

Taxonomic review of *Koroana* Myers (Hemiptera: Cixiidae), with description of a new species

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Abstract The New Zealand genus *Koroana* Myers, 1924 is briefly reviewed. An illustrated key to its three species and diagnoses are provided, with *Koroana lanceleti* described as new. Details of geographical distribution and notes on biology, including host-plant associations, are also given for all three species.

Keywords Hemiptera; Cixiidae; *Koroana*; taxonomy; distribution; biology

INTRODUCTION

The cixiid genus *Koroana* Myers, 1924 was erected for two New Zealand species, *Koroana helena* (= *Cixius interior* Walker; synonymy of Myers 1927: 689) and *K. arthuria*. A study of the male genitalia and other morphological characters, bolstered by new geographical information, has revealed that one more species is involved.

This paper offers a concise review of *Koroana*. Diagnoses and a key to the three included species, based on adults, are given. *Koroana lanceleti* sp. nov. is described.

Koroana can be easily distinguished from other New Zealand genera by features of the head, especially the frons, which is brownish medially with lateral margins ivory to pale yellow, and has a simple (not forked or thickened) median longitudinal carina.

The external morphology of *Koroana* is highly conservative, offering few useful characters for spe-

cies diagnosis. Body colour is highly variable within species as well as between species. Venation of the forewing varies intraspecifically. The externally visible portions of the male genitalia, including the genital styles, have some taxonomic usefulness, but accurate identification depends upon an examination of the aedeagus.

MATERIALS AND METHODS

Females can be identified only by association with male specimens. Fortunately, species of *Koroana* are largely allopatric, which simplifies identification of localised populations.

The male genitalia can be dissected as follows. Pinned specimens are warmed for 5–6 min in hot acetic alcohol, a mixture of 70% absolute ethanol and 30% commercial white vinegar. Each specimen is transferred to a watch glass half-filled with acetic alcohol. The pygofer is then pulled away from the body using fine forceps and a micro scalpel (needle tip from 1.0 ml disposable hypodermic syringe), returned to hot acetic alcohol for 3–4 min, and transferred to acetic alcohol (at room temperature). The anal tube, genital styles, and aedeagus are detached and extracted from the pygofer in this solution. Dissected genitalia can be stored in glycerol in genitalia vials mounted on the pin below the specimens.

The material used for this study was provided by the Auckland Institute and War Memorial Museum, Auckland (AMNZ); B. H. Patrick private collection, Dunedin (BPNZ); Canterbury Museum, Christchurch (CMNZ); Lincoln University, Lincoln (LUNZ); Museum of New Zealand – Te Papa Tongarewa, Wellington (MONZ); New Zealand Arthropod Collection, Landcare Research, Auckland (NZAC); and University of Canterbury, Christchurch (UCNZ).

For each species, area codes of Crosby et al. (1976) are listed from north to south and west to east. Area codes used in this paper are as follows. **North Island:** AK, Auckland; BP, Bay of Plenty; CL, Coromandel; HB, Hawke's Bay; ND, Northland; RI,

Rangitikei; TO, Taupo; TK, Taranaki; WI, Wanganui; WN, Wellington; WO, Waikato. **South Island:** BR, Buller; CO, Central Otago; FD, Fiordland; MK, Mackenzie; MB, Marlborough; MC, Mid Canterbury; NC, North Canterbury; NN, Nelson; OL, Otago Lakes; SD, Marlborough Sounds; SL, Southland; WD, Westland. The latitude and longitude co-ordinates of collection localities are given in Table 1.

Biological notes are based on an analysis of specimen label data. The native plants associated with *Koroana* species are listed in Table 2, along with their family placement.

The status, repository, and full label data of primary type specimens seen (and a summary of label information for secondary type specimens) are cited for each species. In the list of label data different labels are separated by a solidus (/) and different

lines on a label by a semicolon; all other punctuation is as it appears on the label.

The morphological terminology adopted here generally follows O'Brien & Wilson (1985) and recent taxonomic revisions on Cixiidae (e.g., Van Stalle 1991). Diagnoses are based on adults. Descriptive measurements and counts were taken in the following manner: **vertex length** measured from tip of basal emargination to apex of vertex; **vertex width** taken at level of tip of basal emargination (be); **forewing length** taken from base to apex; **forewing width** measured at tip of clavus; **body length** measured from apex of head to tip of forewing, cited as a range with mean in parentheses.

Further study of Australasian Cixiidae is needed before phylogenetic relationships can be hypothesised, hence taxa are treated alphabetically in this paper.

KEY TO SPECIES OF *KOROANA*, BASED PRIMARILY ON MALES

1. Aedeagus (in dorsal view, Fig. 9) with 1 long (approx. half aedeagal length), subrectilinear, dorsolateral spine subapically near base of flagellum and 2 slender, short, sickle-shaped spinous processes near midlength of periandrium, the dorsally directed process slightly longer than the more narrowly coiled ventral process. Forewings usually (90% of specimens) clear, rarely with a weakly defined transverse band of pale brown spots between costa and clavus; apical cells hyaline (not opaque dark brown) *K. interior*
Distribution (Fig. 15): throughout the North Island; northernmost and south-easternmost South Island.
- Aedeagus (in dorsal view, Fig. 8, 10) with 1 shorter (less than half aedeagal length), curved, dorsolateral spine subapically near base of flagellum and 2 robust or differently oriented, sickle-shaped spinous processes. Forewings with a well-defined transverse band of dark spots between costa and clavus; at least 1 apical cell opaque dark brown 2
- 2(1). Aedeagus (in dorsal view, Fig. 8) with 1 very short (less than one-quarter aedeagal length), sinuate, dorsolateral spine subapically near base of flagellum and 2 rather thick, short, sickle-shaped, spinous processes near midlength of periandrium, the dorsally directed process slightly longer than the ventral process *K. arthuria*
Distribution (Fig. 15): Arthur's Pass (NC) and southernmost South Island; Stewart Island.
- Aedeagus (in dorsal view, Fig. 10) with 1 moderately long (approx. one-third aedeagal length), sinuate, dorsolateral spine apically near base of flagellum and 2 thin, short, sickle-shaped spinous processes near midlength of periandrium, the dorsally directed process much longer than the less narrowly coiled ventral process *K. lanceleti* sp. nov.
Distribution (Fig. 15): mostly the South Island west coast and east of the Southern Alps around Otago lakes and Mt Cook (MK).

