

AFFINITIES AND STATUS OF SOME GENUS-GROUP TAXA IN AUSTRALIAN GOMPHIDAE (ANISOPTERA)

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Relevant and mainly structural characters of *Austrogomphus* s. str., *Austroepigomphus* Fraser, *Pleiogomphus* Watson, *Xerogomphus* Watson and *Zephyrogomphus* Watson, all considered by J.A.L. WATSON (1991, *Invertebr. Taxon.* 5: 289-441) as subgenera of *Austrogomphus* Selys, are described and illustrated. On the basis of this information it is suggested that *Austroepigomphus* and *Zephyrogomphus* should be elevated to generic rank, that *Pleiogomphus* should keep its position as a subgenus of *Austrogomphus*, and that *Xerogomphus* should be regarded as a subgenus of *Austroepigomphus*. Some morphological details of the previously undescribed male of what is now *Zephyrogomphus longipositor* (Watson) are given.

INTRODUCTION

The Australian Gomphidae were revised comprehensively by FRASER (1953) and by WATSON (1991). The species FRASER (1953) included in the genera *Antipodogomphus* Fraser, *Austroepigomphus* Fraser and *Austrogomphus* Selys of the subfamilies Epigomphinae and Gomphinae, were treated by WATSON (1991) under “*Austrogomphus* group”. In this group Watson recognised only two genera, *Antipodogomphus* and *Austrogomphus*. *Austroepigomphus* was, along with *Austrogomphus* s. str., *Pleiogomphus* Watson, *Xerogomphus* Watson and *Zephyrogomphus* Watson, considered as a subgenus of *Austrogomphus*. A few years earlier CARLE (1986), in a revision of the systematics of the world fauna of Gomphidae, had partly followed FRASER (1953) listing *Antipodogomphus*, *Austrogomphus* and *Austroepigomphus* under the tribe Austrogomphini.

Work on larvae of the Australian Gomphidae (THEISCHINGER, 1999) showed and amended some inconsistencies in their classification. Others were preliminarily addressed by the order in which WATSON's (1991) subgenera of *Austrogomphus* were

treated (THEISCHINGER, 2000). Two recent observations, however, have presented an incentive for a more thorough study of the groups presently included in the genus *Austrogomphus*. They are:

(1) *Austroepigomphus* Fraser. — When WATSON (1991) gave his account on *Austroepigomphus*, a taxon originally described as a genus (FRASER, 1953) and listed as such by CARLE (1986), that he (Watson) considered as a subgenus of the genus *Austrogomphus*, material of *Austroepigomphus* from south of the Sydney area was not available. With the type species of *Austroepigomphus* from South Australia, described as *A. praeruptus* Selys, being markedly larger than *A. melaleuca* from Sydney and further north, WATSON (1991) listed, under *Austrogomphus* (*Austroepigomphus*), the species *praeruptus* (“status uncertain”) and *melaleuca*. Recently larval material of *Austroepigomphus* became available from two localities in Victoria. One of these localities, Richardson River, is only ca 150 km from the Victoria-South Australia border. In addition an adult gomphid, considerably larger than any known *Austrogomphus* or *Hemigomphus* was observed, but not collected, near the other locality, Ovens River (J. Hawking, pers. comm.). Future collecting of the large gomphid will hopefully soon establish if there are two species of *Austroepigomphus* or if only one, then it would have to be *A. praeruptus*.

After it was shown that the larvae of *Austroepigomphus* and *Xerogomphus* are very close to each other and very different from the larvae of the other subgenera of *Austrogomphus* (THEISCHINGER, 1998, 2000), the rediscovery of *Austroepigomphus* from the very south of its range was reason enough to study adult characters, like male secondary genitalia and terminalia, in order to find out if the indications of relationships from larval features can be backed up by adult morphology.

(2) *Zephyrogomphus* Watson. — WATSON (1991) described *Odontogomphus longipositor*, “with some uncertainty” about its generic placement as he had only two females of the species. It was, however, listed under the same name by WATSON et al. (1991) and WATSON & HOUSTON (1994). THEISCHINGER (1998, 2000), on the basis of larval material believed to be *O. longipositor*, transferred the species to *Austrogomphus*, subgenus *Zephyrogomphus*.

