ODONATA OF THE KERMADEC ISLANDS

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A collection of Odonata was made by the members of the Ornithological Society's Expedition to the Kermadec Islands from November 1966 to January 1967, and forwarded to me by Dr. J. C. Watt of Entomology Division, D.S.I.R., Nelson. This contained five species, of which four are now resident in New Zealand and Australia, and one is an Oceanic species with a wide distribution in Polynesia.

The species are the same as those collected by Oliver in 1907 and identified by Tillyard (1912), showing that in spite of the severe volcanic eruptions and storms the Odonata are able to survive in the island fauna. Since Tillyard wrote the article his three Australian species have become established permanently on the North Island of New Zealand without human assistance, so that his theory that their presence on the island (especially **Hemicordulia**) showed that the island had been joined to Australia in recent geological times cannot be substantiated. (Lieftinck 1953).

The following are the species of Odonata collected. All specimens are in the collection of Entomology Division, D.S.I.R., Auckland.

SUBORDER ZYGOPTERA (DAMSEL-FLIES)

Family Coenagriidae

Ischnura aurora aurora (Brauer 1865).

SUBORDER ANISOPTERA (DRAGON-FLIES)

Family Aeshnidae

Aeshna brevistyla (Rambur 1842).

Hemianax papuensis (Burmeister 1839).

Family Corduliidae

Hemicordulia australiae (Rambur 1842).

Family Libellulidae

Trapezostigma (Tramea) transmarina (Brauer 1867).

KEY TO KERMADEC ODONATA

1. Fore and hind wings closely similar in form and venation, usually held vertically over the abdomen in repose. Eyes projecting laterally and separated by a space greater than their dorsal diameter (SUBORDER ZYGOPTERA — Damsel-flies). Abdomen of male red with black and sky blue on terminal segments; abdomen of female greenish below and blackish above; often dull; wing expanse about 30 mm . **Ischnura aurora**
   Fore and hind wings dissimilar in form and venation, held horizontally or depressed in repose. Eyes large, never separated by more than their dorsal diameter and contiguous dorsally. Wing expanse over 60 mm. (SUBORDER ANISOPTERA — Dragon-flies) 2

2. Top of frons (or face) with dark "T" mark, the stem of the "T" lying in the midline, and a dark line along the front edge of the frons forming the cross 3
   Upper surface of frons without "T" mark, metallic blue, green or purple in the male, metallic of dull in the female 4

3. Sides of thorax with two creamy white or bluish diagonal stripes; wing-span approximately 90 mm . **Aeshna brevistyla**
   Sides of thorax dull, pale brown, wingspan approximately 100 mm . . . . . **Hemianax papuensis**

4. Top of frons metallic bluish-green in both sexes; body creamy yellow and black; wing-span approximately 65 mm.
   . . . . . **Memicordulia australiae**
   Top of frons metallic purple in male, dull orange-red with narrow dark metallic band in front of the eyes in female; body reddish; wing-span approximately 90mm.
   . . . . . **Hemicordulia australiae**

Ischnura aurora aurora (Brauer 1865)

This species is represented by 15 dried specimens, 7 male and 8 female, together with 1 male and 2 female spirit specimens and some nymphs in various stages of development; it is a variable species as regards size and extent of the colour pattern; the blue and black markings on the terminal abdominal segments of the male are variable in extent as has been reported in New Zealand examples; only the heterochrome type of female was found, as was to be expected, as the homochrome females that are present in India and as far as Western Australia do not extend to Eastern Australia and Samoa (Fraser 1927).

Locality

This damsel-fly breeds freely in the stagnant water around the swamp in Denham Bay, where it haunts the sedge grasses, it was also seen in the nymphs collected from the edge of Tui Lake.

Distribution

By wind; found in India, Ceylon, Java, New Guinea, Tahiti from where it was originally described, and many of the Pacific Isles such as Fiji, Samoa, Cook Islands and East to Rapa Isle, as well as all the Australian States and New Zealand. (Lieftinck 1953).

In New Guinea, two closely allied forms have developed, one in the mountain Valley of the Baliem River, Central North New Guinea (**I. aurora viduata** Lieftinck) and the other in the Arfak Mountains of the Vogelkop of West New Guinea (**I. aurora rhodosoma,** Lieftinck 1959).

Aeshna brevistyla (Ramber 1842)

This variable species is represented by three dried specimens, 2 males and 1 female, together with one hatching spirit specimen, the latter taken from a water trough. These specimens do not appear to differ from a New Zealand series of the species. (See also Tillyard 1916).

