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THE SYNONYMY OF *ISCHNURA HETEROSTICTA* (BURMEISTER) AND *ISCHNURA TORRESIANA* TILLYARD (ODONATA: COENAGRIONIDAE)

J. A. L. WATSON

Division of Entomology, CSIRO, Canberra, A.C.T. 2601.

Abstract

The synonymy of *Ischnura heterosticta* (Burmeister) and *I. torresiana* Tillyard is demonstrated.

Introduction

Ischnura heterosticta was described by Burmeister (1839) from several males in Germar's Collection, from "Neu Holland". It is a common, widespread and variable species. Tillyard (1913) recorded it from Melbourne to Brisbane, and described the insular race *I. h. tasmanica* for the large, robust and bluer form from Tasmania. Later work has shown that *I. heterosticta* is widely spread in western, central and southern Australia, extends at least to Rockhampton in Queensland, and occurs in the northern parts of the Northern Territory (Lieftinck 1959a; Watson 1962, 1969, 1973, 1974; Peters 1972). It is also known from as far east as Fiji and Tonga (Tillyard 1924; Watson unpublished data).

Ischnura torresiana was described by Tillyard (1913) on the basis of material from Cooktown and Banks Island, Torres Strait; Kimmins (1970) designated a male from Cooktown as the lectotype. Lieftinck (1949) and Fraser (1960) extended the known range to Aru, southern New Guinea and the New Hebrides, and, within Australia, south to Rockhampton.

Lieftinck (1932) summarized the diagnosis of males of the two species much as follows:

Antehumeral stripes complete and rather broad. Black marking on dorsum of abdominal segment 2 not covering the entire dorsum . . . Superior anal appendages in side view not longer than high, with median branch . . . slender and almost straight. Inferior appendages in side view of same length as superiors, about as long as wide .. .. **heterosticta**

Antehumeral stripes reduced to dorsal point and a small ventral comma-shaped spot. Black marking on abdominal segment 2 covering the entire dorsum and partly also the sides, its side limit straight. Superior anal appendages in side view a little longer than high, with median branch . . . rather thick . . . Inferior appendages in side view of same length or a trace shorter than superiors .. .. **torresiana**

Later, however, Lieftinck (1959b) pointed out that in some specimens of *I. torresiana* the antehumeral stripes were complete, and, in others, were more extensive than in "typical" males, although incomplete. These presumably atypical males came from both northern Australia and New Guinea. In a key in the same paper, Lieftinck described abdominal segment 2 of *I. torresiana* as having the "dorsum . . . metallic greenish black, this mark distinctly expanded sub-basally and narrowest at apex of segment"—in other words, much as in *I. heterosticta* (see below).

Fraser (1960) emphasized the distinctness of the anal appendages, and claimed that the tubercles at the apex of segment 10 of the male project posteriorly in *I. torresiana*, but not in *I. heterosticta*, but his figures (Pl. 4, figs. 9, 10) do not support the diagnosis.

Extensive recent collections from eastern Australia and the Northern Territory have suggested that *I. heterosticta* and *I. torresiana* are not distinct species, but show change from paler individuals, occurring mostly towards the south, to darker individuals, occurring mostly in the north. Other series, from western Arnhem Land in the Northern Territory, have permitted documentation of populations of "*heterosticta*" and "*torresiana*" where they occur together. These series form the basis of this paper.

Although only limited material of the Tasmanian "race" of *I. heterosticta* is available, it also seemed opportune to reassess the status of the island form.

Material

The status of the specific names was determined mainly from a study of males, as earlier diagnoses have depended on male characters, which are more useful and numerous than those of females. Tillyard (1905) claimed that the females of *I. heterosticta* show a distinct dimorphism, one form, the andromorph, resembling the male and the other, the heteromorph, being dull, greyish black. However, it is now evident that the dull coloration is a product of age, and that the pigmentation of the young, andromorphic female persists under the overlying grey pruinescence of the aged. It is therefore possible to compare the thoracic and, if necessary, abdominal pigmentation of females with that of males, although abdominal segment 2 of the female bears a pattern different from that of the male.

