



## The potential direct impacts on human health resulting from the establishment of the painted apple moth (*Teia anartoides*) in New Zealand

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### Abstract

This article examined the available evidence on the potential adverse reactions to human health associated with exposure to the painted apple moth (*Teia anartoides*; Lepidoptera: Lymantriidae). There seems to be no evidence of human health effects in the field, even though this species appears to be common in urban and suburban gardens in Australia. There are, however, rare accounts of laboratory exposure in that country and New Zealand. Allergic and toxic reactions following exposure to arthropods are common occurrences, and exposure to any insect setae may cause adverse reactions in susceptible people. Therefore, it is likely that some people would experience adverse reactions following exposure to the setae on *Teia anartoides* caterpillars, and the possibility that more sensitive persons could experience more severe reactions cannot be discarded. However, in contrast to previous claims, the direct impacts on human health as a result of the establishment of the painted apple moth in New Zealand would likely be minor.

The painted apple moth (Figure 1) *Teia anartoides* (Lepidoptera: Lymantriidae) was discovered in West Auckland in 1999.<sup>1</sup> An aerial spraying programme was subsequently carried out, which seems to have led to the eradication of this moth from New Zealand.<sup>1,2</sup>

The MAF Biosecurity New Zealand (this country's lead biosecurity agency and a division of the Ministry of Agriculture and Forestry—MAF) website states in regards to human exposure to *T. anartoides* caterpillars that “some people may also be allergic to the hairs on the caterpillars”.<sup>2</sup> However, in contrast, in a recent radio interview regarding the eradication campaign, Jim Anderton (New Zealand's current Minister for Biosecurity) stated that the painted apple moth “caterpillar has a very toxic effect on human beings” and “if you have contact with it, it has a toxic reaction [*sic*], quite a serious one”.<sup>3</sup>

A MAF report from 2000 stated that “both the number of people likely to be affected [*by exposure to T. anartoides*] and the probability of severe reaction are low” (p.5).<sup>28</sup> Interestingly, a different view, but similar to that expressed by the current minister, was given by MAF to the public at the time of the eradication programme. What could be seen as scare-tactics were employed to gain public support for the controversial aerial spraying. This included the broadcast of 30-second radio advertisements portraying the moth as a dangerous and scary creature, and media releases stating for example “we [*MAF*] strongly advise anyone who thinks they have come in contact with a Painted Apple Moth [*sic*] to seek medical attention”.<sup>4</sup>

**Figure 1. Painted apple moth caterpillar (*Teia anartoides*)**



Source: Alan Flynn (MAF), [www.forestryimages.org](http://www.forestryimages.org)

A media release from Jim Sutton (Biosecurity Minister at the time) also stated that “it was clear from overseas experience that about 95% of the population was allergic to the hairs on the painted apple moth”.<sup>5</sup>

It seemed important, therefore, to examine the issues.

### **Evidence for adverse reactions**

Such claims of human health effects associated with exposure to *T. anartoides* might have originated from a MAF commissioned health impact assessment report. The document contained a section entitled *Risk Assessment of Exposure to the Painted Apple Moth*, which examines “the potential for adverse health effects resulting from establishment of the painted apple moth in Auckland, should eradication efforts fail” (p.50).<sup>6</sup> The report states that:

Contact with larval stages of the painted apple moth is known to cause adverse health effects, including skin lesions, eye irritation, and respiratory reactions. In extreme situations, surface water can be so contaminated with frass (larval excrement) that it affects water quality. This may be enhanced by degradation of the vegetative canopy leading to an increase in water runoff.

The above claims however, were not substantiated, and the only reference provided refers to an impact assessment on gypsy moth (*Lymantria dispar*) prepared by the United States Department of Agriculture (USDA).<sup>7</sup> The gypsy moth is a member of the same Lepidoptera family (Lymantriidae), but no other connections to *Teia anartoides* seem to exist.

The document states that “adverse effects on human health from contact with moth larvae or their hairs entrapped in shed pupa have been reported in the following literature” (p.51). The literature referred to encompasses 10 references, 8 of which were articles from peer-reviewed journals. An examination of these references shows that the human health effects discussed were associated with Douglas fir tussock moth (*Orgyia pseudotsugata*),<sup>8,9</sup> gypsy moth,<sup>10-12</sup> and tussock moth (*Euproctis bipunctapex*).<sup>13,14</sup> Another reference refers to unidentified species of Australian caterpillars,<sup>15</sup> while a USDA report cited refers to gypsy moth.<sup>16</sup> These, or the text in pages 51 and 52, make no direct references to *Teia anartoides*. Nonetheless, the report discusses further potential impacts such as the effects of heavy infestation on water quality, but it mentions neither the source of the claim nor the species involved.

