

Indigenous hostplants of New Zealand's endemic Lepidoptera

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Introduction

I estimate that New Zealand has nearly 2,300 species of indigenous Lepidoptera (butterflies and moths) with 92% of these endemic to New Zealand. This is the highest rate of endemism globally for Lepidoptera (Dugdale 1988).

The caterpillar stage of these species can be split broadly into those feeding on leaf litter and dead wood; those feeding on non-vascular plants, such as mosses and liverworts, or lichens; and thirdly, those feeding on vascular plants. This third category is the subject of this paper.

New Zealand's indigenous Lepidoptera

New Zealand has a disharmonic Lepidoptera fauna of about 2,300 species, with representatives of just 55 families of the 126 families accepted worldwide (Dugdale 1988). However, one family, the Mnesachaetidae, is endemic, reflecting the antiquity and complexity of the country's geology, and richness of its indigenous biodiversity (Hoare 2010).

While its butterfly and moth fauna are out of harmony with the rest of the world in terms of family representation, New Zealand is considered to be a global hotspot for moth and butterfly fauna based on both its species-richness and high proportion of endemism (92%) (Dugdale 1988). Globally, this rate of endemism is the highest known.

Epitomising New Zealand's Lepidoptera fauna is the fact that just two of the five recognised butterfly families are present in the endemic fauna with 39 species in the Nymphalidae (admirals and ringlets) and Lycaenidae (coppers and a blue) (Patrick and Patrick 2012), as illustrated (Fig.1). For both admirals and coppers New Zealand is the global hotspot in terms of biodiversity.

Hoare et al. (2017) provide a comprehensive assessment of the conservation status of the butterfly and moth fauna: 174 species, including two butterflies, are classified as Threatened (54 species), At Risk (69 species), or Data Deficient (56 species).

Dugdale (1998) presented a preliminary overview, without a list of the hostplants of New Zealand's indigenous moth and butterfly fauna.



Figure 1. Highlighting three of New Zealand's endemic butterflies, from left: Maui's copper (*Lycaena edna*), Janita's tussock butterfly (*Argyrophenga janitae*), and red admiral (*Vanessa gonerilla*).

Methods

The rearing data and the association of New Zealand's endemic Lepidoptera (butterflies and moths) fauna with its natural vascular hostplants listed here is based on a lifetime of sampling and rearing of caterpillars by the author.

Much of this information has been published over the years but is here brought together to highlight which members of our indigenous flora support most Lepidoptera species. The list emphasises what excellent botanists our moths and butterflies are with amazing patterns of speciality over latitude and altitude across New Zealand.

I started locating and rearing caterpillars in my backyard growing up in Invercargill from the 1960s onwards. I also explored nearby Thomson's Bush reserve from an early age followed by numerous holidays in Central Otago. Later opportunities were made to sample all over the country from the Sub-Antarctic to the far north of the North Island, and to venture into the mountains all over New Zealand.

This labelled collection of pinned adult moths and butterflies is stored in the Otago Museum together with numerous diaries, images and notes to back-up the collection of adult Lepidoptera and caterpillars stored in ethanol.

Results

The annotated list of New Zealand's 621 indigenous Lepidoptera and their indigenous vascular hostplants highlights that New Zealand's Lepidoptera are fussy feeders: larvae of those that feed on vascular plants are specialists on a single host species, or on a group of taxonomically closely-related species (Table 1, p.7). Other Lepidoptera are specialists on mosses, lichens, liverworts, and dead wood and leaf litter.

The 22 most Lepidoptera-rich vascular plants are listed (Table 2, p. 28). This list shows that in any given lepidopteran genus more species are specialists than are generalists, with the noctuid genus *Meterana* typical. It has just one generalist (*Meterana ochthistis*) among its many species.

What the list shows is that only one indigenous canopy tree species in New Zealand supports significant specialist Lepidoptera. That widespread tree is silver beech (*Lophozonia menziesii*), which supports ten indigenous moths from seven families. Many canopy tree species, such as kamahi, kahikatea, rimu, and other beech species, support just one or two specialist moths, while the widespread tree fuchsia and broadleaf do not support any specialist moths or butterflies.

The widespread lianes of pōhuehue, such as *Muehlenbeckia australis*, *M. complexa* and the mats of *M. axillaris* and *M. ephedroides*, are all rich in specialist moths and butterflies, and support more butterflies and moths than any other endemic plant genus. All four plants are conspicuous components nationwide of many natural plant communities from rocky coastlines, estuarine shrubland and sand dunes, through river terraces and dry grasslands, forest and shrubland edges to alpine grassland and high alpine rocky ridges. In all these habitats they collectively support a rich insect fauna that in turn supports numerous indigenous birds and lizards, making such areas extremely ecologically important, and pivotal in nurturing our endemic biodiversity.