Recently a freshly emerged male and female of *A. longipositor* were collected flying off from large boulders embanking a sandy pool of an otherwise rather fast flowing rainforest stream on Mt Lewis (Queensland). The subsequent search there for fresh exuviae was successful and supported the earlier association of larvae and adults. The new material made it possible to study some of the morphological features of the male of *A. longipositor* and to re-assess, based on larvae and adults, the relationships between this species and *A. lateralis* and between these two species and the remaining members of *Austrogomphus*.

Below relevant taxonomic characters of larvae and adults of the taxa regarded by WATSON (1991) as subgenera of *Austrogomphus*, are collated, followed by a discussion and conclusions from this information and consideration of the hitherto undescribed male of a species of previously doubtful systematic position.

DIAGNOSTIC CHARACTERS OF THE TAXA PREVIOUSLY REGARDED
AS SUBGENERA OF *AUSTROGOMPHUS*

AUSTROGOMPHUS SELYS

Larvae (Fig. 1): Premental ligula simply rounded, without distinct teeth (Fig. 2); postocular lobe rounded to angulated. Abdominal terga widely arched; lateral spines rarely on segments 3- or 4-9, more commonly on 5- or 6-9; segment 9 short and wide, segment 10 at least twice as wide as long (Fig. 3).

Adults: Antehumeral stripes aslant (Fig. 4); metepimeron posteriorly not margined with dark (Fig. 5). Male: Secondary genitalia with apex of penis sheath medially produced (Fig. 6); median segment of penis with distinct pair of posterior ventral lobes and long posterior dorsal lobe, distal segment markedly narrower than median segment, flagellate, the two flagella long and thin (Figs 7, 8). Dorsal portion of abdominal segment 10 with posteromedial excision and with posterolateral corners produced, ventral portion strongly receding (Figs 9, 10). Superior anal appendages not widely divergent.

Species included: *angelorum*, *arbustorum*, *australis*, *collaris*, *cornutus*, *doddi*, *guerini*, *mjobergi*, *mouldsorum*, *ochraceus*, *pusillus*.

PLEIOGOMPHUS WATSON

Larvae (Fig. 11): Premental ligula simply rounded, without distinct teeth (Fig. 12); postocular lobe angulated and protuberant. Abdominal terga widely arched; lateral spines on segments 3-9; segment 9 short and wide, segment 10 at least twice as wide as long (Fig. 13).

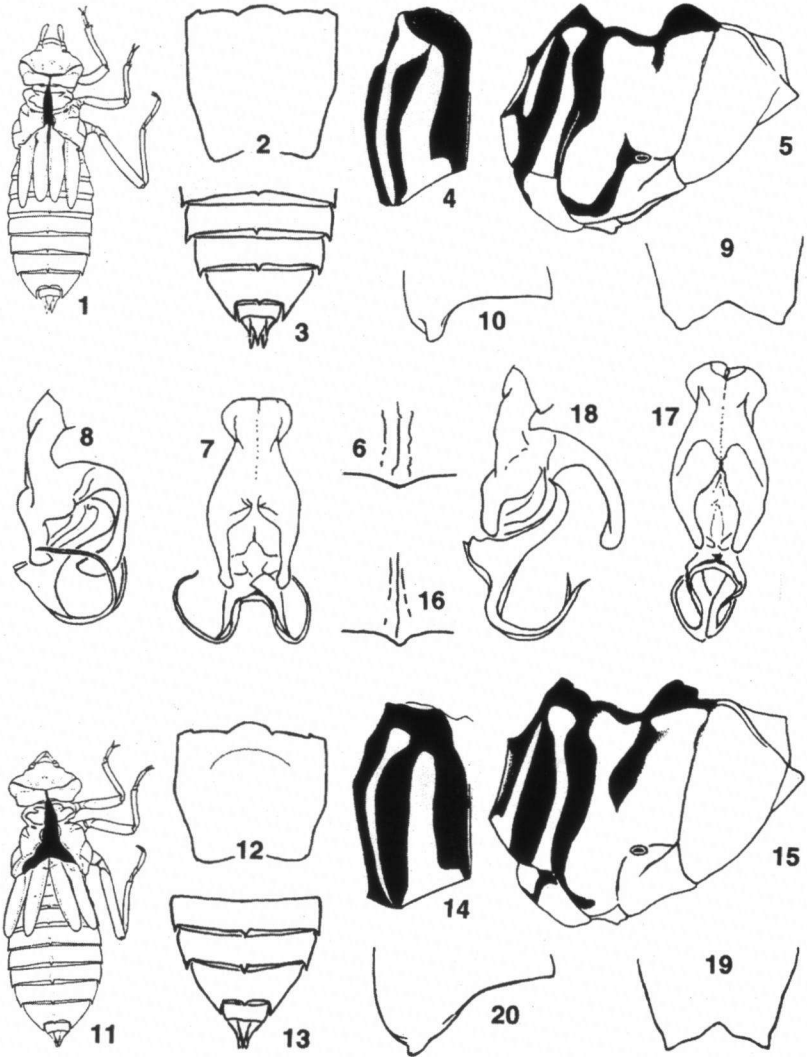
Adults: Antehumeral stripes parallel to mid-dorsal carina (Fig. 14); metepimeron posteriorly not margined with dark (Fig. 15). Male: Secondary genitalia with apex of penis sheath medially produced (Fig. 16); median segment of penis with distinct pair of posterior ventral lobes and long posterior dorsal lobe, distal segment markedly narrower than median segment, flagellate, the two flagella long and thin (Figs 17, 18). Dorsal portion of abdominal segment 10 with posteromedial excision and with posterolateral corners produced, ventral portion very strongly receding (Figs 19, 20). Superior anal appendages not widely divergent.