Although unpublished, there seems to have been adverse human health reactions to exposure to *T. anartoides* in the laboratory in New Zealand.<sup>4</sup> The same media release also states that “the hairs cause a nasty reaction resulting in painful and itchy rashes in the majority of the human population”. However, since *T. anartoides* seems to be a common pest in suburban orchards and on urban garden plants,<sup>17-19</sup> if the claims of widespread human susceptibility and consequent adverse reactions were indeed accurate, one would expect case reports of human exposure in Australia.

A 86-page monograph written by Southcott is probably the most complete work available on the human health effects associated with exposure to Lepidoptera in the Australian-New Zealand region.<sup>20</sup> However, this report contains only a brief reference (two paragraphs) to *T. anartoides* (referred to by its synonym *Orgyia anartoides*), which states that (p.149):

Mr ED Edwards, Division of Entomology, CSIRO, has advised (pers. comm., 1978) that the cast final instar larval skins of this species [*Orgyia anartoides*] “have caused mild skin irritation on soft skin of wrists and between fingers in the laboratory here. I have not heard of it causing irritation in the field”.

Southcott makes no other references to any adverse human health impacts associated with exposure to *T. anartoides*.<sup>20</sup> In comparison, the section concerning another Australian moth species introduced to New Zealand (*Uraba lugens*, gum leaf skeletoniser) and its associated human health effects is approximately 9 pages long. In a later publication, Southcott re-emphasised the issue regarding exposure to *T. anartoides*, stating that “contact with this larva [*Orgyia anartoides*] in the laboratory has resulted in mild skin irritation” (p.251),<sup>21</sup> with no mention of adverse consequences to human health having been observed in the field. Such a lack of evidence was also supported by an extensive search of online databases (CAB Abstracts, Current Contents, PubMed, and Web of Science) and search engines (Google, Scirus, and Yahoo), all of which failed to yield published accounts on this matter.

There are anecdotal reports of *T. anartoides* affecting the health of forestry workers in *Pinus radiata* plantations in South Australia, but there is however no confirmation of the species involved (Charlma Phillips, pers. comm. 2008). Southcott described outbreaks of another Lymantriid *Acyphas leucomelas* in *P. radiata* plantations in the region, whose health effects on forestry workers meant that many were “unable to work due to [the adverse] reactions”.<sup>20</sup> Therefore, although it is possible that the south Australian cases might have been a result of exposure to *T. anartoides*, the

involvement of other lymantriids cannot be disregarded. Especially since *T. anartoides* appears to be rare in those plantations, and it seems difficult to distinguish its larvae from those of *A. leucomelas* and *Orgyia australis* in the field (Charlma Phillips, pers. comm. 2008).

It is worth mentioning that the extent of the possible physiological differences between apparently closely related Lepidoptera taxa may be inferred for example, from studies on insecticide susceptibility. The lethal concentration values as a result of caterpillar exposure to insecticides may vary over 100-fold between genera<sup>22</sup> or even strains of the same species.<sup>23</sup> In the same way biochemical differences seem to account for such different caterpillar susceptibility to exposure to foreign compounds,<sup>23</sup> extensive antigenic differences may occur between moth species, leading to contrasting effects on human health.

Therefore, based on the available evidence, it appears that the human health impacts associated with exposure to *T. anartoides* were mistakenly estimated to be equivalent to those resulting from exposure to gypsy moth and other lymantriids. Although these moth species are systematically allocated to the same Lepidoptera family, there seems to be no evidence that their biochemical profiles are similar to an extent so as to cause equivalent adverse reactions in humans. The published evidence indicates the opposite.

## Conclusion

Allergic and toxic reactions following exposure to non-stinging arthropods are common occurrences.<sup>24</sup> Exposure to any insect setae may cause adverse reactions in susceptible people.<sup>25</sup> Therefore, it is likely that some people would experience adverse reactions following exposure to the setae of *Teia anartoides* caterpillars. As with any human exposure to arthropods, the possibility that some people may be more sensitive and experience severe reactions cannot be discarded.

However, the direct consequences to human health resulting from the establishment of the painted apple moth in New Zealand would likely be minor, and lesser than for example the likely impacts resulting from exposure to *Uraba lugens* (recently discussed in this journal,<sup>26,27</sup> and widely established in the Auckland region). This is likely to be the case, as there seems to be no published evidence of adverse reactions to human health as a result of field exposure to *Teia anartoides* in Australia, despite, as already stated, its apparently common presence in urban and suburban gardens in that country.

**Competing interests:** The author worked for two and a half years for MAF Biosecurity New Zealand, having recently resigned from his position as Human Health Senior Advisor.

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