

## New Zealand cicadas of the genus *Maoricicada* (Homoptera: Tibicinidae)

J. S. DUGDALE

*Entomology Division, Department of Scientific and Industrial Research,  
Private Bag, Auckland, New Zealand*

and

C. A. FLEMING

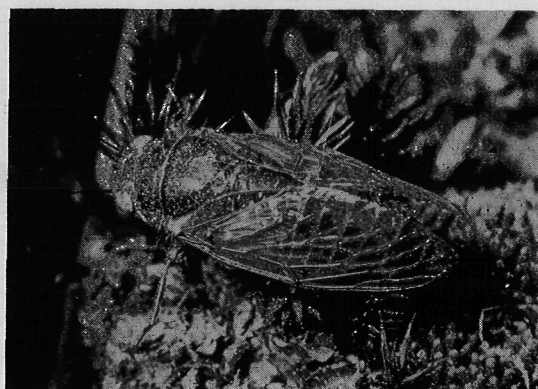
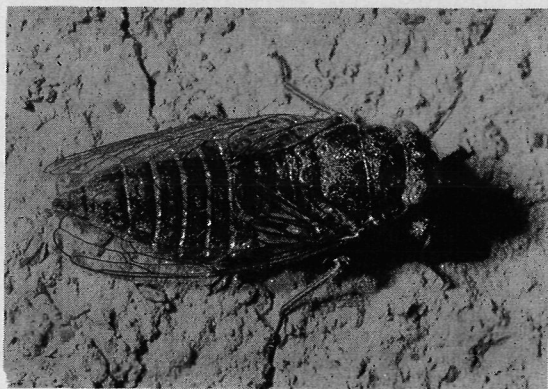
*42 Wadestown Road, Wellington, New Zealand*

The genus *Maoricicada* Dugdale, 1972 includes 19 taxa, of which 15 are described here. Ten from the South Island mountains are described as new: *M. alticola*, *M. clamitans*, *M. mangu gourlayi*, *M. m. multicostata*, *M. m. celer*, *M. nigra frigida*, *M. otagoensis otagoensis*, *M. o. maceweni*, *M. phaeoptera*, and *M. tenuis*. The distributions of most taxa are mapped, their songs are represented by sonograms, and their known periods of emergence are recorded. Evidence of hybridisation is unknown. Most species are characteristic of open, unforested sites; *M. nigra nigra* and *M. oromelaena* occur close to the summer snowline, a zone not known to be inhabited by cicadas elsewhere in the world.

### INTRODUCTION

The genus *Maoricicada* was proposed (Dugdale 1972) for nine species of New Zealand cicadas in the family Tibicinidae (Boulard 1976) distinguished from other New Zealand cicadas by the lack of dark pigment in the pterostigma, by the elongate aedeagus with dorsally unsclerotised endotheca, by predominantly dark body colour, and by black, grey, or golden pubescence. Their general appearance is illustrated in Fig. 1. In their acoustic behaviour (Fleming 1975)

species of *Maoricicada* are characterised by lack of an alarm call and by the structure of the pulse groups in their tymbal song. In most species the song consists of doublet pulse groups generally from both left and right tymbals in unison and generally "coherent" (in the sense of Fleming 1975); occasionally the repetition rate of clicks is increased by alternation of the left and right tymbals, or decreased by suppression of the out-click in doublet pulse groups.



**Fig. 1.** Live examples of alpine *Maoricicada* species, showing characteristic singing posture and shortened wings: (left) *M. m. mangu*, ♂, on bare soliflaxed soil, Porters Pass, MC, 21 Jan 1968; (right) *M. phaeoptera*, ♂, in subalpine vegetation, New Pass, Hawkdun Ra., MK, 10 Feb 1968.

*Photos: C. A. Fleming*

One species, *M. iolanthe* (Hudson), is characteristic of forested regions; another, *M. myersi* (Fleming), occurs on low-altitude rock fans in the North Island. *M. lindsayi* (Myers) lives on the loess-covered downlands of the north-eastern South Island. *M. hamiltoni* (Myers) and the type-species *M. campbelli* (Myers) both inhabit riverbeds and terraces in the South Island, but in the North Island the former is confined to riverbeds of southern Wellington and the latter is

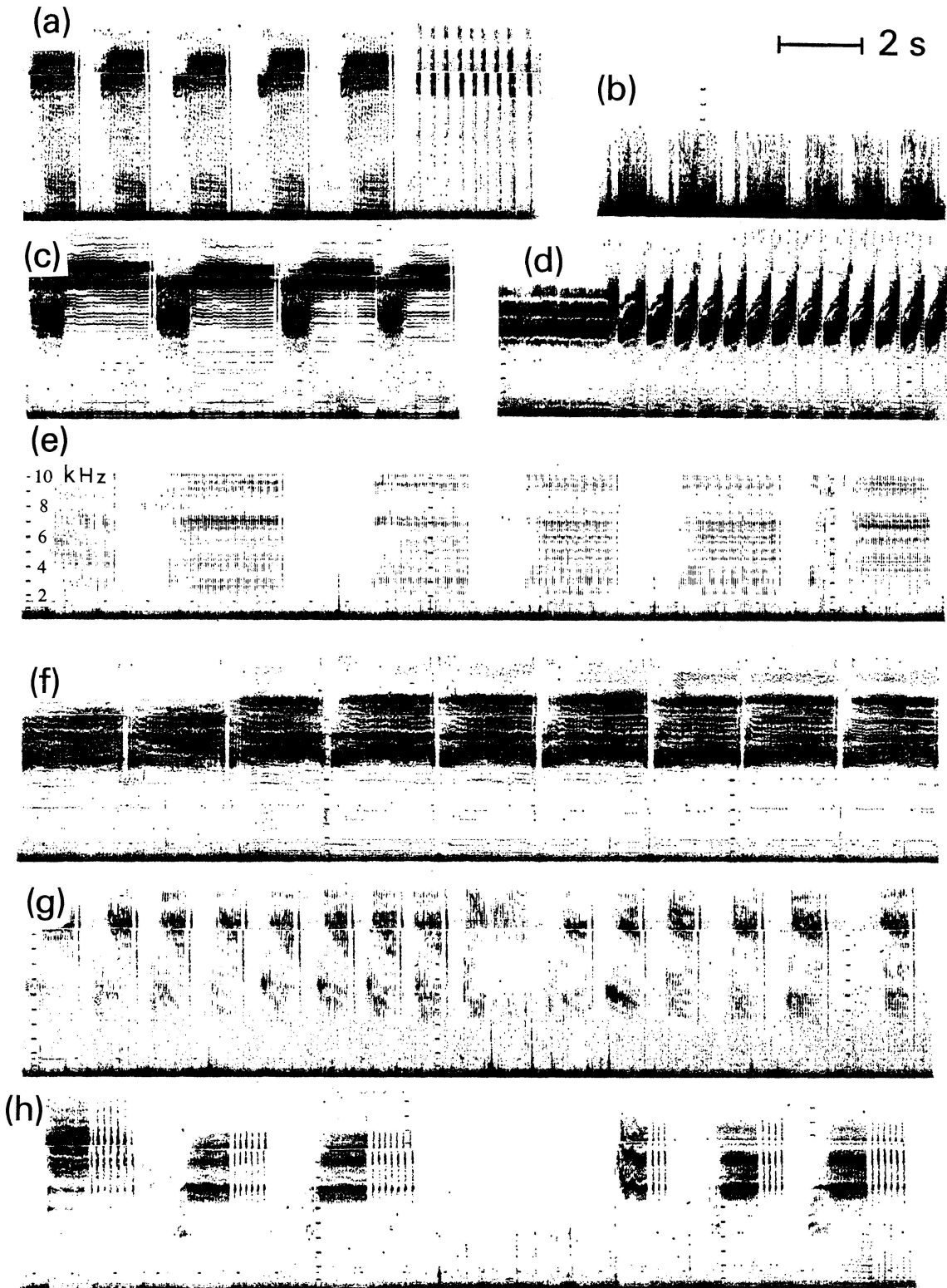
a glacial relict on subalpine lavas and ashes of the central volcanic plateau. *M. cassiope* (Hudson) lives on subalpine scrub in the south-central North Island and the northern half of the South Island. These species are characterised by the long, coiled aedeagus of the male. All the other species of *Maoricicada* have the aedeagus comparatively short and shallowly curved, and are confined to the South Island in subalpine scrub and grassland or in alpine meadow and

**Table 1.** Song characteristics of *Maoricicada* species and subspecies

TAXON	VOCALISATION	CLICK REPETITION RATE (clicks/s)	REMARKS
<i>campbelli</i>	'tut-tut-tut ... who-ó-ose dik? who-ó-ose dik?'	220-330	Repeated prefix ('tut'), main note ('whose'), suffix
<i>cassiope</i>	'crrr-eeee ..... crrr-eeee'	370-385	Upward modulation of main note linked to shrill suffix
<i>hamiltoni</i>	'peep-peep-peep-peep buzz peep buzz ....'	c.600 ('peep') c.240 ('buzz')	Abrupt frequency change makes 'buzz' seem a bass accompaniment
<i>iolanthe</i>	'tut-tut-es-me-rál-da-me-rál-da-ral-da'	300-360	Prefix ('tut, es') variable. Main note: 'rál'; wide spread of frequencies (Fleming 1971)
<i>lindsayi</i>	'tut-tut-tut-tut-who-o-o-o-s hit?'	c.200	Octuplet pulse groups in main note ('who's'). Distinctive harmonics (Fleming 1971)
<i>myersi</i>	'tut-who-o-o's hit it? who-o-o-s it hit it?'	c.150-240	2-3 suffixes distinctive
<i>alticola</i>	'switch-chit switch-chit ....'	c.400	Coherent doublets; more work needed
<i>clamitans</i>	'yodle-yodle-yodle-yodle ....'	up to >600	Accelerating doublets and later quadruplets in modulated rising phrase
<i>m. mangu</i>	'ah-ah-ah-ah-ah-ah-ah ..... taha' or 'hr-r-r-r-r-r-r ..... didid ....'	c.22	Guttural croak or rattle; main note retarded, suffix double
<i>m. multicostrata</i>			
<i>m. gourlayi</i>			
<i>m. celer</i>			
<i>n. nigra</i>	'er-chit-er-chit-er-chit-er-chit ....'	c.540 ('er')	Similar to above, but accelerated c. × 2
<i>n. frigida</i>	'zip-zip-zip-zip-eeze, zip-zip-zip .... ee-ee-eeze'	516 ('zip') 344 ('eeze')	Abrupt frequency change from repeated prefix to main note
<i>oromelaena</i>	'ee-ee-ee-ee-ee-ee-zip ....'	c.400	Long, quavering main notes with initial modulation, and short, high suffix
<i>o. otagoensis</i>	'ee-yer ee-yer-chick, ee-yer-chick ....'	200	Merging prefix and main note, generally with short, high suffix
<i>o. maceweni</i>			
<i>phaeoptera</i>	'ee yer-chup-chup-chup-chup ....'	<200 to >200	Accelerating click repetition rate in main note ('ee yer'); repeated suffix
<i>tenuis</i>	'ee-yer-chick, ee-yer-chick ....'	c.128 (?)	Cf. <i>otagoensis</i>

**Fig. 2** (opposite page). Sonogram records of songs of *Maoricicada* species (time and frequency scales are the same for all records). (a) *M. campbelli*: 5 'who's dik?' phrases followed by 9 'tut' notes (Hermitage). (b) *M. iolanthe*: 6 phrases, 3 with prefix, all with suffix (Miramar). (c) *M. cassiope*: 4 phrases, showing regular upward modulation of main note; suffix absent from 3rd phrase (Lewis Pass). (d) *M. clamitans*: part of preliminary 'warming up' phrase, followed by yodelling song of repeated, rapidly modulated phrases (Mackenzie Pass). (e) *M. mangu*: 6 phrases of rattle song of up to 40 low-frequency clicks; with suffix (absent in 3rd phrase) (Porters Pass). (f) *M. oromelaena*: 9 phrases, showing initial modulation of long main notes, increase of high frequencies with progress of song, and merging suffix; note lack of lower frequencies (Mt Sebastapol). (g) *M. otagoensis*: 15 phrases, each a main note and suffix (Coronet Peak). Song of *M. tenuis* is similar. (h) *M. phaeoptera*: 2 groups of 3 phrases, showing variable number of repeated suffixes (Hawkdun Ra.).





fellfield up to the summer snowline; the males commonly sing on screes and bare rock surfaces warmed by the sun. No species is known or suspected to occur outside the two main islands of New Zealand. The genus is thus endemic, and has speciated most extensively in the South Island mountains.

Under the generic name *Cicadetta*, Metcalfe (1963) published extensive synonymies for the named species of *Maoricicada*; some of Metcalfe's references lack nomenclatural significance, and are omitted from the species synonymies given below. Fleming (1971) redescribed *M. iolanthe*, *M. campbelli*, and *M. lindsayi*, and synonymies cited there are not repeated here; in the same paper he described *M. myersi*. All species were referred (temporarily) to *Cicadetta* auct., pending Dugdale's (1972) generic revision of New Zealand cicadas.

In this paper the abbreviation *M.* before a species name is freely used for *Maoricicada*, and has no other connotation. The taxa discussed are as follows.

- M. alticola* Dugdale & Fleming n.sp.
- M. campbelli* (Myers)
- M. cassiope* (Hudson)
- M. clamitans* Dugdale & Fleming n.sp.
- M. hamiltoni* (Myers)
- M. iolanthe* (Hudson)
- M. lindsayi* (Myers)
- M. mangu mangu* (White) n.stat.
- M. mangu celer* Dugdale & Fleming n.ssp.
- M. mangu gourlayi* Dugdale & Fleming n.ssp.
- M. mangu multicostata* Dugdale & Fleming n.ssp.
- M. myersi* (Fleming)
- M. nigra nigra* (Myers) n.stat.
- M. nigra frigida* Dugdale & Fleming n.ssp.
- M. oromelaena* (Myers)
- M. otagoensis otagoensis* Dugdale & Fleming n.sp., n.ssp.
- M. otagoensis maceweni* Dugdale & Fleming n.ssp.
- M. phaeoptera* Dugdale & Fleming n.sp.
- M. tenuis* Dugdale & Fleming n.sp.

Localities are arranged according to the area codes outlined in Crosby *et al.* (1976). Repositories of specimens (paratypes, if of new taxa) are abbreviated as follows. AM: Auckland Institute and Museum. BM: British Museum (Natural History), London. CM: Canterbury Museum, Christchurch. Ecol. Div.: Ecology Division, DSIR, Lower Hutt. ED: Entomology Division, DSIR, Mt Albert, Auckland. F: Fleming Collection, Wellington. GVH: Hudson Collection, National Museum, Wellington. NM: National Museum, Wellington. PMJ: P. M. Johns Collection, Zoology Department, University of Canterbury. TLG-T: T. L. Grant-Taylor Collection, Lower Hutt. Lane: David Lane Collection, Wellington. SC: Stuart Chambers Collection, Mangatarata, Hauraki Plains.

## ACOUSTIC BEHAVIOUR OF *Maoricicada* SPECIES

As with other Cicadidae, males of most species of *Maoricicada* differ in their tymbal songs; indeed four of the new taxa described here (*M. clamitans*, *M. mangu celer*, *M. otagoensis*, *M. phaeoptera*) were first distinguished by their unfamiliar songs.

*Maoricicada* species produce no alarm note. In free song the bucklings of the tymbals produce IN-OUT doublet pulse-groups, generally in unison (i.e., synchronised), which in most species are regularly repeated and 'coherent', the interval between doublets being equal to that between the IN and OUT clicks (Pringle 1954, Fleming 1975). In some species the frequency of the pulse can be altered to a limited extent during the production of a prolonged note, which is thus somewhat modulated. In *M. hamiltoni*, *M. nigra nigra*, and *M. n. frigida* (= *M. sp. F* of Fleming 1975), the song consists of alternating notes of two strongly contrasting frequencies. It has been suggested (Fleming 1975) that the high-frequency notes result from alternation of right and left tymbals in such a manner that a doublet from one tymbal is interposed between two doublets from the other, resulting in a coherent sequence with high click repetition rate, whereas in the low frequency notes the doublets are synchronised.

Most species of *Maoricicada* have in common a song pattern consisting of a prolonged main note generally uniform in frequency or only slightly modulated, with a staccato suffix and occasionally a prefix. The songs of individual species deviate from this basic pattern in several ways (Table 1, Fig. 2). Those species capable of producing two contrasting notes have very distinctive song patterns. Others may repeat the prefix or suffix or modulate the main note or differ in the characteristic frequencies and/or harmonics of the pulses or pulse-groups making up the main note (Fleming 1971). The distinctive songs of *Maoricicada* species are probably the best guide to identification in the field (Table 1).

Fleming (1971) used the term 'pulse frequency' incorrectly for the frequency of pulse groups, and since the pulse groups in the species there described consist of doublets, sextuplets, or octuplets, an appropriate correction has been made to obtain a figure for 'click repetition rate'. This correction has been applied to 'part 2' of the main note to obtain click repetition rates (Table 1). The repetition rates of the species mentioned by Fleming (1975, p. 52-7) were measured from sonograms made from tape recordings played at slow speed, and for other species were calculated from counts of clicks in timed intervals, monitored aurally from tape recordings played at one-thirty-second of the natural speed. Since the click repetition rate varies within one note (cf. Fleming 1971, fig. 13), the figures given are only

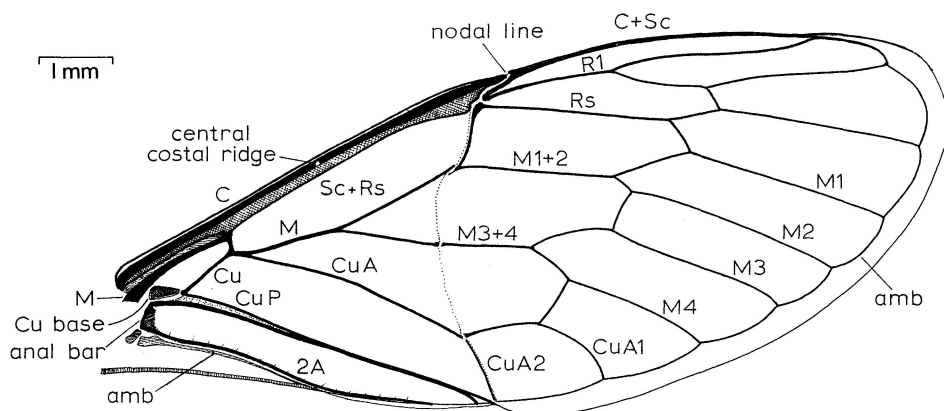


Fig. 3. Wing venation and terminology, *Maoricicada iolanthe*.

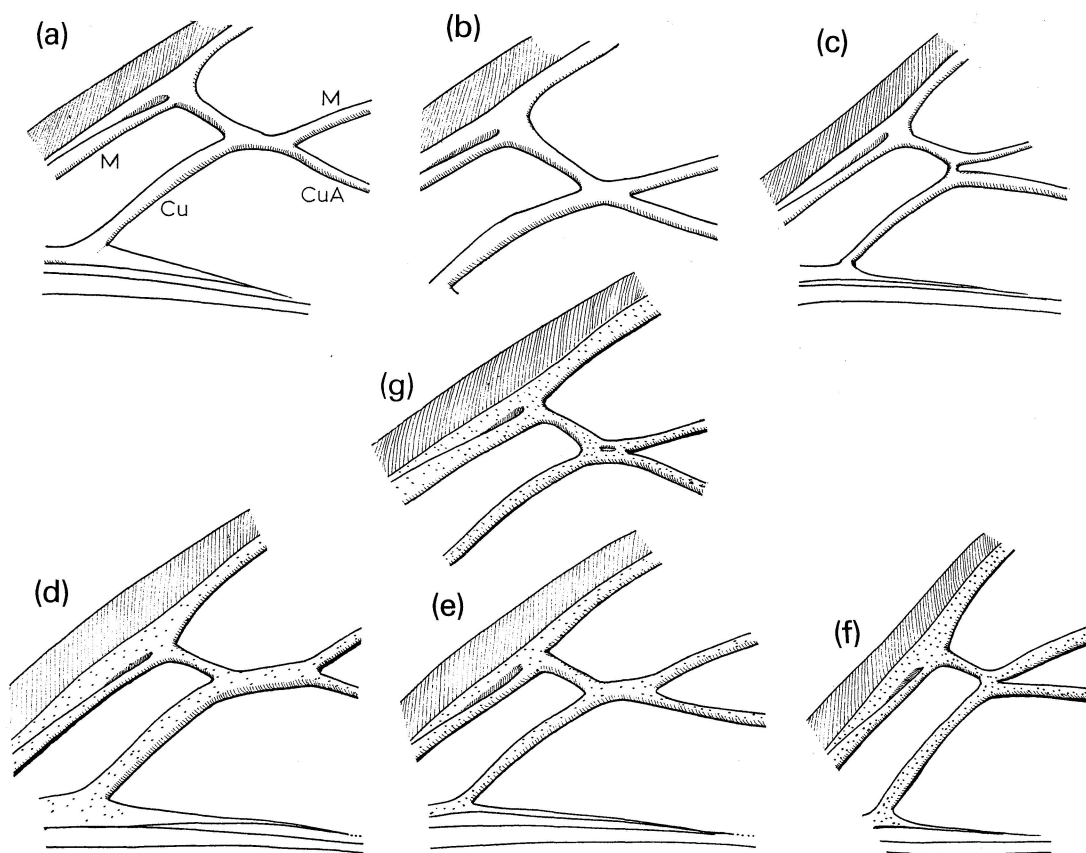


Fig. 4. Confluence states in basal portions of forewing veins M and Cu in (a-c) *Maoricicada nigra frigida* and (d-g) *M. phaeoptera*: a, d, long confluence; b, e, short confluence; c, f, veins connate; g, hollow confluence.

approximate. Indeed, the comparative acoustic behaviour of *Maoricada* deserves considerable further study.

## MORPHOLOGY

### VENATION (Fig. 3, 4)

Venation of the *Maoricada* forewing is annotated in Fig. 3. The absence of the 'insula', a pigmented zone in the hindwing anal lobe (Dugdale & Fleming 1969, fig. 2b), is diagnostic for *M. phaeoptera*.

In *M. nigra frigida* and *M. phaeoptera* the length of the confluence of veins M and Cu (at the base of the discal cell) varies, and for each taxon we distinguish three states of confluence.

#### *M. n. frigida*:

- (i) M-Cu confluence about as long as the oblique portion of M immediately preceding the M-Cu junction (Fig. 4a);
- (ii) M-Cu confluence shorter than the oblique portion of M, i.e., connate – contiguous at one point, divergent beyond (Fig. 4b);
- (iii) M-Cu confluence absent, M and Cu joined by a very short vertical bar (Fig. 4c), or this absent.

#### *M. phaeoptera*:

- (i) M-Cu confluence longer than, or as long as, the oblique portion of M (Fig. 4d);
- (ii) M-Cu confluence shorter than the oblique

portion of M (Fig. 4e);

- (iii) M and Cu connate (Fig. 4f), or separate.

In states (i) and (iii) of *M. phaeoptera* the confluence was 'hollow' in some specimens (Fig. 4g).

### ABDOMINAL STERNITE PIGMENTATION

*Maoricada* species vary greatly in sternite pigmentation, but males are consistently darker than females. Although in any large series of a species (even from one locality) the amount of black pigment varies: each species has a basic pattern common to most individuals which is useful for field identification. For instance, Craigieburn Range specimens of *M. mangu mangu* and *M. oromelaena* can be distinguished by sternite pattern, *M. oromelaena* having darker (though variable) sternites.

In the illustrations of abdominal patterns (see Fig 7, pp. 314–17) black areas are inked, corneous or pink areas are blank, and areas of intermediate tone are shaded. No attempt was made to draw the limb as though they were symmetrical, or to represent the tomentum. Although it is not possible to figure the full range of individual variation, the illustration given should assist in identification.

### GENITALIA

Terminology for genital structures follows that in Dugdale & Fleming (1969, p. 935–6) and Dugdale

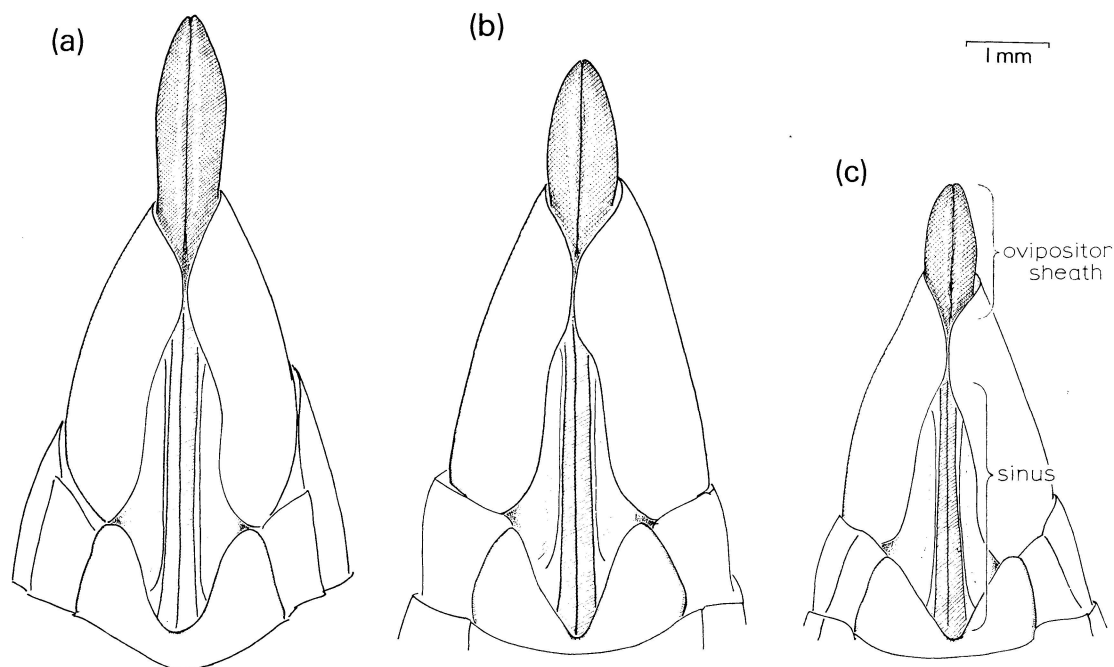


Fig. 5. Ventral view of ♀ pygophore, *Maoricada* spp., showing relative lengths of ovipositor sheaths and sinus: (a) *M. phaeoptera*, Sentinel Peak; (b) *M. tenuis*, Turk Ridge; (c) *M. nigra*, Sealy Ra.



(1972, p. 857-9), and is illustrated in Fig. 8f, 9a,d,e, and 11l. A new term, 'sinus' (Fig. 5), is proposed for the area bounded anteriorly by sternite VII, laterally by the ventral edges of the pygophore, and posteriorly by the zone where the ventral margins of the pygophore meet. Within the sinus lie the shafts of the ovipositor, flanked by the gonocoxites (valvifers). The length of the sinus relative to the length of the ovipositor sheaths (which project beyond the pygophore caudally) is useful in distinguishing females of *M. phaeoptera* from similar infuscated-winged females of other species.

#### DIMENSIONS

All measurements presented in the species descriptions are in millimetres, unless otherwise noted. Where appropriate, the range of measurements is followed by the mean in parentheses.