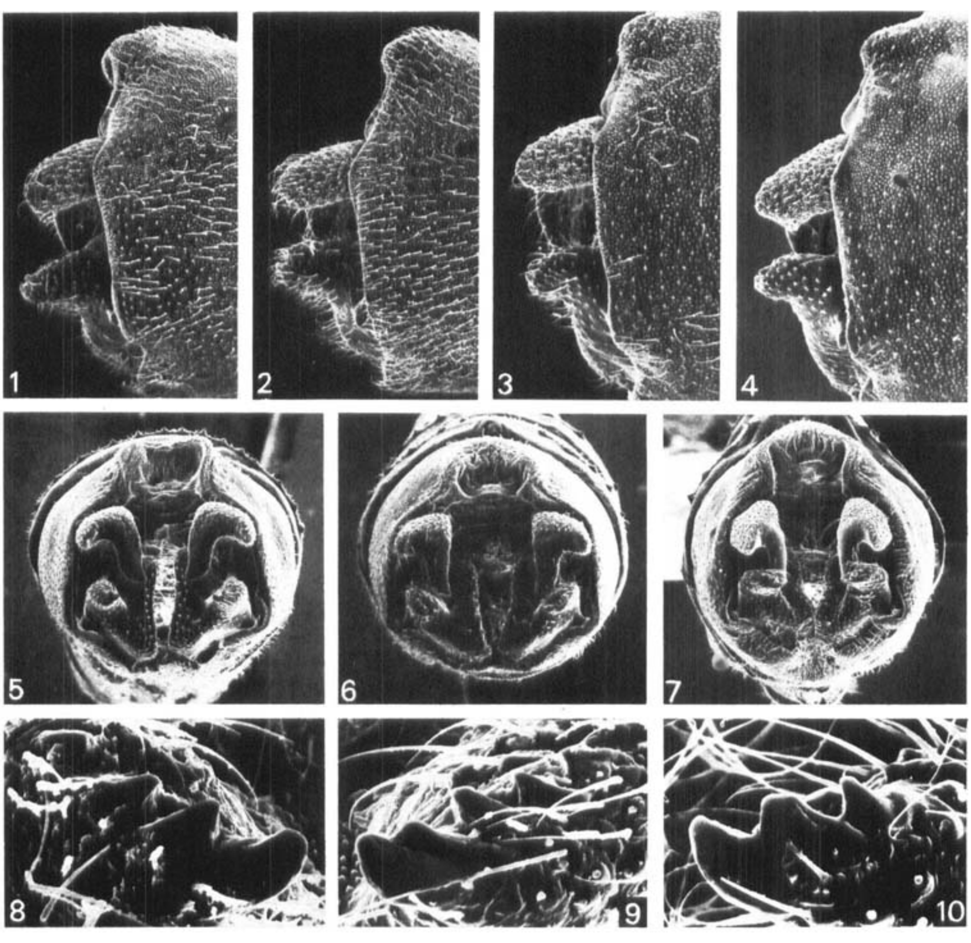
The material examined is listed below, the localities within each state or territory being listed in roughly latitudinal order. Unless otherwise indicated, all specimens are held in the Australian National Insect Collection, CSIRO, Canberra; the exceptions are specimens in the collections of the Department of Zoology, University of New England, Armidale (UNE), the Australian Museum, Sydney (AM), or the Rijksmuseum van Natuurlijke Historie, Leiden (ML). To save space, details of locality labels are not given for the extensive material collected during the Alligator Rivers Region Environmental Fact Finding Study, 1972-73, or the surveys of the insect fauna associated with the permanent waters of the Fortescue River system on and near Millstream Station, undertaken in 1958 and 1970-71. Details of these are available in the ANIC, and in summary form in Watson (1969, 1973).

