



## Description of the nymph of *Gomphurus gonzalezi* (Odonata: Gomphidae)

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(Received 22 August 2017; final version received 12 October 2017)

*Gomphurus gonzalezi* (Dunkle) is a locally distributed dragonfly ranging from the Lower Rio Grande in south Texas southward to San Luis Potosi state in northeastern Mexico. We describe and illustrate the nymph based on specimens from Hidalgo County, Texas. The palpal lobe of *G. gonzalezi* has 7–8 small teeth in a straight line with the bifid end tooth approximately the same size as the more proximal teeth, typical of the *Gomphurus fraternus*-group. *Gomphurus gonzalezi* is distinct from the other species in this group by the long, round-tipped posterolateral spines on abdominal segment 9. In the Lower Rio Grande, the nymphs of *G. gonzalezi* bury themselves in sand and mud in slow flowing reaches.

**Keywords:** dragonfly; Anisoptera; Texas; Mexico

### Introduction

*Gomphurus gonzalezi* (Dunkle, 1992) was described based on adult specimens from San Luis Potosi, Mexico and Cameron and Starr counties, Texas. Abbott (2011) added Hidalgo County, Texas to the known distribution of the species. Adults (Figure 1) are medium-sized dragonflies with brown stripes on a gray-green to yellow-green ground color and apical abdominal segments that are largely yellow (Abbott, 2015; Needham, Westfall, & May, 2014). The species has a limited range and is locally distributed; it was rated as “data deficient” by the IUCN, as current population trends are unknown (Abbott, 2006). However, sizeable populations have recently been discovered in the Lower Rio Grande of Texas (R. Nirschl pers. comm.). At their highest densities, 5–6 exuviae/m<sup>2</sup> were observed (pers. obs. by JCA).

The purposes of this paper are to describe and illustrate the nymph of *G. gonzalezi* and to diagnose it within the genus *Gomphurus*. With the discovery of the nymph of *G. gonzalezi*, all species of the genus are now known in the F-0 nymph stage (Garrison, von Ellenrieder, & Louton, 2006; Needham et al., 2014).

### Materials and methods

Nymphs and exuviae were preserved in 80% ethanol; associated adults were soaked in acetone and dried (Needham et al., 2014). Nymph terminology follows Needham et al. (2014) for

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Figure 1. Adult male of *Gomphurus gonzalezi* (photo by J. C. Abbott).

body characters and Watson (1956) for mandibular formula. Drawings were made with aid of a camera lucida. Measurements (mm) were made with a calibrated ocular micrometer as follows: (1) total length from anterior margin of labrum to tips of paraprocts; (2) head width across compound eyes; (3) prementum width anteriorly, length medially from ligula to posterolateral angle (excluding palps and hinge); (4) abdomen length ventrally including appendages. Total length, head length, and head width were measured only on exuviae that were not obviously distorted. Reared specimens with associated exuviae have been deposited in the Florida State Collection of Arthropods (FSCA) and the Alabama Museum of Natural History (ALMH) collections; non-associated exuviae have been deposited in both institutions and the US National Museum.

In total, 119 specimens were examined: two nymphs, 36 exuviae, TX, Hidalgo County, Rio Grande, Anzalduas County Park, (26.1380°, -98.3346° to 26.1415°, -98.3284°, upstream of the Anzalduas Dam), 1–19 March 2012, R. Nirschl; 22 exuviae, same locality, 3 March 2013; two exuviae (with associated adults), four nymphs, same locality, 6 March 2013; one exuviae, same locality, 8 March 2013; 50 exuviae, two nymphs, same locality, 9 March 2013, J.C. Abbott. Forty of these, in the best condition, were chosen as representatives for detailed measurements.

Abbreviations: antm = antennomere (e.g., antm3 = third antennomere); L = left; R = right; S = abdominal segment (e.g., S10 = tenth segment).