#### KEY TO *Maoricicada* SPECIES

1. Sternites lacking long erect setulae; a conspicuous, dense band of long, whitish-grey setulae below lateral flange of pronotum; forewing veins with numerous scale-like silver setulae. Black, somewhat fusiform cicadas with a distinctive grey pruinosity; length 14-16 mm\*. Wellington, and South Island south to Canterbury ..... *M. hamiltoni*  
 —Sternites with long and short erect setulae; no conspicuous band of whitish-grey setulae below lateral pronotal flange, many setulae dark ..... 2
2. Forewing costa red or pale beyond nodal line, central costal ridge before nodal line lacking stout black setae (some pale setae in *M. lindsayi*); vein 2A usually with short erect setulae (these long in *M. cassiope*); ♂ - aedeagus longer than pygophore, coiled, phallobase (gonocoxite IX, Fig. 9a) hidden in repose; ♀ - ovipore tube shorter than vagina, copulatory tube not angled at carrefour (Fig. 11a) ..... 3  
 —Forewing costa blackish beyond nodal line (partly red in some *M. clamitans*), central costal ridge usually with stout black setae; vein 2A with long erect setulae; ♂ - aedeagus not as long as pygophore (Fig. 9f), straight or gently curved, gonocoxite IX visible in repose; ♀ - ovipore tube as long as vagina, copulatory tube at an angle to carrefour (Fig. 11c) ..... 7
3. Length over 17 mm, usually 18-20 mm; robust black, olive-green, and red cicadas with pronotum red-trimmed, tergites red-margined caudally, forewing costa dark red; Cu base and vein 2A with long black setulae, membrane at costa base yellowish-orange; antennal ledge with dense tuft of stiff, erect black setulae. Central North Island, northern South Island to South Canterbury ..... *M. cassiope*  
 —Length under 15 mm, usually 12-14 mm; Cu base nude or with short setulae; vein 2A with short setulae; basal costal membrane green or pallid; antennal ledge lacking dense tuft of black setulae ..... 4
4. Forewing with Cu base and anal bar nude; ♂ - opercula roseate, aedeagus slender apically; ♀ - abdomen abruptly narrowed at midlength. Lowland-upland, North Island ..... *M. iolanthe*  
 —Forewing with Cu base and anal bar setulose; ♂ - opercula pallid or blackish; ♀ - aedeagus either slender or thick and deflexed apically; abdomen uniformly tapering ..... 5
5. Forewing costa entirely red, other veins red from base to near apical forks; abdomen with dorsal and lateral patches of silver setulae; ♂ - aedeagus with apex slender; ♀ - abdominal tergites with caudal margins red. Central North Island, widespread in South Island ..... *M. campbelli*  
 —Forewing costa pallid; abdomen lacking conspicuous patches of silver setulae; ♂ - aedeagus with apex deflexed, thickened; ♀ - abdominal tergites not red caudally ..... 6
6. Body 'dusted' with appressed yellowish-grey scales, opercula pallid; Cu base and anal bar with pale setulae; ♀ lacking black setae on pygophore; length 12-14 mm. North Canterbury - Marlborough, South Island ..... *M. lindsayi*  
 —Body with dark grey scales, opercula blackish; Cu base and anal bar with black setulae; ♀ with black setae on pygophore; length 13-15 mm. Around Orongorongo Valley, North Island ..... *M. myersi*
7. Wings brown-tinted, veins bordered with black; ♀ - pygophore narrowly triangular in dorsal view, basal depression broad, rarely exposed; ovipositor sheaths protruding about 0.4 × dorsal length of pygophore ..... 8  
 —Wings hyaline; ♀ pygophore stout, basal depression narrow, exposed; ovipositor sheaths protruding less than 0.2 × dorsal length of pygophore ..... 12
8. Wing vein setulae black; ♂ - pseudoparameres longer than aedeagus ..... 9  
 —Wing vein setulae pallid; ♂ - pseudoparameres shorter than aedeagus ..... 11
9. Length over 18 mm; ♂ with 4 long tymbal ridges, dorsal ridge interrupted centrally (Fig. 12e); pseudoparameres wider than aedeagus (Fig. 9i); gonapophyses VIII with 21 teeth; forewing vein M with fine setulae basally. Restricted to Crimea Range, Marlborough ..... *M. alticola*  
 —Length under 17 mm; ♂ with 2 long and 2 short tymbal ridges (Fig. 12h); pseudoparameres not wider than aedeagus; gonapophyses VIII with 14-15 teeth; forewing vein M with stout setulae basally; (*M. nigra* complex) ..... 10
10. ♂ - fore and mid coxae black, sternites and opercula usually black; ♀ - 1st antennal segment dark; pygophore with black setae ventrally (Mt Niger specimens with pallid setae). Spenser Mountains to Fiordland ..... *M. nigra nigra*  
 —♂ - fore and mid coxae, sternites, and opercula with broadly pallid margins; ♀ - 1st antennal segment pallid, pygophore with pallid setae ventrally. Central Otago ranges ..... *M. nigra frigida*

\*Length ranges cover both sexes.

11. ♂ - pseudoparameres arising laterally, strongly sclerotised, as wide as shaft; ♀ - ovipositor sheath only slightly shorter than sinus (Fig. 5a); forewing costa with all setae pallid; genital scale with transverse grooves basally (Fig. 11k); hindwing lacking insula. Mackenzie Basin south to Dunstan Range ..... *M. phaeoptera*
- ♂ - pseudoparameres arising ventrolaterally, unsclerotised, narrower than shaft; ♀ - ovipositor sheath about half as long as sinus (Fig. 5b); forewing costa with dark setae, usually some black; genital scale smooth dorsally (Fig. 11j); hindwing with insula. Nelson to western Marlborough ..... *M. tenuis*
12. Forewing costa pale or dark olive (occasionally pink) with many stout black setae basally (tending pallid in northern low-rainfall localities); 2nd antennal segment with black setulae ventrally, and 1 prominent black setula dorsally; ♂ - sternites black, opercula distally pale; ♀ robust, sternites greyish-green, often with narrow, transverse dark bar. Travers Range to Fiordland ..... *M. oromelaena*
- Forewing costa red, pink, or pale basally, costal setae concolorous (sometimes a few black setae); 2nd antennal segment with setae pale or brownish; both sexes with sternites yellowish, or pink, or roseate, with or without dark patches ..... 13
13. ♂ - pronotum olive or pinkish-olive around clefts; long tymbal ridges free apically; ♂ - pygophore inner lobe (Fig. 8c) not projecting, lower lobe stout; sternites immaculate (sternite VI sometimes dark apically); aedeagus swollen basally (Fig. 9f); forewing costa and posterior margins of abdominal tergites red in more northern specimens; genital scale smooth dorsally; pygophore with numerous black setulae laterally. South Canterbury to Central Otago ..... *M. clamitans*
- ♂ - pronotum entirely black or with pallid median flecks at posterior margin; long tymbal ridges usually fused apically; pygophore inner lobe projecting, lower lobe finger-like apically; sternites, particularly sternite VI, centrally blackened; aedeagus not basally swollen; ♀ - genital scale with deep transverse grooves dorsally; pygophore with pallid lateral setae, sometimes with a few black setae ..... 14
14. ♂ - aedeagus with apex smooth ventrally; pseudoparameres arising ventrolaterally, basally curved (Fig. 9j); ♀ - clypeus largely black, narrowly pallid on margins; copulatory tube (Fig. 11e) straight or bowed, never angulated; (*M. mangu* complex) ..... 15
- ♂ - aedeagus with apex granulate ventrally; pseudoparameres arising subdorsally, basally not curved (Fig. 9d); ♀ - clypeus broadly pallid, with a central black spot (more extensive in Takitimu specimens); copulatory tube angulate (Fig. 11i); (*M. otagoensis* complex) ..... 18
15. ♂ - pseudoparameres narrower and shorter than aedeagus, weakly sclerotised (Fig. 9k); tymbal deeply folded (Fig. 12l), with 4 ridges (3 fused apically). Bryant and Travers Ranges, Nelson ..... *M. mangu gourlayi*
- ♂ - pseudoparameres as long and as stout as aedeagus, strongly sclerotised; tymbal not deeply folded, with 4-8 ridges (4-5 fused apically, northern; 2-3 fused apically, southern). Marlborough to Mackenzie Basin ..... 1
16. ♂ - forewing with M-stem bearing black setula basally; tergite VIII entirely black; ♀ - sternite extensively dark, vestigial opercula black, margins narrowly pallid. Restricted to Crime Range, Marlborough ..... *M. mangu cele*
- ♂ - forewing with M-stem bearing pallid setula basally; tergite VIII pink or fawn laterally; ♀ - sternites pallid, or each with a small median dark spot; vestigial opercula largely pallid ..... 1
17. Tymbals with 4-5 ridges fused apically. Marlborough ..... *M. mangu multicostata*
- Tymbals with 2-3 ridges fused apically. Canterbury ..... *M. mangu manganui*
18. ♂ - 2 long tymbal ridges fused apically (Fig. 12d); sternites often roseate, narrowly darkened mesally, or with a basal spot; ♀ - forewing with M-stem bearing pale setulae, Wanaka area to Garvie Range ..... *M. otagoensis otagoensis*
- ♂ - all long tymbal ridges free; sternite broadly dark, margined in fawn; ♀ - forewing with M-stem bearing black setulae basally. Restricted to Takitimu Range ..... *M. otagoensis maceweni*

## SPECIES DESCRIPTIONS

- A. Species with the aedeagus longer than the pygophore and coiled in repose (*M. campbelli*, *M. cassiope*, *M. hamiltoni*, *M. iolanthe*, *M. lindsayi*, *M. myersi*).

*Maoricicada campbelli* (Myers, 1923) (Fig. 2a 7A)

1971 *Cicadetta campbelli* (Myers); Fleming, N.Z. Journal of Science 14(3): 445-9, fig. 1, 5a, 6a-d, 10a.g, 11a.f (with synonymy).

1972 *Maoricicada campbelli* (Myers); Dugdale, N.Z. Journal of Science 14(4): 876, fig. 2, 29-31 (as type-species of genus).

Fleming (1971) summarised what was known of variation, tymbal structure, dimensions, genitalia nymph, distribution, and song. Dugdale (1972), in proposing the genus *Maoricicada* with *M. campbelli* as type-species, illustrated the tymbal and genitalia. This information is omitted here, but a sonogram is given (Fig. 2a), the sternite pattern is shown (Fig. 7A), and new locality records are listed.

NEW LOCALITY RECORDS (all South I.). NN. Cobb Reservoir (Lane). MB. Saxton R. (F). SC. Waimate 450 m (P. Child). OL. Makarora (F). Ruth Flat, E Matukituki Vly (F). FD. Divide, Milford Road (F).

*Maoricicada cassiope* (Hudson) (Fig. 2c, 6a, 7A, 8a, 9a, 10a, 11ab, 12a, 13A)

1891 *Cicada cassiope* Hudson, Transactions N.Z. Institute 23: 54.

- 1892 *Melampsalta nervosa*; Distant, Annals & Magazine of Natural History (6)9: 327 (not of Walker, 1850; *cassiope* as synonym) [error].
- 1893 *Melampsalta nervosa*; Hudson, Transactions N.Z. Institute 25: 163 (not of Walker, 1850; *cassiope* as synonym) [error].
- 1896 *Melampsalta cassiope*; Kirby, Transactions N.Z. Institute 28: 457.
- 1898 *Melampsalta cassiope*; Hutton, Transactions N.Z. Institute 30: 184.
- 1904 *Melampsalta cassiope*; Hutton, Index Faunae N.Z.: 224.
- 1906 *Melampsalta quadricincta*; Distant, Synonymic Catalogue of Homoptera I, Cicadidae: 171 (not of Walker, 1850; *cassiope* as synonym) [error].
- 1907 *Cicadetta cassiope*; Kirkaldy, Annales Société entomologique de Belgique 51: 308.
- 1909 *Cicadetta cassiope*; Kirkaldy, Transactions N.Z. Institute 41: 27 ("? *nervosa* Walker").
- 1921 *Melampsalta quadricincta*; Myers, Transactions N.Z. Institute 53: 246, pl. 45 fig. 3, 4 (not of Walker 1850; *cassiope* as synonym) [error].
- 1926 *Melampsalta cassiope*; Myers, Psyche (Cambridge, Massachusetts) 33(3): 72, pl. 3 fig. 14 (♂ genitalia).
- 1927 *Melampsalta cassiope*; Myers, Transactions N.Z. Institute 57: 688.
- 1929 *Melampsalta cassiope*; Myers, Transactions Royal Entomological Society of London 77: 48–50, 54, fig. 24, 45.
- 1929 *Melampsalta cassiope*; Myers, "Insect Singers": 129, 142, 229, fig. 112 (*quadricincta* sensu Myers as synonym).
- 1950 *Melampsalta cassiope*; Hudson, "Fragments N.Z. Entomology": 142, pl. 26 fig. 3, 4.
- 1966 *Melampsalta cassiope*; Fleming & Ordish, Records Dominion Museum (Wellington, N.Z.) 5(20): 198 (lectotype designated).
- 1971 *Maoricicada cassiope*; Dugdale, N.Z. Journal of Science 14(4): 876.

TYPE MATERIAL. Lectotype ♂ (designated Fleming & Ordish 1966): "Dun Mountain, Nelson Feb. 1885, G.V. Hudson" (NM).

DESCRIPTION. See Hudson (1950). Eyes projecting (Fig. 6a). Antennal ledge with a dense tuft of black setulae. Ground colour of pronotum, mesonotum, and legs dull brick-red (♂) tending dark olive (♀); markings black. Forewing costa pinkish-olive to red; basal costal membrane bright orange, axillary membrane greyish-white; veins Cu and 2A bearing long, black setulae. Abdomen in ♂ short, abruptly tapered caudally. Abdominal tergites black, their caudal margins pink or dull brick red (♂) or pinkish-olive (♀); tergite VIII in ♂ black basally, broadly reddish apically. Sternites marbled, purplish (♂) or pinkish, slightly marbled (♀) (Fig. 7A), in both sexes with a mesal series of black wedges. Pygophore (♀) pinkish-red with subdorsal black stripes. Whole abdomen 'frosted' with conspicuous silvery setulae.

DIMENSIONS: ♂ – length 15.0–20.0(19.4), wing spread 35.0–44.0(39.3) ( $n=99$ ); ♀ – length 19.0–

23.0(21.2), wing spread 39.5–50.0(44.5) ( $n=28$ ).

GENITALIA. MALE: pygophore beak narrow, acuminate (Fig. 8a); aedeagus slender, coiled in repose, its apex slender, acuminate; pseudoparameres (Fig. 9a) arising laterally, about  $0.8\times$  as long as endotheca. FEMALE: genital scale (Fig. 10a) barrel-shaped, with quadrangular basal 'wings'; copulatory tube sinuous, often deflected; vulval lamella (Fig. 11a) irregularly sclerotised.

TYMBALS with 4 ridges, 2 long, 1 interrupted, 1 short; basal dome with apical appendage (Fig. 12a).

SONG "... extremely low – a short muffled rasp, followed by a faint shrill hiss about one and a half times as long as the rasp" (Hudson, in Myers 1921), piercing; end phrase high-pitched, vocalised as 'crrr-eeeeee ... crrr-eeeeee ...'. Song structure (see Fig. 2c) apparently formed by synchronised coherent doublets, click repetition rate about 375/s (Fleming 1975).

DISTRIBUTION (Fig. 13A). North Island: volcanic mountains of Tongariro National Park and adjacent pumice-coated areas of Kaimanawa and northern Ruahine Ranges. South Island: Marlborough, Nelson, Canterbury, and Westland, south to Mt Alford (Canterbury) and Otira (Westland).

LOCALITIES (lectotype, 150 ♂♂, and 50 ♀♀ examined). NORTH I. **TO.** Bruce Road, Scoria Flats (NM). Whakapapa Village (F). Turoa, Ohakune Mtn Road (ED, F). Iwikau Village (F). Mangatepopo Hut and Vly (F, AM). Above Soda Springs, Ngauruhoe (F). Keketahi Track (F). Mt Ruapehu, up to 1760 m (NM, F, BM). Silica Springs (ED). Above Inglis Bush, W Kaimanawa Mtns, 1340 m (ED). **RI.** Purity Ridge, W Ruahine Ra. (ED). [No records for Tararua Ra., WN.]

SOUTH I. **SD.** Port Underwood Saddle, 460 m (ED, F). **NN.** Third House, Dun Track, 670 m (ED). Roding and Miner Vlys (F). Beeby's Knob (F, ED). Asbestos Creek, Upper Takaka Vly (F). Cobb Ridge (F). Iron Hill, Iron Lake, L. Sylvester (F, ED). L. Sylvester Track, 1160 m (ED). Mt Arthur (BM); Tableland (NM); Balloon Hut (F). Mt Peel [Tasman Mtns], 910–1520 m (F, ED, AM, NM). Mt Flanagan (F). Mt Patriarch (F). Mt Domett (nymphs; ED). Hope Saddle (ED). Mt Alexander and Stockton Plateau (F, ED). Denniston Hill (ED). Mt Owen (ED). **NN/MB.** Mt Rintoul, 1520 m (F). Dun Mtn (**type loc.**) (NM, ED, BM). **MB.** Altmarlock, Black Birch Ra. (F, ED). Upper Waiau (F). Jack's Pass, Hammer (F, ED). **MB/BR.** St Arnaud Ra. (ED). **KA.** Tapuaenuku, 910–1200 m (GVH). Hodder R. (TLG-T). Tarahaka and Mt Fyffe, Seaward Kaimour Ra. (F, ED). **BR.** Mt Murchison, 1220 m (ED). Cupola Basin, Travers Ra. (F). Victoria Ra. – S end, 1200 m (F, ED); Garvie Crk coalmine. (ED). Lucretia Ridge and Lewis Pass (F, ED). Mt Trovatore (F, PMJ). Paparoa Ra. – Mt Dewar, Lochnagar Ridge, 1300 m (reared; ED); Sewell Peak (F). Mt Ryall (F). **NC.** Mt Blowhard, Puketeraki Ra. (CM). Arthurs Pass (F). Temple Basin (F, ED, BM). Mt Blimit (NM). **MC.** Mt Betwixt, Cass (NM). Fog Peak, Torlesse Ra. (CM, F). Porters Pass (F, ED). L. Lyndon, and L. Lyndon – L. Coleridge rd (F). Mt Hutt (F). Alford Radio Stn, Mt Alford Ra. (F).

**HABITAT.** Alpine and subalpine scrublands developed near the bushline (upper limit of forest) and up to 1500 m (South I.) or 1700 m (North I.), and in scrublands below bushline on exposed saddles, swampy areas, soils on ultramafic rocks (e.g., Dun Mountain), or areas modified by fire, down to 450 m (e.g., Port Underwood) or 360 m (e.g., Roding River, Lewis Pass, Garvie Creek); adults also in forest canopy 200 m below bushline (e.g., Lewis Pass). Usually found singing on *Dracophyllum* (*Oreothamnus*) species, but these are absent from some localities (e.g., Hope Saddle, Port Underwood Saddle).

**EMERGENCE PERIOD** 5 December (Miner River, Nelson) to 17 April (Balloon Hill) or 5 May (Porter River). Most records are for January and February; about 25% are for March, and about 15% for April-May.

**REMARKS.** The early descriptions of this species included material of species such as *M. mangu* and *M. oromelaena* from Mt Earnslaw, Lake Harris, Wakatipu, etc., well south of the range of *M. cassiope*; Hudson's collection at the National Museum still has these catalogued under *M. cassiope* [No. 25 in Hudson's catalogue].

Hudson's original description was restricted to specimens from mountains in Nelson and Marlborough, and failed to mention the characteristic reddish coloration conspicuous in this species on forewing costa, pygophore, mesonotum, and abdominal tergites. His statement that it "delights to bask in the hot sunshine amongst the rocks and shingle of the mountain tops" suits *M. mangu* and *M. oromelaena* better than *M. cassiope*. On the other hand, Hudson considered (as we do) that *M. iolanthe* is closely related to the much larger *M. cassiope*; they are similar in shape, coloration—cf. Fig. 7A and fig. 2 in Fleming (1971)—and some genital characters.

For Myers's (1921) revision Hudson supplied a better description mentioning the tawny or reddish abdominal margins. Later Myers (1926), recognising five alpine black cicadas, confirmed the 1921 figures and description as applying correctly to *M. cassiope*, and that "a strong pinkish suffusion of the body is a constant character". This character, accentuated in old specimens, is shared with *M. iolanthe*.

We emphasise that the lectotype collected on Dun Mountain in 1885 (Fleming & Ordish 1966) was catalogued as *Melampsalta cassiope* by Hudson before it was transferred to the National Museum collection, so that the name *cassiope* has not been transferred to a species different from Hudson's original intent, but has been restricted.

*M. cassiope* could be confused with *M. clamitans*, described below; the two species are geographically separated, but occupy similar niches in their respec-

tive ranges. *M. cassiope* differs from *M. clamitans* in the shape of the male's abdomen, and in the colour pattern of tergite VIII of both sexes (cf. Fig. 7A and 7B).

The southernmost recorded locality of *M. cassiope* is Mt Alford, north of the Ashburton River.

***Maoricicada hamiltoni* Myers (Fig. 6b, 7A, 8b 9b, 11b, 12b, 13B)**

1926 *Melampsalta hamiltoni* Myers, Psyche (Cambridge, Massachusetts) 33(3): 71.

1927 *Melampsalta hamiltoni*; Hudson, Transactions, N.Z. Institute 58: 74.

1929 *Melampsalta hamiltoni*; Myers, "Insect Singers": 129, 148, 167, 226, text-fig. 106.

1929 *Melampsalta hamiltoni*; Myers, Transactions Entomological Society of London 77: 31, 33, 38, 43, 45, 48–50, 52, 54, 56, pl. 2, fig. 21, pl. 4, fig. 42.

1950 *Melampsalta hamiltoni*; Hudson, "Fragments of N.Z. Entomology": 145, pl. 15, figs 7, 8.

1967 *Melampsalta hamiltoni*; Fleming, N.Z. Entomologist 3(5): 17.

1971 *Melampsalta hamiltoni*; Fleming, N.Z. Journal of Science 14(3): 444.

1972 *Maoricicada hamiltoni*; Dugdale, N.Z. Journal of Science 14(4): 876.

**TYPE MATERIAL.** Holotype ♂: "Otira [Otira River at Otira, Westland], 2/11/22" (BM).

**DESCRIPTION.** See Myers (1926) and Hudson (1950, pl. 15 fig. 8, 9). Head, thorax, and abdomen dark grey; ♀ with greyish-white vestiture, thus appearing paler grey than ♂. Pronotal flange, posterior margin of pronotum (occasional specimens), posterior edge of mesonotum, and posterior margins of tergites III–V dull orange. Tymbals pallid. Thoracic pleurites with a conspicuous band of dense, white setulae which extend well beyond body outline. Opercula black to dusky fawn. Abdomen in both sexes characteristically cigar-shaped (Fig. 6b), almost parallel-sided anteriorly, abruptly attenuated to the sharply keeled pygophore. Abdominal sternites evenly clad in appressed silvery setulae (long, erect setulae absent), largely dull orange or fawn (North I.) or extensively dark grey (South I.), with dark grey median line and lateral blotches (Fig. 7A).

**DIMENSIONS:** ♂ – length 14.0–17.5(15.6), wing spread 28.5–37.0(33.0) ( $n=28$ ); ♀ – length 14.0–16.0(15.2), wing spread 33.0–37.0(34.7) ( $n=6$ ). The largest specimens are southern, the smallest northern, but there is much overlap.

**GENITALIA. MALE:** pygophore beak broadly triangular, with black setae apically and (sometimes) laterally; upper lobe of pygophore (Fig. 8b) usually with black setae basally; aedeagus (Fig. 9b) slender, pseudoparameres arising ventrolaterally, slender, almost as long as endotheca, aciculate apically, endotheca apex scarcely expanded, weakly decurved.

(Continued on p. 312)



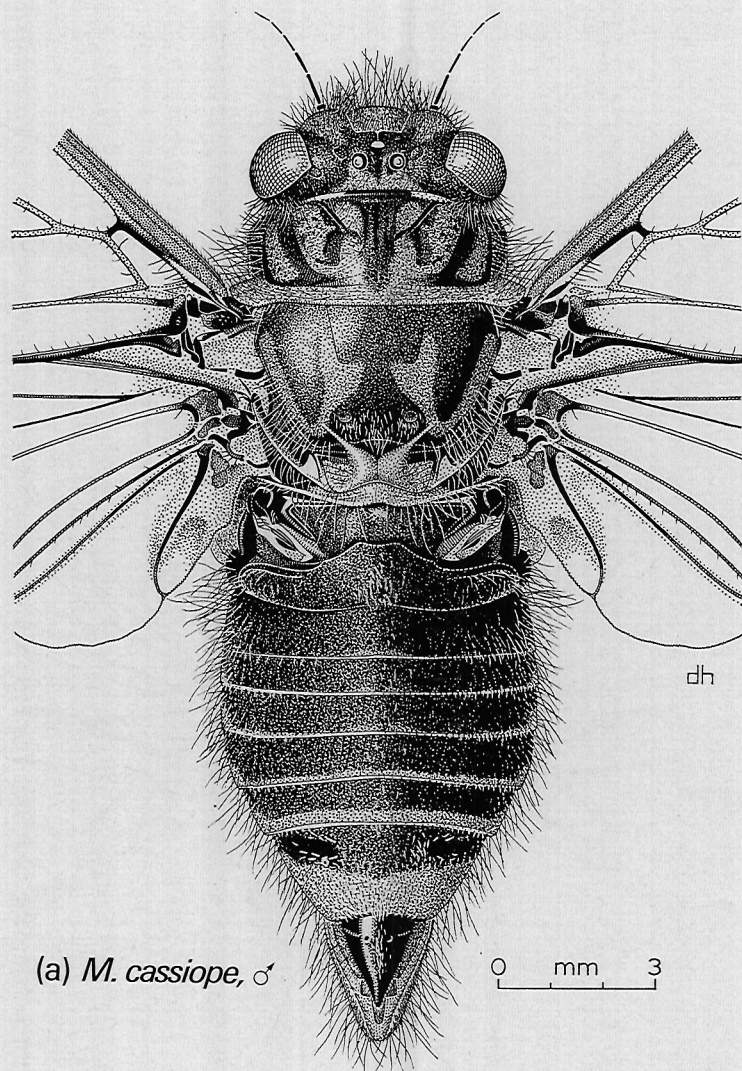
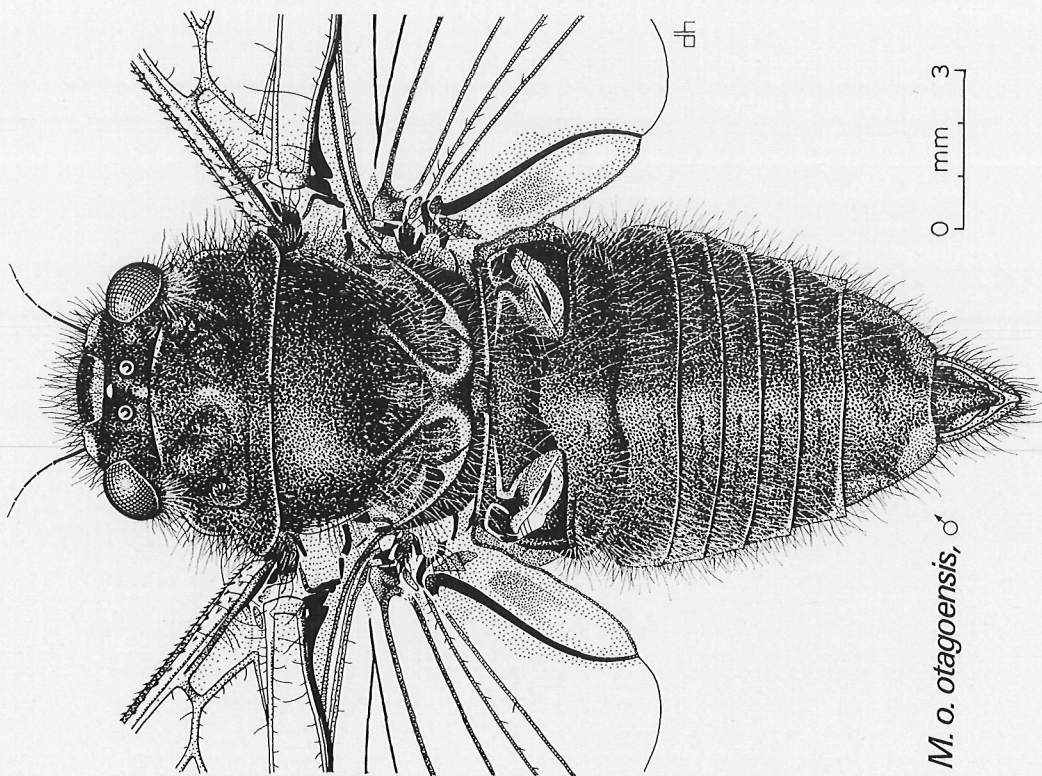
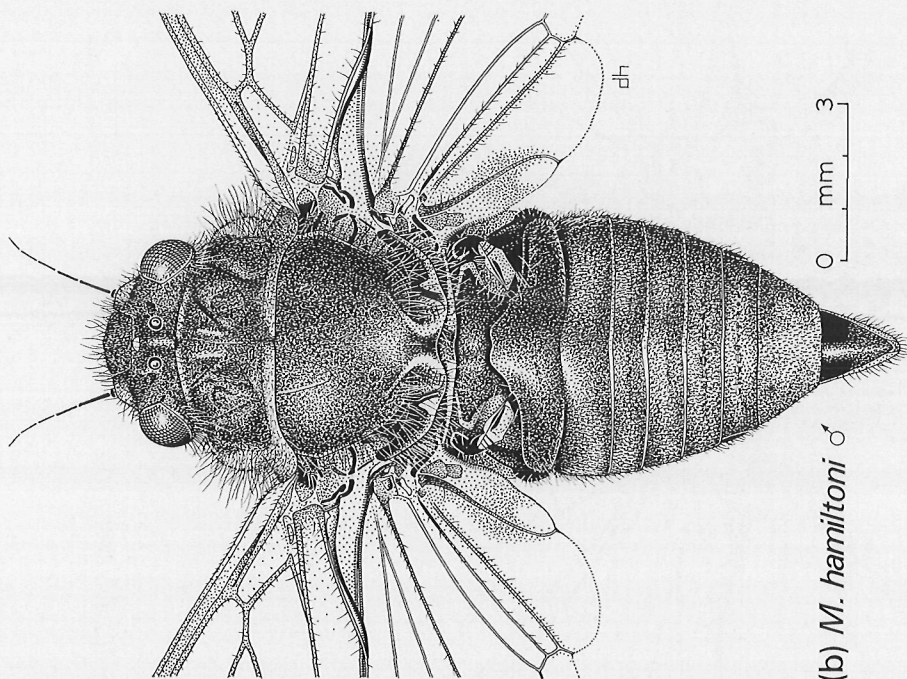