NORTHERN TERRITORY: 5 ♂♂, Darwin, 19.iv.1966, F. J. Gay, 20.iv.1972, A. J. Lack, 3-7.ix.1972, R. W. Matthews; 1♂, Howard Springs, ix.1972, R. W. Matthews; 5 ♂♂, Fogg Dam, Humpty Doo, 10.iv.1972, J. Wombey, 19.v.1973, J. A. L. Watson; 2♂♂, Wildman River Lagoon, 21.xi.1972, J. A. L. Watson; 145 ♂♂, 82 ♀♀, Alligator Rivers region, 8-21.xi.1972, 21.v-2.vi.1973, J. A. L. Watson; 4 ♂♂, 59 km SW of Daly River, 28.viii.1968, M. Mendum; 1 ♂, Katherine River, Katherine, 7-11.ii.1968, J. A. L. Watson; 1 ♂, Illara Rockhole, 26.viii.1963, P. Ranford. QUEENSLAND: 1♂, *paralectotype* of *I. torresiana*, Banks Island, 19.ii.1910, H. Elgner; 1 ♂, swamp near Scrub Hen Creek, Portland Roads, 23.x.1974, M. S. Moulds (AM); 14 ♂♂. dam near Coen airstrip, 30.x and 29.xi.1974, M. S. Moulds (AM); 7 ♂♂, lagoon *ca* 30 km E of Musgrave Station, 30.xi.1974, M. S. Moulds (AM); 3 ♂♂, Cooktown, i.1908, R. J. Tillyard (*paralectotypes* of *I. torresiana*), 28.i.1951, R. Dobson; 2 ♂♂, Saltwater Creek at Mossman-Daintree road, 29.x.1966, J. A. L. Watson; 4 ♂♂, Barron River, Kuranda, 15.i.1955, R. Dobson, 6.xi.1966, J. A. L. Watson; 2 ♂♂, Nordellos Lagoon, Walkamin, 6.xi.1966, J. A. L. Watson; 1 ♂, Green Island, 22.vi.1930, R. J. Tillyard; 3 ♂♂, Eubenangee Swamp, Innisfail, 3-4.xi.1966, J. A. L. Watson; 1 ♂, Mena Creek, Paronella Park, Innisfail, 20.ix.1952, R. Dobson; 1 ♂, Inverleigh Station, Normanton, 17.v.1931, T. G. Campbell; 9 ♂♂, 19 km N of Ayr, 28-29.vii.1967, J. A. L. Watson; 2 ♂♂, Reid River at Townsville-Charters Towers road, 1.i.1968, R. Dobson; 1 ♂, Elliott River at Bruce Highway 46 km NW of Bowen, 22.vii.1967, J. A. L. Watson; 1 ♂, Goorganga Creek at Bruce Highway 8 km S of Proserpine, 22.vii.1967, J. A. L. Watson; 3 ♂♂, Lake Moondarra, Mount Isa, 31.vii.1968, J. A. L. Watson; 1 ♂, Yeppoon, 15.iii.1963, C. Vallis; 1 ♂, Rockhampton area, 13.iv.1965, C. W. Frazier (UNE); 1 ♂, Rockhampton, 8.iv.1954, C. Vallis; 4 ♂♂, Scrubby Creek at Capricorn Highway, Rockhampton, 20.vii.1967, J. A. L. Watson; 3 ♂♂, Edungalba, 20.x.1953, 1.xii.1957, 11.i.1961, E. E. Adams; 6 ♂♂, Palmwoods, 17-19.i.1968, R. Dobson; 2 ♂♂, Coomera River, xi.1955, E. E. Adams; 2 ♂♂, Petrie, 21.ix.1955, R. Dobson; 1 ♂, Brisbane, 18.i.1910, R. J. Tillyard; 1 ♂, Brisbane River, Mount Crosby, 5.vi.1966, J. A. L. Watson; 1 ♂, Tambourine, 11.iii.1953, D. Curtis. NEW SOUTH WALES (including AUSTRALIAN CAPITAL TERRITORY): 1 ♂, Koreelah Creek 16 km S of Woodenbong, 5.ii.1968, R. Dobson; 5 ♂♂, Woolgoolga area, 30.xi.1963, C. W. Frazier (UNE); 1 ♂, Boomi Creek, 16.iii.1962, C. W. Frazier (UNE); 2 ♂♂, Armidale, xii.1962, A. F. O'Farrell (UNE); 1 ♂, Tea Tree Creek, Armidale, 25.i.1962, A. F. O'Farrell and C. W. Frazier (UNE); 2 ♂♂, Gara River E of Armidale, xii.1962, A. F. O'Farrell, 24-28.xii.1962, J. Overell (UNE); 2 ♂♂, Powers Brook near Gara, 14.xi.1962, collector unknown (UNE); 1 ♂, Wattle Flat, Styx River, 6.xi.1962, collector unknown (UNE); 5 ♂♂, Dangars Falls, xii.1964, collector unknown (UNE); 1 ♂, Lagoon, Uralla, 11.ii.1962, A. F. O'Farrell (UNE); 1 ♂, Bandon Grove, near Dungog, 26.xi.1967, J. A. L. Watson; 4 ♂♂, Windsor, 1.xi.1952, 2.v.1954, R. Dobson; 1 ♂, Devlins Creek, Epping, 1.iv.1954, R. Dobson; 1 ♂, Eastwood, Sydney, 6.x.1949, R. Dobson; 1 ♂, La Perouse, no further data; 1 ♂, Myrtle Creek S of Picton, 24.xi.1967, J. A. L. Watson; 2 ♂♂, Moss Vale, 4.xii.1953, R. Dobson; 1 ♂, 8 km SW of Moss Vale, 31.i.1968, M. S. Upton; 2 ♂♂, Goodmans Ford, Wollondilly River, 3.xii.1953, R. Dobson; 1 ♂, Darling River, Wentworth, 10-11.xii.1966, J. A. L. Watson; 1 ♂, Muttama Creek at Hume Highway E of Gundagai, 2.xii.1966, J. A. L. Watson; 1 ♂, Cotter River below Cotter Dam, 5.ii.1967, J. A. L. Watson; 1 ♂, Spring Ranges, Canberra, 3.ii.1929, M. Fuller; 1 ♂, Shoalhaven River at

