

THE GENUS *COSTELYTRA* GIVEN  
(MELOLONTHINAE : COLEOPTERA)  
INCLUDING DESCRIPTIONS OF  
FOUR NEW SPECIES

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*Summary*

The distribution and affinities of the genus *Costelytra* are briefly discussed. Relationships of species and species groups are outlined and illustrated by a chart, and a revised key to members of the genus is provided, including four new species, descriptions of which are included. Diagnostic characters are illustrated, including series where it is necessary to demonstrate variability.

INTRODUCTION

The genus *Costelytra* is endemic to New Zealand and contains an interesting assemblage of species among which is *C. zealandica* (White), the most serious insect pest of pastures in this country. In this paper, *C. zealandica* is not dealt with in detail.

In a previous catalogue of the subfamily Melolonthinae in New Zealand (Given, 1960, p. 378), the genus was placed in the tribe Colpochilini as outlined for the group in Australia (Britton, 1957). This as well as other tribal placements for the subfamily, is a matter of convenience and not of accuracy. For instance, Britton's Colpochilini requires an antennal club of five or six lamellae, whereas in most New Zealand representatives and all of the genus *Costelytra* the club has only three lamellae. Tribal definitions and boundaries for the New Zealand Melolonthinae should be drafted to suit the New Zealand fauna until such time as a world classification can be formulated.

*C. zealandica* and *C. diurna* Given stand out from the remaining known species on account of colour, structure, and behaviour. The former ranges throughout the country from sea level to over 4,000 ft, in rainfall from 14 in. to over 100 in. per annum, through most soil types and associated with most plant communities except dense forest. The latter (*C. diurna*) is the only known diurnal species of the genus and is the smallest in size. This species poses something of a problem as at the time of its initial discovery near Timaru in 1955 it was flying in thousands in gregarious fashion in two known localities and has only once been located since.

The remaining members appear to be a relatively compact species group centred about *C. brunneum* (Broun). This species has a wide, but discontinuous distribution while all other species of the group appear to be

relatively local (Fig. 1). While this indicates species development from the *brunneum* line, examination of genitalia does not support this contention.

In the following account, four new species are described and the distribution, variability, and relationships of species are discussed.

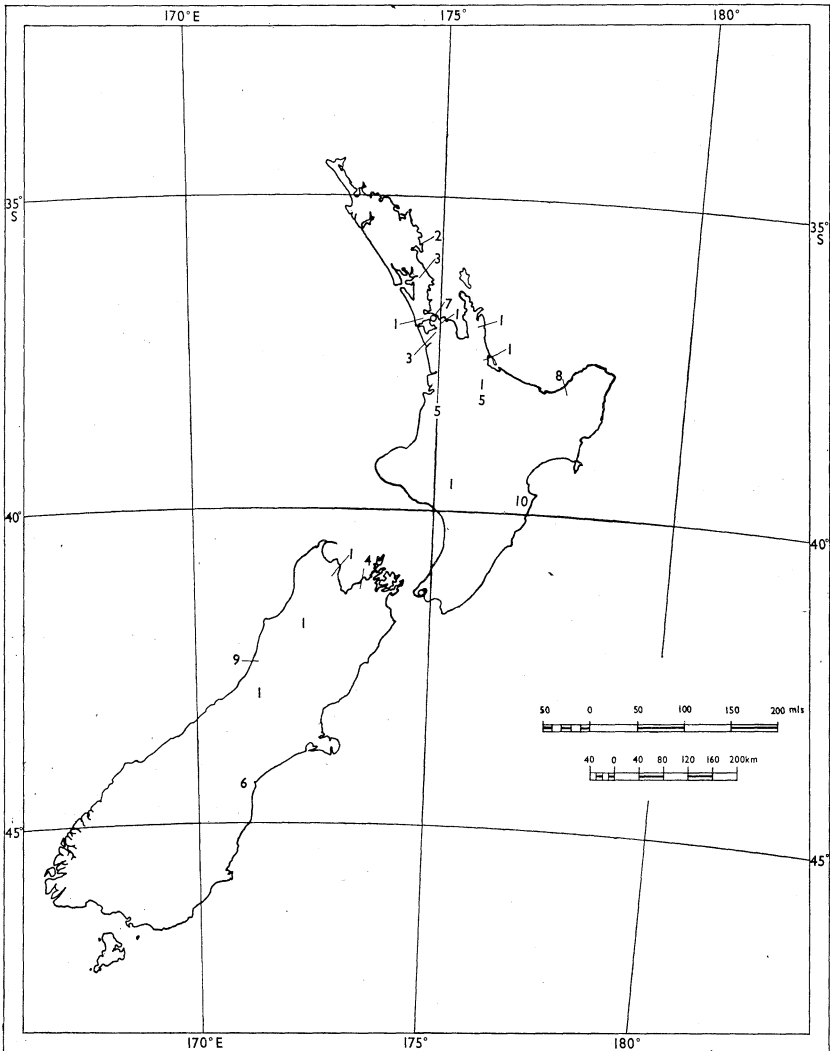


FIG. 1.—Map of New Zealand showing known distribution of the genus *Costelytra*. Species are indicated as follows: 1. *C. brunneum*, 2. *C. pseudobrunneum*, 3. *C. macrobrunneum*, 4. *C. austrobrunneum*, 5. *C. picebrunneum*, 6. *C. diurna*, 7. *C. brookesi*, 8. *C. symmetrica*, 9. *C. distincta*, 10. *C. gregoryi*, (*C. zealandica* is not indicated, as it occurs in suitable areas throughout both islands.)

KEY TO SPECIES OF THE GENUS *Costelytra*

The original key to species of the genus (Given, 1952, p. 14) was applicable to males only and resorted to the use of genital characters for ultimate separation. This has proved to be unsatisfactory, and an attempt has been made to construct a key avoiding both primary and secondary sexual characters. Key separation is in some cases difficult and it may be found necessary to refer to figures and descriptions when a range of species is not available for direct comparison.