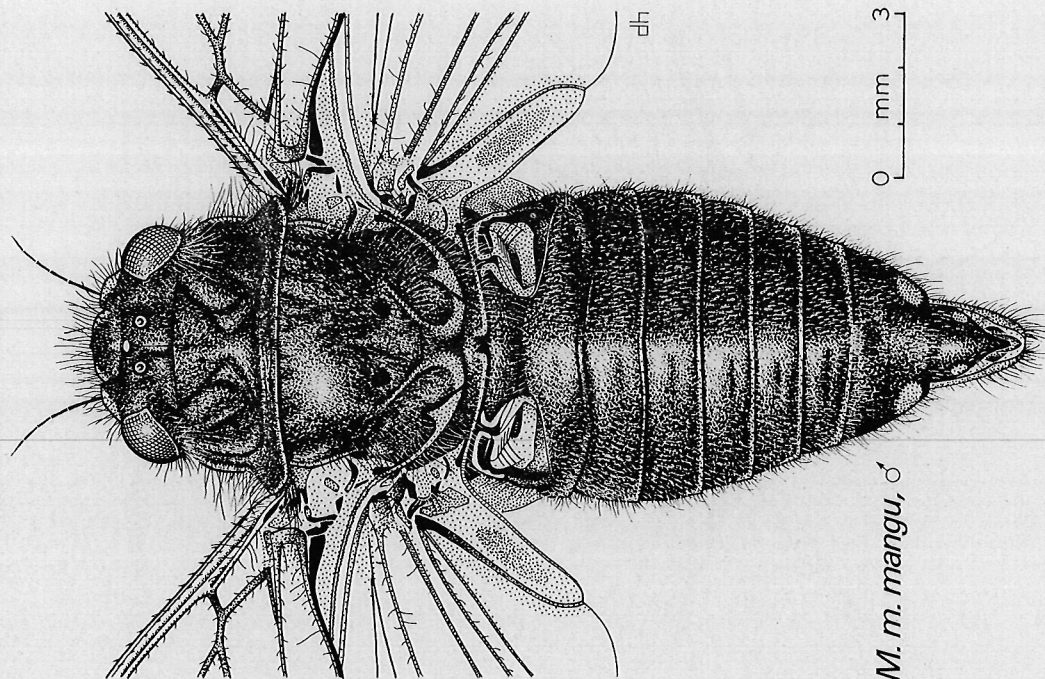
Fig. 6 (pp. 305–11). Dorsal views, *Maoricicada* spp: (a) *M. cassiope*, ♂; (b) *M. hamiltoni*, ♂; (c) *M. o. otagoensis*, ♂, Coronet Peak; (d) *M. clamitans*, ♂, Mackenzie Pass; (e) *M. m. mangu*, ♂, Porters Pass; (f) *M. oromelaena*, ♂; (g) *M. oromelaena*, ♂, Turk Ridge; (h) *M. oromelaena*, ♀; (i) *M. alticola*, ♂, Turk Ridge; (j) *M. n. nigra*, ♂, Arthurs Pass; (k) *M. n. frigida*, ♂, Old Man Ra.; (l) *M. phaeoptera*, ♂; (m) *M. tenuis*, ♂, Island Pass.



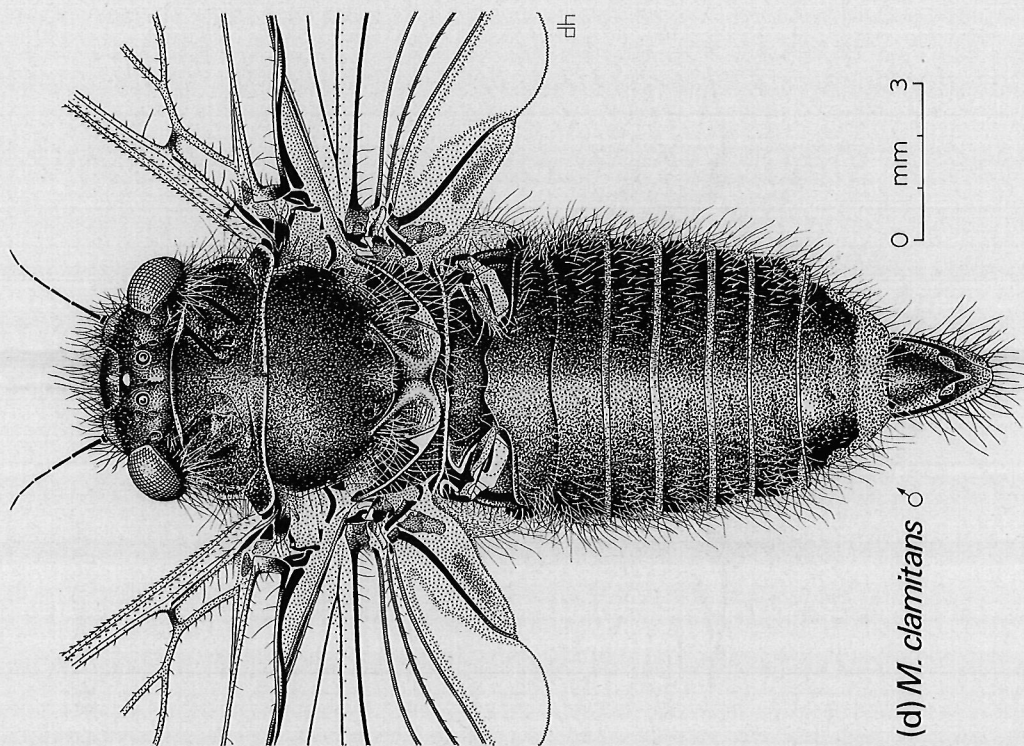
(c) *M. o. otagoensis*, ♂



(b) *M. hamiltoni* ♂

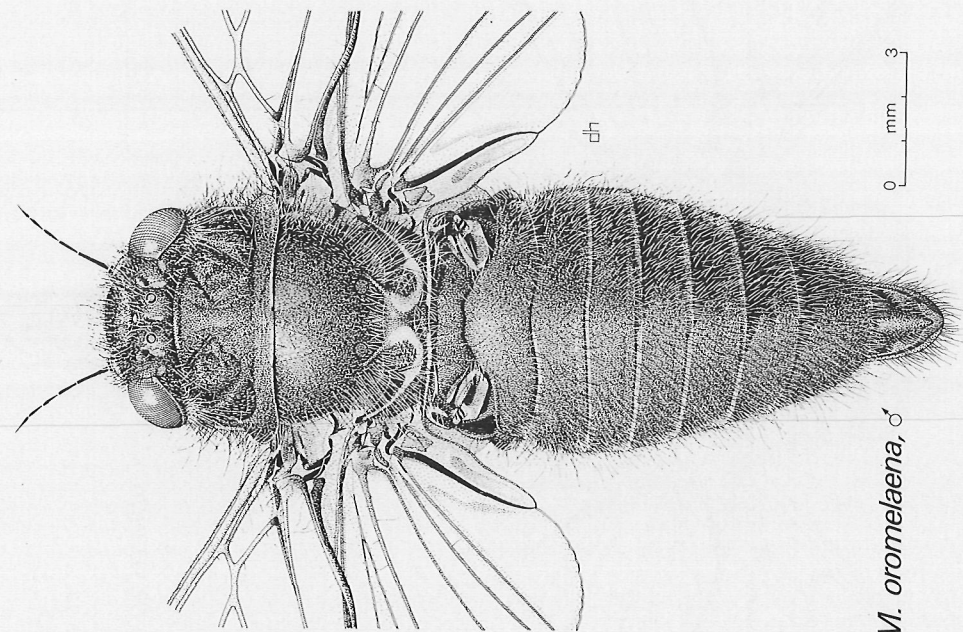
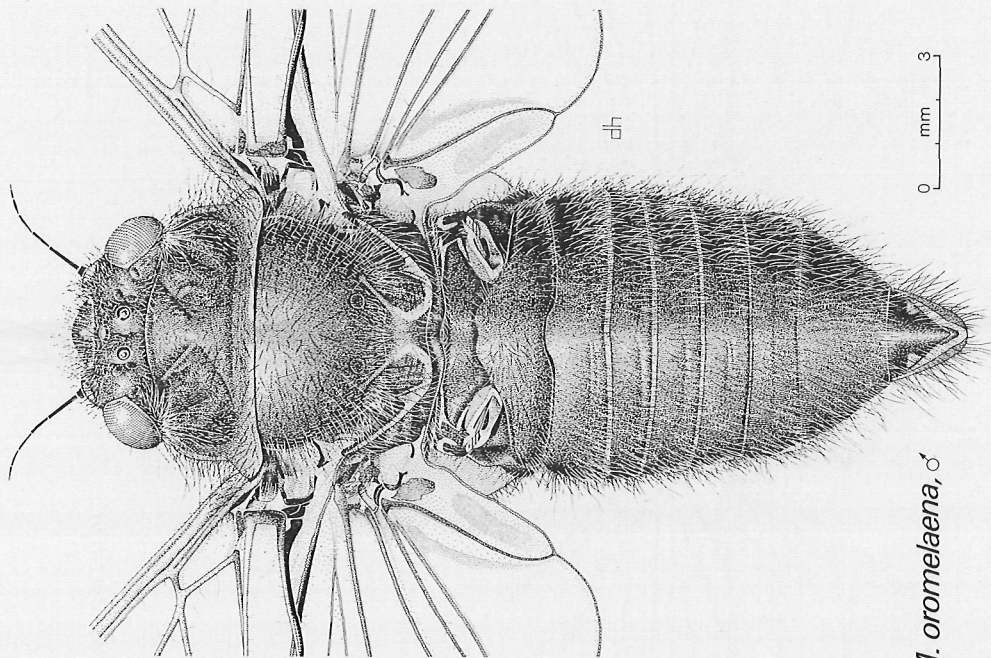


(e) *M. m. mangu*, ♂

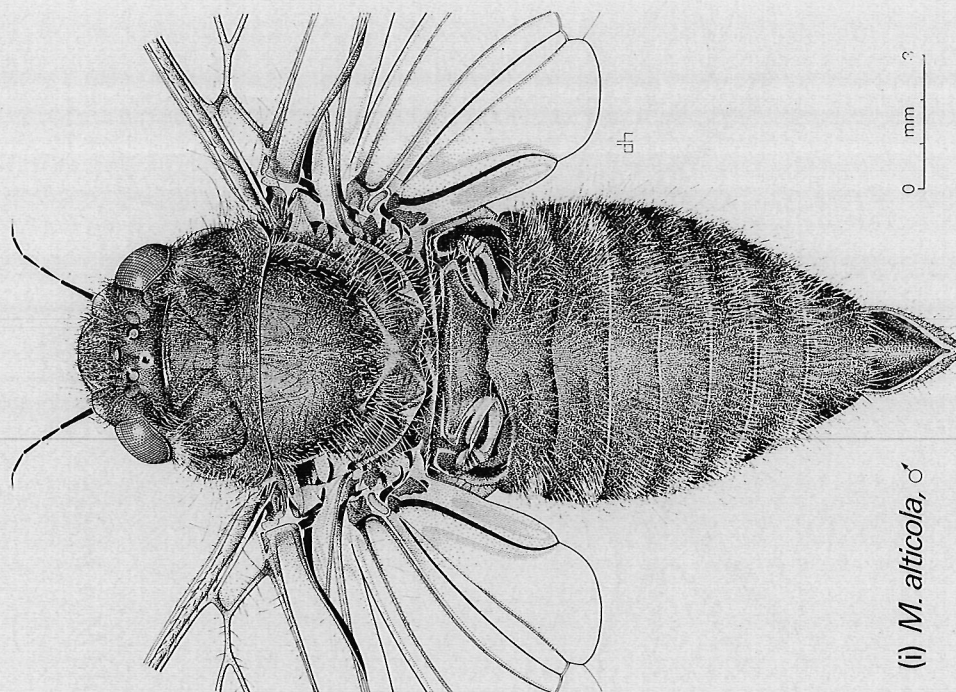


(d) *M. clamitans* ♂

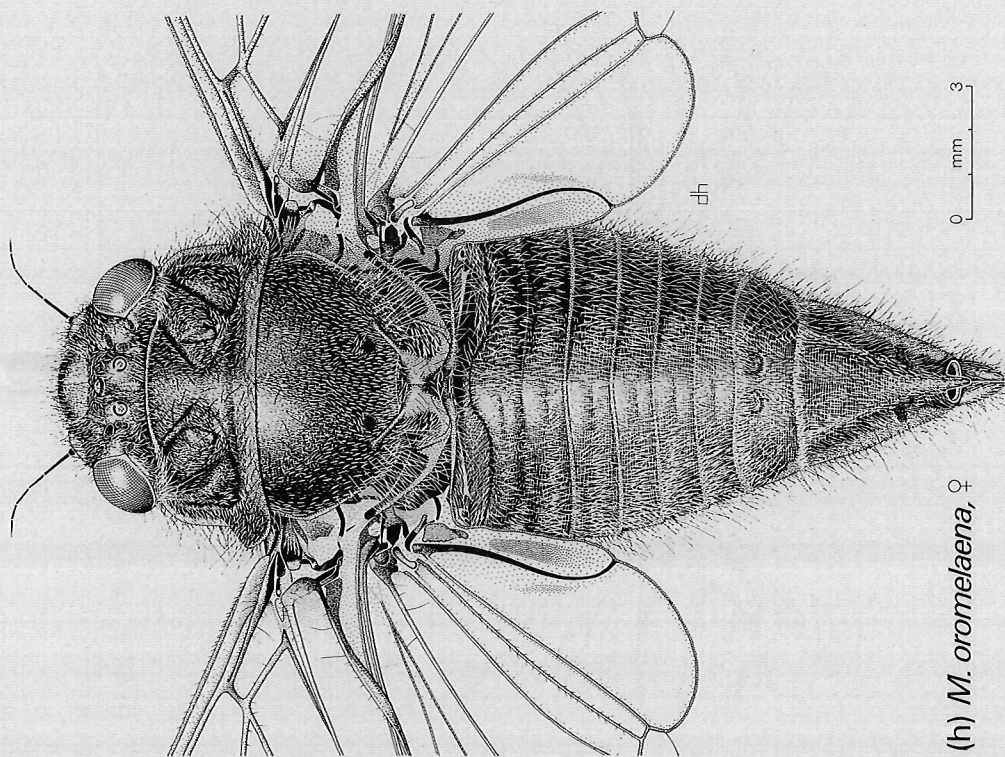


(g) *M. oromelaena*, ♂(f) *M. oromelaena*, ♂

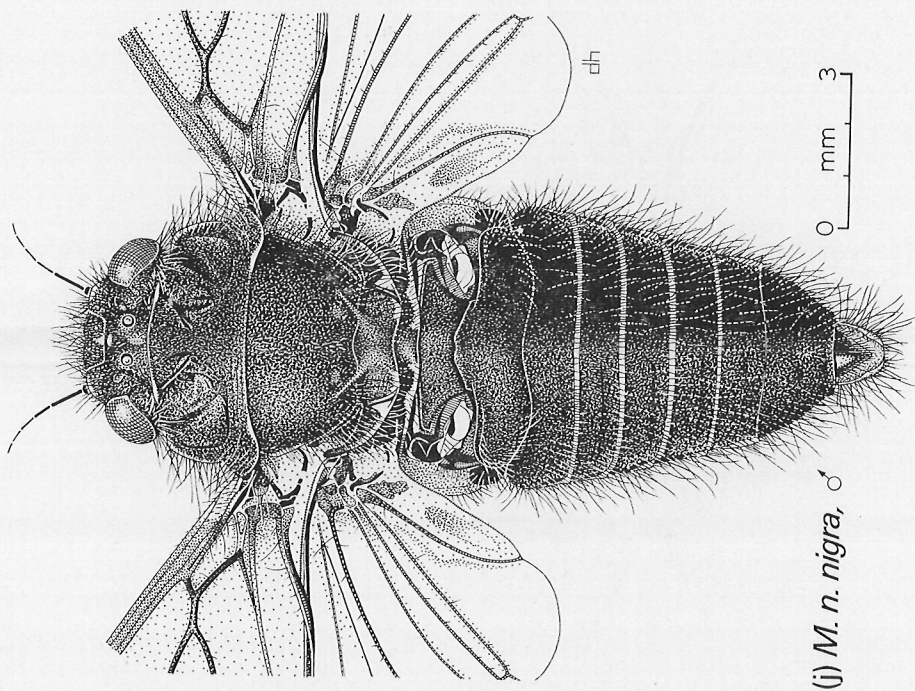
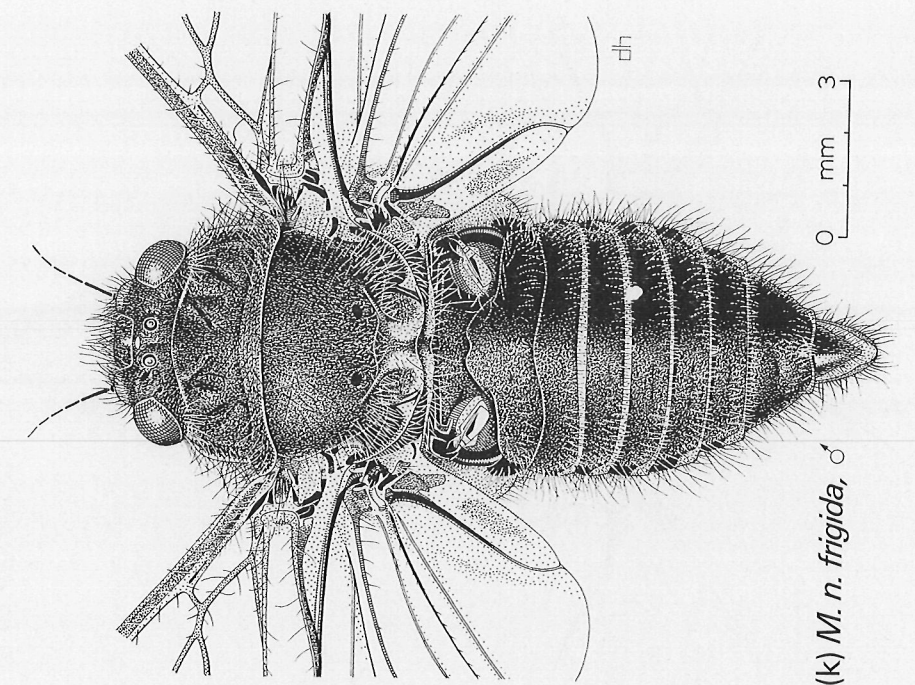


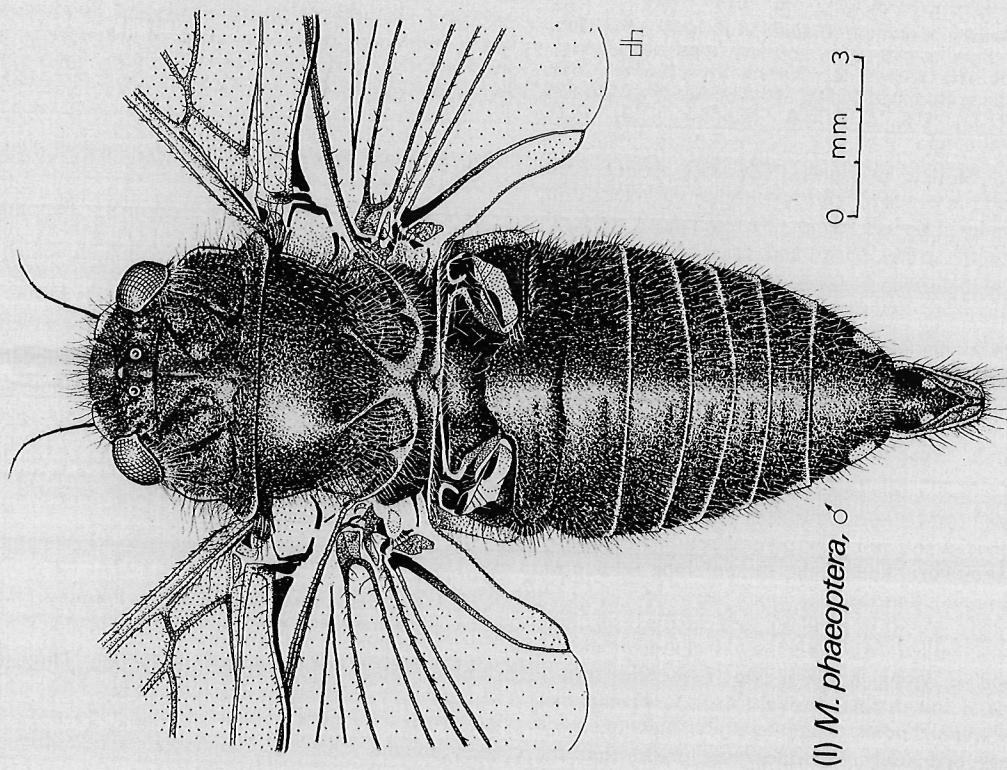
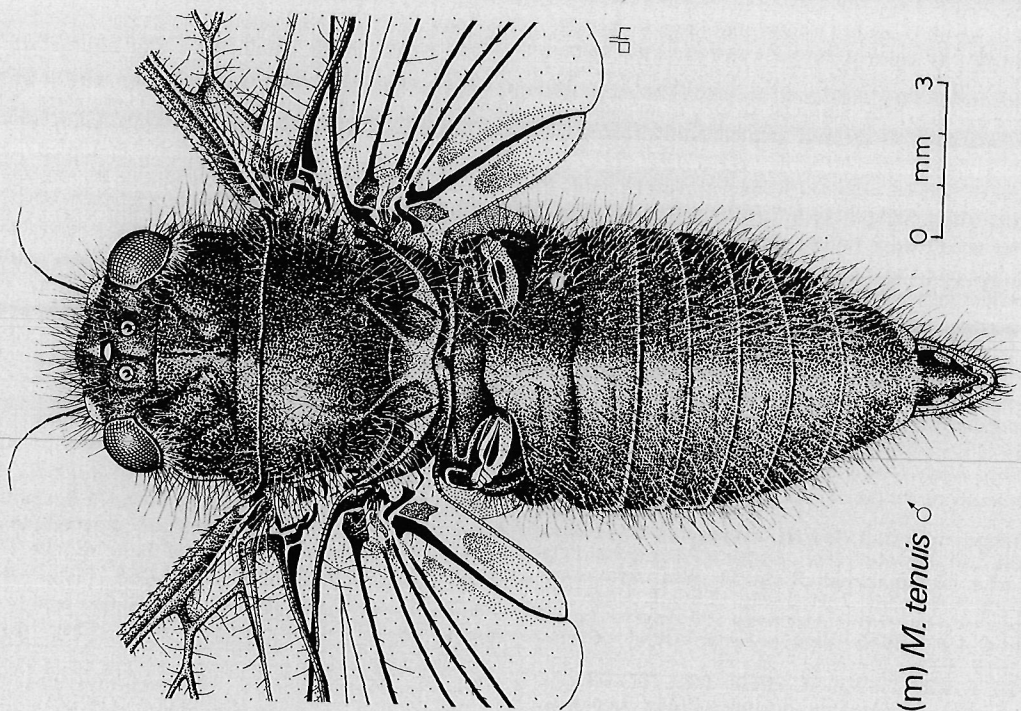


(i) *M. alticola*, ♂



(h) *M. oromelaena*, ♀







FEMALE: genital scale 'round-shouldered' basally (Fig. 11b), its apex bilobed ventrally, its orifice dorsal (as in *M. iolanthe* — see Fleming 1971, fig. 11b); copulatory tube sinuous, over 3× as long as ventral margin of genital scale; vulval lamella sclerotised along junction with vagina (Fig. 11b).

TYMBALS with 4 ridges (3 long, 1 short) and 2 free intercalary strips; spur truncate, basal dome with appendage area faintly demarcated (Fig. 12b).

SONG vocalised as 'peep—peep—peep—peep', later with drone-like base notes (a buzzing sound) strictly in alternation — 'peep—peep—buzz—peep—buzz—peep—buzz' — but sounding as though both are produced at the same time. (See Remarks for a more detailed discussion.)

DISTRIBUTION (Fig. 13B). North Island: southward from Pohangina River. South Island: east of Alpine Divide south to Pukaki River (Mackenzie Basin).

LOCALITIES. NORTH I. **WI/RI**, Pohangina R. (Totara Reserve), Manawatu (F). Upper Pohangina Vly (NM). **WA**, Ruamahanga R. at Te Whiti (F). Tauherenikau R. by No. 2 Highway (TLG-T, Lane, F). Waiohine R. by No. 2 Highway, Wairarapa (aural record, C.A.F.). **WN**, Akatarawa R. (NM); Cloustonville (F, ED).

SOUTH I. **BR**, Travers R. (Ecol. Div., TLG-T). L. Rotorua (ED, F). Maruia Springs (PMJ). Lewis R. (F, ED). **MB**, Serpentine Crk, Upper Clarence (F, ED). L. Tennyson (Ecol. Div., F). **KA**, Kowhai R. (ED). **NC**, White Rock, Ashley Gorge (Hudson 1950; ?CM). Mt Thomas (F, ED). Arthurs Pass (NM). Bealey riverbed, Bridal Veil Falls (F). **WD**, Barrack Stm, Otira Vly. Otira (**type loc.**). **MC**, Harper R. (F). Kowai R., Porters Pass (Lane). Cave Crk, Broken R. basin (ED). Mt Algidus (F, ED). Mt Somers (ED). **MK**, Mt Cook [Hooker Vly] (GVH Coll. catalogue).

HABITAT. Shingle riverbeds; males sing on hot, bare boulders 25 m or more from vegetation, in association with females. Exuviae found (Ruamahanga) on sand patches with sparse herbs and grass. Singing noted on several occasions to cease at Akatarawa by 1530 h NZST.

EMERGENCE PERIOD 2 November (White Rock; S. Lindsay, 1922) to 29 January (Akatarawa). Of dated records, 11% are in November, 33% in December, and 56% in January; a sharp decline in numbers occurred at Akatarawa between 24 and 29 January 1966.

REMARKS. *M. hamiltoni* differs from other *Maoricicada* species in the hoary pleural setulae, especially on the propleura, and in the lack of long setulae on the abdominal sternites.

Subjective aural impression and analysis of tape recordings indicate that the song is characteristically composed of tymbal notes of two frequencies sounding as if a low-pitched drone ('buzz') accompanies repeated piping notes ('peep—peep'). Slowing down the tapes and study of sonograms reveal that the

two notes strictly alternate.

The treble notes result from the alternation of IN-OUT doublets produced by left and right tymbals, and Fleming (1975) suggested that the bass notes are produced by a sudden synchronisation of the doublets from the two tymbals, coupled with changes in tymbal convexity produced by the tensor muscle.

In the field the song is penetrating, rising from the bare boulders of a riverbed and often audible above the noise of a torrent. Although the two-frequency structure of the distinctive song of *M. hamiltoni* is shared by the songs of members of the *M. nigra* complex, apparently no other characters suggest a close relationship.

