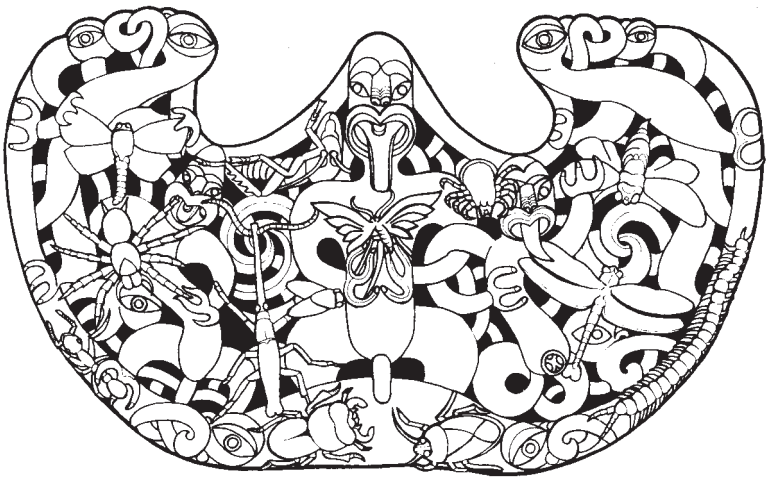

Fauna of New Zealand

Ko te Aitanga Pepeke o Aotearoa

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Number / Nama 82

Declana and *Ipana* (Insecta: Lepidoptera: Geometridae: Ennominae)

by
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POPULAR SUMMARY

Class **Insecta**

Order **Lepidoptera**

Superfamily **Geometroidea**

Family **Geometridae**

Subfamily **Ennominae**

Genera ***Declana*** and ***Ipana***

Zebra moths and allies

Looper moths (family Geometridae) get their name from the characteristic ‘looping’ mode of locomotion of their caterpillars, which alternately bend their bodies in a semicircle and stretch themselves out straight as they progress. Loopers are a huge family of moths distributed worldwide, with more than 23,000 species; there are over 280 species known from New Zealand, almost all of them endemic to this country.

This volume covers one small group of New Zealand looper moths, but possibly the most spectacular in terms of size and wing patterns. The ‘zebra moths’ and their allies belonging to the genera *Declana* and *Ipana* are medium-sized to large, robust moths with densely ‘furry’ bodies. There are 15 species, 4 of which are described as new in this book. The North Island and South Island Zebra Moths (*Ipana atronivea* and *I. egregia*) are amongst New Zealand’s most famous moths, with their striking black and white wing patterns, which nevertheless provide excellent camouflage against lichen-covered tree trunks. The South Island Zebra Moth is even featured on the New Zealand $100 note. Both these moths have extraordinary caterpillars, which mimic fungus-covered twigs of their host-plant, *Pseudopanax* (five-finger and relatives). Another spectacular species is *Ipana glacialis*, the only truly alpine member of this group. It has strongly patterned reddish brown and white forewings and bright orange hindwings; males fly by day and are often conspicuous on sunny days above the treeline in their South Island habitats. Other species, such as *Declana floccosa* and *I. leptomera*, are amongst our commonest forest moths, occurring throughout the country. *Declana floccosa* is particularly interesting because of the extreme variability in its wing pattern: some specimens are almost unicolorous greyish, while others have dark spots or speckles, various lines and sometimes bright orange markings closely resembling lichens.

Some species of *Declana* and *Ipana* are very specific in their choice of host-plant; for example, caterpillars of *Ipana glacialis* will only feed on species of *Dracophyllum* and those of *I. griseata* only on mistletoes (family Loranthaceae). On the other hand, caterpillars of *Declana floccosa*, *Ipana junctilinea* and *I. leptomera* are highly polyphagous, and will feed on plants in many different families.

Two species are of special concern from a conservation perspective. *Declana nigrosparsa* occurs only in the diminishing areas where its host-plants, small-leaved species of tree-daisy (*Olearia*) are common. Much rarer still, *Ipana perdita* is currently only known from a single tiny area of forest in the far north of Northland at Te Paki. Its host-plant is unknown, but may be the rare conifer *Halocarpus kirkii*.

Ngā pūrerehu pukoko me ō rātou whanaunga

I ahu mai te ingoa o ngā pūrerehu tāwhanawhana (nō te whānau Geometridae) i te āhua nekeneke 'tāwhana' a ā rātou tōtorongū, ka piko ō rātou tinana ki te porowhita haurua, ka whātoro torotika i te ahunga atu, whakawhitiwhiti atu ai. Ko ngā tāwhanawhana ko tētahi whānau tino rahi o ngā pūrerehu e kitea ana puta noa i te ao, he neke atu i te 23,000 ngā momo; he tata ki te 280 ngā momo e mōhiotia ana nō Aotearoa, ā, ko te nuinga o ērā he momo taketake ki tēnei whenua.

Ka whai wāhi ki tēnei puka tētahi rōpū paku o ngā tāwhanawhana o Aotearoa, otirā tērā pea koia te rōpū tino ātanga mō te rahi, mō ngā tauira o ngā parirau hoki. Ko ngā 'pūrerehu pukoko' me ō rātou whanaunga nō ngā puninga *Declana* me te *Ipana* he pūrerehu kaha, he waenga ki te nui te rahi, he tinana 'huruhuru' apiapi ō rātou. 15 ngā momo, e 4 o ērā kua whakaahuaria hei mea hou ki tēnei pukapuka. Ko ngā Pūrerehu Pukoko o Te Ika-a-Māui,

o Te Wai Pounamu hoki (arā, ko *Ipana atronivea* me *I. egregia*) ko ētahi o ngā pūrerehu tino rongonui o Aotearoa, me ō rātou tauira parirau waiwaiā he pango me te mā, ā, hei aha koa he kirihuna tino pai tērā kei ngā kahiwi kua kapi i te pukoko. Ka kitea hoki te Pūrerehu Pukoko o Te Wai Pounamu ki te $100 tāra o Aotearoa. He tōtorongū mīharo ā ēnei pūrerehu e rua, ka whakatau ai i ngā tākupu kua kapi i te puruheka o tō rātou tipu papa, o te *Pseudopanax* (arā o te whaupaku, o ōna whanaunga hoki). Ko tētahi atu momo ātanga ko te *Ipana glacialis*, arā ko te pūrerehu noho tairanga tūturu kotahi anake o tēnei rōpū. Ko ōna parirau o mua he kaha te tauira, he kehu me te mā, ā, ko ōna parirau o muri he karaka kitakita; ka rērere ngā toa i te ao, ā, he auau te tiwha i ngā rangi e whiti mai ana te rā i runga ake i te pae ngahere i ō rātou nōhanga o Te Waipounamu. Ko ētahi atu momo, pērā i a *Declana floccosa*, i a *I. leptomera*, ko ētahi o ō tātou pūrerehu ngahere tino noa, ā, ka kitea huri noa i te motu. Ka āta arohia a *Declana floccosa* i runga i te whānuitanga nui whakaharahara o ngā tauira o ōna parirau: he tata ki te hina taetahi ētahi, ā, kei ētahi atu he kōtingotingo, he kōiraira hiwa ō rātou, he rārangi rerekē, ā, i ētahi wā he tohu karaka kitakita e tino ōrite ana ki ngā pukoko.

Ka āta kōwhirihia e ētahi momo o te *Declana* me te *Ipana* tō rātou tipu papa; hei tauira, ka whāngai anake ngā tōtorongū a te *Ipana glacialis* ki ngā momo *Dracophyllum*, ā, ko ā *I. griseata* ka whāngai anake ki ngā momo mistletoe (nō te whānau Loranthaceae). Manohi anō, ka kai ngā tōtorongū a *Declana floccosa*, a *Ipana junctilinea*, a *I. leptomera* hoki i te whānuitanga o ngā kai, ā, ka kai rātou i ngā tipu nō ngā tini whānau.

He mea āwangawanga ngā momo e rua mai i te tirohanga whāomoomo. Ka kitea anake a *Declana nigrosparsa* i ngā wāhi kei reira ka tino kitea ōna tipu papa, arā ko ngā tini momo rau-paku o te tree-daisy, arā, o te *Olearia*, ā, e mimiti haere ana aua wāhi. He tino ongeonge ake a *Ipana perdita*, i tēnei wā kei te mōhiotia anake mai i tētahi wāhi tino riki o te ngahere i Te Hiku o te Ika, i Te Paki. Tē mōhiotia tōna tipu papa, engari tērā pea ko te rākau koroī ongeonge tērā, arā ko te monoao, ko *Halocarpus kirkii*.

CONTRIBUTORS

Contributor **John Dugdale** (1934–2020) was born in Christchurch and attended Christchurch Cathedral Grammar School and Canterbury University. He went straight on from there to join the Forest Research Institute (FRI) in Rotorua, but from 1967 until his retirement in 1995, his career was spent at the DSIR in Nelson and subsequently Auckland. John's entomological interests began at an early age, and he became a tireless and highly successful insect collector. He built up an impressive collection for FRI in the 1950s and '60s, not confined to forest insects. His major contribution, however, was to the New Zealand Arthropod Collection (NZAC). From 1967 onwards, on innumerable expeditions throughout the country, he gathered an immense amount of material. He did not confine his attentions to his favoured groups, but collected most insect orders. He collected from sea level to the alpine zone, and visited offshore islands including the Chathams, the Poor Knights and the Auckland Islands. Many of the remote localities he and his colleagues collected in have never since been visited by entomologists.

Apart from collecting adult insects, John reared many species, especially of Lepidoptera, and worked out the life histories and host-plant associations of a large number of taxa for the first time. He took a particular interest in the early stages of Lepidoptera and preserved these to form a remarkable voucher collection, often linked to reared adults. He had a rare level of understanding of larval classification and identification, one of the most difficult branches of Lepidoptera study.

John's collecting and rearing revealed a level of diversity in the New Zealand Lepidoptera unsuspected by earlier workers. It was through his desire to summarise that diversity and bring the classification of the fauna onto a modern footing that he achieved what is probably his landmark publication, the Annotated Catalogue of New Zealand Lepidoptera eventually published as *Fauna of New Zealand* volume 14 (1988).

John did not by any means confine his interests to Lepidoptera, and also became a noted expert on Cicadidae as well as on the extremely challenging fly family Tachinidae. He could converse with great knowledge and insight about many other insect groups, especially phytophagous groups such as longhorn beetles and weevils, many of which he had reared during his time at FRI and subsequently. And, importantly, he always sought to place the New Zealand fauna in a world context. His interest in the Australian, New Caledonian and wider Pacific faunas also resulted in significant publications.

In spite of the extraordinary energy and commitment he gave to entomology, John also found time to be a much-loved family man. One secret to his success, as described in family tributes at his funeral, was carrying a butterfly net on family outings to places of entomological interest. His beloved wife Kathy sadly died 13 years before him and her loss was deeply felt. In addition, John was an excellent, reliable and witty correspondent; his letters and e-mails are full of unusual insights and perspectives, and often exhibit a delightful and characteristic mildly grumpy stoicism.

John will live on very long in our memories, and indefinitely in his vast contribution to New Zealand science.

I whānau mai te kaituhi a **John Dugdale** (1934–2020) i Ōtautahi, ā, i kuraina ki Christchurch Cathedral Grammar School, ki Te Whare Wānanga o Waitaha anō hoki. I tōtika atu ia i reira ki te uru atu ki te Forest Research Institute (FRI) i Rotorua, heoi mai i te tau 1967 ki te wā i tāoki ia i te tau 1995, i te DSIR i Whakatū, kātahi i Tāmaki Makaurau tāna mahi. I tīmata te kaingākau a John ki te mātai pepeke i a ia e nohinohi ana, ā, ka tū mai ia hei kaikohi pepeke he pūtohe, he tino angitu hoki. Nāna te kohinga mīharo mō FRI i ngā tau 1950, 1960 hoki, ā, kāore i noho whāiti ki ngā pepeke ngahere anake. Heoi mō te New Zealand Arthropod Collection (NZAC) tāna tukunga tino nui. Mai i te tau 1967 āmua ake nei, i ngā haerenga maha puta noa i te motu, nāna te rahinga nui whakaharahara o te rawa i kohi. Kāore ia i whakawhāiti i tana aronga ki āna rōpū rorotu, engari kē i kohi ia i te nuinga o ngā pūtoi pepeke. Ka kohi ai ia mai i te pae moana tae noa atu ki te rohe tairanga, ā, ka toro atu ia ki ngā motu i waho atu i te tuawhenua, pērā i Rēkohu, i Aorangi, i Tawhiti-rahi, i Maungahuka hoki. He maha ngā wāhi mohoao kohikohi ai rātou ko ōna hoa mahi i reira, mai i tērā wā kāore anō kia torohia anō e ngā kaimātai pepeke.

Atu i te kohi i ngā pepeke kātua, i whakatipu a John i ngā tini momo, inarā i ngā momo o te Lepidoptera, ā, nāna i whiriwhiri ngā āhuatanga ora, ngā piringa ki ngā tipu papa hoki o ngā tini rōpū mō te wā kotahi. I āta aro ia ki ngā wāhanga tuatahi o te Lepidoptera, ā, nāna ērā i rokiroki kia tū mai hei kohinga mauhanga tūturu whakamīharo, he auau te tūhono atu ki ngā pakeke kua whakatipuria. Me uaua ka kite tana momo māramatanga ki te whakarōpū, ki te tautuhi hoki i ngā torongū, arā koinei tētahi o ngā peka tino uaua o te mātai i ngā Lepidoptera.

I whakakitea e te mahi kohi, e te mahi whakatipu a John te nui o te kanorau ki ngā Lepidoptera o Aotearoa kāore i whakaarohia e ngā kaimahi i mua i a ia. Nā tōna hiahia ki te whakarāpopoto i taua kanorau, ki te tō mai i te whakarōpūtanga o te kīrehe rā ki te tūnga o nāianei, i whakatutuki i a ia tana putanga tino rongonui pea, arā ko te Annotated Catalogue of New Zealand Lepidoptera, mea ake ka whakaputaina hei te *Fauna of New Zealand* puka 14 (1988).

Kāore a John i paku whakawhāiti i ōna aronga ki ngā Lepidoptera, ā, i tū mai hoki ia hei mātanga rongonui mō ngā Cicadidae, tae rawa atu hoki ki te whānau rango tino uaua rā ko te Tachinidae. He kaha ia ki te kōrerorero i runga i te mātauranga nui me te māramatanga ki ngā rōpū pepeke maha atu anō, inarā ko ngā rōpū tuaiwi-kore kai tipu pērā i te longhorn beetle, i te weevil hoki, he maha o ērā kua whakatipuria e ia i a ia e mahi ana i FRI, i muri ake hoki. Ā, he mea hira, i kaha tana whai kia whakatū i a ngāi kīrehe o Aotearoa ki te horopaki o te ao. I hua mai ngā putanga hira i tana aronga ki a ngāi kīrehe o Ahitereiria, o Niu Karetōnia, o Te Moana-nui-a-Kiwa whānui ake hoki.

Ahakoa te nui whakaharahara o te ngoi, o te manawanui i tukuna e John ki te mātai pepeke, i whai wā hoki ia kia noho hei tāne ā-whānau tino matapopore. Ko tētahi take huna i angitu ai ia, pērā i te whakaahuaranga ki ngā mihi a tōna whānau i tana tangi, ko te kawe i tētahi kupenga pūrerehua ki ngā haerenga ā-whānau ki ngā wāhi whaitake mō te mātai pepeke. E pōuri ana te mate a tāna hoa wahine 13 ngā tau i mua i a ia, ā, he nui te mamae i tana ngaronga atu. Waihoki, he kaituhi kairangatira, he whirinaki, he kōkō tātākī hoki ia; kua kī āna reta, āna īmēra hoki ki ngā māramatanga rerekē, ki ngā tirohanga whanokē, ā, he auau te whakaatu i te māia paku ārita he rekareka, he āhuatanga motuhake ōna.

Ka karioi mai te ora a John ki ō tātou maharatanga, ā, ka ora mō ake tonu atu i tana āwhina nui ki te pūtaiao o Aotearoa.

Contributor **Alan Emmerson** was born in the Waikato in 1947 and grew up in Hamilton where he attended Hamilton Boys' High School. In 1969 he completed a B.Sc. at Victoria University in Wellington where he studied Chemistry, Mathematics and majored in Zoology. He worked in Fisheries Research for a year, studying population dynamics of commercial species, then set off overseas intending to do post-graduate study in the UK. Life intervened, and he met and married his wife, Kathleen, finding himself in Aberdeen, Scotland. Unable to get work in his field, he took a job on an offshore drilling rig in 1972 when oil exploration in the North Sea was in its infancy. This led to a 30-year career that took him and his wife to Dubai for two years, then to Guatemala for four more before returning to the UK. By this time there were two sons added to the family. He worked as a Drilling Fluids ("Mud") engineer for seven years, then as both Drilling and Subsea Engineer for oil companies, finishing his professional life as a consultant. His interest in natural history was satisfied initially with bird watching, and work-related travel (to Bolivia, the Caribbean, Ivory Coast, Algeria and Greece, to name a few) provided him with a bird list to envy. In the late 80's, almost by chance, he discovered moths and began collecting while back working in the UK. He took early retirement and returned to NZ in 2002, where he began working on the moth collection at

NZAC as a volunteer under the direction of Robert Hoare. In 2017 he returned to the UK to enjoy his two grandchildren growing up. In 2019 a third grandchild was born in Paris.

I whānau mai te kaituhi, a **Alan Emmerson** i Waikato i te tau 1947, ā, i tipu ake ia i Kirikiriroa i reira ia i tae atu ki Te Kura Tamatāne o Kirikiriroa. I te tau 1969 i oti i a ia tana tohu paetahi pūtaiao i Te Herenga Waka i Te Whanganui-a-Tara, i reira ia i whai i te Mātai Matū, i te Pāngarau, ā, ko tana kaupapa matua ko te Mātai Kīrehe. I mahi ia i te Rangahau Ahunga Ika mō te kotahi tau, e rangahau ana i ngā āhuatanga o ngā taupori o ngā momo ahumoni, kātahi ka hoake ki tāwāhi me te takune kia whai i te mātauranga tohu paerua i Peretānia. Heoi i raweke mai te ao, ā, ka tūtaki ia i tana wahine, i a Kathleen, ka mārena i a ia, ā, ka tau ki Aberdeen, ki Kōtirana. Tē taea te whiwhi mahi i tana mātai ake, nā ka uru kē ia ki te mahi i tētahi hanganga ore ki tai i te tau 1972, i taua wā he mea hou te rapu hinu ki te North Sea. Nā konei te ara mahi e 30-tau te roa i tōia atu rāua ko tana wahine ki Dubai mō ngā tau e rua, kātahi ki Kuatamāra kia whā anō ngā tau, i mua i te hokinga atu ki Peretānia. Tae noa atu ki tērā wā e rua ngā tama kua tāpirihia ki te whānau. I mahi ia hei kaipūkaha Ore Wē ("Mud") mō ngā tau e whitu, kātahi hei Kaipūkaha ki Raro i te Pae Moana me te Ore mō ngā kamupene hinu, ā, he mātanga ia i te otinga o tana ao ngaio. I te tīmatanga i ea tana aronga ki te ao koiora i te mātakitaki manu, ā, i ana haerenga mō te mahi (ki Poriwia, ki te whaitua Karipina, ki Te Tai Rei, ki Aratiria, ki Kirihi, hei whakahua i ētahi ruarua noa iho) i riro i a ia te rārangi

manu kia pūhaehae mai te tangata. I te mutunga o ngā tau o te 80, he tata ki te tūpono noa, ka whai mōhio ia ki ngā pūrerehu, ā, ka tīmata ki te kohi i ērā i a ia e mahi ana i Peretānia. I tāoki tōmua ia, ā, ka hoki mai ki Aotearoa i te tau 2002, i konei tīmata ai ia ki te mahi ki te kohinga pūrerehu ki NZAC hei kaimahi tūao ki raro i te tohutohu a Robert Hoare. I te tau 2017 i hoki atu ia ki Peretānia kia pārekareka ai i te tipuranga ake o ana mokopuna e rua. I te tau 2019 i whānau mai tētahi mokopuna tuatoru i Parī.

Contributor **Robert Hoare** was born in Winchester in the south of England in 1967. He was educated at Eton, and then attended Oxford University where he completed a degree in Classics (Latin and Greek literature and philosophy). He followed this, logically enough, with a degree in Biological Sciences at Exeter University. An early interest in butterflies was fostered by his father Ian, who painstakingly reared many species through from egg to adult. The acquisition of a Robinson pattern mercury vapour moth trap at a formative point in life transformed him instantly into a mothman, after which he progressed inexorably towards the study of smaller and smaller moths, culminating in his PhD thesis on the Nepticulidae of Australia at the Australian National University in Canberra (nepticulids are the smallest moths of all). Since joining Landcare Research in 1998, Robert has concentrated his research efforts on slightly less tiny moths, especially those of the family Xyloryctidae and Noctuidae, but retains a broad interest in all Lepidoptera, particularly leaf-miners and detritus-feeders. He is currently engaged in a study of the New Zealand Dryadaulidae. From 2000 to 2010 he lectured annually on systematic entomology at the University of Auckland, and he has often given talks to primary school children about moths and other insects. In 2014, he produced a popular guide to New Zealand moths and butterflies through New Holland Publishers, with photographs of living moths by Olivier Ball. He aims to foster a wider interest in moths throughout New Zealand so that we can learn much more about these neglected creatures, so many of which are endemic to this country.

I whānau mai te kaituhi a **Robert Hoare** i Winchester i te tonga o Ingarangi i te tau 1967. I whakaakongia ia i Eton, kātahi ka tae atu ki Oxford University, i reira oti ai i a ia tētahi tohu paetahi ki te Whakaakoranga Puāwaitanga (te mātākōrero me te tautake Rātini me te Kariki). Nā ka whāia tēnei e te tohu paetahi ki te Pūtaiao Koiora ki Exeter University. I poipoia tana aronga tōmua ki ngā pūrerehua e tōna pāpā, e Ian, nāna i āta whakatipu i ngā tini momo mai i te hua ki te kātua. I whakahuria wawetia ia ki te tāne aro pūrerehu e te rironga mai o tētahi tawhiti pūrerehu tākohu konuoi he tauira Robinson i tētahi pūwā huringa i tōna ao, i muri i tērā tē taea te pēhea mō tana ahunga atu ki te mātai i ngā pūrerehu, ka paku ake kātahi ka paku ake anō, ā, ko te otinga atu ko tana tuhinga whakapae Tohu Kairangi mō ngā Nepticulidae o Ahitereiria i te Australian National University i Canberra (ko ngā nepticulid ko ngā pūrerehu tino paku o ngā pūrerehu katoa). Mai i tana urunga mai ki Manaaki Whenua i te tau 1998, kua whakawhāiti a Robert i āna mahi rangahau ki ngā pūrerehu kāore i te pērā rawa te riki, inarā ko ērā nō te whānau Xyloryctidae me te Noctuidae, engari he aronga whānui tonu tōna ki ngā Lepidoptera katoa, inarā ki ngā mea kai rau, ki ngā mea kai toenga whakapopo hoki. I tēnei wā e mahi ana ia i tētahi rangahau i ngā Dryadaulidae o Aotearoa. Mai i te tau 2000 ki te tau 2010 i whakaako ia i ia tau mō te mātai pepeke pūnahanaha i Waipapa Taumata Rau, ā, he auau tana kauhau atu ki ngā tamariki kura tuatahi mō ngā pūrerehu, mō ērā atu pepeke anō hoki. I te tau 2014, i whakaputaina e ia tētahi pukapuka aratohu mō ngā pūrerehu me ngā pūrerehua o Aotearoa nā New Holland Publishers, me ngā whakaahua o ngā pūrerehu ora nā Olivier Ball. E whai ana ia ki te whakatītina i te aronga whānui ake ki ngā pūrerehu puta noa i Aotearoa kia nui ake ai tā tātou ako e pā ana ki ēnei mea e whakangongotia ana, te maha hoki o ērā e taketake ana ki tēnei whenua.

Māori translation by Melanie Nelson

ABSTRACT

The endemic New Zealand genus *Declana* as previously circumscribed (Lepidoptera: Geometridae: Ennominae) is shown to consist of two genera, *Declana* Walker and *Ipana* Walker that together form a definable group. Recent molecular phylogenies tentatively place this group as sister to the newly expanded tribe Diptychini. We informally refer to this isolated group as the 'declanoids' and leave it unplaced to tribe pending further study. The genera can be distinguished from each other morphologically on adult and larval characters. *Declana* (type species *D. floccosa* Walker, 1858) includes the following five species: *D. floccosa*, with *Argua scabra* Walker, 1863 and *Declana callista* Salmon, 1946 as established synonyms, *D. nigrosparsa* Butler 1877 **reinstated species** (removed from synonymy with *D. floccosa*), with *D. toreuta* Meyrick, 1929 as a **new synonym**, *D. niveata* Butler, 1879, *D. foxii* **new species**, and *D. lupa* **new species**. *Ipana* (type species *I. leptomera* Walker, 1858) includes the following ten species: *I. atronivea* (Walker, 1865) **new combination**, with an established synonym, *?Chlenias manxifera* Fereday 1880, *I. egregia* (Felder & Rogenhofer, 1875) **new combination**, *I. griseata* (Hudson, 1898) **new combination**, *I. feredayi* (Butler, 1877) **new combination**, with an established synonym, *Declana sinuosa* Philpott, 1915, *I. glacialis* (Hudson, 1903) **new combination**, *I. halocarpi* **new species**, *I. perdita* **new species**, *I. hermione* (Hudson, 1898) **new combination**, *I. junctilinea* (Walker, 1865) **new combination**, with an established synonym, *Chlenias verrucosa* Felder & Rogenhofer, 1875, and *I. leptomera* **reinstated combination**, with an established synonym, *Amphitape crassitibia* Felder & Rogenhofer, 1875. Keys to species based on late instar larvae (morphology, colour patterns), adult external characters, male and female genitalia are presented. Some terminology is defined, and habitus, aspects of male and female genitalia, and available last instar larvae are illustrated. Declanoid larval, adult external and genitalic characters are briefly reviewed and compared with other southern hemisphere Ennominae genera formerly placed in Nacophorini (mostly now in Diptychini, Drepanogynini and Odontoperini), based on a review of the literature.

The larvae and hostplants of most species are known, but not so for three species (*Declana foxii*, *D. lupa* and *Ipana perdita*). Hostplant ranges run the gamut from polyphagy (*Declana floccosa*, *Ipana junctilinea, I. leptomera*) through oligophagy on a single plant family (*Declana niveata* on Malvaceae, *Ipana atronivea* and *I. egregia* on Araliaceae, *I. feredayi* on Nothofagaceae, *I. griseata* on Loranthaceae, *I. halocarpi* on Podocarpaceae), to monophagy on a single plant genus (*Declana nigrosparsa* on *Olearia*, *Ipana glacialis* on *Dracophyllum*). While its native hosts are in Podocarpaceae, *Ipana hermione* has adapted to exotic conifers in Cupressaceae and Pinaceae.

Eight species are common to both North and South Islands. The North Island has 13 species, with five (*D. foxii, D lupa, I. atronivea, I. halocarpi, I. perdita*) restricted to it. The South Island has 12 species with two (*I. egregia, I. glacialis*) restricted to it. Species with restricted distributions are *D. nigrosparsa* (on divaricating *Olearia*), both islands; *D. foxii* and *D. lupa*, North Is. localities in TK / southern WN/WA, and AK respectively (hosts unknown); *I. glacialis*, subalpine in the South Is.; *I halocarpi*, North Is., TO / western GB; *I. perdita*, Te Paki, northernmost ND.

Conservation status is 'Not Threatened' for 11 species. At least two species are threatened, i.e. *D. nigrosparsa* (host communities threatened by increasingly intensified farming practices and supreme ease of shrubland destruction) and *I. perdita* (host communities surrounded by extensive dry flammable shrublands and only known population restricted to a small area in northernmost ND). At present, *Declana foxii* and *D. lupa* are data poor for hosts and distribution, and their status needs assessing by further survey.

http://www.zoobank.org/urn:lsid:zoobank.org:pub:FB5A74F9-8616-4345-8108-E3FC1CBB67AA

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CHECKLIST OF TAXA

CONTENTS

PREFACE

This revision of a striking endemic moth group was begun 'in the depths of last century' (as its original author JSD put it), in 1965. Other tasks and priorities, not to mention a long illustrious entomological career, intervened, and John never published this significant contribution. The original typed manuscript was rediscovered amongst old files in NZAC around 2012 by RJBH and AWE. AWE then persuaded John to collaborate on resurrecting the work, since two new species had recently been discovered (here described as *Declana lupa* and *Ipana perdita*), and before John could resist, he had already retyped the entire (substantial) manuscript into Word! There followed a long and productive period of work to bring the revision up to date and align it with the style and scope of the *Fauna of New Zealand* series. AWE was based in Auckland and John in Nelson, so progress was intermittent, but during John's visits to NZAC, it surged ahead and, from 2012 to 2017, gradually took shape. AWE made most of the slide-mounts of wings and genitalia, edited the evolving manuscript and made lists of queries for John to resolve; John wrote descriptions, kept abreast of current Geometridae literature, and continually reviewed his interpretations of morphology and ideas about relationships. A 'watershed moment' came with John's recognition that two genera should really be recognised in this group rather than just the traditional *Declana*, and for a while the second genus stood in the manuscript as *Detunda* (type species *atronivea* Walker). John was later horrified to realise that *Ipana* (type species *leptomera* Walker), a name shared with a brand of unusually flavoured toothpaste heavily marketed in the 1950s, had priority over the more homely *Detunda* (see Appendix C)!

AWE's move to England in 2017 made collaboration more difficult and progress slowed after this. RJBH stepped in at this point in an editorial capacity, and John patiently worked through his many comments on the manuscript. AWE also continued to assist with further comments and editing. When John passed away in 2020, the revision was in a very advanced state of preparation, and RJBH undertook to bring it to completion. Because his input has been largely editorial, and he was not involved in drawing up the original species descriptions, RJBH is not an author on the new species described herein.

ACKNOWLEDGMENTS

The authors are grateful to Graham Fairless and Olivier Ball for the donation of images of larval *Declana floccosa* and *Ipana griseata* respectively, and especially to Birgit Rhode for her patience despite a wicked workload for her layered images and plate composition of adult habitus, genitalia and larvae. Following Birgit's retirement in 2021,

Leanne Elder took some additional images and further edited the maps and plates; we thank her for her skilful contribution and forbearance under sometimes difficult circumstances (imaging systems proved temperamental at first!). We are also very grateful for ready technical help in NZAC by the ever astute and well-informed Leonie Clunie, also now retired. We thank George Gibbs for allowing us to reproduce his fine photos of adult *D. floccosa* and *I. feredayi* at rest, and for putting us in contact with David Bartle (England) for the photo of *Ipana glacialis* trapped by the sundew *Drosera arcturi*. George also contributed the important records of *Declana foxii* within cooee of Wellington, and kindly donated the specimens to NZAC. AWE is particularly grateful for help by Judith Thompson, whose permission to light trap at her property on Lone Kauri Road led to the rediscovery of *D. lupa*. Hossein Rajaei kindly provided an image that showed clearly the presence of cristate hairs on the membranous ridges either side of the juxta base.

We warmly acknowledge the two late great Taranaki entomology stalwarts Kenneth Fox (Manaia), and Peter Peckham ("Harbledown", New Plymouth), longtime friends and collecting companions of JSD here and abroad. We are grateful for information on specimens in the private collections of: Eric Edwards (Wellington), Chris and Olwyn Green (Auckland: *Declana lupa* n.sp.), Neville Hudson (Auckland), Brian Lyford (Queenstown: *D. nigrosparsa*), and Brian Patrick (Christchurch). We thank curators of New Zealand public museums and universities who allowed us to examine collections in their care: John Early and Rosemary Gilbert (AMNZ), the late John Bain (FRNZ), Ricardo Palma and Phil Sirvid successively (MONZ), Peter Johns and Cor Vink (CMNZ), John Marris (LUNZ), and Emma Burns (OMNZ: *Declana nigrosparsa*). Marianne Horak and Ted Edwards allowed JSD to browse the extensive ANIC collection in CSIRO, Canberra, A.C.T. and Lawrence Mound, then Keeper of Entomology NHMUK, did the same for that collection in 1980-81. Catherine Byrne (then Young), at University of Tasmania and later at TMAG, Hobart, was very helpful also; her extensive papers on Australian Ennominae enabled us to confirm the lack of close relationship of declanoids with their presumed Australian counterparts. We sincerely thank Catherine and an anonymous reviewer for their crucially important comments on the manuscript, which was much improved and saved from embarrassing omissions by their intervention!

We cannot close without acknowledging the debt we owe to the former Forest Biology Survey of the NZ Forest Research Institute (now SCION) then under the leadership of Dr T.C.R. White (now of Adelaide, South Australia), and based on a Canadian Forest Service model. We also acknowledge with gratitude the technical help of Bill Faulds (SCION, Rotorua) over 1956 to 1967 when JSD was employed there as a lepidopterist. The Forest Biology Observers were sampling New Zealand 'exotic' plantation forests administered by the then N.Z. Forest Service and NZ Forest Products Ltd for defoliating caterpillars (then thought of as potential pests); as many defoliating species were known to be present in 'native' forests, these were also sampled where convenient. Host records generated by the Foest Biology Observers were collated by Dr John Bain (2009). We are mindful of the enthusiasm this addition instilled and the collections it generated. The fate of the original information on Hollerith (punch) cards—to be riddled by paper-eating insects—is one of life's many Ozymandian disasters.

INTRODUCTION

The 15 species of declanoids are distinctive in the New Zealand Geometridae because of their relatively robust bodies and more or less oblong wings that make them look like refined owlets (Noctuidae s.s.), and the characteristic appearance of most of the species, the majority of which can be identified on colour pattern (Fig. 1a–15d). *Ipana egregia*, the so-called zebra moth, with a very distinctive forewing pattern (Fig. 7a, b), is featured on our $100 banknote, while its close relative (*I. atronivea,* the lichen moth) also with a distinctive forewing pattern (Fig. 6a, b), is on a postage stamp ca 1970 (and erroneously called *Declana egregia* in one catalogue). *Declana floccosa* is one of two common polyphagous arboreal forest geometrids (alongside *Pseudocoremia suavis* Butler, 1879 (e.g., Kay 1982)). It is ubiquitous in suburbia, shrublands, indigenous forests, and especially plantations of exotic conifer species. The forewing colour pattern is confusingly variable (Fig. 1a–j) and there are two synonyms.

Larvae of all species feed on shrubs and trees. Many have grotesquely camouflaged larvae (Fig. L6a), often with disguises finely attuned to parts of the host. See, e.g., the notes on *Ipana atronivea, I. egregia, I. feredayi* and *I. griseata* for unusually crafty host-specific crypsis. Hosts of the declanoids cover a large number of woody plants (Appendices A, B) and each species has its own host spectrum, ranging from polyphagous (hosts unrelated,

including conifers and dicot angiosperms) (*Declana floccosa, Ipana junctilinea* and *I. leptomera*) to oligophagous on one plant family (*D. niveata,* Malvaceae; *I. feredayi,* Nothofagaceae; *I. hermione,* Podocarpaceae; *I. griseata,* Loranthaceae) to oligophagous below the plant family level (*I. atronivea*, *I. egregia*, on *Pseudopanax* and *Raukaua* in Araliaceae), to monophagous on a single plant genus (*D. nigrosparsa, Olearia*; *I. glacialis, Dracophyllum; I. halocarpi*, *Halocarpus*). Hosts of *D. foxii, D. lupa,* and *I. perdita* are unknown.

Declana niveata is a perceptive botanist; it has recently been found on salt-marsh ribbonwood, *Plagianthus divaricatus*, a small-leaved, fastigiate, densely branched estuarine malvaceous shrub vastly different in growth habit from its other hosts, which are broad-leaved forest trees (*Plagianthus regius* subsp. *regius, Hoheria* spp.). The record from *Rubus australis* by Philpott (1917: 214) quoted by Hudson (1928) has not been sustained. *I. hermione* has been regularly found on exotic conifers planted near natural communities of Podocarpaceae. In suburbia, the polyphagous *D. floccosa* and *I. leptomera* predominate, particularly as kanuka, manuka, Australian eucalypts and Holarctic conifers are popular in garden and municipal plantings.

Historical notes. The first species to be described was *Declana floccosa,* by Francis Walker (1858) in Part XV of his monumental but cumbersomely titled *List of the specimens of Lepidopterous insects in the collections of the British Museum* (now The Natural History Museum, London, here referred to as NHMUK). Specimens were collected by Colonel D. Bolton, probably at his residence in Emily Street, now in central Auckland. As *D. floccosa* is a variably patterned moth, Walker described it again as *Argua scabra* in 1863 from a Nelson specimen collected by T.R. Oxley but recorded as from Auckland (see the section on this labelling mishap under 'Conventions' below).

The second species to be named was *Ipana leptomera*, again described by Francis Walker in 1858, 11 pages further on from *D. floccosa*. At this stage, *Declana* and *Ipana* were placed in Noctuidae. Meyrick (1917) formally synonymised *Ipana* with *Declana*. *Amphitape crassitibia* was described in 1875 by the Austrian lepidopterists Dr Cajetan Felder and A.F. Rogenhofer based on material supplied by T.R. Oxley of Nelson (see below) to the Austrian world scientific expedition (*Reise der Österreichischen Fregatte Novara um die Erde*). That specific name refers to the male's thickened hind-tibia which houses a scent tuft. Also collected by Oxley from Nelson, was the type of *(?)Chlenias egregia,* named and figured by Felder and Rogenhofer in the same vast, hand-coloured *Novara* tome.

From Wellington's Hutt Valley in 1850, Major Parry sent a striking black and white declanoid to NHMUK, which Walker described as *Detunda atronivea* in 1865. In 1880, the Christchurch lawyer/lepidopterist, R.W. Fereday described *(?)Chlenias manxifera* collected by W.L. Travers in Wellington; Meyrick (1884) synonymised it with *atronivea*. Fereday's name refers to the three-legged Manx emblem, which the large black discal patch on the forewing resembles.

In 1863, Walker in NHMUK had received material from Thomas Jefferson Randolph Oxley in Nelson (Dugdale 1988). Oxley's specimens were collected at Nelson in 1863 and were described by Walker in 1863 and 1865, but labelled as originating from Auckland. They included *Politeia junctilinea* (re-described in 1875 by Felder and Rogenhofer as *Chlenias verrucosa*). See under 'Methods and Conventions' for further discussion of the Oxley collection. The species described by Felder and Rogenhofer, who also received Oxley material in Vienna, are part of the "Novara" Lepidoptera collection, now in NHMUK.

In 1877 A.G. Butler at NHMUK described a declanoid (*Declana feredayi*) sent by F.W. Hutton (Otago Museum, Dunedin). It had been sent to Hutton from Castle Hill MC and was possibly collected either by J.D. Enys or R.W. Fereday. Later Hutton sent his own collections for identification, from which Butler described *Declana nigrosparsa* and *D. niveata* in 1879. After that, Edward Meyrick revised the described fauna, synonymising the genera *Ipana*, *Argua, Detunda, Politeia* and *Amphitape* with *Declana,* and the species *Declana nigrosparsa* with *floccosa*, *manxifera* with *atronivea,* Felder and Rogenhofer's *crassitibia* with *leptomera,* and their *verrucosa* with *junctilinea* (Meyrick 1884). Hudson described *griseata* and *hermione* in 1898, and *glacialis* in 1903 in *Declana*. Meyrick (1917) revised the Geometridae again as Notodontina in part, following Hudson in placing all the declanoids described to that date in *Declana.* Hudson may well have done this on Meyrick's advice in his book "*New Zealand Moths and Butterflies*" (Hudson 1898), as by then they were in regular communication (Dugdale 1988: 10). Meyrick, at heart a microlepidopterist, retained an interest in Macrolepidoptera of New Zealand, as

shown by his willingness at age 75 to describe *Declana toreuta* and ten other macrolepidoptera, nine years before his death in 1938 (Meyrick 1929).

The spirit of Victorian lepidopterology was still alive in 1946, when the colourful *Declana callista* was described by J.T. Salmon based on a specimen he collected in "Gertrude's Cirque" [sic] FD (the nearby Homer Tunnel and the road to it were being constructed at the time). Dugdale (1988) synonymised the taxon with *D. floccosa* as extensive rearing and genitalic examination showed that the *callista* colour pattern (Fig. 1g) was present in many *D. floccosa* populations and the genitalia of those specimens did not differ from those of *floccosa*.

B.H. Patrick teased out the herbivorous Lepidoptera fauna of small-leaved "grey shrubland" *Olearia* spp. (Asteraceae) and considered the grey-tinted *Declana* he reared from these shrubs as a possible new species (Patrick 2000); we show that this is *Declana nigrosparsa* Butler (Fig. 2a), sunk by Meyrick in synonymy with *D. floccosa* for 140 years and now seen to be genitalically and externally distinct from that species. Butler's *nigrosparsa* and Meyrick's (1929) *toreuta* represent exposed grey shrubland (grey) and high-rainfall forest (white) colour forms of a single species. At the *toreuta* type locality (Arthur's Pass NC) adults of both colour forms were reared from the same hosts by Mr Burrow (Meyrick 1929). Confusingly, populations of *D. floccosa* show a similar preponderance of grey adults in grey shrublands.

The declanoids *Ipana hermione, I. halocarpi* and *I. perdita* form a morphologically close-knit trio. *Ipana hermione,* described from Khandallah, Wellington by Hudson (1898), is known throughout New Zealand south of the Aupouri Peninsula ND on forest podocarps and can invade neighbouring exotic Cupressaceae and Pinaceae stands. On the Volcanic Plateau TO, it is locally sympatric with *halocarpi* which is largely restricted to *Halocarpus* spp., but which can invade contiguous *Phyllocladus alpinus*. Male specimens of *I. perdita* were collected by RJBH in 2007 at Te Paki (northern Aupouri Peninsula) ND close to an isolated *Halocarpus kirkii* stand (Fig. T12, Te Paki forest and shrubland) but neither larvae nor adults of *I. hermione* were found.

Note on declanoid names. The generic names used by Francis Walker, an early lepidopterist at NHMUK, have often been deemed 'clumsy' and assumed to be nonsensical. The source of many of Walker's names was discovered by RJBH in Claudius Ptolemy's 'Geography' as indexed online by B. Thayer (Thayer [2020]; Hoare 2010: 12). *Detunda* Walker is a Ptolemaic name; *Argua*, *Declana, Politeia* and *Ipana* are not in Thayer's index (*op. cit*.), but conform to the style of many Ptolemaic names used by Walker; e.g., Deciana is listed and might have been misread by Walker as 'Declana'. *Atossa* is a classic Meyrick name, mother of Xerxes and wife of Darius.

Specific names (including those newly coined here) are usually descriptive (e.g., *atronivea, floccosa*) or refer to the collector or sender (e.g., *feredayi*) or the hostplant (e.g., *halocarpi*), or classical characters e.g., *Hermione*, Leontes' wife, and their reclaimed daughter *Perdita* in "A Winter's Tale" (Shakespeare 1623). One name might cause confusion in today's world: *egregia,* whose English equivalent 'egregious' today usually implies contempt (as in *'the egregious Jones'* which means '*that notorious ass Jones'* (Fowler 1950)) but in its original Latin meaning, as used by Felder and Rogenhofer in 1875, it is a term of approbation: 'eminent' or 'exceptional' ('*e grege*, out of the herd' (Fowler 1950)).

MATERIAL AND CONVENTIONS

Collection. Adults of all species bar *I. glacialis* have been collected at light, both pressure lamp (fuelled either by white spirit or kerosene) and 125W mercury vapour bulb being equally effective. With practice, most adults can be sexed in the field on antennal and abdomen appearance; and species can be distinguished on colour pattern. *Ipana glacialis* is the only diurnal species and the males are recognisable by their fast, upwind, rolling flight as they hawk for female calling (sex) pheromones; females are rarely encountered but may be dislodged from their hosts (species of *Dracophyllum,* inaka or turpentine scrub). Adults of the nocturnal species spend the day on trunks, branches, or clasping twigs with their wings; in some species, the mesoscutellar crest resembles the stump of a broken twiglet.

Larvae can be beaten from host trees and shrubs onto a beating tray (some entomologists use an upturned umbrella) and taken for subsequent rearing and/or identification. Results of beating at night are more indicative of presence than daytime beating, particularly for *I. glacialis,* larvae of which hide by day in the copious host litter. Once collected, all live material including larvae needs to be kept cool and shaded.

Rearing. Larvae (see key) are specifically distinct; the early instars are of two colour forms: either pink-striped, or dark dorsally and ventrally, separated by a pale or white lateral stripe. Later instars are cryptically patterned and either semi-loopers with fully functional prolegs on A5 (known *Declana* spp.) or imitate dead twigs that are either broken off apically (most *Ipana* spp.) or diseased, as well as fruit or bird-droppings (*I. atronivea, I. egregia, I. griseata*). All are readily reared singly but a ready source of fresh hostplant is necessary. For *D. foxii, D. lupa*, and *I. perdita,* larvae of which are unknown, there is exciting new territory to explore.

Rearing is most successful when the field collection has been kept cool and shaded, the rearing container is well aerated and moisture is not allowed to condense on the foliage or container walls. Clear-walled plastic containers with plastic lids that can be easily perforated work well. For many years at FRNZ (now SCION), the Forest Biology Survey, operating in the pre-plastic era, used lidded drinking glasses with a phosphor bronze meshed area on the lid, and about a third filled with damp sand on which the larva and a spray of host foliage were placed. The damp sand also provided a suitable pupation site. Nowadays paper towels are a useful replacement not least because they indicate by staining the incipient invasion of pathogenic organisms.

Specimen preparation. Adults are pinned and the wings spread as described by Hoare (2010: 13), and Common (1990: 471–481).

For morphological studies, there are two common approaches: 1) maceration / descaling / staining most often of dry specimens, and 2) dissection after tissue fixation by plunging the deep-frozen moth into near boiling water. Both Hoare (*loc. cit*.) and Common (*loc. cit*.) describe the first, and anatomically vital, technique. The second type of preparation is useful for examination of mesodermal structures (innervation, musculature, and genital tract conformation) without their loss incurred by maceration. Addition of "Dettol" antiseptic fluid stains the Malpighian tubules green, affording a visible anatomical reference point, if needed.

Larvae for preservation may be killed in near-boiling water (instantaneous) leaving several minutes for the body to extend as the tissues fix and placing in cold 70% ethanol for further fixing in an extended state so that intersegmental features are exposed.

Wing venation preparation follows the method described by Common (1990) but care is needed as some pigmented scales resist bleaching and prolonged bleaching can lead to distortion of the wing membrane. Scale removal can be done (with the utmost delicacy) with a very fine brush, snipe (thumb) feather, and/or using the head of a nylon-headed 38 mm entomological pin.

Identification. Adult specimens in good condition can be identified to species by reference to the colour figures (Fig. 1a–15d).

Larvae can be identified as declanoids by recourse to the key to Ennominae genera in Dugdale (1961) and identified to species using the key provided in this paper. Colour photographs (Fig. L1a, b; L6a; L8a–d) and line drawings (Fig. L1c–f; L6b; L9a, b; L10; L13; L15a–d) illustrate some features of larval appearance and morphology.

Specimen Repositories and abbreviations. In the course of this revision the institutional collections of New Zealand have been visited and label data of specimens checked. Some type specimens of declanoids are held in New Zealand institutions (AMNZ, MONZ, CMNZ and NZAC). Most are held in the Natural History Museum, London. These were examined and photographed in 1980–1981 by JSD; his notes on all types are in Volumes V and VII of seven large notebooks held in NZAC in two boxfiles. Photographic slides of most type specimens of New Zealand Lepidoptera, including declanoids, are also held in NZAC, in black ring-binders with pages of plastic pockets for the slides.

The collections consulted are:

AMNZ: Auckland War Memorial Museum, Auckland;
BPNZ: Brian Patrick Collection, Christchurch;
CMNZ: Canterbury Museum, Christchurch;

FRNZ: SCION (formerly Forest Research Institute), Rotorua;
LUNZ: Lincoln University, Lincoln;
MONZ: Museum of New Zealand (Te Papa Tongarewa), Wellington;
NHMUK: The Natural History Museum, London (formerly BMNH);
NZAC: New Zealand Arthropod Collection, Auckland;
OMNZ: Otago Museum, Dunedin.

In addition, for some species, the private collections of AWE (Essex, England), Eric Edwards (Wellington), George Gibbs (Wellington), Chris Green (Auckland), Neville Hudson (Auckland), and Brian Lyford (Queenstown) have been accessed. (See Acknowledgments.)

The G.V. Hudson Collection. The Hudson Collection in MONZ, including Hudson type specimens, was unavailable for study during most of the preparation of this revision, but is now available (G.W. Gibbs pers. comm.).

All Hudson specimen labels are characteristically small rectangular white paper labels with the species number and specimen letter written in lower case, e.g., '317e', in pencil. Details of Hudson Collection specimens are recorded in the Hudson Register under the species number: e.g., 317 is '*Declana glacialis'* and the locality records 'b', 'c', 'd', 'e' and 'f' refer to where Hudson collected it. The locality information often includes biological information such as host or observations, e.g. "flying wildly in the hot sun".

Labels on specimens in NHMUK. One important early collection sent in 1863 by T.R. Oxley to NHMUK, and registered there as "63/73", had its provenance wrongly recorded as "Auckland", a North Island locality at 36.51°S rather than "Nelson" in the South Island at 41.18°S (Dugdale 1988). The declanoids affected are the type specimens or series of *Argua scabra* (a synonym of *Declana floccosa*) and *Politeia junctilinea*, both described by Walker as from Auckland. The true provenance of Oxley's collection was established by Kevin J. Tuck's discovery in NHMUK of a companion collection, clearly labelled "Nelson 1863, Oxley", which he had sent to his friend Henry Stainton in London at the same time (Dugdale 1988). Another truly Auckland-based collection was recorded as "54/4" and sent to London by Lt.-Col. D. Bolton who lived while in New Zealand at Emily St, Auckland.

Meyrick references (dates in parentheses). For four years (1882–1885) the polymath G.M. Thomson published the *New Zealand Journal of Science* (NZJS) (Dunedin) (Fleming 1987: 32). His aim was to speed up dissemination of scientific information within New Zealand by publishing summaries of manuscripts about to be published in the *Transactions and Proceedings of the New Zealand Institute* the following year. Thus for Meyrick's synonymy of *Argua* with *Declana*, the NZJS pre-published this synonymy in 1883. The New Zealand Institute published the full paper in its *Transactions and Proceedings* for 1884 (Dugdale 1988: 18). Relevant NZJS (Dunedin) entries in this study are annotated, e.g., "(Meyrick, 1883, p. 530 abstract)". The journal died for lack of paying patronage in 1885.

Species concept and order. The species concept employed here is morphological, with consistent definable differences in morphology being regarded as indicative of reproductive isolation (through non-recognition of the other sex as an appropriate mate) as in the Biological Species Concept. The aim is to provide characters that can be tested for congruence against a molecular phylogeny should one be derived. The taxa (genera and species) are arranged alphabetically, except for the closely similar sister-species *Declana foxii* and *D. lupa* and the following two species groups recognised within *Ipana*: the *I. atronivea* group (*atronivea, egregia, griseata*) and the *I. hermione* group (*halocarpi, hermione, perdita*); these groups are kept together in the text and illustrations.

Hostplant names and records. Botanical names are taken from the online database Ngā Tipu Aotearoa and some Māori names from Allan (1961). The term 'hostplant' is used in the sense of Burkhardt *et al.* (2014), i.e., the plant or plants on which a species completes its development. The hostplants' full botanical names with authorities are listed in Appendix A (by plant family) with references to the sources of the declanoid species records on each host, and biotic status of the plants (i.e., endemic, indigenous or man-adventive). Appendix B summarises the known host-plant spectrum for each declanoid species. For *D. floccosa,* 63 host species are endemic, one is indigenous and 48 are man-adventive; there are 27 plant families involved. Most declanoid species are restricted to

hosts in one family. Many of these are Forest Biology Survey records compiled by Bain (2009) and are searchable on the Manaaki Whenua–Landcare Research database PlantSyNZ™ (https://plant-synz.landcareresearch.co.nz); others are from specimen labels, especially from specimens in FRNZ.

MORPHOLOGY

Anatomical terminology. Terms used here are largely as in Kristensen (2003) for body structures including the labial palpi, antennae, forewing venation, musculated parts of the male genital capsule, female genital structures, and larval structures including chaetotaxy. As terminology changes with re-interpretation, some later-used terms are referenced, e.g., larval seta L4 (Young 2008b, p. 46 and fig. 201). Significant character-states of structures used in diagnoses are indicated below.

1. Labial palpus structure (Fig. 15e). Declanoid species have the labial palpi *geniculate* (elbowed), with the apical segment decumbent or horizontal, slender, smooth-scaled and subclavate, as described by Rindge (1983) for his Group 4 Nacophorini.