1. Pronotum with discal bristles ..... 2  
    Pronotum without discal bristles ..... 4
2. Discal bristles uniformly distributed over entire pronotal surface ..... 3  
    Discal bristles confined to two or three transverse median groups  
    (Fig. 3) ..... *pseudobrunneum* Given.
3. Fore tibial teeth short and blunt (Fig. 10); elytral suture, pronotal  
    disc and head almost black ..... *diurna* Given.  
    Fore tibial teeth elongate and acute (Fig. 9); pronotal disc and  
    entire elytral area concolorous ..... *symmetrica* n. sp.
4. Pronotum with posterior margin strongly depressed (Fig. 12a); hind  
    tibia not distally expanded (Fig. 35) ..... *distincta* n. sp.  
    Pronotum with posterior margin not strongly depressed (Fig. 11a);  
    hind tibia distally expanded (Figs. 33, 34, 36-53) ..... 5  
    Scutellum impunctate except in very rare cases; pygidium translucent  
    or transparent ..... *zealandica* (White).  
    Scutellum punctate; pygidium densely pigmented and opaque ..... 6
6. Hind tibia sub-basally excavated (Fig. 36)\*; clypeus very broad and  
    large, very narrowly anteriorly reflexed (Fig. 5) ..... *gregoryi* n. sp.  
    Hind tibia without a sub-basal excavation (Figs. 33, 34, 37-53);  
    clypeus not unusually broad or large, not very narrowly reflexed  
    (Fig. 6) ..... 7
7. Outer lateral (impunctate) interstices obscure; colour uniform dark  
    red brown or piceous without lighter dorsal markings ..... *piceobrunneum* Given.  
    Outer lateral (impunctate) interstices not obscure; colour usually  
    ferruginous or with elytra lighter than pronotum ..... 8
8. Fore tibial calcarium very short, length about equal to width of first  
    tarsal segment (Fig. 7); posterior and lateral marginal areas of  
    pronotum lighter in colour than disc ..... *austrorunneum* Given.  
    Fore tibial calcarium not very short, length at least twice width of first  
    tarsal segment (Fig. 8); pronotum unicolorous ..... 9
9. Pygidium strongly convex (Fig. 87) ..... *brookesi* n. sp.  
    Pygidium not strongly convex (Fig. 85) ..... *brunneum* (Broun).

\*To distinguish excavation, correct orientation is important.

## DESCRIPTIONS OF NEW SPECIES

*Costelytra distincta* n. sp.

(Figs 1, 12, 12a, 20, 35, 56, 77, 85, 97)

A small, very dark species, immediately recognised by its strongly convex almost bulbous pronotum and sublobate clypeus.

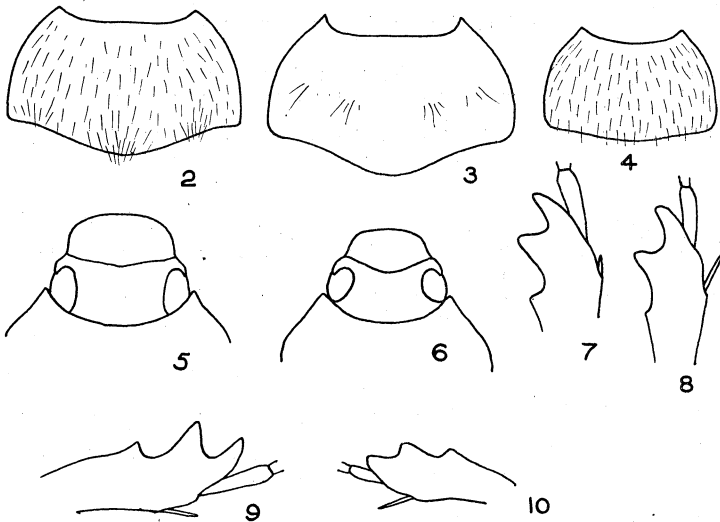
Colour deep reddish brown, somewhat lighter ventrally, on legs and on the head.

Head finely and closely punctate, clypeus very strongly reflexed with the anterior margin medially incurved to produce a somewhat bilobed appearance (Figs 12, 12a); apical segment of maxillary palp elongate and slender (Fig. 77); antennal club very short, the lamellae shorter than segments 2-4 combined (Fig. 20).

Pronotum (Figs 12, 12a) finely punctate, strongly convex, anterior angles acute but not greatly produced, anterior margin straight between bases of angles; posterior narrower than middle, posterior angles broadly rounded.

Scutellum punctate.

Elytra (Figs 12, 12a) strongly convex, almost parallel sided, finely punctate except on alternate, narrow interstices.



FIGS 2-4—Pronota: 2. *C. symmetrica*, 3. *C. pseudobrunneum*, 4. *C. diurna*.

FIG. 5-6—Heads: 5. *C. gregoryi*, 6. *C. brunneum*.

FIGS 7-10—Fore tibiae: 7. *C. austrobrunneum*, 8. *C. brunneum*, 9. *C. symmetrica*, 10. *C. diurna*.

Pygidium (Figs 84, 84a) somewhat bulbous, rather sparsely punctate.

Fore tibia (Fig. 56) very broad, width at middle tooth to length ratio being 3 : 7. Hind tibia (Fig. 35) not distally expanded, with practically no neck or transverse external carina, uniformly punctate.

Genitalia of male (Figs 97, 97a) with the parameres asymmetrical basally and slender apically.

Length: 10 mm.

Breadth: 5 mm.

Material examined: Holotype male, labelled "Greymouth" in the handwriting of T. Broun. No date or collector's name: In the A. E. Brookes collection, Entomology Division, D.S.I.R.

*Costelytra brooksei* n. sp.

(Figs 1, 17, 33, 54, 75, 87, 94)

A rather small species, very similar in general appearance to *C. brunneum* but distinguished by male genital characters and minor differences, principally on the pygidium, fore and hind tibiae and maxillary palpi.

Colour deep reddish brown, somewhat darker on head and pronotum.

Head not distinctive: clypeus closely, almost rugosely punctate, the anterior margin somewhat reflexed but not sinuate or lobed, nearly uniformly rounded; frons and vertex uniformly finely punctate. Antennae (Fig. 17) not distinctive and falling within the range of variation for *C. brunneum* or *C. pseudobrunneum*, the length of the lamellae being approximately equal to the total length of the remaining antennal segments. Maxillary palpi (Fig. 75) with the second segment not distally expanded.

Pronotum broadest posteriorly, anterior angles somewhat produced, posterior margin arcuate, posterior angles rounded, punctation rather coarse and uniformly dense. Scutellum very obscurely and sparsely punctate.

Elytra rather coarsely and uniformly punctate on the broad alternate interstices.