TAXONOMIC REVIEW

Genus *Koroana* Myers

Koroana Myers, 1924: 319. Type species *Cixius interior* Walker, 1858: 82, by subsequent synonymy of Myers (1927).

DIAGNOSIS: Distinctive genus comprising yellowish

brown slender species, often tinged with mossy green or reddish, and with frons longitudinally bicoloured.

Vertex approximately 0.6× as long as broad; transverse subapical keel subrectilinear or slightly arcuate, not connected to anterior margin by small ridges; basal compartment with median keel more

Table 1 Geographical co-ordinates of main collection localities. Co-ordinates should be read as 00°00'S/000°00'E. Two-letter area codes follow Crosby et al. (1976).

Anatimo, NN, 4049/17256	Lake Rotorua, BP, 3805/17617	Secretary Island, FD, 4514/16655
Arthur's Pass, NC, 4255/17133	Lewis Pass, BR, 4223/17224	Ship Cove, SD, 4106/17414
Auckland, AK, 3551/17446	Little Barrier Island, CL, 3612/17505	Stephensstream, WN, 4119/17441
Bealy Valley, NC, 4301/17136	MacLennan Range, SL, 4631/16918	Stevens Island, SD, 4040/17400
Boatmans Creek, BR, 4203/17154	Makarora, OL, 4414/16914	Tairua, CL, 3700/17551
Boyle River, BR/NC, 4233/17223	Makatote, TO, 3934/17553	Takaka Hill, NN, 4102/17251
Browns Bay, AK, 3643/17445	Mamaku Plateau, BP, 3803/17604	Takitimu Forest, SL, 4543/16751
Canavans Knob, WD, 4323/17010	Mangamuka, ND, 3513/17333	Takitimu Range, SL, 4542/16750
Capleston, BR, 4204/17155	Mangarakau, NN, 4039/17229	Tapu, CL, 3659/17530
Cass, MC, 4302/17145	Maitai Valley, NN, 4116/17317	Tapu-Coroglen Road, CL, 3659/17535
Chinaman Stream, MB, 4150/17256	Mawhera State Forest, BR, 4228/17130	Taranaki/Mt Egmont, TK, 3918/17404
Cobb Reservoir, NN, 4107/17240	Milford [Sound], FD, 4441/16756	Tararua Range, WN, 4103/17520
Codfish Island, SI, 4647/16738	Mill Bay, AK, 3700/17436	Tarawera, TO, 3902/17634
Collingwood, NN, 4041/17241	Mt Anstead, OL, 4430/16837	Taupo, TO, 3841/17605
Croisilles [Harbour], SD, 4104/17340	Mt Arthur, NN, 4113/17241	Tawhai State Forest, BR, 4210/17152
Darran Mountains, FD, 4443/16803	Mt Chrome, MB, 4142/17302	Taylorville, BR, 4226/17119
Dart Hut, OL, 4431/16834	Mt Cook area, MK, 4344/17007	Te Anau Downs, FD, 4511/16750
Doubtful Sound, FD, 4517/16655	Mt Holdsworth, WN, 4052/17525	Tiritea, WI, 4025/17540
Deep Cove, FD, 4528/16710	Mt Ngongotaha, BP, 3807/17612	Te Aroha, WO/BP, 3732/17543
Feilding, WI, 4013/17534	Mt Pirongia, WO, 3759/17506	Tennyson Inlet, SD, 4106/17345
Fletchers Creek, BR, 4159/17150	Mt Robert, BR, 4150/17249	Tihoi, TO, 3837/17537
Franz Josef, WD, 4325/17010	Mt Ruapehu, TO, 3916/17534	Tikitapu/Blue Lake, BP, 3812/17620
Gillespies Beach, WD, 4325/16949	Mt Sewell, BR, 4224/17121	Titirangi, AK, 3656/17440
Gouldan Downs, NN, 4054/17219	Nelson, NN, 4117/17317	Tongariro National Park, TO, 3909/17538
Great Barrier Island, CL, 3607/17530	Ngongotaha, BP, 3805/17613	Trio Islands, SD, 4050/17400
Haurangi State Forest, WA, 4131/17519	Ohakune, TO, 3925/17525	Tutukaka Harbour, ND, 3537/17432
Hikuai Settlement, CL, 3704/17550	Orakeikorako, TO, 3829/17609	Waiaro Bay, CL, 3636/17525
Hokitika, WD, 4243/17058	Oratia, AK, 3655/17437	Waiho, WD, 4322/17010
Hollyford Road, OL, 4440/16810	Otira, WD, 4250/17134	Waikato/Waipakihī Rivers junction, TO, 3914/17546
Homer Tunnel, FD, 4446/16759	Oturere Stream, TO, 3911/17547	Waimana Valley, BP, 3812/17702
Hoophorn Stream, MK, 4346/17005	Owaka, SL, 4627/16940	Waipoua State Forest, ND, 3539/17333
Huia, AK, 3700/17434	Paekakariki, WN, 4059/17457	Waipunga Falls, TO, 3857/17631
Hunua Range, AK, 3705/17512	Port Underwood Saddle, SD, 4118/17407	Waitakere Ranges, AK, 3659/17432
Jackson Bay, WD, 4358/16842	Port Waikato, WO, 3723/17444	Waitete Bay, CL, 3640/17526
Kaimanawa North Forest Park, TO, 3900/17610	Puketitiri, HB, 3917/17632	Wellington, WN, 4115/17445
Kauaeranga, CL, 3709/17536	Puponga, NN, 4031/17243	Whakamaru, TO, 3826/17548
Kawarau Gorge, CO, 4502/16908	Pureora State Forest Park, TO, 3832/17537	Whangamoa Saddle, NN, 4113/17326
Kaweka Range, HB, 3917/17622	Queenstown, OL, 4502/16840	Whangarei, ND, 3543/17419
Keith George Memorial Park, WN, 4106/17505	Rakeahua Valley, SI, 4700/16753	Wilmot Pass, FD, 4531/16711
Kirikiri Saddle, CL, 3710/17536	Rangitoto Island, AK, 3648/17452	Woodhill, AK, 3645/16426
Korokoro, WN, 4113/17452	Riverhead State Forest, AK, 3643/17434	
Lake Paringa, WD, 4343/16925	Rotorua, BP, 3809/17615	
Lake Rotoiti, BR, 4149/17250	Ruahine Range, RI, 4011/17556	
Lake Rotoma, BP, 3803/17634		

or less defined; basal emargination V-shaped. Frons brownish medially, ivory to pale yellow laterally, often tinged with green; median carina simple (not forked); median ocellus apparently absent. Postclypeus yellowish brown to dark brown, not swollen, with a median carina (this sometimes evanescent).