2. Antennal structures. Declanoids have two types of antennal flagellomere structures: pectinate or filiform. Pectinate flagellomeres have the rami basal and their sensory area ventral; filiform flagellomeres lack rami and the sensory area is lateral and ventral (Rindge 1983). (The term 'filiform' is also used in larvae (q.v.) for hair-like fine setae.)

3. Forewing venation (Fig. 1k, l; 4c; 6c; 9c; 14f; 15f). Vein terminology is that adopted by Kristensen (2003). Vein names in parentheses refer to non-tubular veins e.g. vein (*M*) in the discal cell. The character states of veins Sc and R subapically in relation to each other (free, apposed or fused), and the number of veins (2 or 3) arising on Rs are, along with wing shape, of diagnostic importance in New Zealand.

4. The hindwing base subalare sclerite (Fig. 15h). *Ipana leptomera* has a well-hidden pair of scent-scale tufts arising on the underside of this sclerite and the long fine scales are folded in the gap between the base of the hindlegs and the overshadowing abdominal segments A1–3. It was not seen on other species. We can find no mention of a comparable structure in the Australian or southern South American references.

5. The pregenital abdomen (segments A1–A7). Structure of the A2 sternite differs between *Declana* and *Ipana* with the sternite being quadrangular in *Declana* and with broad lateral wings shielding the cavi in *Ipana*. The latter condition is present in Australian *Paralaea* Guest (McQuillan *et al.* 2001) but not commented on. *Ipana perdita* males have persistent, acid fuchsin-staining scale tufts on A4 that we interpret as coremata.

6. Male genitalia (Fig. 1n–15k). Major terms such as uncus, tegumen, gnathos, vinculum, saccus are used as in Kristensen (2003). Interpretation of the complex lepidopteran phallus described by Oiticica (1946), in a paper unfortunately overlooked by Kristensen, is not used here but is explained and illustrated by Fanger and Naumann (1998). Kristensen (2003) advised that the intromittent male organ be called the *phallus;* we retain *aedeagus* for that sclerotised part of the phallus which houses the uneverted vesica (the truly intromittent part) with its cornuti and of course, the gonopore. We use the more neutral term 'phallobase' for the bulbus ejaculatorius (i.e. the membranous 'hood' enclosing the ductus ejaculatorius) of Oiticica (1946). Some terms have been applied in different ways by different authors. Most uncertainty centres on the unmuscled sclerites on the diaphragma (*inter-vincular membrane* of Krüger 2017), for example the *anellifers* of Young (2008a, p.25, fig. 178, 180, 187, 222), which are specialised structures of "the caudo-lateral part of the *anellus"* (illustrated, fig. 133, being the phallocrypt rim) "joined to the proximal region of the valva". The illustrations provided by Young (*loc. cit.*) do not show this structure clearly but from her description and her fig. 133 are not the 'cristate hairs' of Kristensen (2003). (The cristate hairs appear absent from all but two Australian Diptychini genera as figured by Young (2008a) and present in declanoids).

7. Female genitalia (Fig. 1q–15m). Terminology follows Kristensen (2003). Care needs to be taken with interpretation of the sclerites (*lamellae ante-* and *post-vaginalis*) surrounding the copulatory pore (*ostium bursae*). The attachment of the lamella antevaginalis to T8 and incorporating the remnant of the A8 spiracle may be a plesiomorphy. The antrum may be sclerotised and fused with the colliculum (e.g., Fig. 6g, *Ipana atronivea*) or not (e.g., Fig. 3g, *D. niveata*). The *ductus seminalis* arises on a *papilla* at the start of the *ductus bursae,* a not uncommon state.

8. Larvae (Fig. L1a–L15d). Most setal and body structure terminology is as in Hassenfuss and Kristensen (2003) with the exception of the identity of abdominal seta L4 on A1–7 seta. We adopt Young's (2008b, p 11 and 12) resurrection of Dugdale (1961) in fixing the identity of this seta in Geometridae, which is ventral to seta L2 and anterodorsal to seta SV1. Hassenfuss and Kristensen (2003) did not discuss this subject.

This paper adopts the 'neutral' chaetotactic system illustrated by Hassenfuss and Kristensen (2003, fig. 5.11c and f) for the setae of the anal proleg which they termed (from ventral to dorsal) AL1, AL2, AL3 (all facing laterally), AL4 (on the caudal edge) and AL5 (on the paraproct apex). Previously Dugdale (1961) termed seta AL4 as CD2, following Singh's (1953) notation. Young (2008b, p. 24) termed this seta SV1 without comment, noting that it was not on a tubercle in Australian Diptychini (as Nacophorini). In some declanoids (*I. junctilinea*, *I. hermione, I. halocarpi*) seta AL4 is on a prominent tubercle (e.g., Fig. L14a).

One possibly confusing item in larval terminology is the description by Hassenfuss and Kristensen (2003, p.155) of some setae as 'filiform' meaning 'thin, hairlike' as opposed to 'setiform'. In adults, 'filiform' implies of 'even thickness' or 'unpectinate' in relation to antennal flagellomeres. In larvae, filiform setae are receptors of aerial vibrations (Hassenfuss & Kristensen, *loc.cit.*) and are present only on larval Diptychini in New Zealand Ennominae (Weintraub & Scoble 2004).

Declanoid larvae (except for *I. glacialis*) have integumental outgrowths such as a subventral fringe of compound papillae on T2–A9 and functional prolegs on A5 (known *Declana*) or single or compound papillae on A6–8 or 9, and prolegs on A5 minute, non-functional (*Ipana* except for *I. atronivea, I. egregia*). Known *Declana* larvae (Fig. L1a, b) lie outstretched on the substrate and the papillae break up the body outline; *Ipana* larvae (Fig. L8d) rest twig-like and A2, A3, and A5 have bud-like protruberences laterally or dorsally; prolegs on A6 and A10 clasp the body to the substrate when at rest. *Ipana glacialis* lies concealed amongst *Dracophyllum* leaf-litter in daytime and lacks stub-like body structures (cf. Fig. L10 and Fig. L13, L14a, b).

SYSTEMATICS

Overview

The lepidopteran genus *Declana* Walker, 1858 (Geometridae: Ennominae) is here split into two genera, *Declana* with five species and *Ipana* Walker 1858 (previously synonymised with *Declana*) with ten species, differentiated by larval and adult structural apomorphies. For convenience, the two genera are here informally called the declanoids. This paper treats 15 species as valid, and includes four newly recognised taxa (*Declana foxii* n. sp., *D. lupa* n. sp., *Ipana halocarpi* n. sp., and *I. perdita* n. sp.) and synonymises *D. toreuta* (including '*D.* sp. 'grey *toreuta*'' *sensu* Patrick (2000) and White (2002)) with *D. nigrosparsa* Butler, a taxon reduced to a synonym of *D. floccosa* by Meyrick (1884) and accepted as such until now.

Phylogenetic Relationships and tribal placement

Ennominae is the largest subfamily in the Geometridae with over 9800 species (Lévêque 2009). Genome-based studies indicate that it is monophyletic (Sihvonen *et. al.* 2011: 6, Murillo-Ramos *et al.* 2019). Ennomine tribal classification has been largely morphology-based and many of these tribes when analysed genomically are found to be polyphyletic (Murillo-Ramos *et al*. 2019). Some tribes, such as Lithinini and Nacophorini, have long been difficult to distinguish morphologically (Rindge 1983; Pitkin 2002; Young 2006, 2008a; Sihvonen *et al.* 2011); Murillo-Ramos *et al.* (2019) have now shown that Lithinini is a synonym of Diptychini and that many genera formerly assigned to Nacophorini also belong in Diptychini; Nacophorini is an almost exclusively New World tribe

(Brehm *et al.* 2019). Three species of declanoids were included by Murillo-Ramos *et al.* (2019) in their 11-gene, 1206-taxon analysis (*Declana floccosa*, *Ipana egregia* and *I. leptomera*): these were recovered as forming a strongly supported monophyletic group (see their fig. 6, where the 'declanoid clade' is designated as 'Unnamed E4'). The declanoids are sister to Diptychini in their cladogram, but this relationship has much lower support (Murillo-Ramos *et al.* 2019: fig. 6). The declanoids may well require a new tribe once further studies of Australasian Ennominae have been carried out (Murillo-Ramos *et al*. 2019); we do not erect one here, since the placement of the group is still not well resolved.

Group Diagnosis (*Declana* plus *Ipana*)

The morphological characters listed below distinguish the declanoids from all other New Zealand Ennominae (as catalogued by Dugdale 1988). We briefly note the occurrence of these characters, where known, in extralimital taxa formerly assigned to Nacophorini (many of them now transferred to Diptychini, Drepanogynini and Odontoperini).

1. Labial palpus posture characteristically geniculate (Fig. 15e). The apical segment is long, smooth-scaled, clavate (apically weakly swollen). The apical segment is approximately 0.5x as long as the second segment in *Ipana* but is shorter (0.33x) in some *Declana* species. In all other New Zealand ennomine genera palpi are sub-ascending (posture oblique), and the apical segment is short (<0.3x segment 2) or button-like, with erect scaling. Hudson (1928) used labial palpus structure as the leading distinguishing generic character for Meyrick's concept of *Declana*. A similar labial palpus structure is present in descriptions and portrayals of southern South American Nacophorini *sensu* Rindge (1983) and in portrayals of some species groups of South African *Drepanogynis* Guenée (Drepanogynini) (Krüger 2006, 2009) but not seen in Australian Diptychini in the comprehensive ANIC collection examined by JSD in 2015.

2. Body venter and femora densely covered in long, pilose scales. These are absent from other New Zealand geometrid genera, but present in some South American Odontoperini (e.g. *Mallomus* Blanchard, Rindge 1983), in South African Drepanogynini (Krüger 2006) and in some Australian Diptychini genera (formerly in Nacophorini) (Young 2008a).

3. Somewhat rectangular noctuiform forewings, and thickened noctuiform bodies. Other New Zealand genera have typical broadly triangular forewings and slender bodies. The noctuiform forewings and thickened body are also present in some southern South American (Rindge 1983) and South African genera (Krüger 2006, 2009), and in some Australian Diptychini (Young 2008a; Sihvonen *et al.* 2015).

4. Flocculence (groups of upraised scales) on forewing upperside (exceptions are *Ipana glacialis* and *I. leptomera*, which lack them). Raised scales are absent from other New Zealand geometrid genera, not seen in any Australian Ennominae in ANIC examined by JSD in 2015, and not mentioned by Rindge (1983), Pitkin (2002), Young (2008a) or Krüger (2017).

5. Male genitalia, unmuscled diaphragmal sclerites, i.e. dorsal juxtal sclerites (djs, Fig. 1n-15k). Their bases are associated with the dorsal corners of the juxta and can extend dorsally on the diaphragm to the level of the costulae. In declanoids these sclerites can be strap-like, supporting the phallus laterally (*Declana floccosa,* Fig. 1n, o*; D. nigrosparsa,* Fig. 2e), sometimes vestigial (other *Declana* spp.) or sclerotised, arcuate, ending in a dorsally pointing hook (e.g., *Ipana junctilinea,* Fig. 14h) or reduced to a thumb-like tubercle (*I. hermione,* Fig. 13c, d).

6. Male genitalia, juxta (Fig. 1n–15k). This is either reduced, C-shaped in sagittal section with a thin line of cristae on a membranous ridge beside the juxta lateral margins (*Declana*), or large, shield-shaped and with a prominent lateral field of cristae (*Ipana*). In neither genus is the juxta centrally split or with dorsally extended arms (a feature of some Australian Diptychini and some southern African Drepanogynini). The juxta types seen in declanoids are present in South American genera (Pitkin 2002, Rindge 1983, Parra 1998) and the reduced juxtal form of *Declana* is associated with the diamond-shaped genital capsule (e.g., Fig. 1n, o) and with the valval costa armed with a slender curved process.

7. Female genitalia (Fig. 1q–15m). As with their male counterparts, declanoid female genitalia fall neatly into two groups on genital structure involving the sterigma either as two plates, one above and one below the gonopore (*Declana*) or these fused into a complete ring around the gonopore (*Ipana*).

8. Larvae, pattern. Known declanoid instar 1 larvae have the dorsal stripe double, i.e., either side of the dorsal midline; in all other New Zealand ennomine genera it is single (Dugdale 1961). Information from other faunal regions is scanty or lacking so the importance of this distinction is unknown in a wider context.
9. Larvae, A6 proleg. Declanoid larvae have 5 or 7–11 external setae in the SV region of the A6 proleg; the more usual number in Ennominae is 4, though there is wide variation as extensively discussed by Young (2008b); e.g., there are 6 in New Zealand Diptychini (Weintraub & Scoble 2004, as Lithinini) and only 3 in *Gellonia* Meyrick, 1884.

Separation of *Declana* from *Ipana*

The treatment of *Declana* and *Ipana* as separate genera is strongly supported by their consistent genotypical separation in the molecular phylograms of Sihvonen *et al*. (2011, 2015) and Murillo-Ramos *et al.* (2019), and morphologically by the following characters:
1. Forewing veins R and Rs1-4 arrangement. In all *Declana* species two veins branch costally from the R-stem before the R-M junction (Fig. 1l, 4c). In all *Ipana* species three veins branch costally before the R-M junction (Figs 6c, 9c).
The reduced number of branches in *Declana* is the result of the fusion of the R and Rs1 veins in this genus. The second branch comprises the fusion of veins Rs2, Rs3 and Rs4. In *Ipana*, the R and Rs1 veins are separate and the third branch comprises the fusion of veins Rs2, Rs3 and Rs4. There are minor variations of this basic arrangement between species within both *Declana* and *Ipana*.
2. Abdominal sternite 2 (S2). In *Declana*, S2 is unmodified and with auditory chambers fully exposed laterally (Fig. 1m). In *Ipana*, S2 has lateral lobes or flanges (Fig. 14g, lobe) that partly obscure the auditory chambers (cavi), though weakly so in *I. glacialis.*
3. Juxta. In *Declana* (Fig. 1n, 2e, 3d, 4d, 5c) the juxta is small, deeply concave, i.e. 'C-shaped' in vertical section; in *Ipana* (Fig. 6d–15j) it is large, flat in vertical section and broad.
4. Cristate setulae. In *Declana* these are present as membranous setulose ridges flanking the juxta base (not easily visible in photographs); in *Ipana* (e.g., Fig. 9d), they are conspicuous, and borne laterally on the juxta.
5. Male genital capsule. In *Declana*, the peduncular area (junction of the tegumen and vinculum framework) is expanded laterally and the framework stoutly diamond-shaped (e.g., Fig. 1n). In *Ipana*, the peduncular area is not expanded laterally, so the framework appears roughly rectangular (e.g., Fig. 6d).
6. Sterigma. This is incomplete in *Declana,* that is the lamellae are separate as their names imply. One vaginal lamella may be unsclerotised (e.g., Fig. 4g). In *Ipana*, the sterigma consists of a transverse sclerite surrounding the ostium bursae like a collar (e.g., Fig. 9h), with the lateral side of the collar fused with the base of the apophyses anteriores and the rudimentary spiracle of T8.

KEYS TO SPECIES

Main diagnostic characters are given first in each couplet. Additional characters or data of potential use (e.g., hostplants, geographic distribution) are given in square brackets after these in all keys. Where there are secondary setae in the SV region on the A6 proleg, these (together with the SV setae) are referred to as 'external setae' following Young (2008b).

1. Key to Larvae, instars IV–ultimate

The key includes other New Zealand ennomine larvae that may be confused with *Declana* and *Ipana*.
Note 1. Ennomine geometrid larvae have seta SV3 present on A1–5, proleg crotchets in a bi-ordinal, *usually* complete mesoseries (if incomplete, only narrowly so) and seta SV2 lacking on A1 (Dugdale, 1961).
Note 2. Larvae of *Declana foxii, D. lupa, and Ipana perdita* are unknown.

1. Anal proleg seta AL4 closer to dorsal margin of proleg than to ventral margin, i. e., above the level of the conspicuous sensillum Lp ..... *Chalastra*, *Cleora, Pseudocoremia, Zermizinga*

– Anal proleg seta AL4 at about half-way between dorsal and ventral margins of the proleg, i.e., at the level of the sensillum Lp (Fig. L1e, L15c)..... 2 (*Gellonia,* Diptychini, declanoids)

2. A8 with seta L1 filiform (fine or hair-like), rotatory in life; A6 proleg with 6 external setae in SV region (Weintraub & Scoble 2004: fig. 43); [hostplants ferns].....Diptychini (*Ischalis, Sarisa, Sestra*)

– A8 with seta L1 setiform (tapering and stiff); A6 proleg with 3, 5 or 7+ outer SV setae; [hostplants woody dicot angiosperms, conifers] 3

3. A6 proleg with 3 external setae in SV region; head capsule held prognathously at rest; no setae on large conical tubercles; [hostplants woody dicot angiosperms] ..... *Gellonia*

– A6 proleg with 5 or 7+ external setae; head capsule held hypognathously; at least setal pair D1 on A8 on large tubercles; [hostplants tree and shrub conifers, dicot angiosperms]..... 4 (declanoids)

4. A6 proleg with 7–11 external setae in SV region (Fig. L1e); A1–5 (at least) with a prominent subventral fringe of finger-like or branched papillae (Fig. L1b, d); resting pose appressed to substrate ..... 5 (*Declana*)

– A6 proleg with 5 external setae; only A6–9 with subventral papillae (papillae absent in *I. glacialis*); resting pose twig-like (except *I. glacialis*)… ..... 7 (*Ipana*)

5. Papillae on A1–5 mostly simple (unbranched), finger-like, sparsely arranged; [body colour pattern grey-speckled; hostplants Malvaceae]..... ***Declana niveata***

– Papillae on A1–5 mostly multi-branched, densely arranged and forming a fringe, longest at mid-segment (Fig. L1b, d) 6

6. Larva dorsally with prominent dorsal (seta D1) conical tubercle on A8 only; [body grey and brown speckled; hostplants *Olearia* spp.] ..... ***Declana nigrosparsa***

– Larva dorsally (Fig. L1b, d, e) with all D tubercles prominent, conical especially on A2 (setae D2) and A8 (setae D1); [body patterned variously, cryptically; host range polyphagous, excluding monocots] ..... ***Declana floccosa***

7. Head capsule lacking a discernible pair of angular upward or forward epicranial projections; body smooth, stout and lacking conical setal tubercles except on dorsum of A8; no lateral papillae on A6–9; [no A5 proleg; crotchet series broadly interrupted centrally; colour pattern of longitudinal brown stripes; hostplants *Dracophyllum* spp. in South Island subalpine-montane shrubland; larva feeding nocturnally]..... ***Ipana glacialis***

– Head capsule with epicrania angular; body slender, twig-like; with many setae tuberculate; SV area of A6-9 with simple or foliose papillae 8

8. A1 lacking seta SV3; T1 and T2 intersegmental dorsal area grossly modified into an erect structure (Fig. L8b) or grossly swollen and expanded laterally (Fig. L6a, b); antero-lateral spur on A6 anterior to seta L2 modified into a soft papilla (e.g., Fig. L8c) or lacking in ultimate instar..... 9

– A1 with seta SV3; T1 and T2 intersegmental dorsal area unmodified; A6 antero-lateral spur (Fig L8a, insert) firm and acuminate in all instars 11

9. T1 and T2 intersegmentally with a tall, sausage-like, often apically bifid papilla projecting stiffly over head capsule (Fig. L8b); A5 proleg absent in early instars, present in ultimate instar; [hostplants Loranthaceae] ... ***Ipana griseata***

– T1 and T2 intersegmental areas a swollen pinkish white plate with white-spotted black patches (Fig. L6a, b); A2 and A5 each with a large pair of pale dome-shaped tubercles bearing setae D2; A8 tumid laterally and dorsally, pale (Fig. L6a); A5 with functional prolegs (Fig. L6a); [hostplants *Pseudopanax* spp. and close allies, Araliaceae]..... 10

10. North Island..... ***Ipana atronivea***

– South Island..... ***Ipana egregia***

11. Anal proleg with seta AL4 sessile; A2 without fleshy lateral lobes, only bumpy below spiracle; A5 with a pair of rudimentary prolegs; A8 D setae lacking conical tubercles..... 12

– Anal proleg with seta AL4 on a tubercle; A2 with pair of fleshy lateral lobes bearing spiracles dorsally; A5 without prolegs; A8 setae D1 on prominent upstanding fleshy dorsal tubercles 13

12. Body straight in side view; A2 and A5 lacking a dorsal seta D2 bump, A3 lacking a ventral posterior bump; A5 prolegs without visible crotchets; SV papillae on A6–9 unbranched, backswept (Fig. L15c); A6 crotchet series complete; [polyphagous on conifers and dicot trees, shrubs, lianes]..... ***Ipana leptomera***

– Body in side view appearing kinked; A2 posteriorly with a conspicuous dorsal ‘bump’, A3 posteriorly with conspicuous ventral ‘bump’; A5 with a postero-dorsal ‘bump’; A5 proleg rudiments with 5 weak crotchets; SV papillae on A6–9 terminally branched (Fig. L9b); A6 crotchet series interrupted; [hostplants Nothofagaceae (*Lophozonia, Fuscospora*)]..... ***Ipana feredayi***

13. A5, A7 with fields of erect micropapillae on the SV area (Fig. L14a); A6 papillae branched or twisted; [hostplants mostly dicots (rarely on conifers), on shrubs of various families]..... ***Ipana junctilinea***

– A5, A7 lacking fields of erect micropapillae; A6 papillae finger-like; [hostplants conifers] 14
14. A7, A8 without foliose SV papillae (Fig. L13); [hostplant families Cupressaceae, Pinaceae, Podocarpaceae, ND-SL] ..... ***Ipana hermione***
– A7, A8 with an SV line of foliose papillae; [hostplant *Halocarpus* (Podocarpaceae), or *Phyllocladus* in presence of *Halocarpus* spp., BP-TO] ..... ***Ipana halocarpi***

2. Key to adults based on external characters

Note 1. The key should be used with reference to the colour plates of adults. It may not work for worn specimens. If the key does not result in identification, refer to the alternative keys based on genitalia.
Note 2. Flagellomeres can be bipectinate or filiform. In many species the males have long-bipectinate antenna, while in the females the pectinations are shorter. Females require examination with a hand lens in order to establish whether the antennae are short-bipectinate or filiform.
Note 3. With set specimens males can be recognised by the retinaculum on the ventral surface of the forewing holding the hindwing frenulum. The frenulum itself is often difficult to see. The retinaculum is absent in the female where the frenulum is represented by a brush of stiff setae which are caught on the forewing underside by a costally-directed array of stiff scales.
Note 4. The only reliable external character by which *Declana* may be separated from *Ipana* is found in the venation of the forewing: in all *Declana* spp. two veins branch costally from the R-stem before the R-M junction (Fig. 1l, 4c) and in all *Ipana* spp. three veins arise before the R-M junction (Fig. 9c, 15f). Presence of a thoracic crest is diagnostic for *Ipana* excluding *I. glacialis* and *I. leptomera;* the crest is hidden by long pilose scales in *I. griseata*.

1. Antennae filiform (non-pectinate) (Fig. 15e) 2
– Antennae bipectinate (e.g., Fig. 14a–e) 5
2. Male hind-tibia grossly swollen, hindwing three-lobed; female hind-tibia normal, hindwing coarsely crenulated (Fig. 15a–d) ..... ***Ipana leptomera***
– Hind-tibia normal, hindwing more or less evenly rounded 3
3. Hindwing snow-white, with faint grey median band and with or without narrow black terminal line; termen with a distinct 'tooth' (Fig. 3a–c) ..... ***Declana niveata***
– Hindwing dull whitish with broad dark border; termen evenly rounded 4
4. Forewing longitudinal markings pinkish brown (Fig. 4a, b) [TK, WA, WN] ..... ***Declana foxii***
– Forewing longitudinal markings grey (Fig. 5a, b) [AK] ..... ***Declana lupa***
5. Forewing ground-colour white, markings bold, black or dark chocolate; [wingspan at least 36 mm, usually exceeding 40 mm] 6
– Forewing ground-colour and pattern not as above; wingspan less than 40 mm 7
6. Forewing termen with bold black marks (Fig. 6a, b); [North Is.] ..... ***Ipana atronivea***
– Forewing termen either devoid of marks or with reduced, brown dots, dashes or small triangles (Fig. 7a, b); [South Is., Stewart Is.] ..... ***Ipana egregia***
7. Diurnal; compound eyes reduced, bordered by a nude peri-orbital strip; male forewings patterned in shades of bright red-brown, both sexes with hindwing discally yellow (Fig. 10a, b) ..... ***Ipana glacialis***
— Nocturnal; compound eyes surrounded by scales; forewings lacking bright red-brown and hindwings lacking yellow or yellowish scales 8
8. Thorax in both sexes with a prominent 3 mm-high crest; antennae long-bipectinate in both sexes; [forewing costa with series of fine brown strigulae angled towards the termen; antemedian line, where present, strongly angled] (Fig. 14a–e) ..... ***Ipana junctilinea***
– Thorax with crest less than 3 mm; female antennae short-bipectinate 9
9. Thorax clad in long, dense, dark grey, pilose scales (Fig. 8a–c) ..... ***Ipana griseata***
– Thorax not as above 10
10. Costal strigulae angled towards termen 11
– Costal strigulae at right angles to costa or angled towards base 12
11. Costal strigulae bold, black or brown, forewing ground-colour white, transverse lines distinct (Fig. 2b, d) ..... ***Declana nigrosparsa* (*toreuta* form)**

– Costal strigulae faint, grey, forewing evenly pale grey; transverse lines faint (Fig. 2a, c)..... ..... ***Declana nigrosparsa* (*nigrosparsa* form)**

12. Subterminal area of forewing without dark, wavy, oblique transverse lines (Fig. 1a–j) ..... ***Declana floccosa***

– Subterminal area of forewing with dark, wavy, oblique transverse lines 13

13. Forewing median band narrower at costa than at dorsum (Fig. 9a, b)..... ***Ipana feredayi***

– Forewing median band of similar width or broader at costa than at dorsum 14

14. Forewing antemedian line broken; [bright silvery wash in anterior half of median band] (Fig. 13a, b)..... ..... ***Ipana hermione***

– Forewing with antemedian line intact 15

15. Forewing median band dappled silvery grey, postmedian line thickened at angulations; costal strigulae largely obscured (Fig. 11a, b)..... ***Ipana halocarpi***

– Forewing lacking any silvery grey scales in median band, which is dull grey with vertical bands of darker grey, postmedian line lacking conspicuous thickening at its angles; costal strigulae distinct most of forewing length (Fig. 12a)..... ***Ipana perdita***

3. Key to adults based on male genitalia

Note: The term "aedeagus" is used here instead of "phallus". See 'Anatomical terminology' in the section 'Morphology' above.

1. Juxta small (Fig. 1n) or reduced (Fig. 4d); cristate setae (when discernible) few, inconspicuous and separate from juxta (*Declana*)..... 2

– Juxta large, shield-shaped, plano-concave (Fig. 6d), and bearing conspicuous cristate setulae laterally (Fig. 9f) (*Ipana*)..... 6

2. Uncus elongated, flattened, apex triangular with lateral and apical teeth; dorsal valval costal process (dvcp) short and slender (Fig. 3d) ..... ***Declana niveata***

– Uncus short, apically beak-like, lacking apical teeth; dvcp either an elongate looped strap or a stout inwardly directed spike 3

3. Dorsal valval costal process a straight, deeply sclerotised spike; gnathos apex smooth, shovel-like (Fig. 2e)..... ***Declana nigrosparsa***

– Dvcp a long, slender acuminate loop; gnathos apex spinose, trowel-like or double-hooked 4

4. Gnathos apex double-hooked; valva lacking basal raised pulvinus; dvcp with apical half very narrow; dorsal juxtal sclerites strong, with bifid arms (Fig. 1n, o) ..... ***Declana floccosa***

– Gnathos apex single (a broader or narrower trowel shape); valva with basal raised pulvinus (Fig. 4d, 5c); dvcp evenly wide to its acuminate apex; dorsal juxtal sclerites or lobes absent 5

5. Gnathos apex semi-ovate; valval basal pulvinus rounded, distinctly tumid; saccus apically rounded (Fig. 4d); vesica with cornuti strongly sclerotised (Fig. 4e) ..... ***Declana foxii***

– Gnathos apex narrowly trowel-shaped; valval basal pulvinus rectangular, weakly tumid; saccus apically triangular (Fig. 5c); vesica with cornuti lightly sclerotised (Fig. 5d)..... ***Declana lupa***

6. Dorsal juxtal sclerites small to minute, 0.20–0.33x juxta width, thumb-like 7

− Dorsal juxtal sclerites far larger, at least 0.5x juxta width, as arcuate plates with pointed apices articulating with dorso-lateral juxtal margins..... 10

7. Valvae lacking basal coremata; costulae each with a ventral extension, apices triangular, dorsally rugose (Fig. 10c, d); juxta dorsal margin with a short mesal extension; cornuti absent or present as one or two very short needles (Fig. 10e)..... ***Ipana glacialis***

− Valvae with basal coremata (Fig. 9f, 12c); costulae lacking a ventral extension, clad with erect long and short spines often in two groups giving each costula a bifid appearance (e.g., Fig. 13d); juxta dorsal margin gently rounded (e.g., Fig. 11c); vesica with long and short cornuti (Fig. 11d, 12d, 13e)..... 8

8. Uncus slender to apex; gnathos arms basally as wide as the spinose knob of the gnathos apex; costula outer margin concave, with two densely spiculate peaks (Fig. 13d); saccus either straight or very gently emarginated mesally .... ***Ipana hermione***

– Uncus subapically swollen; gnathos arms slender basally, not as wide as the width of the gnathos apical knob; costula outer margin scarcely concave; saccus emarginated forming a 'W' 9

9. A4 tergite with lateral corematal scale tufts (Fig. 12b); aedeagus longer (ca 3.3 mm) ..... ***Ipana perdita***

– A4 tergite lacking lateral coremata; aedeagus shorter (ca 2.5 mm)..... ***Ipana halocarpi***

10. Gnathos apex strongly extended into two-pronged bill-hook (Fig. 15i); subscaphium sclerotised; costulae apices as long outwardly curved undulate spines (Fig. 15j) ..... ***Ipana leptomera***
– Gnathos apex not strongly exended; subscaphium not sclerotised; costulae apices otherwise (Fig. 6d, 7c, 8d, 9d, 14h) 11
11. Cornuti with two far longer than the others (e.g., Fig. 9e) and evenly curved; juxta dorsal margin bluntly extended towards the rim of the phallocrypt 12
– All cornuti short and stout, either straight (Fig. 8e) or angled (Fig. 6e, 7d); dorsal margin of juxta mesally with a small sharp prominence or unsclerotised 13
12. Costulae prominent, each costula with two points; each dorsal juxtal sclerite with single undivided apex (Fig. 9f) ..
..... ***Ipana feredayi***
– Costulae reduced to bumps; each dorsal juxtal sclerite with two apices one below the other (Fig. 14i)..... ***Ipana junctilinea***
13. Uncus apical half trowel-shaped (Fig. 8d, arrowed); saccus W-shaped; valvae extending to or beyond uncus; costulae truncated ending in a vertical spinulose prominence; dorsal juxtal sclerite perpendicular, apically acuminate (Fig. 8d) ..... ***Ipana griseata***
– Uncus with slender to slightly hooked apex (Fig. 7c); saccus evenly curved; valvae not extending to beyond 0.5x uncus length; each costula diamond-shaped, joined mesally; each dorsal juxtal sclerite as two slim arcs lying horizontally (Fig. 6d, labelled)..... 14
14. Gnathos apex with a pair of ventral spines; costulae dorsal margins gently rounded (Fig. 6d); valva tapered, and lower side strongly sclerotised..... ***Ipana atronivea***
– Gnathos apex margined with 12–14 stout teeth; costulae dorsal margins angular (Fig. 7c); valva not tapered, and lower side not strongly sclerotised..... ***Ipana egregia***

4. Key to adults based on female genitalia

Note: The female of *Ipana perdita* is unknown; female genitalia are likely to be very similar to those of its close relative *I. halocarpi*.

1. Sterigma (sclerite associated with ostium bursae) incomplete, with only one lamella present; T8 extending laterally almost to the A8 ventral mid-line, or flanking a flap-like S8 (*Declana*) 2
– Sterigma complete, forming a transverse collar-like sclerite surrounding the ostium bursae; T8 produced laterally but not extending to S8; S8 an ovate rugose weakly sclerotised patch (*Ipana*)..... 6
2. S8 a distinct subtriangular flap-like sclerite, broadest caudally..... 3
– S8 membranous, inconspicuous or obliterated by the apposed extensions of T8..... 4
3. S8 flap shallowly bilobed, with central groove not strongly demarcated (Fig. 4g)..... ***Declana foxii***
– S8 flap strongly bilobed, with central groove strongly demarcated (Fig. 5f) ..... ***Declana lupa***
4. Anterior and posterior apophyses equal in length; [lamella postvaginalis absent; antrum not sclerotised; ductus bursae width 0.25x corpus bursae width] (Fig. 3f, g) ..... ***Declana niveata***
– Anterior and posterior apophyses unequal in length 5
5. Ductus bursae with two longitudinally arranged spinose sclerites (pseudosigna); signum a cordate (heart-shaped) dentate plate (Fig. 1q, r) ..... ***Declana floccosa***
– Ductus bursae lacking pseudosigna; signum a straight, knife-edged plate (Fig. 2g, h)..... ***Declana nigrosparsa***
6. S8 sclerotised, large, transversely folded, posterior edge irregularly dentate; ductus bursae slender, deeply sclerotised, arcuate, length >3x that of corpus (Fig. 15l, m)..... ***Ipana leptomera***
– S8 area membranous, transversely ridged; ductus bursae stout, with sclerotised longitudinal ridges over most of length, length <2x that of corpus 7
7. Ductus bursae forming a short narrow neck to the globose corpus bursae, which is contained in A7; signum rudimentary, S2 lobes reduced (Fig. 10f, g)..... ***Ipana glacialis***
– Ductus bursae as long as or longer than the ovoid corpus bursae which extends anteriorly at least to A5; signum present; S2 lobes well-developed (Fig. 14g)..... 8
8. Ductus bursae lightly and uniformly fluted; junction between ductus and corpus bursae indeterminate (ductus gradually widens to the corpus) 9
– Ductus bursae sclerotised, divided into a fluted posterior section and an expanded smooth anterior section clearly distinct from the unsclerotised corpus bursae 11

9. Fused antrum and colliculum shallow, wider than long; ductus bursae with two longitudinal sclerotised pseudosigna and conspicuous fluting; signum lateral (Fig. 8f, g) ..... ***Ipana griseata***
– Fused antrum and colliculum deep, longer than wide; ductus bursae lacking pseudosigna, fluting weak; signum apical 10
10. Ostium bursae ventral margin crenulate; sterigma anterior margin transverse (Fig. 6f, g) ..... ***Ipana atronivea***
– Ostium bursae ventral margin smooth; sterigma anterior margin concave (Fig. 7e, f) ..... ***Ipana egregia***
11. Anterior and posterior apophyses roughly equal in length; anterior lip of sterigma with a deep narrow median cleft (Fig. 9g, h)..... ***Ipana feredayi***
– Anterior and posterior apophyses of unequal length; anterior lip of sterigma entire (uncleft)..... 12
12. Posterior apophyses ca 2x length of anterior apophyses; ductus bursae fluted in posterior half only; anterior half swollen, unfluted, strongly punctate; sterigma with a dimple at each corner of ostium bursae (Fig. 14k, l)……. .....***Ipana junctilinea***
– Posterior apophyses 3–4x length of anterior apophyses; ductus bursae with flutings ending close to corpus bursae, unfluted area smooth or weakly punctate; ostium without sterigmal dimples..... 13
13. Ostium bursae emarginate medially (Fig. 13g); ductus bursae caudally with one strongly sclerotised pseudosignum; corpus bursae signum a weakly sclerotised blade (Fig. 13f) ..... ***Ipana hermione***
– Ostium bursae ventral lip evenly and weakly concave over entire width (Fig. 11f); ductus bursae caudally with two strongly sclerotised pseudosigna; corpus bursae signum a strongly sclerotised blade (Fig. 11e) ... ***Ipana halocarpi***

TAXONOMY

Genus *Declana* Walker, 1858

Fig. 1a–5f (adult habitus); 1k, l, 4c (forewing venation); 1m (abdominal base), 1n–5d (male genitalia), 1q–5f (female genitalia), L1a–f (larvae).

Declana Walker, 1858. List of the specimens of lepidopterous insects in the collection of the British Museum XV: 1649. Type species: *Declana floccosa* Walker, 1858, by original monotypy.

Argua Walker, 1863. List of the specimens of lepidopterous insects in the collection of the British Museum XXVIII: 448.Type species: *Argua scabra* Walker, 1863, by original monotypy. Synonymised by Meyrick (1883, p. 530, abstract; 1884, p. 102).

Atossa Meyrick, 1884. *Transactions and Proceedings of the New Zealand Institute* 16: 103, 104. Type species: *Declana niveata* Butler, 1879, p. 500, by original monotypy. (Meyrick, 1883, p. 530, abstract.) Preoccupied by *Atossa* Thomson 1854 (Coleoptera) (Meyrick 1886, p. 184). See *Epicasis,* below.

Epicasis Meyrick 1886. *Transactions and Proceedings of the New Zealand Institute* 17: 184. Replacement name for *Atossa* Meyrick, 1884: see above. (Meyrick, 1885, p. 589, abstract.)

Anatossa Warren, 1894. *Novitates zoologicae* 1: 466. Unnecessary replacement name for *Atossa* Meyrick, 1884.

Diagnosis. Mesoscutellar crest absent. Forewing scale cover floccose, either forming little hummocks generally, or with narrow files of stiffly erect scales beside major veins. Forewing venation: only 2 veins branching costally from the R-stem before the R–M junction (cf. 3 veins in *Ipana*). Male hindlegs unmodified. Abdominal S2 lacking lateral lobes so the cavus (tympanal pit) opening is unimpeded. Male genitalia: genital capsule squat, diamond shaped, i.e. tegumen-vinculum articulation (pedunculus) projecting laterally (Fig. 1n, ped); uncus short (Fig. 1n) or long and expanded apically (Fig. 3d); socii present only in *D. niveata*; valvae lacking basal coremata, each valva with a long, looped or short dagger-like basal costal process; juxta folded dorso-ventrally, C-shaped; dorsal juxtal sclerites strap-like or absent, socketed on juxta only in *D. floccosa*, otherwise fused with juxta. Female genitalia: sterigma incomplete, i.e., with lamella antevaginalis and lamella postvaginalis separate, or one or other vaginal lamella absent. Larva (those of *foxii* and *lupa* unknown): A5 proleg functional (i.e. larvae are semiloopers); SV zone on A1–9 with a band of branched or unbranched papillae; resting posture flat (body outline broken by a line of SV papillae).

Description. *Adult male, female*: Antennae pectinate or filiform (non-pectinate). Labial palpus geniculate, apical segment slender, 0.5x length of segment 2 or slightly less, with scaling appressed (not fluffed out) and apex clavate. Forewing radial venation as in Diagnosis; forewing upperside floccose or with lines of erect scales. Male hind-tibia not modified, without hair-pencil. Abdominal S2 (Fig. 1m) lacking lateral lobes, leaving the cavus unshielded.

Male genitalia (Fig. 1n–5d): Genital capsule broadly diamond-shaped so the peduncular area (Fig. 1n, ped) projects laterally. Uncus usually shorter than half valval costal length, basally thick, apically acuminate (except in *niveata* where uncus is longer, flattened, expanded at apex with a tooth at each apical angle, Fig. 3d). Socii reduced or absent. Valvae lacking basal coremata; valva shape as in Fig. 1o, 2e, oval or triangular, lightly sclerotised (*floccosa, nigrosparsa*) or elongate, membranous (Fig. 3d, 4d, 5c: *niveata*, *foxii, lupa*) and with a dorsal costal process, either looped (Fig. 1n, 4d, 5c), curved (Fig. 3d), or dagger-like and splayed (Fig. 2e); costulae meeting mesally, slender and arcuate, or scarcely sclerotised and with a broad base, or absent (Figs 1o, 2e, 3d, 4d, 5c); crista as a thin membranous ridge flanking juxta base, its setulae sparse (not figured); juxta C-shaped in vertical section (i.e. concave in posterior aspect), dorsal margin broadly emarginated; dorsal juxtal lobes fused with juxta (most species, e.g., Fig. 2e) or (*D. floccosa*) articulating sclerites strap-like and projecting caudally supporting phallocrypt entrance (Fig. 1n), or absent. Phallus: the sclerotised part (*aedeagus*) either straight with a weakly decurved apex (e.g., Fig. 1p, most spp.) or sinuously slender and with an acuminate apex (Fig. 3e, *niveata*): cornuti indiscernible in *nigrosparsa* and *niveata*; present in *floccosa, foxii*, and *lupa*, which have 9-10 setiform cornuti in line dorsally, subapically; caecum penis extremely short.

Female genitalia (Fig. 1q–5f): S8 either an oval rugose deeply chitinised plate as in *Ipana* (*D. niveata*, Fig. 3g) or obliterated by the T8 lobes which encircle A8 (Fig. 2g). The sclerotised, hypertrophied, trapezoid plate in *D. foxii* and *D. lupa* is tentatively interpreted, based on position, as a fused S8 + lamella postvaginalis (Fig. 5e, f). Ostium lacking sclerotised lamella antevaginalis (except *foxii, lupa*). Antrum largely membranous, not sclerotised with colliculum. Ductus seminalis exiting ductus bursae at beginning of the ductus bursae on a papilla (e.g., Fig. 1r, 3g). Ductus bursae irregular in width and lacking extensive fluting. Corpus bursae ovoid, scarcely differentiated from the weakly sclerotised ductus bursae. Signum a rounded heart-shaped spinose plate or a semicircular plate with a sharp-edged invaginated blade (e.g., *D. nigrosparsa*: Fig. 2g, sig).

Larva (*D. floccosa, nigrosparsa, niveata* only): Head capsule (HC) prognathous (slanted) (rounded in instar 1) and cryptically patterned to match body pattern; face with two dark curved lines (as if describing a grin); HC laterally somewhat rounded, epicranial halves with a forward-projecting prominence outwardly lateral to a point between setae P1 and P2 (Fig. L1f). Later instars with thoracic intersegmental areas between T1, T2, and T3 dorsally unmodified; A1–A9 with a continuous series of branched papillae at the SV level breaking up the body outline (Fig. L1a, b), A6 without a forward-directed spur anteriorly (i.e., not as in Fig. L8a insert). A5 with functional prolegs, their crotchets arranged in a mesoseries. Body shape: onisciform in cross section (D, SD, and L regions forming a dome over the flat venter) and viewed dorsally gradually widening to A2 and then of uniform width to A8–9. Abdominal D setae on prominent conical pinacula, especially on A2 and A8.

Colour Pattern: Instar 1 body with 4 distinct pink stripes on each side at level of D, SD, L, and SV. Instars II and III become greenish on the middle abdominal segments and browner on anterior and posterior thirds. Instars IV and V blend brown and grey or green patches to provide effective mimicry of bark or of bryophyte-encrusted twigs and small branches. Lying on the substrate the venter remains hidden and, apart from a segmental dark patch, is colourless.

Resting posture: prone (Fig. L1b); the SV branched papillae break up the body outline.

Remarks. *Classification.* The combination of a diamond-shaped frame of the male genital capsule, a large (e.g., Fig. 4d, *D. foxii*) or small (Fig. 3d, *D. niveata*) dorsal valval costal process (dvcp) and a reduced juxta is also seen in South American Ennominae in the tribes Cassymini (three genera) and Odontoperini (one genus, *Dentinalia*, formerly placed in Nacophorini) (Pitkin 2002: figs 316, 322, 324, 350). None of these states is displayed in the Australian Diptychini genera illustrated by Young (2008a) nor in the South African *Drepanogynis* (Drepanogynini) as figured by Krüger (2006).

Declana niveata, while outwardly resembling *D. floccosa* and *D. nigrosparsa*, has distinctive male and female genitalia (Fig. 3d, e, f, g). The male is characterised by its long flat uncus with an expanded apex. In the female, only *niveata* has a sclerotised short narrow weakly fluted ductus bursae (Fig. 3f) and no pseudosignum; the other species (Fig. 1q, 2g, 4f, 5e) have an unsclerotised, long, irregularly broadly widened ductus bursae beset with one or more sclerotised inwardly toothed spinose pseudosigna. *D. foxii* and the very similar *D. lupa* are apparently parapatric but can be defined by their massive S8 (Fig. 4g, 5f), hypertrophied into a furrowed trapezoidal sclerite.

Diversity, distribution and hostplants. *Declana* is one of relatively few polytypic genera with more species in the North Island (all five species, with two endemics) than in the South (three species, no endemics) (cf. Hoare

2010: 20). *Declana floccosa* is found throughout the North, South and Stewart Islands, but two of the three species found in North and South Islands have limited distributions: *niveata* has not been reported north of southern AK and *nigrosparsa* only reaches as far north as the central North Island (TK/TO). Of the two North Island endemics *D. foxii* is known from Taranaki (TK) southwards to WN/WA, and *D. lupa* is so far only reported fom the Waitakere Ranges AK. For hostplants, *Declana* species, like *Ipana*, are restricted to conifers and woody dicotyledonous trees and shrubs (Appendices A and B) (the related genera *Ischalis* Walker, 1863, *Sarisa* Fletcher, 1979 and *Sestra* Walker, 1863 (Diptychini, formerly Lithinini) appear restricted to ferns (Weintraub and Scoble 2004)). *Declana* species may be classed as:

Polyphagous (hosts in genera of many unrelated plant families): *floccosa;*

Oligophagous (hosts in genera of one family): *niveata;*

Monophagous (hosts are species of one genus or of two closely related genera): *nigrosparsa.*

Hosts of *foxii* and *lupa* are unknown, and their recorded adult distribution so far known offers few clues as to possible hostplants. Comparisions of floral compositions of these few sites may shed light on this problem, but success is dependent on thoroughness of the floristic data.

Conservation issues. Of the three widely distributed species *D. floccosa, D. nigrosparsa* and *D. niveata*, the ubiquitous and polyphagous *D. floccosa* has no conservation issues; it has taken to plantation-grown and invasive stands of exotic Coniferales (see Appendix A) and flourishes in suburban gardens and public parks where exotic eucalypt and conifer species abound. *D. niveata,* restricted to *Plagianthus* and *Hoheria*, is reliant on the health of communities of these hosts, one of which, *Plagianthus regius*, has been commonly planted in Nelson recently, augmenting the available *Plagianthus regius* estate. Currently all plantings are as yet immature. The *D. niveata* population at Paremata Reserve at the mouth of the Wakapuaka River (NN) is noteworthy for being now largely dependent on saltmarsh ribbonwood *(Plagianthus divaricatus*). *D. nigrosparsa* is restricted to *Olearia* spp. (Appendix A) particularly in tree-line, inland low-rainfall (rain-shadow) and exposed coastal 'grey-shrub' areas (Patrick 2000) where the communities are under threat from ease of farming "improvement" and expansion. See Remarks under *D. nigrosparsa.*

Both species of the *foxii* group are currently known only from adults. *Declana lupa* is only known from a few restricted areas of the Waitakere Ranges of west Auckland. All specimens of *D. foxii* have been found in protected natural areas (Taranaki National Park TK, Lake Pounui WN and Putangirua Pinnacles WA) from near sea-level (Putangirua) to an upper limit on Taranaki's subalpine shrubland. Our knowledge of the adult voltinism (number and timing of generations per year) is rudimentary.

1. *Declana floccosa* Walker, 1858

Fig. 1a–j (adults); 1k, l (forewing venation); 1m (abdominal base); 1n–p (male genitalia); 1q, r (female genitalia); L1a–f (larvae); R1 (live adult); Map 1

Declana floccosa Walker, 1858. *List of the specimens of lepidopterous insects in the collection of the British Museum* XV: 1649–1650.

Argua scabra Walker, 1863. *List of the specimens of lepidopterous insects in the collection of the British Museum* XXVII: 448. Synonymised by Meyrick (1883, p. 530, abstract); 1884, p. 102.

Declana callista Salmon, 1946. *Dominion Museum (Wellington, New Zealand) Records in entomology* 1: 4. Synonymised by Dugdale (1988, p. 164).

Diagnosis. *Declana floccosa* is the most variably patterned of all declanoid species (Hudson 1889) and Fig. 1a-j illustrate some of the variations encountered. These are further discussed under Remarks. *D. floccosa* is distinguished from *D. niveata* by its pectinate antennae (filiform in *D. niveata*). In *D. niveata*, the forewing antemedian line runs in a straight oblique line from the dorsum to very near the costa, whereas in *D. floccosa* the line, when present, is angled in the middle of the wing and meets the costa opposite its inception on the dorsum. From other declanoid species with pectinate antennae and a transverse forewing pattern (i.e., *Declana nigrosparsa* and *Ipana feredayi*) it can be distinguished by: 1) strigulae on the forewing costa short (not crossing vein Sc) and at right angles to the costa (in *D. nigrosparsa* these are long, crossing vein Sc, and slanted towards the forewing termen, in *I. feredayi* short, slanted towards the forewing base), 2) the lack of a mesoscutellar crest (present in *I. feredayi*); and 3) the male antennal pectinations, moderate (length of longest rami less than half compound eye width in *D. floccosa*, whereas longest rami length clearly greater than half eye width (compare Fig. 1f–h and 2c, d) in *D. nigrosparsa*. It is further distinguishable from *nigrosparsa* by the absence of a short longitudinal black streak (on vein Sc) in the pale basal patch of the forewing (Fig. 2a–d), and the blurred (dyslegnic) dark hindwing fringe

(this is sharply defined (eulegnic) in *nigrosparsa*). The late-instar larva has copiously branched papillae along the SV line and the dorsum has prominent D setal pinacula on most segments (*D. nigrosparsa* has D setal pinacula prominent only on A8, see Patrick 2000: fig. 13). The larva of *I. feredayi* is a twig-mimic and lacks a fringe of SV papillae on abdominal segments A1–5, which are cylindrical and patterned all over.

Description. Wingspan 32–40 mm (both sexes). *Adult male*: Antennae bipectinate, length of longest rami 1/2 width of compound eye; third segment of labial palpus >1/2 length of second segment. Thorax colour variable (Figs 1a-j), patagia in some strikingly black (e.g., Fig. 1i); forewing ground-colour pale buff to greyish; costal strigulae short, at right angles to the costa or only slightly angled towards the base; basal patch (proximally in front of the antemedian transverse stripe) lacking a short black longitudinal streak (compare with Fig. 2b, d, *nigrosparsa*); markings largely transverse (Fig. 1a-j); central section of forewing may be contrasting black (Fig. 1i), or variegated (Fig. 1g), median area often with orange blotches (see Hudson (1889) and Remarks for more on colour patterns), termen obliquely convex; hindwing colour varying from almost white through shades of brown or grey, with or without terminal and median bands; termen normally evenly convex, weakly scalloped, some specimens showing weak lobe in the middle. Forewing radial venation (Fig. 1k, l): vein Sc adjacent to vein R subapically, R and Rs1 fusing to form a basal areole (Fig. 1l), Rs1 diverging from R and fusing with vein Rs4 thus obliterating the second areole to a slit formed by the apposed R+Rs1+2+3 and Rs4 (Fig. 1l). Hind-tibia unmodified. Abdomen brown to grey; occasionally with a row of black spots along the dorsal midline.

Adult female: Antennae bipectinate, pectinations short; each pair appearing V-shaped. Other characters as in male.

Male genitalia (Fig. 1n–p): Uncus short (not longer than gnathos arms). Gnathos apex with 2 upcurved teeth joined by a horizontal bar. Valva lightly sclerotised, ovate, apically with cucullus reduced to sparse marginal incurved setae, costa with a long, looped process (dvcp) sub-basally, attenuated from half-length distally. Costula immediately mesad of process, thin and acuminate, costular apices decurved, supporting a weakly sclerotised triangular field joined at the mid-line by a very short membranous transtillar area. Phallocrypt entrance broadly projecting, supported laterally by the projecting arms of each dorsal juxtal sclerite (basally separate and articulating with the juxta) (Fig. 1o). Cristate hairs few, on a membranous ridge beside the lateral margins of the juxta (not figured). Saccus fused with vinculum, gently rounded apically. Phallus (Fig. 1p): Aedeagus straight for most of length, distal quarter tapering to apex, slightly decurved and subapically with a low ventral mid-line flange; vesica with 5 or 6 subapical cornuti longitudinally arranged on sclerotised plate; a thick-skinned appressed sac on ventral midline; two small thin-skinned sacs, one apical, one ventral.