## Results

### *Gomphurus gonzalezi* nymph

(Figures 2–7, 12)

#### *Description*

Preserved nymphs light brown with the dorsal abdominal pattern consisting of patchy, irregularly shaped, dark brown markings on a tan ground color (Figure 2); pattern on exuviae less obvious.

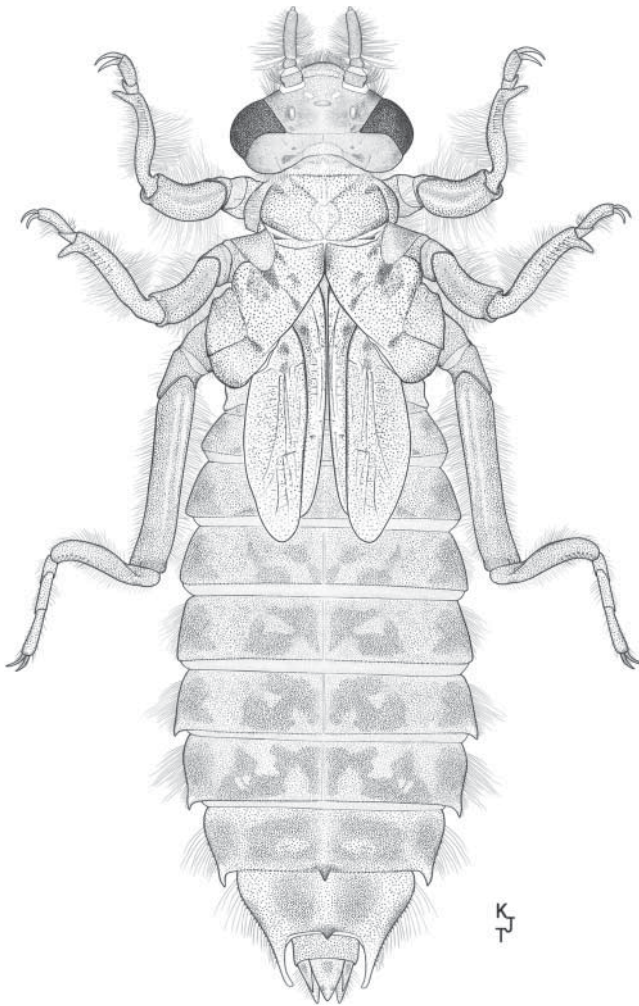
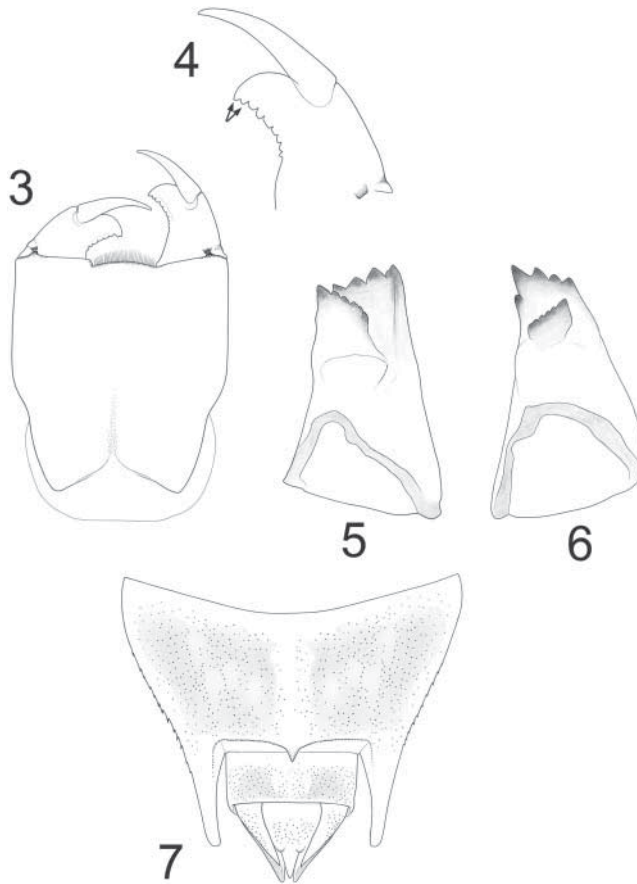


Figure 2. Habitus of *Gomphurus gonzalezi* nymph.