Locality

Denham Bay and Low Flat; probably wide ranging at times.

Distribution

All Australian States, New Calodonia, New Zealand (Fraser 1960).

Hemianax papuensis (Burmeister 1839).

A single male specimen of this large and striking dragonfly was the only adult representative of this species in the present collection, as also in the collection made by Oliver; although it is well represented in the 7 larval forms in spirit in the present collection.

A probable explanation for this is the wariness of this insect

and its wide dispersal after emergence. (Corbet 1962; Watson 1962, 1963).

In Australia, at latitudes similar to those of the Kermadecs, **H. papuensis** is on the wing much of the year; there is evidence to support that the species is bivoltine (Tillyard 1916; Watson 1962, 1963).

The variability in size and instar development of the larvae collected in the Kermadecs may indicate that breeding takes place throughout the year; in view of the Australian findings that the larvae can grow very rapidly, particularly in warm conditions, and the life cycle can be completed in 6 months in the field in winter, and in approximately 3 months in the laboratory at 21°C. (Hodgkin & Watson 1958; Watson 1963).

Locality

Denham Bay Swamp; the adults will range widely over the Island.

Distribution

Recorded from Cocos-Keeling Islands, Australia, Java, Sumba, Lord Howe, New Zealand. (Lieftinck 1953).

Hemicordulia australiae (Rambur 1842).

This species is represented by 15 dried specimens, 14 being males and 1 female. The latter was caught at Boat Cove, Raoul Island 5.vii.66 J. C. Watt, and is remarkable for the bright yellow colour of its body markings, as compared with those of the males. This colouration is produced and fixed when a dragonfly is killed in an atmosphere containing sulphur dioxide and can be used to preserve these colours (yellows or reds). It has been noted to occur in nature when a female **Procorulia gravi** flew over a thermal pool that exuded SO_2 until it died or was drowned but retained the vivid yellow markings.

Recent thermal activity may thus have temporarily diminished the number of females compared to males, as in Oliver's collection there were two of each sex. The presence of three larval forms in spirit (one from Denham Bay and two from Tui Lake) indicates that this species will survive on the Island.

The Kermadec form of this species does not differ from the New South Wales forms according to Tillyard (1912) nor from the recently established New Zealand form.

Distribution

Australia—universal on the south and east coasts, New Zealand North Island, Norfolk Island and north to Bali and Flores Island. (Lieftinck 1953).

Tramea transmarina (Brauer 1867).

This series of dried specimens, 3 males and 3 females, forms

a very valuable addition to our knowledge of this species. A single female taken by Oliver on his 1907 expedition and noted as a **Tramea** (Hagen) by Tillyard without specific identification probably belongs to this species.

The actual specimen has not been located in Tillyard's collections which were divided between Australia, The British Museum and New Zealand; it may have been destroyed as according to a letter from Mr. D. E. Kimmins of British Museum (Nat. Hist.) Dep. of Entomology, 8-viii.1967, "We do have part of Tillyard's Odonata here! it comprises his types, and a third of his main collection. I have examined our series of **Tramea,** and can find no example from the Kermadec Islands here. I believe that some parts of his collection were damaged by **Anthrenus** whilst in Australia, we have one or two non-Odonata types which are reduced to wings only, and perhaps this **Tramea** from the Kermadecs may have suffered the same fate". The specimen could not be located in any New Zealand collection or in the Australian Museum (Sydney).

A male and a female of this species taken in 1944 by J. H. Sorensen and labelled Raoul Island are in the Dominion Museum, Wellington, and were kindly lent to me for comparison by Mr. Ordish of the Museum's Entomological Department. It is reasonable to think that Oliver's specimen belonged to the same species, thus giving a long period of residence on this Island. The species belongs to the **T. limbata** group of Lieftinck (1942), because of the metallic purple top of the frons of the males, and to the South-East Asian and Pacific **transmarina** complex of this group (Lieftinck 1962); it has no affinities with the Australian species **T. loewi** (Brauer), or **T. eurybia** (Selys 1878), and **T. stenoloba** (Watson), of the **T. eurybia** group (cf. Watson, 1967). The size and colouration, according to Dr. J. A. L. Watson, to whom these specimens were submitted, exclude the possibility that the specimens belong to the only Australian species of the **transmarina** complex, **T. propinqua** (Lieftinck), which also occurs in New Guinea, the Bismark Archipelago, Fiji, and the Caroline Island and Eastern Micronesia (Lieftinck 1953, 1962).