*M. hamiltoni* is unknown away from bare riverbeds; its characteristic song distinguishes it from other species in that habitat (*M. campbelli*, and locally *M. mangu* and *M. oromelaena*). Presumably *M. hamiltoni* feeds, oviposits, and emerges in the sparse vegetation at the sides of bare shingle riverbeds. Unlike males of *M. campbelli*, males of *M. hamiltoni* rarely sing in this semi-stable zone, preferring the regularly scoured zone closer to the running water.

In the North Island, *M. hamiltoni* has been sought in vain in many apparently suitable habitats between the Pohangina and Akatarawa Rivers. This discontinuous distribution is perhaps the result of excessive disturbance to riverbeds by flooding and aggradation due to deforestation of watersheds, and by protective engineering works recently undertaken by catchment boards.

*Maoricicada iolanthe* (Hudson, 1891) (Fig. 2b, 3, 7A)

1971 *Cicadetta iolanthe* (Hudson); Fleming, N.Z. Journal of Science 14(3): 449–52, fig. 2, 5b, 6e (with synonymy, to which add the following):

1892 *Melampsalta iolanthe* (Hudson): Distant, Annals & Magazine of Natural History (6)9: 326.

1972 *Maoricicada iolanthe* (Hudson); Dugdale, N.Z. Journal of Science 14(4): 876.

See Fleming (1971) for an account of this species.

ADDITIONAL LOCALITIES. **CL**, Manuka (*Leptospermum scoparium*) scrub c.200 m a.s.l., Kuaotuna, Coromandel Peninsula (SC). **WN**, Waitotara Rd, Tararua Forest Park (F).

*Maoricicada lindsayi* (Myers, 1923) (Fig. 7A)

1971 *Cicadetta lindsayi* (Myers); Fleming, N.Z. Journal of Science 14(3): 453–4, fig. 3, 5a, 6g, 12 (with synonymy).

1972 *Maoricicada lindsayi* (Myers); Dugdale, N.Z. Journal of Science 14(4): 876.

See Fleming (1971). No additional records have been noted.



*Maoricicada myersi* (Fleming, 1971) (Fig. 7A)

1971 *Cicadetta myersi* Fleming, N.Z. Journal of Science 14(3): 455-8, fig. 4, 5c, 6f.

1972 *Maoricicada myersi* (Fleming); Dugdale, N.Z. Journal of Science 14(4): 876.

See Fleming (1971).

ADDITIONAL LOCALITY. WN. North Basin, Green's Stream, c.1500 m, 16 Dec 1973, R. J. Joblin. Green's Stream is a tributary of the Orongorongo River draining the western slopes of the Rimutaka Range. *M. myersi* occurs in the Orongorongo itself at least up to Brown's Stream, 1 km above the mouth of Green's Stream. (M. Meads, pers. comm.)

B. Species with the aedeagus shorter than the pygophore and not coiled in repose (*M. alticola*, *M. clamitans*, *M. mangu* complex, *M. nigra* complex, *M. oromelaena*, *M. otagoensis*, *M. phaeoptera*, *M. tenuis*).

*Maoricicada alticola* Dugdale & Fleming n.sp. (Fig. 6i, 7B, 8d, 9i, 10b, 11d, 12g, 13C)

TYPE MATERIAL. Holotype ♂ and allotype: "Turk Ridge, Crimea Ra., Upper Wairau V. MB [Marlborough] 6500-6900' [2000 m] on barren ledges, 3 Feb 71 J.S. Dugdale & J.I. Townsend" (type collection, ED).

DESCRIPTION. Wings faintly infusate. Banded abdominal vestiture distinctive in ♂, less obvious in ♀. Body in both sexes somewhat scaphoid; abdomen tapering smoothly to pygophore (Fig. 6i). Wing vein setulae black, numerous; M-stem vein with pale, fine setulae basally. Dorsum of thorax and abdomen dark grey or black, with many depressed, short, silvery, flattened setulae and white (♂) or slightly yellowish (♀) long slender setulae. Antennal ledges, pronotal margin, and tergites narrowly bordered in fawn. Venter dark. Opercula blackened and sternites entirely or largely black in ♂; sternites infusate with pallid margins in ♀ (Fig. 7B). Gonapophyses VIII with 21 apical teeth.

DIMENSIONS: ♂ - length 18.0-20.8(19.0), wing spread 38.0-41.5(39.3) ( $n=6$ ); ♀ - length 18.5-22.0 (20.2), wing spread 43.0-44.5(43.8) ( $n=3$ ).

GENITALIA. MALE: pygophore beak narrowly to broadly triangular, clasper lacking setae on the concave ventral face; upper pygophore lobe in line with long axis of pygophore (Fig. 8d); aedeagus curved, shorter than pseudoparameres, which are broad, arise dorsally, and have divergent apices (Fig. 9i). FEMALE: genital scale (Fig. 10b, 11d) ridged dorsally, apical ventral lips expanded ventrally, with basal 'wings' expanded ventrally; copulatory tube and carrefour more or less at right angles (Fig. 11d); vulval lamella scarcely sclerotised.

TYMBALS with 4 distally free, long ridges (uppermost sometimes interrupted) and 3 free intercalary strips; basal dome with an appendage; basal spur

long, acuminate (Fig. 12g).

SONG a uniform, fairly short main note and staccato suffix, vocalised as 'switch-chit, switch-chit . . . '.

DISTRIBUTION (Fig. 13c). East of Spenser and Travers Ranges. Known only from the type locality (holotype, allotype, and 2♂, 1♀ paratypes, 3 Feb 1971; plus 3♂♂, 1♀, 15 Feb 1966, J.S.D. & W.A. Holloway).

HABITAT. Crests of ridges on low-rainfall ranges, associated with isolated rock-dwelling plants; singing on outcrops and in sheltered hollows between rocks.

EMERGENCE PERIOD. All records are in February, but the season is probably longer.

REMARKS. *M. alticola* is distinguished from other 'boat-shaped' (scaphoid) *Maoricicada* species with black sternites and blackened opercula by the yellowish abdominal vestiture in the male, by having 21 rather than 14-16 ovipositor teeth, and by its large size. Although females of *M. oromelaena* and *M. mangu* resemble females of *M. alticola*, the latter differ in their unmarked mesonotum, extensively darkened sternites, and 21 ovipositor teeth.

*M. alticola* is known from only one part of Turk Ridge, but the habitat extends along Turk Ridge to the Crimea Range, at an average altitude of 1900 m. On the Island Pass ridge (the south-eastern extension of the Crimea Range, on the south side of the upper Wairau Valley) the altitude is lower and the topography gentle, quite unlike the steep, jagged, fractured Turk Ridge. Although *M. alticola* lives at the highest altitude of all New Zealand cicadas it is apparently intolerant of permanent snow, for it is absent from the higher and wetter western ranges which merge with the Crimea Range.

The only plant species seen in the zone of *M. alticola* are a prostrate *Dracophyllum* and *Raoulia eximia*.

*Maoricicada clamitans* Dugdale & Fleming n.sp. (Fig. 2d, 6d, 7B, 8c, 9f, 10e, 11c, 12c, 13A)

1975 *Maoricicada* sp. C, Fleming, Journal Royal Society of N.Z. 5: 52-7.

TYPE MATERIAL. Holotype ♂: "MacKenzie Pass [Rollsby Range], South Canterbury, c. 3000' [910 m], 13.2.1968, C.A. & M.A. Fleming" (NM). Allotype: same data but collected 21 Feb 1967 (NM).

DESCRIPTION (Fig. 6d). MALE. Head and thorax largely black; antennal ledge, frontoclypeus, and pronotum obscurely marked in dull corneous. Crux and pronotal and mesonotal margins narrowly brownish. Tymbals pale corneous. Abdominal tergites black, with narrow red posterior marginal band suddenly expanded laterally, tergite VIII broadly

(Continued on p. 318)

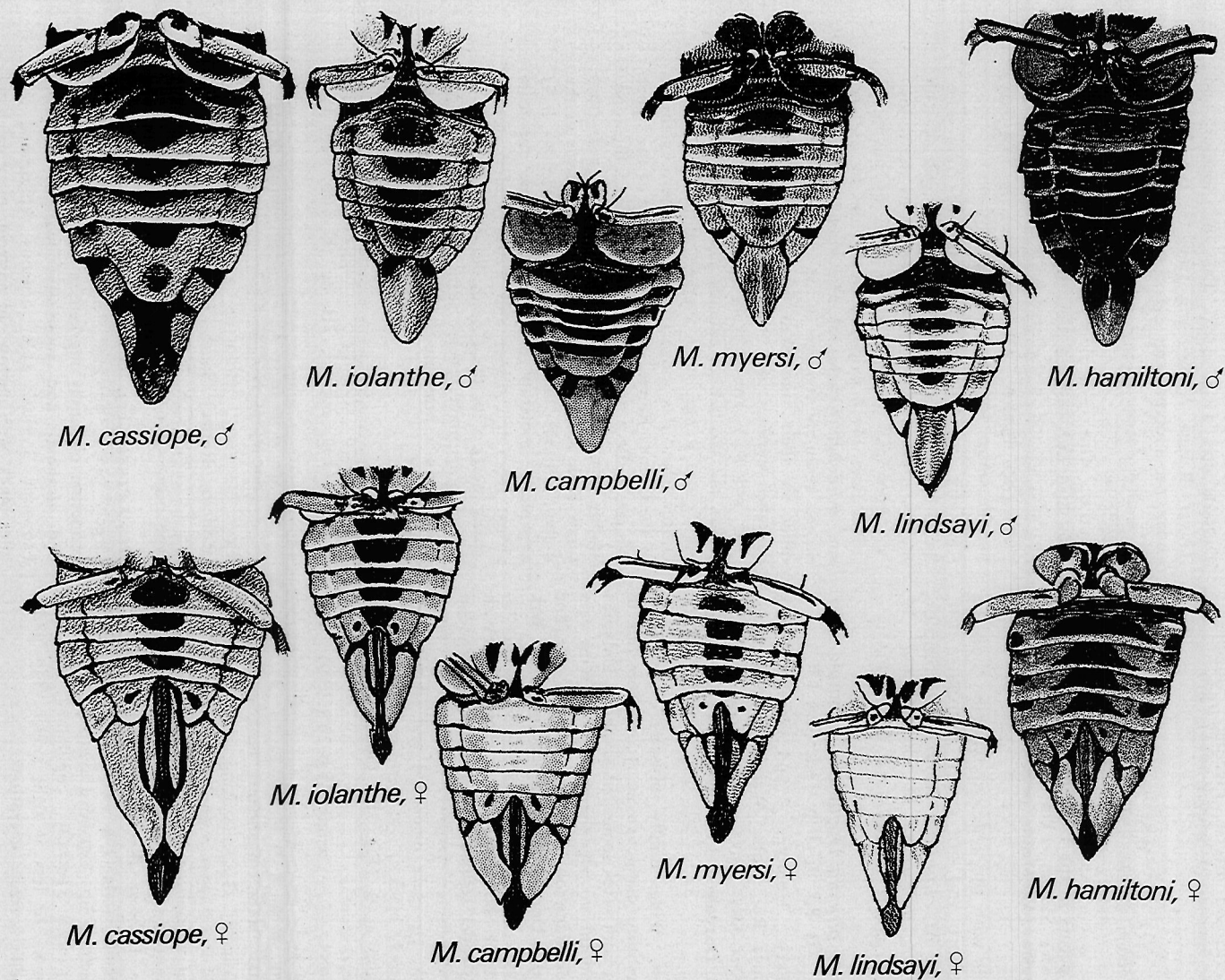


Fig. 7A. Ventral pattern of abdomen, *Maoricada* spp: *M. cassiope* - ♂ Ngauruhoe, 3 Jan 1966, ♀ Ruapehu, 12 Mar 1966; *M. iolanthe* - ♂ Miramar, 26 Nov 1966, ♀ Waitotara Rd, 22 Jan 1972; *M. campbelli* - ♂ Upper

30 Jan 1966; *M. myersi* - Orongorongo Vly, 10 Jan 1970; *M. lindsayi* - ♂ Clarence Vly, 2 Jan 1966, ♀ Waiau Vly, 14 Jan 1967; *M. hamiltoni* - ♂ Barrack Crk, Otira, 28 Jan 1968, ♀ Bealey R., 29 Jan 1966.

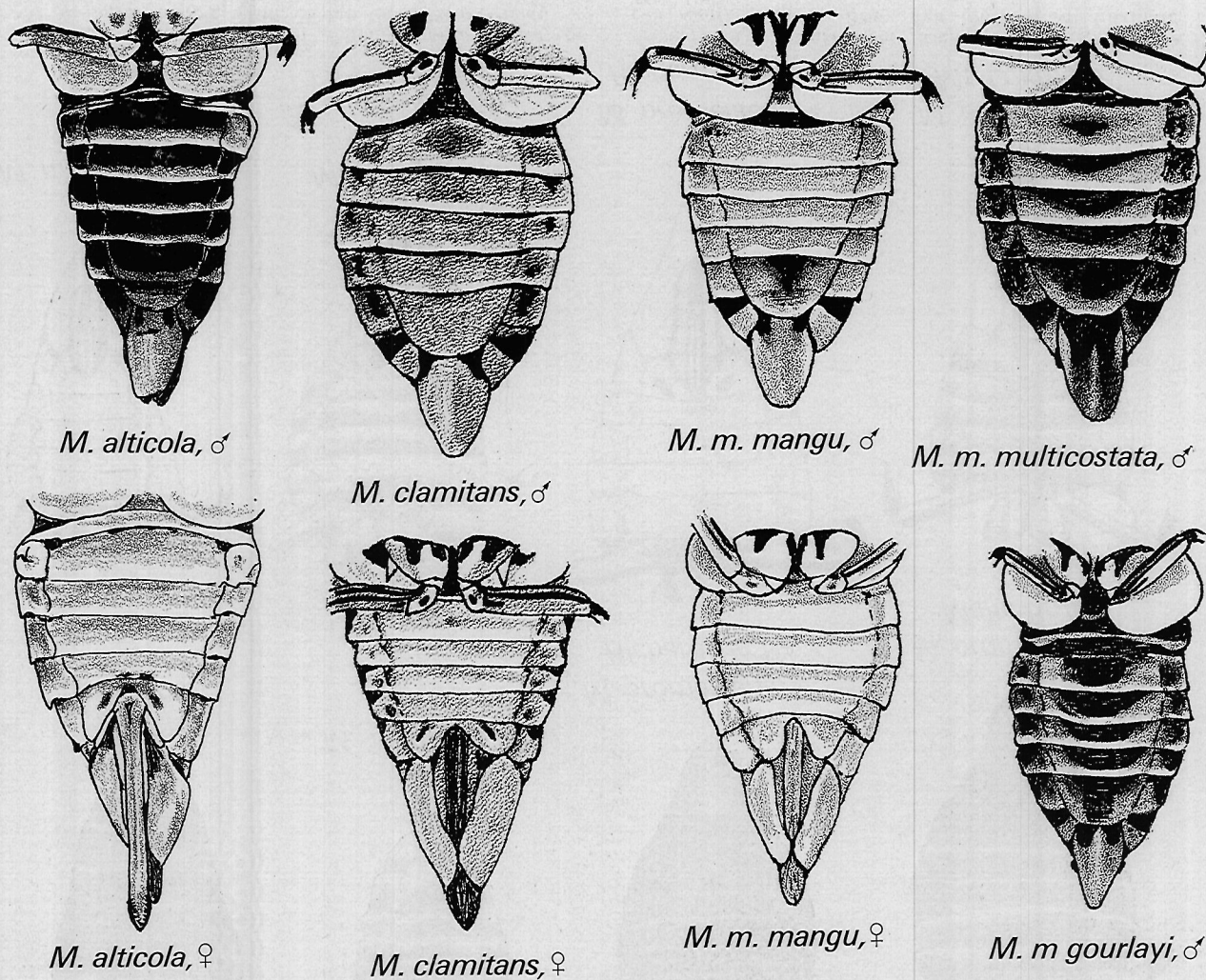


Fig. 7B. Ventral pattern of abdomen, *Maoricicada* spp:  
*M. alticola* – Turk Ridge, 3 Feb 1971; *M. clamitans* – ♂  
 Grandview Ridge, 12 Jan 1971, ♀ Dansey Pass, 9 Feb

1968; *M. m. mangu* – Porters Pass, ♂ 7 Feb 1967, ♀ 26  
 Jan 1966; *M. m. multcostata*, ♂, Altmarlock, 7 Feb 1972;  
*M. m. gourlayi*, ♂, Dun Mtn, 4 Feb 1966.



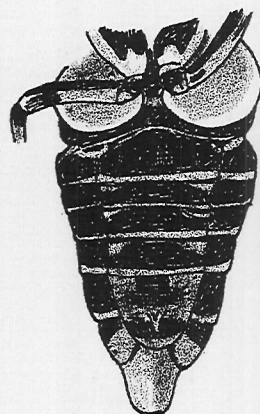
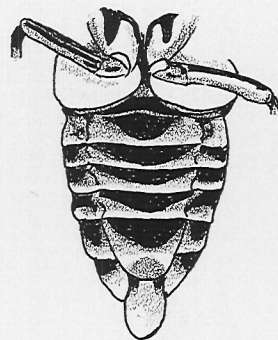
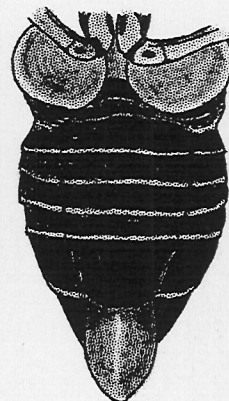
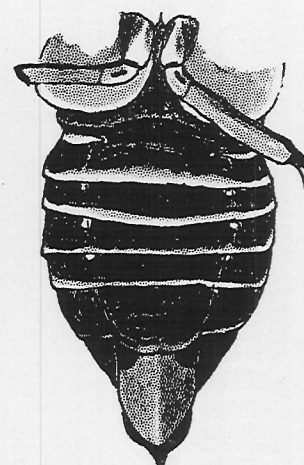
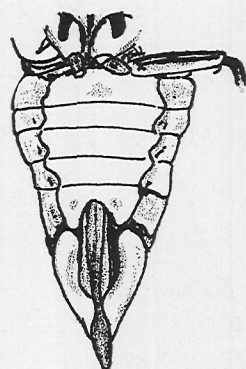
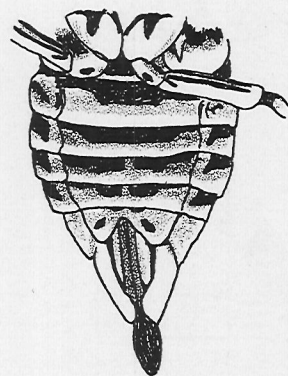
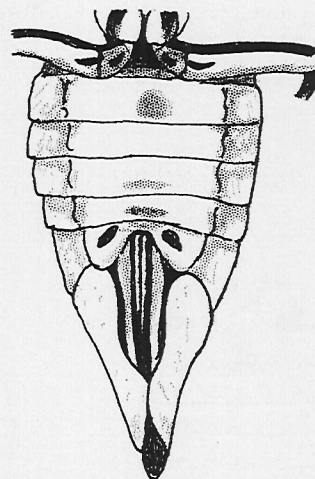
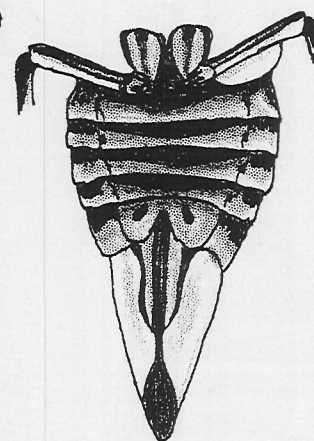
*M. n. nigra*, ♂*M. n. frigida*, ♂*M. oromelaena*, ♂  
Richardson Ra.*M. oromelaena*, ♂  
Malte Brun*M. n. nigra*, ♀*M. n. frigida*, ♀*M. oromelaena*, ♀  
Richardson Ra.*M. oromelaena*, ♀  
Mt. Luxmore

Fig. 7C. Ventral pattern of abdomen, *Maoricicada* spp: *M. n. nigra*, Temple Basin, 28 Jan 1966; *M. n. frigida* - ♂ Richardson Ra., Feb. 1970, ♀ Okahiko, 21 Jan. 1970. *M. oromelaena* - (centre right) Richardson Ra., 2 Feb 1969, (far right) ♂ Malte Brun, Feb 1969, ♀ Mt Luxmore, 8 Mar. 1967.

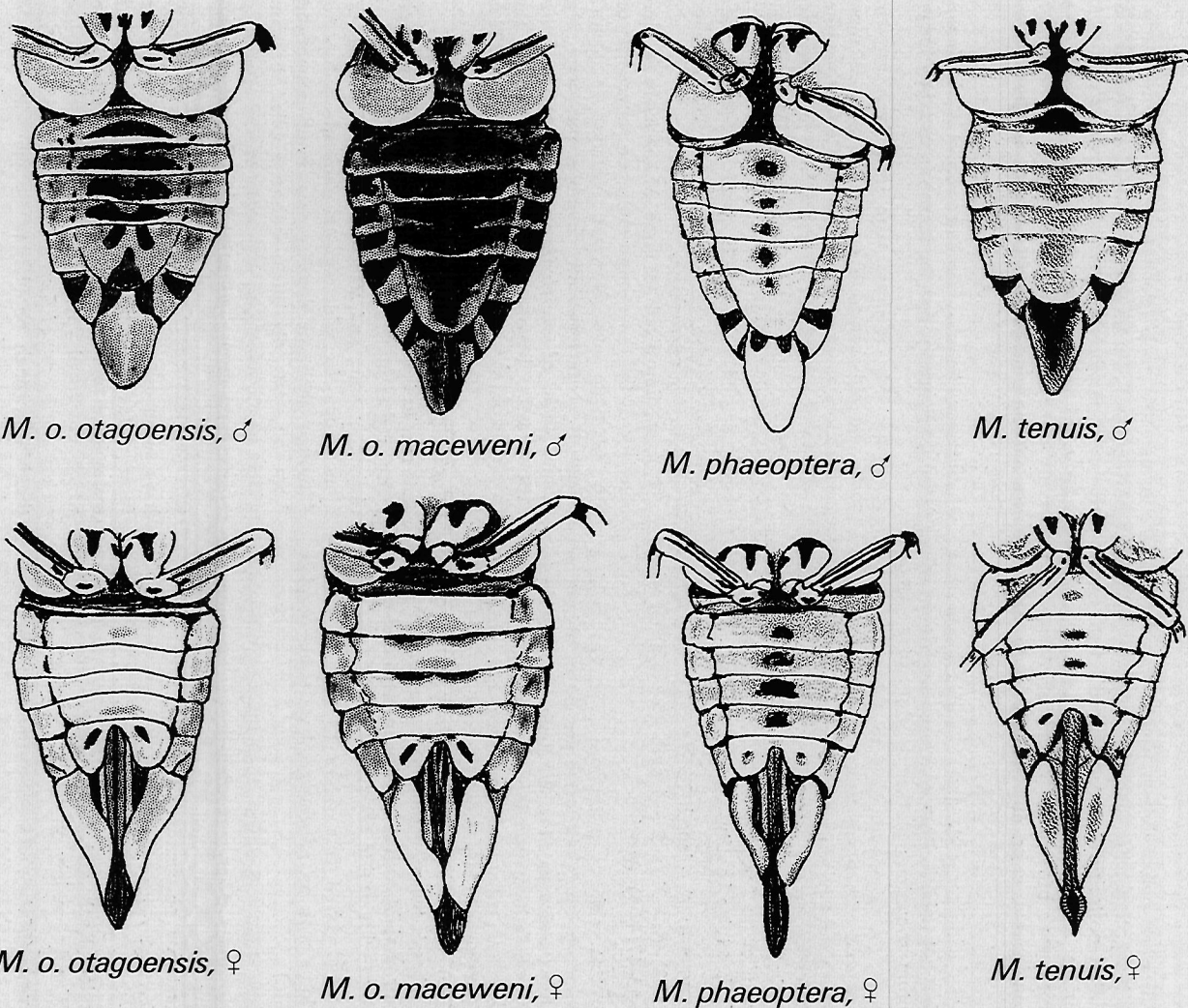


Fig. 7D. Ventral pattern of abdomen, *Maoricicada* spp.: *M. o. otagoensis* - Coronet Peak, 13 Feb 1967; *M. o. maceweni* - Takitimu Ra. 3 Feb 1970; *M. phaeoptera* -

Sentinel Peak, 14 Jan 1971; *M. tenuis* - Island Pass, 12 Jan 1967.

reddish posteriorly, red band interrupted on dorsal midline by a black stripe, all tergites with sparse silver pubescence. Pygophore black dorsally, upper pygophore lobe and base reddish. Ventrally, legs pinkish fawn to dark red, with usual black markings, opercula pallid or faintly pink; abdominal sternites (Fig. 7B) warm pinkish-brown, usually with a median row of blackish patches—largest anteriorly, smallest and faintest posteriorly—and darkened lateral areas; hypandrium and sternite VI concolorous, pinkish, sometimes apex of sternite VI darker. Wings with membrane glassy, costa dull pinkish-red to pinkish-brown.

**FEMALE** with corneous areas tending larger than in ♂, but not reddish. Pronotum extensively marbled; mesonotum sometimes marked in dull olive. Abdomen as in ♂; pygophore olive to reddish laterally, and this area with black setae; abdominal sternites (Fig. 7B) generally pinkish orange, usually immaculate, tomentum sparse. Coxae surrounded by bright pink socket margins. Both sexes lacking scale-like silver setulae on forewing veins; M vein stem with long, dark setulae basally.

**DIMENSIONS:** ♂ – length 16–21 (19.2), wing spread 35–42 (39.2) ( $n=31$ ); ♀ – length 20–22 (20.9), wing spread 43–47 (44.9) ( $n=12$ ).

**GENITALIA.** **MALE:** pygophore (Fig. 8c) lacking black setae on inner lobe, setae present or absent on upper lobe; aedeagus (Fig. 9f) with base stouter in western populations; pseudoparameres  $0.8\times$  as long as endotheca, endothecal apex scarcely expanded, strongly recurved, bifurcate. **FEMALE:** genital scale (Fig. 10e) barrel-shaped, stout, thick-lipped, orifice central, basal 'wings' triangular; copulatory tube curved or straight, vulval lamella unsclerotised except at junction with genital scale (Fig. 11c).

**TYMBALS** with 4 free ridges (3 long, 1 short); basal dome with an appendage; basal spur obsolete (Fig. 12c).

**SONG** a loud, persistent 'yodelling' call (hence specific name), often preceded by a monotonous 'warming up' phrase (see Fig. 2d), delivered from low vegetation or occasionally from rock.

**DISTRIBUTION** (Fig. 13A). Subalpine areas of South Canterbury and Central Otago bounded by Mt Peel, Mt Teviot. Rock and Pillar Range, and Sentinel Peak, Wanaka, mainly on ranges exceeding 1000 m.

**LOCALITIES** (35 ♂♂, 7 ♀♀ examined). **SOUTH I.** SC. Mt Peel (NM, ED). Weaner Run and Trig W, 820–1180 m, Hunter's Hills (F). **MK/SC.** Mackenzie Pass (**type loc.**) (F, ED). Mt Dalgety (F). Grampian Ra. (F). Ohau Ra. (L. Ohau skifield) (F, ED). Benmore – Black Forest transmission line (F). **CO.** Dansey's Pass, Kakanui Ra., c.1000 m (F). Mt Ida, Hawkdun Ra. (BM). Rock and Pillar Ra. (?; sight record, CAF). Mt Teviot, Lammerlaw Ra., 910 m (F). **OL.** Sentinel Peak, NW of L. Hawea (aural

record, JSD). Grandview Ridge, Hawea, c.1200 m (F, ED). Mt Alpha, SW of L. Wanaka (aural record, JSD). Ben Lomond, Queenstown (BM, NM).

**HABITAT.** Occupying highest zone of woody vegetation and/or large *Aciphylla* (speargrass) communities on low-rainfall mountains; only once observed singing from rock (Benmore – Black Forest transmission line). On mountains with alpine fellfields *M. clamitans* is replaced by high-alpine species (*M. frigida*, *M. phaeoptera*, *M. otagoensis*) above the scrub/*Aciphylla* zone. Associates of *M. clamitans* are *Kikihia angusta* (Walker), and locally *K. rosea* (*sensu lato*) and *M. phaeoptera*.