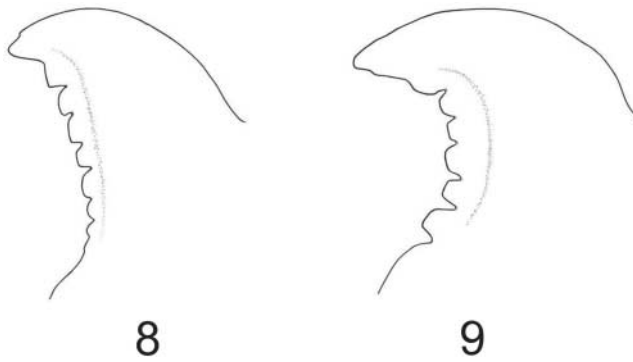
**Head** 1.8–1.9 × as wide as long. Labrum with dense fringe of slightly stout setae about 0.5 mm long. Antm3 longest of 4 antennomeres, length 1.40–1.45 mm, about 3.8 × width; antm4 length 0.13 mm, width 0.12 mm. Prementum constricted in basal third (Figure 3), length 2.75–3.30 mm, width at distal end 2.45–2.80 mm (width:length ratio 0.82–0.96); lateral margins in distal 2/3 usually parallel, sometimes slightly convergent to slightly divergent, with a few white silky setae at anterolateral corners but no short stiff setae; numerous fine pale setae also scattered on lateral margins and ventral surface. Ligula slightly convex (Figure 3), with dense brush of gray setae (length 0.14 mm), without a median tooth. Palpal lobe with 7 or 8 low teeth on inner margin in a straight line with the bifid end tooth approximately the same size as the more proximal teeth (Figure 4); lateral margin of lobe with 8–12 pale silky setae; movable hook L 0.90–0.95 mm,  $c.1.2 \times$  length of lateral margin of palpal lobe. Apex of labial hinge extends to posterior margin of prosternum. Mandibles with 4 or 5 molars between a and b; formula L 1234 0 a(m<sup>1–4or5</sup>)b, R 1234 y a(m<sup>1–4or5</sup>)b, see Watson (1956) for explanation of molar formula; molar crest flexible on membranous cuticle (Figures 5 and 6).



Figures 3–7. *Gomphurus gonzalezi* nymph details. 3. Prementum. 4. Right palpal lobe with arrows showing bifid terminal tooth. 5. Left mandible. 6. Right mandible. 7. S9–S10 + anal appendages. Not to scale.

**Thorax** Prothorax pale brown with numerous long, hair-like setae laterally; pterothorax mostly tan with small dark brown markings above mesothoracic coxae, also with long, hair-like setae. Legs completely pale brown (no dark bands apparent), with numerous long hair-like setae; metathoracic femur length  $0.29\text{--}0.42 \times$  ventral abdomen length (including appendages), apex of metathoracic femur level with, or nearly so, posterior margin of S4 or slightly beyond; pro- and mesothoracic tibiae with apical burrowing hook stout, curved, length  $0.30\text{--}0.35$  mm; ratio of metathoracic tibia:metathoracic femur length  $0.88\text{--}0.95$ . Tarsal formula 2-2-3; metathoracic tarsal claw length  $c.0.9 \times$  third tarsomere length. Apex of metathoracic wing pad extending to anterior portion of S4.

