THE SYSTEMATICS AND KARYOTYPE OF *LABIDURA TRUNCATA* KIRBY, 1903 (DERMAPTERA: LABIDURIDAE)

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Abstract

Systematic and in particular cytogenetic criteria show that the species *Labidura truncata* Kirby, 1903 should be re-erected. The karyotype was found to be $2n♂ = 10$ (4AA + XY), $2n♀ = 10$ (4AA + XX).

The systematic history of the members of the genus *Labidura* Leach, 1815 is reviewed by Brindle (1966), with particular attention to the confused situation concerning *Labidura riparia* (Pallas 1773). Much of this confusion has undoubtedly resulted from the conviction of increasing numbers of authors that *L. riparia* (originally described from W. Siberia) is a very variable cosmopolitan species. Synonymic lists, discussions of the validity of systematically significant characters and of the relationships of members of the *L. riparia* complex are given by Kirby (1903: 63; 1904: 9), Burr (1911: 36), Bey-Bienko (1936: 101) and Brindle (1966: 243, 257, 259). The last author points out that the male genitalia of specimens from different parts of the world are remarkably similar. His figures show that there are only very slight differences in the apices of the lateral lobes.

On the basis of external characters there seems no doubt that *Labidura truncata* is a distinct form. Kirby (1903) gives as diagnostic characters (other than colouration): the absence of paired teeth on the caudal margin of the posterior tergite between the bases of the forceps and the presence of a preapical tooth (of variable size) on the inner margin of each blade of the forceps of the male, the constancy of which is pointed out by Hincks (1954). A study by one of us (E.T.G.) of several large collections from all over Australia has shown both of these to be particularly constant characters. Colouration and the degree of development of the tegmina and wings are variable. Although the female genitalia are not used for diagnostic purposes in the Labiduridae, differences between these organs in specimens in European collections labelled *L. riparia* and in *L. truncata* have been observed (E.T.G.). This also points to a separation between the two forms.

Below are set out the more important elements of the synonymy.

Labidura truncata Kirby, 1903

Labidura truncata Kirby, 1903: 67. Kirby, 1904: 11. Burr, 1908: 70, fig. 7. Burr, 1911: 37. Brindle, 1966: 259 (synonymized with *Labidura riparia* (Pallas, 1773)).

Labidura riparia geogr. race *truncata* Kirby, 1903. Burr, 1910: 185.

Labidura riparia truncata Kirby, 1903. Hebard, 1933: 147. Hincks, 1954: 8. Giles, 1964: 1109. Giles, 1970: 306, figs. 1, 3, 4a, 5b.

Labidura leucotarsata Mjöberg, 1913: 27. Mjöberg, 1924: 5, pl. 2, fig. 2 (redescr.). Hebard, 1933: 147 (synonymized with *L. riparia truncata* Kirby).

A relatively uniform karyotype was found in material of both sexes of *Labidura truncata* from near Perth and Eucla, W.A.; Wyreema, near Toowoomba, Qld and from Lake Boga, Yarrawonga and many localities near Melbourne, Vic. It can therefore be assumed that the description which follows would apply generally to the cytology of the species throughout Australia.

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During spermatogonial and early meiotic prophase heterochromatic blocks are visible on some autosomes (Plate I A, C, D, E). As is common in the Dermaptera, the sex pair appears to be entirely heterochromatic and is positively heteropycnotic throughout meiotic prophase. It is therefore presumed that the sex chromosomes associate non-chiasmatically (Plate I C, D, E). At least two nucleoli are associated with heterochromatic regions; the most distinctive nucleolus is usually, but not always, associated with the sex heterochromatin in meiotic prophase (Plate I C). Nucleoli are seen also in the spermatogonial prophases which are usually present in abundance, but always confused together or broken, in untreated males. Complete spermatogonial prophases were visible in a colcemid-treated male, but in this case nucleoli are not obvious (Plate I A). Spermatogonial metaphases show ten chromosomes with the Y-chromosome the smallest (Plate I B). At first metaphase of meiosis the four autosomal bivalents appear in some cells to be divided into two chromatids with no centric connection (Plate I G) but in others one autosomal pair is more rounded and compact (Plate I H). At first metaphase the long axes of the bivalents are oriented at right angles to the metaphase plate, possibly because the telomeres of the non-chiasmate ends have neo-centric activity as in many organisms with holocentric chromosomes (John and Lewis 1965). The unequal sex pair is more compact than the autosomes, and usually lies on the periphery of the metaphase plate (Plate I G). At first anaphase (Plate I I) segregation appears to be reductional for the sex chromosomes and autosomal non-crossover segments and equational for crossover segments; the situation is presumably reversed for the second division (Plate I J, K).