Pronotum with a median longitudinal carina (often weakly defined); a pair of curved postocular carinae, 1 on either side of middle, subparallel to hind margin. Mesonotum with 3 longitudinal carinae. Forewings 2.5–3.5× longer than broad, hyaline, with or without an irregular pattern of pale or dark brown spots coalescing into a poorly defined transverse

band between costa and distal third of clavus; veins with setiferous granules, costa with 14–20 such granules; apical cells 9–11 in number. Hind tibiae bearing 3 immovable lateral spines; tarsomere I with an apical row of 6 teeth, tarsomere II with 8 teeth.

Male genitalia. Externally visible portions uniform throughout the genus. Pygofer as in Fig. 5. Anal tube (Fig. 6) and left genital style (Fig. 11–13) symmetrical. Aedeagus (Fig. 8–10) with 2 subapical spines arising near base of flagellum (dorsolateral spine short and subrectilinear or slightly curved; ventral spine longer, curved dorsad, forked and ending in 2 sickle-shaped spinous processes near midlength of perianthrium); flagellum unarmed. **Female genitalia.** Uniform throughout genus. Pregenital sternite and ovipositor as illustrated (Fig. 7).

Table 2 Native plants associated with *Koroana* species.

<i>Aristolelia fruticosa</i> Hook. f.	Elaeocarpaceae
<i>Brachyglottis buchananii</i> (J.B. Armst.) B. Nordenstam	Asteraceae
<i>Carmichaelia</i> sp.	Fabaceae
<i>Cassinia</i> sp.	Asteraceae
<i>Coprosma parviflora</i> Hook. f.	Rubiaceae
<i>Coprosma</i> sp.	Rubiaceae
<i>Coriaria arborea</i> Lindsay	Coriariaceae
<i>Fuchsia</i> sp.	Onagraceae
<i>Hebe divaricata</i> (Cheesem.) Cockayne & Allan	Scrophulariaceae
<i>Hebe parviflora</i> (Vahl) Cockayne & Allan	Scrophulariaceae
<i>Hebe salicifolia</i> (G. Forst.) Pennell	Scrophulariaceae
<i>Hebe stricta</i> (Benth.) L.B. Moore	Scrophulariaceae
<i>Hebe subalpina</i> (Cockayne) Cockayne & Allan	Scrophulariaceae
<i>Hebe</i> sp.	Scrophulariaceae
<i>Hoheria</i> sp.	Malvaceae
<i>Meliclytus ramiflorus</i> J.R. Forst & G. Forst.	Violaceae
<i>Meliclytus</i> sp.	Violaceae
<i>Metrosideros</i> sp.	Myrtaceae
<i>Nothofagus</i> sp.	Fagaceae
<i>Olearia avicenniifolia</i> (Raoul) Hook. f.	Asteraceae
<i>Olearia lacunosa</i> Hook. f.	Asteraceae
<i>Olearia moschata</i> Hook. f.	Asteraceae
<i>Pittosporum</i> sp.	Pittosporaceae
<i>Pseudowintera</i> sp.	Winteraceae
<i>Weinmannia</i> sp.	Cunoniaceae

Koroana arthuria Myers Fig. 5–8, 11, 15

Koroana arthuria Myers, 1924: 320

TYPE MATERIAL: Holotype: male (NZAC, indefinite loan from BMNH) labelled "Type (circular red-bordered label) / Arthur's Pass; 12.XI.22; J.G. Myers; 2500' (handwritten) / Emerged; 24.XI.22 (handwritten) / J.G. Myers Coll.; B.M. 1937–789. / Holotype; Koroana; arthuria; ♂ Myers (handwritten); first line at right angle along left border, which is red." Very good condition; mounted on card point.

The allotype, apparently labelled as the holotype, could not be located.

DIAGNOSIS: General colour brown, often with a reddish tinge; forewings with dark brown spots arranged in an irregular transverse band between costa and distal third of clavus.

Vertex brown, with basal compartment often paler; basal emargination deeply V-shaped (more deeply incised than in *K. interior*).

Pronotum pale yellowish brown to brown, often darker laterally. Mesonotum yellowish white, pale brown, or more rarely mossy green medially, darker brown laterally, often tinged with reddish. Forewings hyaline, sometimes slightly infumate or milky; veins yellowish brown, often nearly black; stigma brown; costa with 17–20 granules; Sc+R usually forked distad of Cu, more rarely at same level as Cu; r-m usually located slightly distad of M3+4 or at same level; A1 and Y-vein often whitish with brown spots near distal third of clavus; apical cells usually 9 (sometimes 10) in number, with 1 or 2 partly or entirely opaque dark brown; tegulae slightly darker than pronotum. Hind wings fully developed. Legs brown to almost black, with hind tibiae sometimes yellowish brown; fore and middle tibiae annulated blackish and ivory or yellowish; hind tibiae bearing 3 immovable lateral spines.

Ventral sternites brown to blackish. **Male genitalia.** Anal tube as in Fig. 6. Left genital style as in Fig. 11. Aedeagus (in dorsal view, Fig. 8) with 1 very short (less than one-quarter aedeagal length), sinuate, dorsolateral spine located subapically near base of flagellum and 2 thick, short, sickle-shaped spinous processes near midlength of perianthrium, the dorsally directed process slightly longer than the ventral process.

Body length of males 4.40–5.90 (4.94) mm, of females 4.70–5.40 (4.73) mm. Other characters as in generic diagnosis.