Surprisingly, ferns and podocarps, such a feature of our indigenous forests, do not support a rich lepidopteran fauna except the epiphytic fern *Pyrrosia* that supports seven moth species representing four lepidopteran families. Woody shrubs and small trees that are common forest-edge species, such as *Ozothamnus*, *Coprosma*, *Pimelea*, *Pseudopanax*, and *Hebe*, generally do have a rich specialist Lepidoptera fauna

The list informs us about many aspects of New Zealand plant taxonomy:

- The small and thin-leaved daisy shrubs and small trees of *Olearia* section *Divaricaster* should be in a new genus as not only are they rich with specialist moths but they also do not share this moth fauna with other *Olearia* groups.
- The separation of silver beech from other beeches was a correct decision.

- *Hebe* is rich in specialist moths, in stark contrast to its close relatives *Chionohebe*, *Heliohebe*, *Leonohebe*, *Parahebe*, and *Hebejeebie*, none of which supports any specialist Lepidoptera.

Interesting, and I think very telling, is the fact that 16 exotic *Veronica* species have been in New Zealand and widespread as weeds for over 150 years and in close contact with many populations of *Hebe* and its moth fauna, but not one of our specialist *Hebe* moths has ever been recorded as feeding on a *Veronica*. And yet it has been mooted that our *Hebe* should be synonymised under *Veronica*. I reject that based on the data presented here.

The list highlights the intimate relationship that New Zealand's indigenous Lepidopteran fauna has with our indigenous flora. If we want to nurture the maximum diversity in any area being protected or restored, then protection and restoration with the appropriate plant species that support significant numbers of indigenous moths and butterflies will benefit not just them but also indigenous lizards and birds that depend on invertebrates for survival. This list directs us to choosing the best indigenous plants to support maximum diversity of all fauna.

It is satisfying to see that in recent years considerable quantities of pōhuehue species, particularly *Muehlenbeckia complexa* and *M. axillaris*, have been planted in parks, playgrounds, traffic islands and in general landscaping, based on advocacy for their important ecological role in a range of different communities at different altitudes nationwide. This will result in a pay-off ecologically by supporting local ecology and biodiversity.

References

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Table 1. Indigenous hostplants of endemic specialist New Zealand Lepidoptera (updated July 2021).