**EMERGENCE PERIOD.** Earliest record 12 January, latest 23 February, but the season is certainly longer.

**REMARKS.** *M. clamitans*, with its reddish forewing costa and red-rimmed abdominal tergites, is superficially close to *M. cassiope*, but can be distinguished easily by the markings of tergite VIII in both sexes. *M. clamitans* differs from pink-flushed *M. otagoensis* in lacking the pink suffusion at the base of the tymbal membrane and in its distally free long tymbal ridges; females have black setae laterally on the pygophore (pallid in *M. otagoensis*).

This medium-sized to large *Maoricicada* is characteristic of the low-rainfall mountain ranges between the Rangitata and Kawarau Valleys. In Central Otago it characteristically inhabits the often well defined belt of *Aciphylla colensoi* or *A. aurea* (speargrasses, bayonet grasses; Umbelliferae) that have replaced scrub species between 900 m and 1200 m.

### *Maoricicada mangu* (F. Buchanan White)

This species is considered to comprise four geographically representative subspecies, of which one is distinct in song and structure and two in structure alone from the wide-ranging nominate subspecies. Although the type locality was firmly established from the start, subsequent authors applied the name widely to all subspecies and some related species.

The populations here grouped in *M. mangu* show discontinuities in tymbal ridge numbers and in numbers of fused ridges. North-east of Lewis Pass males have seven or eight ridges, four or five of which are fused (*M. m. multicostata*). South of Lewis Pass males have four to six ridges, three (rarely two) of which are fused (*M. m. mangu*). *M. m. gourlayi*, 60 km north-east of Lewis Pass, and isolated from the Marlborough populations by the wide corridor of the Wairau Valley, retains the southern *M. m. mangu* tymbal structure, with the addition of a deep oblique fold. *M. m. celer* has retained the number of fused ridges characteristic of the Marlborough population, but the total number of ridges is less.

We infer from this that the complex of subspecies is a response to alternate expansions and constrictions

of habitat during the Pleistocene. The combined range of *M. m. mangu* (southern) and *M. m. gourlayi* (northern) may represent the original greatest extent of 'proto'-*mangu* during a glacial age. The close structural resemblances—including loss of sclerotisation of the pseudoparameres—between *M. m. gourlayi* and *M. tenuis* also suggests that 'proto'-*mangu* may have extended into north-west Nelson when the bushline was lowered, reducing lowland barriers. Subsequent isolation on the interglacial return of forest may then have given rise to two distinct populations, *tenuis* in the west and *mangu* in the east and south. At a later time, *tenuis*, by this time specifically distinct in song, structure, and habitat, reinvaded the northern and more western *mangu* territory, achieving sympatry in the Richmond Range and west of a line down the Wairau and Lake Tennyson.

The *mangu* populations show marked regionalism. *M. m. gourlayi*, so far known only from Dun Mountain and Mt Robert, is a geographical isolate. So too, apparently, is *M. m. celer*, on the Crimea Range; in song and habitat it is the most deviant of the *mangu* subspecies. That the only consistent difference between Marlborough and Canterbury populations is in tymbal structure suggests that their subspeciation may be slightly less advanced than that of other populations of *M. mangu*.

*Maoricicada mangu mangu* (White) (Fig. 1, 2e, 6e, 7B, 8i, 9j, 10h, 11e, 12m, 13D)

- 1879 *Melampsalta mangu* White; Entomologist's Monthly Magazine 15: 214.
- 1892 *Melampsalta nervosa*; Distant, Annals & Magazine of Natural History (6)10: 67 (not of Walker, 1850) [error].
- 1896 *Melampsalta mangu* White; Kirby, Transactions N.Z. Institute 28: 457 (removed from synonymy with *M. nervosa* Walker, 1850).
- 1898 *Melampsalta mangu* White; Hutton, Transactions N.Z. Institute 30: 184.
- 1904 *Melampsalta mangu* White; Hutton, Index Faunae N.Z.: 224.
- 1906 *Melampsalta quadricincta*; Distant, Synoptic Catalogue of Homoptera, Part 1, Cicadidae: 171 (not of Walker, 1850).
- 1907 *Cicadetta mangu* (White); Kirkaldy, Annales Société entomologique de Belgique 51: 308.
- 1909 *Cicadetta mangu* (White); Kirkaldy, Transactions N.Z. Institute 41: 27.
- 1921 *Melampsalta quadricincta*; Myers, Transactions N.Z. Institute 53: 246 (not of Walker, 1850) [error].
- 1926 *Melampsalta mangu* White; Myers, Psyche (Cambridge, Massachusetts) 33: 67, pl. 3 fig. 7 (genitalia).
- 1927 *Melampsalta mangu* White; Myers, Transactions N.Z. Institute 57: 687, 688.
- 1929 *Melampsalta mangu* White; Myers, Transactions Royal Entomological Society of London 77: 48–50, 55.

- 1929 *Melampsalta mangu* White; Myers, "Insect Singers": 129, 172, 229, text-fig. 113.
- 1950 *Melampsalta mangu* White; Hudson, "Fragments of N.Z. Entomology": 146–7, pl. XV fig. 10, 11.
- 1969 *Cicadetta mangu* (White); Dugdale & Fleming, N.Z. Journal of Science 12(4): 955.
- 1972 *Maoricicada mangu* (White); Dugdale, N.Z. Journal of Science 14(4): 876.

TYPE MATERIAL. Myers (1926, 1927) records that Mr W. E. China had borrowed some of the Buchanan White type material—from the Perth Museum, Scotland—for him to study, and that the only remaining specimen of *M. mangu* was 'a female in poor condition labelled "*mangu*", presumably in White's handwriting, and with the locality "Porter's Pass"'. Myers supposed this to be one of the original four [mentioned by White], and therefore "by elimination to be considered the type of *M. mangu*". This syntype, here selected as lectotype, was presented by the Perth Museum to the British Museum (Natural History), where it was examined by C.A.F. in April 1967. Hudson's (1950, p. 147) nomination of a neotype is contrary to the Code. White had 'four specimens from Mr Wakefield, labelled "On rocks at Porter's Pass, Canterbury, about 3500 ft [1070 m]"' including, as Myers remarked, both *M. mangu* (as restricted by choice of lectotype) and *M. cassiope*, which is abundant at Porter's Pass. The specific name is probably an incorrect version of the Maori word for 'black', suggested by [E.G.] Wakefield. Although Hudson (1950) supposed that this species was originally discovered by J.D. Enys of Castle Hill and forwarded to England by J. Hector, there seems no reason to doubt that Wakefield (who was living in Christchurch in the 1870s) collected it and forwarded material to Scotland shortly before his death in 1878.

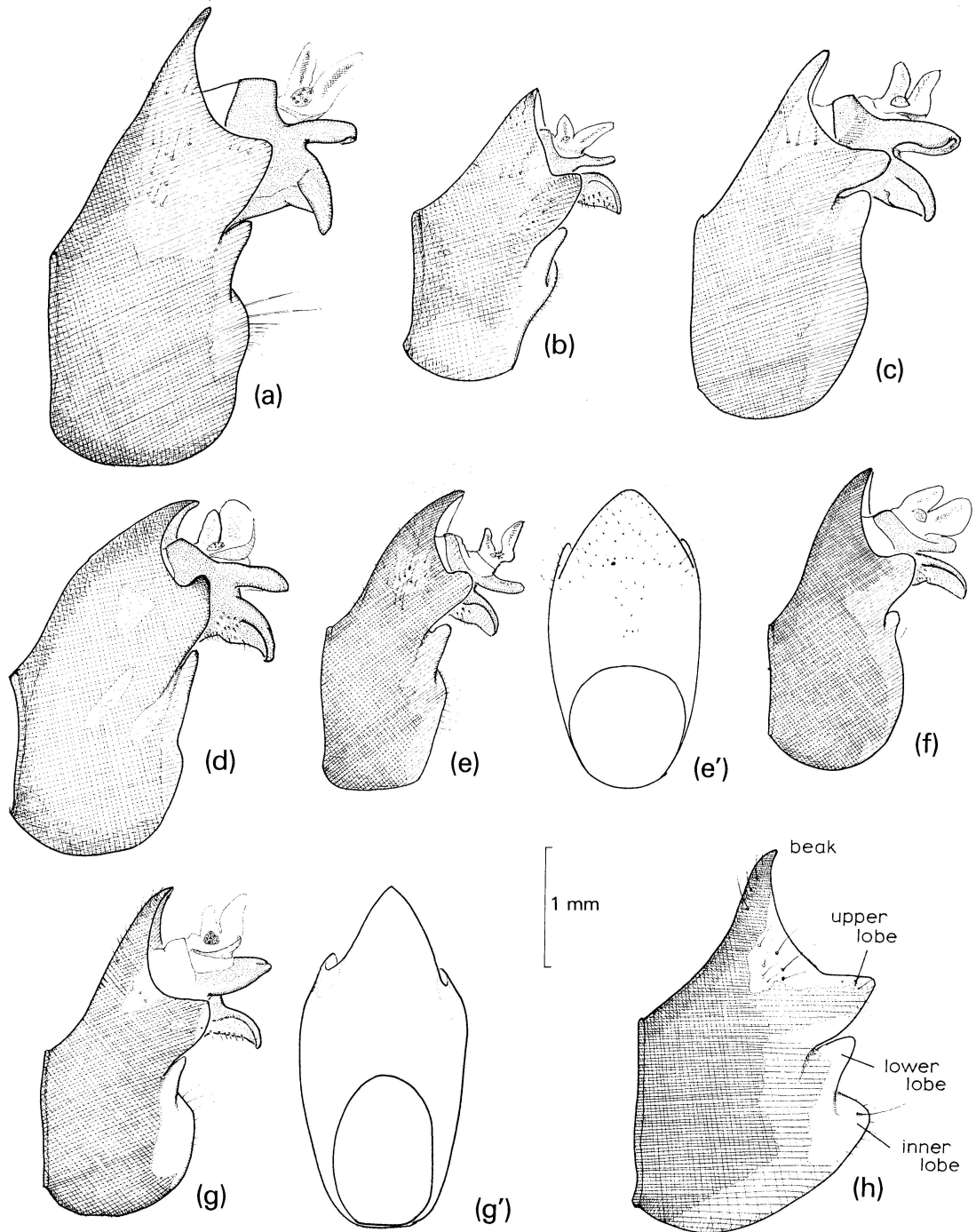
DESCRIPTION (Fig. 1, 6e). See Hudson (1950, pp. 146–7, pl. 15 fig. 10 ♂ ♀). Pubescence of pale yellowish or gold scale-like depressed setulae on a black ground, giving a warm grey, rather scintillant appearance. Forewing veins with grey or whitish setulae. Abdominal tergites edged with orange-yellow. Abdominal sternites in ♂ buff to flesh-coloured, weakly to strongly pink-tinged, with variable central black patches, especially on sternite VII, and black pigment continuing from dorsal surface on to pleural areas on segment VIII, in ♀ usually immaculate (Fig. 7B). Opercula straw-coloured. Limbs warm straw-coloured, with rather smaller black stripes and spots than in related species.

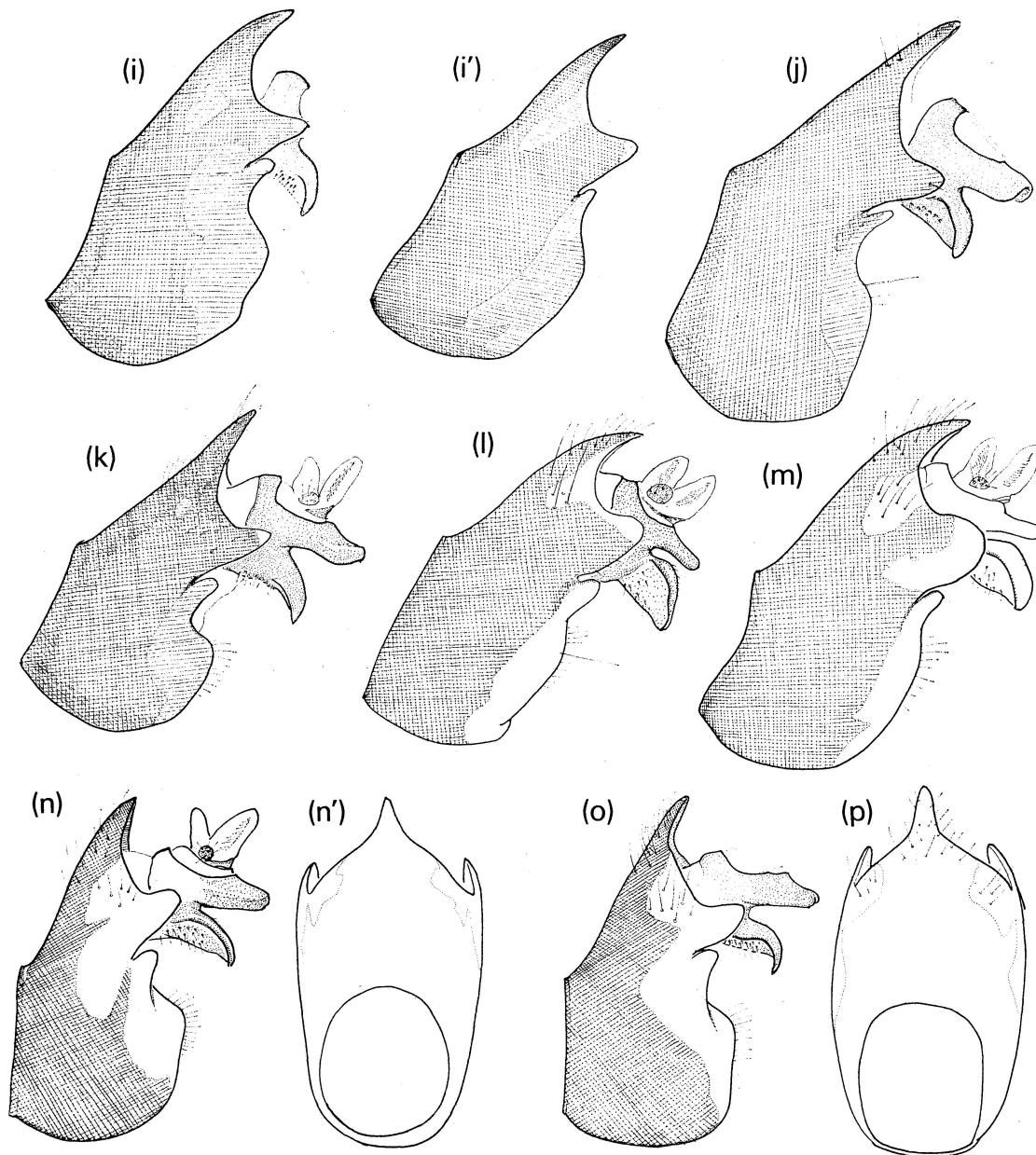
DIMENSIONS: ♂ – 16.5–20.0(18.7), wing spread 32.0–40.0(36.5) ( $n=39$ ); ♀ – length 18–20(19), wing spread 38.0–42.0(40.2) ( $n=10$ ).

GENITALIA. MALE: pygophore beak sharp, upper pygophore lobe nearly in line with long axis of

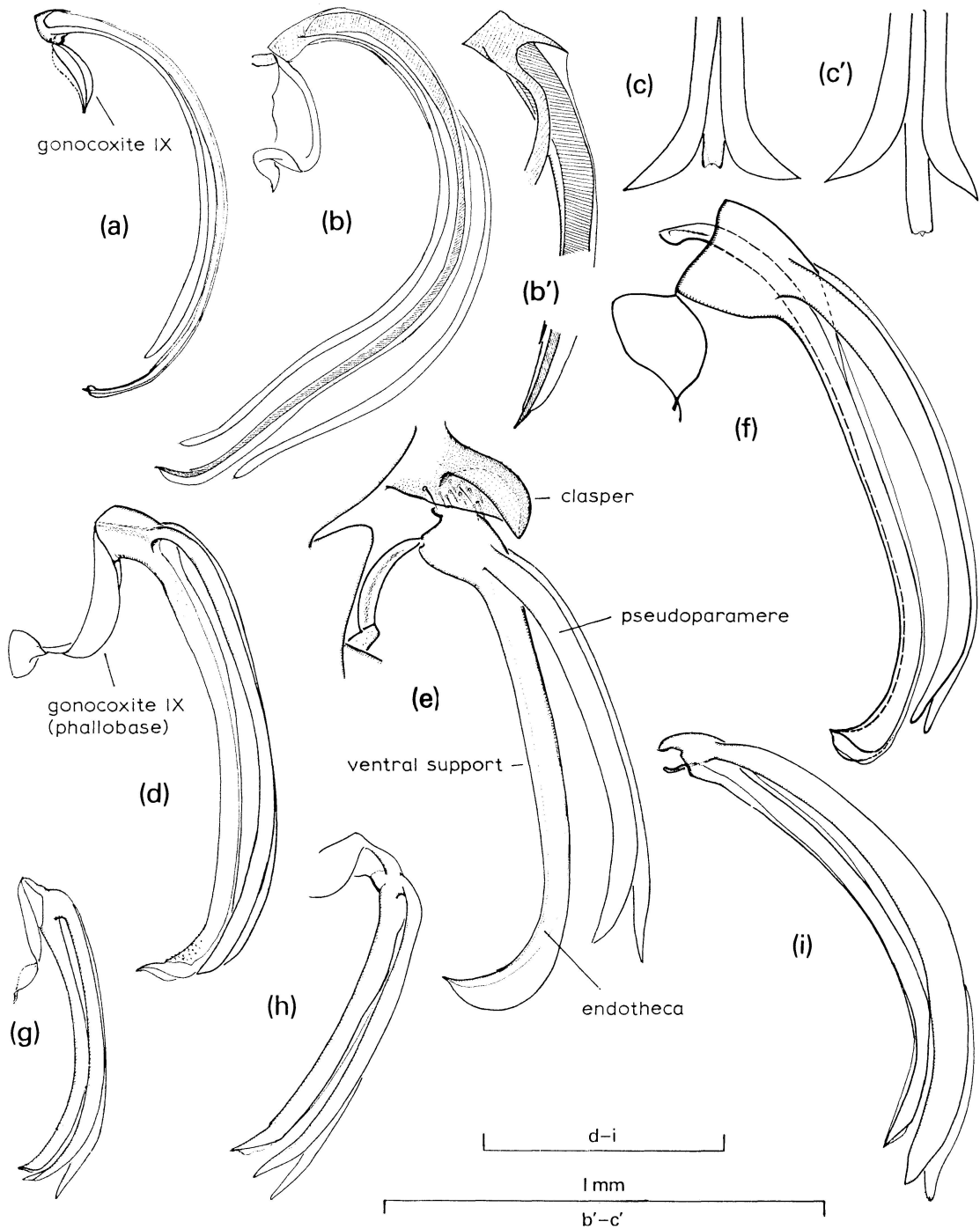
(Continued on p. 323)







**Fig. 8** (includes opposite page). Male pygophores, *Maoricicada* spp., in lateral view unless otherwise stated: (a) *M. cassiope*, Ruapehu; (b) *M. hamiltoni*, L. Rotoroa; (c) *M. clamitans*, Mackenzie Pass; (d) *M. alticola*, Turk Ridge; (e) *M. n. nigra*, Arthurs Pass; (e') same, anterodorsal view; (f) *M. n. frigida*, Old Man Ra.; (g) *M. phaeoptera*, Sentinel Peak; (g') same, anterodorsal view; (h) *M. oromelaena*, Mt Cleughearn; (i) *M. m. mangu*, Porters Pass; (i') same, Fox's Peak; (j) *M. m. celer*, Turk Ridge; (k) *M. m. gourlayi*, Dun Mtn; (l) *M. o. otagoensis*, Coronet Peak; (m) *M. o. maceweni*, Takitimu Ra.; (n) *M. tenuis*, Island Pass; (n') same, anterodorsal view (cf. Fig. 8g, *M. phaeoptera*); (o) *M. tenuis*, Mt Chrome; (p) *M. tenuis*, Mt Arthur, anterodorsal view.



**Fig. 9** (includes opposite page). Aedeagal structures, *Maoricada* spp., in lateral view unless otherwise stated: (a) *M. cassiope*, Ruapehu; (b) *M. hamiltoni*, L. Rotoroa; (b') same, details of base and apex; (c) *M. n. nigra*, Arthurs Pass, dorsal view of aedeagus apex; (c') same, Gertrude Saddle, Fiordland; (d) *M. o. otagoensis*, Coronet Peak; (e) *M. oromelaena*, Cleughearn; (f) *M. clamitans*, Grandview

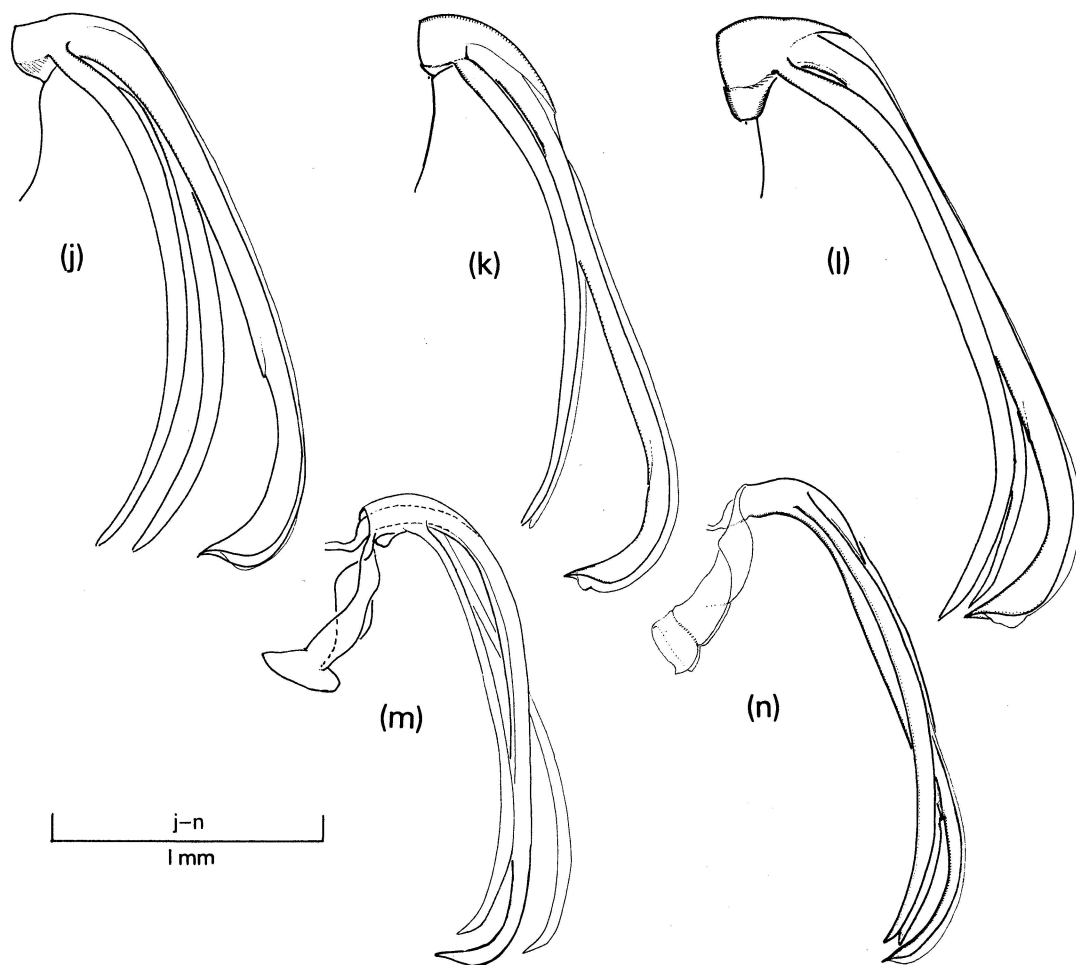
pygophore (south of Rakaia Valley) or strongly oblique, pale-tipped; lower pygophore lobe stout, inner lobe strongly projecting in lateral view (Fig. 8i); aedeagus apex expanded and strongly deflexed, ventral support ending at 0.6 of shaft length, pseudo-parameres as long as aedeagus shaft, arising ventrolaterally and bowed out at base, apically acuminate, sclerotised (Fig. 9j). FEMALE: genital scale tubular, nearly twice as long as wide, dorsally with deep transverse furrows on proximal half, basal wings 'square-shouldered', their caudal margin expanded (Fig. 10h, 11e); vagina evenly curved or angulate to carrefour (Fig. 11e).

TYMBALS fulvous, with 4-6 ridges, not more than 3 fused distally; basal spur strong, acuminate (Fig. 12m).

SONG a low-pitched monotone of discrete staccato notes of "dull toneless quality" (Myers 1926), like the rattle of a drumstick on a table, followed by a double suffix (see Fig. 2e). Each staccato note in the rattle consists of a single, presumably synchronised doublet in which the OUT click seems to be suppressed. The rattle comprises about 30 notes, some 45 ms apart, followed after an interval of about 130 ms by a double suffix, each note of which consists of two doublets 13 ms apart. Data source: recordings from Boundary Creek (Rangitata) and Porter's Pass.

DISTRIBUTION (Fig. 13D). Eastern foothills of Southern Alps from Lewis Pass to Tekapo.

LOCALITIES (40 ♂♂, 11 ♀♀ examined). SOUTH I.



Ridge; (g) *M. n. nigra*, Gloriana Peak; (h) *M. n. frigida*, Old Man Ra.; (i) *M. alticola*, Turk Ridge; (j) *M. m. mangu*, Porters Pass; (k) *M. m. gourlayi*, Dun Mtn; (l) *M. m. celer*, Turk Ridge; (m) *M. tenuis*, Island Pass; (n) *M. phaeoptera*, Omarama.



**BR.** Mt Trovatore, 1200 m (ED, PMJ, F, ♀♀ only). **NC.** Mt Binser, Waimakariri Vly, 670–1500 m (PMJ). **MC.** Mt Misery, Cass. Sugarloaf, Cass, over 900 m (PMJ). Mt Hamilton and Mt Cockayne, Craigieburn Ra., 1200–1600 m (ED, F). Dry Crk, Castle Hill Basin, 750 m (F). Porter's Pass (**type loc.**) (NM, ED, F, PMJ); Fog Peak, 945 m (PMJ). Torlesse Ra. (NM, F); Mt Hutt (ED, F). Mt Somers, 1200 m (ED). S branch, Ashburton R. (PMJ). **SC.** Mt Peel, 900 m (ED). Boundary Crk, Rangitata Vly (F). **SC/MK.** Fox's Peak, 900 m (ED, F). Mt Dalgety, 1600 m (ED). **MK.** Richmond skifield, Round Hill, Two Thumb Ra., Tekapo (F).

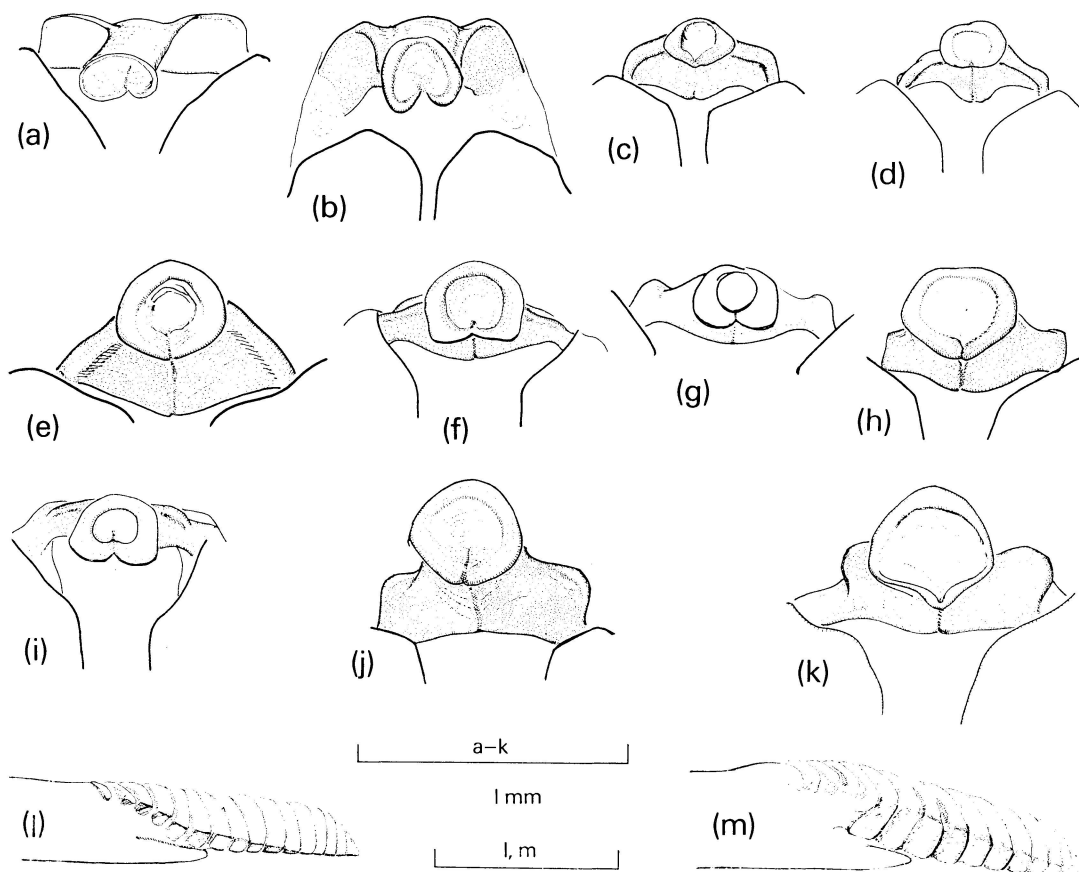
**HABITAT.** Males sing on screes and degraded soliflual debris; both sexes emerge on the edges of such bare areas, close to tussock grassland under which nymphs probably live.