Braidwood-Goulburn road, 13.i.1967, A. F. O'Farrell and J. A. L. Watson; 1♂, Moonbar River, Jindabyne, 17.i.1954, R. Dobson; 16 ♂♂, Albury, 26.i.1967, E. F. Riek. VICTORIA: 1 ♂, 13 km W of Strathmerton, 3.xii.1966, J. A. L. Watson; 1 ♂, Ovens River at Murray Valley Highway, 3.xii.1966, J. A. L. Watson; 1 ♂, Nowa Nowa, 19.ii.1952, R. Dobson; 1 ♂, Lake Bolac, 24.xi.1969, E. F. Riek. SOUTH AUSTRALIA: 1 ♂, Coward Springs N by W of Marree, 22.ix.1972, Z. Liepa; 1 ♂, Chain of Ponds, 9.xii.1966, J. A. L. Watson; 1 ♂, Murray River, Toilem Bend, 6.xii.1966. J. A. Watson; 1 ♂, 24 km E of Keilira on Kingston-Bordertown road, 5-6.xii.1966, J. A. L. Watson. WESTERN AUSTRALIA: 1 ♂, Goosehill, 40 km E of Wyndham, 8-9.ix.1968, G. F. Mees (ML); 1 ♂, Wyndham, 9-12.ix.1968, G. F. Mees (ML); 1 ♂, Roebourne, 28.ii.1954, E. P. Hodgkin; 18 ♂♂. Millstream Station area, i-ii.1958, vii.1958, J. A. L. Watson, 4-14.iv.1971, M. S. Upton; 6 ♂♂, Murchison River, Galena, 1.ix.1958, J. A. L. Watson, 27.iii.1971, E. F. Rick; 5 ♂♂, Northampton, 21.ix.1958, J. A. L. Watson; 3 ♂♂, Greenough River Ellendale, 22.ix.1958, J. A. L. Watson; 6 ♂♂, Mortlock River, Noggojerring, 22.iii.1957, J. A. L. Watson; 1 ♂, Northam, 22.iii.1957, J. A. L. Watson. TASMANIA: 3 ♂♂, Richmond, 11.xii.1973, P. Allbrook; 3 ♂♂, Mount Nelson, x.1973, P. Allbrook.

Diagnostic characters

The characters used for diagnosis of *I. heterosticta* and *I. torresiana* by Tillyard (1913), Lieftinck (1932) and Fraser (1960)—anal appendages, abdominal segment 10, colour pattern of abdominal segment 2, and antehumeral pattern—are not correlated. The antehumeral pattern has been found to be the most useful analytical character, principally because it can be scored readily and consistently.



FIGS. **1-10.**—Anal appendages of male *Ischnura heterosticta/torresiana:* **(1-4)** right lateral view (× 50): **(1)** Cotter River, A.C.T.; **(2)** Greenough River, Ellendale, W.A.; **(3)** Millstream Station, W.A.; **(4)** Cooktown, Q. *(paralectotype* of *I. torresiana)*; **(5-7)** posterior view (× 34): **(5)** Northam, W.A.; **(6)** Millstream Station, W.A.; **(7)** Oberie Rock, N.T.; **(8-10)** tips of inferior appendage (× 295): **(8, 9)** Albury, N.S.W. (one individual); **(10)** Richmond, T.

Anal appendages

Southern populations, ranging from the Northam area in Western Australia through South Australia, Victoria and New South Wales to central Queensland and the Ayr region, generally have elongate tips on the inferior appendages, which may extend beyond the tips of the superiors (Fig. 1). The inferiors commonly bear 2-3 upturned, dark, subterminal spines (Figs. 5, 8). However, some have 4-5 spines, and asymmetry is common (Figs. 8, 9). The tip of the inferior branch of the superior appendages bends slightly inwards towards the midline (Fig. 5.)

The appendages of Tasmanian specimens are indistinguishable from those of specimens from the southernmost parts of the mainland (Fig. 10).

Northern populations, from Cape York, the "Top End" of the Northern Territory, and the Kimberley and Pilbara Regions of Western Australia, tend to have shorter, rounder tips to the inferior appendages, generally crowned with a row of 3-4 spines, often asymmetrical (Figs. 6, 7), and the inferiors are about the same length as, or marginally longer than, the superiors (Figs. 3, 4). The inner lower margin of the inferior branch of the superior appendage is generally straight or nearly so (Figs. 6, 7). Samples from intermediate areas—between Cairns and Ayr in the east, and between the Murchison and Irwin Rivers in the west—generally have inferior appendages of intermediate length (Fig. 2), and the spination is variable and may be asymmetrical. The tubercles are also variable, and can project posteriorly in both northern and southern forms; indeed, the southern forms commonly appear to show more projection than the northern (Figs. 1-4).