GEOGRAPHICAL DISTRIBUTION (Fig. 15): Southernmost areas of the South Island, Stewart Island, and one population from Arthur's Pass (NC).

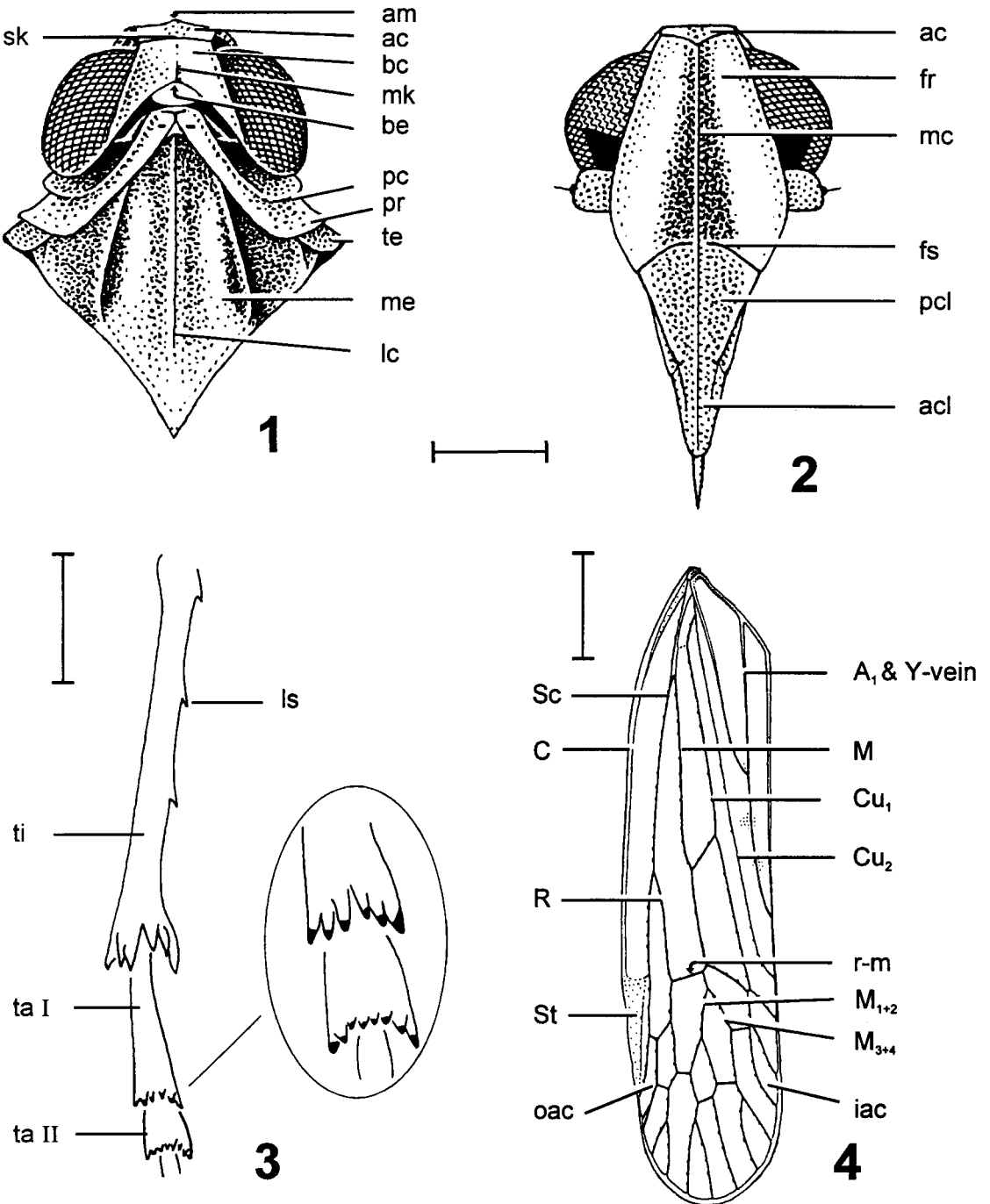


Fig. 1–4 *Koroana interior*, external morphology: **1**, head, pronotum, and mesonotum, dorsal view (ac, apical compartment of vertex; am, anterior margin of vertex; bc, basal compartment of vertex; be, basal emargination of vertex; lc, longitudinal carina; me, mesonotum; mk, median keel; pc, postocular carina of pronotum; pr, pronotum; sk, subapical keel of vertex; te, tegula); **2**, head, frontal view (ac, apical compartment of vertex; acl, anteclypeus; fr, frons; fs, frontoclypeal suture; mc, median carina; pcl, postclypeus); **3**, left hind leg, ventral view (ls, lateral spines; ta I, tarsomere I; ta II, tarsomere II; ti, tibia); **4**, left forewing (A₁, first anal vein and Y-vein; C, costa; Cu, cubital vein; iac, inner apical cell; M, median vein; oac, outer apical cell; r-m, crossvein between R and M veins; R, radial vein; Sc, subcosta; St, stigma). Scale lines = 0.5 mm (Fig. 4, 1.0 mm).