**Abdomen** Length:width ratio, measured ventrally,  $1.9\text{--}2.5$ ; dorsum with irregular dark brown markings on each side of median line (Figure 2). Posterolateral spine on S6 to S9 (Figure 2), usually divergent on S6 and S7, slightly curved inward on S8 and S9; S9 spine length  $1.07\text{--}1.50$  mm, apex rounded (Figure 12),  $1.53\text{--}2.38 \times$  mid-dorsal length of S10 (mean = 1.86),  $2.35\text{--}2.55 \times$  length of S8 posterolateral spine; S8 spine about  $1.55 \times$  length of S7; S6 posterolateral spine shortest of posterolateral spines, length  $0.20\text{--}0.24$  mm. Triangular, flat mid-dorsal hook on S8 (length  $0.16\text{--}0.18$  mm, basal width about  $0.2\text{--}0.25$  mm) and on S9 (length  $0.22\text{--}0.24$  mm, basal width  $c.0.3\text{--}0.35$  mm), apex acute. Segment 6 without spinules along lateral margin of



Figures 8–9. Palpal teeth of *Gomphurus* species representing the two major species groups. 8. *G. externus*. 9. *G. dilatatus* (Rambur).

segment, S7 with 0 or 1, S8 with 4–10, S9 with 18–21. Segment 9 ventral length:maximum width ratio 0.46–0.60; S9 maximum width (4.0–4.75 mm), posterior margin with 14–18 small dark spinules; S10 W 1.50–1.84 mm, 2.0–3.0 × S10 mid-dorsal length (0.60–0.80 mm). Dorsum of S10 and epiproct appearing granulate due to numerous conspicuous dark setal bases. Epiproct length 0.98–1.16 mm (1.25–1.85 × S10 mid-dorsal length); cercus length:epiproct length ratio 0.80–0.87; tip of epiproct slightly anterior to tips of paraprocts (Figure 7).

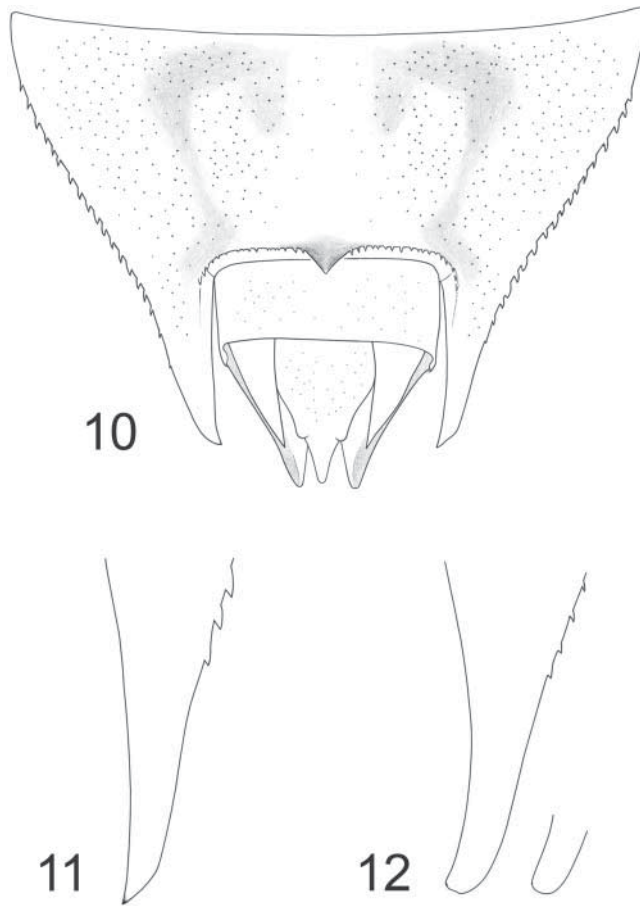
*Measurements (mm)* Total length 23.9–28.5; head W 4.80–5.70; prementum length 2.75–3.30; metathoracic femur length 5.15–6.60; abdomen length 14.8–18.6; maximum abdomen width 7.0–7.9.

### Diagnosis and discussion

Measurements of exuviae matched those of nymphs except for minor differences between total and abdomen length, metrics that become slightly extended during metamorphosis.