LEPIDOPTERAN FAMILY genera and species					
HOSTPLANT FAMILY genera and species	Nymphalidae / Lycaenidae (Butterflies)	Noctuidae (Cutworms)	Geometridae (Loopers)	Tortricidae (Leaf-rollers)	Other families
Polygonaceae					
<i>Muehlenbeckia:</i> <i>M. australis</i> <i>M. complexa</i> <i>M. axillaris</i> <i>M. ephedroides</i>	Lycaenidae: <i>Lycaena rauparaha</i> <i>Lycaena edna</i> <i>Lycaena salustius</i> <i>Lycaena feredayi</i> <i>Lycaena enysii</i> <i>Lycaena ianthina</i> <i>Lycaena caerulea</i> <i>Lycaena boldenarum</i> <i>Lycaena tama</i> <i>Lycaena maui</i> <i>Lycaena</i> nsp. (ca. 15)	<i>Bityla defigurata</i> <i>Bityla sericea</i> <i>Meterana alcyone</i> <i>Meterana coeleno</i> <i>Meterana stipata</i>	<i>Pasiphila muscosata</i> <i>Pasiphila sphragitis</i> <i>Pseudocoremia indistincta</i>	<i>Harmologa scoliastes</i> <i>Harmologa amplexana</i> <i>Pyrgotis eudorana</i>	Thyrididae: <i>Morova subfasciata</i> Momphidae: <i>Zapyrastra calliphanes</i> <i>Zapyrastra stellata</i> Crambidae: <i>Diasemia grammalis</i> <i>Udea flavidalis</i> Carposinidae: <i>Heterocrossa exochana</i> Plutellidae: <i>Chrysorthenches prasinodes</i> Oecophoridae: <i>Hierodoris</i> nsp. Gelechiidae: <i>Kiwaia</i> nsp.
Urticaceae					
<i>Urtica:</i> <i>U. ferox</i> <i>U. aspera</i> <i>U. linearifolia</i> <i>U. sykesii</i>	Nymphalidae: <i>Vanessa ida</i> <i>Vanessa gonerilla</i>	<i>Meterana inchoata</i> <i>Meterana</i> nsp <i>Diarsia intermixta</i>	<i>Pasiphila urticae</i> <i>Pseudocoremia pergrata</i> <i>Pseudocoremia flava</i>	<i>Epichorista crypsidora</i>	Crambidae: <i>Udea marmarina</i> <i>Udea antipoda</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
Violaceae					
<i>Melicytus</i>		<i>Austramathes fortis</i> <i>Austramathes pessota</i> <i>Austramathes purpurea</i> <i>Austramathes nsp.(2)</i> <i>Feredayia graminosa</i> <i>Ichneutica lithias</i>		<i>Dipterina imbriferana</i> <i>Dipterina nsp.</i> <i>Harmologa nsp.</i>	Crambidae: <i>Heliothela atra</i>
Asteraceae					
<i>Ozothamnus</i>		<i>Physetica homoscia</i> <i>Ichneutica lindsayorum</i>	<i>Pseudocoremia colpogramma</i>	<i>Harmologa petrias</i> <i>Harmologa sisyra</i> <i>Harmologa nsp.</i> <i>Pyrgotis nsp.</i>	Nepticulidae: <i>Stigmella cassiniae</i> Oecophoridae: <i>Hierodoris atychioides</i> <i>Hierodoris electrica</i> Stathmopodidae: <i>Stathmopoda nsp.</i>
<i>Olearia</i> Section Divaricaster		<i>Meterana exquisita</i> <i>Meterana grandiosa</i> <i>Meterana tetrachroa</i>	<i>Pseudocoremia cineracia</i> <i>Pseudocoremia nsp. (2)</i> <i>Pasiphila cotinaea</i> <i>Pasiphila nsp.</i> <i>Declana nigrosparsa</i>	<i>Pyrgotis nsp.</i> <i>Maoritenes modesta</i> <i>Maoritenes nsp.</i>	Stathmopodidae: <i>Stathmopoda nsp. (2)</i> <i>Stathmopoda albimaculata</i> <i>Stathmopoda campylocha</i> Gelechiidae: <i>Thiotricha oleariae</i> Plutellidae: <i>Protosynaema nsp.</i> Nepticulidae: <i>Stigmella ilsea</i> <i>Stigmella nsp.</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
<i>Olearia</i> other Sections			<i>Pseudocoremia rudisata</i> <i>Declana toreuta</i>		Choreutidae: <i>Asterivora oleariae</i> Oecophoridae: <i>Agriophara colligatella</i> <i>Hierodoris electrica</i> Gelechiidae: <i>Epiphthora melanombra</i> Nepticulidae: <i>Stigmella erysibodea</i> <i>Stigmella hakekeae</i> <i>Stigmella watti</i> <i>Stigmella hamishella</i> <i>Stigmella fulva</i> <i>Stigmella laqueorum</i>
<i>Celmisia</i>			<i>Chloroclystis nereis</i> <i>Pseudocoremia berylia</i> <i>Pasiphila</i> nsp.	<i>Gelophaula aenea</i> <i>Gelophaula aridella</i> <i>Gelophaula palliata</i> <i>Gelophaula</i> <i>lychnophanes</i> <i>Gelophaula palliata</i> <i>Gelophaula siraea</i> <i>Gelophaula</i> <i>praecipitalis</i> <i>Gelophaula tributaria</i> <i>Gelophaula trisulca</i> <i>Gelophaula vana</i> <i>Gelophaula</i> nsp. (5)	Choreutidae: <i>Asterivora barbigera</i> <i>Asterivora fasciata</i> <i>Asterivora nivescens</i> <i>Asterivora marmarea</i> Nepticulidae: <i>Stigmella childi</i> <i>Stigmella insignis</i> <i>Stigmella oriastra</i> Gelechiidae: <i>Epiphthora</i> nsp. Oecophoridae: <i>Hierodoris eremita</i>
<i>Pachystegia</i>					Oecophoridae: <i>Hierodoris pachystegiae</i>
<i>Pseudognaphalium</i>					Pyralidae: <i>Homoeosoma anaspila</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
<i>Vittadina</i>		<i>Australothis volatilis</i>			Choreutidae: <i>Tebenna micalis</i> Pterophoridae: <i>Stenoptilia celidota</i> Pyralidae: <i>Homoeosoma anaspila</i>
<i>Helichrysum</i>			<i>Helastia triphragma</i> <i>Helastia angusta</i> <i>"Xanthorhoe" occulta</i>		Nepticulidae: <i>Stigmella tricentra</i> Choreutidae: <i>Asterivora chatuidea</i> <i>Asterivora microlitha</i> Nolidae: <i>Celama parvitis</i>
<i>Craspedia</i>			<i>Chloroclystis nereis</i>		
<i>Senecio</i>					Choreutidae: <i>Asterivora colpota</i> Stathmopodidae: <i>Stathmopoda skelloni</i> Arctiidae: <i>Nyctemera annulata</i> Nepticulidae: <i>Stigmella ogygia</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
<i>Raoulia</i>		<i>Ichneutica moderata</i>			Crambidae: <i>Orocrambus xanthogrammus</i> Choreutidae: <i>Asterivora tillyardi</i> Gelechiidae: <i>Kiwaia caerulea</i> <i>Kiwaia glaucoterma</i> <i>Kiwaia jeanae</i> <i>Kiwaia lapillosa</i> <i>Kiwaia lithodes</i> <i>Kiwaia</i> nsp. Scythridae: <i>Scythris triatma</i> <i>Scythris</i> nsp.
<i>Brachyglottis</i>			<i>Pasiphila</i> nsp.		Nepticulidae: <i>Stigmella atrata</i> <i>Stigmella cypracma</i> <i>Stigmella platina</i> Pterophoridae: <i>Stenoptilia orites</i> Choreutidae: <i>Asterivora exocha</i> <i>Asterivora iochondra</i> <i>Asterivora ministra</i> <i>Asterivora</i> nsp. (2)
Thymelaeaceae					
<i>Pimelea</i>		<i>Meterana meyricki</i> <i>Meterana pictula</i> <i>Meterana</i> nsp.	<i>Helastia semisignata</i> <i>Notoreas casanova</i> <i>Notoreas edwardsi</i> <i>Notoreas perornata</i> <i>Notoreas elegans</i> <i>Notoreas paradelpha</i> <i>Notoreas</i> nsp. (11)	<i>Ericodesma aerodana</i>	