Female genitalia (Figs 1q, r): Posterior apophyses >3x length of anterior; T8 extended laterally to ventral midline, forming a 2-humped persistently scaled median band (S8 obliterated). Ostium bursae wide, transverse, lacking lamella antevaginalis; lamella postvaginalis narrow, contiguous with anterior margin of the swollen ventral extensions of T8. Antrum lightly sclerotised, colliculum broadly split dorsally, tapering anteriorly. Ductus seminalis arising dorsally on the left in ventral view on a short papilla (Fig. 1r, d.s.p.). Ductus bursae (Fig. 1q) irregular in shape and about as long and as wide as corpus bursae, with two sinuous lines of toothed pseudosigna, and a short posterior fluted area. Corpus bursae sock-like with a distinct, transverse terminal caecum on a neck (unmated condition) or caecum weakly defined (mated condition); signum a heart-shaped spinose plate (Fig. 1q).

Larva. Late instar Morphology: Abdominal segments A1–A8 with setae D1, D2 on variably prominent pinacula (cf. *D. nigrosparsa*), A1–7 D2 setal pinacula larger than D1 pinacula; on A8, D1 pinacula more prominent. SV papillae numerous, mostly branched, on A1–10, including both proleg pairs, but absent from foreleg bases (cf. *D. nigrosparsa*). A6 proleg crotchets bi-ordinal, in unbroken mesoseries (cf. *D. niveata*), A5 proleg primary; A5 and A6 prolegs respectively with 6 and 8–13 external setae in SV region (cf. *D. nigrosparsa*); in later instars, body widens gradually to A8.

Colour patterns: Head capsule in early instars pale tan; in later instars concolorous with body and with a transverse, ventrally concave, often broken fascia (cf. *niveata*). Instar I: ground-colour pallid with pink D, SD, L, SV and V (longitudinal) stripes expanded in mid-segment; L and SV stripes often coalescing in mid-segment. Instar II: ground-colour browner, stripes brown-shaded with L and SV stripes expanded and strong. Instar III: D and SD area pale, often greenish, L and SV evenly dark contrasting with above, V with a dark patch centrally on abdominal segments. Later instars: D, SD and L areas usually variably patterned in browns and greys, with

greenish patches especially where larvae browse on hosts with copious bryophyte and lichen epiphytic communities (e.g. *Myrsine divaricata*).

Resting pose: Appressed to substrate (Fig. L1b).

Hostplants. Polyphagous on a very wide range of native and introduced trees and shrubs, including both conifers and angiosperms. Appendix A lists recorded hostplants by plant families. Appendix B shows it is the most polyphagous of our declanoid species.

Flight period. Mainly September to April, but may be encountered any month of the year; adults come to light.

Distribution. Common to abundant throughout all parts of the North, South and Stewart Islands from sea level to the bush line, or, where this is depressed (e.g. Arthur's Pass), to subalpine shrub communities.

ND, AK, CL, WO, BP, TK, TO, GB, HB, RI, WI, WA, WN / SD, NN, BR, WD, MB, KA, NC, MC, SC, MK, OL, CO, DN, FD, SL / SI.

Type material. *Declana floccosa* Walker: Lectotype ♀ [effectively designated by Dugdale (1988: 164), but selected previously]: '1. Declana floccosa / New Zeal|54.4 / Type [green circle] / Geometridae genitalia slide no. 5361' [NHMUK] [Bolton, Auckland]. Wingspan 33.5 mm. Condition: minimally worn, right antenna missing. Paralectotypes, 2 ♀♀: 1 labelled 'N. Zeal /54/4' [printed], and lacking abdomen; the other 'New Zeal /54.4' [D. Bolton, Auckland], right hindwing lacking anal area. Both labelled 'Declana floccosa Walker paralectotype ♀ / paralectotype JSD 1981' [NHMUK].

Argua scabra Walker: Lectotype ♀ [effectively designated by Dugdale (1988: 164)]: 'Lectotype [green, circular] / Auckland N. Zeal / 60-73 [circular, white]' [Oxley, Nelson]. Condition: worn, wingspan 34.5 mm. Paralectotype, 1 ♀: 'Auckland N. Zeal. / 60-73; Argua scabra Walker paralectotype / paralectotype ♀, JSD 1981' [Oxley, Nelson] [NHMUK].

Declana callista Salmon: Holotype ♂: 'HOMER 29 [12 [43 [*sic*] J.T. Salmon / Declana calista [*sic*] Det. J.T. Salmon Type [rectangular label with red dot fixed to top right corner] / Genitalia Preparation No. 140' [MONZ].

Remarks. Of all our larger moths (*sensu* Hoare *et al*. 2011) *D. floccosa* is possibly the most commonly encountered arboreal herbivore, feeding on a wide range of endemic, indigenous, and exotic trees and shrubs (Appendices A, B). It is encountered by home gardeners, horticulturalists, foresters, and trampers in beech, podocarp, kauri and tawa-dominated forests. It can be as abundant in the canopy as on the understorey shrubs (e.g., *Myrsine divaricata*) and small trees (e.g., *Pseudowintera colorata*). It is present in manuka (*Leptospermum scoparium*) and kanuka (*Kunzea ericoides*) shrub communities, and is prominent in low-rainfall, small-leaved, divaricating *Olearia* shrub communities, where the adult can be confused with grey *D. nigrosparsa* but the larvae are easily distinguished (see Diagnosis above). Hudson (1939) described (p. 416), and portrayed (pl. LIII, fig. 31–33) instars I, III, and V, as well as a white *D. floccosa* larva on *Lophomyrtus bullata*. *D. floccosa* was dubbed the 'Forest Semi-looper' by the then Forest Research Institute's (now SCION's) Forest Biology Survey team over 1955–late 1970s. It vies in abundance, host variety and distribution with *Pseudocoremia suavis*. It has, like *P. suavis*, a bewildering variety of adult and larval colour patterns, some of which are figured by Kay (1982), who also gave notes on life history, but populations never reached the epidemic levels achieved by *P. suavis* at Eyrewell State Forest (Canterbury plains) and Balmoral State Forest (Hurunui Basin), both NC, in the 1950s and early 1960s. Occasionally, small trees of *Pseudowintera colorata* may be found completely defoliated and being debarked by the remaining larvae, as seen in silver beech forest above Wilmot Pass FD, in 1970 by JSD.

Earlier, G.V. Hudson (1889) was intrigued by the endless variety of adult forewing colour patterns, as was J.T. Salmon, who found yet another variation in a Homer FD specimen he collected, and described it as *Declana callista* (Fig. 1g) (Salmon 1946). Extensive collection and rearing of larvae by the Forest Biology Survey at the then Forest Research Institute revealed that the *callista* pattern form is present in several populations in North and South Islands. Most of the colour patterns discussed by Hudson (*op. cit*., pl. ix, figs 1─8) can be found in many localities. His fig. 1 is equivalent to our Fig. 1f, his fig. 2 and 3 are variants on our Fig. 1e, his Fig. 5 to our Fig. 1a, his fig. 6 to our Fig. 1b, his fig. 7 to our Fig. 1h. His fig.4 may represent a dark version of our Fig. 1c (*floccosa*), or our 2a, c (*nigrosparsa*) or even 3a (*niveata*) which have an all-grey form but can be distinguished by the characters given in the Diagnosis. We also show forms that are characterised by large dark areas on the forewing (Fig. 1d, 1i).

The presence of multiple external setae in the SV region on the A5 proleg in the larvae of this species and *D. nigrosparsa* is a remarkable feature, possibly not documented elsewhere in the Ennominae (C. Byrne, pers. comm.).

2. *Declana nigrosparsa* Butler, 1879, reinstated species

Fig. 2a–d (adults); 2e, f (male genitalia); 2g, h (female genitalia); Map 2

Declana nigrosparsa Butler, 1879. *Cistula Entomologica* 2: 500. Synonymised [incorrectly] with *D. floccosa* by Meyrick (1883, p.530, abstract); Meyrick, 1884, p.102.

Declana toreuta Meyrick, 1929. *Transactions and Proceedings of the New Zealand Institute* 60(3): 486–487. **New synonymy.**

Diagnosis. *Declana nigrosparsa* has two forewing patterns: form *nigrosparsa* (Fig. 2a, c) is pale grey, weakly marked in darker grey and while the only form found in drier and exposed shrubland areas, it is also found together with form *toreuta* (Fig. 2b, d), boldly marked dorsally in black on creamy-white, characteristic of high rainfall forest and subalpine shrublands. Both forms differ from *D. floccosa* in the following characters: 1) the longer male antennal pectinations (rami) > half the width of the compound eye (longest rami < half width of compound eye in *D. floccosa*); 2) forewing costal strigulae long, with many crossing vein Sc, and angled slightly towards the termen (short in *D. floccosa* and at right angles to costa or angled to base); 3) a small black longitudinal streak on the base of vein Sc in the white or pale grey basal patch of the forewing (some *floccosa* have the white basal patch with a black spot, but not a black streak); 4) third labial palpus segment usually <1/2 the length of the second segment (>1/2 in *floccosa* and other possible confusion species, e.g., *I. feredayi*); 5) underside of the hindwing with a definite dark grey discal spot. Larvae of both forms are brown with only the A8 pinacula prominently conical on dorsal tubercles (bearing seta D1) (see Patrick 2000: 16, fig. 13). *D. floccosa* larvae are pale to dark grey, often dappled with greenish patches and with prominent D seta pinacula on tubercles on all abdominal segments.

Description. *Adult male* (Fig. 2c, d): Wingspan 32-36 mm. Antennae strongly bipectinate, length of longest rami >1/2 width of compound eye. Third segment of labial palpus variable, usually <1/2 length of second segment.

Nigrosparsa form (Fig. 2c): Thorax grey, without definite transverse bands. Forewing ground-colour white mixed with light grey scales; pattern elements indefinite; costa with faint grey strigulae angled towards the termen; basal patch off-white, rather speckled with grey scales, obscuring the basal streak; postmedian line visible and the same shape as for the *toreuta* form (compare Fig. 2c, d); suggestion of a blackish apical streak but without terminal spots, termen convex; hindwing white, dulled by scattered grey scales, underneath base of wing pure white, hindwing termen with tooth (area around CuA1 apex) scarcely evident. Abdomen grey-scaled.

Toreuta form (Fig. 2d): Thorax white with two sharply defined black transverse bands; prothoracic band very broad. Forewing ground-colour white; pattern elements sharply defined; costa with bold black or brown strigulae angled towards the termen; white basal patch outlined by a black distal band forming a sharp, angulated edge and a central small black streak on vein Sc in the centre; sigma-shaped postmedian line broad on the costa from 1/2 to 3/4, becoming narrower to the dorsum near the tornus; marked by black scaling extending to the apex; North Island specimens often with bright yellow scales bordering postmedian band (not seen in South Island specimens); terminal area white with scattered dark scales; termen convex, with series of black notches. Hindwing bright white. Abdomen white, with prominent row of black spots along dorsal midline.

Adult female (both forms): Antennae shortly bipectinate; each pair of pectinations appearing V-shaped.

Nigrosparsa form (Fig. 2a): As in male, and distinguished from grey *D. floccosa* females by whitish, rather than grey or dark grey hindwings.

Toreuta form (Fig. 2b): Some forewing costal strigulae reduced especially on distal half of costa, brown; basal patch and postmedian line as for the male but basal black streak longer (half as long as basal patch is wide), remainder of wing heavily mottled in dark brown except for pale subterminal area; terminal 'notches' brown. Abdomen off-white with prominent row of dark brown spots along dorsal midline; hindwings as in male.

Male genitalia (Figs 2e, f): Uncus short; gnathos apex a broad trowel, finely scobinate; valva lightly sclerotised as in *D. floccosa* but triangular, apically decurved, not ovate, and with cucullus marginal, sparsely setose; dorsal valval costal process (dvcp) a strong deeply channelled concave spine, directed caudally and almost 0.5x valval length; costulae fusing with the mesal ridge of the dvcp (Fig. 2e, annotation) to the sword-like apex of the now double structure and joined mesally to the transtillar area on a short, knife-like stub (i.e., not extending mesally as in *D floccosa*), apices widely separated by a broad lightly sclerotised micro-sculptured transtillar area;

phallocrypt entrance supported by dorsal arms of the juxtal dorsal margin, these arms fused (not, as in *D. floccosa*, articulated) with juxta, juxta basally recurved (Fig. 2e). Phallus (Fig. 2f): aedeagus with sclerotised obliquely rounded apex; vesica lacking cornuti and other structures.

Female genitalia (Fig. 2g, h): Posterior apophyses 2.5x length of anterior apophyses. T8 evenly sclerotised and extending as lobes laterally, meeting on ventral midline and almost obliterating S8 area (more or less as in *D. floccosa*); sterigma lacking the lamella antevaginalis; lamella postvaginalis an oval plate (Fig. 2h, behind white arrow) and anterior to the ventral apices of the T8 extensions; ductus seminalis apparently on RH side of ductus bursae apex in ventral view (Fig. 2h, d.s.p.); ostium bursae (Fig. 2h) in a broad, cup-shaped fused antrum and colliculum; ductus bursae lightly fluted, stout, 0.5x length and 0.5x width of corpus bursae, pseudosigna absent; corpus bursae baglike, gradually widened from junction with ductus bursae, with a subtriangular transversely folded signum and horizontal knife-like sclerite.

Larva. *Morphology*: [Only penultimate and ultimate instars are known.] Head capsule as in *D. floccosa*, body widening from prothorax to A5 or A6, thence uniform in width to A8 and A9; A5 proleg with 6 external setae in SV region, A6 proleg with 8–11 external setae. Only A8 with a prominent pair of D tubercles (*D. floccosa* with prominent D tubercles on most segments). SV band of papillae simple or weakly branched, absent from anal prolegs but present on one or more other pairs of prolegs.

Colour pattern: HC and body regions D, SD, L, and SV with a longitudinal finely grained dark brown or grey-brown pattern; venter haemocoel green.

Resting pose: Appressed to the substrate.

Hostplants. Both forms feed exclusively on *Olearia* (Asteraceae). The *nigrosparsa* form is recorded from *Olearia bullata*, *O. fimbriata*, *O. fragrantissima*, *O. hectori*, *O. lineata* and *O. odorata* (Patrick 2000; B.H. Patrick, pers. comm.). The *toreuta* form has only been reared from *O. odorata* (specimens in NZAC from Upper Wairau MB). Larval material preserved in OMNZ (OL specimens), and NZAC (MB specimens).

Flight period. TK and TO specimens (*toreuta* form) have been recorded in November and December between 800 and 975m. The *nigrosparsa* form has been mainly recorded from August to December, with a few records from January (MK: see White 2002) and February (WD) (B.H. Patrick, pers. comm.).

Distribution. Present on North and South Islands in high rainfall forest (*toreuta* form), and South Island grey shrublands (*nigrosparsa* form), often locally abundant; apparently one generation per year. The *nigrosparsa* form is known from MC south (White 2002, and material in OMNZ, BPNZ) with records from sea-level to 920m.

TK, TO / NN, MB, WD, NC, MC, MK, OL, CO, DN, SL

Type material. *Declana nigrosparsa* Butler: Holotype ♀: [rectangular, small, buff label] 'Otago 79.19 / [rectangular, larger, white label] 2 / Type [red-rimmed, circular label] / Declana nigrosparsa Butler, type' [NHMUK]. Wingspan 35 mm. Condition: scarcely worn, abdomen missing.

Note. Although the abdomen of the holotype is missing and the genitalia cannot be checked, the direction of the forewing costal strigulae (angled towards the termen) shows that this specimen is conspecific with recent South Island specimens reared from divaricating *Olearia* species, which have genitalia indistinguishable from those of *Declana toreuta* Meyrick. Meyrick's synonymy of *nigrosparsa* with *floccosa* is incorrect, and *nigrosparsa* is resurrected here as a valid name, with *toreuta* as a junior subjective synonym.

Declana toreuta Meyrick: Lectotype ♀ (designated by Dugdale 1988: 165): 'Selidosema toreuta Meyrick, type ♀ det. D.S. Fletcher 1960 / [accession label] / Arthur's Pass New Zealand WHB[urrow] bred '28 / Type [round, red circle]' [NHMUK]. Condition: scarcely worn; abdomen missing. Wingspan 32 mm.

Note. The lectotype is the only Arthur's Pass specimen sent to Meyrick seen by JSD in 1980-81. The paralectotype, also a female, was described separately by Meyrick (1929) underneath the main description; it was regarded as atypical by him, being dwarfed and grey-tinged, but he also stated that it was certainly conspecific in his view, so there is no reason to exclude it from the type series. The (white) lectotype is depicted by Hudson (1939: pl. LV, fig. 34); the forewing's long costal strigulae and black streak in the basal white patch are well-depicted.

Remarks. The *nigrosparsa* form of this species was first collected around Dunedin by Dr F.W. Hutton, Director of the Otago Museum, and described by A.G. Butler in 1879. Over a century later, similar adults were reared from small-leaved *Olearia odorata* shrubs at Heyward's Point on Otago Peninsula by Brian Patrick. Both Patrick (2000) and White (2002) treated the *nigrosparsa* form as an unnamed species of *Declana* ('grey *toreuta*' of

White 2002), based on the longstanding incorrect synonymy of *nigrosparsa* with *floccosa*. We found the male and female genitalia of the *nigrosparsa* form to be identical with those of specimens of the *toreuta* form from the Upper Wairau MB, which in turn were identical to Meyrick's (1929) *toreuta* externally. Hudson (1950: pl. VIII, fig. 9) figured a specimen as *Declana floccosa* from forest at Sullivan's Dam, Dunedin collected by George Howes on 7 October 1939. The painting clearly shows the longer costal strigulae, line of black abdominal spots, and white hindwings characteristic of *nigrosparsa* form *toreuta.* Of the four males collected in 1940 by S. Lindsay at Arthur's Pass village and identified as *toreuta* by Hudson (1950: 97), the one figured by him (*ibid*., pl. V, fig. 5) is indisputably *Ipana hermione (q.v.).*

Declana nigrosparsa and *D. floccosa* have populations in low rainfall areas with a seemingly fixed grey colour pattern coincident with the presence of small-leaved species of the host genus *Olearia*, which predominate in 'grey scrub' communities in the lee of the Southern Alps in MK, CO, OL (Patrick 2000). In higher rainfall areas *D. nigrosparsa* adults are often of the *toreuta* form, characteristically vividly white, with largely sharply defined dark-grey and black markings, e.g., Sullivan's Dam DN, Mt Taranaki TK. At Arthur's Pass both forms occur as noted by Meyrick (1929). Brian Patrick (pers. comm.) has recently discovered the *nigrosparsa* form of *D. nigrosparsa* on *Olearia fimbriata* on exposed sites on Banks Peninsula MC, a significant north-eastward extension of range.

3. *Declana niveata* Butler, 1879

Fig. 3a–c (adults); 3d, e (male genitalia); 3f, g (female genitalia); Map 3

Declana niveata Butler, 1879. *Cistula Entomologica* 2: 500.

Diagnosis. Adults of *Declana niveata* (Fig. 3a–c) differ from pale specimens of *D. floccosa*, *D. nigrosparsa* and *Ipana feredayi* (declanoids with roughly rectangular forewings and a transverse forewing pattern) by their non-pectinate antennae and usually pure white hindwings. The shape of the forewing antemedian line is also diagnostic in *D. niveata*: it runs in a straight, very oblique line from the dorsum and fades very near the costa; in *D. floccosa*, the line, when present, is more or less V-shaped, with the angle in the middle of the wing, and the section on the costa is usually fairly distinct. *Declana niveata* also possesses a more-or-less distinct mid-termen lobe on the hindwing, a feature not shared with the typical form of *D. nigrosparsa* or with *I. feredayi* (but there may be an indistinct lobe in this position in *D. floccosa*). In the larva of *D. niveata*, the SV papillae on segments A1–5 are unbranched (branched in *D. floccosa*).

Description. *Adult male* (Fig. 3c): Wingspan 27–36 mm. Antennae filiform. Thorax white or pale grey; forewing ground-colour pale greyish white; costal strigulae short, slightly angled towards the termen; wing markings transverse, grey, irregular and of varying intensity, normally weakly pigmented; in fresh specimens, disc dotted with scale mounds; termen evenly convex, weakly scalloped; hindwing pure snow-white; a black line on the termen present in many, but not all, specimens; termen moderately scalloped with a more or less distinct 'tooth' mid-termen at the end of vein CuA1. Abdomen pale greyish white, with or without a row of black dots along dorsal midline.

Adult female (Fig. 3a, b): Transverse forewing markings usually bolder than in male; costal strigulae often, though not always, longer. Hindwing not always pure white; some (those with well-marked forewings) with faint grey median line or lines, termen with tooth as in male. Abdomen pale to dark grey; with or without a row of black dots along dorsal midline.

Male genitalia (Fig. 3d, e): Uncus elongate, dorso-ventrally flattened, widest apically, apex with three teeth, two lateral and one central; socii (Fig. 3d) short-setulose, pendent; gnathos arms meeting mesally, fusing to form a long two-pronged hook as long as each arm; dvcp a decurved spine about 0.25x valval length; costulae arising mesad of this spine, basally expanded and mesally sinuous, lightly sclerotised and broadly joined mesally by a thickened membranous transtillar area; valva elongate, strap-like, broadly rounded apically; cucullus setae sparse; juxta (Fig. 3d, labelled) lightly sclerotised, juxtal lobes and phallocrypt entrance scarcely discernible. Cristae (not shown in Fig. 3d) as separate membranous mounds flanking juxta base, setulose. Saccus short, flat, bent anteriorly. Phallus (Fig. 3e) lightly sclerotised, distally sclerotised, pointed and sinuous, cornuti absent.

Female genitalia (Fig. 3f, g): Anterior and posterior apophyses about equal in length, T8 lightly sclerotised. S8 a membranous corrugated oval plate; only the lamella antevaginalis discernible; antrum an unsclerotised pit intersegmentally between A7 and A8 and not fused with the colliculum, which is a separate, dorsally split collar;

ductus seminalis arising on a papilla on the LH side of the ductus bursae in ventral view; ductus bursae weakly fluted (ribbed) but lacking pseudosigna, its width 0.3x that of corpus bursae; about 0.33x length of corpus bursae; corpus bursae (Fig. 3f) sub-globose; signum a semi-circular, lightly sclerotised blade, closer to ductus than to anterior apex of corpus, anterior margin narrowly blade-like with an internal short thorn at half-length of the blade.

Larva. *Morphology*: Late instar larvae widened from head capsule to A5, thence sides parallel. SV papillae on A1–A5 simple, unbranched; on A6–A8 simple or branched; setal pair D2 on A1–A8 on a conspicuously larger tubercle than on other segments; A5 proleg primary; A6 proleg with 10 SV setae.

Colour pattern: Head capsule with a blackish horizontal band at half head height. Body colour: dorsal, subdorsal, lateral, and subventral areas mid-grayish, grainy-patterned; venter haemocoel green.

Resting pose: Appressed to the substrate.

Hostplants. The larva feeds on two genera of endemic woody Malvaceae (Appendices A, B). Recorded hosts are houhere or lacebark (*Hoheria angustifolia*, *Hoheria glabrata*, *H. lyalli*, and *H. populnea*); saltmarsh ribbonwood (*Plagianthus divaricatus*); and manatu or ribbonwood (*Plagianthus regius*). There is a single record on *Rubus australis* (Philpott 1917) but as this is a liane, with foliage intermingling with that of the supporting tree(s) (not recorded), the association could be in error and has not been corroborated in more recent decades. The larvae feed on foliage, and, on *Plagianthus divaricatus*, the flowers and developing fruit.

Flight period. September until March, peaking December and January. Comes to light.

Distribution. Occurs in varying abundance from Miranda (AK) and Whitianga (CL) to Southland (SL), from sea level to over 950 m.

AK, CL, WO, BP, HB, RI, WA, WN / NN, BR, WD, MB, NC, MC, SC, MK, OL, DN, FD, SL

Type material. *Declana niveata* Butler: Holotype ♂: 'Otago 79.19 / Declana niveata Butler (Type) / 8 [rectangular] / Type [circular, red-rimmed]' [NHMUK]. Wingspan 30 mm. Condition: very good,

Remarks. *Declana niveata* is a distinctive element in *Declana*: the male has short pendent socii (Fig. 3d, labelled) (also present but longer in *Ipana*), and a distinctive long apically flattened uncus; the female bursa copulatrix has a narrow ductus bursae and globose corpus bursae reminiscent of *Ipana glacialis.* Nevertheless the ostium bursae characters, the diamond shape of the male genital capsule, the concave juxta, lack of external coremata on the valva and the larval habitus closely resemble the character states of other species of *Declana*, and it is confidently assigned to this genus here.

This species can be locally abundant, particularly where its two host genera co-exist. At Paremata Reserve at the mouth of the Wakapuaka River NN possibly 5 small trees of *Hoheria angustifolia* persist but a *D. niveata* population thrives on the contiguous estuarine *Plagianthus divaricatus* shrubland. Larvae are typical but the adults are somewhat greyer than those associated with *Hoheria* spp. and *Plagianthus regius*. *Declana niveata* has not yet been recorded from saltmarsh ribbonwood communities now distant from forest along the Nelson coast. This species has a relict distribution in some eastern South Island areas, where according to Dr P. Johnson (pers. comm.) "From Oamaru to Timaru / *Trifolium* and *Lolium* / stretched out like green linoleum". In coastal Nelson NN and elsewhere, *Plagianthus regius* is now a commonly planted tree; it will be interesting to see if *D. niveata* can establish itself on these plantings.

4. *Declana foxii* Dugdale & Emmerson, new species

Fig. 4a, b (adults); 4c (forewing venation); 4d, e (male genitalia); 4f, g (female genitalia); Map 4

Etymology. This species is named for its discoverer, Kenneth J. Fox, who recognised and appreciated its uniqueness; happily, the colour pattern has a fox-red tinge compared to the lupine grey of *lupa.*

Diagnosis. *Declana foxii* is one of the four declanoid species with filiform antennae. It bears a close resemblance to *D. lupa* (q.v.) but its thoracic scaling and forewing ground-colour is reddish fawn compared to the pale grey of *D. lupa* and the hindwings are bordered brownish-fawn (grey in *lupa*). See Diagnosis under *D. lupa* below for a list of diagnostic characters.

Description. Wingspan 34–40 mm. *Adult male* (Fig. 4b): Antennae filiform. Third segment of labial palpus <1/2 length of second segment. Thorax reddish fawn, matching forewing ground-colour; darker dorsal midline stripe; forewing ground-colour reddish fawn with markings dark brown; costa with a series of strigulae angled towards the termen, the bases reaching a line of dark scales following the Sc vein; termen moderately scalloped; the only transverse element is the angled basal line. Basal line of raised dark brown scales, mixed with brassy scales

towards dorsum, line angled at 2/3 its length and from this angle a sweeping concave dark brown line extends to the termen just under the apex; base of this concave line and a short broad near-straight line above it partly enclose an elongate ellipse of paler scales forming a half-closed 'eye' (in *D. lupa* the 'eye' is fully enclosed, Fig. 5b), the end of the upper line does not form a distinct dark-scaled dot as in the female (Fig. 4a); termen oblique, convex, edge scalloped; forewing radial venation with two fully formed areoles (Fig. 4c, labelled; cf. one in *D. floccosa* (Fig. 1l)); hindwing pale fawn with a broad brownish-fawn terminal band; termen with dorsal half at most weakly curved, weakly scalloped, discal spot absent or barely visible. Hind-tibia unmodified. Abdomen warm buff with a pair of longitudinal black parallel lines dorsally, one either side of the pale midline.

Adult female (Fig. 4a): Closely resembles male but antenna slightly narrower; forewing discal and termen markings less definite; discal area of forewing with discal dot.

Male genitalia (Fig. 4d, e): Uncus short, (ca 1/3 tegumen length). Gnathos apex broadly trowel-shaped with coarse scobinations. Valva strap-like and membranous, cucullus sparsely setose, dorsal valval costal process (dvcp) as in *D. floccosa* but apical section not attenuated, and apex pointed with a short apical needle (Fig. 4d, arrowed), valva basally with a pulvinus close to the costa forming a conspicuous, rounded, setose mound (oblong in *D. lupa*). Costulae slender, lightly sclerotised, apices separated but connected by a stoutly membranous transtilla. Phallocrypt entrance unsupported. Juxta reduced and the paired basal lateral bands of cristate setulae are difficult to see. Saccus: gently rounded (as in *D. floccosa*). Phallus (Fig. 4e): aedeagus stout, straight, tapering in distal 1/4 to a rounded apex 0.5x diameter of aedeagus shaft; vesica with ca 15 cornuti, evenly graded from longest to shortest on a sclerotised plate, as in *D. floccosa.* Eversible sacs not seen.

Female genitalia (Fig. 4f, g): Posterior apophyses 5x length of anterior apophyses. T8 anteriorly weakly sclerotised (T8 entirely deeply sclerotised in *D. lupa,* q.v.), extending laterally and ventrally as narrow angulated setose lobes (Fig. 4g, labelled). S8 / lamella postvaginalis (Fig. 4g) a massive, enlarged, weakly bilobed, entirely densely micro-pilose trapezoid, lacking a basal transverse bulla, mesal furrow evident from half sternite length and ending on caudal margin in a small prominence, caudal margin weakly biconvex (strongly so in *D. lupa*), width 1.55x anterior margin. Ostium supported by a concave lamella antevaginalis; antrum membranous, colliculum sclerotised, broad, slightly flared caudally. Ductus bursae moderately sclerotised, about half the length and a quarter the width of the corpus bursae, as in *D. lupa* (Fig. 5e), fluted (ridged) but no visible sclerotised armatures (pseudosigna). Corpus bursae roughly ovoid, with signum close to the junction with ductus bursae, signum an oval blade, flat, smooth, deeply folded, lightly sclerotised.

Larva: Unknown.

Hostplants. Unknown.

Flight period. Information is limited: TK specimens were collected during November, December and January; the single WA specimen was taken in December and the four WN specimens in July. Comes to light.

Distribution. Confined to the southern North Island, with specimens being collected from the slopes of Mt. Taranaki from 600–1070 m, and from "Meremere Bush", Tarere Forest, (ca 400 m) by Mangaone Trig, in south-eastern Taranaki. A single specimen from WA (Putangirua Pinnacles) and four from eastern WN (Lake Pounui) extend the range considerably. (Note: the WA and WN sites are approximately 16 km apart).

TK, WA, WN / –.

Type material. Holotype ♂: 'Mt Egmont East Side 1070m, 1 Dec 1968, K J Fox / AWE slide Geo. 83 genitalia ♂ / NZAC04251671 [database accession number]' [NZAC]. Paratypes: 3 ♂♂, 1 ♀ [all NZAC]: TK: ♂, Holly Hut, North Egmont, 950 m, 26-30 Dec 1975, J.S. Dugdale; ♂, North Egmont, 3200 ft [975 m], 1 Jan 1993, [P. Peckham?] (Fig. 4b; NZAC04251669); ♂, North Egmont, 975 m, 3 Dec 1992, J.S. Dugdale, P. Peckham; ♀, TK: Mt Egmont 14 Jan 1993, [P. Peckham?] (Fig. 4a; NZAC04251670).

Remarks. *Declana foxii* was first recognised as new by the lepidopterist Dr Kenneth J. Fox. Ken found this species somewhat unpredictably at several of his collecting sites on Mt Taranaki (see his obituary by Dugdale (1987)). All sites where *D. foxii* has been captured are floristically rich except perhaps Lake Pounui WN which is dominated by kanuka (*Kunzea ericoides*) (G.W. Gibbs, pers. comm.). Complex treeline subalpine shrublands dominate the Mt Taranaki sites, and the southern Taranaki Tarere Forest site is in floristically rich upland forest, so finding the host could be a challenge. Dr Gibbs' information may indicate kanuka as one of several possible hosts; however, kanuka is not a feature of subalpine Mt Taranaki shrublands. *Carmichaelia* was prominent at the

Putangirua Pinnacles site, and is another possibility (RJBH pers. obs.). Comparisions of floristics of the known localities of *D foxii* to find plant taxa in common may simplify this challenge.

The gnathos scobinations of this species and its close relative *D. lupa* possibly connect with the enlarged scobinate female S8 / lamella postvaginalis during copulation, serving to open the ostium bursae.

5. *Declana lupa* Dugdale & Emmerson, new species

Fig. 5a, b (adults); 5c, d (male genitalia); 5e, f (female genitalia); Map 5

Etymology. The name is derived from the Latin *lupa*, she-wolf (a feminine noun in apposition). The moth is considered wolf-like, being grey where *foxii* is reddish fawn.

Diagnosis. *Declana lupa* is one of the four declanoid species with filiform antennae. It bears a close external resemblance to *D. foxii* differing in 1) the pale grey forewing ground-colour compared to the reddish fawn of *D. foxii*, 2) the grey and white speckled patagia and abdominal dorsal scales of *D. lupa*, 3) the shining grey colour of the paler raised scales in the curved basal forewing line (brassy in *D. foxii*), 4) the eye-shaped marking in the middle of the forewing fully enclosed by black lines / dark shading (open distally in *D. foxii*), 5) the rather dark greyish hindwing border in *D. lupa* (much paler brownish fawn in *D. foxii*) and 6) the faint but distinct discal dot in the hindwing compared to the unspotted or extremely faintly spotted *D. foxii* hindwing. In the male genitalia, the narrower, more 'pinched' gnathos apex distinguishes this species from *D. foxii*.

Description. *Adult male* (Fig. 5b): Wingspan 36-38 mm. Antennae filiform as in *D. foxii.* Third segment of labial palpus 1/2 length of second segment. Thorax grey with dark dorsal midline stripe, patagia grey-speckled. Forewing ground-colour pale grey with markings dark grey or black, form of markings much as in *D. foxii* (Fig. 5b, compare with Fig. 4b), but with paler scales of basal line shining grey rather than brassy; 'eye' mark in wing centre enclosed by dark grey to blackish scaling; costa with a series of strigulae angled towards the termen as in *D. foxii*, the bases reaching a line of dark scales following the Sc vein; termen oblique, convex and moderately scalloped, as in *D. foxii.* Forewing radial venation with a secondary areole as in *D. foxii* (Fig. 4c). Hindwing pale grey with a hazy discal dot and a broad dark terminal band; termen weakly scalloped. Hind-tibia unmodified. Abdomen speckled grey with a pair of longitudinal black parallel lines dorsally, one either side of the midline.

Adult female (Fig. 5a): Resembles male, but antenna slightly narrower; forewing discal markings diffuse.

Male genitalia (Fig. 5c, d): Uncus short (ca 1/2 tegumen length); gnathos apex narrowly trowel-shaped, scobinate; valva straplike with pulvinus rectangular, its dorsal margin straight; cucullus as in *D. foxii*, sparsely setose; costulae ovate, meeting in mid-line and lightly sclerotised; dcvp looped (as in *D. floccosa*, q.v.) but, as in *D. foxii*, not distally attenuated until just before its apex (compare Fig. 5c with Fig. 1n); juxta and phallocrypt area lack supporting sclerites, cristate setae not observed; saccus with a small apical point. Phallus (Fig. 5d): aedeagus straight, apex broad, ca 0.75x width of aedeagus shaft; vesica and cornuti as in *D. foxii*, but cornuti ca 20, weakly sclerotised.

Female genitalia (Fig. 5e, f): Posterior apophyses 5x length of anterior apophyses. T8 entirely sclerotised, extending laterally and ventrally to S8 as setose lobes; S8 / lamella postvaginalis (Fig. 5f) a massive, bilobed, entirely micro-spinulose trapezoid, central furrow narrow (as in *D. foxii*) but extending anteriorly to a transverse basal bulla (absent in *D. foxii*), caudal margin 2x anterior margin width, biconvex, (i.e., mesally indented); ostium bursae supported only by lamella antevaginalis; colliculum parallel-sided, not flared caudally; ductus bursae stout, sclerotised, weakly fluted, about 1/2 length of corpus bursae and about 1/4 as wide; no pseudosigna; signum a transverse, sinuous deeply folded smooth blade, weakly sclerotised.

Larva: Unknown.

Flight period. October until December (n=14 specimens); comes to light.

Distribution. Known only from Auckland's Waitakere Ranges and immediately to the north. The earliest known capture is a single specimen taken by Chris Green at Matuku (Forest and Bird) Reserve northwest of the Waitakere Ranges in 1983 and a further thirteen specimens have been collected from three other sites in the Ranges. The localities are all in or close to botanically diverse native bush, and in proximity to the west coast.

AK / –.

Type material. Holotype ♂: 'NEW ZEALAND AK 36°59.6'S 174°29.2'E Karekare, 71 Lone Kauri Rd, 170m, m.v. trap, 27–28 Nov 2010 A.W. Emmerson, R.J.B. Hoare / AWE slide Geo. 99 genitalia ♂ / NZAC04251668 [database accession number]' [NZAC]. Paratypes: 3♂♂, 1♀ [all NZAC], same locality and

collectors as holotype, but collected in m.v. trap on 8-9 Nov 2009 (female (Fig. 5a) with accession number NZAC04251672).

Remarks. The adults of *D. foxii* and *D. lupa* are similar in morphology, especially in wing pattern and male and female genitalia, and while the males of both species resemble *D. floccosa* in having a looped costal arm, the female genitalia are of a different conformation, and more resemble *D. niveata* in ductus and corpus bursae structure (compare Fig. 5e, *D. lupa* and Fig. 3f, *D. niveata*). When the larvae are discovered, it will be interesting to see if they possess the larval apomorphies described for other *Declana* species in this paper such as functional A5 prolegs and an outline-breaking line of SV papillae. If other declanoid examples are any guide, the hostplants of these two species may well be the same (e.g., *I. atronivea*, *I. egregia* on Araliaceae), or taxonomically closely related (*I. hermione, I. halocarpi,* on Podocarpaceae).

Genus *Ipana* Walker, 1858

Fig. 6a–15d (adult habitus); 15e (adult head); 6c, 9c, 14f, 15f (forewing venation); 12b, 15g, h (coremata); 14g (abdominal base), 6d–15k (male genitalia), 6f–15m (female genitalia), L6a, b, L8a–d, L9a, b, L10, L13, L14a, b, L15a–d (larvae); T10, T12 (threats).

Ipana Walker, 1858. List of the lepidopterous insects in the collections of the British Museum XV: 1661–1662. Type species: *Ipana leptomera* Walker, 1858: 1662. by original monotypy. Synonymised with *Declana* by Meyrick (1917: 270). **Reinstated genus.**

Detunda Walker, 1865. List of the lepidopterous insects in the collections of the British Museum XXXII: 618–619. Type species: *Detunda atronivea* Walker, 1865, p. 619, by original monotypy. Synonymised with *Declana* by Hudson (1898: 95).

Politeia Walker, 1865. List of the lepidopterous insects in the collections of the British Museum XXXII: 642. Type species: *Politeia junctilinea* Walker 1865: 643, by original monotypy. Synonymised with *Declana* by Meyrick (1885: 65).

Amphitape Felder & Rogenhofer, 1875. Reise der österreichischen Fregatte *Novara* um die Erde (zoologischer Theil), Band 2 (Abtheilungen 2), Hefte 2: plate cix, fig 10. Type species: *Amphitape crassitibia* Felder & Rogenhofer, 1875: plate cix, fig 10, by original monotypy (= *Ipana leptomera* Walker, 1865). Synonymised (by implication) with *Ipana* by Butler (1877, p. 382).

Diagnosis. Mesoscutellar crest present in most species, either prominent, ca 5 mm high (*atronivea, egregia, junctilinea*) or low, ca 2 mm high (*feredayi, hermione* group) or as a tumid mound of large scales (*griseata)*; absent from *glacialis* and *leptomera*. Forewing floccosity weakly developed on most species; absent from *glacialis* and *leptomera*. Venation: 3 veins branch costally from the R-stem before the R–M junction (cf. 2 in *Declana*). Male hindlegs unmodified except in *leptomera,* where the tibia is swollen and with a hair-pencil (Fig. 15g). Abdominal S2 lateral lobes present, prominent, shielding the cavus entrance (Fig. 14g), rudimentary only in female *glacialis* (absent in *Declana*). Male genitalia: genital capsule rectangular, pedunculus not protruding laterally (Fig. 6d, cf. Fig. 1n, *Declana*), uncus base with socii present (Fig. 13d) (absent in *Declana* except for *D. niveata*, Fig. 3d, vestigial); valva with outer corematal tuft (Fig. 9f, b.v.c., Fig. 12c); juxta a large flat shield (e.g., Fig. 9d, 11c; cf. C-shaped and reduced in *Declana*) and with articulating, often sharp-pointed dorsal sclerites. Female genitalia: ostium bursae encircled by the fused ante- and post-vaginal lamellae to form a 'complete' sterigma (Fig. 9h, *Ipana feredayi*, st) (incomplete and lacking the lamella postvaginalis in *Declana*). Larvae: HC held perpendicularly to body (hypognathous, Fig. L8b); except for *I. glacialis,* larvae are stick mimics. Body cylindrical (venter concolorous with rest of body) and not flattened ventrally except for abdominal segments A6–10; in *I. glacialis* the body is stout, smooth.

Description. *Adult male, female*: Antennae pectinate in all species except *I. leptomera.* Labial palpus geniculate, apical segment slender, length >1/2 length of second segment, with scaling appressed and apex clavate. Forewing radial venation as in Diagnosis. S2 with prominent lateral lobes partly occluding the cavus opening (Fig. 14g) (cf. *Declana*, where these are absent).

Male genitalia (Fig. 6d–15k): Genital capsule more or less oblong as peduncular area is not produced laterally; uncus elongate, in some species slightly swollen apically, and basally with socii; valvae with basal coremata (Fig. 9f, b.v.c.) present, long-scaled, dense (Fig. 12c, intact), absent in the diurnal *I. glacialis*; valva elongate, lacking a costal process (dvcp), with a more or less distinct cucullus of stouter setulae; costulae meeting mesally but not fusing, costula shape various, e.g.: (a) dorsal margin a smooth, convex, strongly sclerotised ridge with a lightly sclerotised broad ventral flap receiving muscles m2, m4 (Fig. 6d, *I. atronivea*; Fig. 7c, *I. egregia*) (for musculature, see further Kristensen 2003: fig. 4.34B, C); (b) each a slender recurved sclerite with a stouter less sclerotised basal area receiving m2 and m4 and apposed to the other costula (Fig. 15j, *I. leptomera*); (c) each with a stout, sclerotised, dorsally spinulose or roughened arm from which a weakly-divided sclerotised flap (receiving the

muscles) hangs (Fig. 9d, *I. feredayi*; Fig. 10c, *I. glacialis*; Fig. 8d, *I. griseata;* Fig. 14i, *I. junctilinea*); (d) entire transtilla evenly strongly sclerotised and dorsally densely spinulose (Fig. 11c, 12c, 13d, *I. hermione* group (*I. halocarpi*, *I. perdita*, *I. hermione*, respectively)); juxta (e.g., Fig. 9d, *I. feredayi*) shield-like, discally flat, sides weakly incurved and bearing cristate setulae (but not in *I. glacialis*, Fig. 10c), dorsal margin generally extending into phallocrypt (not in *I. glacialis, I. griseata*) or margin broadly rounded (*I. hermione* group); dorsal juxtal sclerites present, either large and sharp-pointed (most species), or small and arcuate (*I. glacialis*), or small and thumb-like (*I. hermione* group). Phallus: aedeagus either stout (length 4x width) or elongate (length >10x width, as in *I. leptomera*) and with a very short caecum penis (e.g. Fig. 7d, *I. egregia*, Fig. 15k, *I. leptomera*); vesica straight, either coarsely (e.g., Fig. 10e, *I glacialis*) or finely (e.g. Fig. 8e, *I. griseata*) striate, striations indiscernible in *I. leptomera* (Fig. 15k); cornuti present, number and form various (e.g., Fig. 9e, *I. feredayi*), but short, bent and thick in the *atronivea* group (Fig. 6e, 7d, 8e); in *I. glacialis,* at most two, and extremely reduced in size and intensity of sclerotisation (Fig. 10e).

Female genitalia (Fig. 6f-15m): Posterior apophyses longer than anterior apophyses except in *I. egregia* and *I. feredayi;* S8 various, either (a) a broad sculptured apically incised plate which is transversely folded into a pleat with upper and lower lobes (Fig. 15m, *I. leptomera*) or (b) a small thickened ovate transversely ridged membranous area (other species, e.g., Fig. 6g, *I. atronivea*); sterigma a single plate surrounding the ostium bursae with the post-vaginal section tending less strongly sclerotised (e.g., Fig. 14l, *I. junctilinea*); antrum and colliculum sclerotised and fused with the sterigma (e.g., Fig. 6g, *I. atronivea*); ductus seminalis exiting ductus bursae on a papilla at ductus bursae entrance (e.g., Fig 6g, *I. atronivea*) as in *Declana* (*q.v.*); ductus bursae various: (a) shorter and thinner than corpus bursae and membranous (Fig. 10f, *I. glacialis*); (b) long and slender (length 2x, and width 0.3x corpus bursae), deeply sclerotised, with a split cestum and a sclerotised oblique junction with the corpus bursae (Fig. 15l, *I. leptomera*); (c) ductus sclerotised, with longitudinal ridges forming a fluted appearance and some ridges more strongly sclerotised forming pseudosigna (e.g., Fig. 6f, *I. atronivea*; also *I. egregia, I. feredayi, I. griseata, I. hermione* group, *I. junctilinea*). Corpus bursae membranous, either transversely confluent with ductus (Fig. 6f*, I. atronivea*; Fig. 8f*, I. griseata*), or confluence oblique, either weakly (Fig. 9g, *I. feredayi*; Fig. 14k, *I. junctilinea*), or strongly (Fig. 11e, 13f, *I. hermione* group). (*I. glacialis* has ductus and corpus bursae unsclerotised.) Signum (absent from *I. glacialis*) is a weakly arcuate internally projecting blade in other known species.

Larva. *Morphology*: HC in later instars held hypognathously (vertically) with each epicranium bearing a forward-directed projection between setae P1 and P2 as in *Declana*, but more prominent because of the vertical head posture. Prothorax and mesothorax either unmodified (most species) or modified intersegmentally (*I. atronivea* group (*I. atronivea, I. egregia*, *I. griseata*)), either transversely as a flattened swelling (Fig. L6a, b*, I. atronivea*) or vertically as a stub (Fig. L8b, *I. griseata*); metathorax (T3) unmodified. Abdominal segments A1–5 cylindrical, lacking SV papillae; A5 prolegs where present either functional (*atronivea, egregia*) or vestigial, with 5 or fewer crotchets haphazardly arranged, and not in a mesoseries; A2–6 with seta SV2 antero-mesal to setae SV1 and SV3 and distant from them (cf. *Declana*, q.v.); A6 with sublateral spine (Fig. L8a insert, *I. griseata,* arrowed) on its anterior margin anterior to L2, becoming an erect fleshy thumb in last instar larvae of *I. griseata* (Fig. L8c, arrowed) (apparently absent in *I. atronivea* and *I. egregia* as in *Declana*). Segments A6–10 with flattened venter and a series of SV finger-like papillae principally on the back of the A6 proleg, and on the SV area of A7, A8 and A9 (these papillae branched (compound) in larvae of the *hermione* group); body-shape except for *I. glacialis* stick-like, body bearing excrescences, and conical setal pinacula, especially pinacula of segmental setae D2 and D8. Anal proleg seta AL4 either sessile (e.g., *I. feredayi*, Fig. L9b) or on a tubercle (*I. hermione* group, Fig. L13; *I. junctilinea*, Fig. L14a). *Ipana glacialis* differs in having a plump unadorned body.

Larval characters that appear to mimic host structures are described for each species or allopatric species pair; these modifications are extremely finely developed in *I. feredayi* and the *atronivea* group, mimicking characters specific to their hosts.

Colour pattern: Instar 1 either with 6 reddish stripes as in *Declana,* or body bicoloured with dark merged D, SD and SV and V areas separated by a pallid or white lateral stripe. Instars II and III increasingly bark-patterned, instars IV and V fully bark-patterned or otherwise cryptic with only A6–10 with an unpigmented venter as these segments clasp the substrate (see Fig. L1a, *D. floccosa* and L8d, *I. griseata*). (Instar IV and V colour patterns described for each species.)

Resting posture (Fig. L8d): Later instars pose twig-like (except for *I. glacialis* which hides by day concealed in the copious litter of its host shrub, *Dracophyllum* spp.).

Remarks. *Classification.* Ten species are recognised in *Ipana*. Two groups of 3 species each can be recognised based on structural synapomorphies: the *atronivea* group (*atronivea*, *egregia*, *griseata*) and the *hermione* group (*halocarpi*, *perdita*, *hermione*), while *feredayi*, *glacialis, junctilinea*, and *leptomera* appear to be idiosyncratic singletons. The *atronivea* group is defined by two late instar larval characters, modification to intersegmental areas of thorax (T1/T2 and T2/T3: Fig. L6b, ISA) and a modified, fleshy A6 anterior spur, plus one adult character, the confluent junction between a fluted ductus bursae and membranous corpus bursae. The *I. hermione* group is defined by the following adult characters: the reduced, thumb-like dorsal juxtal sclerites and dorsally rounded juxta.

Diversity, distribution and hostplants. Like *Declana*, *Ipana* is more diverse in the North Island (8 species, 3 endemics) than in the South Island (7 species, 2 endemics); five species are shared between both islands. Of the three North Island endemics, *I. atronivea* is the allopatric sister of South Island *I. egregia*, with the same or closely allied hosts, but with a more modified forewing pattern. *I. halocarpi* is confined to sites centred around Lake Taupo TO on endemic *Halocarpus* conifer species, which are otherwise widespread throughout North and South Islands; *I. halocarpi* now shares its restricted geographic range with the widely distributed *I. hermione. Ipana perdita*, apparently restricted to Te Paki in the far northern North Island, is sister to *I. halocarpi*. The other South Island endemic (apart from *I. egregia*) is the alpine, diurnal *I. glacialis*. Of the widespread species, *Ipana feredayi* is present wherever *Fuscospora* and *Lophozonia* (Nothofagaceae) occur, although a northerly *Fuscospora* site (Omahuta Forest) in ND has so far failed to produce this species. Possibly the most ubiquitous species is *I. junctilinea*, which has a twig-like larva clearly evolved on a range of widely distributed divaricating shrubs or lianes in six families, and nine genera, but surprisingly, not *Coprosma* (Rubiaceae), or *Hebe* (Plantaginaceae) (Appendices A, B).

The hostplant range of *Ipana,* as with *Declana*, is restricted to conifers and dicotyledonous shrubs and trees. Species can be classed (Appendix B) as the following:

(1) polyphagous: *junctilinea*, largely in non-forest shrub communities; *leptomera*, largely in forest communities and now suburbia;

(2) oligophagous (i.e. largely restricted to a single plant family): *hermione* on Podocarpaceae (but adapting to exotic Pinaceae); *feredayi* on Nothofagaceae; *griseata* on Loranthaceae;

(3) monophagous (i.e. restricted to a single plant genus or two closely related genera): *atronivea, egregia* on *Pseudopanax, Raukaua* (Araliaceae); *glacialis* on *Dracophyllum* (Ericaceae); *halocarpi* on *Halocarpus* (and sometimes contiguous *Phyllocladus*) (Podocarpaceae).

The hostplant of the recently discovered *Ipana perdita* is unknown, but it is strongly suspected to be monophagous on *Halocarpus* like its close relative *I. halocarpi* (see under species description of *I. perdita*). Specific herbivores on Araliaceae (*atronivea, egregia*), Loranthaceae (*griseata*), Nothofagaceae (*feredayi*) and Podocarpaceae (*halocarpi*, *hermione*) have larvae that closely resemble twigs of their hosts.

All ten *Ipana* species are relatively easy to distinguish as adults on wing pattern, external morphology, genitalia and larval morphology. They appear, like New Zealand's Micropterigidae (Gibbs 2014: 25) to be "stable, well-defined entities, easily recognisable from a glance at a colour image...and their genital morphology provides unambiguous confirmation of identity". In view of the morphological disparities within the genus, it is tempting to speculate that *Ipana* is an old group ravaged by extinctions, perhaps coinciding with the loss of plant diversity in New Zealand since the Miocene (Lee *et al.* 2016).

Conservation issues: Two species are listed by the New Zealand Department of Conservation in their Threat Classification System report for 2015 (Hoare *et al.* 2017). *Ipana griseata* is classified as At Risk, predicted decline 10–70%. This reflects the observed reduction (extinction, in some places) of its hosts, leafy Loranthaceae, through browsing by the introduced Australian brushtail possum (*Trichosurus vulpecula* (Kerr)), particularly in the North Island (Ogle 1997: 141–147, but note that Norton 1997: 149–153, describes conflicting evidence). The situation is explored further under *I. griseata* (q.v.). The recently discovered *I. perdita* is classified as Nationally Critical, predicted decline 10–50%. This is because the possible host (*Halocarpus kirkii*) grows in moist gullies surrounded by broad ridges of dry, flammable *Kunzea* and *Hakea* forest at Radar Bush, Te Paki ND, the only known locality for this species.

