

**A NOTE ON THE GROUP OF SPECIES ALLIED TO
ISCHNURA RUFOSTIGMA SELYS
(ZYGOPTERA: COENAGRIONIDAE)**

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Four closely related taxa of the *I. rufostigma*-group, viz. *I. annandalei* Laid., *I. carpentieri* Fraser, *I. rufostigma* Sel. and *I. mildredae* Fraser are compared. On the basis of distinct differences in the male appendages it is suggested that these 4 taxa should be considered as good species.

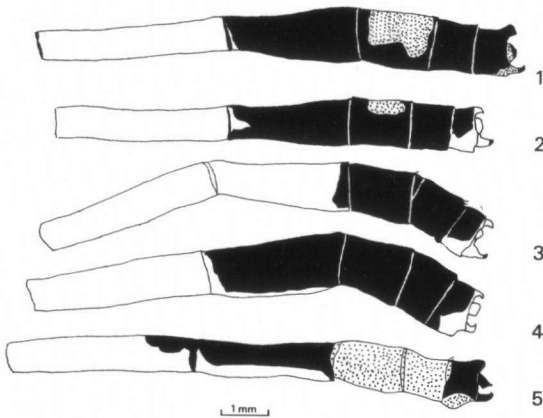
INTRODUCTION

In South East Asia occurs a group of closely related taxa of the genus *Ischnura* which has been referred to as the *rufostigma* group (FRASER, 1946; SCHMIDT, 1964). All of the taxa are small (abdominal length in the range 21-25 mm) and the abdomen of the males is predominantly bright-orange. According to the taxon, there may be black markings present on tergites 1-2 and 7-10 and pale blue markings on tergite 8 (on 9 also in some specimens of *I. carpentieri* Fraser). Strikingly noticeable in all of the members of the group, the pterostigma of the forewing of the male is bright red while that of the hindwing is pale brown. The bifurcated dorsal tubercle on tergite 10 of the male is blunt and does not project above the mid-dorsal axis at more than 40°. The male superior anal appendages are small and partly concealed by tergite 10; they do not project beyond the apex of the inferior appendages or the apex of the dorsal tubercle.

The following taxa are considered to belong to the *I. rufostigma* group (with type locality): *Ischnura rufostigma* Selys, 1876 (India); — *I. annandalei* Laidlaw, 1919 (Burma: Inle Lake); — *I. mildredae* Fraser, 1927 (Burma: Maymyo near Mandalay); — and *I. carpentieri* Fraser, 1946 (Anam = Vietnam: Danggia). In addition, *I. inarmata* Calvert, 1898 (type locality Kashmir) has been considered to

be a member of the group (SCHMIDT, 1946). Although the abdomen is predominantly orange in the male, the lack of a red pterostigma in the male forewing and the form of the male superior appendages suggest that *inarmata* is somewhat more distantly related to the other four taxa than they are to each other and I follow FRASER (1946) in excluding it from the group.

The colour pattern of the abdominal segments 6-10 of males of all five of these taxa is illustrated in lateral view in Figures 1-5. SCHMIDT (1946) also gives schematic drawings in dorsal view of all of these taxa except *I. carpentieri*. In the opinion of Fraser the abdominal patterns of the males show a direct and continuous chain of evolution running from *rufostigma* (with tergites 8-10 black)



through *annandalei* (with tergites 7-10 black and black markings on 1 and 2 also) and *mildredae* (similar to *annandalei* but with a small mid-dorsal blue spot on tergite 8) to *carpentieri* (similar to *mildredae* but the dorsum of tergite 8 almost entirely blue). Fraser considers the retention in the male of the primitive orange of the female justifies the group being considered to be the most primitive of the genus.

Figs 1-5. Left lateral view of abdominal segments 6-10 of males of *Ischnura* species to illustrate colour pattern. Dark areas black, pale areas orange, stippled areas pale blue: (1) *I. carpentieri*, Nepal, Godavari, 11.VII.1984, G.S. Vick leg., M.A. Lieftinck det.; — (2) *I. mildredae*, Burma, Maymyo, 15.V.1925, F. Wall leg.; — (3) *I. rufostigma*, Nepal, Pokhara, Phewa Tal, 21.VII.1984, G.S. Vick leg.; — (4) *I. annandalei*, Burma, Inle Lake, 9.III.1922, N. Annandale leg.; — (5) *I. inarmata*, Kashmir, VI.1923, T.B. Fletcher leg.

THE FOUR TAXA CONSIDERED CONSPECIFIC

ASAHINA (1970) placed *carpentieri* and *annandalei* in the synonymy of

mildredae, which he considered as a subspecies of *rufostigma*, considering that the colour pattern differences were due to individual variation and states of maturity of the available material. This decision was followed by DAVIES & TOBIN (1984). However, this analysis does not take into account structural differences that exist between these four taxa as described below.

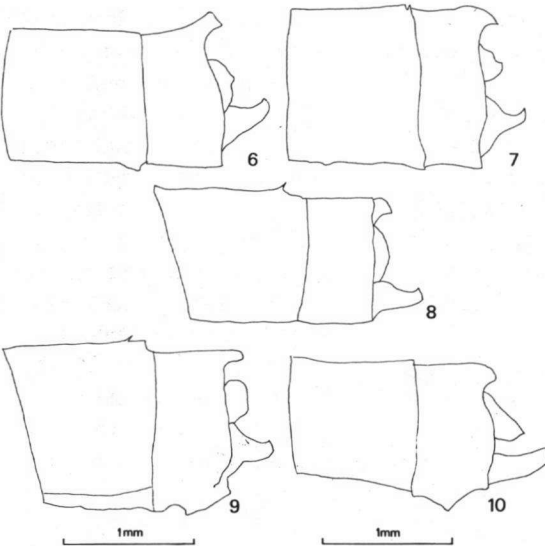
I. inarmata stands apart from the other taxa and its taxonomic status has never been questioned.