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
<i>Kelleria</i>			<i>Notoreas arcuata</i> <i>Notoreas blax</i> <i>Notoreas atmogramma</i> <i>Notoreas regilla</i> <i>Notoreas isomoera</i> <i>Notoreas chioneres</i> <i>Notoreas galaxias</i> <i>Notoreas ortholeuca</i> <i>Notoreas isoleuca</i> <i>Notoreas ischnocyma</i> <i>Notoreas mechanitis</i> <i>Notoreas chrysopeda</i> <i>Notoreas nsp. (7)</i>	<i>Pyrgotis nsp.</i>	
Plantaginaceae					
<i>Hebe</i>		<i>Meterana asterope</i> <i>Meterana nsp.</i>	<i>Dasystemnica callicrena</i> <i>Dasystemnica fulminea</i> <i>Dasystemnica strategica</i> <i>Pasiphila acompsa</i> <i>Pasiphila bilineolata</i> <i>Pasiphila charybdis</i> <i>Pasiphila dryas</i> <i>Pasiphila erratica</i> <i>Pasiphila furva</i> <i>Pasiphila fumipalpata</i> <i>Pasiphila halianthes</i> <i>Pasiphila lunata</i> <i>Pasiphila nebulosa</i> <i>Pasiphila rivalis</i> <i>Pasiphila rubella</i> <i>Pasiphila nsp.</i> <i>Pseudocoremia hollyae</i> <i>Pseudocoremia modica</i>	<i>Harmologa sanguinea</i> <i>Harmologa speciosa</i> <i>Harmologa pontifica</i> <i>Prothelymna niphostrota</i> <i>Planotortrix flammea</i> <i>Pyrgotis consentiens</i> <i>Pyrgotis humilis</i> <i>Pyrgotis nsp.</i> <i>Bactramorpha nsp.</i>	Scythridae: <i>Scythris nigra</i> <i>Scythris nsp.</i> Pterophoridae: <i>Platyptilia falcatalis</i> <i>Platyptilia indubitata</i> <i>Stenoptilia epotis</i> <i>Stenoptilia heliastis</i> <i>Stenoptilia lithoxesta</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
<i>Hebe</i> continued			<i>Pseudocoremia terrena</i> <i>Pseudocoremia wardi</i> <i>Pseudocoremia</i> nsp. (3) <i>Xyridacma veronicae</i>		
<i>Plantago</i>			<i>Asaphodes abrogata</i> <i>Arctesthes siris</i> <i>Scopula rubraria</i>		Pterophoridae: <i>Platyptilia repletalis</i>
Brassicaceae					
<i>Cardamine</i>			<i>Asaphodes helias</i> <i>Asaphodes periphaea</i> <i>Asaphodes philpotti</i> <i>Asaphodes prasinias</i> <i>Xanthorhoe orophylla</i> <i>Xanthorhoe semifissata</i>		Plutellidae: <i>Plutella antiphona</i> <i>Plutella</i> nsp.
<i>Cheesemania</i>			<i>Xanthorhoe frigida</i>		
<i>Rorippa</i>					Plutellidae: <i>Leuroperna sera</i>
<i>Lepidium</i>					Plutellidae: <i>Plutella antiphona</i>
Apocynaceae					
<i>Parsonsia</i>					Gracillariidae: <i>Eumetriochroa aethalota</i> Nepticulidae: <i>Stigmella kaimanua</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
Rubiaceae					
<i>Coprosma</i>		<i>Meterana tartarea</i> <i>Meterana vitiosa</i>	<i>Austrocidaria arenosa</i> <i>Austrocidaria bipartita</i> <i>Austrocidaria callichlora</i> <i>Austrocidaria cedrinodes</i> <i>Austrocidaria gobiata</i> <i>Austrocidaria haemophaea</i> <i>Austrocidaria lithurga</i> <i>Austrocidaria parora</i> <i>Austrocidaria praerupta</i> <i>Austrocidaria prionota</i> <i>Austrocidaria similata</i> <i>Austrocidaria stricta</i> <i>Austrocidaria umbrosa</i> <i>Pasiphila plinthina</i> <i>Pasiphila sandycias</i>	<i>Apoctena persecta</i> <i>Holocola emplasta</i> <i>Leucogenes coprosmae</i> <i>Planotortrix coprosmae</i>	Gracillariidae: <i>Corythoestis zorionella</i> Stathmopodidae: <i>Stathmopoda caminora</i>
Winteraceae					
<i>Pseudowintera colorata</i>				<i>Maoritenes cyclobathra</i>	
Araliaceae					
<i>Pseudopanax</i>			<i>Declana atronivea</i> <i>Declana egregia</i> <i>Xyridacma alectoraria</i>		Pterophoridae: <i>Aciptilia monospilalis</i> Gracillariidae: <i>Eumetriochoa aellomacha</i> <i>Eumetriochoa panacicorticis</i> <i>Eumetriochoa panacifinens</i> <i>Eumetriochoa panacitorsens</i> <i>Eumetriochoa panacivagans</i> <i>Eumetriochoa panacivermiforma</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
<i>Schefflera</i>		<i>Meterana merope</i>			Pterophoridae: <i>Aciptilia monospilalis</i>
Pittosporaceae					
<i>Pittosporum</i>			<i>Xyridacma ustaria</i>		Depressariidae: <i>Nymphostola galactina</i> Pterophoridae: <i>Aciptilia furcatalis</i> Gracillariidae: <i>Caloptilia</i> nsp.
Ericaceae					
<i>Leucopogon</i>					Oecophoridae: <i>Prepalla austrina</i> Gelechiidae: <i>Kiwaia</i> nsp.
<i>Dracophyllum</i>			<i>Epiphyrne charidema</i> <i>Pasiphila humilis</i> <i>Pasiphila melanocentra</i> <i>Aponotoreas anthracias</i> <i>Aponotoreas dissimilis</i> <i>Aponotoreas incompta</i> <i>Declana glacialis</i>	<i>Ericodesma melanosperma</i> <i>Eurythecta</i> nsp.	Nepticulidae: <i>Stigmella progonopis</i> Plutellidae: <i>Chrysorthenches septentrionalis</i> <i>Chrysorthenches dictyarcha</i> <i>Chrysorthenches saleuta</i> Gelechiidae: <i>Hierodoris insignis</i> <i>Kiwaia</i> nsp. Depressariidae: <i>Proteodes</i> nsp.
<i>Cyathodes</i>			<i>Aponotoreas anthracias</i>		Depressariidae: <i>Proteodes</i> nsp.