6. *Ipana atronivea* (Walker, 1865) new combination

Fig. 6a, b (adults); 6c (forewing venation); 6d, e (male genitalia); 6f, g (female genitalia); L6a, b (larvae); Map 6

Detunda atronivea Walker, 1865. List of the specimens of lepidopterous insects in the collection of the British Museum XXXII: 619. Placed in *Declana* by Meyrick (1883: 530 (abstract)); Meyrick 1884: 101.

(?)Chlenias manxifera Fereday, 1880. *Transactions and Proceedings of the New Zealand institute 12*: 268–70. Referred to *Chlenias* with a query by Fereday. Synonymised by Meyrick (1884: 101).

Diagnosis. *Ipana atronivea* cannot be confused with other North island species due to its distinctive wing pattern and size (Fig. 6a, b). It differs from the similarly large South Island endemic *I. egregia* by its bold black marks on the forewing termen and the thorax (cf. Fig. 6a with Fig. 7a, *I. egregia,* which has very small dark marks on the forewing termen). In *atronivea* male genitalia the costulae are dorsally rounded (Fig. 6d), not sharply triangular as in *egregia* (Fig. 7c). The female ostium bursae anterior lip is emarginate and crenulated (Fig. 6g), but emarginate and smooth in *egregia* (Fig. 7f).

Description. *Adult male* (Fig. 6b): Wingspan 36–54 mm. Antennae strongly bipectinate, longest rami over half the width of the compound eye. Thorax white, with a lateral black arch from which descend two black diverging lines, one either side of the midline; mesoscutellar crest 4-5 mm high. Forewing ground-colour vivid white with extensive transversely arranged sharply defined black or dark chocolate markings incorporating a three-limbed central symbol, black marginally, dark chocolate centrally; costal strigulae absent; termen evenly plano-convex, marked with 4 or 5 bold black triangular wedges. Hindwing dark grey with two darker transverse lines, the first gently curved from costa to dorsum and the second erratic, ending at the tornus; black sub-terminal line; termen convex. Hind-tibia unmodified. Abdomen usually grey, sometimes brownish grey, with or without darker line along dorsal mid-line; anal tuft white.

Adult female (Fig. 6a): Wingspan on average larger than in male, 42–54 mm. Antennal pectinations more slender and shorter than in male. Other characters as in male.

Male genitalia (Figs 6d, e): Uncus elongate, apex acuminate. Gnathos arms about half uncus length, arms fused apically by a mesal coarsely spinose ball (two teeth separated by a transverse arcuate bar in *I. egregia*); valva elongate with external, basal coremata; costa extending to 7/8 length of valva: costulae subtriangular, meeting mesally, dorsal margin convex and narrowly subspinulose, ventral margin with a short, mesally-directed lobe; juxta width twice length, dorsally irregular, sometimes with a central extension supporting the phallocrypt entrance ventrally; cristate hairs laterally; dorsal juxtal sclerites complex, basally contiguous with the latero-dorsal corners of the juxta as a pair of boomerang-like sclerites supporting the phallocrypt entrance; the long arm of the sclerite arcuate, directed latero-dorsally, the short arm (half the length of the long arm) directed meso-dorsally towards the costula base. Phallus (Fig. 6e): aedeagus stout (as in *egregia*), apex suddenly narrowed, rounded; vesica basally microsetose, centrally coarsely fluted, apically with bent and barbellate cornuti in two groups (of 3–6 and 2).

Female genitalia (Figs 6f, g): Posterior apophyses 2x length of anterior apophyses. T8 uniformly sclerotised, anterior margin laterally emarginate (Fig. 6g); S8 membranous, transversely ridged; fused antrum/colliculum long (width about equal to length); ostium bursae anterior lip emarginated and wrinkled (Fig. 6g). Sterigma anterior margin straight; ductus bursae fluted, slightly sinuous and widening to the corpus bursae, and about 5x length of the hemi-ovoid corpus; signum a semi-circular internally projecting blade.

Larva. Morphology (Fig. L6a, b): Ultimate instar body length ca 25–35 mm. Body stout. Head capsule with face flat, vertical, epicranial cones indistinct. Intersegmental area between prothorax and mesothorax, and mesothorax itself (Fig. L6a, detail, Fig. L6b) dorsally swollen in instars IV and V, forming a knob-like false 'head'. A2 with D2 pinacula conical, often contrastingly coloured (also as in *I. egregia*); seta SV3 absent from A1 and A2; A5 with a rudimentary proleg 0.25x length of A6 proleg and with <18 crotchets in instars IV and V; A6 anteriorly directed lateral spur or papilla absent (as in *I. egregia* and *I. glacialis*), A6 proleg with 3 backswept finger-like papillae on the posterior margin and ca. 60 biordinal crotchets; A7–9 each with a single pair of squat papillae. In instars IV and V, A2 setae D2, L1, A5 setae D2, A6 setae D2 and A8 setae D1 with conspicuous conical pinacula.

Colour pattern: Instar I with D, SD, SV and V areas dark chocolate, L area contrasting white; instar II duller laterally; instar III anteriorly straw or buff, posteriorly chocolate and resembling a bird dropping; instars IV and V (Fig. L6a): thorax swollen, white with dark flecks resembling a fungus-infected araliad shoot (see Remarks, below); rest of body moderate to dark chocolate and variably strewn with minute white dots, the D2 tubercle on A2, and occasionally on A8, resembling dying clasping leaf-petioles contrastingly straw-coloured (see also Hudson 1939: pl. liv, fig. 8).

Resting pose: Changes with instar (Hudson 1939; Sharell 1971: figs 96–101) as follows: Instars I and II with body looped, head resting across A5–6 (bird-dropping pose, Sharell 1971); instar III with the chocolate body humped so that the prominent D2 tubercles resemble the two apices of a mericarp; rests in the inflorescence amongst developing fruit; instars IV and V stick-like, the swollen thoracic segments complete the resemblance to a diseased terminal twig.

Hostplants. The larva feeds on endemic Araliaceae. Recorded hosts: hau hau, whauwhaupaku, five-finger, *Pseudopanax arboreus*; orihau, *P. colensoi*; horoeka, koeka, hohoeka, lancewood, *P. crassifolius*; koareare, koare, raukawa, *Raukaua edgerleyi*; and haumakaroa, *R. simplex*.

Flight period. August until March. Comes to light.

Distribution. Confined to the North Island and near offshore islands. Common, occurring from sea-level to lower subalpine shrublands at 1250 m (Tararua Ranges) and 1280 m (Mt Taranaki).

ND, AK, CL, WO, BP, TK, TO, GB, HB, RI, WI, WA, WN / –.

Type material. *Detunda atronivea* Walker: Holotype ♂: 'Detunda atronivea [printed slip] / 50.17 [NHMUK Register: "Major Parry exchange 29 July 1850"] / New Zealand / Type [round, green circle]' [NHMUK]. Condition: well-set, antennal flagellomeres lost.

?Chlenias manxifera Fereday: Holotype ♀: '2/1/79 Wellington from Travers, taken in his garden [handwritten] / Fereday Collectiou. [sic] [printed] / type [handwritten] / HOLOTYPE [pink card, printed]' [CMNZ]. Wingspan 42 mm. Condition: rather grubby, no antennae, re-pinned, abdomen intact.

Remarks. This distinctive moth is known as the Zebra Moth to some and the Lichen Moth to others (Sharell 1971). *Ipana atronivea* and *I. egregia* are the only declanoids to have diverged and formed a sister-species pair between North and South Islands. Their black and white head, thorax and forewing patterns are boldly and sharply defined (eulegnic) whereas pattern elements in other species are often indistinctly bordered (dyslegnic). This species' life history, adult and larval stages are well described and illustrated by Sharell (1971, pp. 68–70, and figs 96–101) and this remains the only series of photographs illustrating the extraordinary changes in larval appearance over the instars. The last instar caterpillar is also depicted in Fig. L6a and by Dugdale (1974: p. 1071, fig. 3). The late instar's swollen first and second thoracic segments resemble the effect of an infestation of a young shoot of the host (especially of *P. crassifolium*) by an armoured scale (*Leucaspis* sp.) colony, followed by invasion of the colony by the copious white basidiomycete fungus *Septobasidium simmondsii.* The fungus eventually overcomes the scale insects, the dark tests (scales) of which dot the white hyphal mass (Inglis 2004). This exceptional modification is also present in *I. egregia* and is possibly the most complex example of crypsis so far recognised in New Zealand Lepidoptera larvae. Another use for this thoracic structure, as a club, has been seen in *I. egregia* (q.v.).

The species overwinters as an adult or pupa (Hudson 1928). It is one of New Zealand's most striking larger moths, has been portrayed on a postage stamp (Sharell 1971) and misidentified as *Declana egregia* in some philatelic catalogues.

The differences between *I. atronivea* and *I. egregia* are consistent and clear, and no populations of either species show any noticeable differences in colour pattern. Another aspect linking these two morphological siblings is their restriction to the same narrow range of Araliaceae genera. Most other lepidopterous genera with species feeding on these genera are also found on *Schefflera*, and one, the plume moth *Pterophorus monospilalis* (Walker, 1864), has included cultivars of the adventive ivy (*Hedera helix*) in its host range.

7. *Ipana egregia* (Felder & Rogenhofer, 1875) new combination.

Fig. 7a, b (adults); 7c, d (male genitalia); 7e, f (female genitalia); Map 7

Chlenias egregia Felder & Rogenhofer, 1875, Reise der österreichsen Fregatte Novara um die Erde (zoologische Theil) Band 2 (Abtheilung 2), Hefte 4: pl. cxxxi, fig. 24.

Diagnosis. *Ipana egregia* is an extremely distinctive moth (Fig. 7a, b), and cannot be confused with any other South Island species. It differs from its North Island sister *I. atronivea* as follows: forewing pattern is pale grey and dark brown, not black and white; forewing with a stretched three-limbed dark brown icon taking up most of the wing; thorax lacking a black dorsal patch; forewing termen with only small dark marks (large black marks in *atronivea*). Male genitalia: costulae triangular dorsally (Fig. 7c), not rounded; female genitalia: ostium bursae anterior margin smoothly emarginate (Fig. 7f), not crenulated (wrinkled). Larva (Hudson 1950: 98, 99; pl. iv, fig. 5): grey where *I. atronivea* is brown (Hudson 1928: pl. liv, fig. 8)

Description. *Adult male* (Fig. 7b): Wingspan 40–54 mm. Antennae strongly bipectinate; pectinations forming a long double fringe. Thorax white, speckled with grey/brown scales; tegulae fringed posteriorly with long grey/brown scales; mesoscutellar crest ca 5 mm high. Forewing ground-colour white with chocolate brown markings; a basal transverse band and a large H-shaped mark with the basal stroke running from mid-costa to mid-dorsum, where it is poorly defined; distal stroke running from apex to tornus; costal strigulae as a series of small brown lozenges on proximal half; termen shaded with grey, termen weakly convex, bearing six small brown triangles. Hindwing greyish brown with a discal dot, and a fine roughly zig-zag gently curved transverse line from discal dot to the tornus; a faint brown sub-terminal line. Hind-tibia unmodified. Abdomen dark brown or grey, with or without darker line along dorsal midline; anal tuft white.

Adult female (Fig. 7a): Antennal pectinations shorter, stouter than in male. Hindwing with faint discal dot or absent. Other characters as in male.

Male genitalia (Figs 7c, d): As for *I. atronivea* except that the gnathos apex is an arcuate bar flanked by two teeth; the dorsal juxtal sclerite outer arms are only 2x as long as the inner (mesal) arms. Phallus (Fig. 7d): aedeagus stout, apex evenly (not suddenly) narrowed; vesica similar to that of *I. atronivea,* i.e. basally with microsetae, centrally fluted, apically with bent and barbellate cornuti.

Female genitalia (Fig. 7e, f): Posterior and anterior apophyses about equal in length; ostium bursae anterior lip mesally smooth, not crenulated, and sterigma anterior lip emarginated (margin concave) mesally (Fig. 7f); fused antrum/colliculum long (width equals length); ductus bursae fluted; corpus bursae indistinctly separated from ductus, as a small, terminally unfluted, impunctate hemisphere with a signum of scattered small sclerites.

Larva. Morphology: As described for *I. atronivea.*

Colour pattern: Last instar accurately portrayed and described by Hudson (1950: p. 98, pl iv, fig. 5). Howes (1914) remarked on the close similarity with larval *I. atronivea*, but noted that it tends to be more grey than brown (cf. Hudson 1950, *loc. cit*.).

Resting pose: As described for *I. atronivea*.

Hostplants. The larva feeds on endemic Araliaceae. Recorded hosts are whauwhaupaku or five-finger, *Pseudopanax arboreus*; orihau, *P. colensoi ternatus*; and haumakaroa, *Raukaua simplex*.

Flight period. August until March. Comes to light.

Distribution. Confined to the South and Stewart Islands where it is recorded from sea level up to at least 1200 m. It is rather local and uncommon, perhaps more frequent in higher rainfall areas, such as WD, FD, SL and SI. Not known from MB or CO (see Remarks).

– / SD, NN, BR, WD, KA, NC, MC, SC, MK, OL, DN, FD, SL / SI.

Type material. *Chlenias egregia* Felder & Rogenhofer: Holotype ♂: '*Chlenias egregia* Felder & Rogenhofer, 1875: Holotype male: 'Novara cxxxi, f[ig] 24 *Chlenias egregia* n. Austrl ♂ / Type [red circle on white disc] / Rothschild bequest BM1939- 1' [NHMUK]. Wingspan 41 mm. Condition: good; repinned.

Remarks. *Ipana egregia* is restricted to the South and Stewart Islands. It is regarded as the allopatric sibling of *I. atronivea* based on wing markings, genitalic and larval morphology, and with host species in the same host genera (*Pseudopanax, Raukaua*). The forewing markings also suggest a relationship with *I. junctilinea*, the nominate form of which has a pattern from which the *atronivea/egregia* pattern could be derived, but this association is not supported by genitalic or larval characters. The larvae of *I. atronivea* and *I. egregia* share apparent synapomorphies with *I. griseata*, especially the tumid modification of the T1–T2 intersegmental area. Philpott (1917: 213) observed the antagonistic behaviour of the last instar larva, which waves the upper body to and fro when provoked.

Further targeted searching is needed to see whether the gaps in known distribution in Marlborough (MB) and Central Otago (CO) are genuine. MB is an under-collected area: the sparse gallery forests in the deeper valleys remote from road access have scarcely been looked at. The area CO has been fairly intensely collected but is very dry with few areas of forest: hence the species will be very scarce and local, if it occurs at all.

Known as the South Island Zebra Moth, *Ipana egregia* is depicted on old and new NZ$100 banknotes (so we are told).

8. *Ipana griseata* (Hudson, 1898) new combination

Fig. 8a–c (adults); 8d, e (male genitalia); 8f, g (female genitalia); L8a–d (larvae); Map 8

Declana griseata Hudson, 1898. *New Zealand Moths and butterflies (Macrolepidoptera)*: p. 98, pl. x, fig. 32.

Diagnosis. Adult *Ipana griseata* is distinguished from other declanoids with pectinate antennae by its grey, softly pilose thorax, and low mound-like mesoscutellar scaling. Forewings with ante- and postmedian lines and enclosed median band oblique (Fig. 8a–c, cf. Fig. 9a, b, *I. feredayi*). Adults are larger and darker grey than *I. perdita* and the grey forms of *D. floccosa* and *D. nigrosparsa.* In genitalia, the swollen male uncus (Fig. 8d) and paired long female pseudosigna on the ductus bursae (Fig. 8f) are characteristic. Late instar larvae have a dorsal thumb-like process between the pro- and mesothorax looking like the stump of a twig (Fig. L8b), and the pallid A6 lateral spike (Fig. L8a, inset) is fleshy and reduced in the last instar (Fig. 8c, arrowed) (absent in *atronivea, egregia*).

Description. *Adult male* (Fig. 8b, c): Wingspan 36-40 mm. Antennae strongly bipectinate, greatest rami length > width of compound eye. Thorax scales pilose, dark grey with pallid tips; mesoscutellum scaling mound-like; forewing ground-colour slate-grey with oblique darker grey fine striate markings; costa with thickish, short strigulae angled slightly towards the base; an oblique median band defined by a wavy antemedian line at ¼ wing-length and a sharply zigzagged postmedian line at ½, both oblique; median band pale grey or white (Fig. 8b, c, males) or more or less concolorous with rest of wing (cf. Fig. 8a female); a broad area of short, dark transverse streaks at ¾ leaving the subterminal area appearing paler; termen edged in black scales, convex, weakly scalloped; hindwing pale grey or buff. Abdomen dark grey.

Adult female (Fig. 8a): Antennae bipectinate, pectinations very short and blunt, each pair resembling a chevron, and the longest only slightly longer than the flagellomere. Other characters as in male.

Male genitalia (Fig. 8d, e): Uncus apical third swollen, apex pointed (Fig. 8d, arrowed). Gnathos arms broad; gnathos apices fused, spinulose transversely and ventrally; valvae elongate; valval basal corematal tuft conspicuous; costulae developed into broad opposing triangles dorsally bearing a tuft of erect spinules in a field of microspinules (Fig. 8d), the opposing costulae joined by a tenuously sclerotised transtillar bar; dorsal juxtal sclerites each with a single upward and outwardly directed spinose apex; juxta lacking a median projection into the phallocrypt unlike other *Ipana* spp.; saccus broad, emarginated ventrally. Phallus (Fig. 8e): aedeagus with a short acuminate apex; vesica striate (fluted) and bearing two tufts of cornuti, one tuft of 4 (3 slender, one long) and the other of 8 (all short, stout, blunt-tipped).

Female genitalia (Fig. 8f, g): Posterior apophyses length 2x that of anterior apophyses. S8 area membranous, micro-textured; sterigmal anterior lip evenly concave; fused antrum and colliculum short (width 2x length, Fig. 8g); ductus bursae fluted, narrow at first, gradually widening to diameter of corpus bursae, and anteriorly with a smooth, sclerotised lateral section and a pair of pseudosigna (formed of strengthened flutings, Fig. 8f, ps); corpus bursae with an oval pleated, signum, aligned longitudinally.

Larva: *Morphology* (Fig. L8a–d): HC with lateral straight-sided cheeks in instars II–V, face flat, epicranial cones directed forwards. Prothorax longer than meso- and metathorax dorsally in instars III–V, with a thumb-like dorsal prominence (Fig. L8b) between pro- and mesothorax, well-developed in instars IV and V. A2 setae D2 on a common tubercle, A3 with these setae on separate tubercles, A3 SV setae on a tumid wrinkled area; A2–5 with ventral micro-papillae; A5 instars IV and V with rudimentary prolegs; A6 lateral spur in instar III sharp and white (Fig L8a, insert), fleshy and concolorous with body in ultimate instar (Fig. L8c); A8 setae D1 on a common tubercle; SV papillae on A6–9, pointing backwards on A6, and forward on A9. Seta SV3 well-developed on all segments, subequal in size to SV1.

Colour pattern: Instar I: D, SD, L, SV and V stripes irregularly coalesced and greatly expanded on mid-segment, obsolete or absent intersegmentally. Instar II: with red areas faint, D and SD areas dark; L area pale, SV and V areas dark; A6 proleg pale. Instars III–V: body uniformly speckled, dark or light grey; a black vertical line on A6 from seta D2 to the proleg apex. HC with narrow pallid fascia just behind the epicranial cones.

Resting pose: Twig-like.

Hostplants. Foliage and shoots of Loranthaceae: pirinoa, pirita, green mistletoe *Ileostylus micranthus*; scarlet mistletoe *Peraxilla colensoi*; pikirangi, red mistletoe *P. tetrapetala*; tapia, white mistletoe *Tupeia antarctica*.

Flight period. August to March. Comes to light.

Distribution. Found throughout both main islands but in the North Island patchy (e.g., unknown from AK and CL), possibly due to declining host plants which are under threat from possum browsing, although the

mistletoe-feeding larentiine *Tatosoma agrionata* (Walker, 1862) has recently been found in CL. Recorded from coastline to treeline.

ND, BP, TO, WN / NN, BR, WD, KA, NC, MC, SC, MK, OL, DN, FD, SL

Type material. Lectotype ♀: '334b' (Hudson register: 'Head of L. Wakatipu Jan 8 1894'), and Hudson label '183b'. Wingspan 36 mm; antennae intact, MONZ (Hudson collection). Note: Dugdale (1988: 164) wrongly recorded the LT as a male. It is demonstrably female on antennae. The second, earlier label ('183b') dates from a time when Hudson misidentified this specimen as *Declana floccosa*; 183 is his number for that species. However, the original entry under 183b is obscured, as Hudson pasted a new slip of paper over his original collection records on this page of his register, and the new records start with 183N (capital letters for all subsequent specimens).

Remarks. *I. griseata* has many characters that may link it to *I. atronivea* and *I. egregia*. In larvae: the modified larval thoracic region and the rudimentary nature or lack of the A6 lateral papilla in the last instar; in adults: the form of the male genital costula, the relatively simple, arcuate dorsal juxtal sclerites, and the simple, scarcely sclerotised form of the female ductus and corpus bursae.

Larvae of *I. griseata* have been collected from 3 genera of endemic mistletoes in the family Loranthaceae, but so far none has been collected on the other mistletoe family Viscaceae, represented in New Zealand by the almost leafless genus *Korthalsella*. The mid-instar larvae are generalised stick mimics with a white A6 lateral spur (Fig. L8a) while last instar larvae closely mimic the distinctive, almost cartoon-cladistic appearance of the host twigs (Fig. L8d). As in *I. atronivea* group, the T1–T2 intersegmental area is hypertrophied, in this species into a process mimicking a twig stub (Fig. L8b). Patrick and Dugdale (1997) comprehensively summarised biological and distributional data of Loranthaceae-feeding Lepidoptera including *I. griseata* (as *Declana*), for a DoC symposium on threats to Loranthaceae in New Zealand.

Conservation issues: Mistletoe species are considered greatly at risk in the North Island (but curiously less so in the South Island) from the man-adventive brushtail possum, *Trichosurus vulpecula*. In Nelson province, JSD has observed that *I. griseata* is present where *Ileostylus* is abundant, whether on endemic (e.g., totara) or introduced (e.g., tree lucerne) hosts. In Otago and Southland, *I. griseata* can be abundant on flowering *Peraxilla* spp. on southern beech species.

Ipana griseata is classified as At Risk, predicted decline 10–70% (Hoare *et al.* 2017). This reflects the observed reduction (extinction, in some places) of its hosts, leafy Loranthaceae, particularly in the North Island. This decline is usually attributed to browsing by the introduced Australian brushtail possum (Hoare *et al.* 2017; Ogle 1997), but note that Norton (1997) describes conflicting evidence.

9. *Ipana feredayi* (Butler, 1877) new combination

Fig. 9a, b (adults); 9c (wing venation); 9d-f (male genitalia); 9g, h (female genitalia); L9a, b (larvae); R9 (live adult); Map 9

Declana feredayi Butler, 1877. *Proceedings of the Zoological Society of London for 1877*: 398, pl. 43 fig. 5. (Meyrick, 1883: 530; 1884: 102 as synonym of *Declana floccosa*; ditto, Hudson 1898: 96).

Declana sinuosa Philpott, 1915. *Transactions and Proceedings of the New Zealand Institute 47*: 197. (As species, Meyrick, 1917: 270). Synonymised by Prout (1927: 79); Hudson, 1928: 152.

Diagnosis. Among the *Ipana* species with pectinate antennae and a mesoscutellar crest, *I. feredayi* is distinguished by the pale median band (i.e. the area between the ante- and post-median lines) being narrower at the costa than at the dorsum (Fig. 9a, b). From the often similarly transversely patterned *Declana floccosa* it differs in having a mesoscutellar crest, the forewing tip slightly upcurved, with a prominent diagonal pale streak running into an indistinct subterminal line, and a crenulate, rather than a simple zig-zag postmedian line. Late instar larvae are twig-like, with setae D2 on A2 on a prominent tubercle and setae SV1, SV3 on A3 on a common swollen area giving the body a unique kinked appearance, like the twigs of its hostplant.

Description. *Adult male* (Fig. 9b): Wingspan 32-40 mm. Antennae bipectinate; rami greatest length >1/2 compound eye width. Thorax brown to grey, matching forewing ground-colour; mesoscutellar crest short, ± 2 mm high. Forewing main markings (lines and bands) transverse with antemedian and postmedian lines dividing the forewing into thirds; forewing apex slightly angled upwards and with a pale diagonal streak; costal strigulae either at right angles to the costa or directed to the wing base; basal patch lacking a streak of black scales on the front of vein R; antemedian line weakly oblique, irregularly serrate; median band pale and appearing wider at dorsum than at costa, featuring darker spots or patches of scales, sometimes almost immaculate; postmedian line narrow, shaped

as a shallow double U; the flanking outer transverse band darkened grey-brown, often paler towards the tornus; subterminal area dark or pale (compare Fig. 9a, b), diffusely patterned; termen convex, weakly scalloped; most of forewing with sparse scattered floccose scale mounds; hindwings pale grey or diffusely grey-brown, usually darkening towards the termen; a faint straight discal stripe. Hind-tibia unmodified. Abdomen brown to grey, matching forewing ground-colour.

Adult female (Fig. 9a): Antennae bipectinate, pectinations very short, blunt. Forewing costa fringed basally with long projecting scales. Other characters as in male.

Male genitalia (Fig. 9d–f)*:* Uncus elongate, decurved, widened to a narrowly ovate, acuminate, minutely hooked apex, socii pendent; gnathos arms as long as uncus, apices joined by a broad, dorsally spinose plate; each apex ventrally with a larger curved hook; costulae dorsally and outwardly strongly bifid with erect spinules (Fig. 9f) and mesal apices tapering to midline; juxta shield-shaped, scarcely extending into phallocrypt; dorsal juxtal sclerites smaller than costulae, slender, concave, with one mesally and one outwardly directed arm; valva elongate, apex rounded, base with external coremata; saccus base transverse, not emarginated. Phallus (Fig. 9e): aedeagus shortly tapered to a blunt apex; vesica shorter than aedeagus, mid-section finely striate, with seven short stout cornuti and two long, thin cornuti.

Female genitalia (Fig. 9g, h): Posterior and anterior apophyses subequal. Sterigma anterior margin with a deep narrow cleft at mid-line; fused antrum/colliculum short (width 3x length); ductus bursae stout, evenly fluted to 2/3 length, thence smooth; corpus bursae 2/3 as long as ductus, obovoid; signum an oblique, sclerotised blade.

Larva. Morphology: Head capsule (Fig. L9a): face concave, wider than high in later instars and with perpendicular sides from instar II onwards; epicranial projections pointing forward, distinct. Setae D2 on A2 on a common transverse tubercle, and setae L3, SV1, SV3, and V1 on a common swelling on A3; these two structures give a zig-zag appearance in profile like the twigs of the hosts (*Lophozonia* in particular; *Fuscospora* is less compressed); A6 with lateral spur and A5 with a posterior lateral mound with which the spur makes contact ('butting mound'). SV papillae on A6–9 in instars IV and V (Fig. L9b). All D setae with conical pinacula in all instars. A5 with a proleg rudiment in instars IV and V. Anal proleg seta AL4 sessile.

Colour pattern: Instar I as in *I. leptomera*, lateral pallid areas white. Instar II ground-colour pallid laterally, D/SD and SV/V areas dark grey. Instars III–V colour pattern resembles host twigs, being finely marbled. Larvae from *Lophozonia menziesii* and *Fuscospora cliffortioides* are often dark, those from *Fuscospora fusca* usually paler.

Resting pose: Twig-like; the zig-zag lateral profile makes them difficult to see amongst host twigs.

Hostplants. Nothofagaceae: tawhai rauraki, mountain beech, *Fuscospora cliffortioides;* tawhai raunui, red beech, *F. fusca;* tawhai rauriki, black beech, *F. solandri*; tawhai raunui, hard beech, *F. truncata*; tawhai, silver beech, *Lophozonia menziesii*.

Flight period. August until March. Comes to light.

Distribution. Found in association with southern beech forest (Nothofagaceae) from AK (Hunua Range) to SL, from sea level to treeline, up to 1350m. Absent, as are its hosts, from Stewart Island.

AK, BP, TK, TO, GB, HB, WA, WN / SD, NN, BR, MB, NC, MC, MK, OL, DN, FD, SL

Type material. *Declana feredayi*: Holotype ♂: 'Declana feredayi Butler Type / N.Zeal.77.34 / Type [in red circle on white disc]' [NHMUK]. Wingspan 35 mm. Condition: very good, right antenna missing. Colour pattern: forewing median band grey, only slightly contrasting with basal and terminal areas.

Declana sinuosa: Lectotype ♂ (here designated): 'Declana sinuosa Philpott, Holotype [handwritten, white rectangle, 20 x 8 mm] / Ben Lomond [Queenstown OL] 20.[?].14' [no collector but subsequently found to be M.O. Pasco (Dugdale 1988)], locality printed, date written in by Philpott [NZAC]. Wingspan 35 mm. Condition: good, left antenna apical half lost, right antenna apical 2/3 lost. **Note.** *Declana sinuosa* was described from an unspecified number of specimens ('several') of both sexes; there is no mention of a holotype in the original description, so all specimens of the type series must be regarded as syntypes (ICZN Article 73.1). The specimen labelled as the holotype by Philpott and treated as such by Dugdale (1988: 164) is here designated lectotype. There is an ink-blot on the label where the month of collection should be; the blot has a curved 'tail' that could be interpreted as the lower part of a '9', but Philpott did not include September in the flight time he gave in the description. A female paralectotype, labelled as 'Allotype ♀' by Philpott and 'Ben Lomond 21/11/12' (presumably by Pasco) is in NZAC.

Remarks. *Ipana feredayi,* described and depicted by Butler in 1877 in the genus *Declana,* languished as a synonym of *Declana floccosa* until Philpott sent specimens collected by M.O. Pasco at Queenstown on 10 and 25

October 1913 to G.V. Hudson as specimens of a new species, *sinuosa* Philpott for Hudson's collection (Hudson Collection Register: species 898, specimens a, b, page 259). Hudson labelled the Register entry "Declana sinuosa Philp.", later crossing out "sinuosa" and writing "feredayi Butl." as Prout (1927, p. 79) had reported the validity of Butler's species. Hudson and his daughter Stella went on to collect *feredayi* in Wellington WN (Rona Bay (Stella)), Ruapehu TO, Mt Arthur NN, and Arthur's Pass NC.

The type specimen of *Declana feredayi* was recorded as coming from "Christchurch" and the collector as "J.D. Enys Esq." But Enys more likely collected it at his and his brother's sheep station "Castle Hill" in Castle Hill Basin on the eastern flanks of the Craigieburn Range MC, some 70 miles west of Christcurch, which still includes extensive forests of mountain beech (*Fuscospora cliffortioides*), one of the hosts of *I. feredayi*. The nearest stands of *Fuscospora* to Christchurch are small communities on Banks Peninsula MC (Wardle 1991), e.g., head of McQueen's Valley and east of Akaroa. It is not known if Enys ever went there.

The type of *Declana sinuosa* was collected in beech-forests on Ben Lomond, Queenstown OL, by M.O. Pasco who was known to have amassed a large collection of moths of the Wakatipu region. For many years the whereabouts of Pasco's collection was unknown until Brian Patrick recognised it in the Southland Museum in 1981 (Dugdale 1988: 147).

Ipana feredayi is typically associated with New Zealand southern beeches (*Fuscospora*, *Lophozonia*).The northernmost records are from the Hunua Ranges AK, where hard beech is present on the eastern slopes, and from the summit of Mt Te Aroha BP (953m), where silver beech forms the canopy on the top 100 m. Collecting to light at Omahuta Forest ND (where hard beech is present) has so far failed to yield this species.

The later instars of the caterpillar mimic the form and somewhat zig-zag shape of silver beech twigs complete with bud scars at the angle of each zig and zag, and the head capsule resembles the broken-off apex of a truncated twig.

10. *Ipana glacialis* (Hudson, 1903) new combination

Fig. 10a–c (adults); 10c–e (male genitalia); 10f, g (female genitalia); L10 (larva); T10 (adult trapped on *Drosera*); Map 10

Declana glacialis Hudson, 1903. *Transactions and Proceedings of the New Zealand Institute 35*: 245, plate xxx, fig 2, male.

Diagnosis. *Ipana glacialis* is distinguished from all other declanoid species by its rufous thorax and forewing colour (Fig. 10a, b); its hindwings largely yellow, brownish-bordered, and lacking a distinct discal blotch or spot; and reduced compound eyes bordered by a nude periorbital strip; male vesica with only 1 or 2 cornuti (Fig. 10e); female genitalia with ostiolar area perpendicular, facing posteriorly (Fig. 10f, g). Adults are diurnal (all other species are nocturnal). Unlike all other species, larvae are stout, not twig-like (Fig. L10).

Description. *Adult male* (Fig. 10b): Wingspan 32–39 mm. Antennae strongly bipectinate, greatest rami length > half compound eye width; compound eyes reduced, surrounded by a nude strip. Thorax dark brown, deeply pilose, usually with long reddish-brown hairs, mesoscutellar crest lacking; forewing broad with reddish-brown ground-colour, suffused with a purplish hue in fresh specimens; costal strigulae absent; a bold, white, wavy postmedian line from the costa to the dorsum has a branch extending towards the wing-base; a bright reddish longitudinal streak runs from the base to reach the postmedian line in the middle; subterminal line faint, greyish, wavy; termen weakly convex; hindwing bright orange with terminal band dark brown, narrowest near the anal angle. Abdomen dark brown, occasionally reddish-brown.

Adult female (Fig. 10a): Wingspan 30–34 mm. Antennae with pectinations very short, fused at the base so each pair appears heart-shaped. Thorax dark brown. Forewings narrower than in male, with more extensive white markings, and ground-colour brown without reddish overtones; terminal third dark with a strong wavy white subterminal line; termen weakly convex, tending straight; hindwings narrower than in the male; ground-colour pale lemon to dull orange; grey median line (sometimes obsolete) and dark subterminal line; dark terminal band. Other characters as in male.

Male genitalia (Fig. 10c–e): Uncus of even width, length half that of valval costa, apex acute; socii pendent; gnathos arms slender, fused at apex into a thin wedge with upcurved spines along the midline and flanked by fields of short blunt spinules; costulae rectangular, meeting mesally via a short spike; phallocrypt entrance in the diaphragmal area flanked by a pair of conspicuously setulose mounds (cf. *atronivea, egregia*); juxta base variable, W-shaped to scarcely emarginate; dorsal juxtal sclerites reduced to two inwardly projecting thumbs (Fig. 10c,

d.j.s.); valva elongate, sparsely setose; saccus evenly concave. Phallus (Fig. 10e): aedeagus stout, length 4.5x width; vesica short, ¼ length of aedeagus, basally coarsely striate and bearing one or two very short cornuti, one of which may be very lightly sclerotised.

Female genitalia (Fig. 10f, g): Posterior apophyses 2.5x length of anterior apophyses. Ostium bursae slit-like (Fig. 10g, arrowed), opening on the S8 area (a perpendicular wall between the anterior margin of the sterigma and the start of A9); fused antrum/colliculum bowl-like, short (width 2x length, Fig. 10g); ductus bursae lightly sclerotised, scarcely longer than ostium bursae width; corpus bursae membranous, without a signum, ovoid and about 4x diameter of ductus bursae; the whole bursa copulatrix small, contained in A7.

Larva. Morphology (Fig. L10): HC with vertical sides (cheeked) from instar II. Body (Fig. L10) stout; no A6 anterior lateral spur; all segments lacking SV area papillae; no A5 prolegs. Seta SV3 minute on A1, larger on A2–5. All abdominal segments have the L and SV areas wrinkled, tumid; anal shield elongate, conspicuously flat in later instars; anal proleg seta AL4 sessile.

Colour pattern: Instar I: D and SD stripes coalesced, all stripes even, and L stripe faint, all stripes pink on a pallid ground. Instar II: ground-colour brown, stripes reddish brown; SV stripe strong, especially so on the posterior part of each segment. Instar III: SV stripe very strong, HC with a dark patch near ocelli. Instars IV–V: HC with an epicranial white line taking in seta P1, socket Pb and the inner margin of seta P2 socket; body with fine wavy longitudinal lines, dark brown on a brown or greyish ground, and a greyish patch behind each spiracle; venter with a median white line bordered by black patches.

Resting pose: Coiled in instars I–III, flat on the substrate in IV–V; resting concealed in litter; beaten from foliage at night, larvae drop on to beating tray when disturbed with no escape thread.

Hostplants. Presumed hosts are the 20+ erect or semi-erect shrubby *Dracophyllum* spp. (Ericaceae), in South Island alpine, subalpine and depressed subalpine areas, from which larvae have been beaten. The only hostplant confidently identified to species is *D. rosmarinifolium* at Broken River Basin, Craigieburn Range 1460m, MC, but this is certainly not the only species used. The larva has been laboratory-reared to instar III on young foliage of *Schinus molle* (Anacardiaceae). Shrubby *Dracophyllum* species are known to Māori as inaka or inanga (Allan 1961).

Flight period. October until March, peaking in December and January; diurnal; if found attracted to light, adults probably have been disturbed from nearby shrubbery.

Distribution. Confined to the South Island sub-alpine scrub zone from 640 m (Mt Te Kuha BR) to 1700 m.

—/ NN, BR, WD, MB, KA, NC, MC, SC, MK, OL, FD, SL

Type material. Lectotype ♂, '317e' [pencilled rectangular Hudson label] (entry in Hudson Register: "Mueller terminal moraine and lower spurs of Sealy Range, Dec 15–18, 1899"), in Hudson Collection [MONZ]. Wingspan 33 mm. Condition: almost entire, right midleg detached.

Remarks. Hudson (1903) knew of the existence of this moth as he had been given a specimen from 4000ft on the Mt Arthur Tableland (NN) by Mr C W. Palmer in 1898 but it wasn't in very good condition. He found it for himself in mid-December 1899 on the slopes behind the Hermitage, Mt Cook, where over three days he observed the males "flying wildly in hot sunshine" (Hudson Register, #317, p.114).

As Hudson saw, the diurnal *I. glacialis* males in early summer are a distinctive, highly visible feature of the South Island subalpine/alpine zone, more prevalent before mid-January than after. Males have a fast, curving flight, flying into the wind presumably searching for female sex-pheromone plumes; females fly straight and low to their objective, inaka bushes. Philpott (1913) and Hudson (1920) noted the strong resemblance between *I. glacialis* and *Metacrias* spp. (Erebidae, subfamily Arctiinae) in colour and flight. Structurally, *I. glacialis* is modified for diurnal alpine activity in the same way as are species of *Dasyuris* Guenée, *Notoreas* Meyrick (Geometridae) and *Ascerodes* Meyrick, *Gelophaula* Meyrick, *Eurythecta leucothrinca* Meyrick, 1931 and allies (Tortricidae) in that (1) the eyes are reduced and are surrounded by an unscaled area; (2) the body is enclosed in dense, pilose scales, underlain by close-set short scales. A visitor to New Zealand, Dave Bartle, snapped the male *glacialis* coming to a sticky end in a *Drosera arcturi* community at ca 1400 m on the St Arnaud Range BR (Fig. T10). Judging by its condition (purplish sheen to the forewings) it must have emerged that morning.

Most larvae in NZAC were collected at night by sweeping *Dracophyllum* shrubs indicating that larvae retreat to the litter in daytime; one last instar larva was found under *D. rosmarinifolium* (itself under snow) in March 1966. What influences the lower altitude limit is at present a mystery. There is a population on a distinctive 'subalpine'

shrubland area below timberline on Mt Te Kuha BR at 640 m (B.H. Patrick, pers. comm.), which would afford an opportunity to study this aspect.

11. *Ipana halocarpi* Dugdale & Emmerson, new species

Fig. 11a, b (adults); 11c, d (male genitalia); 11e, f (female genitalia); Map 11

Diagnosis. *Ipana halocarpi* is outwardly distinguished from the two other members of the *hermione* trio (see *Ipana* generic description) by the dark dappling on a silvery grey ground-colour in the median band (clear silver grey in *hermione,* uniform dark grey in *perdita*) (Fig. 11a, b), and by the distinctly W-shaped postmedian line (line has a flat central portion in *hermione* and *perdita*, not distinctly W-shaped). *Ipana feredayi* (sympatric in beech-dominated forest sites) has the forewing median band broader at the dorsum than at the costa and has longer antennal pectinations in the male than *halocarpi*. The three oblique streaks in the subterminal area of the forewing of *halocarpi* and *hermione* are absent from *feredayi*.

The ductus bursae of the female has a long caudal portion of even width (not constricted as in *hermione*) and is regularly fluted (with longitudinal ridges and with two weak pseudosigna, i.e. more strongly sclerotised ridges, cf. one in *hermione*). Signum on the corpus bursae is an oval sclerotised pleated plate**.**

Description. *Adult male* (Fig. 11b): Wingspan 34–36 mm. Antennae bipectinate; greatest rami length < half compound eye diameter. Thorax scaling grey-brown interspersed with white; distinct broad dark transverse prothoracic band; mesoscutellar crest short (<2 mm); forewing ground-colour silvery grey; costal strigulae short and generally at right angles to the costa; a fine longitudinal streak at the base before the broad, >-shaped antemedian line; postmedian line zigzagging from costa to dorsum, W-shaped; median band varying from almost all white (rarely) to densely dappled with grey, dark brown, or reddish scales, as broad on costa as on dorsum (or slightly broader); subterminal area bearing up to three oblique dark streaks; termen convex, weakly scalloped; hindwings greyish brown; darker towards the termen; indistinct, wavy, narrow median line. Hind-tibia unmodified. Abdomen dark grey.

Adult female (Fig. 11a): Antennal pectinations very short, blunt, each pair appearing heart-shaped. Other characters as in male**.**

Male genitalia (Fig. 11c, d): Uncus scarcely widened at apex, slender; socii with decurved apices. Gnathos arms width never exceeding uncus shaft width, and apex with a vertical series of spines with rounded apices (as in *perdita*); costulae expanded triangularly, outer slope scarcely concave as in *perdita* (distinctly concave in *hermione*), transtilla as in *hermione.* Valvae elongate, with prominent basal coremata. Dorsal juxtal sclerites very reduced, thumb-like (Fig. 11c). Saccus basally indented (W-shaped). Phallus (Fig. 11d): aedeagus ca 2.5 mm long (cf *perdita*), apex elongate, slenderly spoon-shaped; vesica finely and obscurely striate, and bearing subapically 4 long fine cornuti, one medium cornutus, and a patch of 3 or 4 short thick cornuti.

Female genitalia (Fig. 11e, f): Posterior apophyses 2.5x length of anterior apophyses; ostium bursae lip even and shallowly curved (Fig. 11f); ductus bursae (Fig. 11e) evenly sclerotised and width same as that of ostium bursae, evenly fluted, with 2 long pseudosigna; at 2/3 length ductus is widened dextrally into a humped, unsculptured anterior zone bearing the membranous obovoid corpus bursae with its strongly sclerotised knife-blade signum.

Larva: *Morphology*: HC wider than high and not obviously apically produced (HC as high as wide, or higher and with apices produced in *I. hermione*). Instar I with seta SV2 on A2 directly ventrad of the spiracle (in *I. hermione,* this seta is posteroventrad). Instars II and III: all setal groups, especially the D group, on conical pinacula; often the setae on mid-sections of segments A1–5 strongly so, and with mammilliform protruberances, giving the larva a ragged appearance. Abdominal segment A1 length less than twice its width (length twice width in *I. hermione*); A7–9 SV papillae branched (as in *I. hermione*); anal proleg with seta AL4 on a prominence (as in *I. hermione*).

Colour pattern: Instars I and II: body colouring as in *I. hermione.* Instars II and III: HC fox-red (grey in *I. hermione*). Instars IV and V: colour pattern resembles the criss-cross pattern of a scale-leaved *Halocarpus* twiglet, in red-brown or yellow-brown, distinctly and sharply blackened intersegmentally obliquely on each segment (*I. hermione* lacks this pattern element).

Resting pose: Twig-like.

Hostplants. Podocarpaceae: bog pine, *Halocarpus bidwillii,* pink pine, *H. biformis*; less often on mountain toatoa, *Phyllocladus alpinus*, where growing in association with *Halocarpu*s spp.

Flight period. November and December. Comes to light.

Distribution. Restricted to the North Island Central Plateau and adjoining Hautapu River headwaters.

GB, TO / —.

Type material. Holotype ♂, 'Mt Ruapehu 4,100 ft, Tongariro Nat. Park, 21.11.62 (white label) / AWE slide Geo. 67 genitalia ♂ / NZAC04251675 (database accession number)' [NZAC]. Paratypes: 4 ♂♂, 3 ♀♀ [all NZAC]: 2 ♂♂, Ruapehu, Chateau Tongariro at bush margin, 3800 ft, to light, 19 Nov 1962, J.S. Dugdale, M.A. Stoodley; 2 ♂♂, 2 ♀, TO: Mt Ruapehu, Silica Springs Tk entrance, 6 Dec 1994, J.S. Dugdale, to light (AWE slide Geo. 82 genitalia ♀); 1 ♀, reared: Mt Ruapehu 4200 ft, ex *Dacrydium* [i.e. *Halocarpus*] sp., em. 18 Sep 1963, J.S. Dugdale (Fig. 11a; NZAC04251673).

Remarks. *Ipana halocarpi* is a member of the *I. hermione* group, which is defined in the *Ipana* generic description. It is known only from frosty shrubland *Halocarpus* communities in the central North Island's Volcanic Plateau where it is locally sympatric with *I. hermione*. This restricted distribution contrasts with the wide distribution of *I. hermione* in the North and South Islands over a wide variety of shrubland and forest podocarp sites. The highly localised distribution of *I. halocarpi* is also at variance with that of its hosts, which have extensive ranges: mountain toa-toa, *Phyllocladus alpinus,* is found from subalpine to low alpine regions of both North and South Islands; *H. bidwillii* and *H. biformis* are in montane to alpine zones in the North Island and in lowland to subalpine zones in the South and Stewart Islands.

12. *Ipana perdita* Dugdale & Emmerson, new species

Fig. 12a (adult); 12b (male coremata); 12c, d (male genitalia); T12 (habitat); Map 12

Diagnosis. This species (habitus, Fig. 12a) is distinguished from some grey forms of *I. griseata* by its upright mesonotal crest. Like the other two members of the *I. hermione* group, *perdita* has antennae with short rami, greatest length < half compound eye. It also has a number of distinct oblique streaks on the subterminal region of the forewing. In *I. perdita* the postmedian line is angled towards the base at the costa before curving back to the dorsum at about 4/5 with a straight central portion, whereas in *halocarpi* the postmedian line zigzags from costa to dorsum, forming a W; for other forewing pattern differences from *I. halocarpi* and *I. hermione,* see descriptions of those species. From *I. feredayi* (a similarly proportioned species), *I. perdita* differs by its median band being wider at the forewing costa than at the dorsum. Overall, *I. perdita* is a dull, dark slate-grey moth compared to the more fuscous, speckled forewing markings of *I. halocarpi* and the silvery-grey infused forewing of *I. hermione.* The uncus apex is distinctly spatulate (more slender in *halocarpi* and *hermione*).

Description. *Adult male* (Fig. 12a): Wingspan 30 mm. Antennae bipectinate; longest rami < half width of compound eye. Thorax grey-brown mixed with white and with narrow anterior transverse bands, alternating white and dark brown followed by purplish brown, bands bisected by a short dark longitudinal line; mesoscutellar crest short (2 mm); forewing ground-colour dingy grey; costal strigulae short, bold and either at right angles to costa or slightly angled towards base; a fine longitudinal streak at base; black antemedian line shaded basally with reddish-brown scales; postmedian line angled towards the base at the costa before curving back to the dorsum at about 4/5 dorsum length; median band dark grey, as broad on costa as on dorsum (or slightly broader); subterminal area with oblique streaks and suffused with white scales; termen convex; hindwings greyish brown, darker towards the termen, with a scarcely discernible median line. Hind-tibia unmodified. Abdomen dark grey, pleural area of A4 with short tuft of pilose scales that stain heavily in Acid Fuchsin (Fig. 12b); this structure not seen in other declanoid species.

Adult female: Unknown.

Male genitalia (Fig. 12c, d): As for *I. hermione* and *I. halocarpi* except for uncus base lobes (bearing the socii) slender, acuminate (lobes stoutly triangular in *I. hermione*, with decurved apices in *I. halocarpi*); gnathos arms evenly slender (tapering to apex in *I. hermione* and *I. halocarpi*). Phallus (Fig. 12d): aedeagus ca 3.3 mm long (cf. *halocarpi*), stout, length 5x width, apex produced, narrow spoon-shaped; vesica with 4 long and 3 or 4 short cornuti (vesica uneverted in only available preparation.)

Larva: Unknown.

Hostplants. Unknown (see Remarks).

Distribution. Te Paki, at the tip of the Aupouri Peninsula ND (based on 3 specimens all collected on same date at one site).

ND / —.

Flight period. December. Comes to light.

Type material. Holotype ♂: 'NEW ZEALAND ND 34.28.45S 172.45.8E Te Paki, Kauri Bush Track 170m, mv light 20 Dec 2011 R Hoare, T Buckley, D Seldon / NZAC slide Geo. 8 genitalia ♂ / NZAC04191295 [database accession number]' [NZAC]. Paratypes: 2 ♂♂, same data as Holotype but not dissected [NZAC] (Fig. 12a; NZAC04191516).

Remarks. The species is currently known only from three male specimens taken at mercury vapour light. *I. perdita* is the only member of the *I. hermione* trio known from Te Paki ND. At present this species is regarded as an allopatric member of the *hermione* complex, and presumed to be restricted to Te Paki, a well-recognised area of endemism (see summary in Myers *et al*. 2017: 2), though the putative host-plant is more widespread.

Known endemic hosts of members of the *I. hermione* group are in Podocarpaceae, but the hostplant of *I. perdita* is unknown. At the type locality, Kauri Bush, a possible candidate may be the podocarp *Halocarpus kirkii,* a rare tree species that is relatively common in the restricted area where the moth was found. A day search by RJBH in October 2008, including beating foliage, failed to yield larvae. A night search may be more productive. In the Waitakere Ranges AK, *H. kirkii* populations occur on private land. Whilst light-trapping in the Ranges over many years has only yielded *I. hermione*, no concerted attempt has been made to trap close to the *Halocarpus.* Members of *Halocarpus* and *Podocarpus* have insecticidal properties except for *H. kirkii* (Singh *et al*., 1970: table I). In contrast, that study shows hostplants of *I. hermione* and *I. halocarpi* have high incidences of phytoecdysones (moulting hormones that have strong insecticidal properties).

Conservation issues: Fire is a threat. The species was found in an area with an expansive cover of highly combustible indigenous and adventive trees and shrubs (*Kunzea, Leptospermum, Hakea*), enclosing small, moist endemic conifer and angiosperm communities in sheltered gully-heads (Hoare 2010, fig. 296, reproduced here as Fig. T12 with permission). Unsurprisingly, the Department of Conservation's rating of this species is Nationally Critical (Hoare *et al.* 2017).

13. *Ipana hermione* (Hudson, 1898) new combination

Fig. 13a, b (adults); 13c–e (male genitalia); 13f, g (female genitalia); L13 (larva); Map 13

Declana hermione Hudson, 1898. *New Zealand Moths and Butterflies (Macrolepidoptera)*: 98, pl. x, fig 36.

Diagnosis. Small (wingspan <40mm); forewing median band ground-colour silvery ash (darkly dappled in *I. halocarpi*, dingy grey in *I. perdita*) and as wide at the costa as at the dorsum or wider (wider at the dorsum in *I. feredayi*). *Ipana hermione* has the antemedian line broken in the middle so that the costal half and the dorsal half are on parallel oblique paths (Fig. 13a, b) (antemedian unbroken in *I. halocarpi* and *I. perdita*: Fig. 11b, 12a).

Description. *Adult male* (Fig. 13b): Wingspan 30–38 mm. Antennae bipectinate, greatest rami length < half compound eye diameter. Thorax grey-brown interspersed with white; narrow prothoracic transverse bands, white anteriorly followed by purplish brown; mesoscutellar crest short (height 2 mm); forewing ground-colour varies from purplish brown to grey; costal strigulae, when present, very short and slightly angled towards the base; a fine black longitudinal streak at the base before the broken, broad, dark reddish-brown antemedian line; postmedian line black, forming an acute angle at costa, then straightening and doubling back to join dorsum at about 4/5 dorsum length (not W-shaped as in *halocarpi*); most, but not all, specimens with a bright silvery wash in the costal half of the median band which may extend to the basal patch and also feature to a varying degree in the terminal area; median band as broad on costa as on dorsum (or slightly broader); subterminal area bearing three oblique brown streaks angled towards the costa; termen convex; hindwings greyish brown, darker towards the termen; median line indistinct, wavy, narrow. Hind-tibia unmodified. Abdomen grey-brown.

Adult female (Fig. 13a): Antennae bipectinate; rami very short, blunt; each pair appearing heart-shaped. Otherwise resembles male.