Neither the structure of the appendages nor that of the tubercles correlates with the thoracic colour pattern to form a diagnostic set of characters, although there are independent tendencies for appendages and colour pattern to change latitudinally (see below, and Table 1).

TABLE 1

FREQUENCIES OF THORACIC COLOUR PATTERNS, MALES

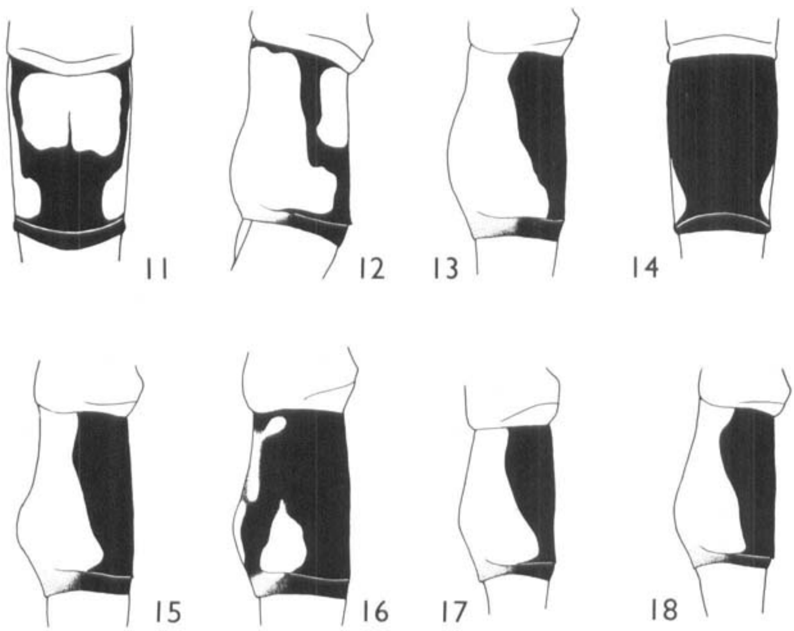
Region and season		Thoracic colour pattern 1	2	3	4
"Top End", N.T.	Jan.-June	79	29	14	16
	July-Dec.	10	6	2	8
Cape York	Jan.-June	4	0	0	0
	July-Dec.	5	4	7	6
N.E. Queensland	Jan.-June	1	2	1	3
	July-Dec.	2	1	6	14
S. and Central Queensland		2	0	5	16
New South Wales		2	1	4	50
Victoria and S. Australia		0	0	0	8
S.W. Australia		0	0	0	21
N.W. Australia		0	0	0	21
Tasmania		0	0	0	6

Abdominal segment 2

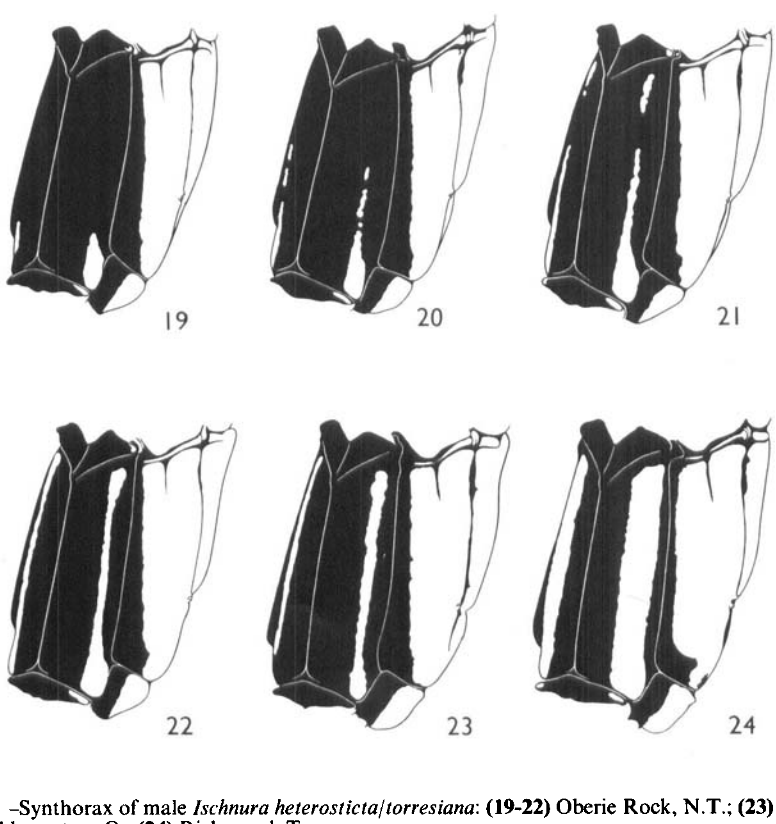
Abdominal segment 2 is substantially blue above in Tasmanian *I. heterosticta* (Figs. 11, 12). In mainland specimens, on the other hand, the dark dorsal pigmentation of segment 2 generally cuts out slightly above the midlateral line, and the lower edge has a sinuous border, generally higher towards the posterior end of the segment. In some southern mainland specimens the border is so high that blue lateral regions can be seen from above (Figs. 13, 14). However, many southern mainland specimens are dark (Fig. 15), and some northern specimens are light (Fig. 17). There appears to be no relationship between the pigmentation of segment 2, the structure of the appendages, or the thoracic pattern; indeed, the darkest segment 2 in the material examined was in a male with typically southern appendages and broad antehumeral stripes like those of *I. heterosticta* (see below), collected from Green Island, near Cairns (Fig. 16), a far darker example than any encountered with *torresiana*-type thoracic pattern or appendages (Fig. 18).