**EMERGENCE PERIOD.** Earliest record 9 January (Fox's Peak), latest 27 February (Mt Hutt); 62%

of records are in January, 35% in February.

**REMARKS.** *M. m. mangu* differs from *M. cassiope* (which was apparently included in White's original material) in its narrower head, lack of red patterning, background colour, and costae; and from *M. oromelaena* in its smaller size, short, pale tomentum, pale opercula, and relatively unpatterned abdominal sternites. *M. tenuis* differs in its longer tomentum and darker abdomen (with more distinct patterning); *M. phaeoptera* in its clouded tegmina, blacker dorsal pigmentation, and darker ventral abdomen; and *M. otagoensis* in its darker (less distinctive) tomentum and the rosy hue of its ventral surface. All these species have distinctive songs.

(Continued on p. 328)



**Fig. 10.** Genital scales, anterior view (a–k) and valvula apices (l, m), *Maoricicada* spp: (a) *M. cassiope* L. Sylvester; (b) *M. alticola*, Turk Ridge; (c) *M. n. nigra*, Arthurs Pass; (d) *M. n. frigida*, Old Man Ra.; (e) *M. clamitans*, Mackenzie Pass; (f) *M. otagoensis maceweni*, Takitimu Ra.; (g) *M. tenuis*, Iron Hill; (h) *M. m. mangu*, Porters Pass; (i) *M. o. otagoensis*, Coronet Peak; (j) *M. mangu celer*, Turk Ridge; (k) *M. oromelaena*, Mt Cleughearn; (l) *M. phaeoptera*, Sentinel Peak; (m) *M. oromelaena*, Ohau Ra.

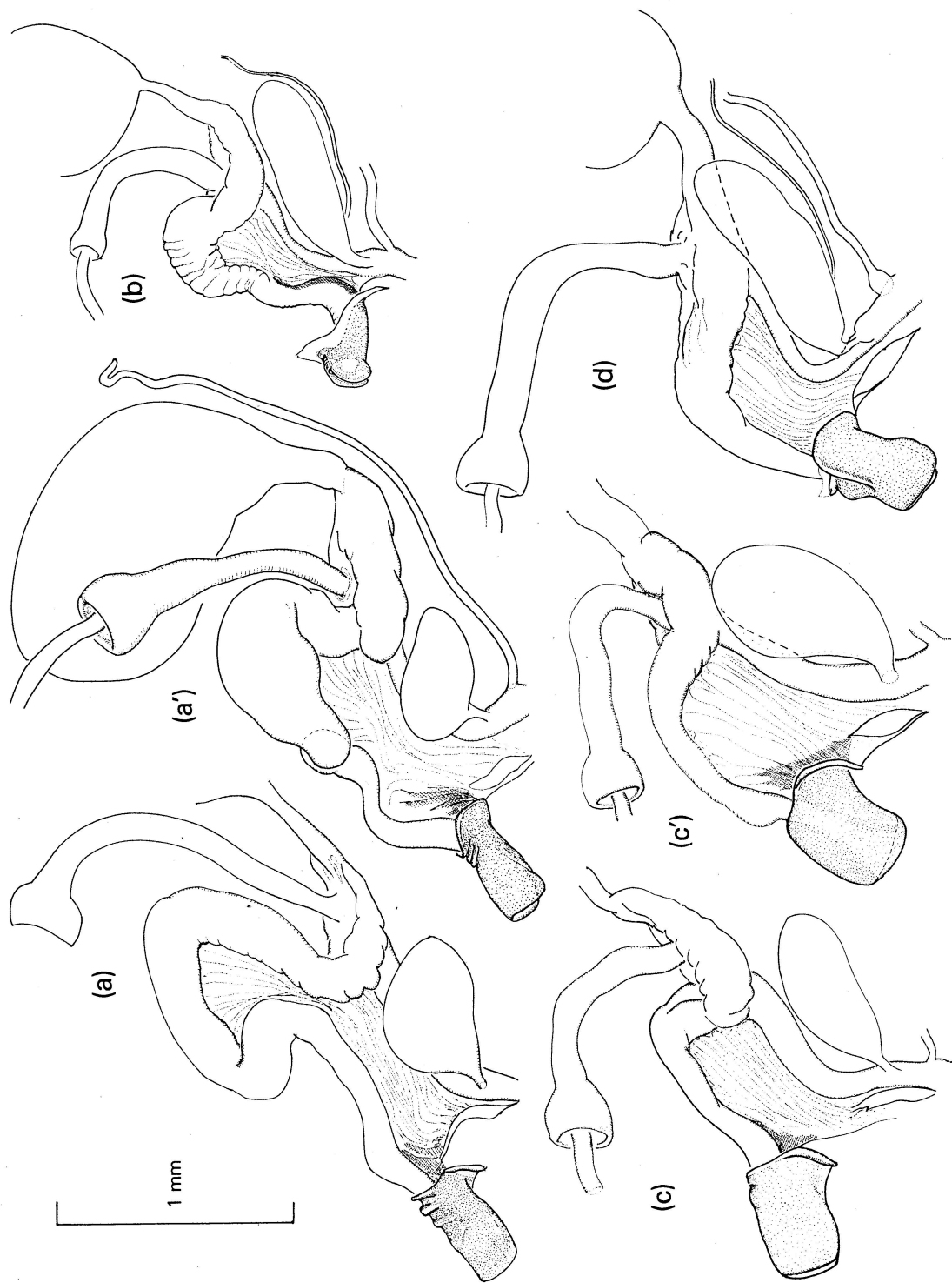
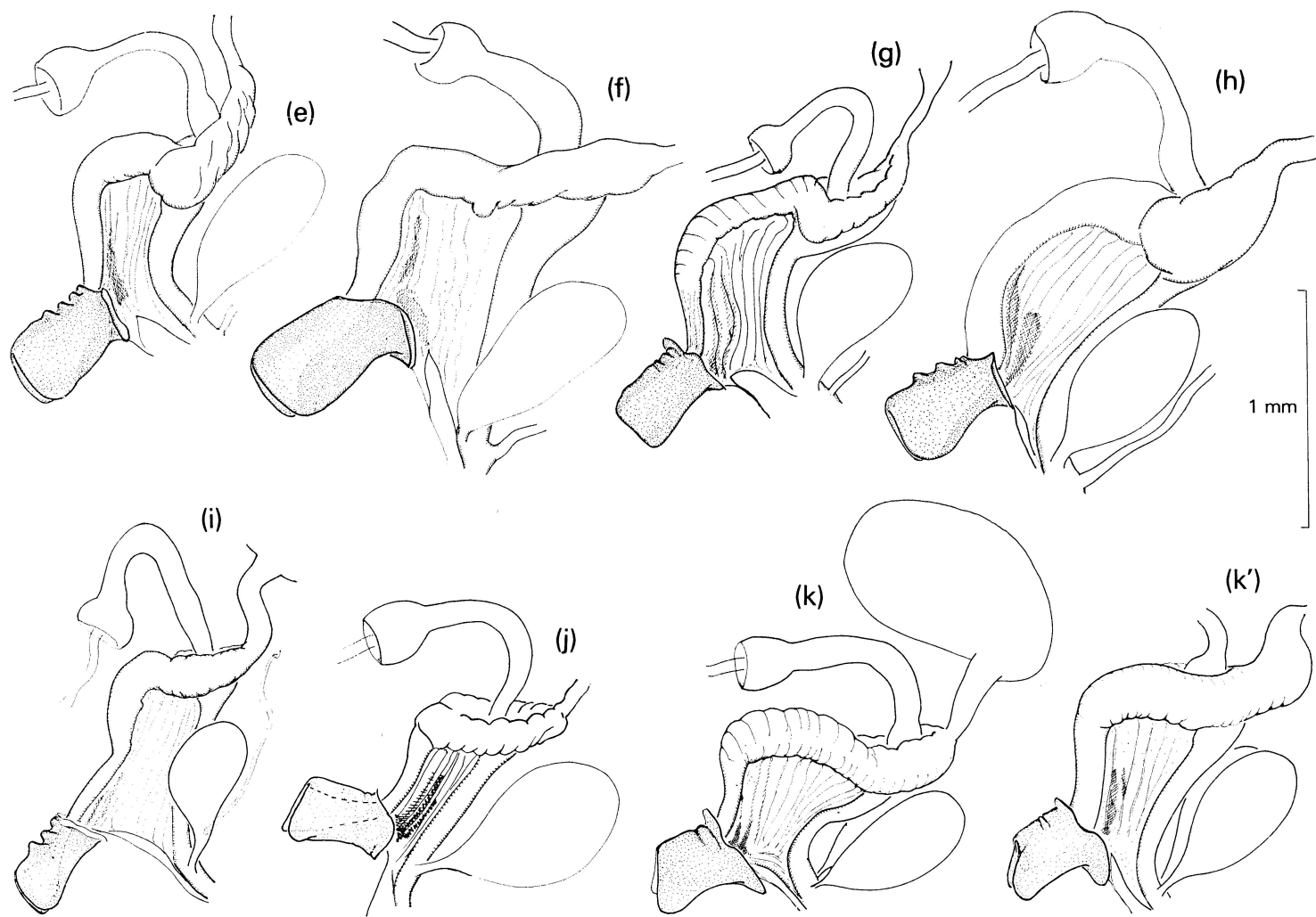
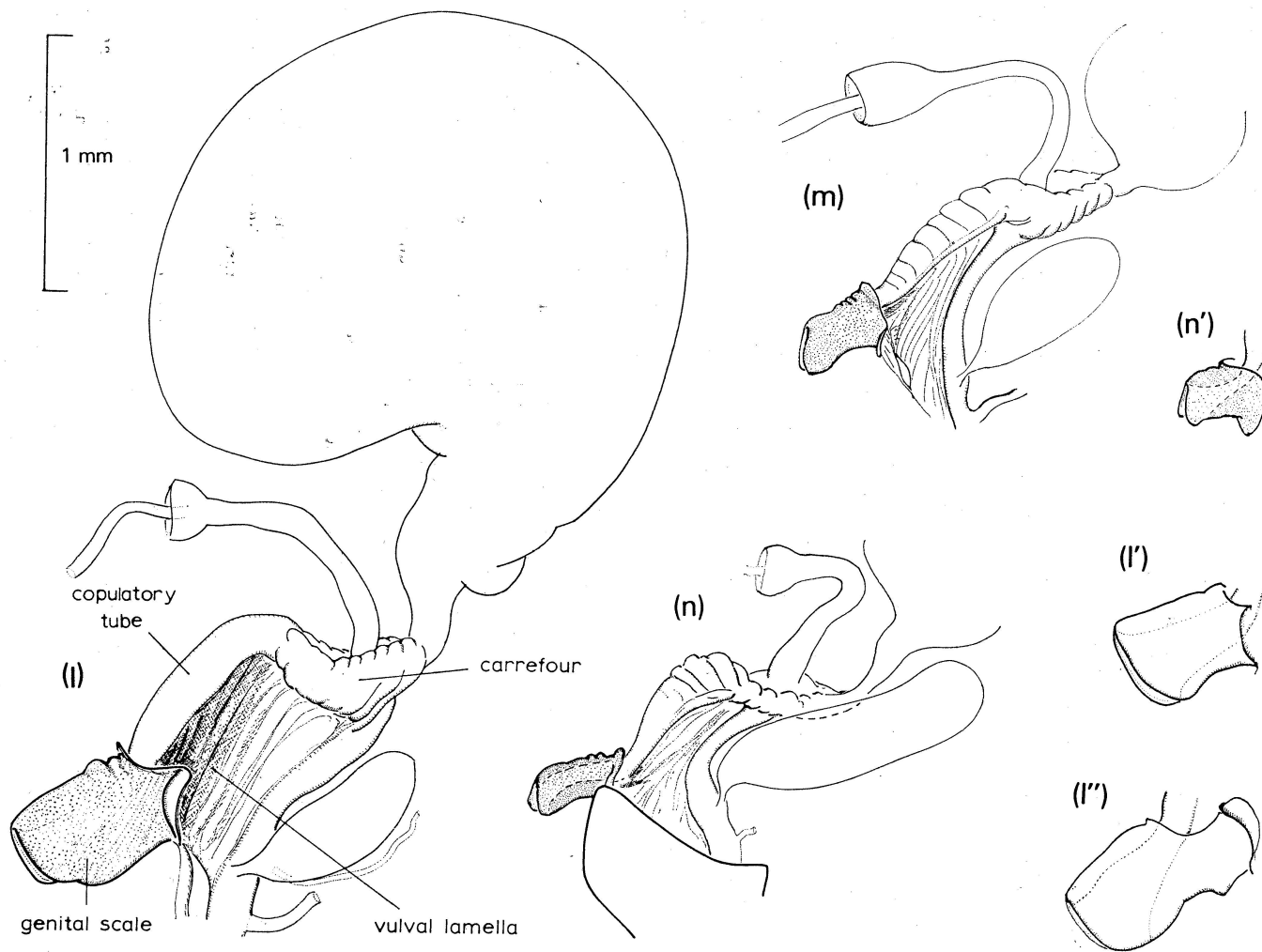


FIG. 11A. Internal female genitalia *Maoricicada* spp. in lateral view: (a) *M. clausenae*; (a') same; (b) *M. clausenae*; (b') same; (c) *M. hamiltoni*; (c') same; (d) *M. clausenae*; (d') same.



**Fig. 11B.** Internal female genitalia, *Maoricicada* spp., in lateral view: (e) *M. m. mangu*, Porters Pass; (f) *M. m. celer*, Turk Ridge; (g) *M. m. gourlayi*, Dun Mtn; (h) *M. m. multicostata*, Altimarlock; (i) *M. o.*

*otagoensis*, Coronet Peak; (j) *M. tenuis*, Island Pass; (k) *M. phaeoptera*, Sentinel Peak; (k') same, Richmond Ra. (MK).



**Fig. 11C.** Internal female genitalia, *Maoricicada* spp., in lateral view: (l) *M. oromelaena*, Mt Cleughearn; (m) *M. nigra*, Arthurs Pass; (n) *M. n. frigida*, Old Man Ra.; (l', l'', n') genital scales - (l') *M.*

*oromelaena*, Cupola Basin, Travers Ra.; (l'') same, Mt Trovatore; (n') *M. n. frigida*, Mt Pisa.



*Maoricicada mangu multicostata* Dugdale & Fleming n.ssp. (Fig. 7B, 11h, 12n, 13D)

TYPE MATERIAL. Holotype ♂, allotype: "Altmarlock Hut, Marlborough, 7 February 1972, A.H. Whitaker" (NM).

DESCRIPTION. Similar to *M. m. mangu* but with less pubescence, especially on salient areas, so that both sexes appear dull black relieved by orange-yellow patches on antennal ledge, in front of median ocellus, and on crux, posterior ridges of mesonotum, and posterior margins of abdominal tergites. Abdominal sternites (♂), especially sternite VII, with less pubescence and larger, more distinct median black markings than in *M. m. mangu* (Fig. 7B); sternite VII (♀) with a black spot on either side of base of ovipositor, and with pleural area more black than in *M. m. mangu*.

DIMENSIONS: ♂ - length 18-21.5(19.4), wing spread 37-42(39.5) ( $n=11$ ); ♀ - length 19.5-20 (19.75), wing spread 42-44(43.5) ( $n=4$ ).

GENITALIA as for *M. m. mangu*; female, Fig. 11h.

TYMBALS with 7-8 ridges (4 fused distally); basal spur strong, acuminate (Fig. 12n).

SONG. Tape recordings made at Island Pass (12 January 1967) and of a captive male from Duncan's Stream, Clarence Valley (6 December 1967) cannot be distinguished from recorded songs of *M. m. mangu*.

DISTRIBUTION (Fig. 13D). Marlborough to Mt St Patrick, North Canterbury.

LOCALITIES (holotype, allotype, and 15 paratypes examined). SOUTH I. MB. Mt St Patrick (St James skifield, c.1500 m) (F). Rocky Spur, Duncan's Stm, Clarence Vly, c.1200 m (TLG-T). Island Pass, Wairau - Clarence Divide, 1350 m (ED, F). Island Pass - Mt Crystal Ridge, Crimea Ra. (F). Altmarlock Hut (type loc.) (NM, F, ED). Mt Harkness, 1500 m (ED). KA. Mt Terako, 1200 m (ED). Mt Fyffe, 1200-1400 m (ED, F). Hodder Vly, Inland Kaikoura Ra. (F). Tarahaka, 2500-3500 m (F).

HABITAT. Subalpine - alpine screes and bare soil faces.

REMARKS. A wide geographic gap separates samples of males of *M. m. mangu* in the Waimakariri Valley from samples of *M. m. multicostata* at Mt St Patrick and Island Pass. The specimens from Mt Trovatore (just north of Lewis Pass) are females of uncertain subspecies.

The subspecific name refers to the large number of tymbal ribs.

*Maoricicada mangu celer* Dugdale & Fleming n.ssp. (Fig. 8j, 9l, 10j, 11f, 12o, 13L)

TYPE MATERIAL. Holotype ♂: "Turk Ridge, Crimea Range, Marlborough 6500 ft [c.1900 m], 17 February 1972, J.S. Dugdale & J.I. Townsend" (type collection, ED). Allotype: same locality and repository, but "15

Feb 1966, J.S. Dugdale & W.A. Holloway".

DESCRIPTION. Body robust, black, with grey pubescence; pronotal flanges, frontoclypeus, unblackened areas on fore femora, pleurites, and sternites pale brownish-red in ♂, tending yellowish-brown in ♀. Sternites with black semicircular area mesally (♂) or extensively blackened (♀). Wings lacking scale-like silver setulae; in ♂, veins with most setulae black (less pronounced in ♀).

DIMENSIONS: ♂ - length 19.5, wing spread 38.0 (holotype); ♀ - length 21.0, wing spread 41.0 (allotype).

GENITALIA. MALE (Fig. 8j): upper pygophore lobe black, directed almost at right angles to long axis of pygophore; lower lobe slender; inner lobe with one black seta; pseudoparameres abruptly narrowed apically, as long as shaft; aedeagus with ventral support ending at 0.7 of shaft length (Fig. 9l). FEMALE: genital scale smooth dorsally, basal wings not produced caudally (Fig. 10j, 11f).

TYMBALS with 6 ridges (4 fused distally; Fig. 12o); basal spur truncate.

SONG a 'basic' *Maoricicada* song consisting of main note and suffix, in which the pulse rate is about twice that of *M. m. mangu* (hence the subspecific name) and the suffix follows immediately. The song, although harsh and relatively low-pitched, is much more like that of other *Maoricicada* species (e.g., *otagoensis*, *alticola*) than is the specialised slow rattle of other subspecies.

DISTRIBUTION (Fig. 13D). Known only from the type locality: crest of Turk Ridge, Crimea Range, above head of Canon Creek, at around 1900 m.

HABITAT. Screes, unstable creek beds, and ridge crests above 1500 m on low-rainfall mountain ranges; rarely descending to 1400 m.

EMERGENCE PERIOD. Both specimens were collected in February.

REMARKS. *M. m. celer* differs from all other subspecies of *M. mangu* in lacking scale-like white setulae on the forewing veins in both sexes, and in having black setulae on the wing veins and a longer aedeagal ventral support in the male; from *M. m. mangu* and *M. m. multicostata* in the smooth genital scale of the female; and from *M. m. gourlayi* in tymbal structure and female genital structure.

*Maoricicada mangu gourlayi* Dugdale & Fleming n.ssp. (Fig. 7B, 8k, 9k, 11g, 12l, 13D)

TYPE MATERIAL. Holotype ♂: "Dun Mountain, Min. Belt, Maitai-Roding Saddle Nelson, c. 3000 ft [914 m] scree C.A.F., 4 February 1966" (NM; ex F). Allotype: same data but coll. E. S. Gourlay.

DESCRIPTION. Small *M. mangu*; ♂ abdominal ster-

nites with broad, median black area (anterior to a straw-coloured posterior margin) and pleura mainly black; ♀ sternites with obscure markings centrally (Fig. 7B); pronotal margins straight laterally.

DIMENSIONS: ♂ - length 16.0-18.0(17.1), wing spread 34.0-36.5(35.5) ( $n=11$ ); ♀ - length 18.0-19.0(18.5), wing spread 39.0-42.0(40.7) ( $n=3$ ).

GENITALIA. MALE: upper pygophore lobe almost in line with long axis of pygophore, pale-tipped; lower lobe thumblike, pallid, inner lobe lacking black setae (Fig. 8k); aedeagus with ventral support ending at 0.8 of shaft length; pseudoparameres shorter than shaft, lightly sclerotised (Fig. 9k, and Myers 1929a, plate IV fig. 38). FEMALE: genital

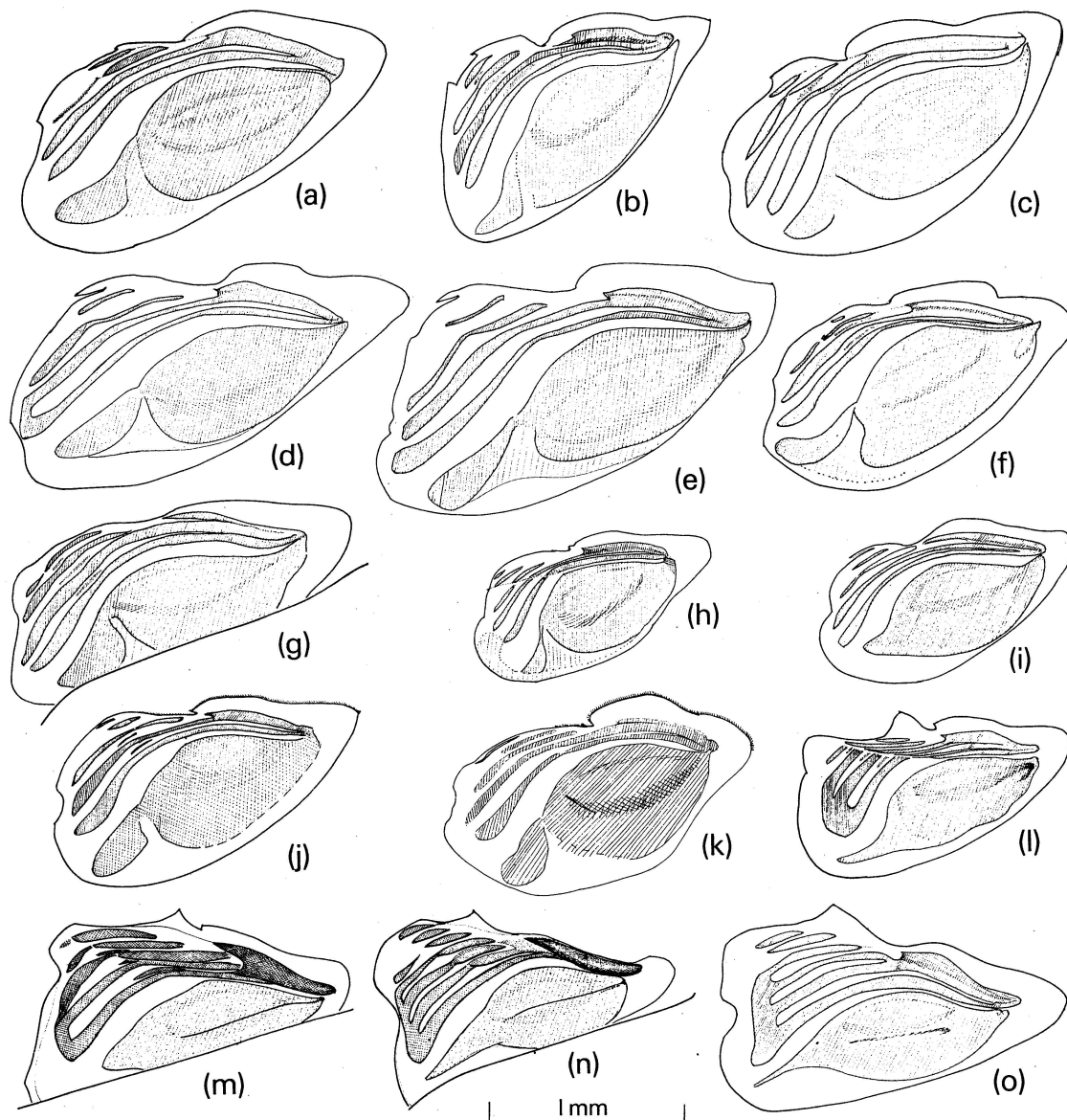


Fig. 12. Left tymbals, *Maoricicada* spp., showing ridge patterns: (a) *M. cassiope*, Victoria Ra.; (b) *M. hamiltoni*, Wilberforce R. (Mt Algidus Stn); (c) *M. clamitans*, Grandview Ridge; (d) *M. o. otagoensis*, Mt Alpha; (e) *M. o. maceweni*, Takitimu Ra.; (f) *M. oromelaena*, Turk Ridge; (g) *M. alticola*, Turk Ridge; (h) *M. n. nigra*, Arthurs Pass; (i) *M. n. frigida*, Mt Pisa; (j) *M. phaeoptera*, Sentinel Peak; (k) *M. tenuis*, Turk Ridge; (l) *M. mangu gourlayi*, Dun Mtn; (m) *M. m. mangu*, Porters Pass; (n) *M. m. multicostata*, Altmarlock; (o) *M. m. celer*, Turk Ridge.

scale and basal wings as in *M. m. mangu*; vulval lamella sclerotised more extensively than in other subspecies, sclerotised zone nearly reaching copulatory tube (Fig. 11g).

TYMBALS with 4 ridges (3 fused distally), basal spur attenuated (Fig. 12l); tymbal membrane with strong, deep, oblique fold, and basal dome with distinctly demarcated appendage.

SONG not recorded, but not noticeably different from that of *M. m. mangu*.

EMERGENCE PERIOD 14 December (Dun Mt, Myers) to 20 February (Mt Robert).

DISTRIBUTION (Fig. 13D). Isolated areas above the bushline in Nelson west of the Wairau Valley, from Mt Robert (north end of Travers Range) to Dun Mountain.

LOCALITIES (holotype, allotype, and 11 ♂, 3 ♀ paratypes examined). SOUTH I. **BR.** Mt Robert skifield, 130 m above bushline (F). **NN.** Dun Mtn, including Matai – Roding Saddle (**type loc.**) (BM, F, ED, NM).

HABITAT. Singing on scree and rock outcrops, especially in the 'mineral belt' of Dun Mountain.

REMARKS. This subspecies is named after Mr E.S. Gourlay, veteran collector of cicadas and other insects, who collected the type series (with C.A.F.) in 1966. *M. m. gourlayi* lacks the scale-like silver setulae on the wing veins of the female, and has shorter pseudoparameres and a longer ventral support than have the other three subspecies. In many respects *M. m. gourlayi* resembles *M. tenuis* (with which it is locally sympatric) more than typical *M. mangu*. In the Richmond Range, *M. tenuis* is distinguished superficially by having four (not three) adlateral hind tibial spurs, and convex lateral margins on the pronotum.