Male genitalia (Fig. 13c–e): Uncus slender, apically only slightly thickened, basal lobes short, stout, concave; gnathos arms broad, somewhat tapering to the stout, spinose, fused apex; costulae sclerotised, basally triangular, and deeply concave laterally, densely spinulose outwardly, inwardly tapering to meet at midline (Fig. 13d, costula);

juxta shield-shaped, with very short thumb-like dorsal juxtal sclerites dorsolaterally at 2/3 juxta height; valvae elongate, saccus indented. Phallus (Fig. 13e): aedeagus stout, length 5x width, apex rounded; vesica bearing 3 fine cornuti and a line of 8-10 shorter coarse cornuti (similar to *I. perdita*).

Female genitalia (Fig. 13f, g): Posterior apophyses ca 4x length of anterior apophyses, i.e. extensible. S8 area deeply transversely ridged; ostium bursae ventral lip margin concave; ductus bursae ridged to junction with corpus and with an inflated smooth zone dorsolaterally (Fig. 13f); an elongate pseudosignum (Fig. 13g, ps) in the narrow neck at the (collicular) end of the ductus; corpus bursae with a sclerotised knife-like (pleated) signum.

Larva. Morphology: HC (Fig. L13) epicranial prominences increasingly enlarged with each instar after instar III; face concave with a 'grin' marking. Abdomen: A1 length twice width; A5 lacking prolegs or crotchet rudiments; A2 with paired lateral protuberances each bearing upward-facing spiracle; A3 with a pair of shorter SV protuberances pointing antero-laterally, these sometimes vestigial; A1, A2 with seta SV3 reduced, almost short-setulose, absent in one population (see Remarks); A7–9 SV papillae branched; A8 with large dorsal prominence (Fig. L13); anal proleg with seta AL4 on a prominent tubercle, as in *I. junctilinea* and *I. halocarpi*.

Colour pattern: Instar I: D, SD, L, SV, and V stripes pink on a pallid ground-colour, pink stripes scarcely widened at each mid-segment (cf. *D. floccosa*). Instar II: pink stripes indistinct, ground-colour grey or brown. Instar III–V: HC with a curved transverse pallid fascia with a contiguous dark fascia giving a 'grinning face'; venter concolorous with rest of body on segments A1–5, body pattern intricate. A8 dorsum has a conspicuous dark V-mark.

Resting pose: Twig-like.

Hostplants. Endemic hosts are in Podocarpaceae: mountain toatoa, *Phyllocladus alpinus*; Hall's totara, *Podocarpus laetus*; totara, *Podocarpus totara*. Populations in podocarp-dominated forest areas have extended to adjoining managed exotic Cupressaceae and Pinaceae plantations, and the following adventive hosts are recorded: Cupressaceae: Lawson's cypress, *Chamaecyparis lawsoniana;* Pinaceae: European larch, *Larix decidua*; Monterey pine, *Pinus radiata*; Douglas fir/Oregon pine, *Pseudotsuga menziesii*.

Flight period. September until March. Comes to light.

Distribution. Widespread, although there are no records from CO; present from sea level (coastal podocarp communities) to eastern major valley-head subalpine coniferous shrublands at 800–1200 m and collected as adults to light up to 1500 m in the South Island.

ND, AK, CL, WO, BP, TK, TO, GB, HB, RI, WN / NN, BR, WD, MB (restricted), NC, MC, MK (restricted), OL, DN, FD, SL / SI

Type material. Holotype ♂ Hudson label: '140a' (Hudson Register: '140a at sugar, n[ea]r railway line at foot of Kaka Hill, Wellington. Nov. 27 [18]88') [MONZ]. Wingspan 30 mm. Condition: perfect.

Remarks. *Ipana hermione* is by far the most widespread member of the *I. hermione* trio as defined in the *Ipana* generic description. All members feed on, or are coincident with, Podocarpaceae but only *hermione* has been collected on exotic conifers, generally where these have been planted close to natural podocarp stands. No *I. hermione* have been recorded from the two rarely sampled native *Libocedrus* species (Cupressaceae) but there have been records of larvae beaten from exotic Cupressaceae. In the central North Island, *I. hermione* is sympatric with *I. halocarpi*, but they share no host-plants; neither is known from Te Paki ND where *I. perdita* occurs.

In the South Island, although *I. hermione* is widespread, postglacial populations at higher altitudes appear not to have diverged from lowland populations. A possible example of incipient differentiation may be larvae of an *I. hermione* population near the head of Speargrass Creek BR on *Phyllocladus alpinus* that lack seta SV3 on A1 and A2; however, adult morphology so far provides no evidence of more than one South Island species.

On the more south-eastern ranges of MK distant from the Southern Alps, White's (2002) extensive trapping programme did not yield any *I. hermione* but did encounter *Declana niveata* (host: *Hoheria* spp), *D. nigrosparsa* (*Olearia* spp), *I. griseata* (Loranthaceae), *I. junctilinea* and *I. leptomera* (polyphagous on shrubs). One of the series of males in CMNZ collected at Arthur's Pass by Stuart Lindsay (then lepidopterist at CMNZ) was depicted and erroneously described by Hudson (1950: 97–98, plate v, fig 5) as a male of *Declana toreuta* (a species described originally from two females).

14. *Ipana junctilinea* (Walker, 1865) new combination

Fig. 14a–e (adults); 14f (forewing venation); 14g (abdominal base); 14h–j (male genitalia); 14k, l (female genitalia); L14a, b (larvae); R14 (live adult); Map 14

Politeia junctilinea Walker, 1865. List of the lepidopterous insects in the collection of the British Museum XXXII: 643.

Chlenias verrucosa Felder & Rogenhofer, 1875. Reise der österreichischen Fregatte Novara um die Erde (zoologischer Theil) Band 2 (Abtheilung 2), Hefte 5: pl. cxxxi fig. 22. Synonymised by Meyrick (1884: 65).

Diagnosis. Among declanoids with pectinate antennae, *I. junctilinea* is the only one, apart from *Declana nigrosparsa*, with *costal strigulae angled towards the termen*; this separates it from *I. feredayi, I. hermione, I. perdita, I. halocarpi, I. griseata* and *D. floccosa*, all of which have strigulae either at right angles to the costa or angled towards the base. Specimens of *I. junctilinea* are equally readily identifiable by the prominent dark mesoscutellar crest (height ca 3 mm) and the somewhat upturned forewing apex with a prominent pallid diagonal streak. Forewing pattern is variable (Fig. 14a-e); weakly or unusually marked specimens can pose identification problems. The forewing median band (when evident; obscured in *verrucosa*-like specimens) is broader at the costa than at the dorsum (this band broader at the dorsum in *I. feredayi*). *Ipana perdita* wingspans are smaller than those recorded for *junctilinea*.

Description. *Adult male* (Fig. 14c–e): Wingspan 34–43 mm; South Island specimens tend to be larger than those from the North Island. Antennae widely bipectinate with longest rami > half width of compound eye, thus forming a conspicuously long double fringe. Thorax matching forewing ground-colour, brown or grey; mesoscutellar crest ca 3 mm high. Forewing ground-colour brown or light to dark grey or grey-brown; costa with series of strigulae angled towards the termen; markings extremely variable although most specimens have a conspicuous diagonal pallid apical streak, sometimes extending irregularly towards the dorsum (generally more strongly marked than in females); clear median band defined by an outwardly angled antemedian line (Fig. 14e) and a zig-zag postmedian line in well-marked specimens; postmedian line usually a broad bar, often with rusty reddish scales centrally; dark patch on the costal half further highlighting the apical streak; median band wider at costa than dorsum; occasionally a longitudinal line joining the ante- and postmedian lines above the midline (*junctilinea* form, Fig. 14c); in some specimens (e.g., Fig. 14d) the markings, with the exception of the costal strigulae, are obscure or absent altogether; termen convex, weakly scalloped; hindwings pale brown or grey with broad terminal shading; hindlegs unmodified. Abdomen grey or brownish.

Adult female (Fig. 14a, b): Antennal pectinations shorter and finer than male. Forewing ground-colour greyer than male and, except for costal strigulae and apical streak, much less well marked. Otherwise resembles male.

Male genitalia (Fig. 14h–j): Uncus apex slightly swollen, with a decurved hook (Fig. 14h); gnathos apex with a swollen transverse, spinulose bar between paired hooks; juxta mesal apex extended dorsally into the phallocrypt entrance (Fig. 14i), dorsal juxtal sclerites bifid, with an upper and a lower hook-like process; costulae dorsally spinulose; saccus base (Fig. 14h) not indented. Phallus (Fig. 14j): aedeagus stout, length 4.5x width; apex acuminate; everted vesica longitudinally finely grooved (fluted), apex with 3 long and slender, and 5 short and thick cornuti.

Female genitalia (Fig. 14k, l): Posterior apophyses length 2x that of anterior apophyses; S8 with rugose microsculpture (Fig. 14l); sterigma as in Fig. 14l, with lateral dimples bordering the ostium bursae; ductus bursae with two longitudinal pseudosigna (Fig. 14k, ps); and with the sclerotised caudal and anterior parts of similar length, caudal part <0.5x width of anterior part and fluted; anterior part smooth and same diameter as the unsclerotised obovoid corpus bursae; signum an oblique sclerotised blade-like pleat, close to ductus bursae.

Larva. Morphology: HC in face view with prominent epicranial prominences; instars IV and V with more or less well-developed, twig-like projections laterally on A2 (Fig. L14b); A5 (Fig. L14a) with a lateral butting mound, but no proleg rudiments; A6 (Fig. L14a) with lateral proclinate spur anterior to seta L2. SV area on A6 with erect micro-papillae; proleg and A7–9 with branched SV papillae; A8 with prominent tubercle bearing setae D1.

Colour pattern: Instars I and II: D + SD, SV + V zones coalesced, dark grey, L area pallid. Instar II L area darkened but still lighter than in Instar I; later instars with intricate variable patterns often incorporating bright green marbling, resembling the epiphytic flora of the hostplant twigs.

Resting pose: Twig-like.

Hostplants. Polyphagous on a wide range of endemic shrubs and trees, also on *Muehlenbeckia* vines and on introduced conifers. Recorded hosts are listed in Appendices A and B.

Distribution. Common and widespread throughout to at least 1180 m. Areas without confirmed records (GB, WI, WA) are all relatively under-collected.

ND, AK, CL, WO, BP, TK, TO, HB, RI, WN / SD, NN, BR, WD, MB, KA, NC, MC, SC, MK, OL, CO, DN, FD, SL / SI.

Flight period. Mainly October until March but can be encountered in any month. Comes to light.

Type material. *Politeia junctilinea*: Holotype ♂, 'Politeia junctilinea [narrow paper strip] / Auckland 60-73 / Politeia junctilinea Walker (rectangular card) / Type (circular, green margin)' [NHMUK]. Wingspan 38.5 mm. Condition: LH antenna missing, RH antenna a stump; wings good; wing-pattern with horizontal connection joining basal and outer median lines (hence *junctilinea*); abdomen present.

Chlenias verrucosa: Holotype ♂, 'Geometridae genitalia slide no. 4211 / Type [circular, red margin / Rothschild Bequest BM1939:1 / Novara CXXX, fig. 22 Chlenias verrucosa ♂n. N. Seeld / '42 [Oxley's pencil-margined square label]' [NHMUK]. Wingspan 35 mm. Condition: LH antenna missing; head, thorax and wings good; floccosity especially towards termen evident.

Remarks. Scoble and Hausmann (2007) were misled by a typo in Dugdale (1988: 165), where, in error, the name *verrucosa* was not indented, and therefore listed it as a good species. It is not a valid name and remains sunk in synonymy under *junctilinea.* We are assured by Dr Hausmann that their on-line catalogue has been amended.

Populations generally have both named adult colour forms, as well as intermediates. The prevalence of this species in nearly all parts of New Zealand is due to the ubiquity of many of its hosts both endemic and adventive (Appendices A, B). It is particularly abundant in, but not restricted to, areas of shrubland and may be found on or beaten from the divaricating shrubs characteristic of those communities, whether in high or low rainfall areas. The prominent 3 mm-high adult thoracic crest, which resembles the stump of a broken-off twiglet, adds to the disruptive appearance of the adult as it clings to a host twig with its forewings firmly wrapped round the twig. The larvae are also elaborate twig mimics but even though the late instar larvae mimic hosts with opposite pairs of twig stubs (Fig L14b), *I. junctilinea* has never been recorded from *Coprosma* (Rubiaceae), a diverse plant genus characterised by twigs with this arrangement.

15. *Ipana leptomera* Walker, 1858

Fig. 15a–d (adults); 15e (adult head); 15f (forewing venation); 15g, h (male coremata); 15i–k (male genitalia); 15l, m (female genitalia); L15a–d (larvae); R15 (live adult); Map 15

Ipana leptomera Walker, 1858. List of the lepidopterous insects in the collection of the British Museum XV: 1662.

Amphitape crassitibia Felder & Rogenhofer, 1875. Reise der österreichischen Fregatte Novara um die Erde (zoologischer Theil) Band 2 (Abtheilung 2), Hefte 5: pl. cix, fig. 10 ('Erklarung'). Synonymised by Meyrick (1884: 234–235).

Diagnosis. *Ipana leptomera* is readily distinguished from all other declanoids by the unique herringbone costal strigulae and noticeably three-lobed hindwings (Fig. 15a–d). It exhibits sexually dimorphic ground-colour (fawn in male, grey in female). It shares filiform antennae with *Declana niveata, D. lupa* and *D. foxii,* none of which resemble it in habitus. Male *I. leptomera* are distinguished by the very long A7 and the hypertrophied genitalia, unique presence of massive hair-pencil arising on the metathoracic subalare sclerites (Fig. 15h), and the swollen hind-tibia bearing a hair pencil (Fig. 15g). Uniquely in the group, the female genitalia bear a sclerotised modification of S8 (Fig. 15m) and the ductus bursae is slender and smoothly sclerotised throughout (Fig. 15l).

Description. *Adult male* (Fig. 15b–d): Wingspan 36–40 mm. Antennae filiform (non-pectinate) (Fig. 15e). Thorax fawn with a darker dorsal mid-line; mesoscutellar crest absent; subalare sclerite (just under the hindwing base) uniquely hypertrophied and modified into a plano-convex plate (Fig. 15h), which bears a large dense tuft of pilose scales, hidden at rest in a large pocket between each oblique, dorsally concave, hindleg base and the dorsal, correspondingly oblique sternal areas of A1 and A2. These areas together form a chamber unique to *I. leptomera* males. Forewing costa with a row of herringbone strigulae (>>>>>), apices pointing towards termen; two transverse series of dark-brown dots parallel with the termen at 3/4 and 7/8 wing length; some specimens (Fig. 15c) with 2 oblique pairs of large black spots discally, one at 1/4, the other at 3/4 wing length; others with a broad black band filling in the area defined by these spots (Fig. 15b); others with forewing marbled with dark grey; termen with dorsal half evenly oblique. Hindwing termen strongly trilobed, plain, more greyish than forewing. Hind-tibia grossly swollen and with pink or mushroom-coloured hair pencil. Abdomen long, fawn or brownish dorsally, often with a central dark line or row of dots, and with A7 (the last visible segment) far longer than the others.

Adult female (Fig. 15a): Antennae filiform (non-pectinate), more slender than male; forewing ground-colour pale grey with costal herring-bone markings reduced or absent; two transverse rows of small black dots as in male, but without large spots, dark bands or marbling; many specimens have dark shading on dorsum; hindwing less deeply lobed than in male; hind-tibia unmodified. Abdomen pale grey; with or without dark line or row of dots along the dorsal midline. Otherwise resembles the male.

Male genitalia (Fig. 15i–k): Genital capsule ca. 3 mm long (all other species are shorter). Uncus slender, as long as tegumen sides. Gnathos arms meeting at half-length, separating before apex to form a paired bill-hook (Fig. 15i); costulae meeting at mid-line, thence each curving outwards forming an acuminate process that is as long as the juxta is high; dorsal juxtal sclerites with long inward and short outward apices and ensconced in a dorsolateral embayment either side of juxta apex; saccus indented. Phallus (Fig. 15k): aedeagus elongate, thin, length >10x width, apex acuminate; vesica with two very long cornuti and one short cornutus, and a line of small recurved teeth on a sclerotised strip.

*Female genitalia (*Fig. 15l, m): Posterior and anterior apophyses subequal in length; S8 hypertrophied as a broad sculptured plate, narrowly incised mesally on apical margin, and folded to form a transverse pleat overshadowing the ostium bursae (Fig. 15m); ductus bursae caudal region uniformly slender, strongly sclerotised, fluted on one side, length 6x width; ductus bursae anterior portion scarcely expanded, length subequal to posterior portion, extending down one side of, and obliquely supporting the corpus bursae (Fig. 15l); corpus bursae about 2x width of ductus bursae, obovoid, signum a transverse sclerotised internal pleat.

Larva. Morphology (Fig. L15a–d)*:* HC (Fig. L15d) higher than wide, parallel-sided with a small prominence pointing forwards between setae P1, P2; face flat. Setae SV1 and SV2 not in line horizontally on any segment. Spiracular area of A2 mammilliform or irregularly swollen. Setae D1 on A8 on a common tubercle; proleg rudimentary on A5 in instars IV and V (Fig. L15c); A6 with spur antero-laterally of seta L2, and the accompanying butting mound postero-lateral on A5 (Fig. L15c); SV papillae on A6-9 simple, backswept.

Colour pattern: Instar I: D, SD, L (paired), SV, and V stripes pink on a pallid ground and expanded in mid-segment, often coalescing, becoming obsolete intersegmentally, especially on L, SV and V areas. Instar II: HC mottled. Body with red stripes faint, ground-colour grey-brown, venter grey and post-spiracular area dark. Instars III to V: colour pattern becomes intricate, variable, often matching bark of twigs of hostplant (based on larvae from BP, TO, NN).

Resting pose: Twig-like.

Hostplants. Polyphagous on a very wide range of endemic and introduced trees and shrubs, including conifers, as well as a mistletoe (*Ileostylus micranthus*). Recorded hostplants are fully listed in Appendices A and B.

Distribution. Common and widespread, including offshore islands; possibly vagrant to Chathams (CH). Recorded from sites up to 1250 m but not above the bush line. Throughout, except for GB (under-collected). Apparently very rare in MK, where several localities have been intensely collected (e.g., White 2002). CH: Reported once from Pitt Island (Lindsay 1930) but collecting by JSD in 1968 on Pitt Is., and in the 1990's on Chatham Is., and on Rangatira (South-east) Is. just east of Pitt, failed to find it either as adults or larvae.

ND, AK, CL, WO, BP, TK, TO, HB, RI, WI, WA, WN / SD, NN, BR, WD, MB, KA, NC, MC, SC, MK, OL, CO, DN, FD, SL / SI / [CH]

Flight period. Mainly September to March but may be encountered in any month; comes to light.

Type material. *Ipana leptomera*: Lectotype ♂: '1. Ipana leptomera [long rectangle, printed] / New Zeal / 54.4 [white circular] / Type [green-rimmed disc]' [NHMUK]. Wingspan 37mm. Condition: very good. Paralectotypes: 2 ♂♂, 1 ♀, each labelled 'New Zeal / 54.4 [white disc]' [NHMUK]. The 4 specimens were collected by Bolton around Auckland.

Amphitape crassitibia, Holotype ♂: 'Type [disc, red margined] / Rothschild Bequest BM 1939-1 / 593 [bordered square card] / CIX fig. 10 Amphitape n.g. crassitibia n. N. Seeld / 42 [T.R. Oxley bordered square label]' [NHMUK]. Wingspan 41 mm. Condition: good, RH antenna lacking apical two thirds. Collected at Nelson by T.R. Oxley.

Remarks. *Ipana leptomera*, like *D. floccosa* and *I. junctilinea,* is a polyphagous species and flourishes in suburbia and in other areas now denuded of indigenous vegetation, making use there of the abundant exotic hosts in families such as Cupressaceae and Pinaceae (conifers), as well as Asteraceae, Myrtaceae and Rosaceae. The species is the only declanoid with the hindwing distinctly three-lobed (more strongly so in the male).

Despite its rather striking anatomical autapomorphies *Ipana leptomera* is classed here with its congeners because of: (1) presence of the larval A6 process anterior to seta L2 (Fig. L15c, absent from *Declana* and *I. glacialis*); (2) male S2 with lateral lobes (as in *I. junctilinea*, Fig. 14g), absent from *Declana*; (3) the over-all flat shield-like conformation of the male juxta (Fig. 15i) (reduced and C-shaped in *Declana*); (4) complete female sterigma that is free of S8 (Fig. 15m, cf. *I. atronivea*, Fig. 6g) (posterior lip of sterigma absent or fused with S8 in *Declana*).

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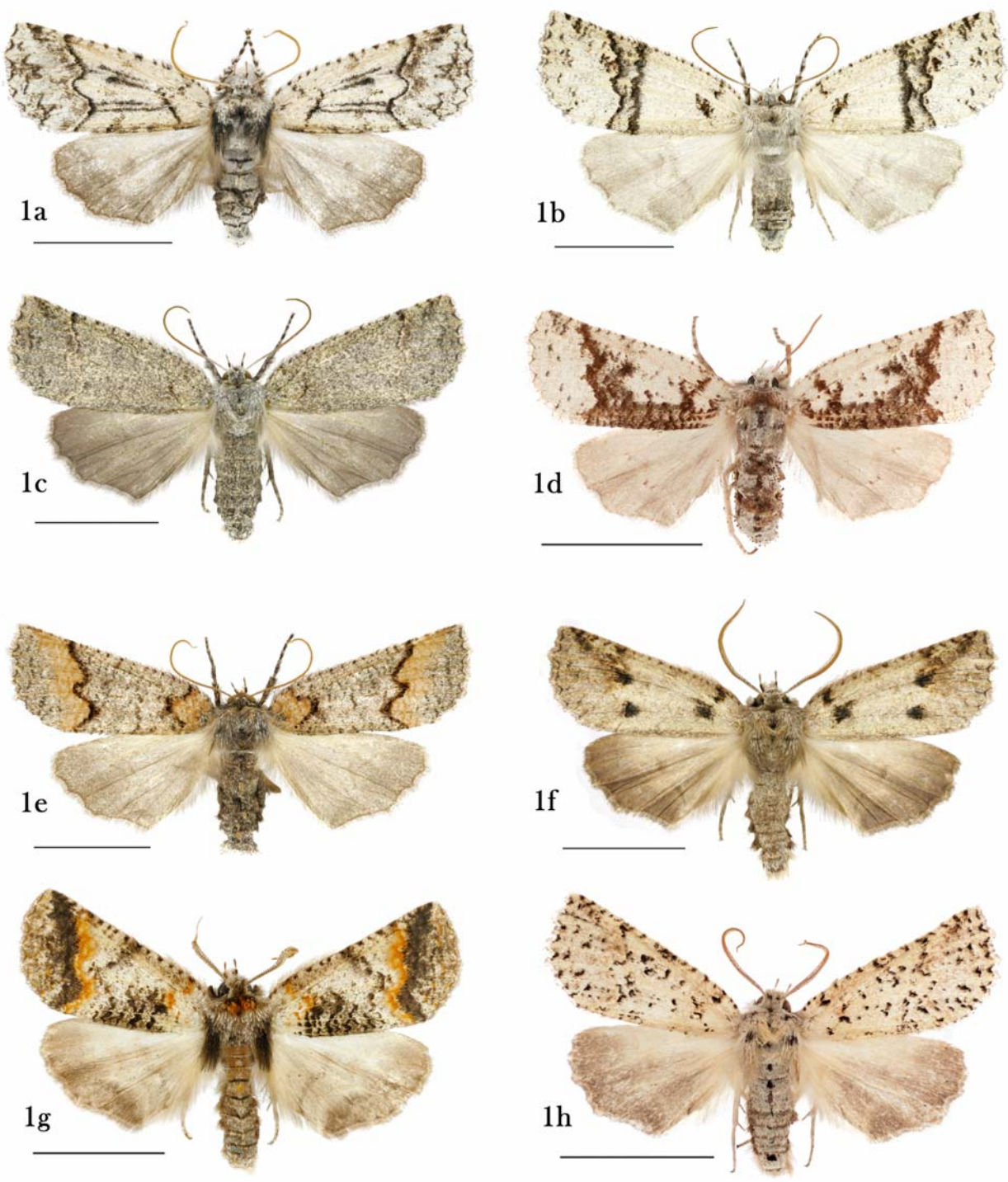


Fig. 1a–15e Adults, dorsal habitus. Automontage photographs by B.E. Rhode. Scale bars 10 mm. Two-letter codes representing area specimen was collected follow Crosby *et al.* (1998); fuller label details only given for type material or other specimens of special interest. Specimens in NZAC. (1a–h) *Declana floccosa* adults*:* 1a, female ND; 1b, female NN; 1c, female (grey form) ND; 1d, female NN; 1e, female HB; 1f, male ND; 1g, male (*callista* pattern) HB; 1h, male AK.

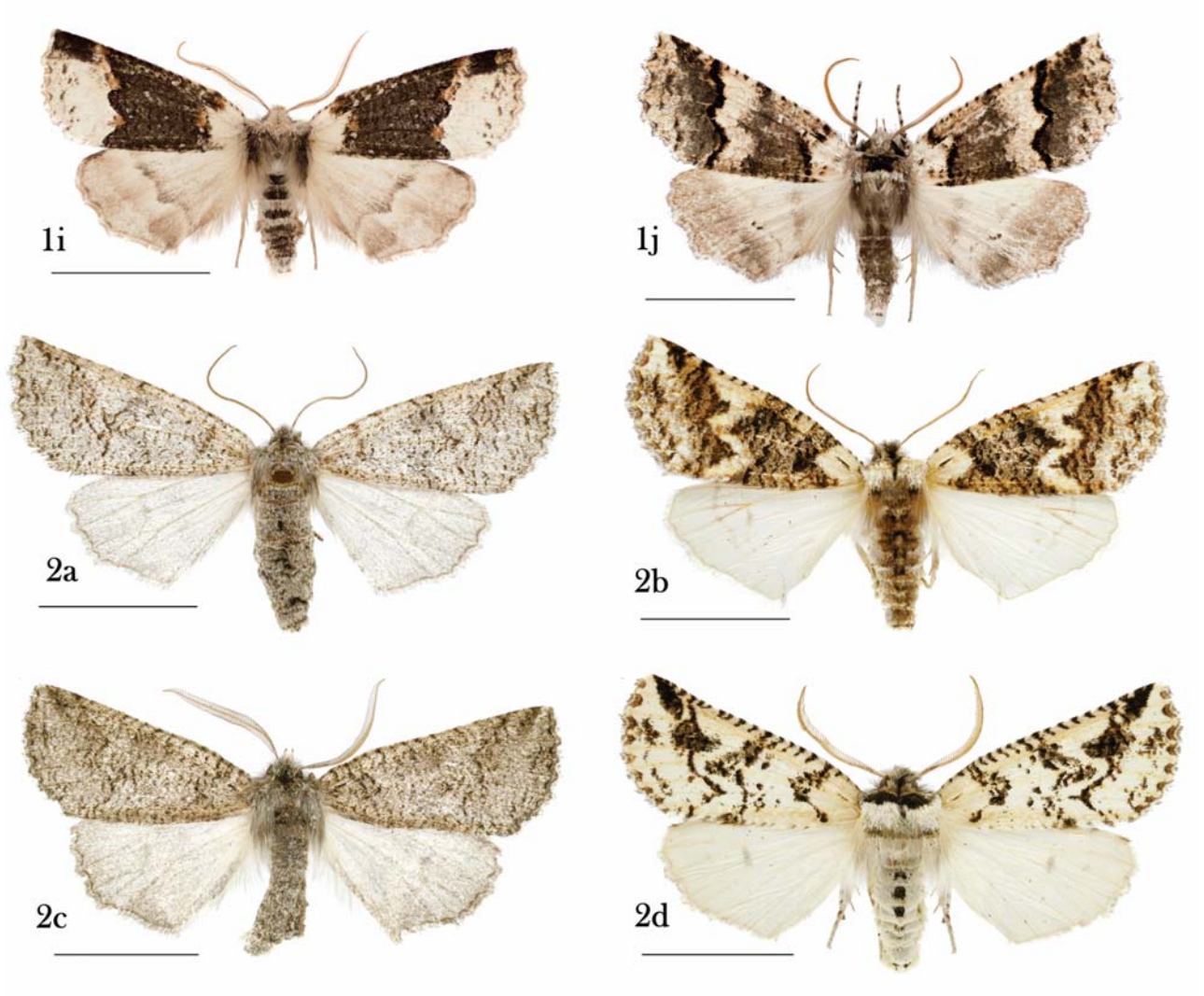


Fig. 1i–2d *Declana* spp. adults. 1i, *D. floccosa,* male WD; 1j, male WD; 2a, *D. nigrosparsa*, female CO (*nigrosparsa* form); 2b, female TK (*toreuta* form); 2c, male CO (*nigrosparsa* form); 2d, male TK (*toreuta* form).

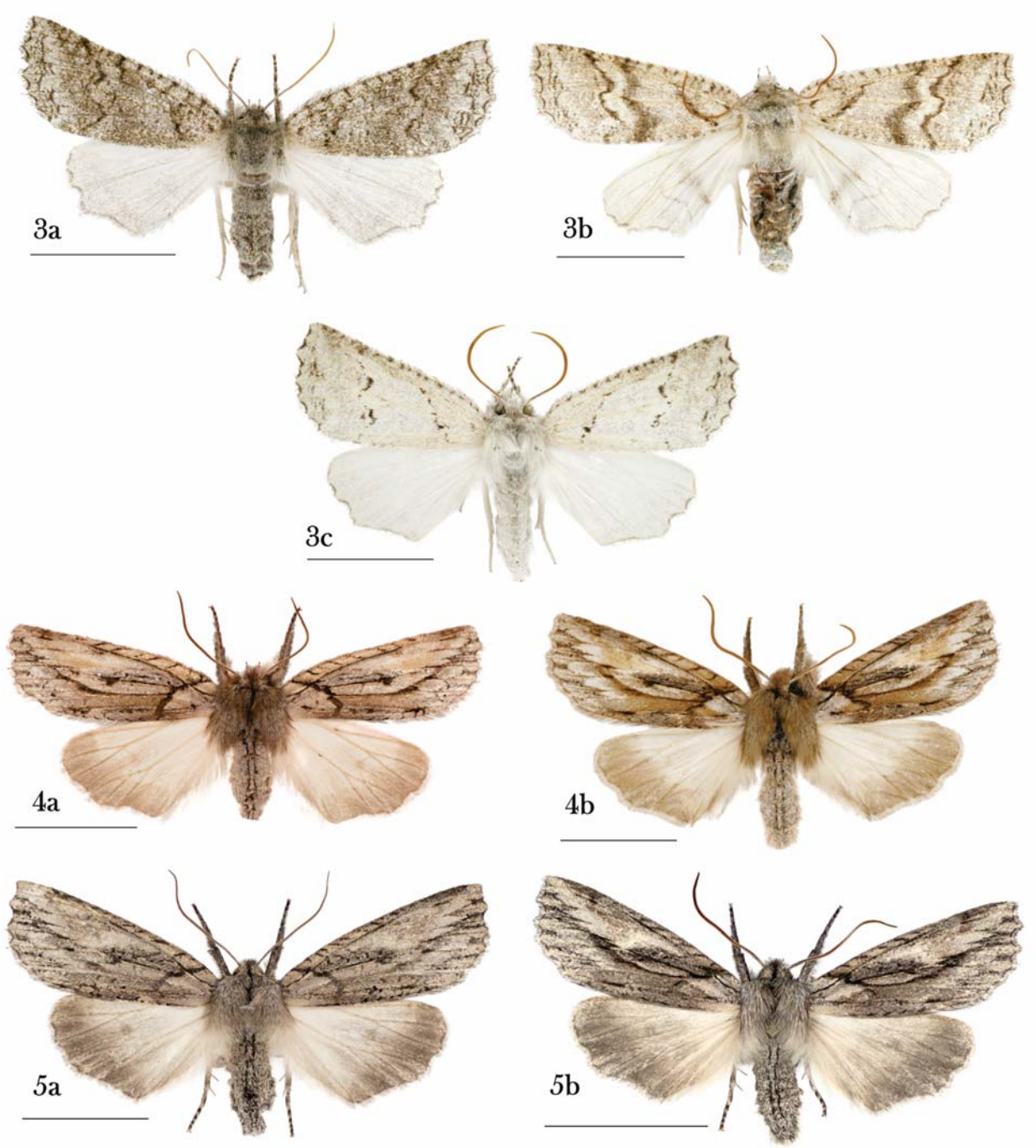


Fig. 3a–5b *Declana* spp. adults. 3a, *D. niveata*, female SC; 3b, female FD; 3c, male NN; 4a *D. foxii*, female paratype TK: North Egmont, 14 Jan 1993; 4b, male paratype, North Egmont TK, 1 Jan 1993; 5a *D. lupa*, female paratype, Lone Kauri Rd AK, 8–9 Nov 2009, A.W. Emmerson, R.J.B. Hoare; 5b, male, Destruction Gully AK.

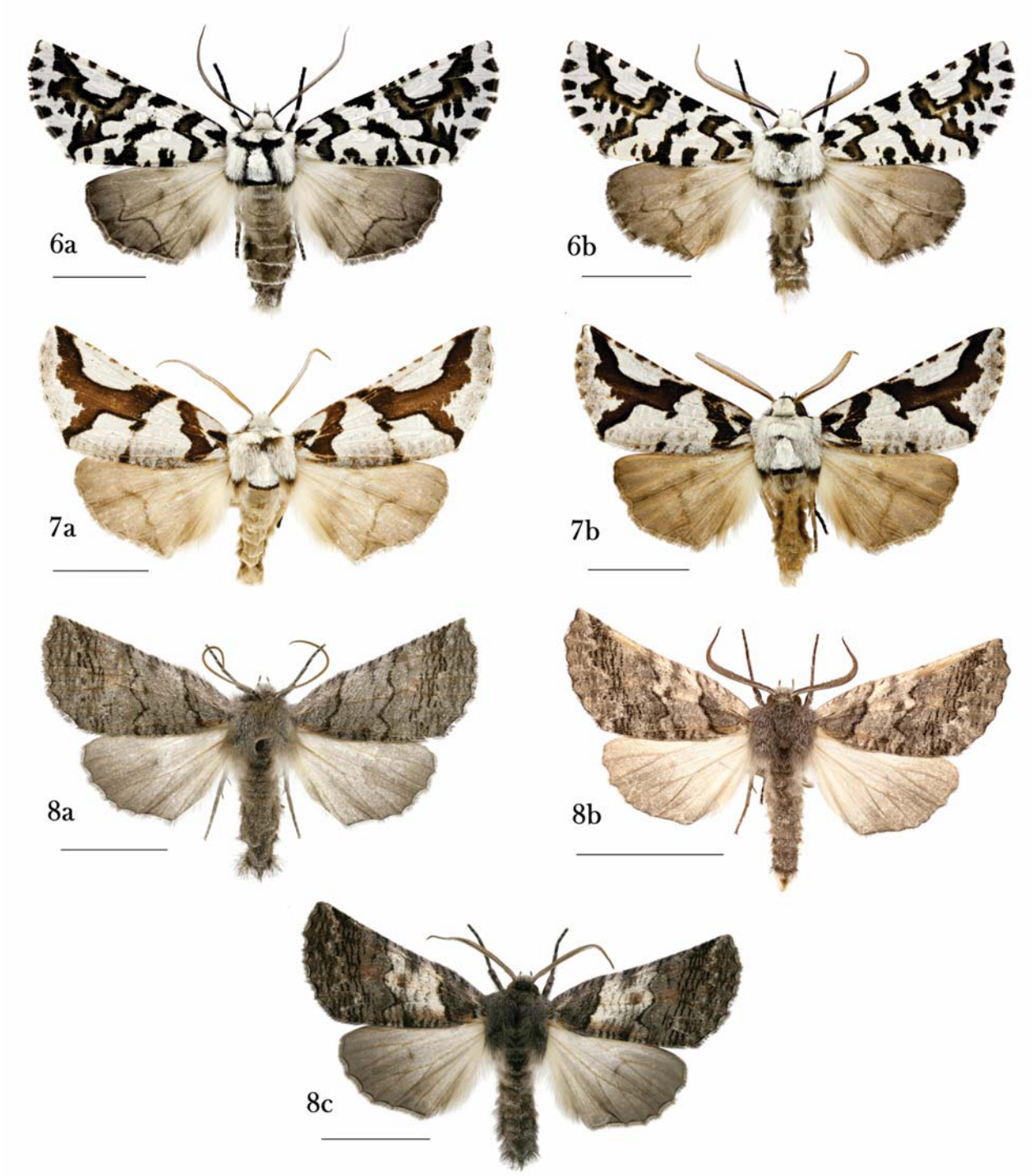


Fig. 6a-8c *Ipana* spp. adults. 6a, *Ipana atronivea*, female GB; 6b, male AK; 7a, *I. egregia*, female NN; 7b, male NN; 8a, *I. griseata* female SL; 8b, male NN (pale form); 8c, male TO (dark form).

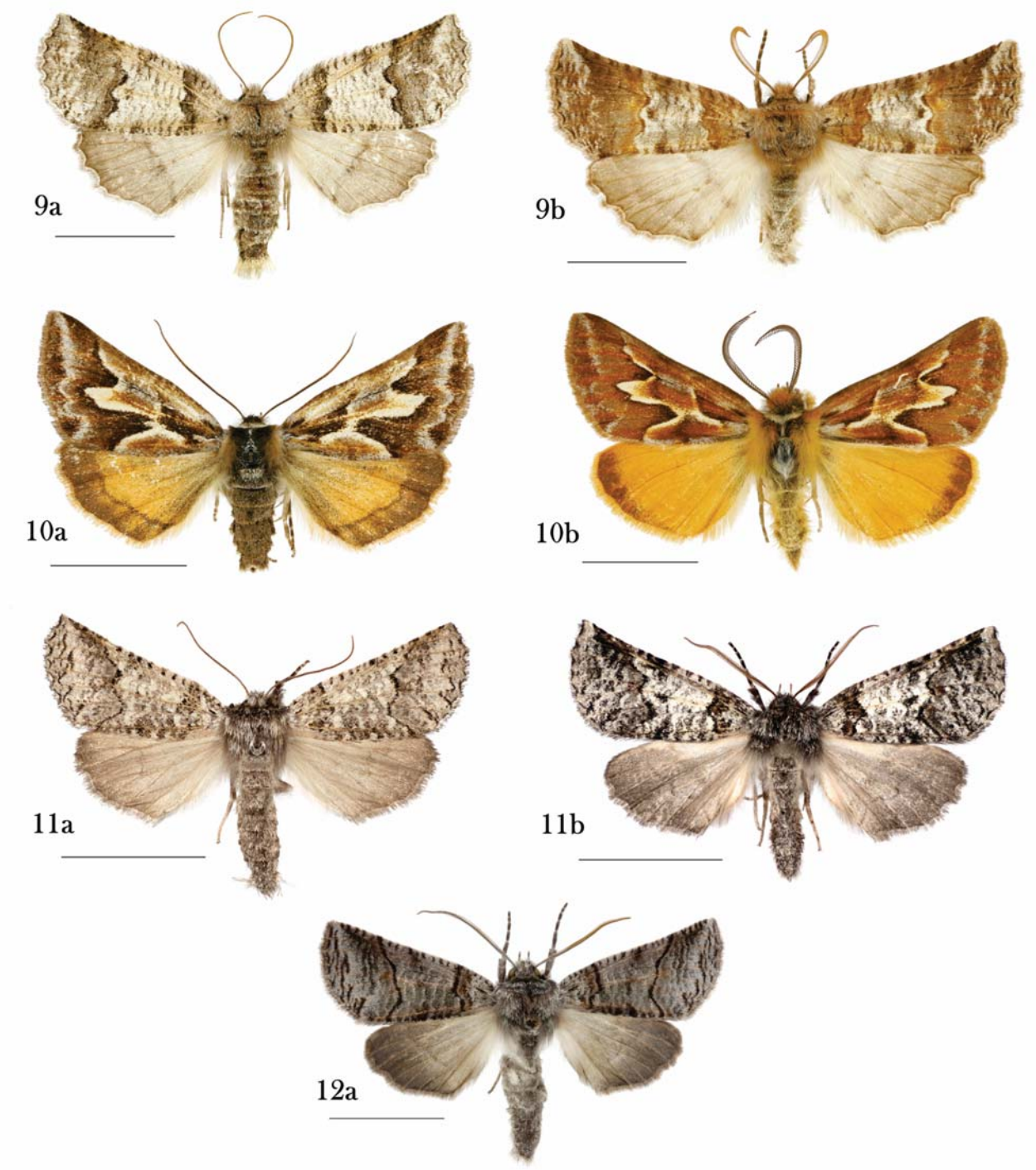


Fig. 9a–12a *Ipana* spp. adults. 9a, *I. feredayi*, female TO; 9b, male FD; 10a *I. glacialis*, female NN; 10b, male NN; 11a, *I. halocarpi* female paratype, Mt Ruapehu TO, ex '*Dacrydium* sp.' [i.e. *Halocarpus*], emg. 18 Sep 1963 J.S. Dugdale; 11b, male, Rangipo Desert TO; 12a, *I. perdita* male paratype, Te Paki ND, Kauri Bush, 20 Dec 2007.

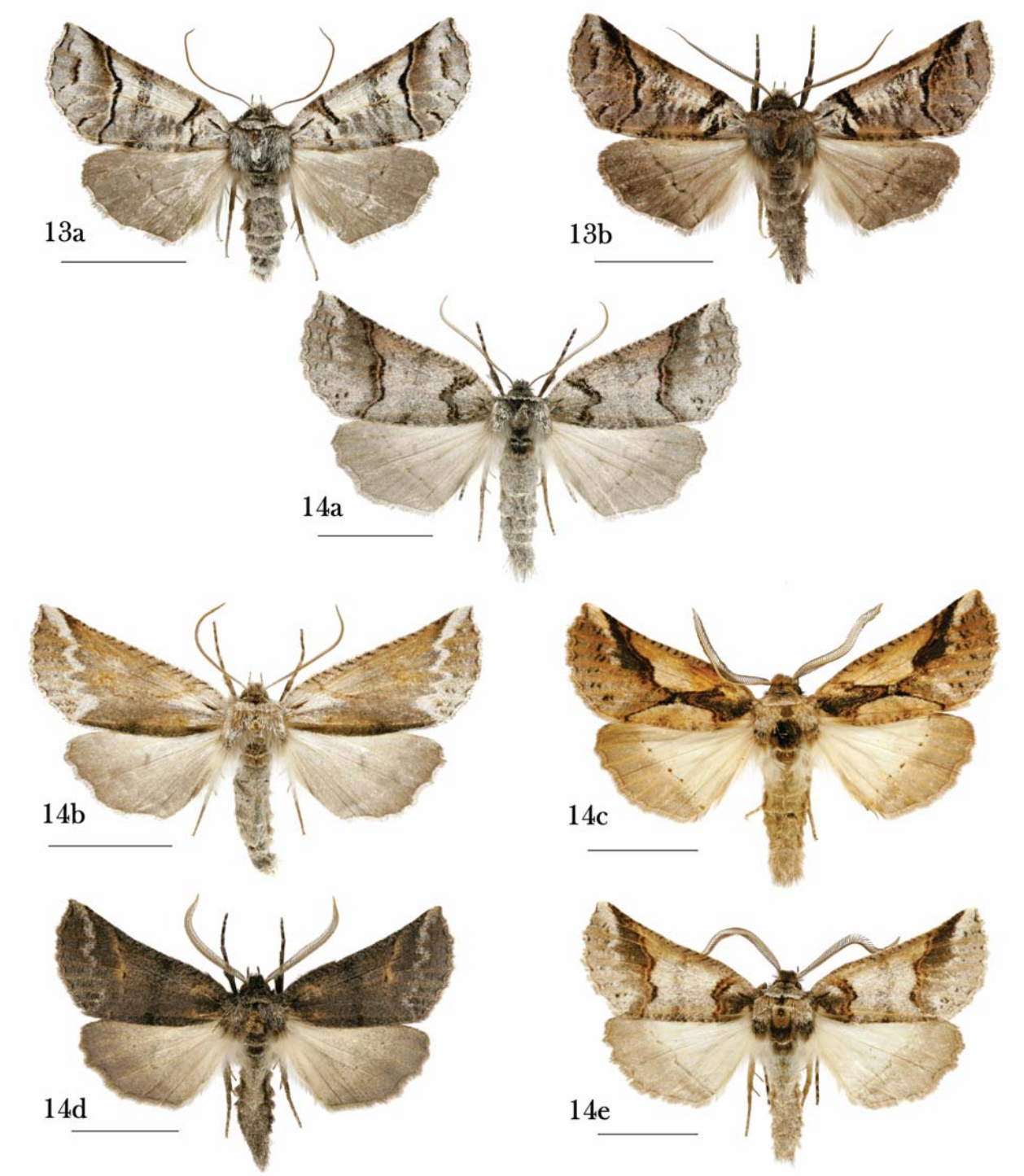


Fig. 13a–14e *Ipana* spp. adults. 13a, *I. hermione* female AK (note broken basal line); 13b, male AK; 14a, *I. junctilinea* female, Pukaki Sci. Res. MK; 14b, female, Wakefield NN; 14c, male, Rakeahua River Hut SI (*junctilinea* form); 14d, male, Pukaki Sci. Res. MK; 14e, male, Mt Cook MK (*verrucosa* form).

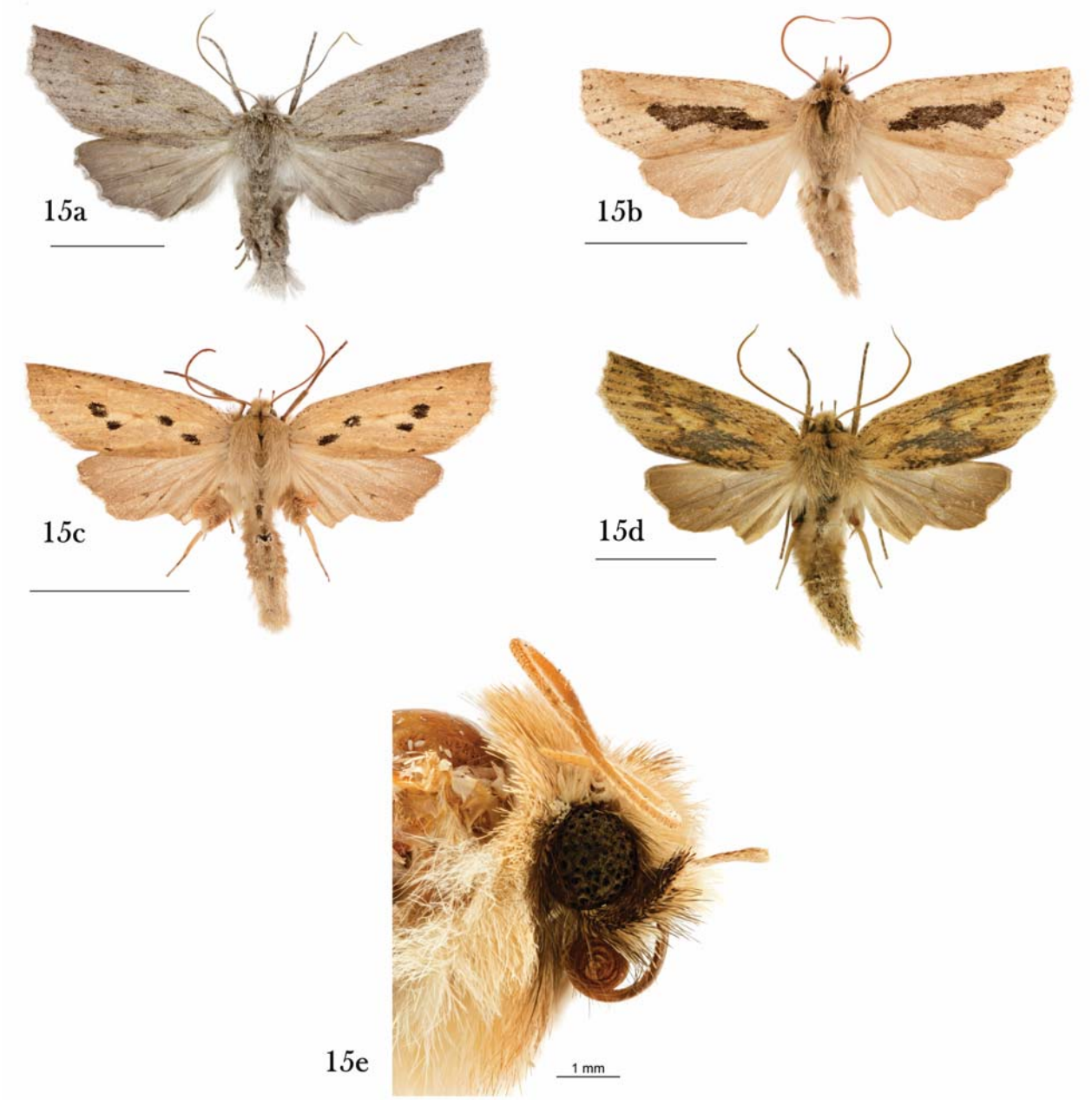


Fig. 15a–e *Ipana leptomera* adults. 15a, female ND; 15b, male SL; 15c, male NN; 15d, male ND;15e, male head, side view (Albany AK), showing geniculate labial palpus and non-pectinate antenna.

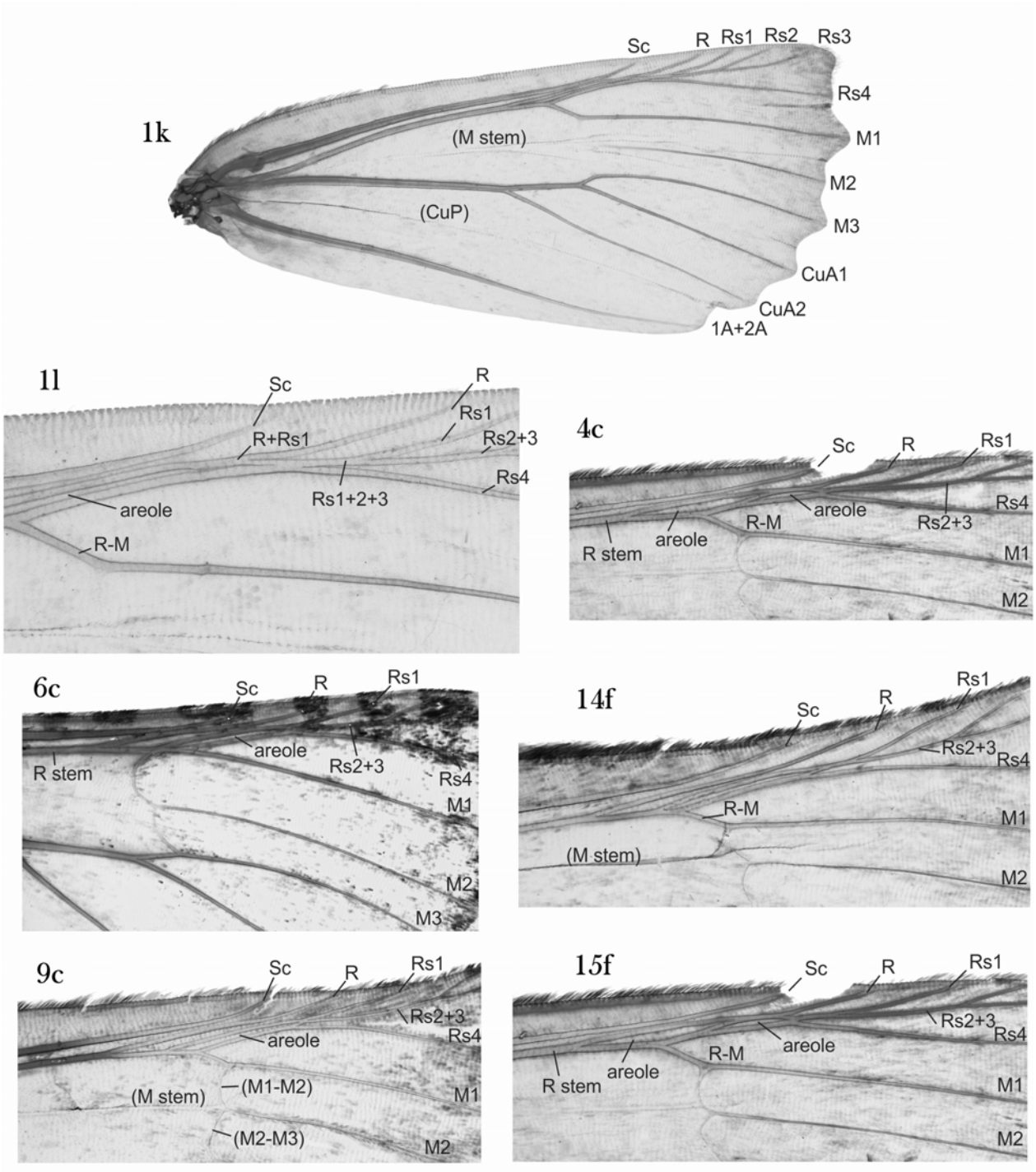


Fig. 1k-15f Declanoid forewing venation (vestigial veins in parentheses): 1k, *Declana floccosa* entire forewing. **Fig. 1l–15f** *Declana* and *Ipana* veins Sc, R, Rs1–4, R–M and (M-stem) configurations: 1l, *Declana floccosa;* 4c, *D. foxii*; 6c, *I. atronivea*; 9c, *I. feredayi*; 14f, *I. junctilinea*; 15f, *Ipana leptomera*.