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
<i>Gaultheria</i>			<i>Pasiphila magnimaculata</i> <i>Poecilasthena pulchraria</i>	<i>Pyrgotis</i> nsp.	Nepticulidae: <i>Stigmella progonopis</i> Plutellidae: <i>Chrysorthenches saleuta</i> <i>Chrysorthenches semifasciata</i> Carposinidae: <i>Heterocrossa canescens</i>
Fabaceae					
<i>Carmichaelia</i>			<i>Pasiphila melochlora</i> <i>Pasiphila aristias</i> <i>Pseudocoremia melinata</i> <i>Samana acutata</i> <i>Samana falcatella</i>		Plutellidae: <i>Chrysorthenches chlorocoma</i> Gelechiidae: <i>Athrips zophochalca</i> <i>Kiwaia pharetria</i> Scythridae: <i>Scythris epistrota</i> <i>Scythris niphozela</i>
<i>Sophora</i>	Lycaenidae: <i>Zizina oxleyi</i>	<i>Meterana decorata</i>	<i>Chalastra ochrea</i>		Nepticulidae: <i>Stigmella sophorae</i> Crambidae: <i>Uresiphita maorialis</i> Stathmopodidae: <i>Stathmopoda aposema</i> Oecophoridae: <i>Hierodoris sesioides</i>
Apiaceae					
<i>Gingidia</i>			<i>Gingidiobora nebulosa</i> <i>Gingidiobora subobscurata</i> <i>Gingidiobora</i> nsp.(2)		
<i>Aciphylla</i>		<i>Ichneutica nullifera</i>	<i>Dasyuris partheniata</i> <i>Dasyuris catadees</i> <i>Dasyuris octans</i>		