Ovarian follicle cell prophases also display heterochromatic chromosome ends (Plate I L, N). The overwhelming majority of cells of the many females examined had ten equal-sized chromosomes (Plate I L-P). However, on squashing, the chromosomes tend to break at constrictions resulting in a few scores of eleven, but in these cases the smaller fragment is obvious. In most colcemid-metaphases the ten chromosomes are highly contracted and featureless but some show secondary constrictions in chromosomes with a limited degree of contraction (Plate I O, P). The number and position of constrictions appear to vary with different localities, but the detection of them is unreliable as it depends to a large extent on the quality of the cytological preparations. In females, as in males, the chromosomes do not display localized centromeres at an interstitial position and the parallel disjunction of the chromatids suggests that localized centromeres are not terminally located (Plate I B, M). There are no observations inconsistent with an interpretation of holocentricity in the chromosomes of *Labidura truncata* and secondary constrictions are known in holocentric chromosomes of the Homoptera (Brown 1960). Ortiz (1969) interpreted the chromosomes of *L. riparia* and other Dermaptera as holocentric, which is supported by White (1971) and Webb (unpublished), but not by Henderson (1970).

The karyotype of specimens determined as *Labidura riparia* from Spain has been found to be $2n♂ = 12$ (5AA + XY) (Ortiz 1969) and from India to be $2n♂ = 14$ (6AA + XY) (Asana and Makino 1934). Material from south-eastern United States and the Bahamas, determined as *Labidura bidens* (Olivier 1791) (synonymous with *L. riparia* according to Brindle 1966), appears to have a karyotype similar to the Spanish material (Morgan 1928). Specimens of *Labidura* sp. from Shizuoka, Japan, appear to have the same karyotype as those from India (Webb—unpublished). The question of the true identity of this widely separated material is scarcely relevant here, but certainly an investigation of the karyotypes of members of the genus *Labidura* from all parts of its range is firmly indicated. This must be correlated with the localities and ranges of species already described.

The re-erection of the species *Labidura truncata* is considered to be even more justified by the finding by one of us (G.C.W.) of a distinctive karyotype in Australian material: $2n♂ = 10$(4AA + XY), $2n♀ = 10$ (4AA + XX). The four autosomal pairs are almost equal in size and equal to the X chromosome: the Y chromosome is smaller. It should be noted that *L. truncata* has the lowest diploid number yet found among the higher earwigs (Suborder Forficulina).