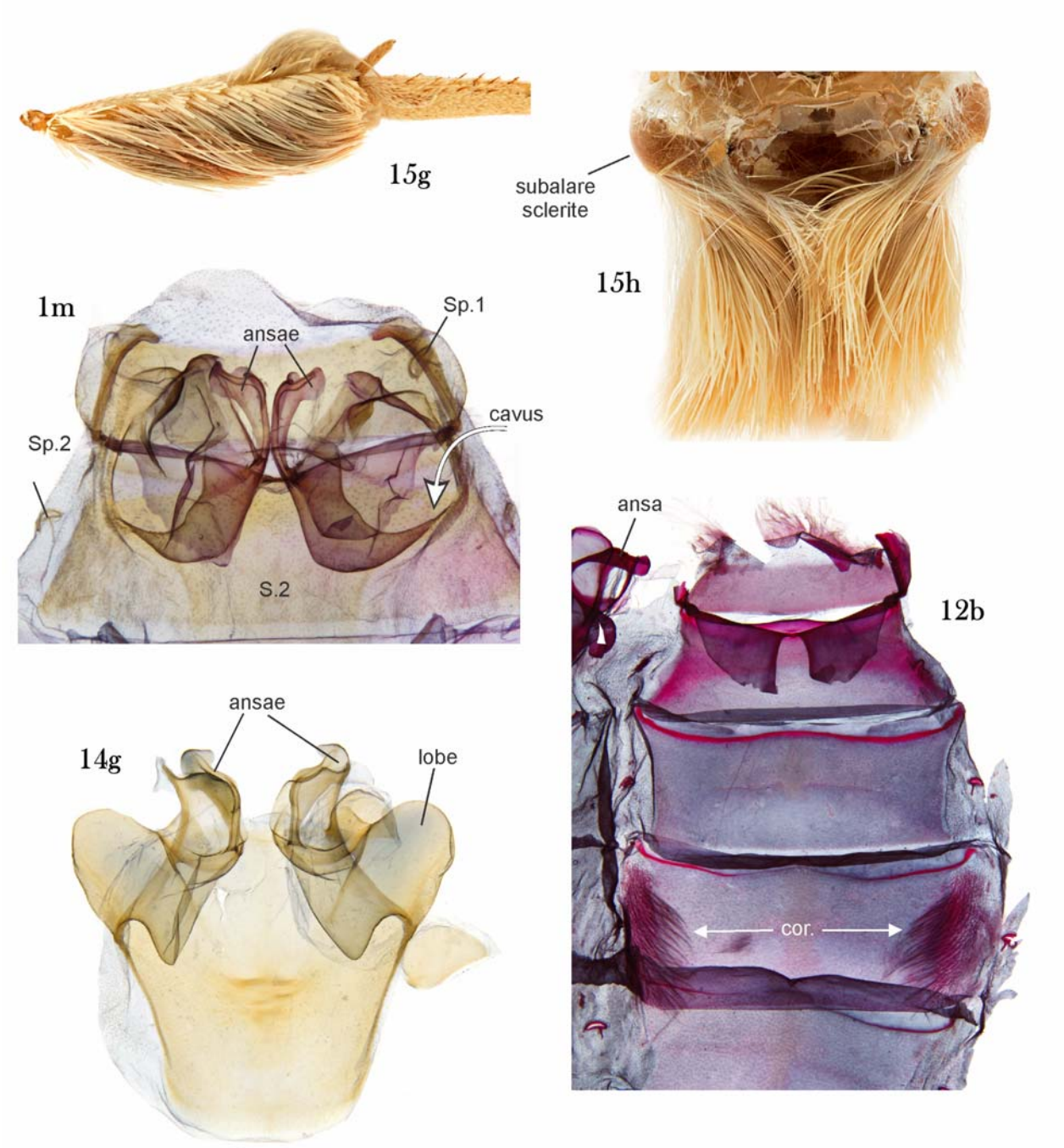


Fig. 15g, h *Ipana leptomera* hair-pencil: 15g, male hind-tibia; 15h, metanotal hair-pencil hanging from the underside of the subalare sclerite of the hindwing. In life these are hidden by the base of the abdomen. **Fig. 1m–12b** Abdominal structures: 1m, *Declana floccosa,* abdomen base showing unmodified S2, position of spiracles A1 and A2, and details of the cavi and ansae; 14g, *Ipana junctilinea,* showing the lobate S2 (lobe); 12b, *I. perdita*, showing the lateral, acid fuchsin-staining scale patches on A4 (cor).

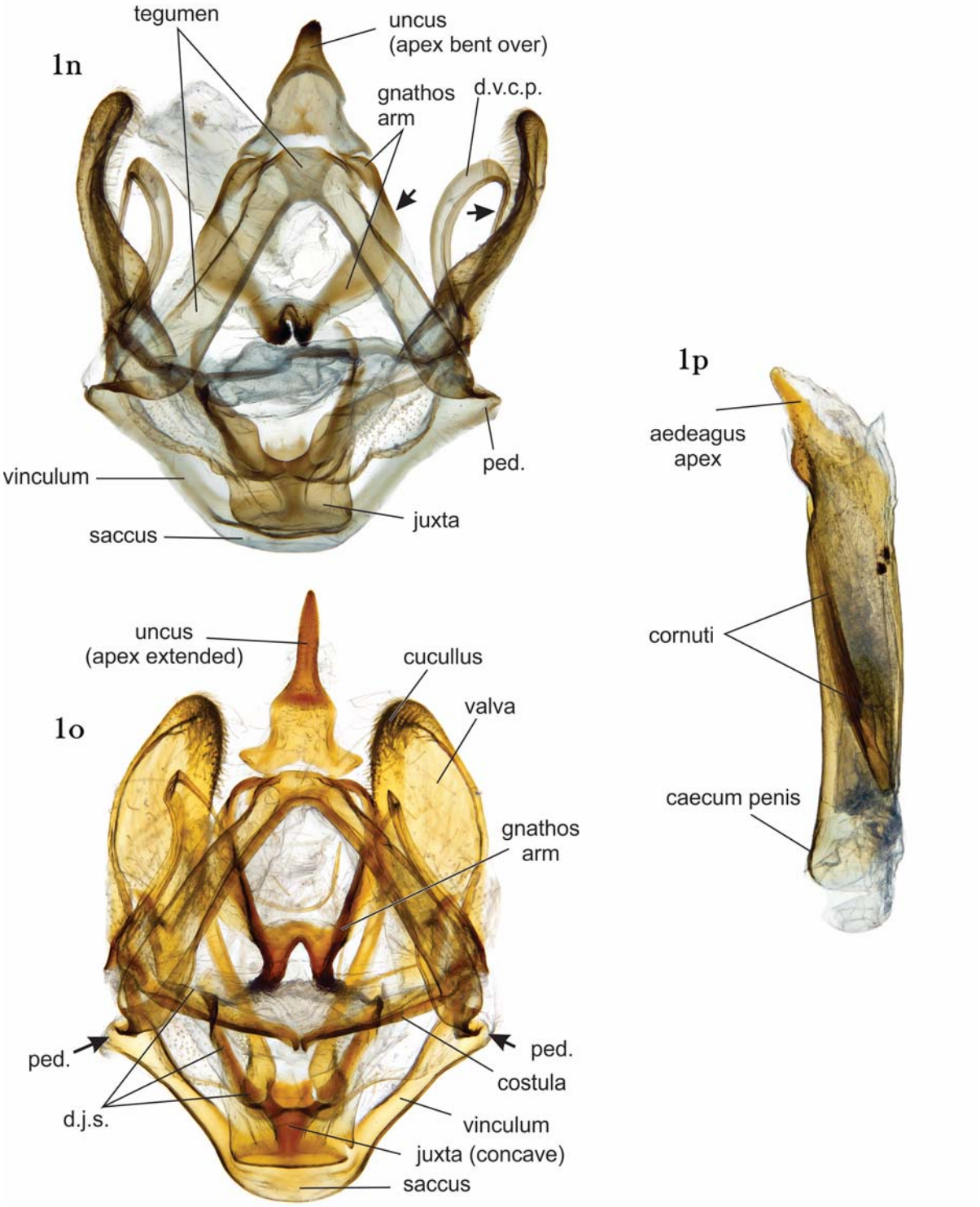


Fig. 1n–5d Male genitalia, *Declana*, ventral aspect unless otherwise stated: 1n, *D. floccosa* viewed from dorsal aspect, (broad gnathos arms and distally narrowed dorsal valval costal process, both arrowed); valvae viewed edgewise and gnathos teeth here artificially appressed; 1o, ditto, viewed from ventral aspect: gnathos teeth and juxtal sclerites natural, costulae sclerotised and abutting mesally; 1p, phallus: aedeagus.

Note on genitalia figures. Localities were provided by JSD for photographed slides of most males only; however, some of the relevant slides (male and female) have not been located in NZAC: these cases are marked 'locality unknown' in square brackets.

Abbreviations, Fig. 1n–15k: **co**: cornuti; **co. p.:** cornutal plate; **d.e.**: ductus ejaculatorius; **d.j.s.**: dorsal juxtal sclerite; **d.v.c.p.**: dorsal valval costal process; **g.p.**: gonopore; **ped.**: pedunculus; **phb**: phallobase; **phc**: phallocrypt

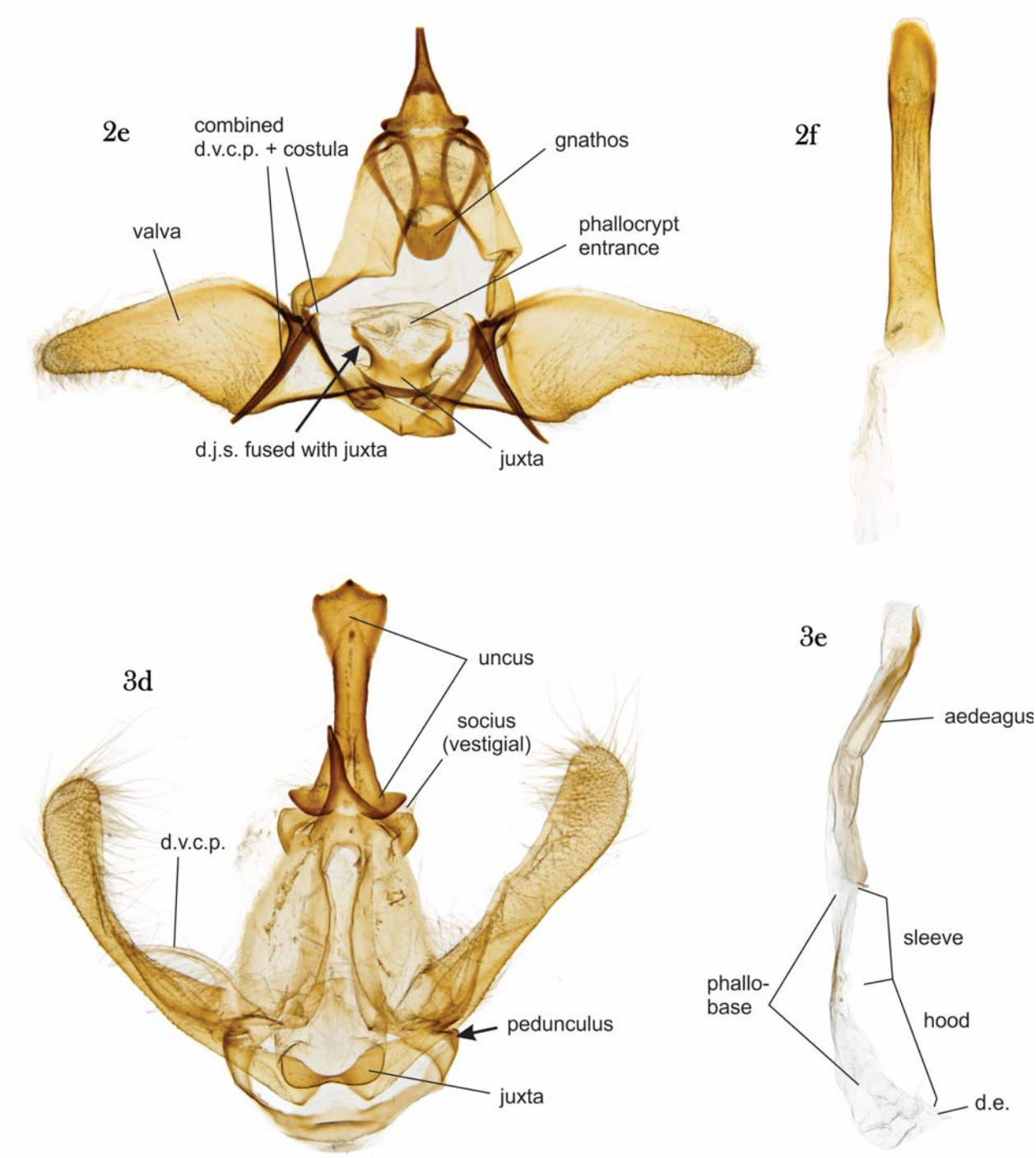


Fig. 2e-3e Male genitalia, *Declana*. 2e, *D. nigrosparsa, toreuta* form, Mt Taranaki TK (note the dvcp and costulae fused into a spine, d.j.s. fused with the juxta and supporting the phallocrypt opening; gnathos somewhat foreshortened in this view); 2f, *D. nigrosparsa*, same slide: aedeagus, apex uppermost (note the short phallobase); 3d, *D. niveata*, Wairoa Gorge NN (note the slender capitate uncus, short dvcp, and laterally prominent pedunculus); 3e, *D. niveata*, same slide, aedeagus (note the phallobase is as long as the aedeagus).

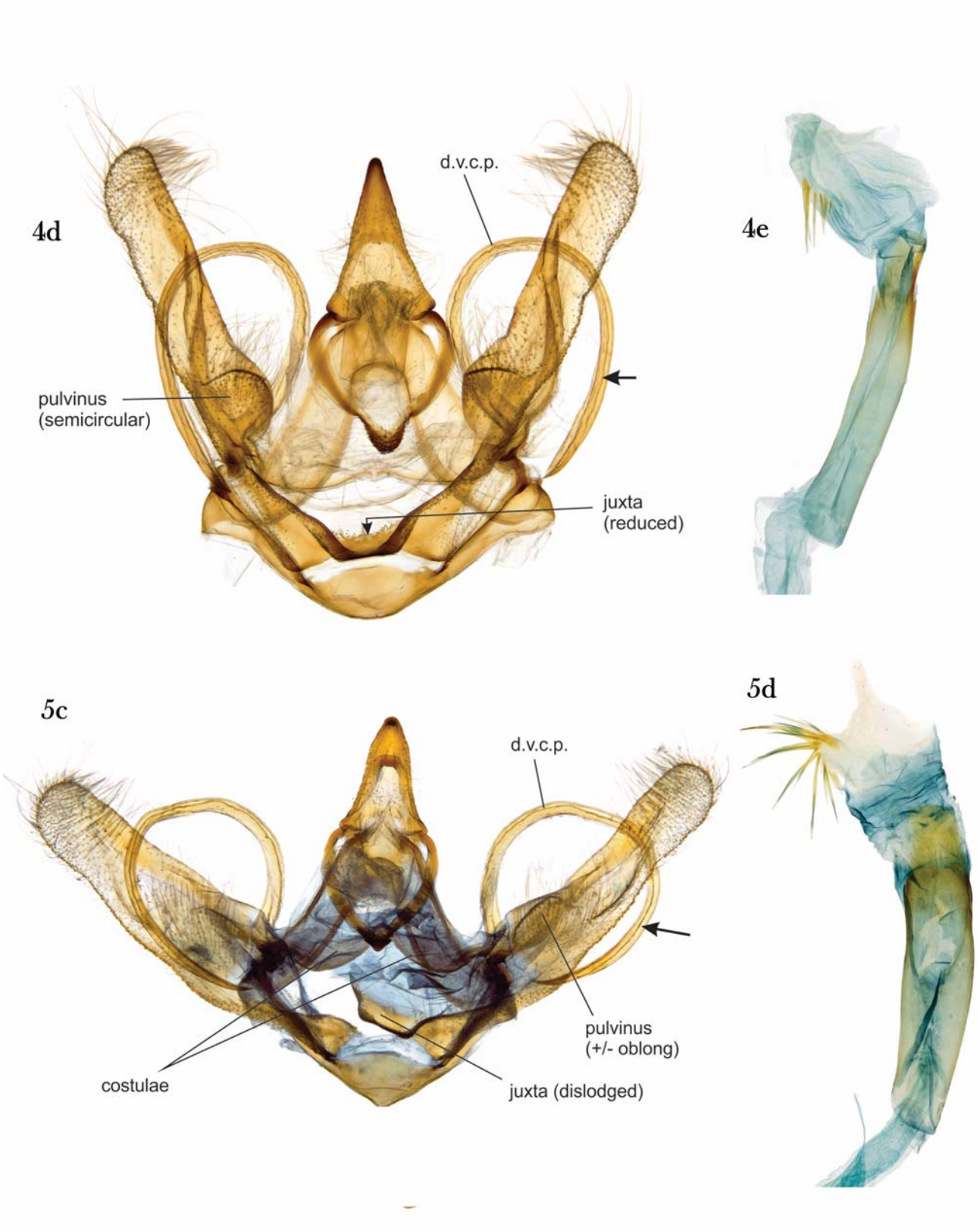


Fig. 4d–5e Male genitalia, *Declana*. 4d, *D. foxii* holotype, Mt Taranaki TK (note semicircular pulvinus and the uniformly wide d.v.p.c.); 4e, *D. foxii* paratype, Holly Hut, North Egmont TK, aedeagus (n.b. 4 cornuti lost in preparation); 5c, *D. lupa* holotype, Karekare AK (note rectangular pulvinus); 5d, *D. lupa* paratype, Karekare AK, aedeagus and partially everted vesica.

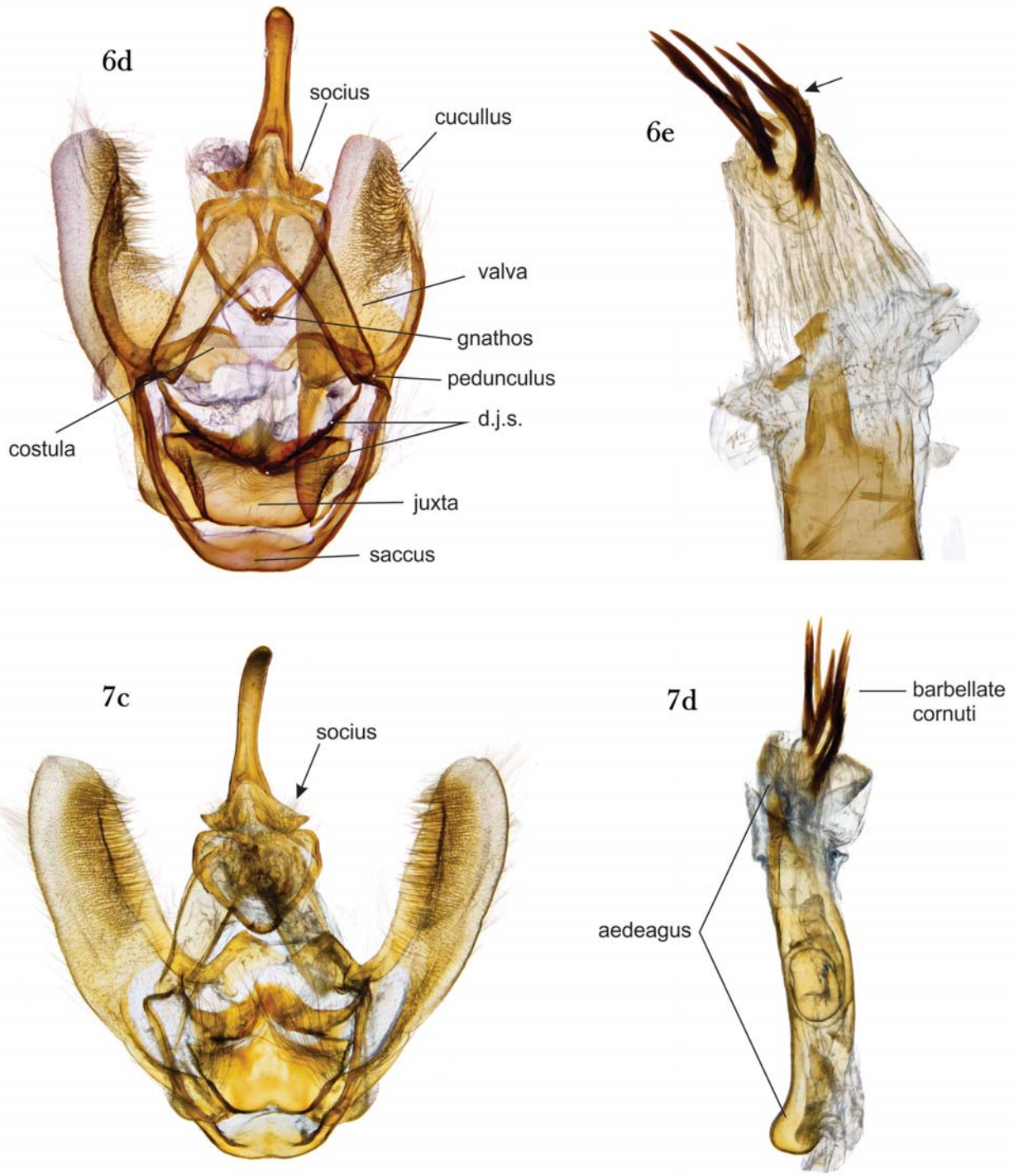


Fig. 6d–15k Male genitalia, *Ipana*, ventral view unless otherwise stated. 6d, *I. atronivea*, Albany AK (note rounded dorsal rim of costula and 3 diagnostic *Ipana* features: flattened shield-like juxta, non-projecting pedunculus and presence of a hairy lobe (socius) on each basal lobe of uncus); 6e, ditto, aedeagus tip and partly everted vesica (note cornuti bent, barbellate); 7c, *I. egregia*, Opouri Valley SD (note angulate dorsal rim of costulae). 7d, ditto, aedeagus and partially everted vesica (cornuti bent, barbellate).

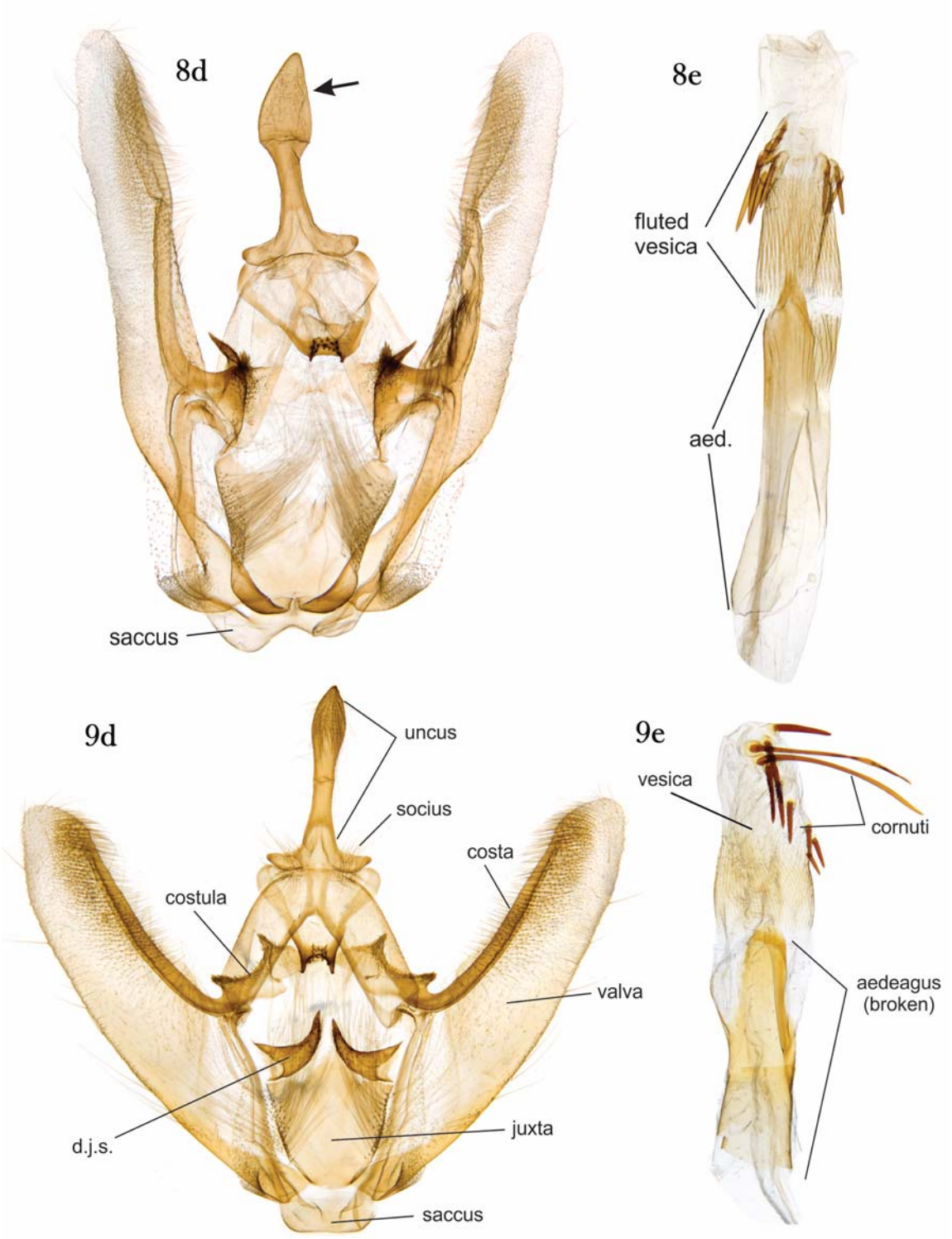


Fig. 8d–9e Male genitalia, *I. griseata*, *I. feredayi*. 8d, *I. griseata*, Mt Cook MK (note subapically swollen acuminate uncus, and dorsal margin of costulae with a short spine obscured in this preparation by the outwardly pointing dorsal juxtal sclerite); 8e, same slide: aedeagus and everted, fluted vesica with two groups of cornuti; 9d, *I. feredayi*, Mt. Ruapehu, 3800' TO; 9e, same slide, distal part of aedeagus and vesica with 2 long, 7 short cornuti.

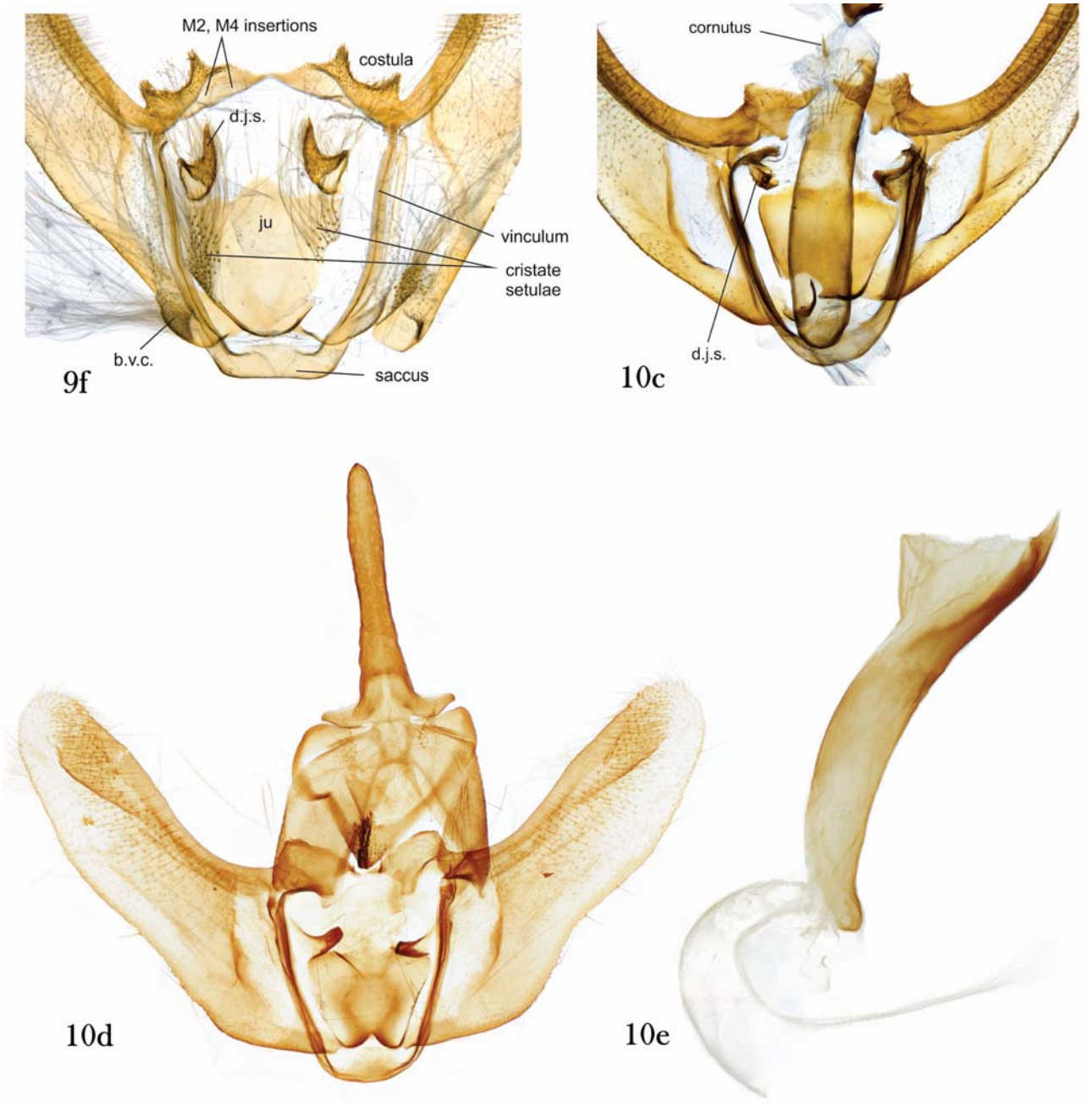


Fig. 9f–10e Male genitalia, *I. feredayi*, *I. glacialis*. 9f, *I. feredayi*, basal frame, Tararua Range 1220 m WN/WA (b.v.c.: basal valval coremata; ju: juxta); 10c, *I. glacialis* dorsal view of frame, proximal half of valva, and aedeagus, Island Saddle 1373 m MB (note reduced d.j.s., and minute cornutus); 10d, *I. glacialis*, Ben Lomond OL, whole capsule; 10e, *I. glacialis*, Ben Lomond OL, aedeagus.

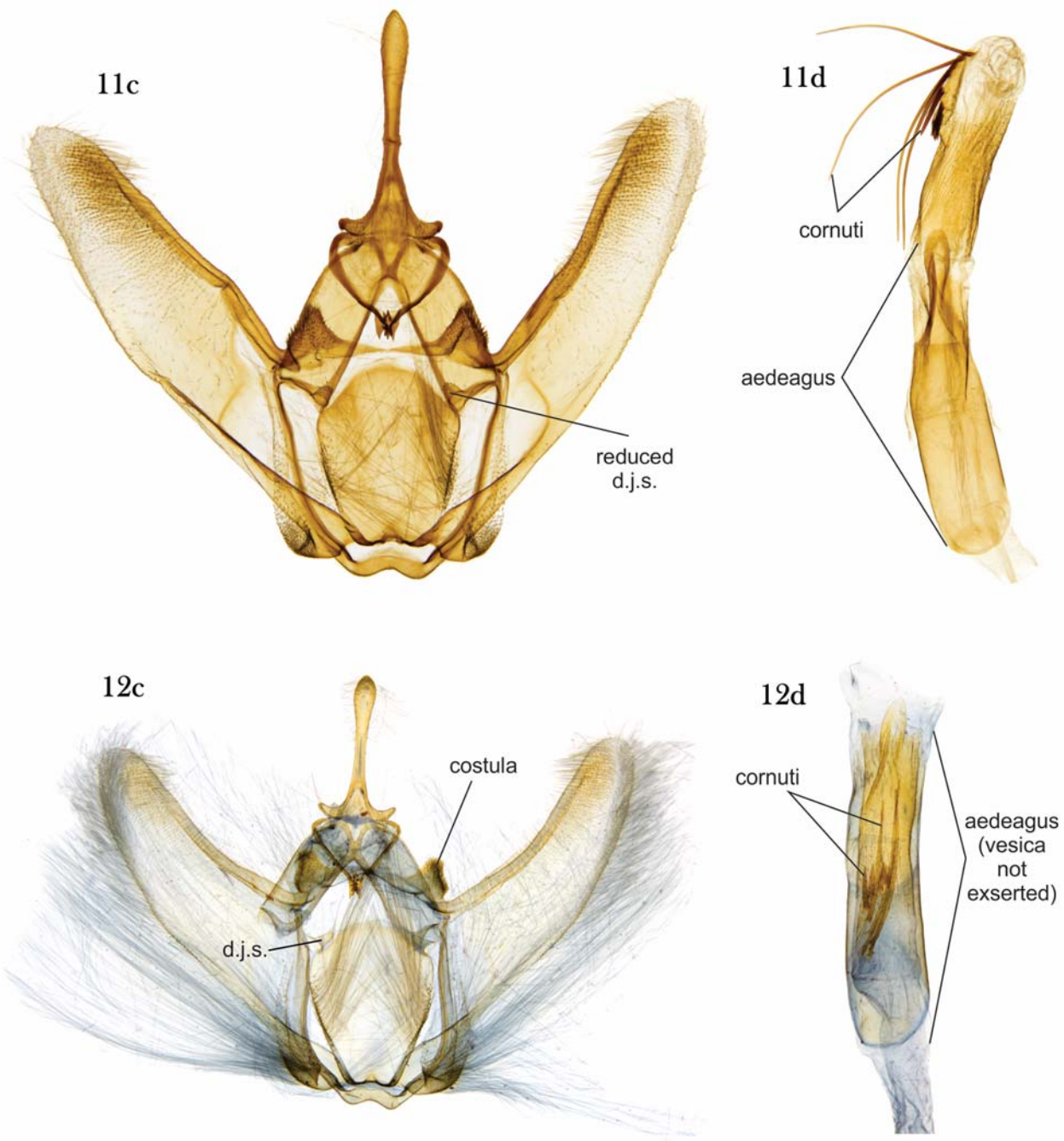


Fig. 11c–12d Male genitalia, *I. halocarpi, I. perdita*. 11c, *I. halocarpi* holotype, Mt Ruapehu 4100' TO, note reduced d.j.s. (partly obscured by tegumen angle); 11d, same slide: aedeagus and everted vesica, note the 4 long cornuti; 12c, *I. perdita* holotype, Kauri Bush, Te Paki ND, whole genital capsule (note the reduced dorsal juxtal sclerite and the weakly bifid costula characteristic of the *hermione* group); 12d, same slide, aedeagus, vesica not everted.

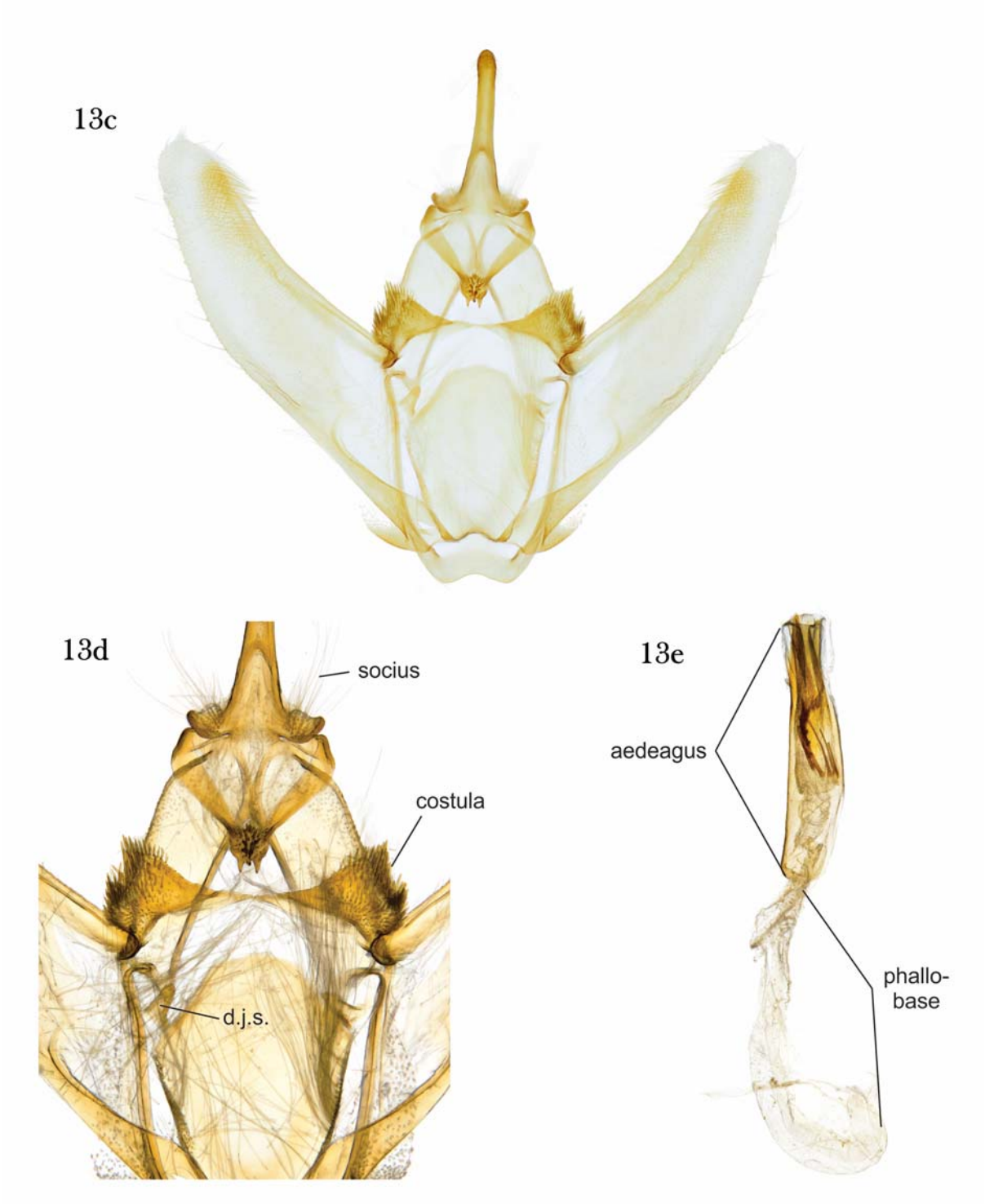


Fig. 13c–e, Male genitalia, *I. hermione*, Mt Ruapehu 3800' TO. 13c, whole genital capsule; 13d, central area of frame, (note the prominent socii and the weakly bifid densely spinose costulae characteristic of the *hermione* group); 13e, (same slide) aedeagus and phallobase, vesica not everted.

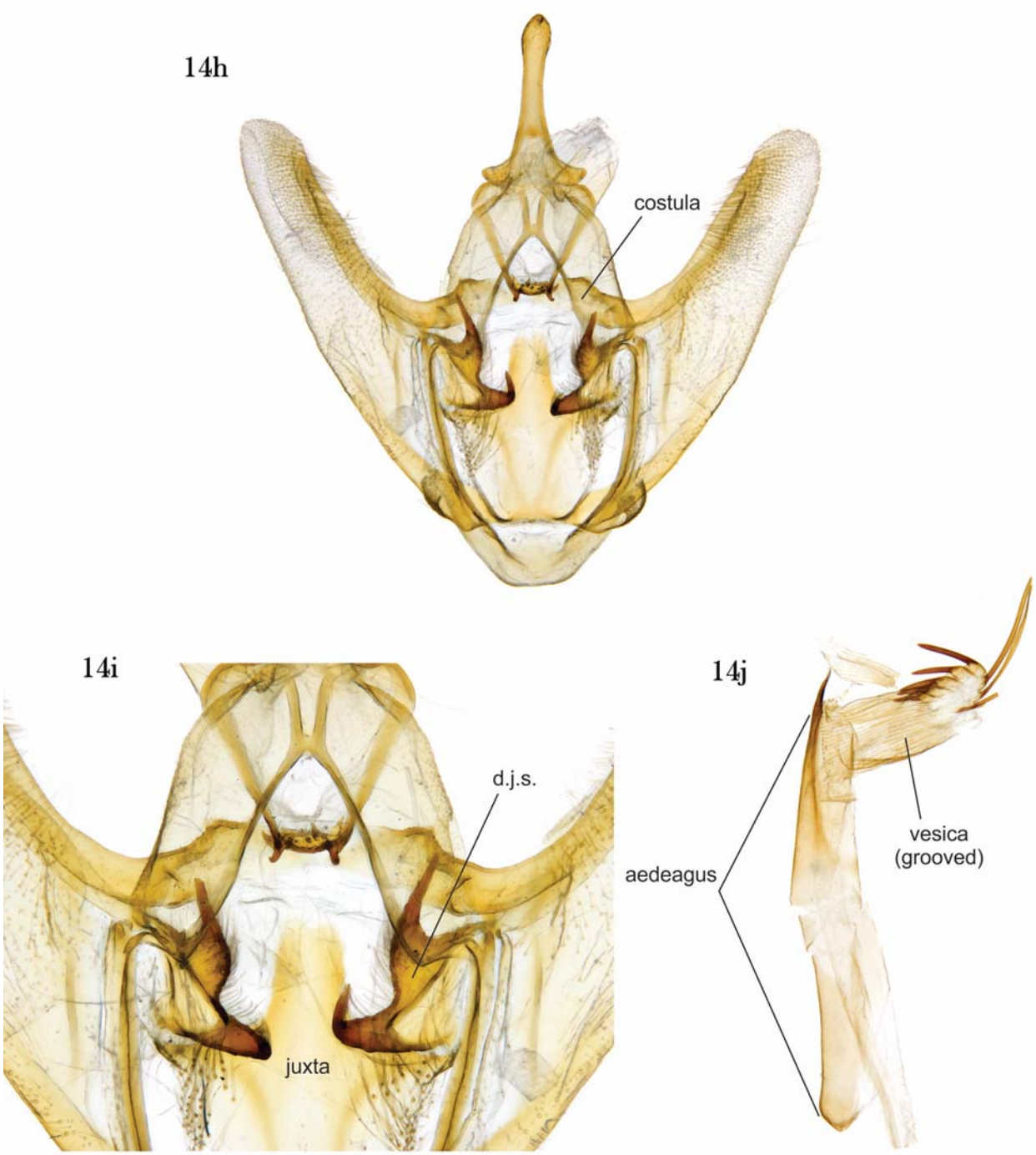


Fig. 14h–j Male genitalia, *I. junctilinea*. 14h, whole genital capsule, [locality unknown]; 14i, central frame details; note the juxta produced into a ventral support for the phallocrypt entrance; 14j, aedeagus and everted vesica with 3 long (1 broken) and line of 5 short cornuti, Wilmot Pass FD.

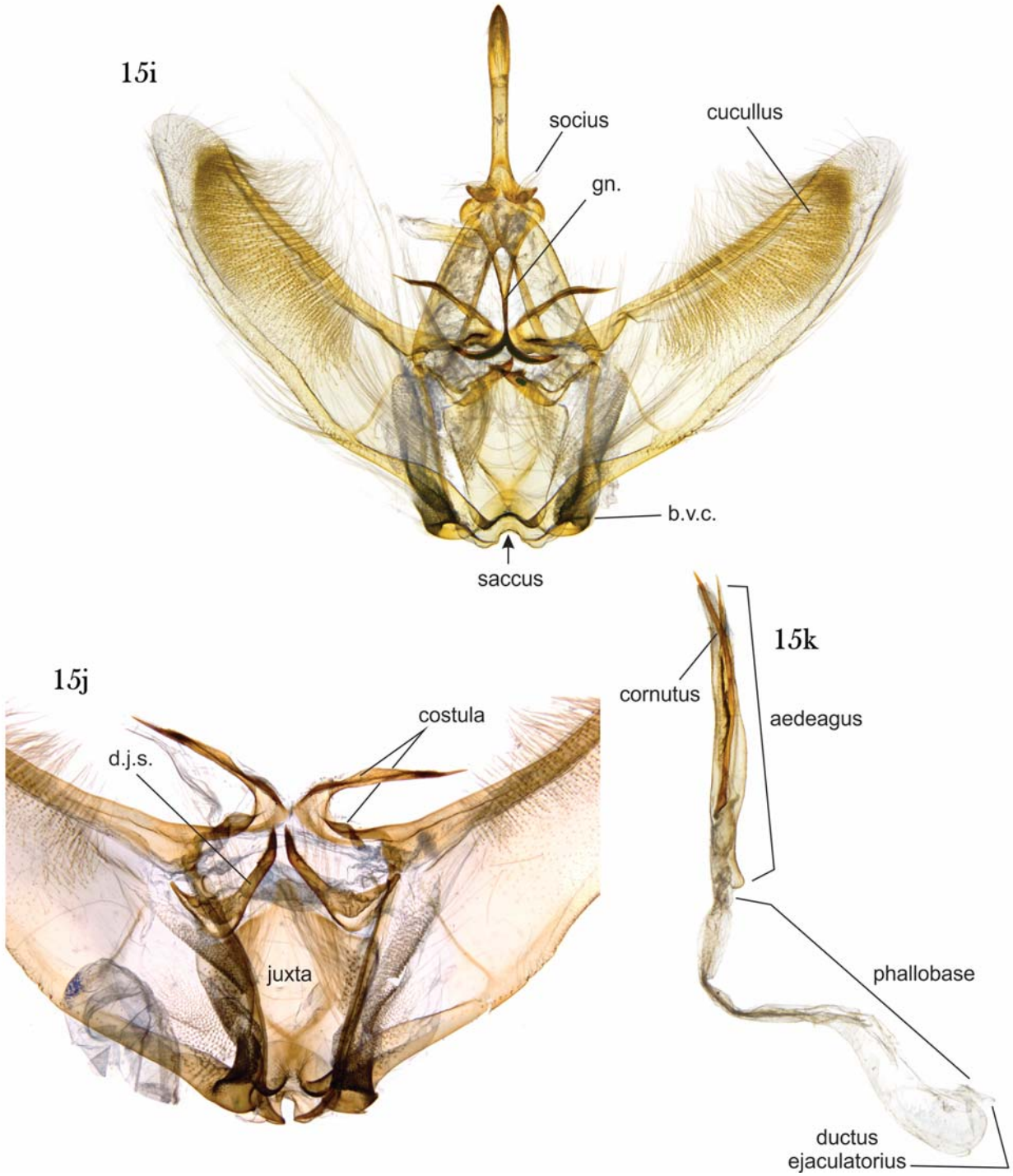


Fig. 15i-k Male genitalia, *I. leptomera* [locality unknown]. 15i, whole genital capsule; 15j, ventral components of frame showing details of costulae and transtillar area, dorsal juxtal sclerites, base of valvae, and sacculus; 15k, aedeagus (note the single long cornutus).

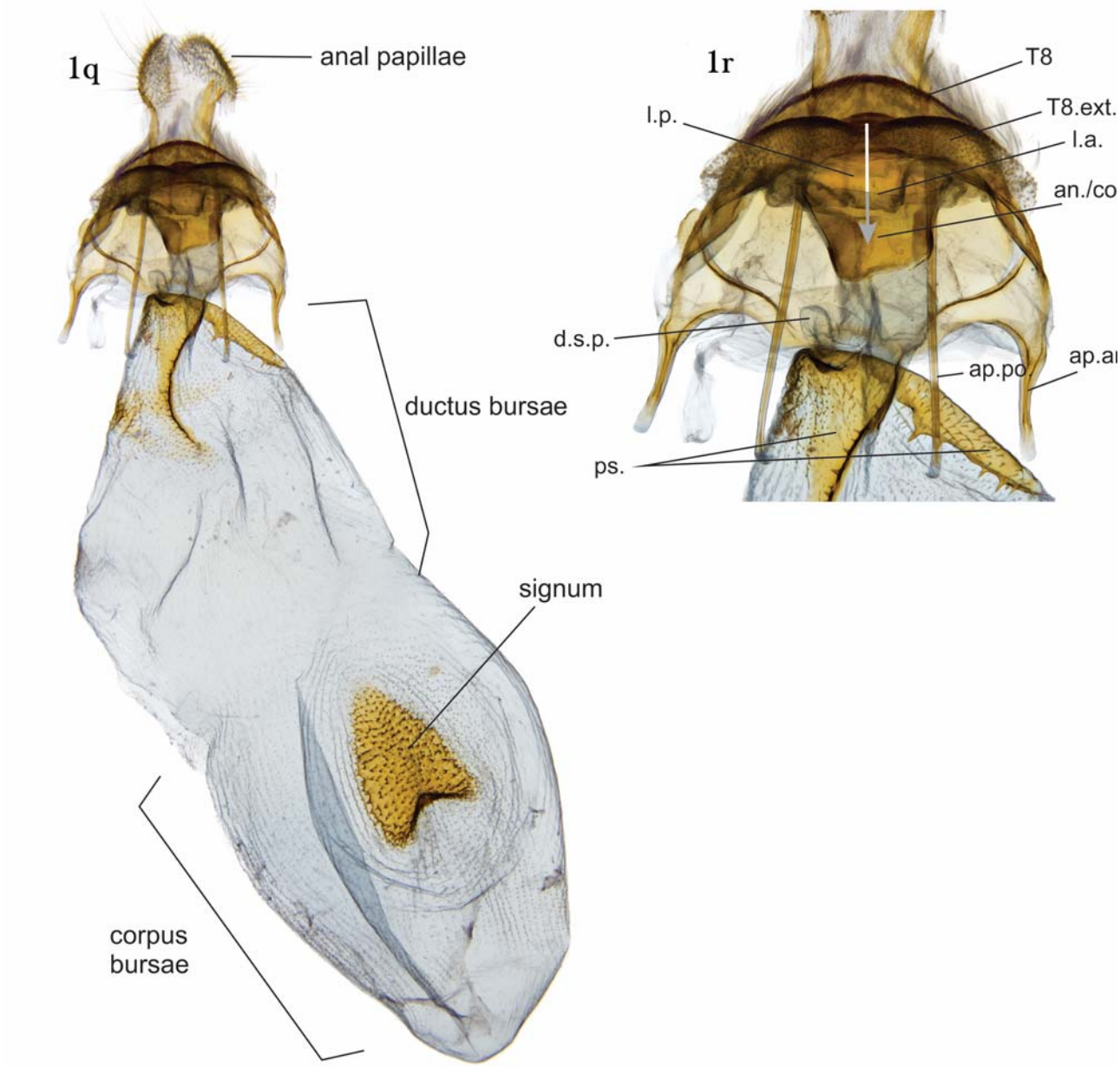


Fig. 1q-5f Female genitalia, *Declana* spp., ventral view unless otherwise stated. 1q, *Declana floccosa*, [locality unknown], showing parts of the bursa copulatrix [appendix bursae just visible as a smooth mound at the end of the corpus bursae (mated specimen)]; 1r, *D. floccosa* ostium and sterigma detail.

Abbreviations, Fig. 1q-5f*:* **an./coll.**: fused antrum and colliculum; **ap. ant.**, **ap. po.**, **a.a., a.p.**: anterior and posterior apophyses; **c.b.**: corpus bursae; **coll.**: colliculum; **d.b.**: ductus bursae; **d.s.p.**: ductus seminalis papilla; **l.a., l.p.**: anterior and posterior lamellae (making up the sterigma); **ps.**: pseudosignum(a); **sig.**: signum. **T8 ext**: T8 extended laterally and ventrally; note that dorsal part of T8 is viewed through the post-abdomen.

(For most figures, the ostium bursae is marked by a white arrow).