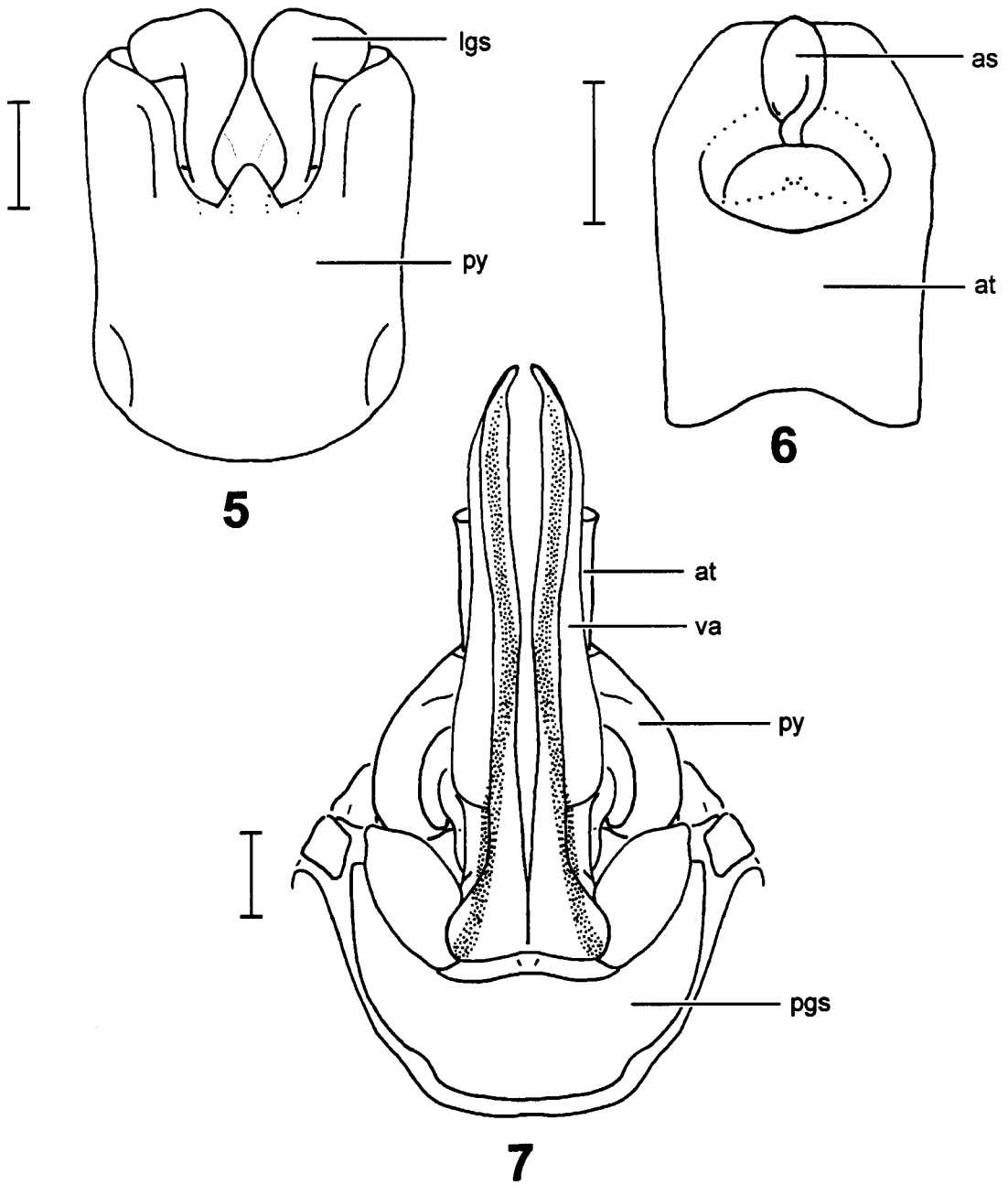


Fig. 5-7 *Koroana arthuria*: 5, male pygofer, ventral view (lgs, left genital style; py, pygofer); 6, male anal tube, dorsal view (as, anal style; at, anal tube); 7, female ovipositor, ventral view (at, anal tube; pgs, pregenital sternite; py, pygofer; va, valvulae). Scale lines = 0.25 mm.

CHOROLOGICAL AFFINITIES: The range of *K. arthuria* slightly overlaps that of *K. lanceoloti* sp. nov. in the south (FD) and that of *K. interior* in the north (NN).

MATERIAL EXAMINED: A total of 122 non-type specimens were examined, from the following localities.

South Island. NC. Arthur's Pass (incl. Andrews Stream; Dobson Memorial Walk; Kellys Creek).

OL. Hollyford Road end. **FD.** Doubtful Sound, Deep Cove. Homer Tunnel. Milford. Secretary Island. Te Anau Downs. Wilmot Pass. **SL.** MacLennan Range. Takitimu Forest (incl. Cheviot Face; Tower Peak; Wyndham Station).

Stewart Island. Codfish Island, Sealers Bay. Lee Bay. Rakeahua Valley.

BIOLOGY: *Koroana arthuria* occurs in lowland to higher montane forest margins and shrublands. Collected more frequently on *Hebe* species (including *H. odora*), also on *Cassinia* sp., *Coprosma parviflora*, *Metrosideros* sp., *Olearia avicenniifolia*, and *Brachyglottis buchananii*. Adults collected from November to February throughout the range of the species, with peaks of abundance in late January and February. Apparently univoltine, overwintering as eggs or nymphs; newly emerged adults collected in late November to early December and in January and February. Forewings and hind wings fully developed, so probably capable of flight.

Literature records (Myers 1924): reared in large numbers from nymphs collected beneath stones at Arthur's Pass; small ants were also observed, but myrmecophily was not definitely established; nymphs of this species found in company with those of *Oliarus oppositus*, very numerous under stones, in some instances with small ants (*Monomorium* sp.) in the boulder-strewn riverbed at Arthur's Pass (2300 ft [700 m] elevation).

Koroana interior (Walker)

Fig. 1–4, 9, 12, 15

Cixius interior Walker, 1858: 82

Cixius rufifrons Walker, 1858: 83. Synonymised by Myers (1927: 689)

Koroana helena Myers, 1924: 319. Synonymised by Myers (1927: 689)

Koroana interior (Walker); Myers 1927: 689

TYPE MATERIAL: Walker's type specimen (not seen) is deposited in The Natural History Museum, London.

DIAGNOSIS: General colour yellowish brown, often tinged with reddish orange or green (fading in dead specimens); forewings usually clear, sometimes with a weakly defined pattern of pale brown spots

arranged in an irregular transverse band between costa and distal third of clavus.

Vertex ivory to pale yellow, often tinged with brown or reddish orange at middle; basal emargination widely V-shaped.

Pronotum ivory to pale yellowish. Mesonotum ivory to pale yellowish brown medially, darker orange-brown laterally. Forewings hyaline, sometimes slightly infumate or milky; veins yellowish brown, often slightly darker apically; stigma brown, sometimes quite pale; costa with 14–17 granules; Sc+R forked distad of Cu, rarely at same level as Cu; r-m usually located at same level as M3+4, more rarely slightly distad; A1 and Y-vein yellowish brown; apical cells usually numbering 10 (sometimes 9 or 11), all hyaline; tegulae concolorous with pronotum. Hind wings fully developed. Legs entirely yellowish or brown, sometimes with base and apex of fore and middle tibiae slightly infuscate; hind tibiae bearing 3 immovable lateral spines and sometimes a feeble, extra spine present between the 2 basal ones.