### *Maoricicada nigra* (Myers)

The distinctive black cicada discovered by G.V. Hudson near Temple Basin has since been recorded elsewhere along the main divide of the Southern Alps. As Hudson (1950) remarked it is the "High Alpine Cicada" of New Zealand—it often emerges and sings within a few metres of summer snow patches. In the drier high ranges of Central Otago, east of the main divide, *M. nigra* is represented by a distinct but related form, here treated as a subspecies.

### *Maoricicada nigra nigra* (Myers) (Fig. 5c, 6j, 7C, 8e, 9c, 10c, 11m, 12h, 13C)

1921 *Melampsalta nigra*; Myers, Transactions N.Z. Institute 53: 247, pl. 45 fig. 1–2.

1926 *Melampsalta nigra*; Myers, Psyche (Cambridge, Massachusetts) 33: 67, 76, pl. 3 fig. 9 (genitalia).

1927 *Melampsalta nigra*; Hudson, Transactions N.Z. Institute 58: 74.

1929 *Melampsalta nigra*; Myers, Transactions Royal Entomological Society of London 77: 31–3 (etc.), pl. 2 fig. 17, pl. 4 fig. 40.

1929 *Melampsalta nigra*; Myers, "Insect Singers": 129, 142, 172.

1950 *Melampsalta nigra* Myers; Hudson, "Fragments of N.Z. Entomology": 142, 144, pl. 16 fig. 1, 2.

1972 *Maoricicada nigra* (Myers); Dugdale, N.Z. Journal of Science 14(4): 876, fig. 32 (aedeagus).

1975 *Maoricicada nigra* (Myers); Fleming, Journal Royal Society of N.Z. 5(1): 55 (song).

TYPE MATERIAL. Holotype ♂, allotype: "Mountain on east side of Arthurs Pass [i.e., Temple Basin] 4600–5200 ft [c.1400–1585 m], 11 February, 1920 G.V. Hudson" (J.G. Myers Coll., BM); examined by C.A.F. in April 1967. Many topotypes, some of them probably paratypes but not so labelled, in New Zealand collections.

DESCRIPTION (Fig. 6j). See Myers (1921), Hudson (1950). Body small, black; wings short, with translucent axillary membrane and rather heavy venation.

MALE squat, glossy black dorsally, with red ocellar dark brown eyes, and dark brown ridges from crura to alar articulations; dorsally the tymbals alone are pale. Abdominal segments usually without pal posterior margins; pubescence plentiful, composed of long, black setulae; venter darker (Fig. 7c) than in other species of similar size; relatively less pal corneous on limbs; fore and mid coxae black opercula either wholly or only basally black; abdominal pleura dark brown to black with corneous distal edges, sternites dark reddish-brown to black except sternite VII and subgenital plate (hypantrium), which are warm orange and corneous. Costa and main veins straw-coloured, conspicuously margined in dark brown.

FEMALE with longer, uniformly tapered abdomen; ovipositor projecting (but less than in *M. phaeoptera* cf. Fig. 5a and 5c); colour as in ♂, but some specimens with pale median spot between ocelli; abdominal tergites with narrow, dull orange posterior edges; tergites VII and VIII dull orange posterolaterally; pygophore dull orange laterally; apices of ovipositor sheaths (3rd valvulae) black dorsally; body pubescence shorter than in ♂; sterna and pleura fawn or orange-fawn, sternites III–IV with median, ill defined dark brown blotches, sternite VIII with a pair of spots (Fig. 7C). Wings suffused with pale brown (this lacking in G.V. Hudson's specimens from "east of L. Harris"). Some specimens from south of Arthurs Pass lack the small anterior fore femoral spine.

DIMENSIONS: ♂ – length 14.0–18.0(15.9), wing spread 28.5–38.0(34.4) ( $n=27$ ); ♀ – length 14.0–18.0(16.5), wing spread 34.0–40.0(36.8) ( $n=22$ ).

GENITALIA. MALE: pygophore beak broadly tri-

angular, clasper lacking setae on the concave face; upper pygophore lobe black, oblique to long axis of pygophore (Fig. 8e); aedeagus evenly slightly curved; pseudoparameres arising dorsally, either as long as aedeagus (Spenser Range to Mt Cook) or short (Mt Niger to Fiordland), their apices slightly expanded (except in Mt Niger specimens) (Fig. 9c). FEMALE: genital scale slightly longer than wide, its base widest centrally (Fig. 10c, 11m); vagina and carrefours in same plane (Fig. 11m); gonapophyses VIII with fewer than 16 teeth apically.

TYMBALS cream, basal dome and anterodorsal rims corneous; 2 long ridges (the ventral short ridge interrupted); basal spur scarcely developed; basal dome with a faint, broad appendage (Fig. 12h).

SONG consists of two contrasting frequencies alternating so rapidly that the human ear conveys the impression of a low-frequency buzz accompanying the short, high-frequency notes. The buzz consists of a rapidly accelerating sequence of nine doublets, produced in an interval of 32 ms, the interval between IN and OUT decreasing from 1.8 ms to 1 ms. The buzz follows (and is immediately followed by) a single doublet of high frequency, produced by both tymbals in unison (Fleming 1975, p. 55). The general impression of the song can be represented as 'chit-er-chit-er-chit-er . . . '.

DISTRIBUTION (Fig. 13C). Mountains of the main divide of the South Island, from the Spenser Mountains and Victoria Range to Fiordland, 1200–1600 m.

LOCALITIES (35 ♂♂, 30 ♀♀ examined). SOUTH I. **BR.** Mt Gloriana, Spenser Mountains (ED). Lucretia Ridge, above Lewis Pass, 1350 m (ED). **NC.** Arthurs Pass National Park: Temple Basin 1300–1500 m (F, ED, NM); Trudge Col, 1500 m (F). **MK.** Mt Cook National Park: Sealey Ra. (NM, ED, GVH); Mt Sebastapol, 1200 m (F); Mt Wakefield, Cook Ra. 1200–1500 m (ED). **WD.** Mt Moltke, 1500 m (NM, AM, GVH). Alma Hut, 1680 m (AM). Waiho Gorge (AM). **WD/OL.** Arawhata Saddle, Mt Aspiring National Park, 1680 m (F). **OL.** Treble Cone and Mt Niger, Matukituki Vly (ED). Bold Peak, Wakatipu. E of L. Harris, Humboldt Mtns, 1800 m (GVH, BM). Tempest Ridge, Olivine Ra. (ED). **FD.** Barrier Knob, Gertrude Saddle, 1600 m. Mt Waitiri, Darran Ra., 1650 m (ED).

HABITAT. Alpine herb field and fellfield, typically in areas where herb communities alternate with a mosaic of frost-shattered pebbles, on which males sing. No particular association with any plant has been noted, but large populations have been found associated with poorly drained cirque floors (Spenser Mountains) and slopes copiously supplied with meltwater (Gertrude Saddle, Mount Waitiri).

EMERGENCE PERIOD. Specimens have been obtained between December (Christmas 1933; S. Hudson) and early March (J. Sweney, pers. comm.).

REMARKS. This subspecies seems to require high-rainfall mountains rising well above 1500 m, but

descends on them at times to much lower altitudes, e.g., to the Temple Basin track at about 1300 m. *M. oromelaena* has been recorded at greater altitudes than *M. nigra*—e.g., in Mt Cook National Park Mr J. Sweney has collected *M. nigra* from 730 m to 1830 m, and *M. oromelaena* from 970 m to 2000 m.

*M. nigra* is distinguished by its small size, almost uniformly glossy dark colour, and chittering song. The exceptional range in dimensions (wing spread 28.5–38.0 mm) doubtless results from the harsh conditions the nymphs must encounter. We can find no record from other countries of a cicada breeding under such extreme alpine conditions.

*Maoricicada nigra frigida* Dugdale & Fleming n.ssp. (Fig. 4a–c, 6k, 7C, 8f, 9h, 10d, 11n, 12i, 13C)

1975 *Maoricicada* sp. F. Fleming, Journal Royal Society of N.Z. 5: 52–7.

TYPE MATERIAL. Holotype ♂, allotype: "Old Man Range, Obelisk, 5400 ft [c.1650 m], 31 Jan 1970, C.A. Fleming" (type collection, ED).

DESCRIPTION (Fig. 6k). Similar to *M. n. nigra*, but tomentum silvery in ♂, wings transparent, not suffused with brown, and venter of head (including frons), thorax, and abdomen much paler, especially ♂ abdominal pleura and sternites (Fig. 7C); ♀ sternites with distinct dark markings (Fig. 7C); fore and mid coxae partly pallid; opercula generally with pale margins. Confluence of Cu and M stem veins often much shorter than in *M. n. nigra*, sometimes connate (i.e., forming an X-junction), whereas in the nominate subspecies it is two Y-junctions (see Fig. 4a–c); ♀ sometimes with costae, legs, and ventral surface magenta (not so in *M. n. nigra*).

DIMENSIONS: ♂ – length 13.5–17.0 (15.4), wing spread 29.0–35.0 (32.3) ( $n=48$ ); ♀ – length 15.0–19.0 (18.1), wing spread 34.0–39.0 (37.1) ( $n=26$ ).

GENITALIA MALE as in *M. n. nigra*, but upper pygophore lobe aligned along long axis of pygophore, pallid (Fig. 8f); aedeagus straight, its apex slightly decurved; pseudoparameres as long as aedeagus (Fig. 9h), their apices divergent. FEMALE: genital scale twice as long as broad (Old Man Range) or scarcely longer than broad (Mt Pisa), with transverse basal ridges; vagina and carrefours angled (Fig. 10d, 11n).

TYMBALS as in *M. n. nigra*, but ridges broader, crowded dorsally (Fig. 12i); anterior tymbal margin with long sliver above apex of dorsal (shorter) tymbal ridge (sliver reduced in *M. n. nigra*).

SONG a sequence of 3–6 treble notes (*zip*), the last followed by a long sibilant note of lower register (*eeze*). The whole sequence is repeated several times until, at the end of the song, the sibilant note is prolonged for several seconds: '*zip-zip-zip-zip-eeze, zip-zip-zip-zip-eeze, zip-zip-zip-zip-zip-zip-ee-ee-ee-ee*'.



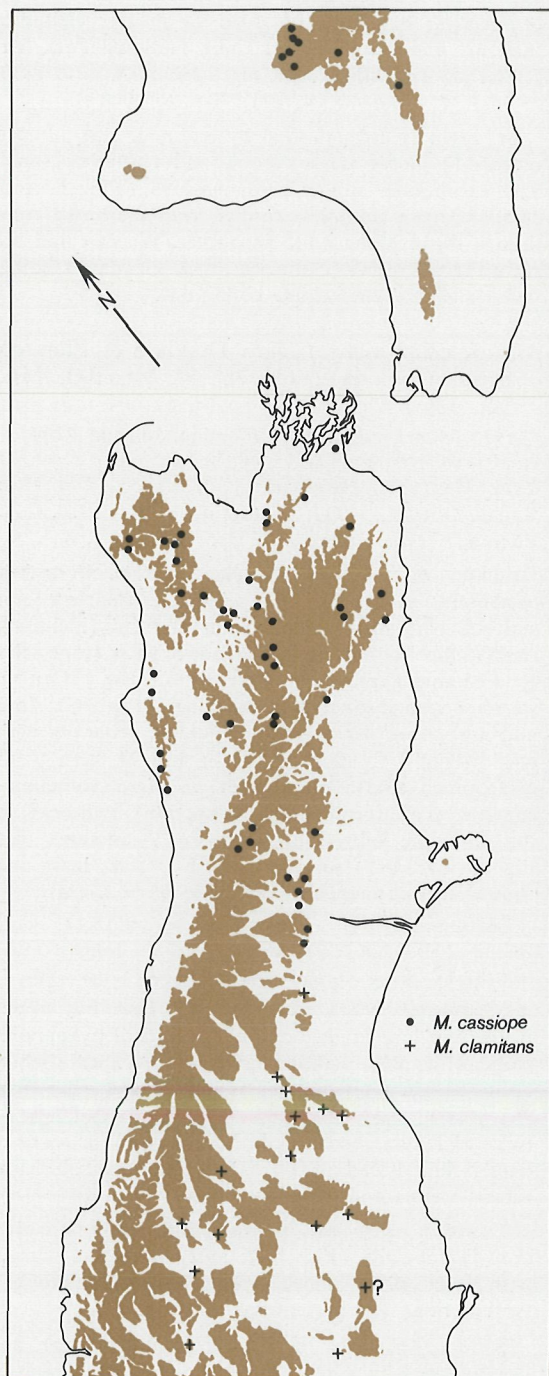


Fig. 13A. Distribution of *Maoricicada cassiope* and *M. clamitans* (for this and the following maps, colour depicts land over 900 m a.s.l.).

*ceze*'. The song thus differs greatly from that of *M. n. nigra*.

**DISTRIBUTION** (Fig. 13C). Summits of high mountains of Central Otago south of Clutha Valley.

**LOCALITIES** (holotype, allotype, and 36 paratype examined). SOUTH I. CO. Old Man Ra. near Obelisk, 1695 m (**type loc.**) (ED, NM, F). Above Fruitlands, c.1500 m, and above Shingle Crk, 1350 m (F). The Remarkables: Double Cone (ED); L. Alta 1800 m (F, ED). Pisa Ra. near L. McKay, 1500 1900 m (F, ED).

**HABITAT.** Alpine herb field and fellfield, locally with appressed scrub c.10 cm tall and abundant herbs in a mosaic with slabby schist exposures.

**EMERGENCE PERIOD** 18 January (Double Cone, Obelisk) to 24 February (Obelisk) or 10 April (Obelisk) but probably little earlier or later than shown by available specimens. None seen or heard in March 1974 on Old Man Range or Remarkables (B.M. May, pers. comm.).

**REMARKS.** *M. n. frigida* differs markedly in song but only slightly in structure from *M. n. nigra*. It is confined to alpine areas of Central Otago south of the Clutha River. Mark & Bliss (1970) have described the climate of some of these mountain tops which differs markedly from that of the dry valley and troughs that border them. In the valleys, annual rainfall is less than 800 mm (locally less than 40 mm) spread over less than 75 days. In the *M. n. frigida* habitat, the mean annual precipitation (rain, snow, hail) is about 1600 mm. Since summer precipitation exceeds estimated potential evapotranspiration, soil moisture remains close to field capacity throughout the growing season. The soils are essentially unfrozen from December to March, but are continuously frozen for the rest of the year. Even so, at least 12 days in February, the warmest month, have a freeze-thaw cycle. There is a high incidence of fog, which also affects adult cicada activity. At present, no comparable data can be found for *M. n. nigra* sites (e.g., Temple Basin), but mean annual rainfall in such sites is known to exceed 2500 mm. Details of February freeze-thaw cycles are unknown.

Newly hatched nymphs were present among roots of *Celmisia viscosa* clumps collected on 24 February.

Table 2. Frequency of occurrence, by locality, of confluence states in forewing veins M and Cu of *Maoricicada nigra frigida* (see p. 300)

	Confluence long (Fig. 4a)	Confluence absent (Fig. 4b)	Confluence connate (Fig. 4c)	n*
Old Man Ra.	13	4	2	19
L. Alta	—	1	—	1
Pisa Ra.	8	4	2	14

\*All Pisa and 16 Old Man Range specimens were collected on one day at each locality.



1974, suggesting that in *M. n. frigida* at least, eggs do not overwinter – cf. *Kikihia muta* (Fabricius), described by Cumber (1952).

The length of the confluence in forewing veins M and Cu varies (see p. 300); frequencies of occurrence for the three confluence 'states' are given in Table 2. The confluence condition did not show the bilateral asymmetry noted by Hudson (1927) for other venation characters of *M. nigra*.

*Maoricicada oromelaena* (Myers) (Fig. 2f, 6f–h, 7C, 8h, 9e, 10m, 11l, 12f, 13E)

1926 *Melampsalta oromelaena* Myers, Psyche (Cambridge, Massachusetts) 33: 65, pl. 3 fig. 8 (♂ genitalia).

1929 *Melampsalta oromelaena* Myers; Myers, Transactions Royal Entomological Society of London 77: 31–49, fig. 18 (♂ genitalia), 39 (aedeagus and copulatory hook).

1929 *Melampsalta oromelaena* Myers; Myers, "Insect Singers": 129.

1950 *Melampsalta oromelaena* Myers; Hudson, "Fragments of N.Z. Entomology": 144, pl. 15 fig. 12, 13.

1963 *Cicadetta oromelaena* (Myers); Metcalf, General Catalogue of the Homoptera, fasc. VIII, Cicadoidea (2): 366.

1972 *Maoricicada oromelaena* (Myers); Dugdale, N.Z. Journal of Science 14(4): 876, fig. 3 (tymbal).

TYPE MATERIAL. Holotype ♂, allotype: "Mt Cleughearn, Hunter Mountains, Southland, 914 m, 25 January 1917" [not "June" as published by Myers (1926)] (Myers Collection, BM). Both examined by C.A.F., April 1967.

DESCRIPTION. See Myers (1926), quoted by Hudson

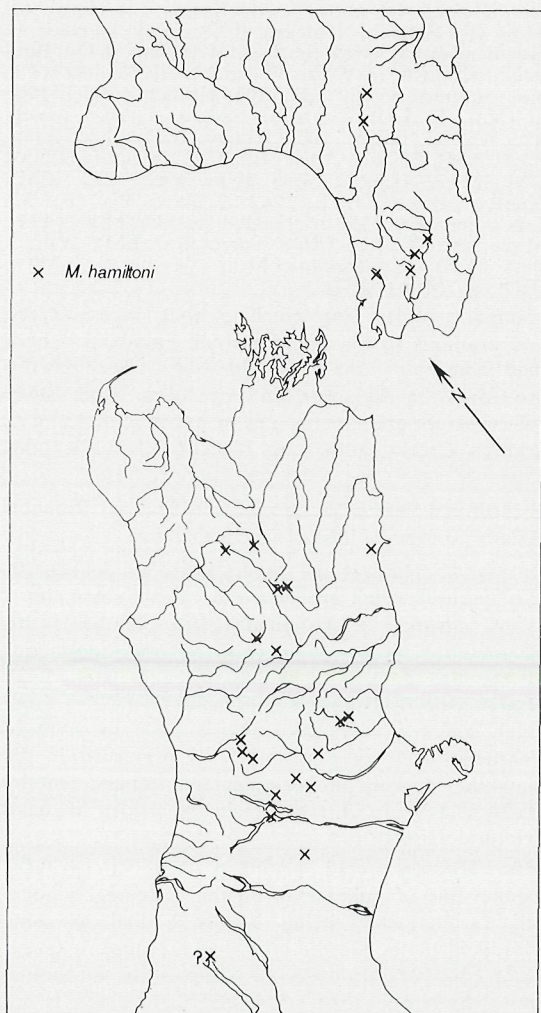


Fig. 13B. Distribution of *Maoricicada hamiltoni*.

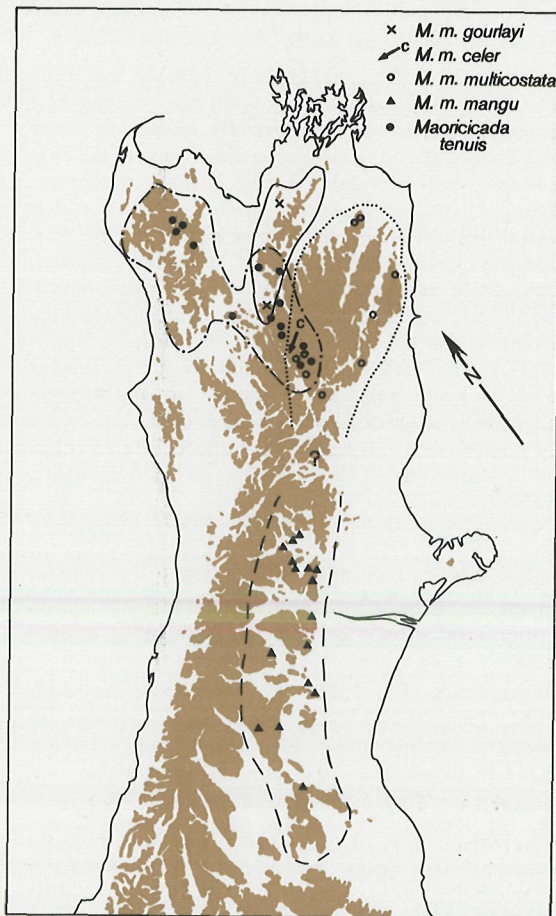


Fig. 13C. Distribution of *Maoricicada alticola*, *M. nigra nigra*, and *M. phaeoptera*.

(1950). Robust (Fig. 6f-h), largely black (♂) or with extensive, obscure pronotal and mesonotal pattern and pallid tergite margins (♀). Thoracic and head setulae erect, largely black (♂) or grey (♀); abdominal hairs tending gold or ginger. Scale-like setulae on head and thorax yellowish. Crux and thoracic pattern greenish-buff in Canterbury and Marlborough specimens, strongly orange in western Otago and Southland specimens. Abdominal tergites with orange posterior margins. Southland specimens with a weak dorsal abdominal stripe of broad, silver setulae. Opercula more or less extensively blackened basally, corneous marginally. Sternites blackened, with pallid margins (♂) or pallid, rarely pinkish, with or without a mesal series of transverse dark patches (♀) (Fig. 7C). Forewing with costa dark or pallid and with spine-like black setae; axillary membrane unpigmented. Apex of apophysis VIII as in Fig. 10m (cf. Fig. 10l).

**DIMENSIONS:** ♂ - length 18-21.5 (19.3), wing spread 37-45 (40.1) ( $n=41$ ); ♀ - length 17-23 (21.75), wing spread 41-47 (44) ( $n=40$ ).

**GENITALIA.** MALE: pygophore massive, its beak slender; upper pygophore lobe oblique to long axis of pygophore, lower lobe broadly triangular, inner lobe rectangular apically in lateral view (Fig. 8h); aedeagus shaft straight, its apex strongly decurved, expanded; pseudoparameres arising dorsally, their ventral support almost as long as aedeagus (Fig. 9e). FEMALE: genital scale smooth, or ridged basally, about twice as long as broad, basally square-shouldered, its caudal margin straight; orifice lacking obviously flanged lips (except in northern specimens); vagina longer than carrefours, perpendicular or at an acute angle to it; vulval lamella strongly and broadly sclerotised near vagina (Fig. 11l).

**TYMBALS** with 2 long ridges, 1 short, broken ridge, and 1 dorsal fleck; basal dome with an elongate, reniform appendage (Fig. 12f).

**SONG** a long sibilant note of uniform frequency, penetrating but not loud, with a staccato suffix of higher pitch (see Fig. 2f): 'e-e-e-e-zip'. In the field the source of the song is difficult to place—the cicada is often located only as it flies off from beneath one's boots.

**DISTRIBUTION** (Fig. 13E). Main divide of the South Island, from the Travers and Victoria Ranges to Fiordland, mainly above 1300 m but locally extending down to around 750 m in suitable habitats.

**LOCALITIES** (75 ♂♂, 60 ♀♀ examined). **SOUTH I.** **BR.** Mt Robert, Travers Ra. (ED); Cupola Basin, 1350-1450 m (ED, F). **Victoria Ra.** N of Rahu Saddle, 1200 m (ED). Peak 2 km SW of Gloriana Peak, Spenser Ra. (ED). **Lucretia Ridge**, S of Lewis Pass (F, ED). **Mt Trovatore (UC).** **MB.** Turk Ridge, Crimea Ra., 1500-2000 m (ED, F). **L. Guyon (UC).** **NC.** Arthur's Pass National Park: Temple Basin, 1300-2000 m (F, ED, UC); Arthur's Pass (GVH, NM); cirque N of Trudge Col (F).

**MC.** Craigieburn Ra., 1800 m, near Mt Cockayne (F). **Mt Lyndon**, 1200 m (ED). **Torlesse Ra.** (F, ED). **SC.** Mt Peel, 1000 m (ED). **Rangitata R.** (ED). **S. Winifred Strm (ED).** **MK.** Mt Cook National Park **Mt Sebastopol**, 1200 m (F, ED); **Mt Rosa**, 1500 m (ED); **Black Birch Strm**, 750 m (F); **Tasman Glacier**, 1200 m (F); **Ball Glacier**, opposite Caroline Face, 1500 m (F); **Beetham Glacier**, 2100 m (F); **Malt Brun Hut**, 1700 m (F); **Mt Wakefield**, 1700 m (GVH); **Sealey Ra.**, 1200 m (GVH, ED). **Ohau sk basin (ED).** **WD.** Candy's Creek, rockfall at main highway, Otira (F, ED). **Mt Moltke (AM).** **Haas Ra.**, S side Waitoto Vly below Hyperia, 700 m (F). **OL.** Mt Judah, scheelite workings, Richardson Rd (F). **Mt Earnslaw**, 1000 m (NM). **Mt Aspirin National Park:** Mt Brewster ridge, 1200 m (F). **Hunter Vly (ED); Gillespie Pass**, between S Young and Siberia Strms, 700 m (F); **Arawata Saddle**, V side, 1680 m (F); **Red Mtn**, 1500 m (ED); **Simoni Pass**, 1000 m (ED); **Mt Annetta (ED); L. Harri Saddle** and nearby **Routeburn Track (BM, NM, F)** **Dart - Rees Saddle (F); E Matukituki Vly (F)** **Routeburn Track** above **L. MacKenzie** and **Humboldt Mtns (F, ED); L. Howden (ED);** peak between **L. Howden** and **L. McRobert**, 1200-1800 m (ED); **Bol Peak**, **Kinloch (GVH); W side Emily Saddle (F)** **Key Summit**, 860 m (ED). **FD.** **Homer Tunnel**, 190 m (NM, F, ED). **Gertrude Saddle.** **Tutoko Bench Mt Waitiri basin**, 1000-1600 m (ED). **McKinno Pass (AM).** **Takahe Vly**, **Murchison Mtns (ED).** **M. Cleughearn**, **Hunter Mtns (type loc.) (ED, BM)** **Hunter Mtns (ED).** **L. Wapiti**, **Doon Vly (F).** **M. Luxmore**, 1200-1350 m (F, ED). **Kepler Mtns (AM)** **Manapouri: L. Roe (ED); Turret Ra. (ED); Wilmo Pass (ED); Kaherekoa Mtns**, **Monowai**, 1300 m (ED); **L. Monk (ED).**

**HABITAT.** Males sing on bare rock faces, screes and boulders in the upper tussock grassland - herb field mosaic or in the herb field above, where female are found in flight or on vegetation. Both sexes follow screes and stream fans to lower altitudes, e.g. Candy's Creek, Otira, and Black Birch Valley, M Cook.

**EMERGENCE PERIOD** 30 December (1974, Mt Brewster Ridge) to April (1966, Tasman Glacier).

**REMARKS.** Hudson and Myers identified females of this species—which are easier to catch than males—as *M. cassiope* or *M. quadricincta* (Walker); this accounts for records of *M. cassiope* from "mountains at the head of Lake Wakatipu" and from Lake Harris. One of Hudson's specimens (No. 25n) from "high country near Lake Harris 3600 to 4000 ft February 1911 when common" is preserved in the National Museum of New Zealand; others, sent by Hudson to W. L. Distant, are in the British Museum (Natural History).

As Hudson noted (1950, p. 145), the silvery median line of pubescence on the abdomen is not a reliable character, being largely limited to some Fiordland males. On the other hand, Hudson's speculation that *M. oromelaena* occupies an altitudinal zone between *cassiope* below and *nigra* above is not substantiated by observations in the regions of overlap. *M. oromelaena* completely overlaps *M. n. nigra*.

at Lucretia Ridge, Temple Basin, and Mt Cook National Park, but extends to lower levels on rock falls and riverbeds. It also overlaps *M. cassiope*, which occupies adjacent scrub and occasionally penetrates up into the zone of *M. oromelaena* if patches of scrub are present at exceptional altitudes. (e.g., at Temple Basin).

One male in the Auckland Museum is labelled "Mt Ida 22.10.23". The locality is probably Mt Ida near L. Coleridge, mid Canterbury, since no *M. oromelaena* have been collected on the Ida Range in Otago. The date is certainly wrong, for no alpine cicadas have been collected as adults before December.

There is little regional variation in *M. oromelaena*. The greenish to yellowish markings in Canterbury – Marlborough – Nelson populations change to more vivid orange or brick-red in western Otago – Southland, but even this is not consistent. Specimens from dry mountains in Marlborough (Fig. 6g) tend towards a rather terracotta colour, and their extensively pallid thoracic pleurites are matched in specimens from Red Mountain, western Otago.