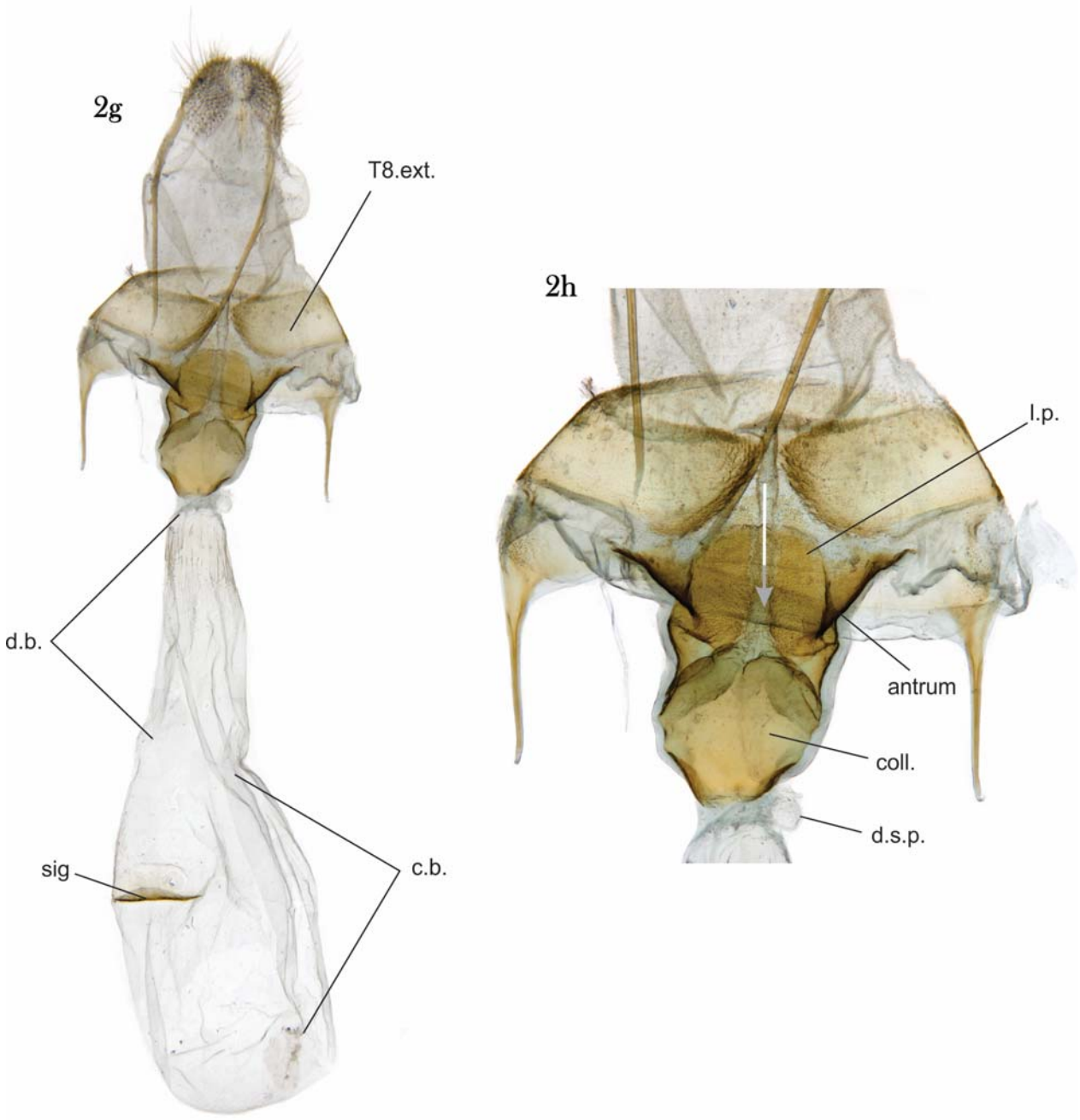


Fig. 2g, h Female genitalia, *Declana nigrosparsa* [locality unknown]. 2g, Whole genitalia; 2h, sterigma and ostiolar features. Note the short posterior apophyses (cf. *D. floccosa*).

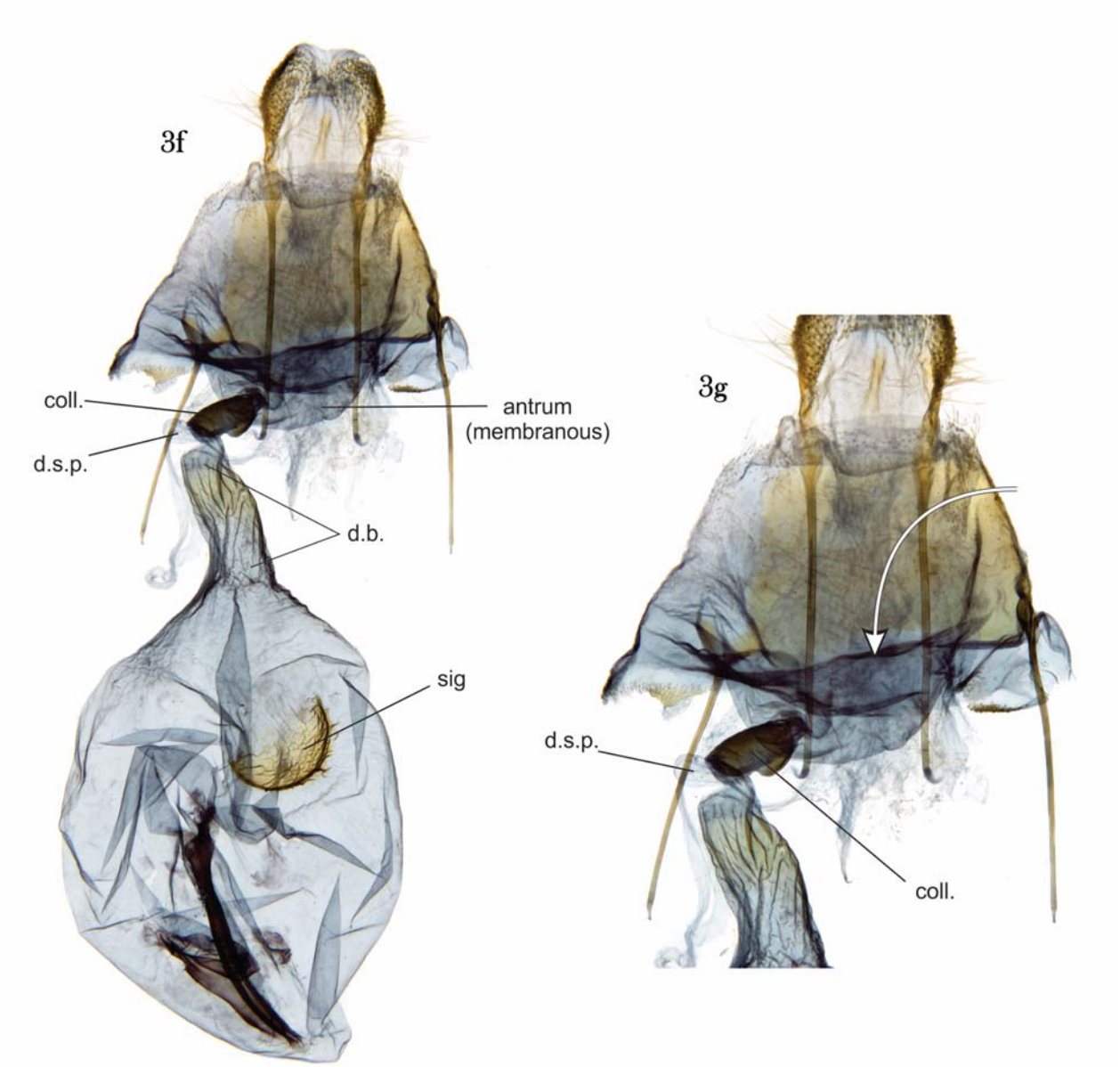


Fig. 3f, g Female genitalia, *Declana niveata* [locality unknown]. 3f, Whole genitalia (note the wide, pit-like ostiolar region and the broad signum); 3g, ostiolar region in detail.

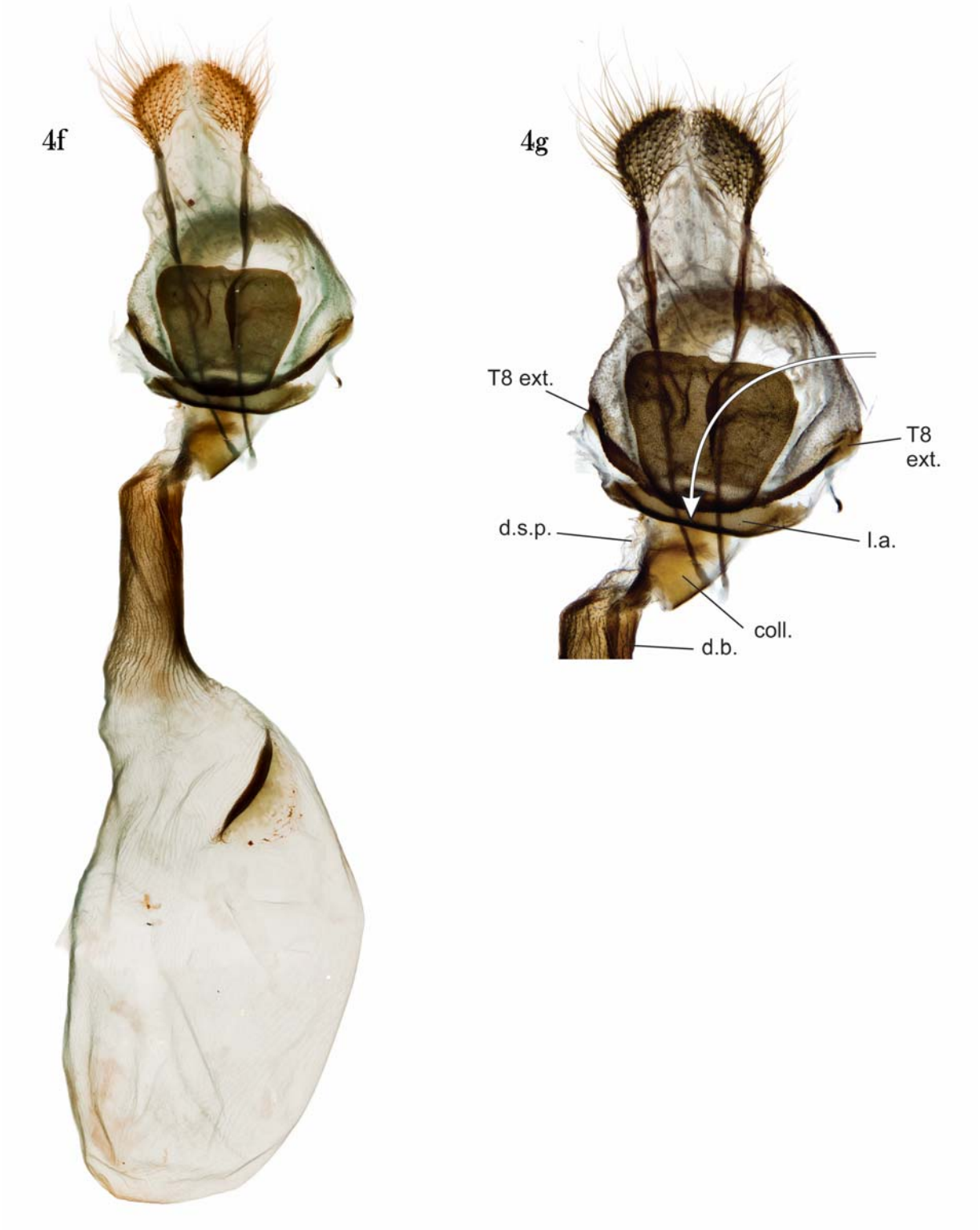


Fig. 4f, g Female genitalia, *Declana foxii*, Meremere Bush TK. 4f, Whole genitalia; 4g, papillae anales, S8, ostiolar and collicular details.

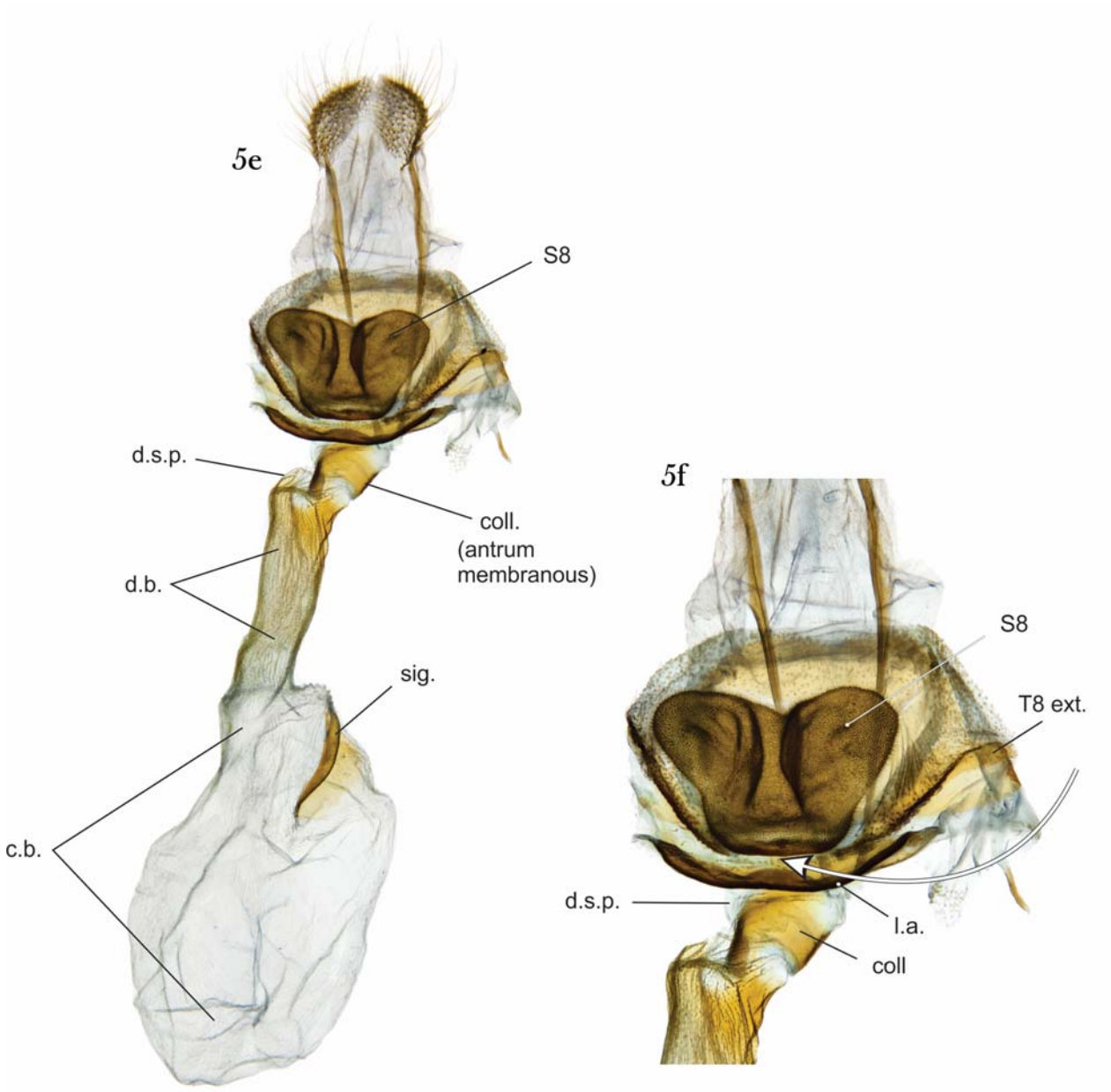


Fig. 5e, f Female genitalia, *Declana lupa*, Destruction Gully, Huia AK. 5e, Whole genitalia; 5f, ostium and sterigmal detail (note the hypertrophied, medially furrowed S8, and the unsclerotised antrum).

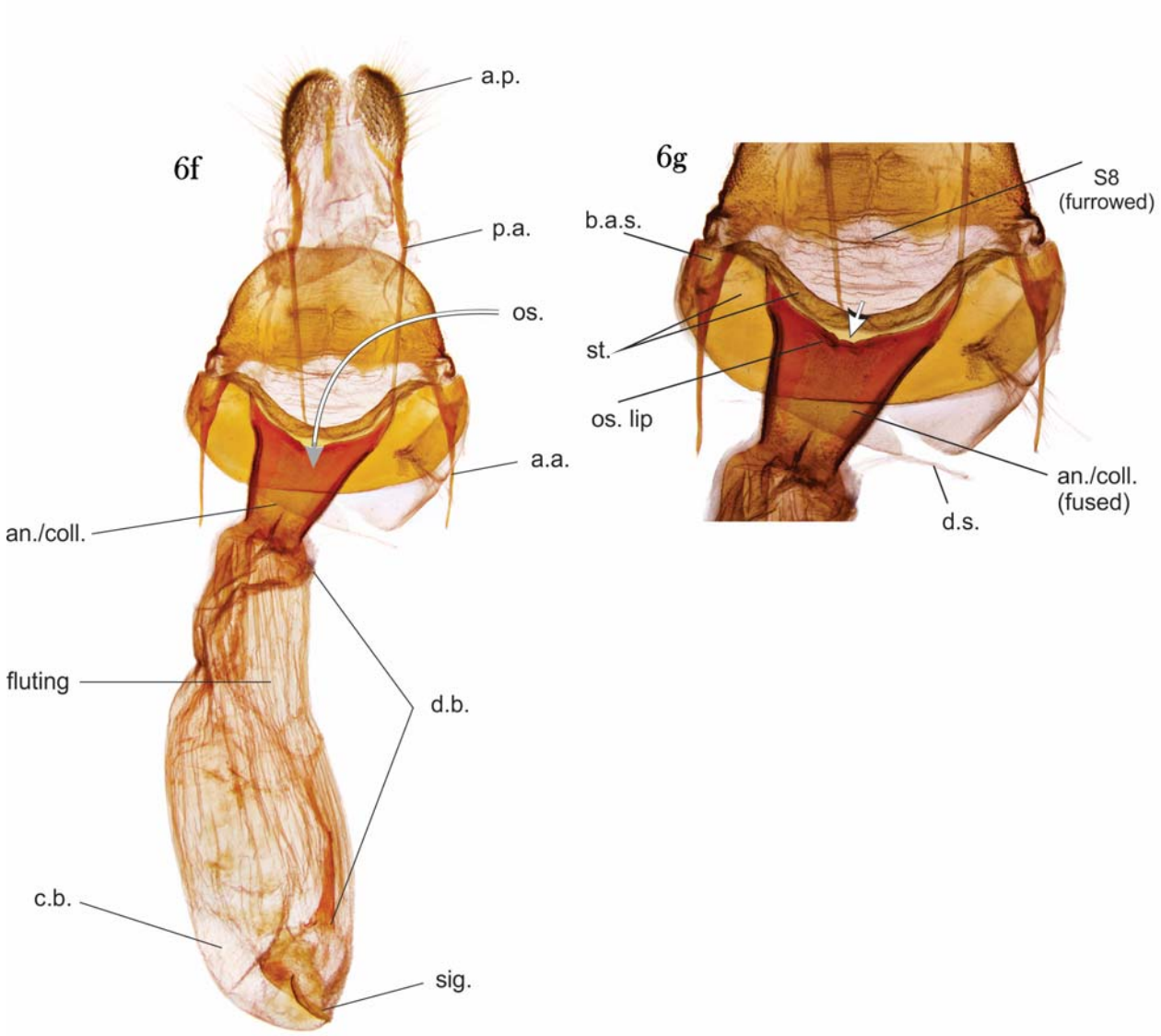


Fig. 6f–15m Female genitalia, *Ipana* spp., ventral view unless otherwise stated. 6f, *I. atronivea*, Dawson Falls TK (note extensive fluting to ductus bursae); 6g, *I. atronivea*, ostiolar and sterigmal area in detail.
Abbreviations, Fig. 6f–15m: **a.a.**: anterior apophyses; **an. /coll.**: antrum/colliculum; **a.p.**: anal papillae; **b.a.s.**: basal apophyseal sclerites: **c.b.**: corpus bursae: **coll.**: colliculum; **d.b.**: ductus bursae; **d.s.**: ductus seminalis; **d.s.p.**: ductus seminalis papilla; **os. lip**: ostium bursae lip; **os.**: ostium bursae; **p.a.**: posterior apophyses; **ps.**: pseudostigma; **S8**: sternite 8; **sig.**: signum; **st.**: sterigma.

Fig. 7e, f Female genitalia, *Ipana egregia*, Beaumont S.F. SL. 7e, Whole genitalia; 7f, ostiolar and sterigmal area in detail.

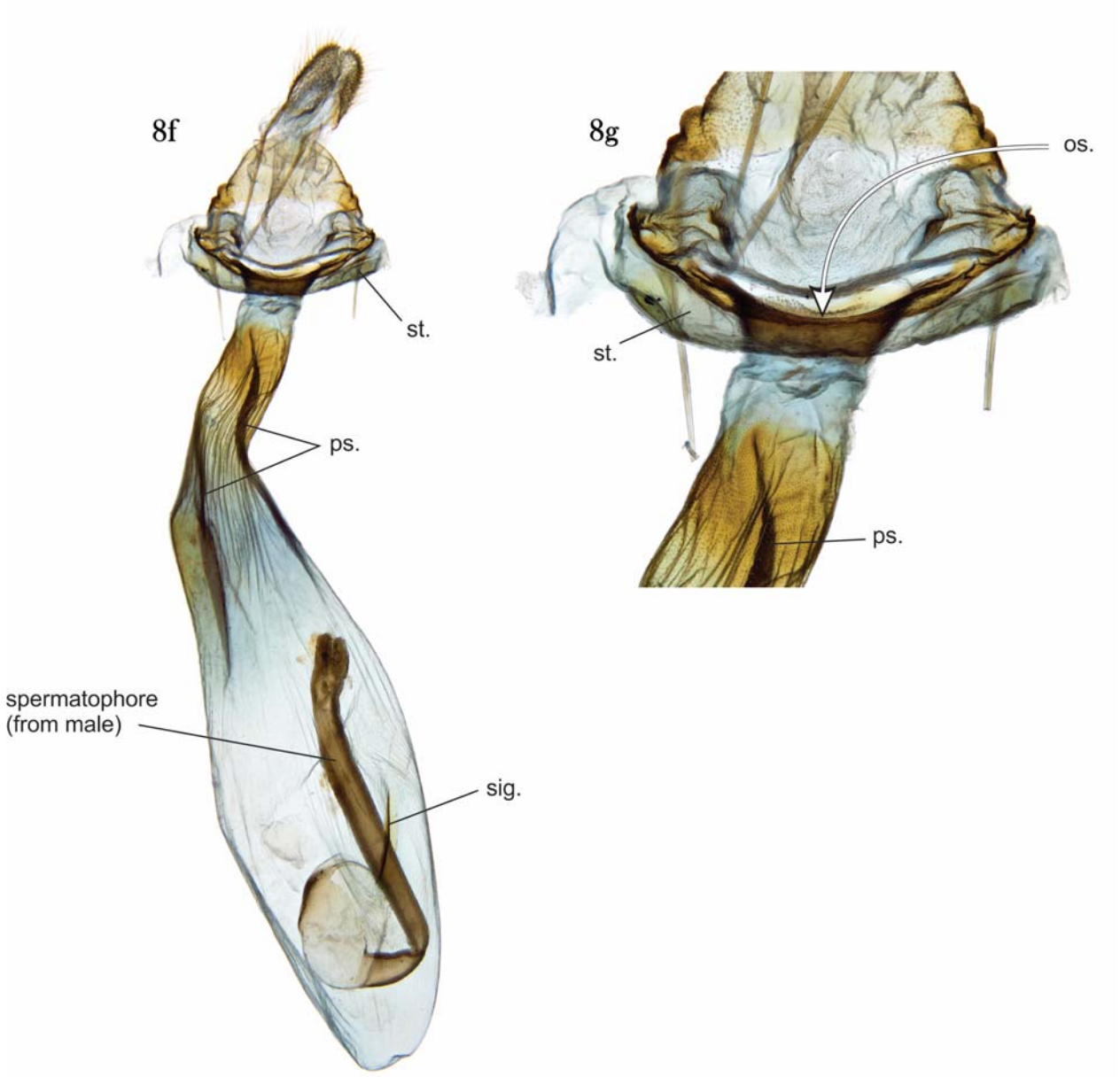


Fig. 8f, g Female genitalia, *Ipana griseata*, Wairoa Gorge NN. 8f, Whole genitalia, showing two pseudosigna, a spermatophore in the bursa copulatrix, and indistinct boundary between bursa and ductus (cf. *I. atronivea*); 8g, detail of sterigmal area.

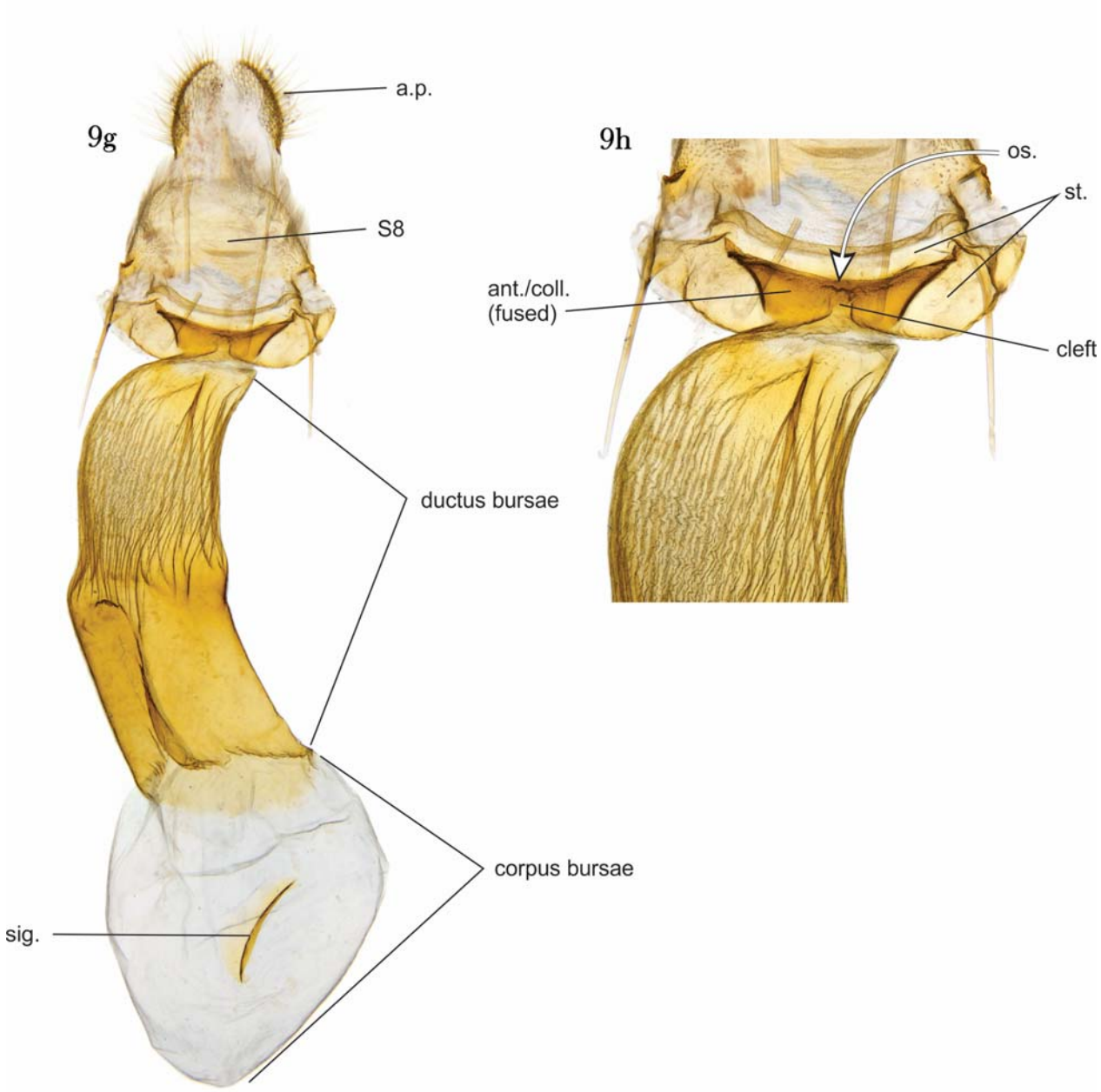


Fig. 9g, h Female genitalia, *Ipana feredayi*, Orongorongo Forest Station WN. 9g, Whole genitalia, showing ventral cleft on sterigma; 9h, detail of sterigmal area.

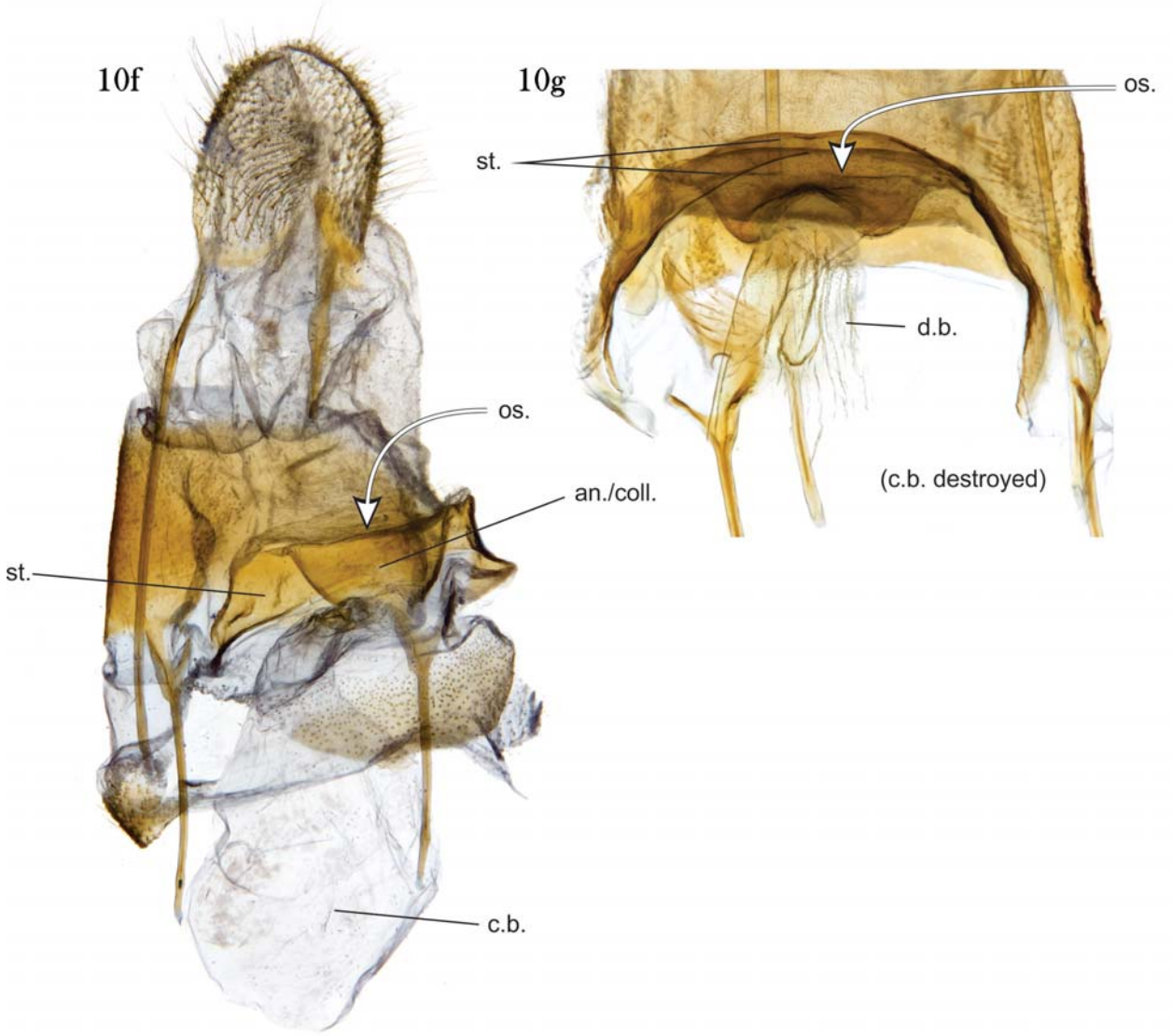


Fig. 10f, g Female genitalia, *Ipana glacialis* [locality unknown]. 10f, Whole genitalia, showing reduced ductus seminalis and corpus bursae, and posterior-facing ostium bursae; 10g, detail of sterigmal area.

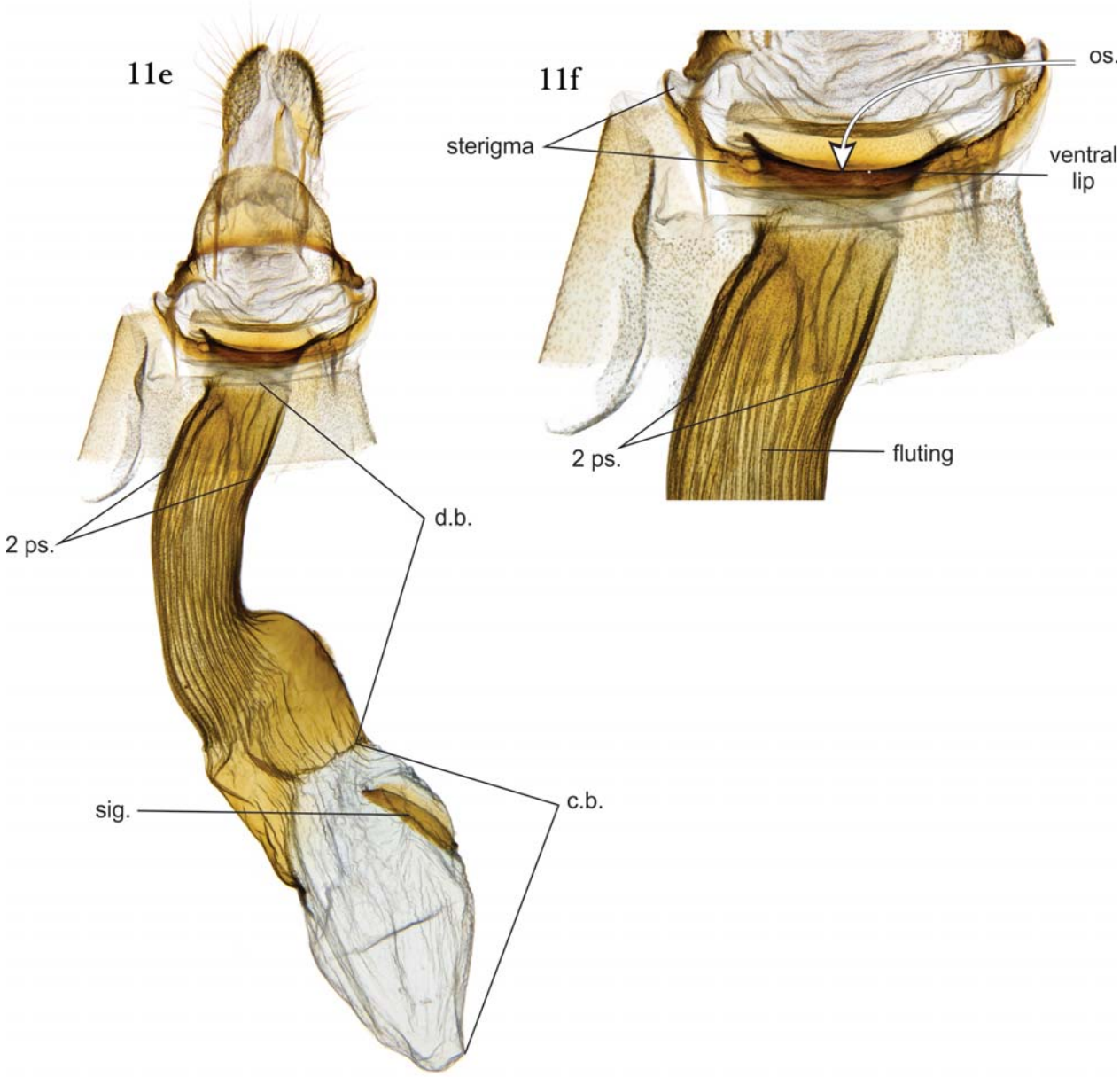


Fig. 11e, f Female genitalia, *Ipana halocarpi* paratype, Silica Springs Tk, Mt Ruapehu TO. 11e, Whole genitalia, showing well-demarcated ductus bursae and two pseudosigna; 11f, detail of sterigmal area.
[Female of 12. *Ipana perdita* unknown.]

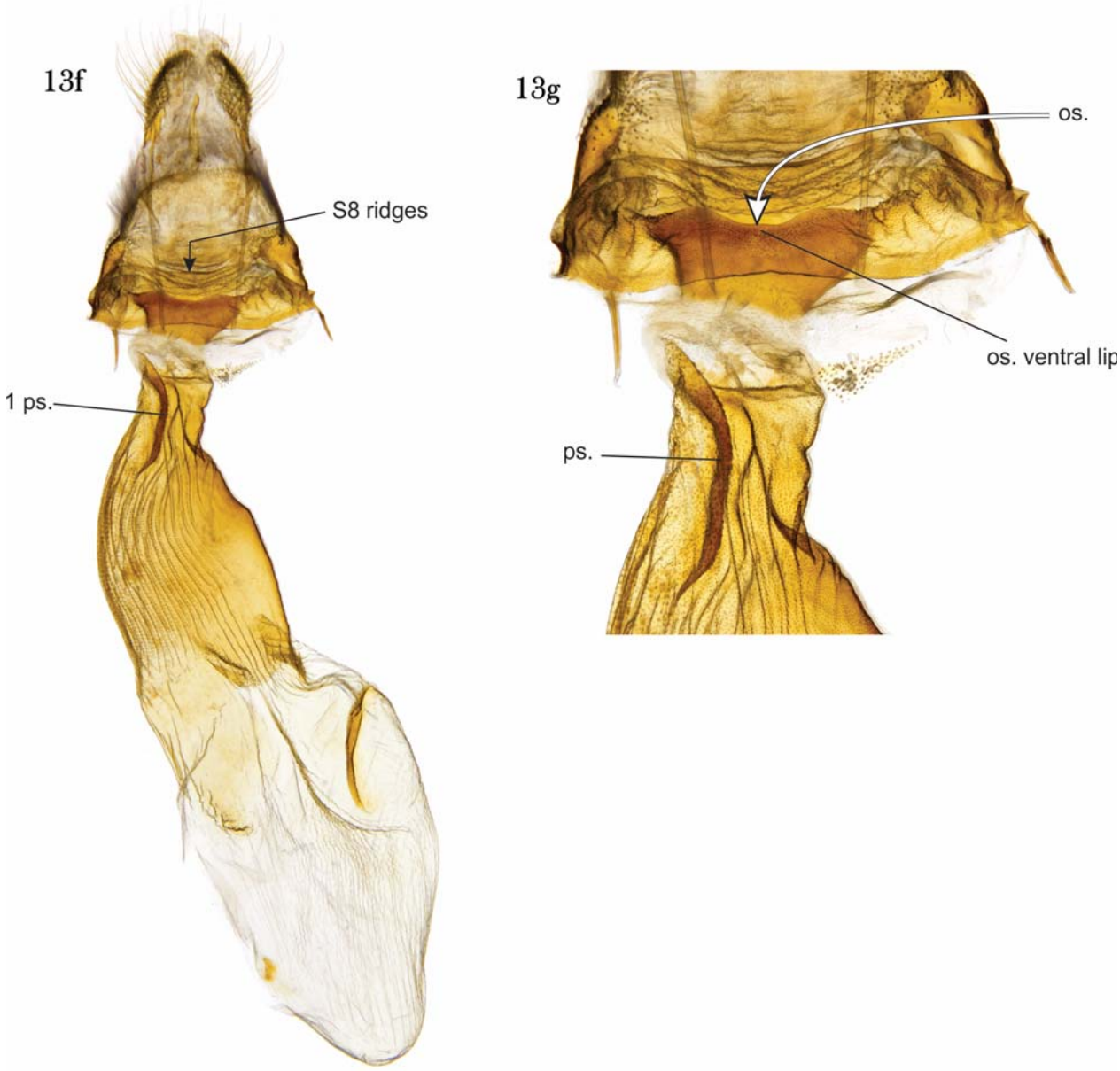


Fig. 13f, g Female genitalia, *Ipana hermione*, Cobb Lake NN. 13f, Whole genitalia, showing a single pseudosignum; 13g, sterigmal area detail showing the emarginated ostium lip.

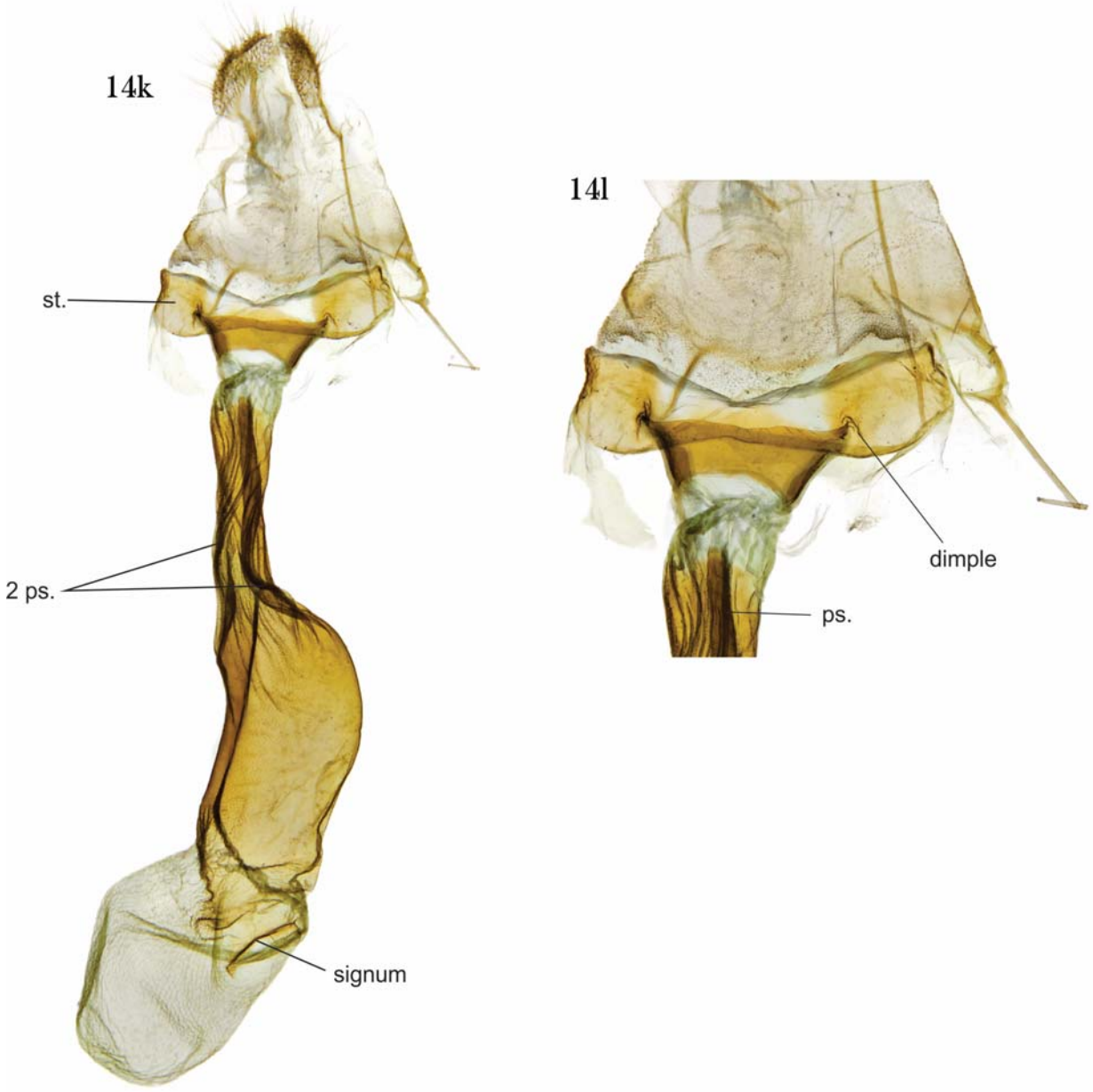


Fig. 14k, l Female genitalia, *Ipana junctilinea* [locality unknown]. 14k, Whole genitalia, showing 2 pseudosigna; 14l, showing laterally expanded sterigma and dimpled ostium 'smile' details.

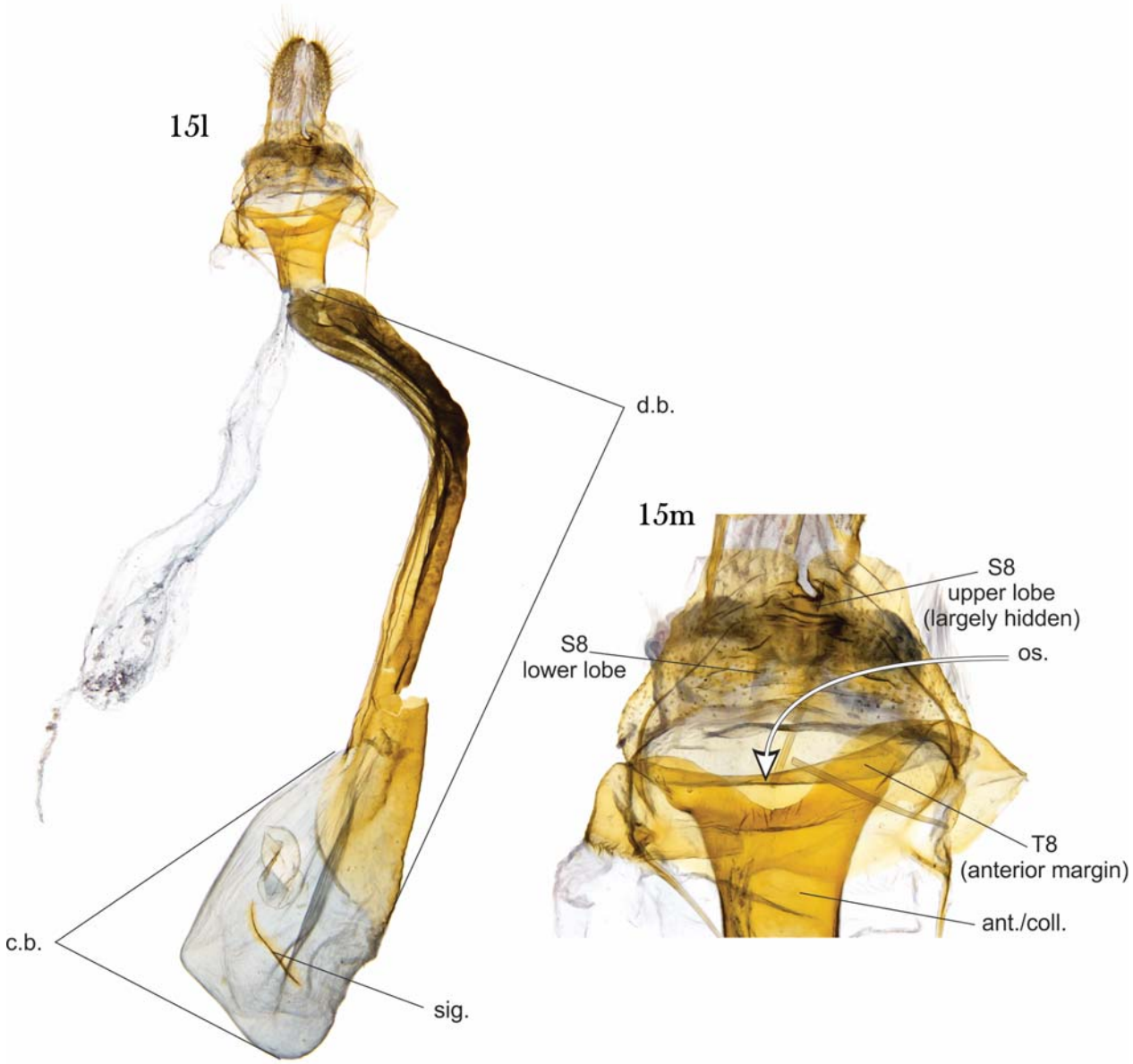


Fig. 15l, m Female genitalia, *Ipana leptomera*, Massey AK. 15l, Whole genitalia, showing the sclerotised elongated ductus bursae; 15m, detail of sterigmal area, showing S8 modifications.

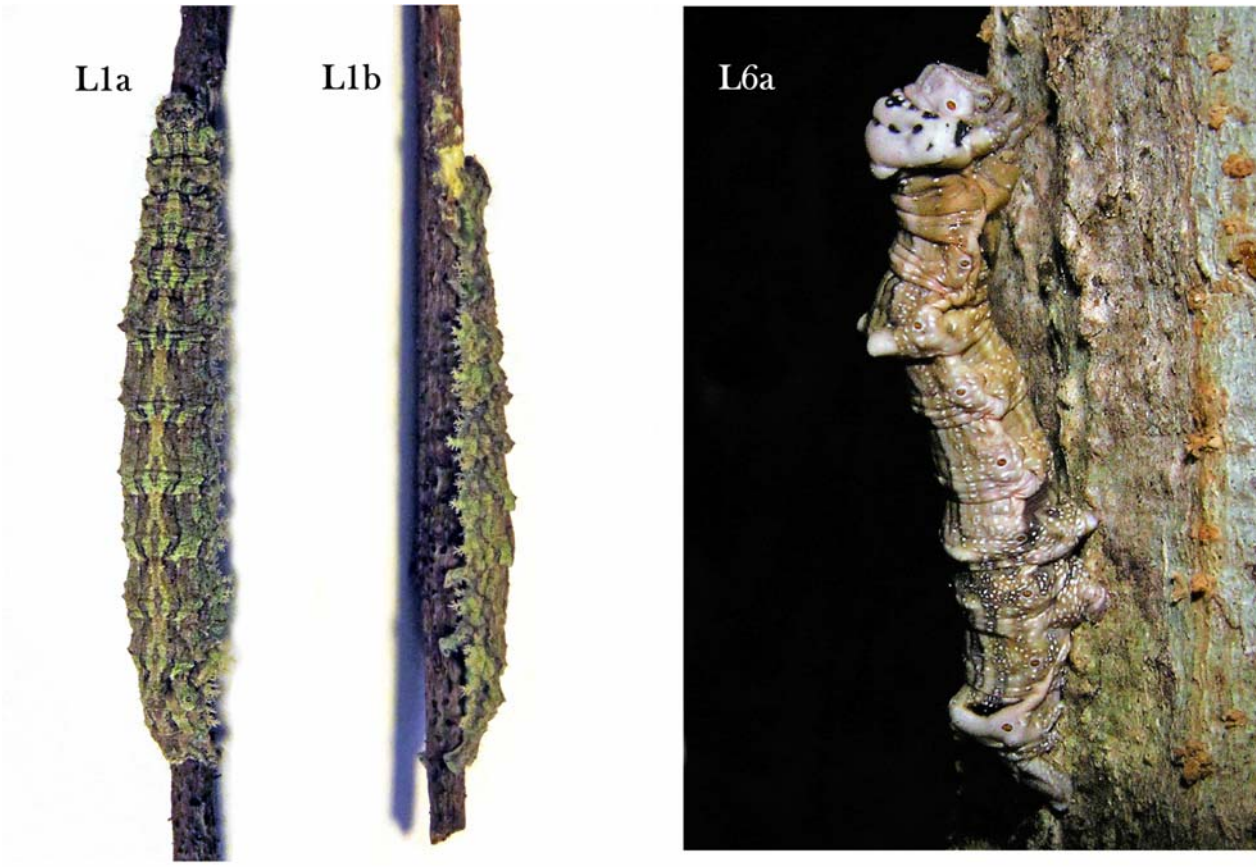


Fig. L1a-L6a Last instar larval habitus, *Declana* and *Ipana* (photographs). L1a, b, *D. floccosa*, dorsal and lateral view respectively, note lateral foliose SV papillae (photos by permission, Graham Fairless, BP); L6a, *I. atronivea* lateral, note modified thorax (photo by RJBH, Parau Track, Waitakere Ranges AK), cf. Fig. L6b.