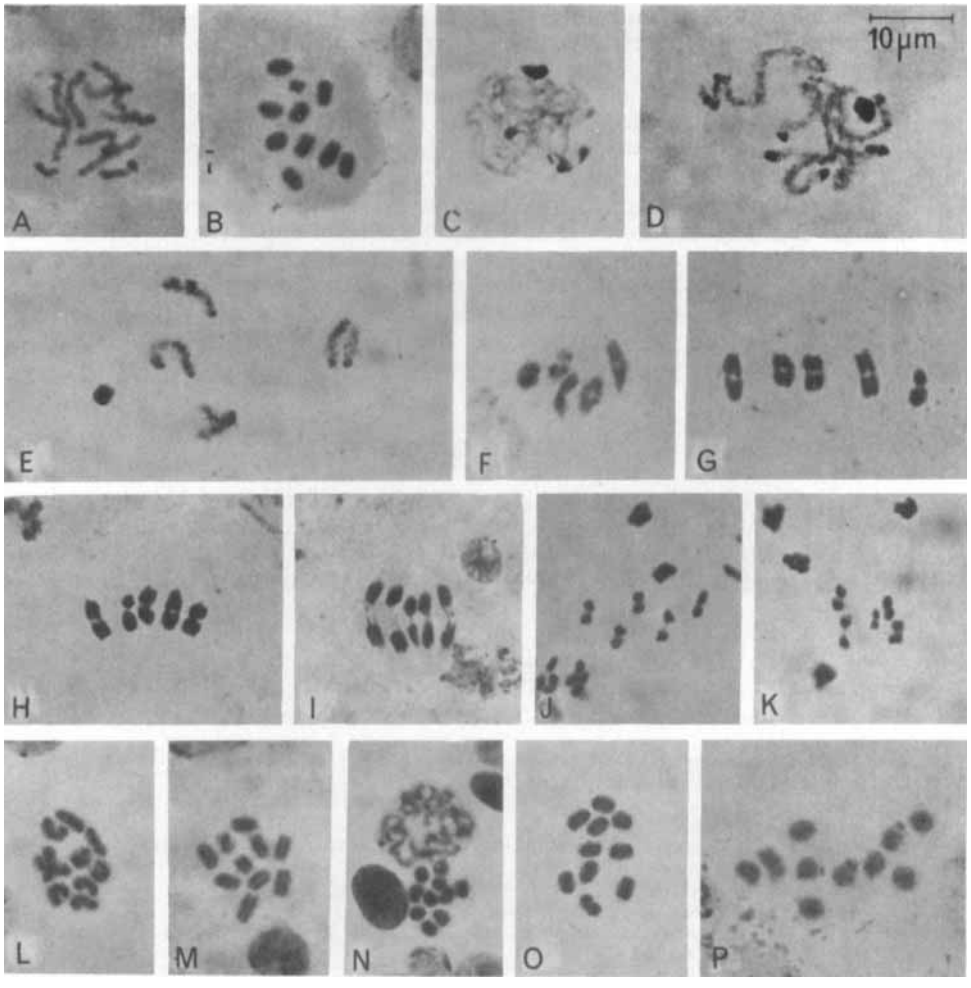

PLATE I

Labidura truncata Kirby, chromosome cytology of male and female; colcemid treatment as in Webb and White (1970); orcein stain after fixation in 3:1 ethanol, acetic acid; all × 1100: (A-K) male.—(A) spermatogonial prophase, colcemid affected, sex chromosomes at bottom; (B) spermatogonial metaphase, colcemid affected, Y-chromosome smallest; (C) leptotene, sex chromosomes and some autosomal ends heterochromatic, two nucleoli visible near centre, one at 11 o'clock and one at 5 o'clock; (D) zygotene-pachytene, comments as for (C) except that nucleoli are not obvious although one is present to the left of the sex heterochromatin; (E) early diplotene, sex chromosomes and autosomal heterochromatin still positively heteropycnotic; (F) diakinesis, Y-chromosome negatively heteropynotic in the sex pair second from left, autosomal bivalent second from right has a clear interstitial chiasma; (G) first metaphase, unequal sex pair on the right; (H) first metaphase, autosomal bivalent on the right is characteristically more rounded, a feature of many cells from all localities; (I) early first anaphase, sex pair in centre; (J) second metaphase with the X-dyad; (K) second metaphase with the Y-dyad at the centre. (L-P) ovarian follicle cells, all colcemid effected. (L) late prophase with some heterochromatic chromosome ends; (M) metaphase showing prallel disjunction of chromatids; (N) early prophase showing heterochromatic regions and metaphase with one constriction; (O) metaphase from same locality as (N) with a similar constriction; (P) metaphase, well squashed, with obvious constrictions near one end of two chromosomes and at least one other constriction. Localities: (A, B, J, K, P) South Melbourne Beach, Vic. 7.ii.1971; (D, H) Yarrawonga, Vic. 11.iv.1971; (C, E) Kew, Vic. 1.ii.1972; (F) Melbourne University Grounds, Vic. 10.viii.1970; (I, M) Eucla, W.A. 7.i.1972; (G) Mt. Pleasant, Perth, W.A. 15.ii.1970; (L, N, O) Wyreema, Qld. 17.vi.1971.

The sex chromosomes and three large autosomal pairs appear to be common to the karyotypes of the *Labidura* complex described to date. Ortiz's illustrations and the observations of one of us (G.C.W.) on the Japanese material indicate that the common chromosomes include the pair which appears more rounded in some spermatocytes (Plate I H). Numerical variation appears to have been brought about by fragmentation or fusion of chromosomal material which is united to form the fourth autosomal pair in *L. truncata*.

The chromosome complement is generally considered to have more importance than a single character in the external phenotype (John and Lewis 1966). In the case of the *Labidura* complex the karyotype appears to be a more useful indicator of biological distinctiveness than the confusing external phenotype.

The Australian material is sufficiently distinct karyotypically, with supporting morphological evidence, to warrant the re-erection of the species *Labidura truncata*.

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