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
<i>Anisotome</i>			<i>Dasyuris anceps</i> <i>Dasyuris austrina</i> <i>Dasyuris enysii</i> <i>Dasyuris grisescens</i> <i>Dasyuris hectori</i> <i>Dasyuris leucobathra</i> <i>Dasyuris micropilis</i> <i>Dasyuris pluviata</i> <i>Dasyuris transaurea</i> <i>Dasyuris</i> nsp. (2)	<i>Apoctena syntona</i>	
<i>Hydrocotyle</i>					Crambidae: <i>Scoparia ustimacula</i>
Myrtaceae					
<i>Kunzea</i>			<i>Poecilasthena schistaria</i> <i>Pseudocoremia amaculata</i>	<i>Holocola zopherana</i>	Oecophoridae: <i>Hierodoris atychioides</i>
<i>Leptospermum scoparium</i>			<i>Poecilasthena schistaria</i>	<i>Holocola zopherana</i>	Oecophoridae: <i>Hierodoris atychioides</i>
<i>Syzygium maire</i>					Gracillariidae: <i>Macarostola miniella</i>
Onagraceae					
<i>Fuchsia perscandens</i>			<i>Cephalissia siria</i>		
<i>Epilobium</i>			<i>Paranotoreas brephosata</i> <i>Paranotoreas opipara</i> <i>Paranotoreas zopyra</i> <i>Anachloris subochraria</i> "Hydriomena" <i>purpurifera</i> "Hydriomena" <i>rixata</i>		Crambidae: <i>Scoparia rotuella</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
Elaeocarpaceae					
<i>Aristotelia</i>					Roeslerstammiidae: <i>Dolichernis chloroleuca</i>
Nothofagaceae					
<i>Lophozonia menziesii</i>		<i>Meterana praesignis</i> <i>Meterana pascoi</i>	<i>Declana feredayi</i>	<i>Apoctena pictoriana</i> <i>Pyrgotis pyramidias</i> <i>Epichorista emphanes</i>	Gracillariidae: <i>Caloptilia selenitis</i> Nepticulidae: <i>Stigmella lucida</i> Gelechiidae: <i>Thiotricha tetraphala</i> Depressariidae: <i>Proteodes profunda</i>
<i>Fuscospora</i>		<i>Meterana dotata</i> <i>Meterana coctilis</i>	<i>Tatosoma tipulata</i>		Oecophoridae: <i>Hierodoris callispora</i> Depressariidae: <i>Proteodes carnifex</i>
Malvaceae					
<i>Plagianthus</i>		<i>Meterana levis</i>	<i>Pseudocoremia lactiflua</i>		Nepticulidae: <i>Stigmella aigialeia</i> Gelechiidae: <i>Anisoplaca acrodactyla</i>
<i>Hoheria</i>		<i>Meterana pansicolor</i>	<i>Declana niveata</i> <i>Epiphryne undosata</i>		Nepticulidae: <i>Stigmella hoheriae</i> Gelechiidae: <i>Anisoplaca achyrota</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
Ranunculaceae					
<i>Ranunculus</i>			<i>Asaphodes adonis</i> <i>Asaphodes philpotti</i> <i>Asaphodes clarata</i> <i>Asaphodes cataphracta</i> <i>Asaphodes declarata</i> <i>Asaphodes ida</i> <i>Asaphodes recta</i> <i>Asaphodes sericodes</i> <i>Asaphodes stephanitis</i> <i>Asaphodes stinaria</i>		
<i>Clematis</i>			<i>Asaphodes chlamydota</i>		Crambidae: <i>Deana hybreasalis</i>
Myoporaceae					
<i>Myoporum laetum</i>				<i>Prothelymna antiquana</i>	
Myrsinaceae					
<i>Myrsine</i>					Cosmopterigidae: <i>Microcolona limodes</i>
Cornaceae					
<i>Corokia</i>			<i>Horisme suppressaria</i>	<i>Ericodesma cuneata</i>	Plutellidae: <i>Chrysorthenches disparilis</i>
Oleaceae					
<i>Nestegis</i>					Gracillariidae: <i>Caloptilia chalcodelta</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
Coriariaceae					
<i>Coriaria arborea</i>					Gracillariidae: <i>Caloptilia linearis</i> <i>Caloptilia elaeas</i> Yponomeutidae: <i>Kessleria copidota</i> Oecophoridae: <i>Hierodoris illita</i>
Elaeocarpaceae					
<i>Weinmannia</i>					Gracillariidae: <i>Caloptilia chrysitis</i>
Moraceae					
<i>Streblus</i>		<i>Meterana octans</i>			Copromorphidae: <i>Phycomorpha metachrysa</i>
Rhamnaceae					
<i>Discaria toumatou</i>		<i>Physetica phricias</i>		<i>Acroclita discariana</i>	
Solanaceae					
<i>Solanum</i>					Crambidae: <i>Leucinodes cordalis</i>
Gunneraceae					
<i>Gunnera</i>			<i>"Hydriomena" arida</i>	<i>Eurythecta</i> nsp.	
Goodeniaceae					
<i>Selliera</i>			<i>Asaphodes frivola</i>		Depressariidae: <i>Eutorna inornata</i> Gelechiidae: <i>Kiwaia lenis</i>
Gentianaceae					
<i>Gentiana</i>					Pterophoridae: <i>Platyptilia aelodes</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
Chenopodiaceae					
<i>Atriplex</i>			<i>Paranotoreas fulva</i>		Crambidae: <i>Loxostege</i> nsp.
Haloragaceae					
<i>Haloragis erecta</i>			<i>Epicyme rubropunctaria</i>		Momphidae: <i>Zapyrastra</i> nsp.
Rosaceae					
<i>Rubus</i>		<i>Meterana diatmeta</i>	<i>Elvia glaucata</i>		
<i>Acaena</i>				<i>Epichorista aspistana</i> <i>Epichorista hemionana</i> <i>Epichorista crypsidora</i>	Gelechiidae: <i>Kiwaia schematica</i> Crambidae: <i>Mnesictena antipodea</i> <i>Mnesictena notata</i>
Convolvulaceae					
<i>Dichondra</i>					Pterophoridae: <i>Aciptilia innotatalis</i>
<i>Calystegia</i>					Bedelliidae: <i>Bedellia psamminella</i>
Sapindaceae					
<i>Alectryon excelsus</i>					Gracillariidae: <i>Conopomorpha cyanospila</i>
Lamiaceae					
<i>Teucrium parvifolium</i>					Gracillariidae: <i>Sabulopteryx botanica</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
Loranthaceae					
<i>Ileostylus micranthus</i>			<i>Declana griseata</i> <i>Tatosoma agrionata</i>		Yponomeutidae: <i>Zelleria sphenota</i>
<i>Peraxilla</i>					Yponomeutidae: <i>Zelleria maculata</i>
<i>Tupeia</i>					Cosmopterigidae: <i>Pyroderces apparitella</i>
Juncaceae					
<i>Juncus</i>			<i>Microdes epicryptis</i>		Glyphipterigidae: <i>Glyphipterix aenea</i> <i>Glyphipterix iocheaera</i> Batrachedridae: <i>Batrachedra tristicta</i>
<i>Luzula</i>					Glyphipterigidae: <i>Glyphipterix astrapaea</i>
<i>Marsippospermum</i>			<i>Aponotoreas orphnaea</i> <i>Asaphodes omichlias</i>		Gelechiidae: <i>Megacraspedus</i> nsp. (2)
Typhaceae					
<i>Typha orientalis</i>					Oecophoridae: <i>Scieropepla typhicola</i>
Cyperaceae					
<i>Carex</i>		<i>Ichneutica semivittata</i> <i>Ichneutica infensa</i> <i>Ichneutica sulcana</i>			Pyralidae: <i>Diplopseustis perieresalis</i> Plutellidae: <i>Plutella psammochroa</i> <i>Phylacodes cauta</i> <i>Protosynaema quaestuosa</i> <i>Protosynaema steropucha</i> Crambidae: <i>Orocrambus apicellus</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
<i>Carex</i> continued					Gelechiidae: <i>Megacraspedus</i> nsp. Elachistidae: <i>Cosmiotes</i> nsp. Glyphipterigidae: <i>Glyphipterix achlyoessa</i> <i>Glyphipterix aulogramma</i> <i>Glyphipterix bactrias</i> <i>Glyphipterix codonias</i> <i>Glyphipterix leptosema</i> <i>Glyphipterix metasticta</i> <i>Glyphipterix scintellella</i>
Restionaceae					
<i>Empodisma minus</i>		<i>Ichneutica similis</i>	<i>Aponotoreas synclinalis</i>		
<i>Leptocarpus</i>					Batrachedridae: <i>Batrachedra tristicta</i>
Gramineae					
<i>Poa</i>	Nymphalidae: <i>Percnodaimon merula</i> <i>Percnodaimon pluto</i> <i>Percnodaimon micans</i> <i>Percnodaimon</i> nsp. (3)	<i>Ichneutica disjungens</i> <i>Ichneutica naufraga</i> <i>Ichneutica pagaia</i> <i>Ichneutica toroneura</i> <i>Ichneutica paraxysta</i> <i>Ichneutica acontistis</i> <i>Ichneutica sistens</i> <i>Ichneutica propria</i> <i>Ichneutica atristriga</i> <i>Ichneutica lignana</i> <i>Ichneutica morosa</i> <i>Ichneutica omoplaca</i>			Elachistidae: <i>Cosmiotes laqueorum</i> <i>Cosmiotes ochroleuca</i> <i>Elachista pumila</i> <i>Elachista galathea</i> <i>Elachista</i> nsp. Glyphipterigidae: <i>Glyphipterix cionophora</i> <i>Glyphipterix nephoptera</i> <i>Glyphipterix triselena</i> Crambidae: <i>Orocrambus abditus</i> <i>Orocrambus callirrhous</i> <i>Orocrambus lewisi</i> <i>Orocrambus machaeristes</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
<i>Chionochloa</i>	Nymphalidae: <i>Argyrophenga antipodum</i> <i>Argyrophenga harrisi</i> <i>Argyrophenga janitae</i> <i>Dodonidia helmsi</i>	<i>Ichneutica ceraunias</i> <i>Ichneutica dione</i> <i>Ichneutica eris</i> <i>Ichneutica notata</i> <i>Ichneutica haedifrontella</i>	<i>Aponotoreas insignis</i> <i>Aponotoreas</i> nsp.		Plutellidae: <i>Proditrix megalynta</i> Gelechiidae: <i>Megacraspedus calamogonus</i> Elachistidae: <i>Elachista plagiacula</i> <i>Elachista thallophora</i> <i>Elachista</i> nsp. Glyphipterigidae: <i>Glyphipterix barbata</i> Crambidae: <i>Orocrambus crenaeus</i> <i>Orocrambus heteraulus</i> <i>Orocrambus philpotti</i>
<i>Elymus</i>					Glyphipterigidae: <i>Glyphipterix oxymachaera</i> Crambidae: <i>Orocrambus ramosellus</i>
<i>Microlaena</i>		<i>Ichneutica sulcana</i>		<i>Epichorists lindsayi</i>	Elachistidae: <i>Cosmiotes ombrodoca</i> <i>Cosmiotes archaeonoma</i>
<i>Austroderia</i>		<i>Ichneutica epiastra</i>			Crambidae: <i>Orocrambus angustipennis</i>
<i>Festuca</i>					Crambidae: <i>Orocrambus ordishi</i>
<i>Gahnia</i>	Nymphalidae: <i>Dodonidia helmsi</i>	<i>Ichneutica theobroma</i>			Crambidae: <i>Clepsicosma iridia</i>
<i>Zoysia</i>					Crambidae: <i>Kupea electilis</i>
<i>Ficinia spiralis</i>		<i>Ichneutica phaula</i>			