Ventral sternite yellowish or brown. **Male genitalia.** Anal tube as in *K. arthuria*. Left genital style as in Fig. 12. Aedeagus (in dorsal view, Fig. 9) with 1 long (approx. half aedeagal length), subrectilinear, dorsolateral spine located subapically near base of flagellum and 2 slender (less robust than in *K. arthuria*), short, sickle-shaped spinous processes near midlength of periandrium, the dorsally directed process slightly longer than the more narrowly coiled ventral process.

Body length of males 4.20–5.40 (4.92) mm, of females 4.90–6.10 (5.38) mm. Other characters as in generic diagnosis.

GEOGRAPHICAL DISTRIBUTION (Fig. 15): Widely distributed in the North Island and with a disjunct distribution in the South Island, where it occurs in the northernmost areas and in Southland (Owaka).

CHOROLOGICAL AFFINITIES: The range of *K. interior* slightly overlaps that of *K. lanceoloti* sp. nov. in the northernmost South Island.

MATERIAL EXAMINED: A total of 286 non-type specimens were seen, from the following localities.

North Island. ND. Mangamuka, summit. Tutukaka Harbour. Waipoua Forest. Whangarei.

AK. Auckland. Browns Bay. Huia. Hunua Range (incl. Hunua Falls; Otau Valley). Mill Bay. Oratia. Rangitoto Island. Riverhead Forest. Titirangi. Waitakere Ranges (incl. Walkers Bush). Woodhill.

CL. Great Barrier Island, Cliff Island. Hikua Settlement. Kauaeranga Valley. Kirikiri Saddle. Little Barrier Island. Tairua. Tapu. Tapu-Coroglen Road.

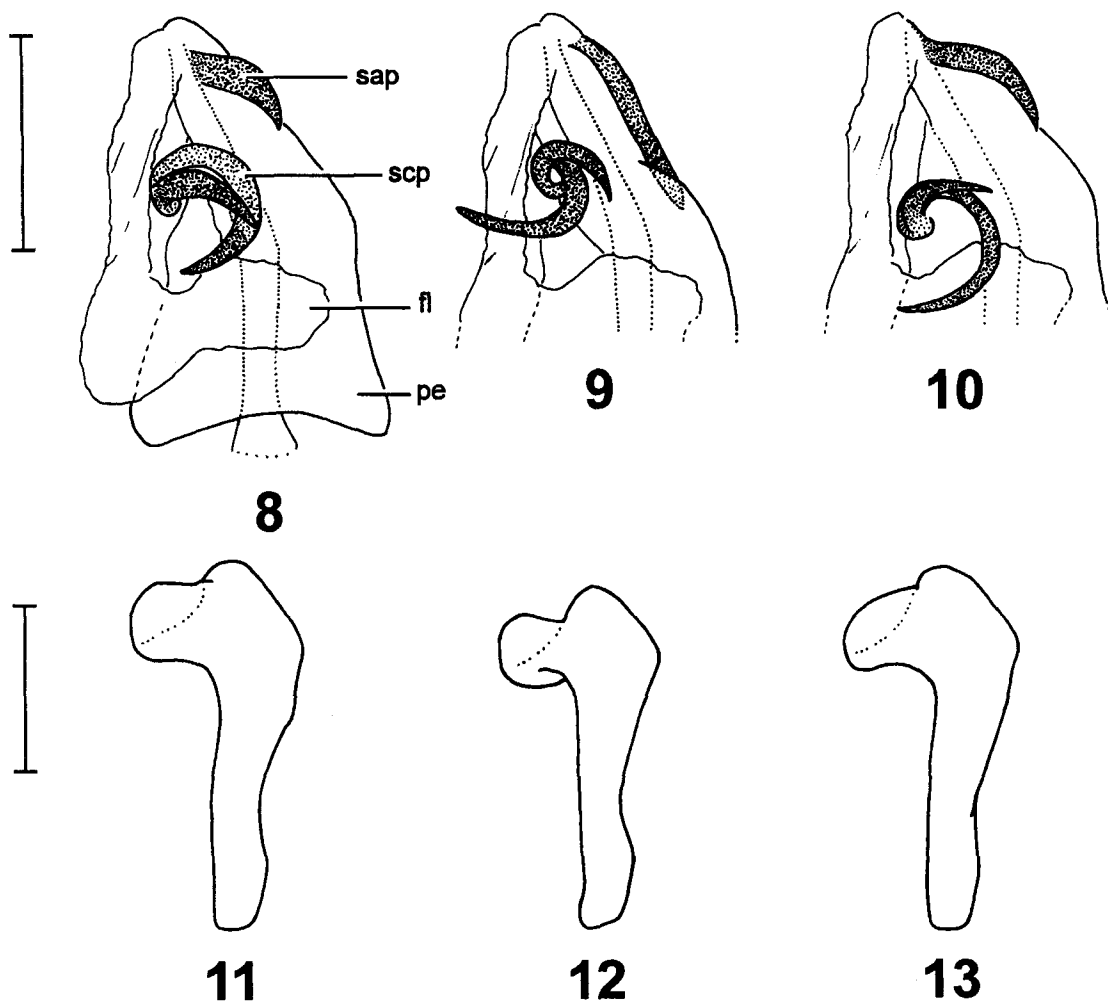


Fig. 8–10 Aedeagus, dorsal view: **8**, *Koroana arthuria* (fl, flagellum; pe, periandrium; sap, subapical process; scp, sickle-shaped process); **9**, *K. interior*; **10**, *K. lanceleti*. **Fig. 11–13** Left genital style of male, ventral view: **11**, *K. arthuria*; **12**, *K. interior*; **13**, *K. lanceleti*. Scale lines = 0.25 mm.