Antehumeral stripes

Much of the documentation has had to depend on the extent of the antehumeral



FIGS. 11-18.—Abdominal segment 2 of male *Ischnura heterosticta/torresiana*: **(11, 12)** dorsal and left lateral views, Richmond, T.; **(13)** left lateral view, Albury, N.S.W.; **(14)** dorsal view, Ovens River, V.; **(15-18)** left lateral view: **(15)** Bandon Grove, N.S.W.; **(16)** Green Island, Q.; **(17)** Eubenangee Swamp, Q.; **(18)** Banks Island, Q. (*paralectotype* of *I. torresiana*).



FIGS. 19-24 –Synthorax of male *Ischnura heterosticta/torresiana*: **(19-22)** Oberie Rock, N.T.; **(23)** Scrubby Creek, Rockhampton, Q.; **(24)** Richmond, T.

stripes. It proved convenient to recognise 4 categories of stripes (Figs. 19-24).

1. Antehumeral stripe restricted to a small ventral spot (Fig. 19). This is the type of stripe which Tillyard (1913) regarded as being characteristic of *I. torresiana.*

2. Antehumeral stripe consisting of a ventral spot with further spots above, and with or without a short line contiguous with the ventral spot (Fig. 20).

3. Ventral spot continuing into a long, narrow line, not approaching the dorsal carina, and often broken (Fig. 21).

4. Antehumeral stripe continuous to just below the dorsal carina, the width ranging from broad to narrow (Figs. 22-24). This is the pattern typical of *I. heterosticta,* described by Burmeister (1839) as having "mesonoto bivittata" (p. 820).

The incidence of thoracic colour in local populations

Even in local populations, particularly in northern Australia, a wide range of patterns can be present in the antehumeral stripes. The most useful example is that of *Ischnura* from the Alligator Rivers region of western Arnhem Land (Table 2). In this population, from a restricted area, both males and females showed a range of thoracic coloration from that typical of *I. torresiana* to that typical of *I. heterosticta,* the females having better developed antehumeral stripes than the males (see below).

TABLE 2

FREQUENCIES OF THORACIC COLOUR PATTERNS IN POPULATIONS FROM WESTERN ARNHEM LAND

Locality	Sex	Colour pattern 1	2	3	4	N
Cannon Hill	♂	11	7	4	4	26
	♀	4	2	4	14	24
Oberie Rock	♂	31	12	8	9	60
	♀	7	6	9	15	37
Pooled data	♂	42	19	12	13	86
		(0.4884)	(0.2209)	(0.1395)	(0.1512)	(1)
	♀	11	8	13	29	61
		(0.1803)	(0.1311)	(0.2131)	(0.4754)	(1)

Seasonal changes in patterns

Collections of *I. heterosticta/torresiana* from the "Top End" of the Northern Territory, and from Cape York, showed a seasonal change in the frequency of thoracic colour pattern. The details for males appear in Table 1. The frequencies for the period summer-winter differed significantly from those for the period winter-summer in both samples, $P < 0.05$ (N.T., χ^2, 1-tailed test) or $P = 0.008$ (Cape York, Fisher exact probability test), the summer-winter individuals being darker than those from the winter-summer samples.