Species included: *amphiplitus*, *bifurcatus*, *divaricatus*, *prasinus*.

AUSTROEPIGOMPHUS FRASER

Larvae (Fig. 21): Premental ligula simply rounded, without distinct teeth but with fewer than 30 denticles (Fig. 22); postocular lobe angulated or protuberant. Abdomen pitched, lateral spines on segments 5-9; segment 9 comparatively long and narrow, segment 10 almost as long as wide (Fig. 23).

Adults: Antehumeral stripes aslant; metepimeron posteriorly not margined with dark (Fig. 24). Male: Secondary genitalia with apex of penis sheath medially notched



Figs 1, 3, 5-10. *Austrogomphus (Austrogomphus) ochraceus* (Selys). — Figs 2, 4. *A. (A.) guerini* (Rambur): (1-3) larva: (1) dorsal; (2) premenum, ventral; (3) posterior abdomen, dorsal; (4-10) male: (4) front of synthorax; (5) synthorax, lateral; (6) apex of penis sheath; (7, 8) penis: (7) ventral; (8) lateral; (9, 10) posterior edge of segment 10: (9) dorsal; (10) lateral. — Figs 11-20. *Austrogomphus (Pleiogomphus) amphiclitus* (Selys): (11-13) larva: (11) dorsal; (12) premenum and premental ligula, ventral; (13) posterior abdomen, dorsal; (14-20) male: (14) front of synthorax; (15) synthorax, lateral; (16) apex of penis sheath; (17, 18) penis: (17) ventral; (18) lateral; (19, 20) posterior edge of segment 10: (19) dorsal; (20) lateral.

(Fig. 25); median segment of penis lacking posterior lobes and markedly narrower than distal segment which lacks flagella (Figs 26, 27). Abdominal segment 10 mediodorsally not excised and with posterolateral corners not produced, slightly excised posterolaterally and medioventrally (Figs 28, 29). Superior anal appendages rather widely divergent.

Species included: *melaleucaea*, *praeruptus*.

XEROGOMPHUS WATSON

Larvae (Fig. 30): Premental ligula simply rounded, without distinct teeth but with at least 40 fine denticles (Fig. 31); postocular lobe angulated. Abdomen pitched; lateral spines on segments 6-9; segment 9 comparatively long and narrow, segment 10 approximately as long as wide (Fig. 32).

Adults: Antehumeral stripes aslant; metepimeron posteriorly not margined with dark (Fig. 33). Male: Secondary genitalia with apex of penis sheath medially notched (Fig. 34); median segment of penis lacking posterior lobes and narrower than distal segment which lacks flagella (Figs 35, 36). Abdominal segment 10 mediodorsally not excised and with posterolateral corners not produced, strongly excised posterolaterally, slightly medioventrally (Figs 37, 38). Superior anal appendages rather widely divergent.

Species included: *gordoni*, *turneri*.

ZEPHYROGOMPHUS WATSON

Larvae (Fig. 39): Premental ligula slightly bilobed and with distinct teeth (Figs 40, 48); postocular lobe rounded to angulated. Abdominal terga widely arched; lateral spines on segments 7-9 only; segment 9 short and wide, segment 10 approximately twice as wide as long (Figs 41, 49).