Pygidium (Figs 87, 87a) somewhat bulbous, uniformly finely punctate, finely rugulose toward anterior border on median area. (On *C. pseudobrunneum* the pygidium (Figs 86, 86a) is of more angular form, and very densely and finely rugose-punctate, becoming finely but very densely rugulose towards apex; on *C. brunneum* (Figs 85, 85a) there is no distinctly rugulose area and the profile is not much curved; on *C. macrobrunneum* (Figs 90, 90a) the pygidium is uniformly finely and densely punctate).

Fore tibia (Fig. 54) rather more slender than in most other species, but not sufficiently so to be readily separated from *C. brunneum*, *C. macrobrunneum*, and *C. austrobrunneum* (Figs 58, 59, 71). The calcarium is

shorter than on *C. brunneum*, *C. distincta*, and *C. gregoryi*, and about the same length as on *C. symmetrica* and *C. pseudobrunneum*.

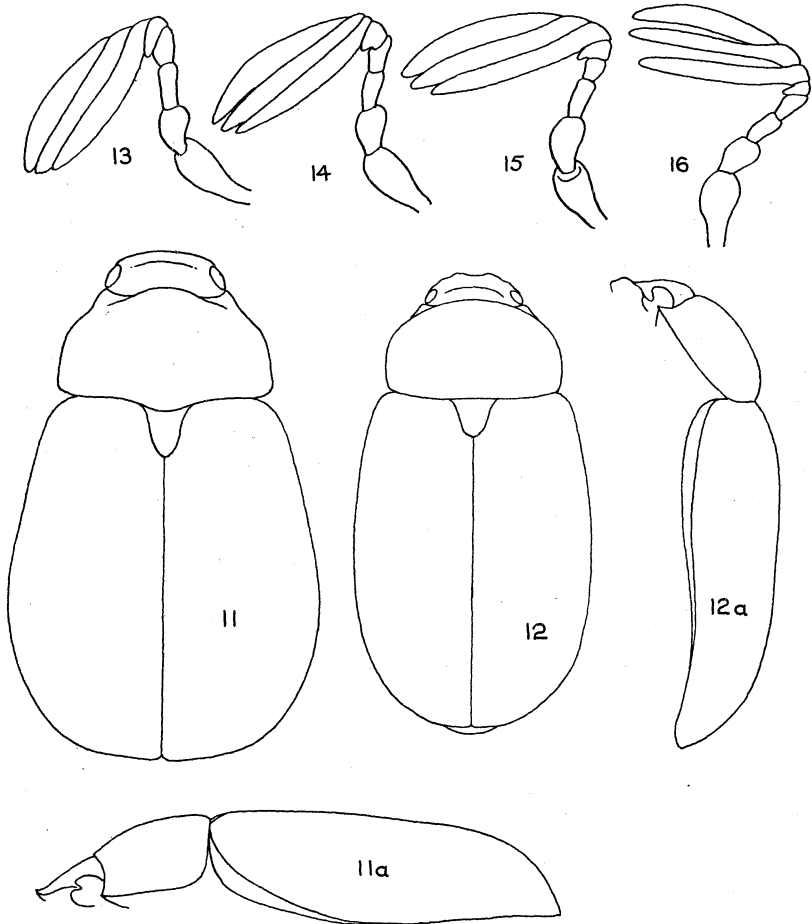
Hind tibia (Fig. 33) not sufficiently distinctive for reliable separation from *C. brunneum*, *C. symmetrica*, or *C. pseudobrunneum*, but is readily distinguished from *C. macrobrunneum* (Fig. 37), *C. gregoryi* (Fig. 36), and *C. distincta* (Fig. 35).

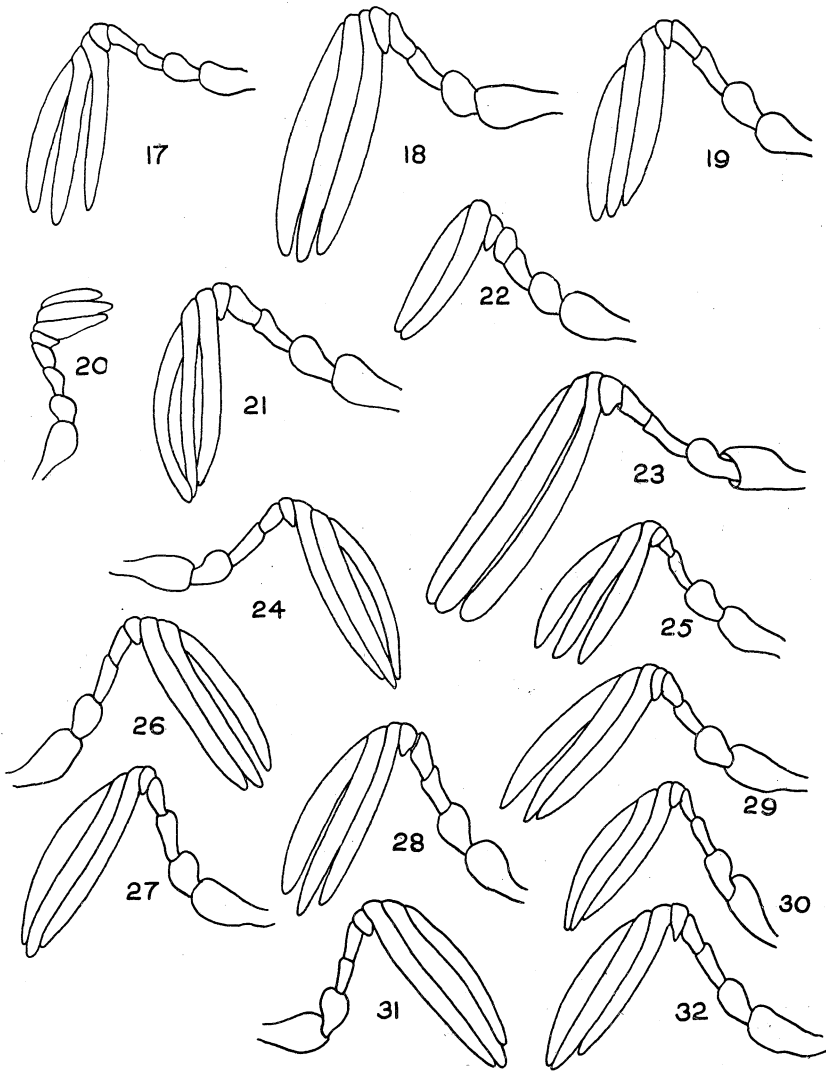
Genitalia of male (Figs 94, 94a) with parameres asymmetrical but not strongly so. Most similar to *C. gregoryi* but less slender and elongate.

