. tristis* larvae; **6**, *C. tristis* pupal casing protruding from emergence hole in tree.

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