OBSERVATIONS

I first encountered problems with this group myself in 1984 when identifying material collected in Nepal (VICK, 1985). The only members of the group which had been recorded in Nepal were *annandalei* (KIAUTA, 1975) and *mildredae* (ASAHINA, 1965b; ST. QUENTIN, 1970). I collected two series of specimens of the *rufostigma* group from Godavari (Kathmandu) and Phewa Tal (Pokhara) which, in addition to colour pattern differences, were clearly structurally distinct; in particular, the shape of the male dorsal tubercle and the form of the anal

appendages was quite different in the two forms. Comparison with the type specimen of *mildredae* and a paratype of *annandalei* (type lost) in the BM Coll. convinced me that neither taxon was represented amongst my Nepalese material. However, the specimens from Phewa Tal agreed very well with paratypes of *rufostigma* from N. India in the BM Coll., but the Godavari material did not agree with any of these taxa. A specimen forwarded with drawings to Professor Kiauta was determined by Dr Lieftinck as *carpentieri*, previously only known from S. Vietnam.

The dorsal tubercle on the 10th abdominal segment of the males shows



Figs 6-10. Left lateral view of abdominal segments 9-10 of males of *Ischnura* species to show form of dorsal tubercle and anal appendages. Data as for Figs 1-5: (6) *I. carpentieri*; — (7) *I. mildredae*; — (8) *I. rufostigma*; — (9) *I. annandalei*; — (10) *I. inarmata*.

good specific differences, especially in lateral view (Figs 6-10). The most distinctive taxon is *carpentieri* in which the dorsal tubercle is broad, straight and blunt-ended, projecting at about 40° above the abdominal axis. In the other taxa, the tubercle scarcely projects above the line of the last tergite; the apex is acute and the tubercle is strongly curved ventrally. The type of *carpentieri* (kindly sent by the Institut Royal des Sciences Naturelles de Belgique, Brussels) differs only slightly from my Nepalese material; the tubercle is rather less blunt-ended and it

projects less strongly above the dorsal line but it is straight and quite distinct from the ventrally-curved tubercles of the other taxa.

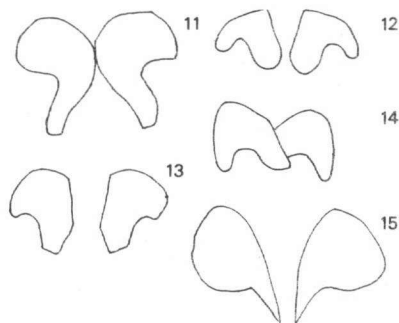
Good taxonomic characters are also provided by the male superior appendages, especially in caudal view (Figs 11-15). Distinct differences in the relative shapes and proportions of the lateral and ventral branches exist. For example, specimens of *annandalei* examined had crossed appendages.

A study of the female prothoracic structures would be useful as there should exist distinct differences correlated with those in the male terminalia noted above. Unfortunately, it is not always possible to be sure that females in collections have been correctly associated with males, especially as some taxa may be sympatric. However, females which I took in-copula with males of *carpentieri* at Godavari in 1985 show differences from females labelled as *rufostigma* in the BM Coll. (e.g. one from Mhow, Central Provinces, India; taken 3.III.1921); the posterior lobe of the pronotum of the *carpentieri* specimens is considerably larger in lateral aspect than is that of the specimens labelled as *rufostigma*. Clearly more work is required on this point.

It may also be worth mentioning here that females of *carpentieri* at Godavari exist in two colour forms; both, however, lack the bright red pterostigma of the male. The commoner, heterochromic form has the dorsum of tergites 3-10 black and the rest of the abdomen a dull brownish orange, except basally where the orange is brighter; the thorax is entirely orange but for a narrow black mid-dorsal stripe; the head is as in the male except that the blue post-ocular spots are replaced by an orange post-ocular stripe. The homeochrome is marked exactly as the male even to the extent of having the blue post-ocular spots. The colour pattern of the male is well described in FRASER (1946). Only the homeochromic female form is known in *rufostigma* and *mildredae* but *annandalei* possesses a heterochromic form also (FRASER, 1933).

CONCLUSIONS

The *Ischnura rufostigma* group consists of four structurally distinct taxa: *rufostigma* s.s.; *annandalei*; *mildredae*; *carpentieri*. In the absence of further information it seems better to regard them as species rather than sub-species as



Figs 11-15. Caudal view of superior anal appendages of males of *Ischnura* species. Data as for Figs 1-5: (11) *I. carpentieri*; — (12) *I. mildredae*; — (13) *I. rufostigma*; — (14) *I. annandalei*; — (15) *I. inarmata*.

the differences in the male appendages and dorsal tubercle are considerable. A study of the structural characters of the females, especially the prothoracic processes, is likely to show differences which can be correlated with these differences in the males.

Two female colour forms are known to exist in *annandalei* and *carpentieri* only.

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