Length: 10.5 mm.

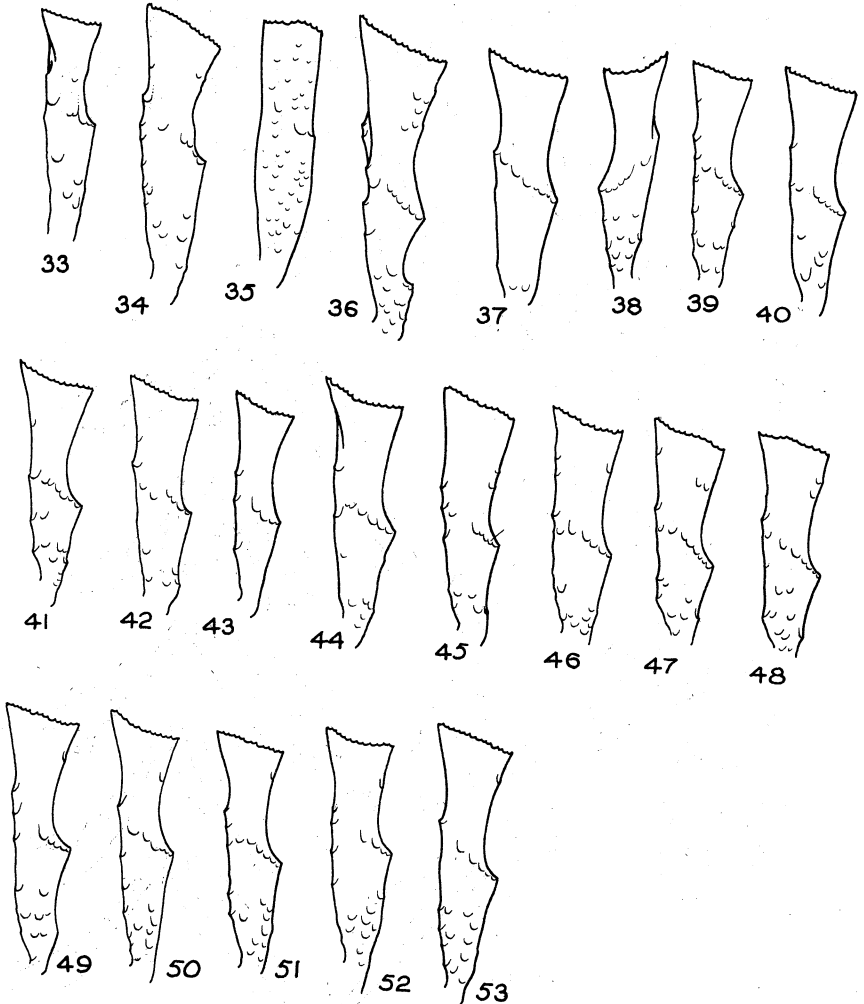
Breadth: 5.7 mm.

Material examined: Holotype male, collected by A. E. Brookes at Mt Albert, Auckland, in 1914. In the A. E. Brookes collection, Entomology Division, D.S.I.R.



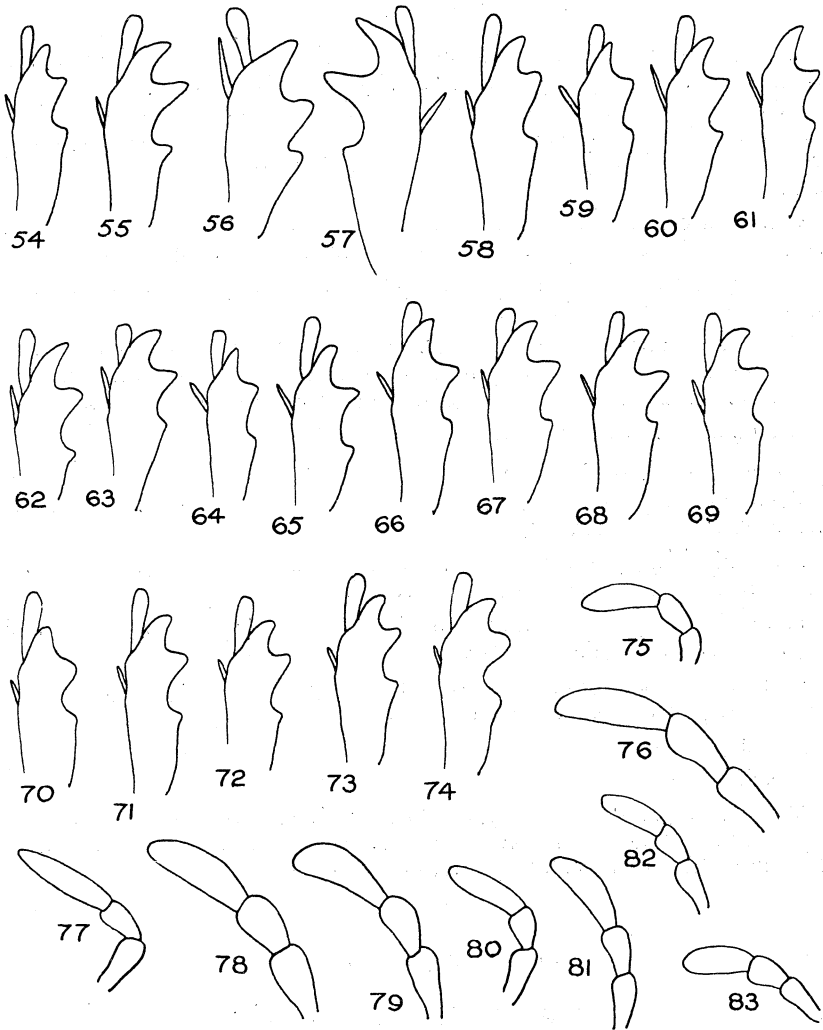
FIGS 11, 11a—*C. brunneum*, dorsal, profile.FIGS 12, 12a—*C. distincta*, dorsal, profile.