*M. oromelaena* differs from Takitimu specimens of *M. otagoensis maceweni* (of which males have free tymbal ridges) in its black setulae on the Cu base of the forewing, its black costal setae, and the presence in the female of black setae ventrally along the pallid ventral margins of the pygophore.

### *Maoricicada otagoensis* Dugdale & Fleming n.sp.

In the drier mountains of Otago and Southland, south of the Clutha River and Lake Wanaka, the ecological niche that is occupied by *Maoricicada mangu* in Canterbury-Marlborough is filled by a new species comprising two geographic subspecies. Fleming (1975) referred to it as "*Maoricicada* sp. O".

*M. otagoensis* is a hirsute black cicada with a corneous to brownish-red forewing costa and more pink ventrally than *M. mangu*, from which it also differs markedly in song, having a generalised *Maoricicada* song resembling more the songs of *M. tenuis* and *M. alticola* than the low rattle of *M. mangu*. In males the apex of the aedeagus is scobinate ventrally, the pseudoparameres arise subdorsally, and their bases are not bowed outward as they are in *M. mangu*. In females the clypeus is pallid, with a central black spot (more extensive in *M. o. maceweni*), and the copulatory tube is angulate.

### *Maoricicada o. otagoensis* Dugdale & Fleming n.ssp. (Fig. 2g, 6c, 7D, 8l, 9d, 10i, 11i, 12d, 13E)

1975 *Maoricicada* sp. O Fleming, Journal Royal Society of N.Z. 5: 52–7.

TYPE MATERIAL. Holotype ♂, allotype: "Coronet

Peak, 3100–5400 ft [940–1600 m], 13 Feb, 1967, C.A. and M.A. Fleming" (NM).

DESCRIPTION (Fig. 6c). Wings transparent; costa pale corneous (or buff) to brownish-red, with pallid, spine-like setae; Cu base with pallid setulae or at most 2 black setulae. MALE: dorsal surface black with silver tomentum, with obscure orange patches on frontal ledge above antennae, on posterior ridges of mesonotum, rarely on crux (this more frequently black), and by narrow, inconspicuous, pallid articular margins to tergites. Sternites corneous to pink with dark central and proximal areas and distinctive black pattern on sternites VII and VIII (Fig. 7D). Opercula flesh-coloured with dark bases. FEMALE similar in colour, but paler because more pubescent. Venter pale corneous to pink; tergite VIII and pygophore concolorous laterally with sternites, so that tergites appear pale at margins. Pleurites with irregular and variable dark patches centrally on pleura. Sternite VI unmarked; sternite VII bearing paired black spots. Gonapophyses VIII with 13 teeth.

DIMENSIONS: ♂ – length 15–20 (16.6), wing spread 33–41 (37.1) ( $n=62$ ); ♀ – length 16.5–20 (18.4), wing spread 35–43 (39.6) ( $n=27$ ).

GENITALIA. MALE: pygophore beak acute; upper pygophore lobe oblique, its apex triangular; lower lobe thumb-like; inner lobe scarcely visible laterally. Claspers with inner face concave, setose (Fig. 8l). Aedeagus shallowly curved, expanded apically, scobinate ventrally near apex. Pseudoparameres arising dorsally (Fig. 9d). FEMALE: genital scale with 2 dorsal ridges (Fig. 10i, 11i), basally rather 'square-shouldered'; vagina angulate (Fig. 11i).

TYMBALS with 3 long ridges (ventral 2 ridges fused distally), 1 short ridge; dorsal sliver joined to tergite; basal spur short, fine; basal dome with an appendage (Fig. 12d).

SONG (see Fig. 2g). To the main note ('yer' or 'ooo') and suffix ('chick') forming the basis of most *Maoricicada* songs is added a high-frequency prefix: 'ee[yer-chick]'. Sometimes the main note, which is fairly long and continuous, is sounded alone or with either the prefix or the suffix (i.e., 'ee-yer, ee-yer', or 'yer-chick, yer-chick'). The song consists of doublets, apparently left and right synchronised, with a click repetition frequency of c.2000/s (Fleming 1975, p. 53). Individuals sing while flying from one rock exposure to another, resulting in curious Doppler effects.

DISTRIBUTION (Fig. 13E). Mountains of Otago and Southland, south-west of Lake Wanaka and the Clutha River and south-east of the 1000 mm isohyet, south to the Mararoa – Oreti gap, at altitudes of 1000–1650 m. but usually below 1400 m.

LOCALITIES (holotype, allotype, and 75 ♂, 30 ♀ paratypes examined). SOUTH I. OL. Alpha Peak,



Wanaka (ED, F). Coronet Peak (**type loc.**) (ED, F). Ben Lomond, Queenstown (NM, ED). CO. Pisa Ra. (F). Old Man Ra. above Fruitlands and above Shingle Crk (F). Nevis Saddle (ED, F). Hector Mtns E of Garston (F). Mid Dome (F, ED). Cannaird Ridge, Eyre Mtns (ED, F). The Titan Rocks, Garvie Ra. (ED).

**HABITAT.** Males sing on schist outcrops and slip scars in degraded tussock grassland with herbs and low scrub (*Dracophyllum*, etc.), on which emergence has been observed.

**EMERGENCE PERIOD** 15 January (Alpha Peak, 1971) to 14 February (Nevis Saddle, 1966) from records, but certainly more extended than this.

**REMARKS.** The song of *M. o. otagoensis* is similar to that of *M. alticola* and *M. tenuis*, but quite different from that of *M. mangu*. The Clutha Valley and its extension as Lake Wanaka separate this species from *M. phaeoptera*, but this allopatry cannot be attributed to close relationship. Moreover, because these subalpine forms must have been forced into the valley bottoms during the maximum advance of Otira Ice, probably less than 20 000 years BP, it

seems unlikely that they were then in the Clutha Valley, for if they had been, it is difficult to believe that they could have remained allopatric. Either one of the two would have advanced by selective advantages to the territory of the other, or the inevitable slight differences in ecological preferences would have led to sympatry. That neither occurred is evidence that their advance towards the Clutha occurred when they had already ascended into the mountains, so that the Clutha Valley was an effective distributional barrier to both species when they reached it. *M. otagoensis* has apparently crossed the Wakatipu – Mataura Valley to colonise the Eyre Mountains east of Kingston (without subspeciation), and has also crossed the broad Mararoa – Oreti Saddle to colonise the Takitimu Mountains, but the Takitimu populations have since been sufficiently isolated to deviate from the parent stock.

Specimens of *M. o. otagoensis* in older collections have been classed as *M. oromelaena* (e.g., Philpott's specimens from Ben Lomond; Myers 1926).

*Maoricada otagoensis maceweni* Dugdale & Fleming n.ssp. (Fig 7D, 8m, 10f, 12e, 13E)

**TYPE MATERIAL.** Holotype ♂, allotype: "Cheviot Face, Takitimu Range, Southland. 2800–3200 ft [850–975 m], C.A. Fleming and A.D. McEwen, 13 February 1970" (NM; ex F).

**DESCRIPTION.** Similar to *M. o. otagoensis* except sternites more extensively black in ♂ (Fig. 7D); more distinct boundaries between black and orange elements in colour pattern; little, if any, orange extending on to dorsal surface of tergite VII (but some intergradation occurs). Little difference in ♀♀ (cf. examples in Fig. 7D).

**DIMENSIONS:** ♂ – length 17.0–20.0(18.6), wing spread 34.0–40.0(38.9) ( $n=19$ ); ♀ – length 18.0–21.5(20.1), wing spread 38.0–44.0(40.1) ( $n=16$ ).

**GENITALIA** similar to those of *M. o. otagoensis*, but upper pygophore lobe rounded apically in ♂ (Fig. 8m), and genital scale with sloping (rather than square) shoulders basally in ♀ (Fig. 10f).

**TYMBALS** similar to those of *M. o. otagoensis*, but lacking distal fusion of tymbal ridges, and with dorsal sliver reduced (Fig. 12e).

**SONG** recorded Blackwood Station, 14 February 1970; indistinguishable from that of *M. o. otagoensis*.

**DISTRIBUTION** (Fig. 13E). Takitimu Range, presumably throughout at appropriate altitudes and in suitable habitat, though the three known localities are all on the western flanks.

**LOCALITIES** (holotype, allotype, and 34 paratypes examined). SOUTH I. SL, Takitimu Ra: Cheviot Face, above Forest Service hut, 1200–1350 m (F, ED, NM); E of Blackmount Homestead in area retired from grazing, 850 m (F); SW ridge, Whare Crk, 1440 m (F).

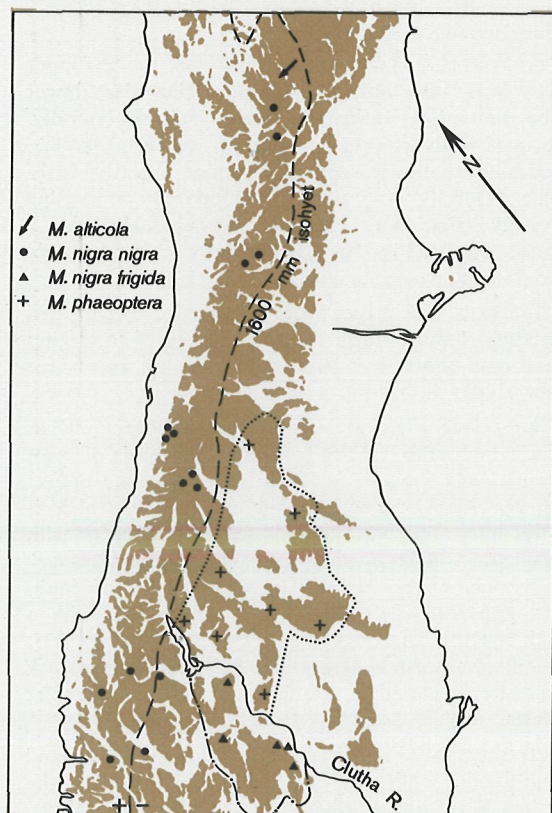


Fig. 13D. Distribution of *Maoricada mangu* sub-species and *M. tenuis*.



REMARKS. Although the nearest recorded *M. o. otagoensis* are from Mid Dome, they are probably present on the southern Eyre Mountains about 40 km to the north-east, across a saddle little above 300 m in altitude which was only partially forested at the beginning of European colonisation. The saddle's effectiveness as a barrier has been enhanced by predominantly north-west winds.

The subspecies is named for Dr A. D. McEwen, of the Forest Research Institute, collector of the first specimens, in recognition of his assistance with collecting on many occasions.

*Maoricicada phaeoptera* Dugdale & Fleming  
n.sp. (Fig. 1, 2h, 4d-g, 5a, 6l, 7D, 8g, 9n,  
10l, 11k, 12j, 13C)

TYPE MATERIAL. Holotype ♂, allotype: "Sentinel Peak, Wanaka, Otago, 4000-5000 ft [1200-1500 m] coll. C.A. Fleming, 14 Jan. 1971" (NM; ex F).

DESCRIPTION (Fig. 1, 6l). Wings usually infusate and relatively short; insula obsolete, usually represented as a faint streak. MALE: abdomen parallel-sided, rather abruptly tapering at segment VII (Fig. 6l). Dorsal surface black with plentiful silver tomentum, except the following corneous areas - ledges above antennae, narrow lateral and posterior margins of pronotum, crux, and ridges running from it to hindwing articulation, posterior margin of mesonotum, tymbals, extreme lateral edges and posterior edges of abdominal segments IV (rarely III) to VII, lateral patches on segment VIII, and subgenital plate. Venter corneous; opercula straw-coloured, with dark bases. Abdominal sternites each with an obscurely defined median crescentic dark patch. Pleura of tergite VIII with conspicuous triangular black marks (Fig. 7D). Forewing costa dull orange.

FEMALE: abdomen gradually tapering. Ovipositor sheaths ('3rd valvulae') projecting posteriorly beyond pygophore. Apex of apophysis VIII as in Fig. 10l. Colour as in ♂, but pubescence denser, giving a more frosted appearance; an additional pale median spot on head behind ocelli; ventral surface straw-coloured, with median dark-brown blotches on abdominal sternites (Fig. 7D). Both sexes with fore coxae pallid, or obscurely infusate centrally. Some specimens lack the anterior (smallest) fore femoral spine.

DIMENSIONS: ♂ - length 15-19(17.0), wing spread 32-39(35.0) ( $n=49$ ); ♀ - length 17-22(18.9), wing spread 34.5-41(37.7) ( $n=22$ ).

GENITALIA. MALE: pygophore beak broadly triangular; upper pygophore lobe more or less horizontal, lower lobe slender, inner lobe prominent; setae present on concave face of clasper (Fig. 8g). Aedeagus straight, its apex decurved, not expanded. Pseudoparameres arising laterally, slightly shorter

than aedeagus, sclerotised (Fig. 9n). FEMALE: genital scale square-shouldered, its tube with lobe-like lips (Fig. 11k). Vagina shorter than and perpendicular to carrefour (Fig. 11k). Ovipositor sheaths almost as long as sinus (area enclosed by sternite VII and sides of pygophore; see Fig. 5a).

TYMBALS with 3 long, 2 short ridges; 2 intercalary strips; basal spur acute, short; basal dome with an appendage (Fig. 12j).

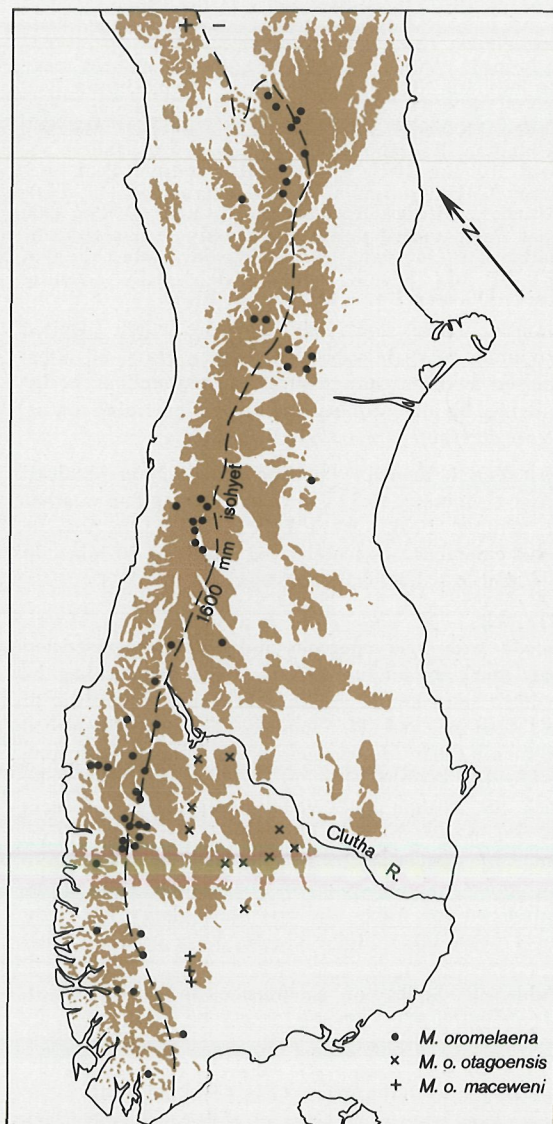


Fig. 13E. Distribution of *Maoricicada oromelaena*, *M. otagoensis otagoensis*, and *M. otagoensis maceweni*.

SONG (see Fig. 2h). The basic *Maoricicada* structure (main note plus suffix; Fleming 1975) is modified; the suffix is extended and repeated 4 or 5 times, following a considerably longer vibrant main note – 'eeyer-r' (or 'chur-r-r-r') 'chup-chup-chup'. The general effect (a long entry note followed by a sequence of short notes) is similar to the normal song of *Kikihia muta* (Fabricius).

DISTRIBUTION (Fig. 13C). Mountains of South Canterbury and North Otago, from the Mackenzie Basin south to Lake Wanaka and the Clutha Valley.

LOCALITIES (holotype, allotype, and 71 paratypes examined). SOUTH I. MK. Richmond skifield, near Round Hill, Richmond Ra., S of Two Thumb Ra., 1300–1350 m (F, ED). L. Ohau skifield, above Ohau Lodge, 1400 m (F). Ball Ridge, 1530 m (ED). MK/SC. Grampian Ra. above Hakataramea Pass (aural record, 10 Jan 1971, J.S.D.). OL. Sentinel Peak, between L. Hawea and L. Wanaka (type loc.) (F, ED). Grandview Ridge, ENE of Hawea Flat, 1350 m. CO. New Pass, unused power transmission route from St Bathans to Oamarua (N end Hawkdun Ra.), 1300 m (F). Mt Ida (S end, Hawkdun Ra.) (ED). Leaning Rock, Dunstan Ra., c.1500 m (F, ED).

HABITAT. Sings on rock outcrops and metalled mountain roads in subalpine tussock grassland interspersed with prostrate shrubs and abundant herbs. Judging by the numbers of adults emerging on it, *Celmisia lyallii* is a favoured host.

EMERGENCE PERIOD. Specimens have been obtained from 12 January to 12 February. During fine weather at Sentinel Peak on 14 February 1971 a possible peak emergence was noted (62 adults in 30 min), in a *Celmisia* – *Chionochloa* sward.

REMARKS. *M. phaeoptera* is a small, black *Maoricicada* with pale opercula and with very restricted pale markings on the dorsal surface, but lacking the reddish suffusion of ventral surfaces characteristic of *M. cassiope* and *M. clamitans*. It is distinguished from all other *Maoricicada* species by its very long ovipositor sheaths (Fig. 5a). *M. mangu* subspecies lack the median black patches on sternites (except *M. m. multicostata*, in which their pattern is different). *M. otagoensis*, which replaces *M. phaeoptera* in similar habitats south of the Clutha, lacks infuscation on the wings and has much darker sternites; most other black alpine cicadas have predominantly

black opercula. *M. tenuis*, which also has long ovipositor sheaths and at least the distal opercula pale, has ovipositor sheaths shorter than in *M. phaeoptera*, and darker sternites, especially sternite VIII and the subgenital plate. *M. phaeoptera* also differs from *M. tenuis* in its male genitalia, having strongly sclerotised lateral pseudoparameres which are as wide as the shaft; the female has pallid forewing setae (dark in *M. tenuis*) and a transversely grooved genital spout.

The distribution of *M. phaeoptera* in relation to that of *M. otagoensis* is discussed under the latter species. No records exist from the eastern side of the Two Thumb Range, and we were unable to locate *M. phaeoptera* on the Rock and Pillar Range, under initially ideal conditions.

In *M. phaeoptera*, the length of the confluence of forewing veins M and Cu varies (p. 300, Fig. 4d–g, and Table 3). Of 62 specimens taken on 14 January 1971 at Sentinel Peak, 14 lacked a confluence (i.e., M and Cu connate) and 26 had the confluence shorter than the oblique portion of M closing the base of the discal cell.

Populations of *M. n. nigra* and *M. phaeoptera* include individuals in which the smallest and distal-most fore femoral tooth is reduced or absent.

The specific name refers to the infusate wings of many individuals.

*Maoricicada tenuis* Dugdale & Fleming n.sp.  
(Fig. 5b, 6m, 7D, 8n–p, 9m, 10g, 11j, 12k, 13D)

TYPE MATERIAL. Holotype ♂: "Island Pass, MB 1400 m, grassland, 13 Jan 1967, JSD & W.A. Holloway"; allotype, same loc., "12.1.67., JSD/WAH, tussock and low scrub"; (type collection, ED).

DESCRIPTION (Fig. 6m) Wings usually infusate, relatively short. MALE: abdomen tapering from segment V; dorsally black except for antennal ledge, lateral pronotal margin, crux, and abdominal tergite margins, which are pallid; tymbals dark brown; head and thoracic scales pale gold, hairs black; abdomen with long blond hairs; ventral areas with long, dull-grey hairs; sternites pallid, centrally blackened; opercula pallid, basally blackened; apical abdominal pattern as in Fig. 7D. FEMALE: similar to ♂, but pallid areas larger, pronotum usually pallid on posterior margin, and sternites extensively pallid; (both sexes with abdominal sternites more extensively blackened in high-altitude specimens); forewing costa with some dark setulae, and Rs base with many long black setulae; ovipositor sheaths long (Fig. 5b); abdomen strongly tapering. Both sexes having fore coxae with a distinct black stripe, and all specimens with apical (smallest) fore femoral tooth well defined.

Table 3. States of confluence in M-Cu veins, *Maoricicada phaeoptera* (see p. 300)

Locality	Confluence long (Fig 4d)	Confluence short (Fig. 4e)	Veins connate or separate (Fig. 4f)	n
Round Hill	—	—	1	1
Oamarua	1	2	1	4
Grandview	3	—	1	4
Ida Ra.	—	1	—	1
Dunstan Ra.	1	3	1	5
Sentinel Peak	22	26	14	62

**DIMENSIONS:** ♂ - length 16-20(17), wing spread 32-39(35) ( $n=16$ ); ♀ - length 16-20(17.9), wing spread 34-44(37.7) ( $n=25$ ).

**GENITALIA.** MALE: pygophore beak slender, acute; upper pygophore lobe directed obliquely or perpendicular to long axis of pygophore, its apex acute (NW Nelson) or rounded (elsewhere); lower lobe thumb-like; inner lobe prominent, rectangular in lateral view (Fig. 8n-p). Aedeagus straight, its apex expanded, strongly decurved; pseudoparameres not quite as long as aedeagus, unsclerotised, slender, arising ventrolaterally (Fig. 9m). FEMALE: genital scale with basal shoulders produced, base widest centrally (Fig. 10g); vagina perpendicular to and as long as carrefour. Vulval lamella with 3 long sclerotised strips (Fig. 11j). Ovipositor sheaths as in Fig. 5b.

**TYMBALS** with 3 long ridges, 1 short; a very slender, irregular ridge dorsally; basal spur weak; basal dome with an appendage (Fig. 12k).

**SONG** of basic *Maoricicada* form (main note plus suffix) modified by addition of a high-frequency prefix; vocalised as 'zee-yorrrk-up, zee-yorrrk-up' (based on magnetic tape recordings from Turk Ridge by W.V. Ward; Island Pass by CAF).

**DISTRIBUTION** (Fig. 13D). Alpine areas of north-west Nelson, and Mt Murchison; eastern Nelson, western Marlborough.

**LOCALITIES** (holotype, allotype, and 46 paratypes examined). SOUTH I. **NN.** Iron Hill, L. Sylvester, 1400-1850 m (F, ED). Ridge E of L. Sylvester, 1200-1350 m (F). Mt Arthur (AM). Mt Peel, 1600 m (F). Red Hills Plateau, Mt Chrome, 1000-1550 m (ED, F). Gordon's Knob, 1370 m (ED). **BR.** Mt Murchison, Buller Vly, 1370-1450 m (ED). Mt Robert, 1250 m (ED). Mt Hopeless, Travers Ra., 1900 m (ED). Cupola Basin, Travers Ra. (F). **MB.** Mt Richmond, 1300 m (ED). St Arnaud Ra., 1520 m (ED). Turk Ridge, Crimea Ra., *Celmisia* herb field, 1860 m (ED). Island Pass (**type loc.**) and Mt Maling, Crimea Ra., 1350-1790 m (F, ED). Mt McCabe, L. Tennyson, 1500 m (ED).

**HABITAT.** Singing on bare soil, rocks, or vegetation in alpine scrub - grassland and herb fields. A large assemblage in *Celmisia* herb field at 1860 m, Turk Ridge, 3 February 1971.

**EMERGENCE PERIOD** 13 January (Island Pass) to 21-22 March (Mt Hopeless, Mt Arthur); none heard on Mt Robert on 1 January 1969, nor on 20 February 1970, when other species were singing.

**REMARKS.** The British Museum (Natural History) has one specimen of *M. tenuis* in the Distant Collection labelled "New Zealand" and sent by the late G.V. Hudson, who collected within its range in the Mt Arthur - Mt Peel area. This species inhabits mountain ranges with rainfall as high as c.2500 mm and as low as c.1200 mm. It overlaps and is sympatric with *M. cassiope* throughout; in the north-east

with *M. mangu gourlayi* on Mt Robert; and in the south-east with *M. m. celer* on Turk Ridge and with *M. m. multicostata* at Island Pass (and at Mt McCabe, Lake Tennyson; A.K. Walker, pers. comm.). The female of *M. tenuis* is superficially similar to those of several other taxa: *M. phaeoptera*, from which it differs in the many long, black setulae on the M stem base and its shorter ovipositor sheaths - cf. Fig. 5a and 5b; *M. mangu gourlayi*, from which it differs in the area of sympatry by having the pronotum explanate and convex laterally, instead of straight (Fig. 6m), and in having short, black setae on the costa and some black setae ventrolaterally on the pygophore; *M. m. celer*, from which it differs markedly in size, the strongly tapering abdomen, and comparatively longer ovipositor sheaths; and *M. m. multicostata*, from which it differs in lacking the stout, silver, scale-like hairs characteristic of *M. m. multicostata* and *M. m. mangu*.

The name refers to the slender, unsclerotised, fragile pseudoparameres characteristic of the males.

## ACKNOWLEDGMENTS

We are grateful to the following persons, who have collected or donated specimens of *Maoricicada* on our behalf, or provided field information, or have arranged transport or accommodation for our field work: Mr Graeme Anderson (Otago Catchment Board); the late Dr J. S. Armstrong (Taupo); Mr G. C. Baker (N.Z. Forest Service); Mr S. N. Beatus and Dr Graham Bishop (N.Z. Geological Survey); Dr J. Braggins (University of Auckland); Master M. Breen (Motupipi); Mr J.D.M. Campbell (Wellington); Mr S. Chambers (Mangatarata); Mr P. Child and Mr P. Clure (Alexandra); Mr C. Christie and Mr C.M.H. Clarke (N.Z. Forest Service); Mr Ray Cleland (Mt Aspiring National Park); Mr J. Coulter (Tawa); Mr Dixie Deans (and Mrs Horne), Cannaird Station (Garston); Mrs A. and the late Mr L. J. Dumbleton (Christchurch); Mr M. J. Esson (Entomology Division, DSIR); M. A. Fleming; Dr and Mrs K. J. Fox (Manaiia); Mrs D. France and family (Glenrock Station, Mackenzie Country); Mr R. Garnett; Mr and Mrs E. S. Gourlay (Nelson); Mr T. L. Grant-Taylor (Lower Hutt); Dr Elsie Griffin (Wellington); the late Dr J. T. Holloway (Rangiora); Mr W. A. Holloway (Golden Downs); Mr and Mrs P. M. Johns (University of Canterbury); Mr D. J. Kershaw and Mr M. Kershaw (N.Z. Forest Service); Mr David Lane (Wellington); Mr G. J. Lensen (Wainuiomata); Dr and Mrs A. D. McEwen (Rotorua); Mr I. C. McKellar (Dunedin); Prof. A. F. Mark (Dunedin); Messrs Matheson (Rock and Pillar Range); Mr C. C. Meikle (Nelson); Dr I. M. Morice (Wellington); Mr M. Moss (Christchurch); Dr V. E. Neall (Massey University); N.Z. Forest Service Officers (at Hanmer, Golden Downs, Invercargill, Nelson, Rangiora, and Reefton); Mr R. J. Ordish (National Museum); Mr J. Payton and Mr O. J. Marston (Dunedin); Mr W. Sandford (Bluecliffs Station); Mr M. A. Stoodley (Palmerston North); Mr J. Sweney (Lincoln College); Mr J. Syme (N.Z. Geological Survey); Mr J. I. Townsend (Nelson); Master S. Trotter (Makarora); Mr S. Tun



(Upper Hutt); Mr and Mrs R. A. Urquhart (Erewhon Station); Dr A. H. Whitaker, Mr M. Meads, and other members of Ecology Division, DSIR (Lower Hutt); Miss A. K. Walker (Entomology Division, DSIR); Messrs Guyon and J. H. Warren (Christchurch); Mr P. Williams (Christchurch); and Mrs Airini Woodhouse (Timaru). Mr W. V. Ward (then at Nelson) kindly made tape recordings of specimens of *M. alticola*, *M. mangu celer*, and *M. tenuis* from Turk Ridge in February 1971. Mr B. B. Given (Blenheim) kindly produced monochrome photographs from colour transparencies. Dr W. J. Knight (British Museum, Natural History) kindly sent the Museum's holdings of *Maoricicada* on loan. Figures 6a-m are the work of Mr D. W. Helmore, to whom we are also grateful for assembling all illustrations for reproduction.

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