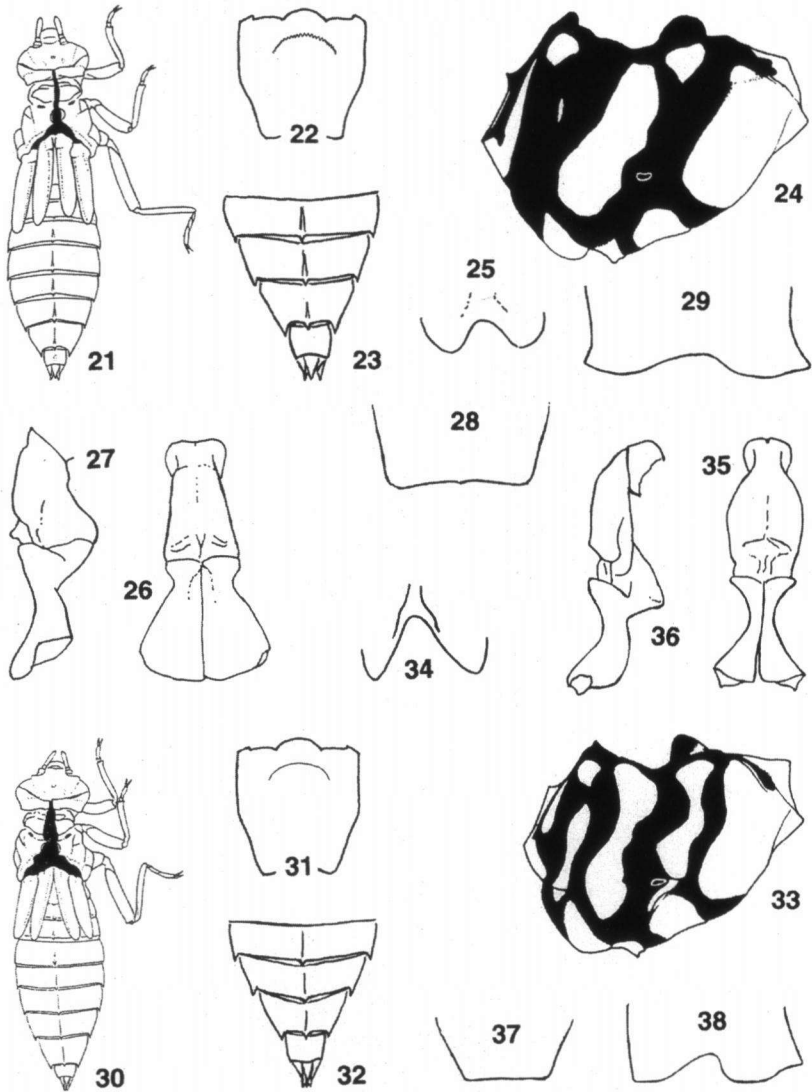
Adults: Antehumeral stripes aslant; lower half of metepimeron posteriorly margined with dark (Figs 42, 50). Male: Secondary genitalia with apex of penis sheath medially produced (Figs 43, 51); median segment of penis with posterior dorsal lobe only; distal segment markedly wider than median segment, lacking flagella, but with or without pair of triangular apical tips (Figs 44, 45, 53, 54). Abdominal segment 10 variably excised mediodorsally and with posterolateral corners not produced, very slightly and shallowly excised posterolaterally and medioventrally (Figs 46, 47, 55, 56). Superior anal appendages not widely divergent.

Species included: *lateralis*, *longipositor*.

DISCUSSION AND CONCLUSIONS

The above collation of characters of the taxa presently considered as subgenera of *Austrogomphus* strongly indicates some affinities which can be expressed without introducing new names.