Waiaro Bay. Waitete Bay. **WO**. Mt Pirongia. Pitaruru. Port Waikato, Te Kohunga. **BP**. Korere. Lake Rotoma. Lake Rotorua. Mamaku Plateau. Mt Ngongotaha. Rotorua. Te Aroha. Tikitapu/Blue Lake. Urewera National Park, Waimana Valley. **TO**. Waikato and Waipakihi Rivers junction. Kaimanawa North Forest Park. Makatote. Mt Ruapehu (incl. Chateau). Ohakune. Orakeikorako. Oturere Stream. Pureora State Forest Park, Waipapa Reserve. Tarawera. Taupo. Tihoi. Tongariro National Park, Tawhai Falls. Waipunga Falls. Whakamaru. **HB**. Kaweka Range. Puketitiri. Putaihimi. **TK**. Taranaki/Mt Egmont. **RI**. Ruahine Range. **WI**. Feilding.

Tiritea. **WN**. Haurangi State Forest, Aorangi Range, Ruakokopatuna River tributary. Keith George Memorial Park. Korokoro. Mt Holdsworth. Paekakariki. Silverstream. Tararua Range: Dundas Hut Ridge; Waikawa Stream. Wellington (incl. Botanical Garden, Days Bay, Wiltons Bush).

South Island. SD. Croisilles [Harbour]. Port Underwood Saddle. Ship Cove. Stephens Island. Tennyson Inlet, Tuna Bay. Trio Islands. **NN**. Anatimo. Cobb Reservoir. Collingwood. Goulund Downs. Mangaraka. Maitai Valley. Mt Arthur Range, Flora Hut. Mt Chrome, Red Hills Hut. Nelson (incl. Glen Valley Bush). Puponga. Takaka Hill.

Whangamoia Saddle. **BR.** Lake Rotoiti. **MB.** Rainbow State Forest, Chinaman Stream at Wairau River. **MC.** Cass. **SL.** Owaka.

BIOLOGY: *Koroana interior* occurs on trees and shrubs of coastal to submontane forest margins and shrublands, often on stream sides. Often collected on *Hebe parviflora* and other *Hebe* species (including *H. stricta* and *H. divaricata*) and on *Melicytus ramiflorus*. Found less frequently on *Coriaria arborea*, *Fuchsia*, and on rare occasions on *Hoheria*, *Metrosideros*, *Nothofagus*, *Pittosporum*, *Pseudowintera*, or *Weinmannia*. Large numbers of newly emerged individuals collected in November in the Waimana Valley (Urewera National Park, Bay of Plenty), near a stream at the edge of a mixed podocarp-broadleaf forest, by beating mixed vegetation of *Fuchsia-Melicytus-Hebe*. Adults collected from October to April throughout the range of the species, with peaks of abundance in January and February. Apparently univoltine, overwintering as eggs or nymphs; newly emerged adults collected in October, November, January, and February. Forewings and hind wings fully developed, so probably capable of flight.

***Koroana lanceleti* sp. nov.**

Fig. 10, 13–15

TYPE MATERIAL: Holotype: male (NZAC) labelled "NEW ZEALAND OL; Dart Hut, 945 m; 15 Feb 1980; J.C. Watt; beaten at night." Mounted on card point; genitalia dissected and stored in mini-vial containing glycerol, underneath the specimen.

Allotype: female (NZAC), labelled as for holotype.

Paratypes (LUNZ, NZAC): 11 males, 9 females labelled as for primary types; 4 males, 8 females "Dart Hut, 13–15 Feb 1980, J.S. Dugdale"; 2 males, 4 females "Dart Valley, 940 m, 17 Feb 1980, J.C. Watt"; 2 males, 2 females "Dart Valley, 950 m, 19 Feb 1980, J.C. Watt."

DIAGNOSIS: General colour brown, often with a reddish tinge; forewings with dark spots arranged in an irregular transverse band between costa and distal third of clavus.

Vertex brown, with basal compartment often paler; basal emargination deeply V-shaped (more deeply incised than in *K. interior*).

Pronotum pale yellowish brown to brown, often darker laterally. Mesonotum yellowish white, pale brown, or more rarely mossy green medially, darker brown laterally, often tinged with reddish. Forewings hyaline, sometimes slightly infumate or milky; veins

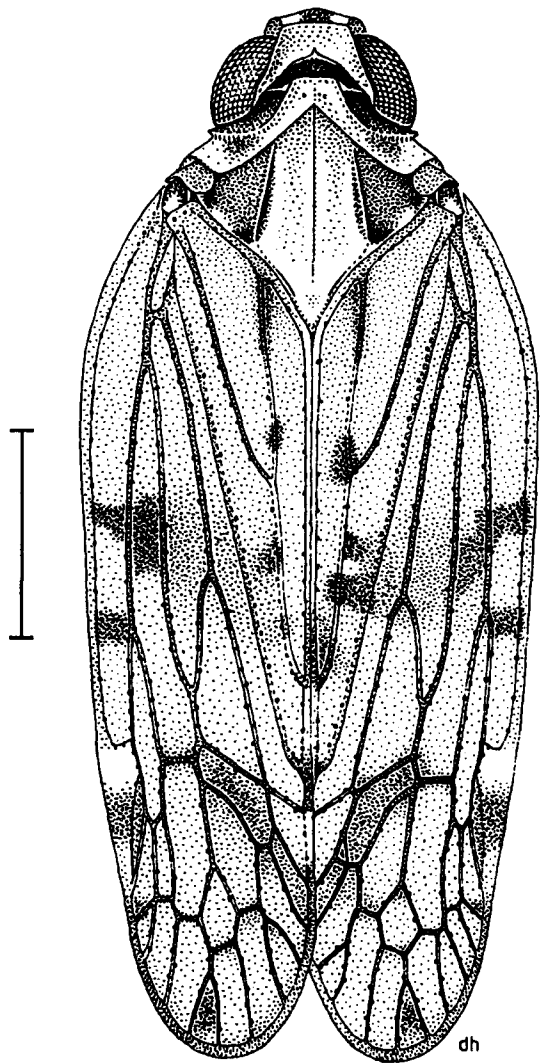
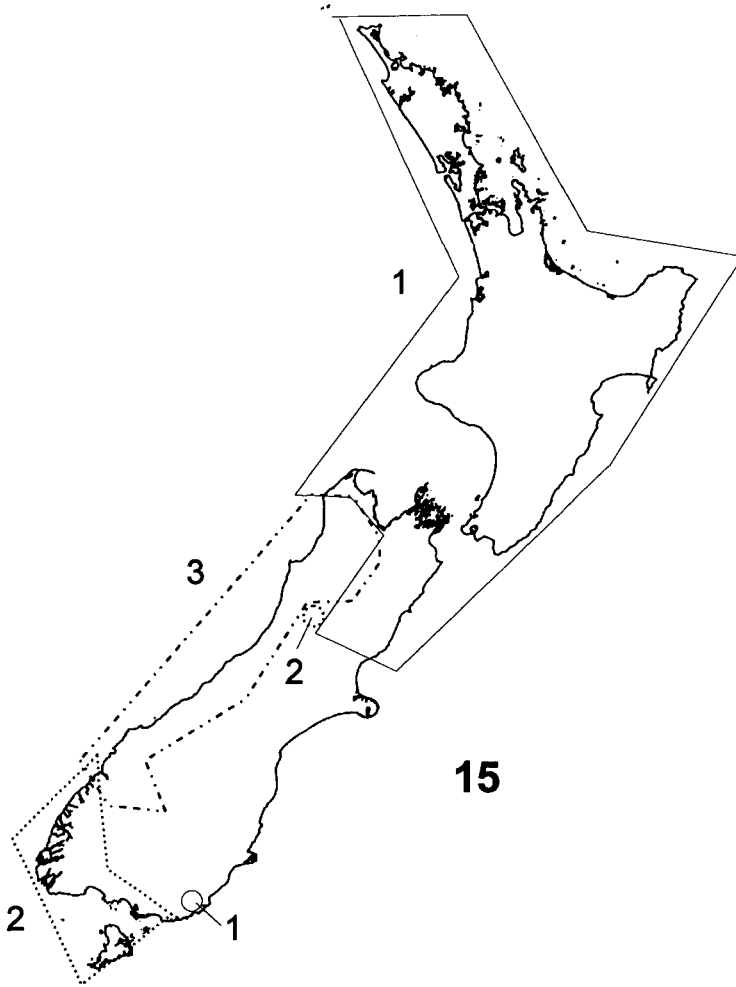