FIGS 13–32—Male antennae: 13–16 and 21. *C. pseudobrunneum*, 17. *C. brookesi*, 18. *C. gregoryi*, 19. *C. symmetrica*, 20. *C. distincta*, 22. *C. brunneum* (abortive), 23. *C. macrobrunneum*, 24–32. *C. brunneum*.



FIGS 33-53—Hind tibiae: 33. *C. brookesi*, 34. *C. symmetrica*, 35. *C. distincta*, 36. *C. gregoryi*, 37. *C. macrobrunneum*, 38-48. *C. brunneum*, 49-53. *C. pseudo-brunneum*.





FIGS 54-74—Fore tibiae: 54. *C. brookesi*, 55. *C. symmetrica*, 56. *C. distincta*, 57. *C. gregoryi*, 58. *C. macrobrunneum*, 59-69. *C. brunneum*, 70-74. *C. pseudobrunneum*.

FIGS 75-83—Maxillary palpi: 75. *C. brookesi*, 76. *C. symmetrica*, 77. *C. distincta*, 78. *C. gregoryi*, 79. *C. pseudobrunneum*, 80, 81. *C. brunneum*, 82. *C. zealandica*, 83. *C. diurna*.

*Costelytra symmetrica* n. sp.

(Figs 1, 2, 9, 19, 34, 55, 76, 88, 95)

A species unusual in the genus in that it has almost perfectly symmetrical parameres. Moderately large and externally very similar to the more typical members of the genus (*C. brunneum*, *C. pseudobrunneum*, *C. macrobrunneum*, *C. austrobrunneum*, *C. brookesi*, and *C. gregoryi*). Distinguished from its close allies by the presence of long and prominent discal pronotal bristles.

Colour deep reddish brown, disc of the pronotum, frons and vertex darker, lateral areas of pronotum, clypeus and legs testaceous-ferruginous.

Head not distinctive; finely, closely punctate, the clypeus rugose-punctate, antennae (Fig. 19) not characteristic.

Pronotum (Fig. 2) liberally clothed with long suberect bristles over entire discal surface; anterior angles not markedly acute, apically rounded, width greatest at the rounded posterior angles; posterior margin arcuate.

Scutellum very finely punctate.

Elytra in no respect distinctive.

Pygidium (Fig. 88) very finely obscured punctate, in form similar to that of *C. brunneum* (Fig. 85).

Fore tibia (Fig. 55) similar to that of *C. pseudobrunneum* (Figs 70-74), but with the teeth rather more produced and acute.

Hind tibia (Fig. 34) similar to that of *C. brunneum* (Figs 38-48) and *C. pseudobrunneum* (Figs 49-53).

Genitalia of male (Figs 88, 88a) with the parameres very long, slender, and almost perfectly bilaterally symmetrical.

Length: 11.5 mm.

Breadth: 6.5 mm.

Material examined: Holotype male, collected by A. E. Brookes, 12/10/1928, Marainui, mouth of Motu River, Bay of Plenty. In the A. E. Brookes collection, Entomology Division, D.S.I.R.

*Costelytra gregoryi* n. sp.

(Figs 1, 5, 18, 36, 57, 78, 89, 96)

A rather large species best distinguished from related forms (*C. brunneum*, etc.) by the large broad, narrowly reflexed clypeus and the form of the hind tibia.

Colour somewhat iridescent reddish brown, pronotum and head darker, elytra marginally infusate.

Head (Fig. 5) characterised by the broad, narrowly reflexed, coarsely punctate clypeus; frons and vertex not distinctive; antennal club (Fig. 18) with the lamellae longer than segments 1-5 combined.

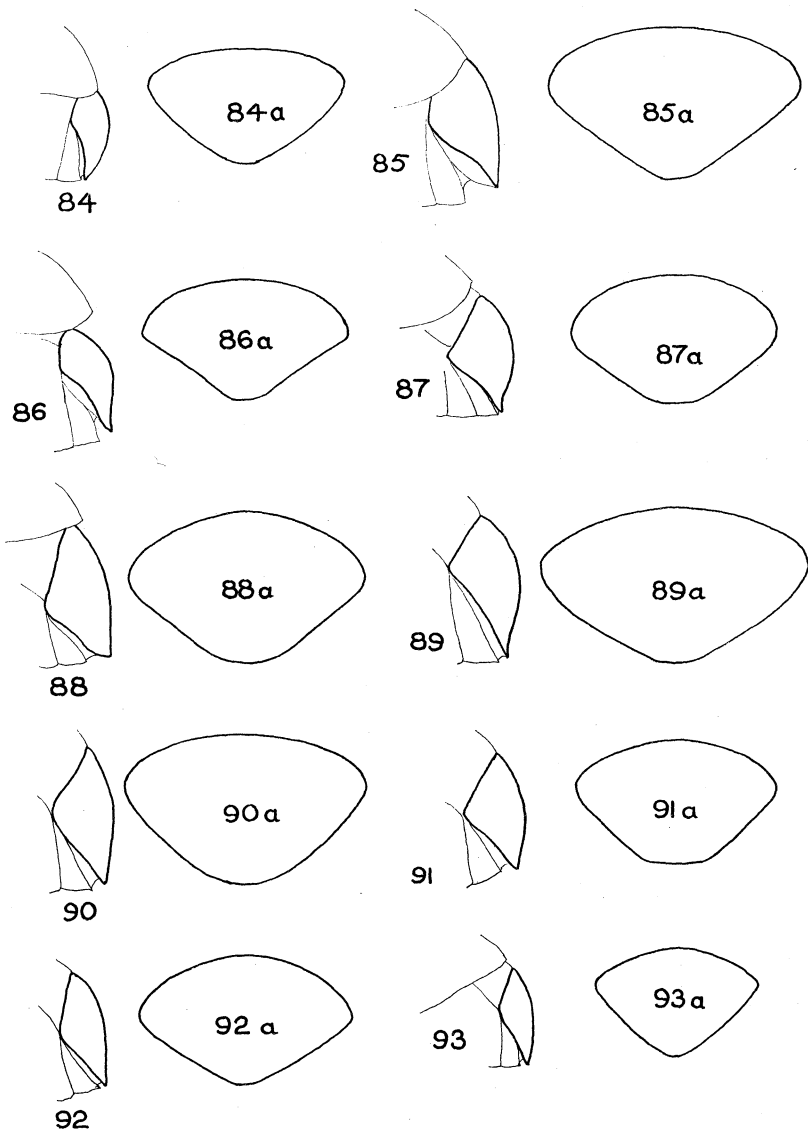


FIG. 84-93—Pygidia, lateral and (a) posterior: 84. *C. distincta*, 85. *C. brunneum*, 86. *C. pseudobrunneum*, 87. *C. brookesi*, 88. *C. symmetrica*, 89. *C. gregoryi*, 90. *C. macrobrunneum*, 91. *C. picebrunneum*, 92. *C. zealandica*, 93. *C. diurna*.