Larval characters, like an evenly rounded premental ligula without distinct teeth in connection with short, wide abdominal segments 9 and 10, and adult character like the



Figs 21-29. *Austroepigomphus (A.) melaleucae* (Tillyard): (21-23) larva: (21) dorsal; (22) prementum and premental ligula, ventral; (23) posterior abdomen, dorsal; (24-29) male: (24) synthorax, lateral; (25) apex of penis sheath; (26, 27) penis: (26) ventral; (27) lateral; (28, 29) posterior edge of segment 10: (28) dorsal; (29) lateral. — Figs 30-38. *Austroepigomphus (Xerogomphus) turneri* (Martin): (30-32) larva: (30) dorsal; (31) prementum and premental ligula, ventral; (32) posterior abdomen, dorsal; (33-38) male: (33) synthorax, lateral; (34) apex of penis sheath; (35, 36) penis: (35) ventral; (36) lateral; (37, 38) posterior edge of segment 10: (37) dorsal; (38) lateral.

trilobed, flagellate penis, the produced posterolateral corners and the strong ventral recession of segment 10 of the male are shared by the *Austrogomphus* s. str. and *Pleiogomphus*. The same characters clearly set them apart from *Austroepigomphus*, *Xerogomphus* and *Zephyrogomphus*.

However, larvae of *Austrogomphus* s. str. can generally be distinguished from *Pleiogomphus* by their less strongly developed postocular and lateral abdominal armatures, adults by the different direction of the antehumeral stripes.

The present situation with *Pleiogomphus* considered as a subgenus of *Austrogomphus* appears realistic and appropriate.

The pitched abdomen and the long segment 10 of the larvae and adult characters, like the medially notched apex of the penis sheath, the lack of posterior lobes on the median segment of the non-flagellate penis, the posterolaterally notched abdominal segment 10 and the wide angle included by the male superior anal appendages, suggest that *Austroepigomphus* and *Xerogomphus* are very close to each other and fairly distant from the remaining subgenera of *Austrogomphus*. *Austroepigomphus* and *Xerogomphus* also appear more similar ecologically to each other than to any other members of *Austrogomphus* and are, according to the available records, almost geographical vicariants.

As a consequence it is suggested to return *Austroepigomphus* to the rank of a full genus [as described by FRASER (1953)], and to transfer *Xerogomphus*, as a subgenus, from *Austrogomphus* to *Austroepigomphus*.

Larvae of *Austroepigomphus* can be separated from *Xerogomphus* by the smaller number of the teeth along the margin of the premental ligula, adults by the much darker synthoracic pleura and by the lack of reddish or orange colouration on the terminal abdominal segments.

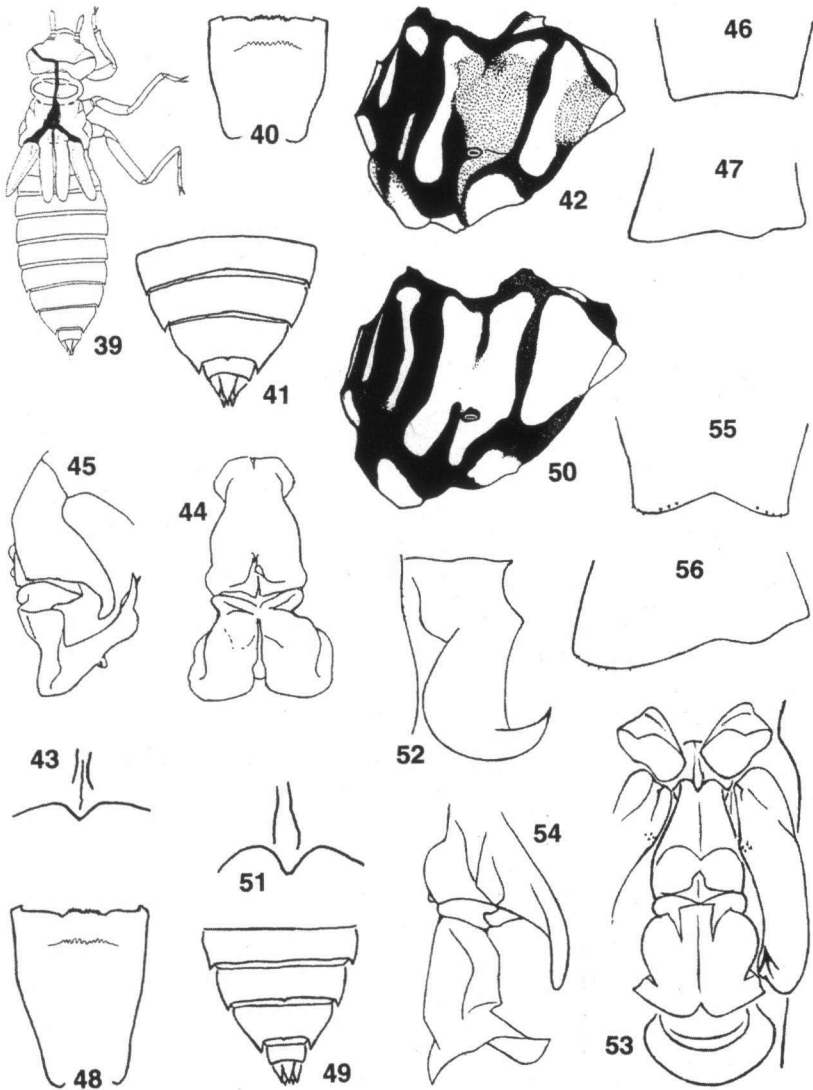
The bilobed premental ligula bearing distinct teeth and the poorly armed abdomen (only segments 7-9 with lateral spines) of the larvae and adult characters like the unique colour pattern of the synthoracic pleura, the particular shape of both pairs of hamules and the wide distal segment of the penis lacking flagella, together with the lack of ventral lobes on the median segment, and the only undulate posterior margin of abdominal segment 10 of the male suggest that there are no close ties between the subgenus *Zephyrogomphus* and the remaining subgenera of *Austrogomphus*. As a consequence full generic rank is proposed here for *Zephyrogomphus* Watson.