Fig. 14 *Koroana lanceleti* sp. nov, habitus, female. Scale line = 1.0 mm.

yellowish brown, often nearly black; an irregular transverse band of dark brown spots between costa and apex of clavus, usually darker and better defined than in *K. arthuria*; stigma brown; costa with 17–20 granules; Sc+R forked slightly distad of Cu, rarely at same level or basad; r-m slightly distad of M3+4, more rarely at same level; A1 and Y-vein often whitish with brown spots near distal third of clavus; apical cells usually 11 (sometimes 10) in number, with

Fig. 15 Distribution of *Koroana* species (1, *K. interior*; 2, *K. arthuria*; 3, *K. lanceleti*).



1 or 2 partly or entirely opaque dark brown; tegulae slightly darker than pronotum. Hind wings fully developed. Legs brown to almost black, with hind tibiae sometimes yellowish brown; fore and middle tibiae annulated blackish and yellowish white; hind tibiae bearing 3 immovable lateral spines.

Ventral sternites brown to blackish. **Male genitalia.** Anal tube as in *K. arthuria* and *K. interior*. Left genital style as in Fig. 13. Aedeagus (in dorsal view, Fig. 10) with 1 moderately long (approx. one-third aedeagal length), sinuate, dorsolateral spine apically near base of flagellum and 2 thin, short, sickle-shaped, spinous processes near midlength of perianthrium, the dorsally directed process much longer than the less narrowly coiled ventral process.

Body length of males 4.26–5.25 (4.70) mm, of females 4.62–5.63 (5.07) mm. Other characters as in generic diagnosis.

TAXONOMIC COMMENTS: The unbalanced phenotypic expression in male genital characters of individuals from populations in the zones of geographic overlap suggests occasional hybridisation between this species and the others. Hybridisation is suspected in material examined from the following localities: BR, Lake Rotoiti; NN, Mt Arthur Range (*K. lanceleti* × *K. interior*); FD, Doubtful Sound; OL, Hollyford Road end, Homer Tunnel, Milford, Wilmot Pass (*K. lanceleti* × *K. arthuria*).

GEOGRAPHICAL DISTRIBUTION (Fig. 15): South Island west coast, from Nelson/Buller to Fiordland, extending eastwards into Otago lakes area, Central Otago, and the Mt Cook area.

CHOROLOGICAL AFFINITIES: The range of *K. lanceleti* slightly overlaps that of *K. arthuria* in western Fiordland (FD).

MATERIAL EXAMINED: A total of 185 non-type specimens were seen from the following localities.

South Island. NN. Mt Arthur Range: Flora Hut/Saddle; Tableland. BR. Boatmans Creek. Caplestone. Lake Rotoiti. Lewis Pass. Mawhera State Forest. Mt Robert. Mt Sewell. Taylorville. Tawhai State Forest, Big River road. Fletchers Creek. WD. Canavans Knob. Franz Josef. Gillespies Beach. Hokitika. Jackson Bay. Lake Paringa. Otira, Barrack Creek. Waiho. MK. Hoophorn Stream. Mt Cook area (incl. Kea Point; Kea Walk; Tasman Valley, Ball Hut; Thar Lodge). OL. Dart Valley/Hut. Hollyford Road end. Mt Anstead. Makarora. Queenstown. CO. Kawarau Gorge, Roaring Meg. FD. Darran Mountains: Middle Gully, Tutoko Bench. Doubtful Sound. Homer Tunnel. Milford. Secretary Island, on way to Grono Bay. Wilmot Pass.

BIOLOGY: *Koroana lanceleti* is found in lowland to subalpine forest margins and shrublands. Collected regularly on *Olearia* species (including *O. moschata*, *O. avicenniifolia*, *O. lacunosa*), *Hebe* (especially *H. salicifolia* and *H. subalpina*), and *Coprosma* in these habitats. Other associated plant records include *Carmichaelia*, *Cassinia*, and *Aristotelia fruticosa*. Adults collected from November to April; teneral individuals from November to February and in July. Apparently univoltine, overwintering as eggs or nymphs. Forewings and hind wings fully developed, so probably capable of flight.

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