Regional distribution of thoracic colour pattern

The frequencies of thoracic colour patterns in males from different parts of Australia are shown in Table 1. The samples from southern and Western Australia showed only the *I. heterosticta* pattern, but in the series from New South Wales some males, from Sydney to the New England Tableland, had a thorax typical of *I. torresiana.* In southern and central Queensland, north to the Rockhampton area, *torresiana*-type individuals occur at a frequency not significantly different from that found in N.S.W. ($P > 0.05$, χ^2), as is also the case in at least the winter-summer sample from north-eastern Queensland, as defined in Watson (1974). In the winter-summer samples from Cape York, however, the incidence of darker individuals (thoracic stripe types 1 + 2) was significantly higher than in winter-summer samples from north-eastern Queensland ($P < 0.05 > 0.01$, χ^2), and higher again than in N.S.W. ($P < 0.001$, χ^2), or in the pooled sample from Victoria, South Australia and Western Australia ($P < 0.0001$, Fisher exact probability test). The stripes of Tasmanian males are very broad (Fig. 24), apparently broader than those of mainland males.

Clearly, there is a region of overlap or intergrade between the extreme types, a region extending from central New South Wales to Queensland and the Northern Territory, and the farther south the sample, the lower the frequency of *torresiana*-type individuals.

Mating frequencies

Ischnura collected in May 1973 at localities a few kilometres apart in western Arnhem Land, and in the same drainage system, Cannon Hill Creek (12°23′S, 132°57′E) and ponds near Oberie (Obiri) Rock (12°25′S, 132°57′E), showed a wide range of thoracic patterns spanning the extremes from *I. heterosticta* to *I. torresiana*, and pairs were numerous. It was therefore possible to assess the frequency of individuals of the 4 types, and to compare this with the frequency of males paired with females of similar or dissimilar type.

The series from Cannon Hill and Oberie Rock are scored separately in Table 2. The frequencies of thoracic patterns in males do not differ significantly between the samples, nor do they in the females ($P > 0.50$, χ^2). The data were therefore pooled, and the result appears at the foot of Table 2, expressed both as frequencies and as proportions of the total sample. About half the males are of type 1, *torresiana* type, while about half the females are of type 4, *heterosticta* type.

If two species were present in these samples, one would expect them to segregate in mating, and there should be a tendency for individuals of similar colour pattern to pair. If only a single, variable species were present, the frequencies of combinations of colour patterns in the pairs should be random, and follow the products of the proportions given in Table 2.

Twenty-one pairs were collected and scored (Table 3). The marginal totals agree closely with the frequencies in the population of the area as a whole, and there is overwhelming agreement between the observed frequencies and the frequencies expected from random mating. A test of observed versus expected frequencies for darker males (types 1-3) against dark (1-3) and pale (type 4) females gave a χ^2 of 0.0278 with 1 d.f. ($P > 0.80$).

Thus all individuals in the area are members of a single, variable population.

TABLE 3

FREQUENCIES OF MATING BETWEEN MALES AND FEMALES OF THE FOUR TYPES (FREQUENCIES EXPECTED FROM RANDOM MATING GIVEN IN PARENTHESES)

		Thoracic pattern, female				N♂
		1	2	3	4	
Thoracic pattern, male	1	1 (1.9)	2 (1.3)	3 (2.2)	6 (4.9)	12 (10.3)
	2	1 (0.8)	0 (0.6)	0 (1.0)	3 (2.2)	4 (4.6)
	3	0 (0.5)	1 (0.4)	0 (0.6)	1 (1.4)	2 (2.9)
	4	0 (0.6)	0 (0.4)	1 (0.7)	2 (1.5)	3 (3.2)
	N♀	2 (3.8)	3 (2.7)	4 (4.5)	12 (10.0)	21

Discussion

The data indicate that *I. heterosticta* and *I. torresiana* do not show diagnostic structural characters, but constitute the ends of a range of forms varying in the structure of the appendages, and in abdominal and thoracic coloration. Even in the northern parts of Australia, where the dark, *torresiana* form is most prevalent, the pale, *heterosticta* form also occurs, together with abundant intermediates. In such mixed populations, mating is random. The frequencies of individuals of the extreme types, as of the intermediates, show seasonal and latitudinal change.

Clearly, the concept that *I. heterosticta* and *I. torresiana* are distinct species is no longer tenable. Nor is it useful to regard the two as subspecies, even if only because of the independent variation of the characters examined. In contrast, the diagnostic blue dorsal patch of abdominal segment 2 suggests that the Tasmanian populations can best be regarded as a subspecies of *I. heterosticta*. The synonymy is as follows.