It appears obvious that *Austrogomphus* s.str. and *Pleiogomphus* on one hand and *Austroepigomphus* and *Xerogomphus* on the other are each others' sister groups. The relationships between *Austrogomphus*, *Austroepigomphus* and *Zephyrogomphus* and *Antipodogomphus* are less clear.

THE MALE OF *ZEPHYROGOMPHUS LONGIPOSITOR* (WATSON)

Figures 48-56

Even from the unique and teneral male of *A. (Z.) longipositor* can be detected that its overall colouration and colour pattern closely agree with WATSON's (1991) descrip-



Figs 39-47. *Zephyrogomphus lateralis* (Selys): (39-41) larva: (39) dorsal; (40) prementum and premental ligula, ventral; (41) posterior abdomen, dorsal; (42-47) male: (42) synthorax, lateral; (43) apex of penis sheath; (44, 45) penis: (44) ventral; (45) lateral; (46, 47) posterior edge of segment 10: (46) dorsal; (47) lateral. — Figs 48-56. *Z. longipositor* (Watson): (48, 49) larva: (48) prementum and premental ligula, ventral; (49) posterior abdomen, dorsal; (50-56) adult: (50) synthorax, female, lateral; (51-56) male: (51) apex of penis sheath; (52) posterior lamina, lateral; (53) secondary genitalia, ventral; (54) penis, lateral; (55, 56) posterior edge of segment 10: (55) dorsal; (56) lateral.

tion of the female, and that the terminalia are very similar to those of *A. (Z.) lateralis*. However, the badly preserved and somewhat damaged specimen allows only an incomplete description.

Measurements (mm). — Forewing 26.6; hindwing 25.5; abdomen 34.5.

Head and thorax similar in pattern but generally much paler in colouration than the female (Fig. 50) [as described by WATSON (1991)], however, more extensively darkened in anterior portion of mesepimeron and metepisternum and in the dorsal half of metepimeron (remining of *Z. lateralis*).

Wings hyaline; 13-14/10 antenodals; 11-12/10-11 postnodals; 2-3 crossveins between the sectors of arculus proximal to fork of Rs; pterostigma overlying 4-5 crossveins; anal angle about as long as wide, 3-celled.

Abdomen with anterior 1/6-1/4 of segments 2-7 somewhat paler than the rest.

Secondary genitalia with apex of penis sheath medially produced (Fig. 51); anterior hamules shell-shaped, posterior hamules roughly subrectangular in profile but with double-pointed base and strong apical hook (Figs 52, 53); median segment of penis with slightly and evenly curved posterior dorsal lobe only, distal segment markedly wider than median segment, lacking flagella or triangular apical tips (Figs 53, 54). Abdominal segment 10 hardly excised mediodorsally and with posterolateral corners not produced, very slightly and shallowly excised posterolaterally and medioventrally (Figs 55, 56). Superior anal appendages not widely divergent.

Even from the brief description it appears that the species *longipositor* Watson can be included with confidence in the genus *Zephyrogomphus* Watson and that it can perhaps be regarded as the sister species of *Z. lateralis* (Selys).

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