Pronotum broadest at posterior angles, which are not broadly rounded; anterior angles not greatly produced or rounded, lateral margins slightly angled medially.

Scutellum uniformly punctate on anterior half.

Elytra in no respect distinctive.

Pygidium (Figs 89, 89a) somewhat bulbous, obscurely punctate, with a small very finely rugulose subapical area.

Fore tibia (Fig. 57) with very prominent, acute teeth.

Hind tibia (Fig. 36) characteristically externally excavated below transverse carina.

The vestiture on this species is very long. The lateral and anterior marginal pronotal bristles are about a third as long as the pronotum, the internal hind tibial spines a quarter the tibial length.

Male genitalia (Figs 96, 96a) with the parameres asymmetrical, broad, short, and not greatly modified.

Length. 12 mm.

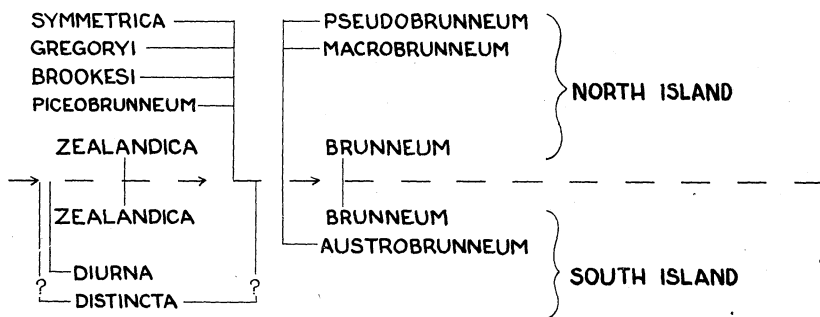
Breadth: 7.2 mm.

Material examined: Holotype male and paratype male, collected by W. P. Thomas and B. Gregory, Te Mata peak, Havelock north, Hawke's Bay, 11/8/60. In the collection of the Entomology Division, D.S.I.R., Nelson.

#### RELATIONSHIPS OF KNOWN SPECIES

In the study of any genus, the grouping of elements into species groups is of value as it does not carry a binding taxonomic obligation as does a formally named grouping. It is a grouping of convenience and may be based on strictly phylogenetic premises or on artificial and purely convenient lines. In Table 1, an effort has been made to assemble species of the genus *Costelytra* in phylogenetic order on a basis of increasing elaboration and general form of the male genital parameres. Parallel with elaboration is a

TABLE 1—Probable Relationships of *Costelytra* Species



marked tendency towards lack of bilateral symmetry. On this basis, the following species groups emerge:

1. *C. zealandica*  
*C. diurna*
2. *C. symmetrica*  
*C. brookesi*  
*C. gregoryi*  
*C. piceobrunneum*
3. *C. brunneum*  
*C. pseudobrunneum*  
*C. macrobrunneum*  
*C. austrobrunneum*
4. *C. distincta*

On genital characters alone *C. distincta* (Figs 97, 97a) should fall into group 3 above. Other characters have been taken into account in this case as the general morphological divergence from the *brunneum* group, and indeed from all other members of the genus, is so great.

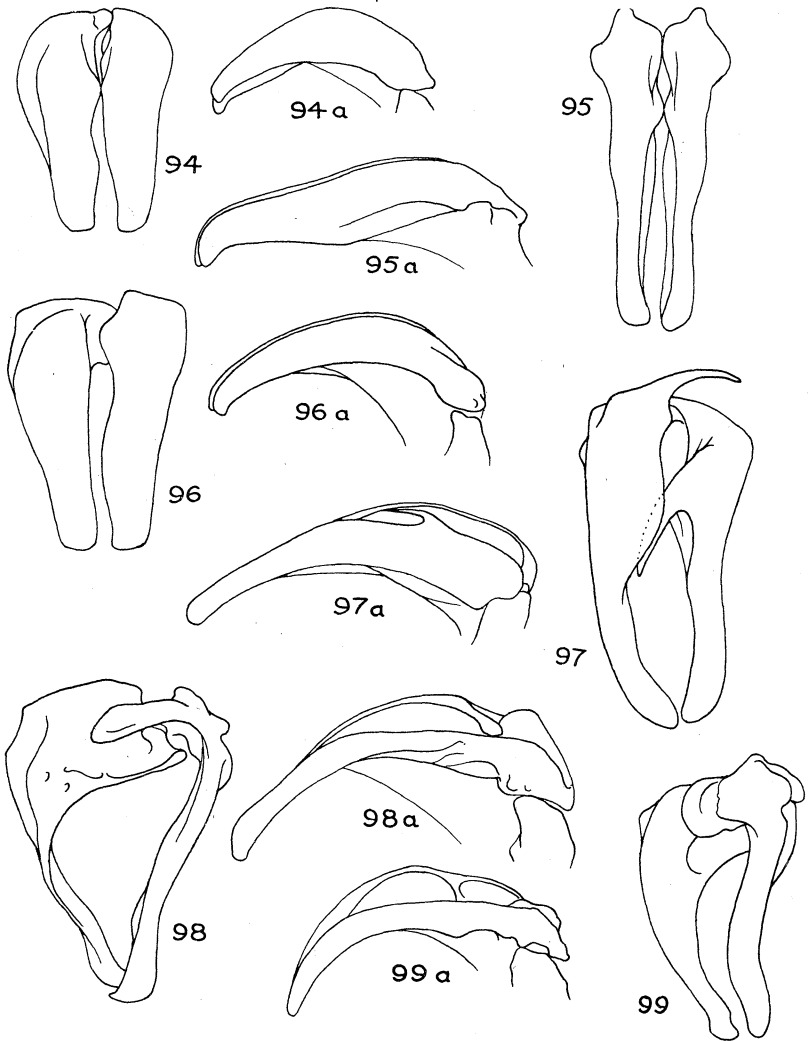
The grouping in the key (q.v.) is not in accordance with Table 1, having been built on convenience rather than phylogenetic relationships. For instance, *C. diurna*, *C. pseudobrunneum*, and *C. symmetrica* are grouped because of common possession of discal pronotal bristles. On external characters, groups 2 and 3 above are very similar and it is in fact very difficult to separate *C. brookesi* from *C. brunneum*, despite the considerable differences in structure of the parameres (Figs 94, 99).