Ischnura heterosticta heterosticta (Burmeister)

Agrion heterostictum Burmeister, 1839: 820-1 (♂, New Holland).
Agrion (Ischnura) heterosticta: Selys, 1876: 271 (♂, ♀, south-eastern Australia, Western Australia, New Caledonia).
Ischnura heterosticta: Martin, 1901: 246 (Australia, New Caledonia).
Ischnura heterosticta: Tillyard, 1905: 302-6 (♂, ♀, south-eastern Australia).
Ischnura heterosticta heterosticta: Tillyard, 1913: 451.
Ischnura heterosticta: Tillyard, 1924: 339 (♂, ♀, Fiji).
Ischnura heterosticta: Watson, 1962: 8, 17, 63, 64, 66, 68 (biology, south-western Australia).
Ischnura heterosticta: Watson, 1969: 79, 108 (biology, distribution, north-western Australia).
Ischnura heterosticta: Watson, 1973: App. 3 (biology, distribution, Alligator Rivers region).
Ischnura heterosticta: Watson, 1974: 141 (distribution).
Agrion (Ischnura) distigma Brauer, 1869: 14 (♂, Rockhampton).
Ischnura distigma: Martin, 1901: 246.
Agrion (Ischnura) distigma: Lieftinck, 1959a: 5-6 (synonymy).
Ischnura torresiana Tillyard, 1913: 452-3 (♂, ♀, Cooktown, Banks Island) (syn. n.).
Ischnura torresiana: Lieftinck, 1949: 230 (references, distribution).
Ischnura torresiana: Fraser, 1960: 17 (Rockhampton).
Ischnura torresiana: Kimmins, 1970: 192 (*lectotype* designation).

Ischnura heterosticta tasmanica Tillyard

Ischnura heterosticta tasmanica Tillyard, 1913: 451 (♂, ♀, Tasmania).

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References

BRAUER, F. M. (1869).—Beschreibung neuer Neuropteren aus dem Museum Godeffroy in Hamburg. *Verh. zool.-bot. Ges. Wien* **19:** 9-18.
BURMEISTER, H. (1839).—"Handbuch der Entomologie" (T. C. F. Enslin: Berlin). **2** (2): 757-1050.
FRASER, F. C. (1960).—"A Handbook of the Dragonflies of Australia" (Royal Zoological Society of New South Wales: Sydney).
KIMMINS, D. E. (1970).—A list of the type-specimens of Odonata in the British Museum (Natural History) Part III. *Bull. Br. Mus. nat. Hist.* (Ent.) **24:** 171-205.
LIEFTINCK, M. A. (1932).—The dragonflies (Odonata) of New Guinea and neighbouring islands Part I. *Nova Guinea* **15** (Zool. 5): 485-602.
LIEFTINCK, M. A. (1949).—The dragonflies (Odonata) of New Guinea and neighbouring islands Part VII. *Nova Guinea* (N.S.) **5:** 1-271.
LIEFTINCK, M. A. (1959a).—Synonymic notes on Brauer's types of Odonata in the Hamburg Museum. *Ent. Mitt. zool. StInst. zool. Mus. Hamb.* **21:** 1-8.
LIEFTINCK, M. A. (1959b).—On the New Guinea species of *Ischnura* Charpentier and *Oreagrion* Ris. *Nova Guinea* (N.S.) **10:** 213-240.
MARTIN, R. (1901).—Les odonates du continent australien. *Mém. Soc. zool. Fr.* **14:** 220-248.
PETERS, J. V. (1972).—A list of the dragonflies (Odonata) collected in the Northern Territory. *Aust. ent. Mag.* **1**(1): 3-4.
SELYS LONGCHAMPS, E. DE (1876).—Synopsis des agrionines, 5me légion: *Agrion* (suite). Le grand genre *Agrion. Bull. Acad. r. Belg. Cl. Sci.* (2) **41:** 247-322.
TILLYARD, R. J. (1905).—On dimorphism in the female of *Ischnura heterosticta*, Burm. *Proc. Linn. Soc. N.S.W.* **30:** 302-306.
TILLYARD, R. J. (1913).—On some new and rare Australian Agrionidae (Odonata). *Proc. Linn. Soc. N.S.W.* **37:** 404-479.
TILLYARD, R. J. (1924).—The dragonflies (Order Odonata) of Fiji, with special reference to a collection made by Mr H. W. Simmonds, F.E.S., on the island of Viti Levu. *Trans. R. ent. Soc. Lond.* **71:** 305-346.
WATSON, J. A. L. (1962).—"The Dragonflies (Odonata) of South-western Australia" (Western Australian Naturalists' Club: Perth).
WATSON, J. A. L. (1969).—Taxonomy, ecology, and zoogeography of dragonflies (Odonata) from the north-west of Western Australia. *Aust. J. Zool.* **17:** 65-112.
WATSON, J. A. L. (1973).—Odonata (dragonflies). *In* "Alligator Rivers Region: Environmental Fact Finding Study: Entomology" (CSIRO Division of Entomology: Canberra).
WATSON, J. A. L. (1974).—The distributions of the Australian dragonflies (Odonata). *J. Aust. ent. Soc.* **13:** 137-149.

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