Having compared specimens from Fiji, Samoa and Tonga of the **transmarina** complex with the Kermadec series, the Fiji specimen seemed to be their nearest relative, but in variable species such as this, which may tend to form territorial communities due to isolation, it requires a much larger series of specimens of the various communities than is available to me to decide the affinities of the Kermadec series.

Locality:

Captures all recorded as Denham Bay, one on 15.xii.66, one on 12.i.67, three on 13.i.67, and one on 18.i.67.

Distribution

Fiji, Samoa, Tonga and other Pacific Islands.

Note: Gloyd (1972) resurrects the generic name **Tramea** Hagen so that **Trapezostigma** used in recent papers becomes a synonym, for the genus.

CONCLUSIONS

In conclusion it would seem that the Odonata found on the Kermadecs are wide ranging in their habit, and can disperse far from their breeding rounds; two species, **I. aurora and H. papuensis** are known to be opportunists elsewhere, and to breed in temporary waters, and a third, **T. transmarina,** belongs to a genus at least some species of which do the same (Watson 1962, 1963). The limiting factor in their establishment is thus the availability of breeding grounds, but the ecelogical conditions acceptable to the species appear to be wide.

It was very fortunate that Tui Lake and the Swamp and Denham Bay were not seriously polluted by the recent volcanic eruptions and so have kept the fauna intact; the lack of marked territorial types in the fauna suggests that it is either of recent arrival or that it is regularly being augmented from its original source.

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REFERENCES

BRAUER, F., 1865: **Verh. zool.-bot.Ges. Wien. 15:** 510.
1867: **Verh. zool.-bot.Ges. Wien. 17:** 21.

BURMEISTER, H., 1839: Handbuch der Entomologie. Berlin, Eslin, Bd. II.

CORBET, P. S., 1962: A Biology of Dragonflies." pp. XVI + 247. Witherby, London.

FRASER, F. C., 1927: Insects of Samoa," part VII, pp. 19-14. British Museum Publication.

1960: "A Handbook of the Dragonflies of Australasia." pp. 1-67, 27 plates. Royal Zoological Society of New South Wales, Sydney.

GLOYD, L. K., 1972: **Tramea, Trapezostigma,** and time (Anisoptera : Libellulidae). A nomenclatural problem. **Odonatologica 1:** 131-136.

HAGEN, H. A., 1840: Synonymia Libellularum Europearum.

HODGSON, E. P. and WATSON, J. A. L., 1958: Breeding of Dragonflies in Temporary Waters. **Nature, London, 181:** 1015-1016.

LIEFTINCK, M. A., 1942: The Dragonflies (Odonata) of New Guinea and neighbouring Islands. Part VI. **Treubia 18:** 441-608.

1953: The Odonata of the island Sumba, with a survey of the dragonfly fauna of the Lesser Sunda Islands. **Verh. Naturf. Ges. Basel 64:** 118-228.

1959: On the New Guinea species of **Ischnura** Charpentier and **Oreagrion** Ris. with special reference to the larval forms and notes on the species of adjacent regions. **Nova Guinea (NS) 10:** 213-240, 29 figs.

1962: Insects of Micronesia, Odonata. Insects of Miconesia 5: 1-95. Bernice p. Bishop Museum; Honolulu.

RAMBUR, J. P., 1842: Histoire naturelle des Insectes Nevropteras. Paris, Roret.

SELYS LONGCHAMPS, E., 1878: **Mitt. Mus. Dresden 3:** 298.

TILLYARD, R. J., 1912: Dragonflies from the Kermadec Islands. **Trans. N.Z. Inst. 44:** 126-127.

1916: Life histories and descriptions of Australian Aeschninae; **J. Linn. Soc. (ZOOL) 33** (222): 1-83.

1917: "The Biology of Dragonflies." pp. XII + 396. Cambridge University Press.

WATSON, J. A. L., 1962: "The Dragonflies (Odonata) of South Western Australia." pp. 1-72. Western Australian Naturalists' Club: Perth.

1963: Life history, distribution and ecology in the Odonata of South Western Australia. **Proc. N.C. Branch, Ent. Soc. Amer. 18:** 130-133.

1967: An analysis of **Trapezostigma eurybia** (Selys, 1878) and related Indo-Australian species (Odonata, Libellulidae). **Nova Guinea, Zool. 36:** 377-400.