The most problematical species is *C. distincta*. Examination of Figs 97, 97a indicates a relationship to the *C. brunneum* group but comparison of external characters (Figs 12, 12a, 20, 35, 56, 77, 84 compared with 11, 11a, 24, 40, 60, 80, 85) does not support this. It is possible that *C. distincta* is an extremely aberrant offshoot from the *C. brunneum* line, but it is also possible that the genital similarity of the two species is a convergent development arising from a very remote relationship.

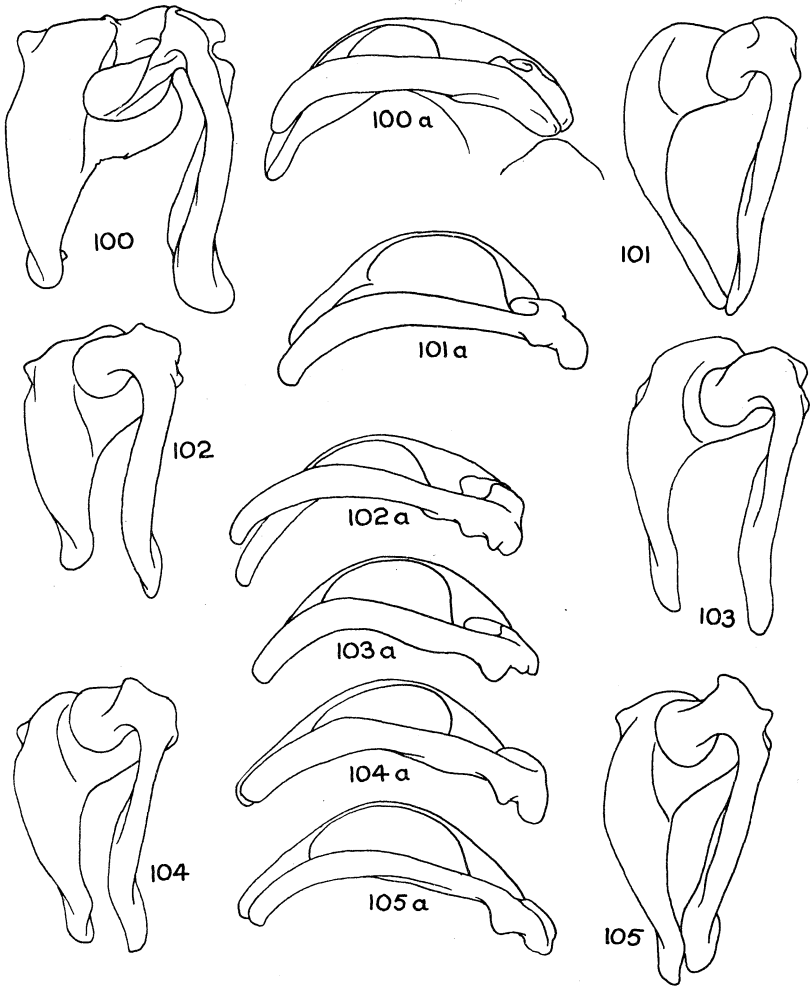
As a group, the weakest relationship is between *C. zealandica* and *C. diurna* (group 1). However, it is felt that genital and other structural characters are of greater significance than the obvious difference in behaviour displayed by the diurnal flight of *C. diurna* compared with nocturnal or sub-nocturnal flight of *C. zealandica*. An analogy may be drawn here with the genus *Chlorochiton* in which *C. pulcher*, *C. discoidea*, *C. intermediata*, *C. simmondsi*, and *C. prasinus* are known to be diurnal whereas *C. suturalis* and *C. longicornis* are nocturnal except on very rare occasions; while morphologically *C. prasinus*, *C. suturalis*, and *C. longicornis* form a compact species group despite disparity of flight habit.

#### VARIABILITY OF TAXONOMIC CHARACTERS

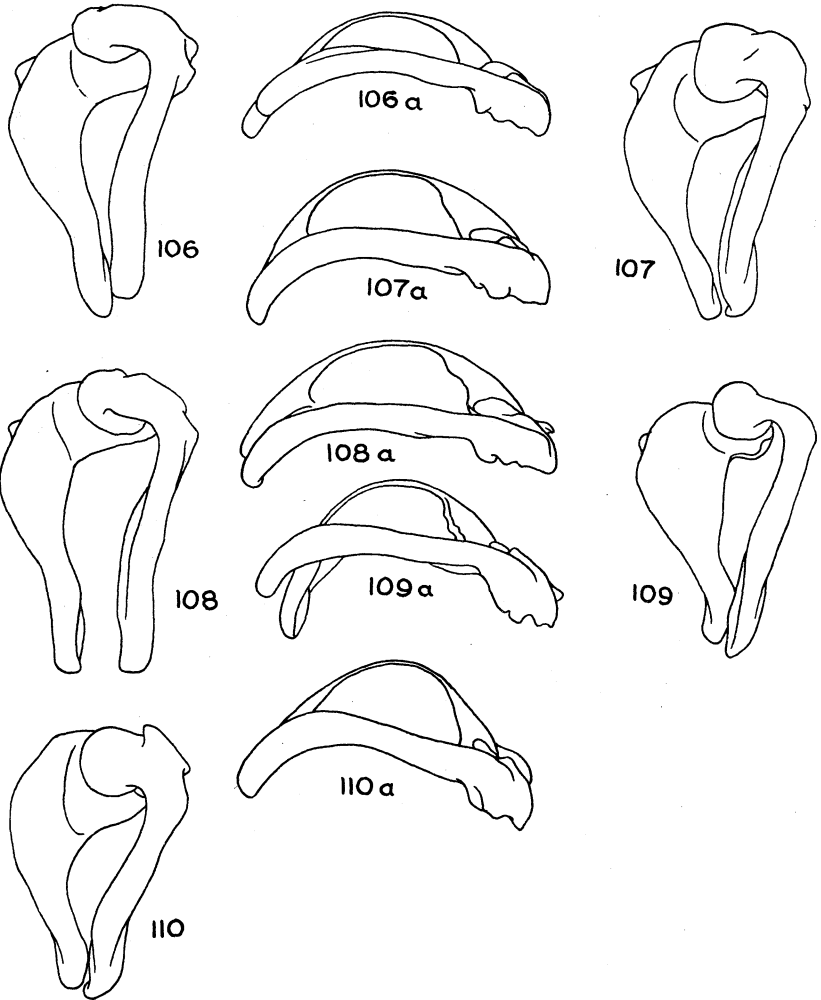
At the time of erection of the genus *Costelytra* (Given 1952, p. 13) some misgiving was felt in the distinction of the species *pseudobrunneum*, *macrobrunneum*, and *austrobrunneum*. The first of these three species was estab-