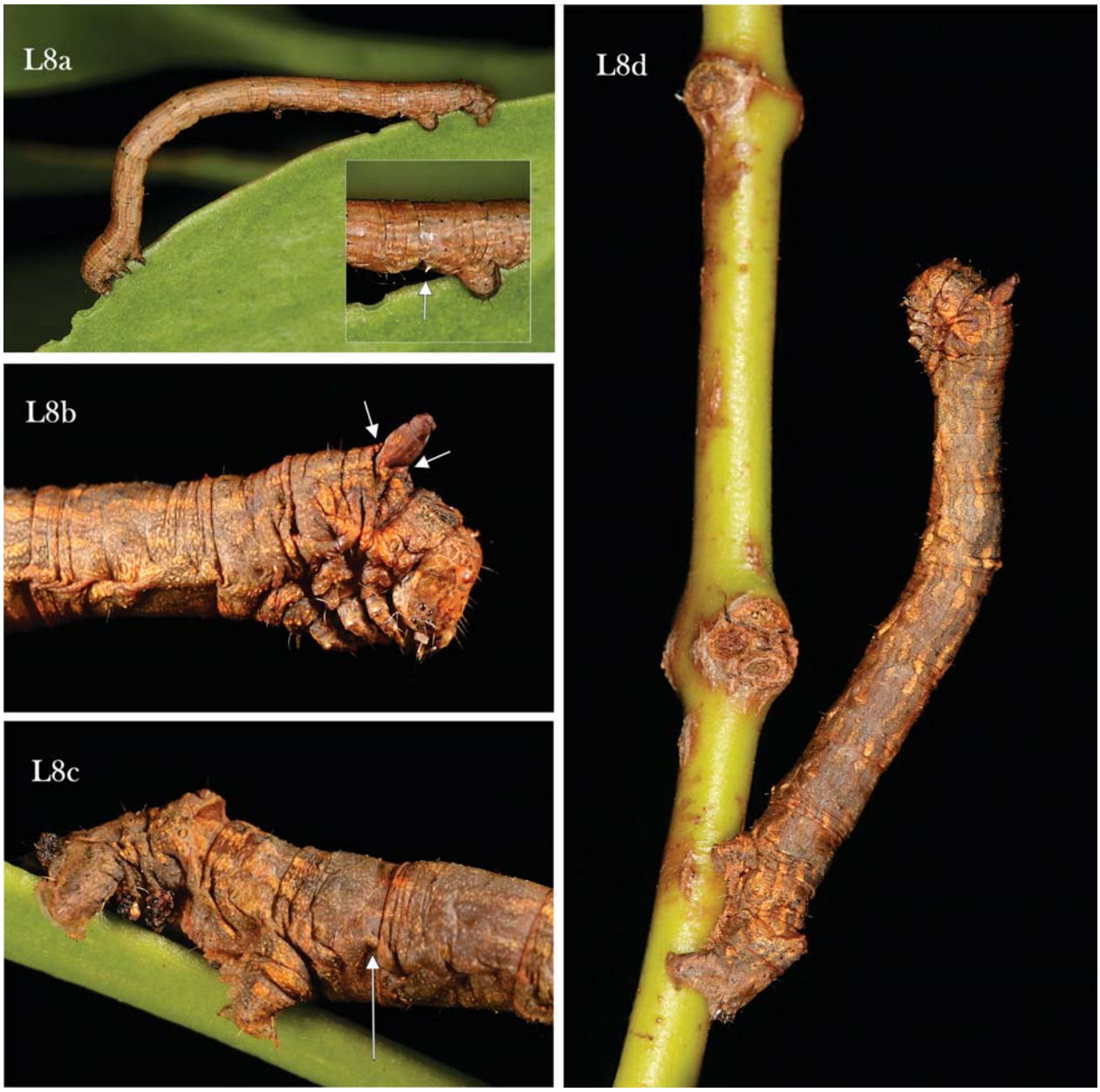


Fig. L8a-d Larval habitus and structure, *Ipana griseata*. L8a, Third instar, A6 anterior margin sublateral spur arrowed in inset; L8b, last instar, head and thorax with dorsal T1–T2 intersegmental area (arrowed) bearing the intersegmental papilla; L8c, last instar, A6 anterior margin spur now a turgid fleshy lobe (arrowed); L8d, last instar larval habitus showing angulate twig-like posture. (All from Upper Moutere NN; photos by Olivier Ball, reproduced with permission.)

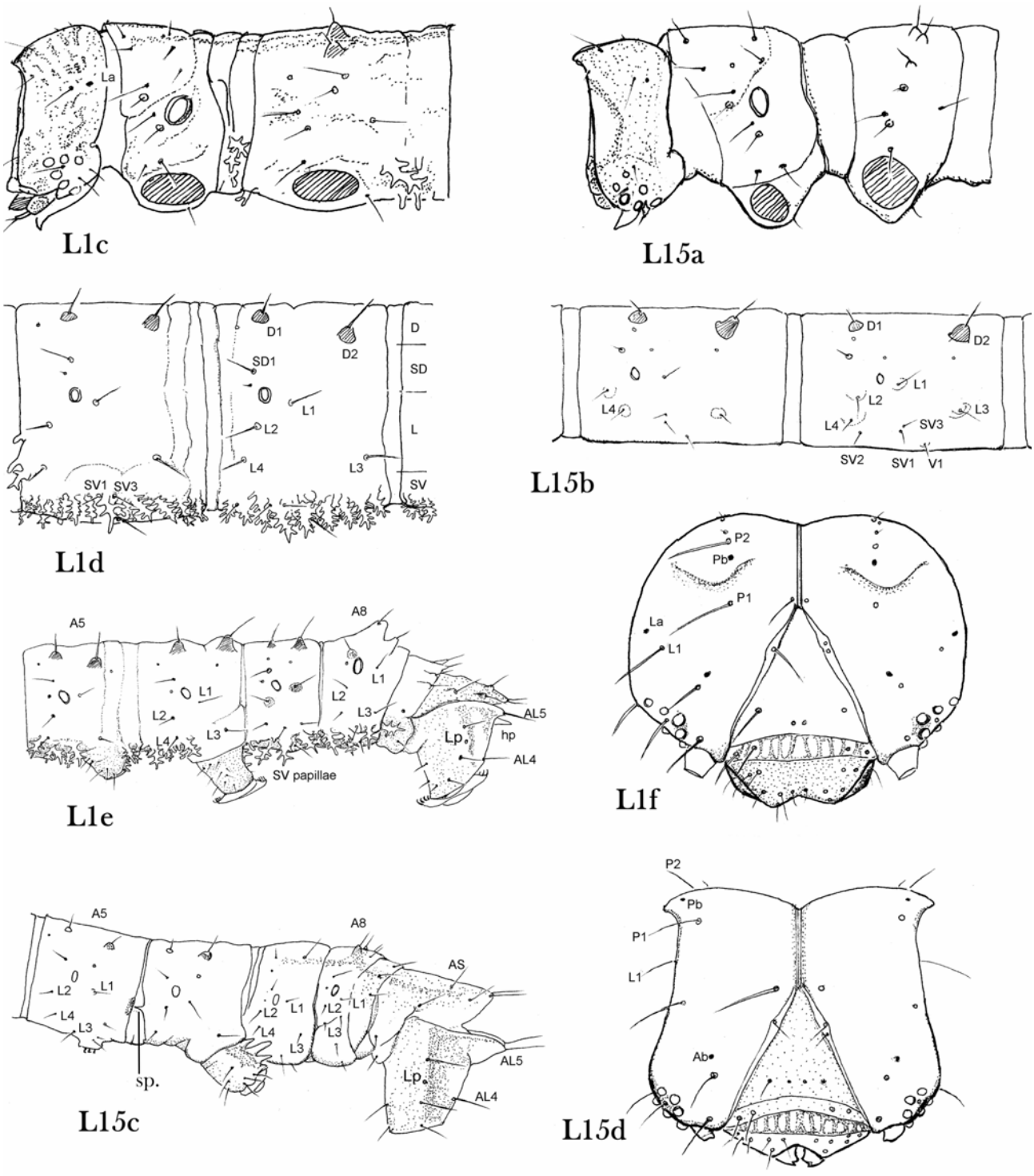


Fig. L1c-L15d Larval structures (drawings, semidiagrammatic) of lateral view of head capsule (HC), thoracic (T1, T2) chaetotaxy, abdominal chaetotaxy and structure, *Declana* and *Ipana* type species. L1c, *D. floccosa:* last instar larval head capsule posture and T1, T2 thoracic chaetotaxy (Wilmot Pass FD); note SV papillae on T2 (also present on T3); L15a, *I. leptomera,* ditto (Nelson NN). (L1d, L15b) Abdominal segments A1, A2 side view: L1d, *D. floccosa*; L15b, *I. leptomera*. (Note SV zone papillae and the flat venter in *Declana*, and the cylindrical body (convex venter) in *Ipana.*) Zonal notation shown in Fig L1d: D, dorsal; SD, subdorsal; L: lateral; SV, subventral; V, ventral. Note prominent (raised) D2 pinacula on *I. leptomera* and absence of seta SV2 on A1 in both genera. (L1e, L15c) Larval segments A5–10 side view: chaetotaxy and protuberances, last instars: L1e, *D. floccosa*; L15c, *I. leptomera*; note presence of A6 lateral spur (sp.) on *I. leptomera* (cf. fleshy lobe in Fig. L8c, *I. griseata*). (L1f, L15d) Head capsule, frontal view, with chaetotaxy: L1f, *D. floccosa*; L15d, *I. leptomera*. (Chaetotaxy notation includes campaniform sensilla La, Lp, Aa.)

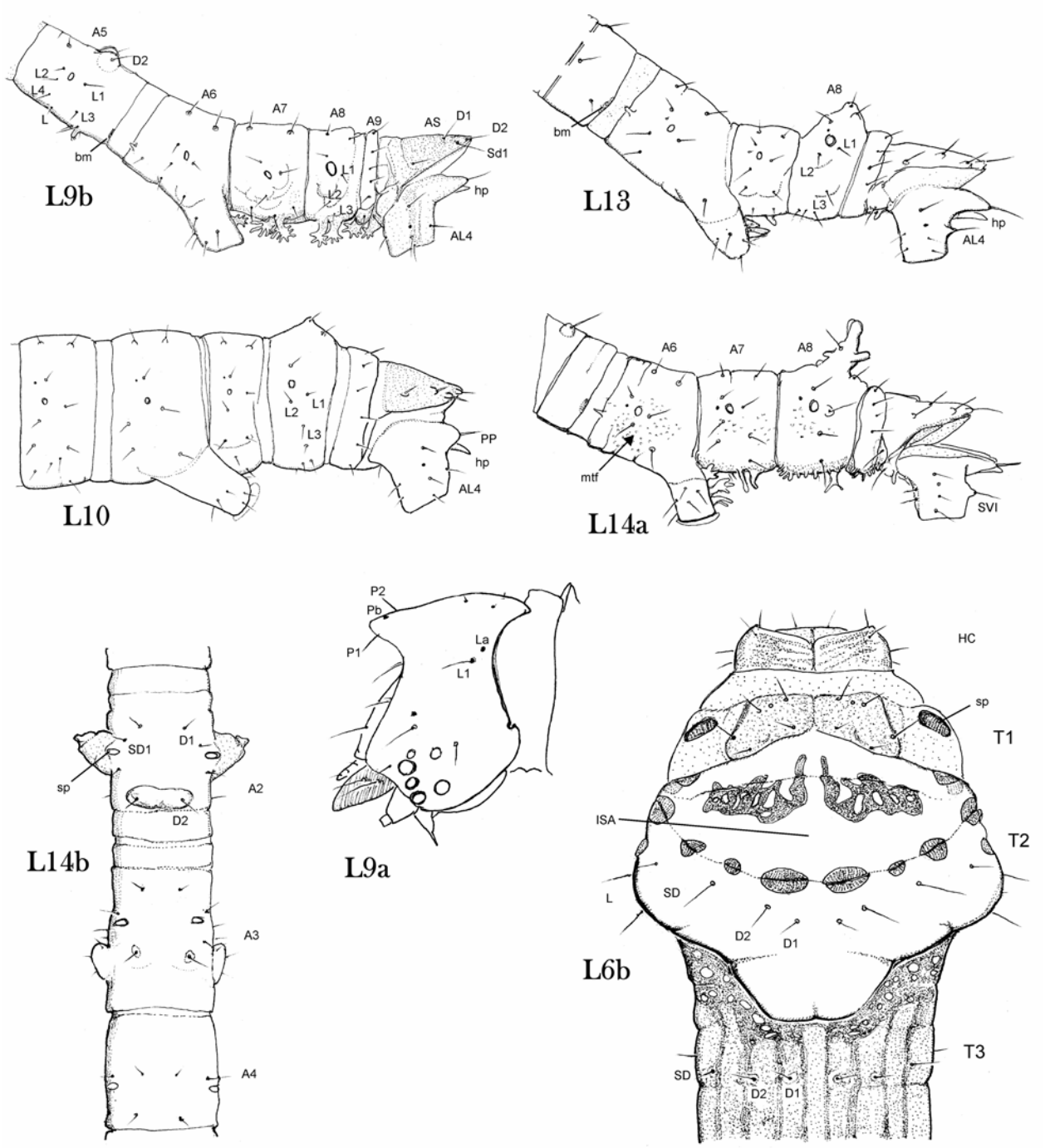


Fig. L9a–L14b Larval structures, *Ipana* spp. L9a [to left of fig. L6b], *I. feredayi* head capsule, side view (note large epicranial prominences and concave face); (L9b–L14a) abdominal segments A5 to anal shield and prolegs: L9b, *I. feredayi* Waipakihi River TO (note A8 without dorsal modifications, and micro-papilla-like A5 proleg with 2–3 mini-crotchets); L13, *I. hermione* Speargrass Valley NN (A8 with a dorsal tubercle and anal proleg seta tuberculate); L10, *I. glacialis*, Camp Creek Basin, Craigieburn Range MC (note absence of anterior lateral spur on A5, anal proleg with seta AL4 on tubercle); L14a, *I. junctilinea,* Upper Wairau MB (note A8 with large dorsal 'stump', A5–8 with lateral fields of micro-tubercles, and anal proleg with seta AL4 on a tubercle); L14b, *I. junctilinea* dorsal view of A2–4, with lateral prominences on A2 and A3 (same specimen as in Fig. L14a); L6b, *I. atronivea*, HC and T1–3 in dorsal view (Whakarewarewa BP); note the massively incrassate thorax resembling a diseased twig.

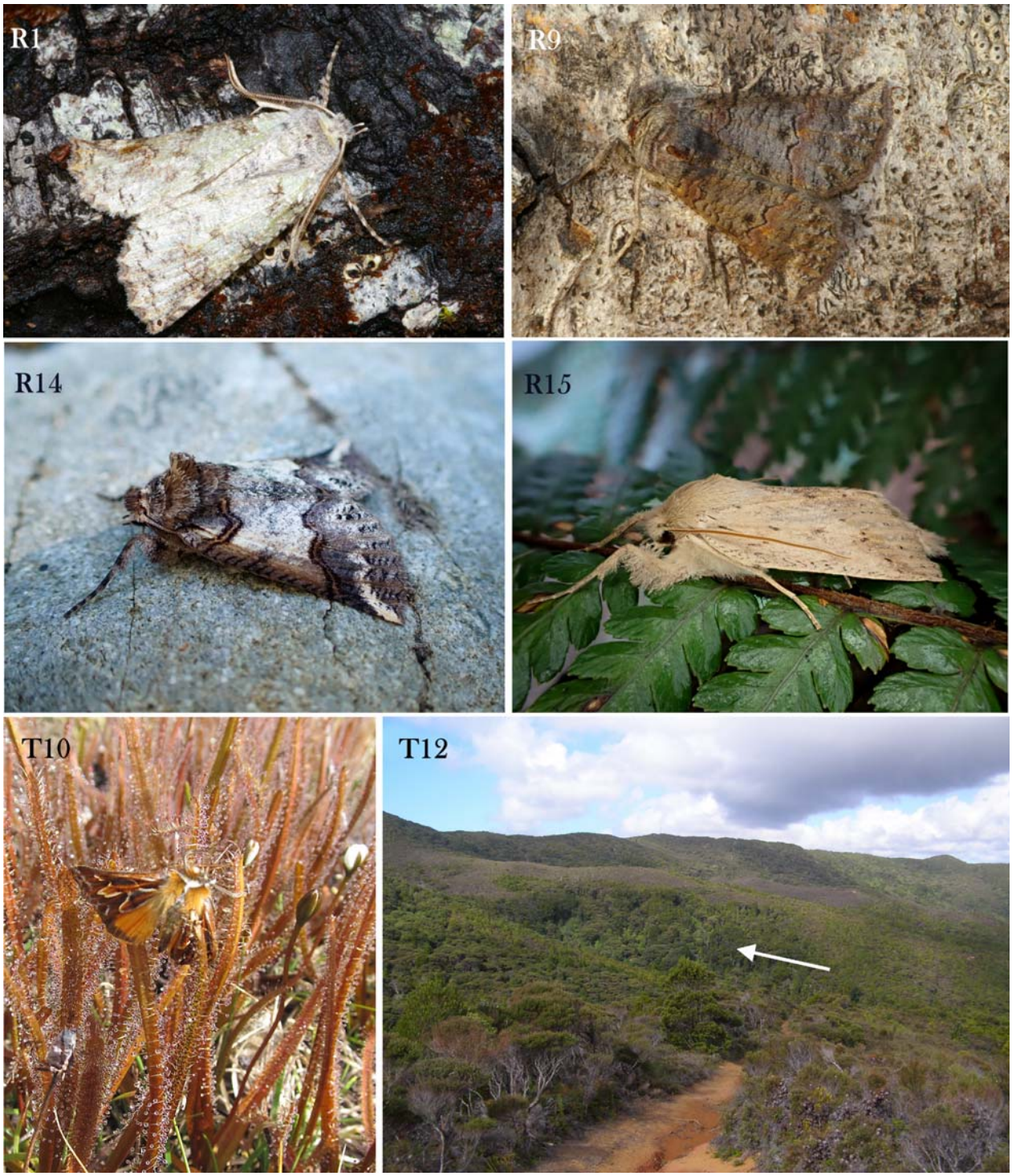
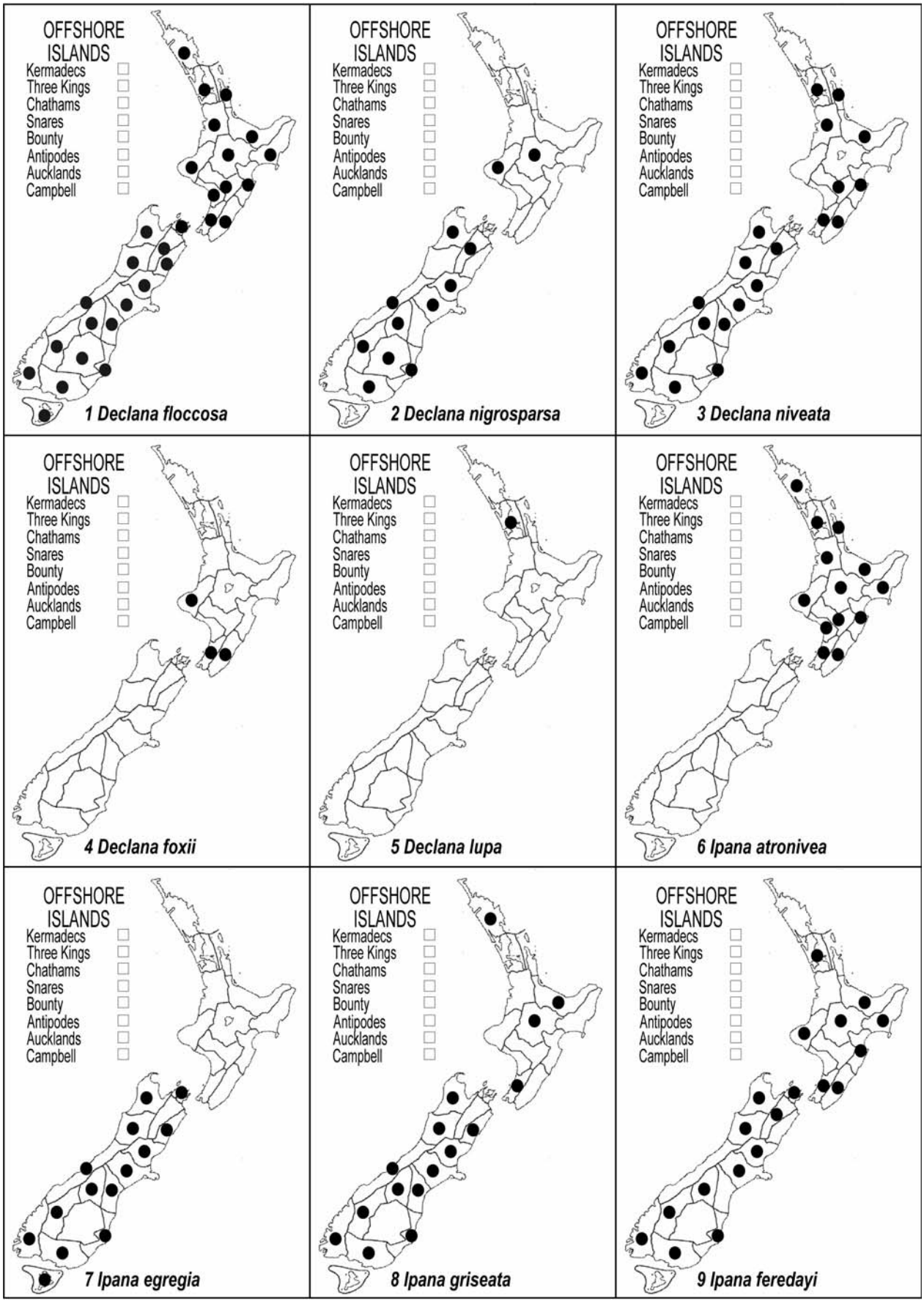
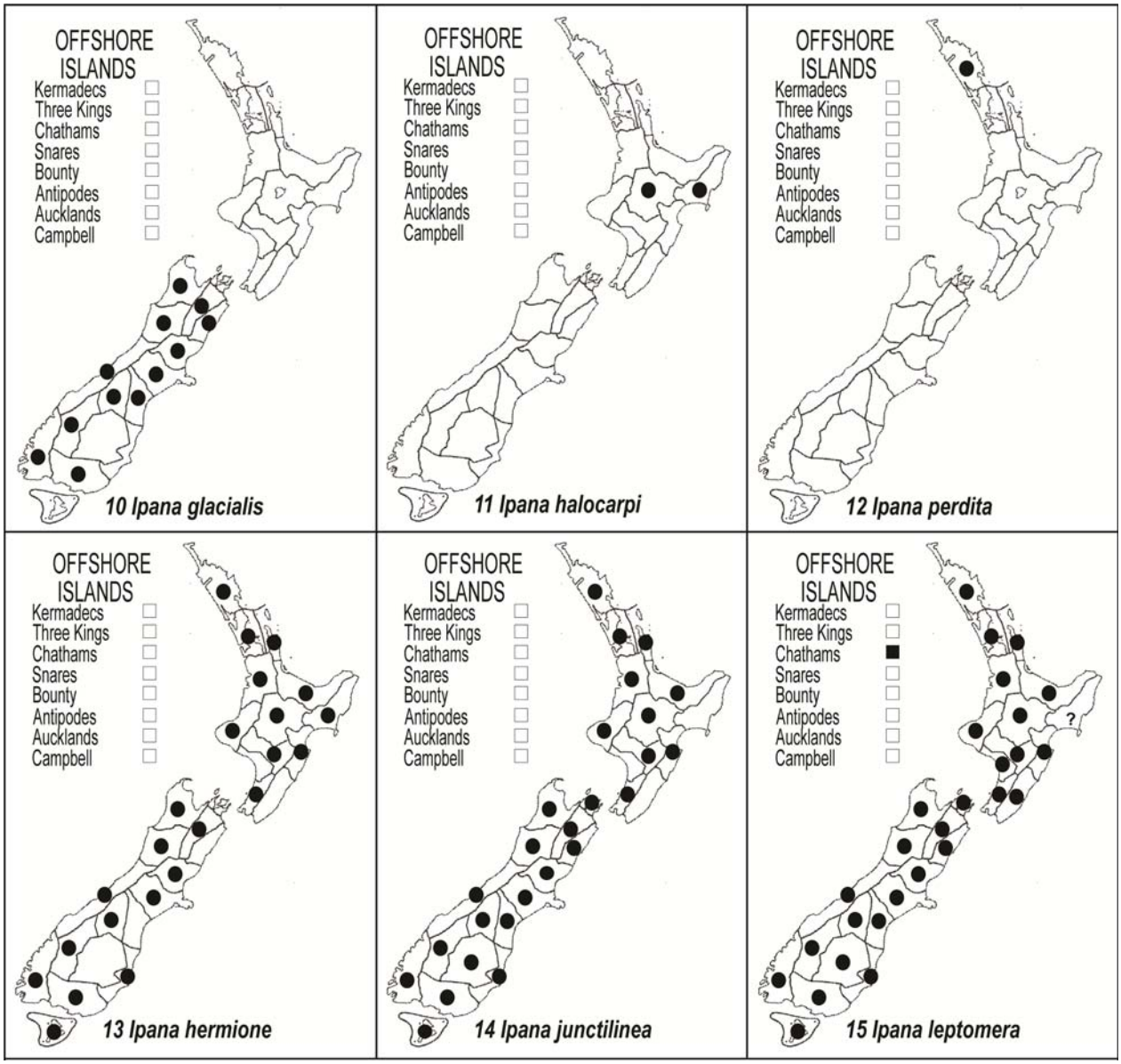


Fig. R1–15 Resting posture / live habitus of adults. R1, *Declana floccosa*, Eastbourne WN (photo by G.W. Gibbs); R9, *Ipana feredayi*, Eastbourne WN (photo by G.W. Gibbs); R14, *I. junctilinea*, Moana WD (photo by RJBH); R15, *I. leptomera*, Donald McLean Tk, Waitakere Ranges AK (photo by RJBH). **T10, T12** Threats at individual and species level. T10, *Ipana glacialis* male caught by a field of *Drosera arcturi*, St Arnaud Range NN, subalpine shrubland (photo by D. Bartle, reproduced with permission); T12, view over Kauri Bush, Te Paki ND, showing gully stand of the conifer *Halocarpus kirkii,* possible host of *I. perdita*, surrounded by flammable *Hakea* (Proteaceae), *Kunzea* and *Leptospermum* (Myrtaceae).

DISTRIBUTION MAPS





Map 1: *Declana floccosa*
Map 2: *D. nigrosparsa*
Map 3: *D.niveata*
Map 4: *D. foxii*
Map 5: *D. lupa*
Map 6*: Ipana atronivea*
Map 7: *I. egregia*
Map 8: *I. griseata*
Map 9: *I. feredayi*
Map 10: *I. glacialis*
Map 11*: I halocarpi*
Map 12: *I. perdita*
Map 13: *I. hermione*
Map 14: *I. junctilinea*
Map 15: *I. leptomera*. Note: one record (Lindsay 1930) from Pitt I. CH; species not found in Chathams by JSD in 1987.

APPENDIX A: HOST-PLANTS BY PLANT FAMILY

Listed in alphabetical order of family. Plant taxa for which all larval records were considered doubtful by JSD are enclosed in square brackets.

Annotations:

E: endemic; I: indigenous (naturally shared), MA: man-adventive

*: assumed or highly possible

?: doubtful record (see text)

1. Hudson (1928, 1939, 1950);
2. PlantSynz;
3. Bain, J. (2009);
4. Peralta *et al.* (2017);
5. Winks *et al*. (2004);
6. Patrick (2000);
7. Patrick (1994);
8. White (2002);
9. Patrick & Dugdale (1997);
10. Berndt *et al*. (2006);
11. Wardle (1971) (pers. comm. from JSD);
12. Kay (1982);
13. Rawlings (1961);
14. Wearing *et al.* (2010).

No annotation: taken from 1965 version of MS [original source unconfirmed]

ARALIACEAE

Pseudopanax arboreus (Murray) Philipson E:
I. atronivea [1]; *I. egregia* [1]; *D. floccosa* ? [2, 3]

Pseudopanax colensoi (Hook. f.) Philipson E:
I. atronivea [1]

Pseudopanax colensoi ternata Wardle E:
I. egregia

Pseudopanax crassifolius (Sol. ex. Cunn) K. Koch E:
I. atronivea

Raukaua edgerleyi (Hook.f.) Seem. E:
I. atronivea

Raukaua simplex (Forst.) A.D. Mitch., Frodin & Heads E:
I. atronivea [2, 3]; *I. egregia* [2, 3]; *D. floccosa* [2, 3]

ARAUCARIACEAE

Agathis australis (D. Don) Lindl., ex Loudon (1829) E:
D. floccosa [2]

ARGOPHYLLACEAE

Corokia cotoneaster Raoul E:
D. floccosa

ASTERACEAE

Chrysanthemoides monilifera (L.) Norl. MA:
I. leptomera [2, 5]

Olearia bullata H. D. Wilson & Garn. Jones E:
D. nigrosparsa [2]; *I. junctilinea* [2, 6]
Olearia fimbriata Heads E:
D. nigrosparsa [6]; *I. junctilinea* [2, 6]; *I. leptomera* [2, 6]
Olearia fragrantissima Petrie E:
D. nigrosparsa [6]; *I. leptomera* [2, 6]
Olearia gardneri Heads E:
I. leptomera [6]
Olearia hectori Hook.f. E:
D. nigrosparsa [2, 6]
Olearia lineata (Kirk) Cockayne E:
D. nigrosparsa [6]
Olearia x *macrodonta* Baker E:
**D. nigrosparsa*
Olearia odorata Petrie E:
D. nigrosparsa [6]; *I. leptomera* [2, 6]
Ozothamnus leptophyllus (G.Forst.) Breitw. & J.M.Ward E:
I. leptomera [2, 7, 8]

ATHEROSPERMATACEAE

Laurelia novae-zelandiae A. Cunn., 1838 E:
D. floccosa [1, 2, 3]

CORIARIACEAE

Coriaria arborea R.Linds. E:
D. floccosa [1, 2, 3, 4]; *I. leptomera* [4]
Coriaria sarmentosa G.Forst. E:
D. floccosa [2, 3]

CUNONIACEAE

Note. The familiar genus *Weinmannia*, long used for these New Zealand trees, was recently split by Pillon *et al*. (2021), resulting in their transferral to *Pterophylla*.
Pterophylla racemosa (L.f.) Pillon & H.C.Hopkins E:
D. floccosa [2, 4]; *I. leptomera*
Pterophylla sylvicola (Sol. ex A.Cunn.) Pillon & H.C.Hopkins E:
D. floccosa [2, 3]

CUPRESSACEAE

Chamaecyparis lawsoniana (Murray) Parl. MA:
D. floccosa [2, 3]; *I. hermione*; *I. junctilinea*; *I. leptomera*
Cryptomeria japonica (Thunb. ex L.f.) D.Don MA:
D. floccosa [2, 3]; *I. leptomera*
Cupressus macrocarpa Hartw. ex Gordon MA:
D. floccosa [1, 2, 3]; *I. junctilinea*; *I. leptomera*
Sequoia sempervirens (D.Don.) Endl. MA:
D. floccosa [2, 3]

[**CYATHEACEAE**

Cyathea dealbata (G.Forst.) Sw. E:
D. floccosa ? [4]]

[**DENNSTAEDTIACEAE**

Pteridium esculentum (G.Forst.) Cockayne I:
I. leptomera ? [4]]

ELAEOCARPACEAE

Aristotelia serrata (J.R. & G.Forst.) W.R.B.Oliver E:
D. floccosa [1, 2, 3]; *I. leptomera*
Aristotelia fruticosa Hook.f. E:
I. junctilinea
Elaeocarpus dentatus (J.R. & G.Forst.) Vahl E:
D. floccosa [2]

ERICACEAE

Arbutus unedo L. MA:
D. floccosa [2, 3]
Dracophyllum spp., subgenus *Oreothamnus* E:
I. glacialis
Dracophyllum rosmarinifolium (G.Forst.) R.Br. E:
I. glacialis
Dracophyllum subulatum Hook.f. E:
D. floccosa [2, 3]
Erica lusitanica Rudolphi MA:
D. floccosa [4]; *I. leptomera* [2]
Gaultheria spp. (NZ shrubby species) E:
D. floccosa
Leucopogon fasciculatus (G.Forst.) A.Rich. E:
D. floccosa [4]; *I. leptomera* [2, 3, 4]

FABACEAE

Acacia dealbata Link MA:
D. floccosa
Acacia melanoxylon R.Br. MA:
D. floccosa [2]
Carmichaelia sp. E:
D. floccosa [2, 3]
Ulex europaeus L. MA:
D. floccosa [2, 4, 10]

[**GRISELINIACEAE**

Griselinia littoralis Raoul E:
D. floccosa ?; *I. leptomera* ?]

GROSSULARIACEAE

Ribes sanguineum Pursh MA:
I. leptomera

LAURACEAE

Beilschmiedia tawa (A.Cunn.) Benth. & Hook.f. ex Kirk E:
D. floccosa [1, 2, 3]

LORANTHACEAE

Ileostylus micranthus (Hook.f.) Tiegh. I:
I. griseata [2, 9]; *I. leptomera*
Peraxilla colensoi (Hook.f.) Tiegh. E:
I. griseata [2, 9]
Peraxilla tetrapetala (L.f.) Tiegh. E:
D. floccosa [2, 3]; *I. griseata* [2]
Tupeia antarctica (G.Forst.) Cham. & Schlecht E:
I. griseata [2, 9]

MALVACEAE

Hoheria angustifolia Raoul E:
D. niveata
Hoheria glabrata Sprague & Summerhayes E:
D. niveata
Hoheria lyallii Hook.f. E:
D. niveata [2]
Hoheria populnea A.Cunn. E:
D. niveata
Plagianthus divaricatus J.R. Forst. & G. Forst. E:
D. niveata
Plagianthus regius (Poit.) Hochr. E:
D. niveata
Tilia x *europaea* L. MA:
D. floccosa [2, 3]

MONIMIACEAE

Hedycarya arborea J.R. Forst. & G. Forst. E:
D. floccosa [1, 2, 3]

MYRSINACEAE

Myrsine australis (A.Rich.) Allan E:
D. floccosa [2, 3]
Myrsine divaricata A.Cunn. E:
D. floccosa [2, 3]; *I. junctilinea* [2, 3]
Myrsine salicina Hew. ex Hook.f.
D. floccosa [2, 3]

MYRTACEAE

Eucalyptus bridgesiana R.T.Baker MA:
D. floccosa [2, 3]
E. cinerea F.Muell. ex Benth. MA:
D. floccosa [2, 3]
E. deanei Maiden MA:
D. floccosa [2, 3]
E. delegatensis R.T.Baker MA:
D. floccosa [2, 3]
E. fastigata H.Deane & Maiden MA:
D. floccosa [2, 3]

E. globulus Labill. MA:
D. floccosa [2, 3]
E. leucoxylon F.Muell. MA:
D. floccosa [2, 3]
E. macarthurii H.Deane & Maiden MA:
D. floccosa [2, 3]
E. muelleriana A.W.Howitt MA:
D. floccosa [2, 3]
E. nicholii Maiden & Blakeley MA:
I. leptomera
E. pilularis Sm. MA:
D. floccosa [2, 3]
E. pulchella Desf. MA:
D. floccosa [2, 3]
E. regnans F.Muell. MA:
D. floccosa [2, 3]
E. saligna Sm. MA:
D. floccosa [2, 3]
E. tenuiramis Miq. MA:
I. leptomera
E. viminalis Labill. MA:
D. floccosa [2, 3]; *I. leptomera* [2, 3]
Kunzea ericoides (A.Rich) Joy Thomps. E:
D. floccosa [1, 2, 4, 10]; *I. junctilinea* [1, 2, 4]; *I. leptomera* [1, 2, 4]
Leptospermum scoparium J.R. & G.Forst. I:
D. floccosa [1, 2, 3, 4]; *I. junctilinea* [1, 2, 4]; *I. leptomera* ? [4]
Lophomyrtus bullata Burret E:
D. floccosa [1, 2, 3]
Lophomyrtus obcordata (Raoul) Burret E:
I. leptomera
Metrosideros excelsa Sol. ex Gaertn. E:
I. leptomera [2]
Metrosideros umbellata Cav. E:
D. floccosa [2, 11]; *I. leptomera* [2, 3]

NOTHOFAGACEAE

Fuscospora cliffortioides (Hook.f.) Heenan & Smissen E:
D. floccosa [1, 2, 3]; *I. feredayi*
Fuscospora fusca (Hook.f.) Heenan & Smissen E:
D. floccosa [2, 3, 4]; *I. feredayi*; *I. leptomera*
Fuscospora solandri (Hook.f.) Heenan & Smissen E:
D. floccosa; *I. feredayi*; *I. leptomera*
Fuscospora truncata (Colenso) Heenan & Smissen E:
**I. feredayi*
Lophozonia menziesii (Hook.f.) Heenan & Smissen E:
D. floccosa [2, 3, 4]; *I feredayi* [4]; *I. leptomera*

ONAGRACEAE

Fuchsia excorticata (J.R.Forst. & G.Forst.) L.f. E:
D. floccosa

PENNANTIACEAE

Pennantia corymbosa J.R.Forst. & G.Forst. E:
D. floccosa [2, 3]

PINACEAE

Cedrus deodara (Roxb.) G.Don MA:
D. floccosa
Larix decidua Mill. MA:
D. floccosa [2, 12]; *I. hermione* [2, 3]; *I. junctilinea* [2, 3]; *I. leptomera* [2, 3]
Larix kaempferi (Lamb.) Carrière MA:
D. floccosa [2, 3]
Picea sitchensis (Bong.) Carrière MA:
D. floccosa [2, 3]
Pinus banksiana Lamb. MA:
D. floccosa [2, 3]
Pinus contorta Loudon MA:
D. floccosa [2, 3]; *I. leptomera*
Pinus echinata Mill. MA:
D. floccosa [2, 3]
Pinus elliotii Engelm. MA:
D. floccosa [3]
Pinus muricata D.Don MA:
D. floccosa [2, 3]
Pinus nigra J.F.Arnold MA:
D. floccosa [2, 3]
Pinus patula Schltdl. & Cham. MA:
D. floccosa [2, 3]
Pinus pinaster Aiton MA:
D. floccosa [2, 3]
Pinus ponderosa Douglas ex C.Lawson
D. floccosa [2, 3]; *I. leptomera*
Pinus radiata D.Don MA:
D. floccosa [2, 3]; *I. hermione* [2, 13]; *I. junctilinea*; *I. leptomera* [4]
Pinus strobus L. MA:
D. floccosa [2, 3]
Pinus sylvestris L. MA:
D. floccosa [2, 3]
Pinus taeda L. MA:
D. floccosa [2, 3]
Pseudotsuga menziesii (Mirb.) Franco MA:
D. floccosa [2, 4, 12]; *I. hermione*; *I. junctilinea*; *I. leptomera*
Thuja plicata Donn ex D.Don MA:
D. floccosa [2, 3]; *I. leptomera*
Tsuga heterophylla (Raf.) Sarg. MA:
D. floccosa; *I. leptomera*

[**PIPERACEAE**

Piper excelsum G.Forst. E:
D. floccosa ?]

[**PITTOSPORACEAE**

Note. The following record must be regarded as very doubtful, since *D. niveata* is a specialist on endemic Malvaceae. RJBH, 2022.

Pittosporum eugenioides A.Cunn. E:
D. niveata ? [4]]

PODOCARPACEAE

Dacrycarpus dacrydioides (A.Rich.) de Laub. E:
D. floccosa [2, 3]
Dacrydium cupressinum Lamb. E:
D. floccosa [2, 3]; *I. leptomera* [2, 3]
Halocarpus bidwillii (Kirk) Quinn E:
D. floccosa [2, 3]; *I. halocarpi*
Halocarpus biformis (Hook.) Quinn E:
D. floccosa [2, 3]; *I. halocarpi* [this study]
Halocarpus kirkii (Parl.) Quinn E:
**I. perdita* [this study]
Phyllocladus alpinus Hook.f. E:
D. floccosa [2, 3]; *I. halocarpi*; *I. hermione*
Phyllocladus trichomanoides D.Don E:
D. floccosa [2, 3]
Podocarpus laetus Hooibr. ex Endl. E;
D. floccosa; *I. hermione*
Podocarpus totara G.Benn. ex D.Don E:
D. floccosa; *I. hermione*
Pectinopitys ferruginea (G. Benn. ex D.Don in Lamb.) C.N.Page E:
D. floccosa [1, 2, 3]
Prumnopitys taxifolia (D.Don) de Laub. E:
D. floccosa [1, 2, 3]

POLYGONACEAE

Muehlenbeckia australis (G.Forst.) Meisn. E:
D. floccosa; *I. leptomera*
Muehlenbeckia complexa (A.Cunn.) Meisn. E:
I. junctilinea [2, 7, 8]

PROTEACEAE

Toronia toru (A.Cunn.) L.A.S.Johnson & B.G.Briggs E:
D. floccosa

RHAMNACEAE

Discaria toumatou Raoul E:
Declana floccosa [2, 3]; *I. junctilinea* [2, 7, 8]; *I. leptomera* [2, 3, 7, 8]
Pomaderris phylicifolia Lodd. E:
D. floccosa

ROSACEAE

Malus x *domestica* Borkh. MA:
I. leptomera [2, 14]

Rubus australis G.Forst. E:
D. floccosa [2, 3]; *I. leptomera*
Rubus cissoides A.Cunn. E:
D. floccosa [2, 3]
Rubus spp. E:
I. leptomera

ROUSSEACEAE

Carpodetus serratus J.R. & G.Forst. E:
D. floccosa [2, 4]; *I. leptomera*

[**RUBIACEAE**

Note: JSD evidently regarded every record from *Coprosma* as suspect, since he queried them all in the manuscript. This is likely because *Coprosma*-feeding Lepidoptera tend to be specialists on this genus and polyphagous moths are rarely found on it. However, given the number of records, perhaps further investigation is needed, and it may be, for example, that *D. floccosa* and *I. leptomera* can complete development on *Coprosma* when they are nearing maturity, though it may not be a natural host for egg-laying. RJBH 2022.

Coprosma foetidissima J.R.Forst. & G.Forst. E:
D. floccosa ? [2, 3]
Coprosma microcarpa Hook.f. E:
I. leptomera ? [4]
Coprosma propinqua A.Cunn. E:
I. leptomera ?
Coprosma rhamnoides A.Cunn. E:
D. floccosa ? [4]; *I. leptomera* ? [4]
Coprosma rigida Cheeseman E:
D. floccosa ? [2, 3]
Coprosma rotundifolia A.Cunn. E:
D. floccosa ?]

RUTACEAE

Melicope simplex A.Cunn. E:
D. floccosa

SAPINDACEAE

Acer pseudoplatanus L. MA:
D. floccosa
Alectryon excelsus Gaertn. E:
D. floccosa [2]
Dodonaea viscosa Jacq. I:
D. floccosa

THEACEAE

Camellia sp. MA:
D. floccosa [2, 3]

VIOLACEAE

Melicytus alpinus (Kirk) Garn.-Jones E:
I. junctilinea

Melicytus ramiflorus J.R. & G.Forst. E:
D. floccosa ? [4]

WINTERACEAE

Pseudowintera colorata (Raoul) Dandy E:
D. floccosa [2, 3]; *I. leptomera*

APPENDIX B: HOST-PLANT BY MOTH SPECIES

Records regarded as dubious by JSD are placed in square parentheses with a question-mark after the plant name. An asterisk* denotes a highly likely but unconfirmed association. For authorities for plant names and publications / databases on which records are based, see Appendix A.

1. *Declana floccosa*. Araliaceae: [*Pseudopanax arboreus* ?]; *Raukaua simplex*. **Araucariaceae:** *Agathis australis*. **Argophyllaceae:** *Corokia cotoneaster*. **Atherospermataceae:** *Laurelia novae-zelandiae*. **Coriariaceae:** *Coriaria arborea*; *C. sarmentosa*. **Cunoniaceae:** *Pterophylla racemosa*; *P. sylvicola*. **Cupressaceae:** *Chamaecyparis lawsoniana*; *Cryptomeria japonica*; *Cupressus macrocarpa*; *Sequoia sempervirens.* [Cyatheaceae: *Cyathea dealbata* ?] **Elaeocarpaceae:** *Aristotelia serrata*; *Elaeocarpus dentatus*. **Ericaceae:** *Arbutus unedo*; *Dracophyllum subulatum*; *Erica lusitanica*; *Gaultheria* spp.; *Leucopogon fasciculatus*. **Fabaceae:** *Acacia dealbata*; *A. melanoxylon*; *Carmichaelia* sp.; *Ulex europaeus*. [Griseliniaceae: *Griselinia littoralis* ?] **Lauraceae:** *Beilschmiedia tawa*. **Loranthaceae:** *Peraxilla tetrapetala*. **Malvaceae:** *Tilia* x *europaea*. **Monimiaceae:** *Hedycarya arborea*. **Myrsinaceae:** *Myrsine australis*; *M. divaricata*; *M. salicina*. **Myrtaceae:** *Eucalyptus bridgesiana*; *E. cinerea*; *E. deanei*; *E. delegatensis*; *E. fastigata*; *E. globulus*; *E. leucoxylon*; *E. macarthurii*; *E. muelleriana*; *E. pilularis*; *E. pulchella*; *E. regnans*; *E. saligna*; *E. viminalis*; *Kunzea ericoides*; *Leptospermum scoparium*; *Lophomyrtus bullata*; *L. obcordata*; *Metrosideros umbellata*. **Nothofagaceae:** *Fuscospora cliffortioides*; *F. fusca*; *F. solandri*; *Lophozonia menziesii*. **Onagraceae:** *Fuchsia excorticata*. **Pennantiaceae:** *Pennantia corymbosa*. **Pinaceae:** *Cedrus deodara*; *Larix decidua*; *L. kaempferi*; *Picea sitchensis*; *Pinus banksiana*; *P. contorta*; *P. echinata*; *P. elliottii*; *P. muricata*; *P. nigra*; *P. patula*; *P. pinaster*; *P. ponderosa*; *P. radiata*; *P. strobus*; *P. sylvestris*; *P. taeda*; *Pseudotsuga menziesii*; *Thuja plicata*; *Tsuga heterophylla*. [Piperaceae: *Piper excelsum* ?] **Podocarpaceae:** *Dacrycarpus dacrydioides*; *Dacrydium cupressinum*; *Halocarpus bidwillii*; *H. biformis*; *Phyllocladus alpinus*; *P. trichomanoides*; *Podocarpus laetus*; *P. totara*; *Pectinopitys ferruginea*; *Prumnopitys taxifolia*. **Polygonaceae:** *Muehlenbeckia australis*. **Proteaceae:** *Toronia toru*. **Rhamnaceae:** *Discaria toumatou*; *Pomaderris phylicifolia*. **Rosaceae:** *Rubus australis*; *R. cissoides*. **Rousseaceae:** *Carpodetus serratus*. [Rubiaceae: *Coprosma foetidissima* ?; *C. rhamnoides* ?; *C. rigida* ?; *C. rotundifolia* ?] **Rutaceae:** *Melicope simplex*. **Sapindaceae:** *Acer pseudoplatanus*; *Alectryon excelsus*; *Dodonaea viscosa*. **Theaceae:** *Camellia* sp. [Violaceae**:** *Melicytus ramiflorus* ?] **Winteraceae:** *Pseudowintera colorata*.

2. *Declana nigrosparsa*. Asteraceae: *Olearia bullata*; *O. fimbriata*; *O. fragrantissima*; *O. hectori*; *O. lineata*; *O. odorata*; **O. x macrodonta*.

3. *Declana niveata*. Malvaceae: *Hoheria angustifolia*; *H. glabrata*; *H. lyallii*; *H. populnea*; *Plagianthus divaricatus*; *P. regius*. [Pittosporaceae: *Pittosporum eugenioides* ?]

4. *Declana foxii*. Host(s) unknown.

5. *Declana lupa*. Host(s) unknown.

6. *Ipana atronivea*. Araliaceae: *Pseudopanax arboreus*; *P. colensoi*; *P. crassifolius*; *Raukaua edgerleyi*; *R. simplex*.

7. *Ipana egregia*. Araliaceae: *Pseudopanax arboreus*; *P. colensoi ternata*; *Raukaua simplex*.

8. *Ipana griseata*. Loranthaceae: *Ileostylus micranthus*; *Peraxilla colensoi*; *P. tetrapetala*; *Tupeia antarctica*.

9. *Ipana feredayi*. Nothofagaceae: *Fuscospora cliffortioides*; *F. fusca*; *F. solandri*; *Lophozonia menziesii*.

10. *Ipana glacialis*. Ericaceae: *Dracophyllum* subgenus *Oreothamnus* spp.; *D. rosmarinifolium*.

11. *Ipana halocarpi*. Podocarpaceae: *Halocarpus bidwillii*; *H. biformis*; *Phyllocladus alpinus*.

12. *Ipana perdita*. Podocarpaceae: **Halocarpus kirkii*

13. *Ipana hermione*. Cupressaceae: *Chamaecyparis lawsoniana*. **Pinaceae:** *Larix decidua*; *Pinus radiata*; *Pseudotsuga menziesii*. **Podocarpaceae:** *Phyllocladus alpinus*; *Podocarpus laetus*; *P. totara*.

14. *Ipana junctilinea*. Asteraceae: *Olearia bullata*; *O. fimbriata*; *O. odorata*; *Ozothamnus leptophyllus*. **Cupressaceae:** *Chamaecyparis lawsoniana*; *Cupressus macrocarpa*. **Elaeocarpaceae:** *Aristotelia fruticosa*. **Myrsinaceae:** *Myrsine divaricata*. **Myrtaceae:** *Kunzea ericoides*; *Leptospermum scoparium*. **Pinaceae:** *Larix decidua*; *Pinus radiata*; *Pseudotsuga menziesii*. **Polygonaceae:** *Muehlenbeckia complexa*. **Rhamnaceae:** *Discaria toumatou*. **Violaceae:** *Melicytus alpinus*.

15. *Ipana leptomera*. Asteraceae: *Chrysanthemoides monilifera*; *Olearia fimbriata*; *O. fragrantissima*; *O. gardneri*. **Cunoniaceae:** *Pectinophylla racemosa*. **Cupressaceae:** *Chamaecyparis lawsoniana*; *Cryptomeria japonica*; *Cupressus macrocarpa*. [Dennstaedtiaceae: *Pteridium esculentum* ?] **Elaeocarpaceae:** *Aristotelia serrata*. **Ericaceae:** *Erica lusitanica*; *Leucopogon fasciculatus*. [Griseliniaceae: *Griselinia littoralis* ?] **Grossulariaceae:** *Ribes sanguineum*. **Loranthaceae:** *Ileostylus micranthus*. **Myrtaceae:** *Eucalyptus nicholii*; *E. tenuiramis*; *E. viminalis*; *Kunzea ericoides*; *Leptospermum scoparium*; *Lophomyrtus obcordata*; *Metrosideros excelsa*; *M. umbellata*. **Nothofagaceae:** *Fuscospora fusca*; *F. solandri*; *Lophozonia menziesii*. **Pinaceae:** *Larix decidua*; *Pinus contorta*; *P. ponderosa*; *P. radiata*; *Pseudotsuga menziesii*; *Thuja plicata*; *Tsuga heterophylla*. **Podocarpaceae:** *Dacrydium cupressinum*. **Polygonaceae:** *Muehlenbeckia australis*. **Rhamnaceae:** *Discaria toumatou*. **Rosaceae:** *Malus* x *domestica*; endemic *Rubus* spp. including *Rubus australis*. **Rousseaceae:** *Carpodetus serratus*. [Rubiaceae: *Coprosma microcarpa* ?; *C. propinqua* ?] **Winteraceae:** *Pseudowintera colorata*.

APPENDIX C. THE DEMISE OF *DETUNDA*: A SYNONYMIC SOLILOQUY

[See Preface and synonymy under each genus.]

It's tearing us asunder…
It's loosening our grip…
To find our dear *Detunda*
A synonym of *Ip*.!

It ought to be unlawful…
It puts a moth to shame…
Encumbered by so awful
Atossa of a name.

But though we're very bright 'ere
And went to super schools,
We're terribly *Politeia*
And follow all the rules….

Amongst the non-*Declana*'s
Both delicate and dire
Regrettably *Ipana*'s
Un*Argua*bly prior…

So tell your dentist gaily
(When with his fury faced)
That you've been brushing daily
With *atronivea* paste!

RJBH (who would have written something longer but thought this was *Epic as is*).

TAXONOMIC INDEX

This index covers the nominal invertebrate taxa mentioned in the text, regardless of their current status in taxonomy. Taxa in **bold** are those included in the checklist. Page numbers in **bold** indicate main entries. Page numbers in *italics* indicate figures. The letter '**p**' after a page indicates habitus photographs of adults or larvae, the letter '**k**' indicates a key, and the letter '**m**' indicates a distribution map.

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He titiro whāiti tā tēnei pukapuka ki ngā mea noho whenua, kāore he tuarā; i pēnei ai i te mea kei te mōhio whānuitia ngā mea whai tuarā, ā, ko ngā mea noho moana, koirā te tino kaupapa o te huinga pukapuka *NIWA Biodiversity Memoirs.*

Ka āhei te tangata ki te **whakauru tuhituhinga** mehemea kei a ia ngā tohungatanga me ngā rauemi e tutuki pai ai tana mahi. Heoi anō, e wātea ana te Kohinga Angawaho o Aotearoa hei āta tirotiro mā te tangata mehemea he āwhina kei reira.

Me whāki te kaituhi i ōna whakaaro ki tētahi o te Kāhui Ārahi Whakarōpūtanga Tuarā-Kore, ki te Ētita rānei i mua i te tīmatanga, ā, mā rātou a ia e ārahi mō te wāhi ki tana tuhinga.