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
Asteliaceae					
<i>Astelia</i>		<i>Ichneutica purdii</i>			Depressariidae: <i>Donacostola notabilis</i> Glyphipterigidae: <i>Charixena iridoxa</i> <i>Hierodoris stellata</i>
Asphodelaceae					
<i>Phormium</i>		<i>Ichneutica steropastis</i>	<i>Orthoclydon praefectata</i>		Stathmopodidae: <i>Stathmopoda skelloni</i>
Asparagaceae					
<i>Cordyline</i>			<i>Epiphryne verriculata</i>	<i>Catamacta lotinana</i> <i>Catamacta</i> nsp.	Stathmopodidae: <i>Stathmopoda holochra</i> Batrachedridae: <i>Batrachedra</i> nsp. Tineidae: <i>Astrogenes chrysograpt</i> <i>Astrogenes insignita</i>
Dennstaedtiaceae					
<i>Histiopteris</i>			<i>Sestra flexata</i>		Crambidae: <i>Musotima nitidalis</i>
Adiantaceae					
<i>Adiantum</i>					Crambidae: <i>Musotima aduncalis</i>
Polypodiaceae					
<i>Pyrrosia</i>			<i>Sarisa muriferata</i>	<i>Apoctena taipana</i> <i>Philocryptica polypodii</i>	Crambidae: <i>Eudonia zophoclaena</i> <i>Scoparia illota</i> <i>Scoparia molifera</i> Stathmopodidae: <i>Calicotis crucifera</i>