FIGS 94–110—Male parameres, posterior and (a) lateral: 94. *C. brookesi*, 95. *C. symmetrica*, 96. *C. gregoryi*, 97. *C. distincta*, 98. *C. pseudobrunneum*, 99. *C. brunneum*.



Figs 94-110: Male parameres, posterior and (a) lateral: 100. *C. macrobrunneum*, 101-105. *C. brunneum*.



Figs 94-110—Male parameres, posterior and (a) lateral: 106-110. *C. brunneum*.



lished with reasonable confidence, as 26 specimens were available for examination. Concerning the other two it was felt that if extreme variability were to be proven for a species such as *C. brunneum*, then one or both these species could be collapsed. This has not so far proved to be the case, and the addition of further species has not complicated the situation.

Examination of a series of mounted male genitalia demonstrated firstly that the form of the parameres varies infra-specifically as much as does any external character, but that the parameres normally show significant interspecific differences, and secondly that in cases of extreme elaboration (as in *brunneum*, *pseudobrunneum*, etc.) a certain amount of warping due to differences in time of caustic treatment and in handling during dissection can cause slight differences in the final mount. This, in addition to the inconvenience of the necessity to dissect, and the fact that female genitalia are not of comparable value, made it important to find reliable external characters for specific separation. Consequently where possible both external and internal diagnostic characters have been carefully examined and the more important of these illustrated.

Only the species *C. brunneum*, *C. pseudobrunneum*, *C. macrobrunneum*, and *C. austrobrunneum* are likely to be confused from study of the parameres of the male. The mounted genitalia of *C. austrobrunneum* are no longer in fit condition for redrawing to suit the present study and so this species must be omitted from his section of the discussion.

In this group (Figs 98-110) the form of the basal process on the right paramere which extends across part of the basal area of the left paramere is significant. In *pseudobrunneum* (Fig. 98) it is rather narrow and relatively small; in *macrobrunneum* (Fig. 100) it is larger, but still somewhat elongate; in *brunneum* (Figs 99, 101-110) it is subcircular or at least not elongate. The apical portions of the parameres are more slender in *pseudobrunneum* and broader in *macrobrunneum* than in *brunneum*.

To consider the degree of paramere variation within the species *C. brunneum* Figs 101-110 are arranged in geographical order from north to south. The obvious apparent difference between Figs 101 and 102 can be explained by differences in twisting of the left paramere in relation to the right during mounting. Differences in form of the basal process on the right paramere appear to be as great between individuals of one population as between specimens from any two points on the geographic range. Figs 106, 107, 108, and 109 are all of specimens from one population, taken at Murchison. There is obviously as much variation in all characters between these specimens as there is between them and specimens from Auckland (Figs 101, 102, 103).

The fore tibia is sometimes described as a diagnostic character and Figs 58-69 (*C. brunneum*) and 70-74 (*C. pseudobrunneum*) illustrate the degree of variation to be expected within one species and within one population. All the figures of *C. pseudobrunneum* are from specimens of a single local population. Figure 70 is from an old individual and shows the effects of wear, and Fig. 74 shows the same influence to a lesser extent. Figs 66-69 are from a population unit of *C. brunneum* taken at Murchison and show some variation, but not as much as with specimens from other populations (e.g., Figs 59 and 64, both of specimens from near Auckland). In this

case it would appear that definable constant local forms may occur, but considering that Figs 60, 61, and 62 are also of specimens from the Auckland area, this comes into doubt. In this series of fore tibiae, one constant difference between *brunneum* and *pseudobrunneum* is the constantly smaller calcarium in the latter species.

The hind tibia shows variation comparable with that of the fore tibia. Figs 38–48 (*brunneum*) and 49–53 (*pseudobrunneum*) disclose no character or measurement giving certainty of separation between the two species, although other species can be separated on hind tibial form.

Antennal structure at first appear to give useful distinctions between closely allied species, but examination of series illustrates the dangers of apparent differences. An extreme case is illustrated by Fig 22. On this specimen of *C. brunneum* both antennae are as illustrated, with the ultimate lamellar segment missing and segments 3 and 4 much broadened, representing bilateral abortive development.

Even in normal cases considerable variation occurs. Figs 24–32 are all of the species *brunneum*. In Fig. 25, segment 3 is much longer than 4 as is also the case to a lesser degree in Fig. 24. Other specimens (e.g., Figs 29, 31) have these segments of approximately equal length. Similarly, the length of the lamellae relative to prelamellar segments shows some variation. Similar variation is evident in *pseudobrunneum* (Figs 13–16). Male antennal characters are of use for separation of *C. distincta* (Fig. 20), *C. gregoryi* (Fig. 18), and *C. macrobrunneum* (Fig. 23), but not for *C. brunneum*, *C. pseudobrunneum*, *C. brookesi*, *C. symmetrica*, *C. austrobrunneum*, or *C. piceobrunneum*.

Considerable caution is therefore necessary in the selection of diagnostic characters for the more closely related species of the genus *Costelytra*. It is unfortunate that (apart from *C. zealandica*) this genus is not better represented in collections and it is extraordinary that out of 11 species, seven have so far been collected only once, and two only twice, leaving only two species generally collected.

The genus is not a static one and the range of variation within species and the close alliance of some species indicates that active speciation is in progress.

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