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
<i>Phymatosorus</i>					Stathmopodidae: <i>Thylacosceles radians</i>
<i>Alsophila colensoi</i>			<i>Chalastra aristarcha</i>	<i>Cnephasia microbathra</i> <i>Ctenopseustis filicis</i> <i>Ecclitica torogramma</i>	
Aspidiaceae					
<i>Polystichum</i>			<i>Ischalis fortinata</i> <i>Chalastra pellurgata</i>		
Aspleniaceae					
<i>Asplenium</i>					Batrachedridae: <i>Batrachedra psithyra</i>
Psilotaceae					
<i>Tmesipteris</i>		<i>Ichneutica subcyprea</i>			
Blechnaceae					
<i>Blechnum</i>			<i>Ischalis gallaria</i>		
Gleicheniaceae					
<i>Gleichenia</i>				<i>Apoctena clarkei</i>	

	Butterflies	Noctuidae	Geometridae	Tortricidae	Other families
Araucariaceae					
<i>Agathis australis</i>					Gracillariidae: <i>Acrocercops leucocyma</i>
Podocarpaceae					
<i>Dacrycarpus</i>				<i>Pyrgotis arcuata</i>	Oecophoridae: <i>Hierodoris atychioides</i>
<i>Podocarpus</i>			<i>Declana hermione</i> <i>Tatosoma apicipallida</i>	<i>Pyrgotis zygiana</i>	Plutellidae: <i>Chrysorthenches polita</i> <i>Chrysorthenches porphyritis</i> <i>Chrysorthenches drosochalca</i> <i>Chrysorthenches glypharcha</i> Oecophoridae: <i>Hierodoris atychioides</i>
<i>Dacrydium</i>			<i>Pseudocoremia fenerata</i>	<i>Pyrgotis plinthoglypta</i>	Oecophoridae: <i>Hierodoris atychioides</i>
<i>Halocarpus</i>					Plutellidae: <i>Chrysorthenches halocarpus</i> Oecophoridae: <i>Hierodoris atychioides</i>
Cupressaceae					
<i>Phyllocladus</i>			<i>Tatosoma alta</i>	<i>Catamacta alopecana</i>	Plutellidae: <i>Chrysorthenches</i> nsp.
<i>Libocedrus</i>					Plutellidae: <i>Chrysorthenches virgata</i>

Table 2. List of the indigenous vascular plants richest in specialist endemic New Zealand Lepidoptera.

Plant family and genus	Number of specialist lepidopteran species	Number lepidopteran families represented
Polygonaceae: <i>Muehlenbeckia</i>	45	11
Plantaginaceae: <i>Hebe</i>	41	5
Gramineae: <i>Poa</i>	30	5
Asteraceae: <i>Celmisia</i>	27	6
Rubiaceae: <i>Coprosma</i>	22	5
Thymelaeaceae: <i>Pimelea</i>	21	3
Gramineae: <i>Chionochloa</i>	20	8
Asteraceae: <i>Olearia</i> (section <i>Divaricaster</i>)	20	7
Thymelaeaceae: <i>Kelleria</i>	19	2
Cyperaceae: <i>Carex</i>	17	8
Ericaceae: <i>Dracophyllum</i>	16	6
Apiaceae: <i>Anisotome</i>	12	2
Asteraceae: <i>Olearia</i> – other sections	11	5
Urticaceae: <i>Urtica</i>	11	5
Violaceae: <i>Melicytus</i>	11	3
Asteraceae: <i>Ozothamnus</i>	11	6
Asteraceae: <i>Raoulia</i>	11	5
Araliaceae: <i>Pseudopanax</i>	10	3
Asteraceae: <i>Brachyglottis</i>	10	4
Fabaceae: <i>Carmichaelia</i>	10	4
Ranunculaceae: <i>Ranunculus</i>	10	1
Nothofagaceae: <i>Lophozonia</i>	10	7