The nymph of *G. gonzalezi* belongs to the *G. fraternus*-group within *Gomphurus*, characterized by palpal lobes armed with seven or eight low teeth in a nearly straight line and an end tooth that is approximately equal to or slightly larger in size than the proximal teeth (Figure 4). Five other species belong in this group [*G. externus* (Hagen in Selys, 1858), *G. fraternus* (Say, 1839), *G. hybridus* (Williamson, 1902), *G. lynnae* (Paulson, 1983), and *G. ventricosus* (Walsh, 1863)]. Louton (1983) mistakenly included *G. ozarkensis* Westfall in the *G. fraternus*-group, but the end tooth is large and the line of proximal teeth is incurved (Huggins & Harp, 1985). In some individuals of the *G. fraternus*-group, the end tooth projects slightly beyond the adjacent proximal tooth (Figure 8), but we have not seen the markedly enlarged end tooth that characterizes the other major group within the *Gomphurus*, the *G. dilatatus* group (Figure 9) (see also Westfall, 1974).

*Gomphurus lynnae* is unique within the *G. fraternus*-group by typically lacking a posterolateral spine on S6, although sometimes a very tiny spine is present, hidden by silky setae (Tennessee & Valley, 2013). The ligula in *G. ventricosus* has a straight margin that is recessed to a greater degree than in the other five species; Louton (1983) illustrated the recessed position of the ligula but did not mention it in his diagnosis or description. The ligula of *G. hybridus* is slightly convex (Louton, 1982), whereas that of *G. fraternus* varies from nearly straight to slightly convex (Walker, 1958).



Figures 10–12. Posterolateral spines on abdominal segment 9. 10. *Gomphurus externus* S9–10 + appendages, dorsal view. 11. Enlargement of *G. externus* S9 right posterolateral spine. 12. Enlargement of *G. gonzalezi* S9 right posterolateral spine (inset = more rounded apex).

*Gomphurus gonzalezi* nymphs resemble nymphs of *G. externus* more closely than any other congeneric species based on the convex ligula and long S9 posterolateral spines; posterolateral spine length is similar in the two species (*G. gonzalezi* 1.07–1.27 mm, *G. externus* 1.07–1.33 mm). The geographic range of *G. externus* is also the closest of any congener to that of *G. gonzalezi* (Abbott, 2015). *Gomphurus gonzalezi* nymphs are slightly smaller than *G. externus* in several characters, including distal prementum width (2.45–2.80 mm versus 2.80–3.20 mm), abdomen width (7.0–7.9 mm versus 7.7–9.1 mm), metathoracic femur length (5.2–5.6 mm versus 5.6–6.6 mm), metathoracic tibia length (4.7–5.2 mm versus 5.3–6.1 mm), S9 width (4.00–4.75 mm versus 4.60–5.60 mm), and epiproct length (0.98–1.16 mm versus 1.11–1.35 mm). Three additional characters help to separate *G. gonzalezi* from *G. externus* [in brackets]: (1) dorsum of S10 and epiproct with numerous dark, conspicuous setal bases, similar to those on S9 (Figure 7) [relatively few, mostly pale, inconspicuous setal bases, usually less conspicuous than those on S9 (Figure 10)]; (2) tips of S9 posterolateral spines rounded (Figures 7 and 12) [acute (Figures 10 and 11)]; (3) S9 mid-dorsal hook acute (Figure 7) [usually right-angled (Figure 10) or obtuse, rarely acute]. The sides of the *G. gonzalezi* prementum were parallel in about 80% of the specimens examined, slightly convergent in about 15%, and rarely slightly divergent; in *G. externus*,





Figure 13. Shoreline of Rio Grande near Anzalduas Dam, Hidalgo County, Texas, site of *Gomphurus gonzalezi* emergence (photo by J. C. Abbott).



Figure 14. Male of *Gomphurus gonzalezi* emerging on shore of Rio Grande near Anzalduas Dam, Hidalgo County, Texas (photo by J. C. Abbott).

the sides were usually divergent (nearly 90%), rarely parallel. The spinules on the lateral and posterior margins of S6–9 of *G. gonzalezi* are less stout than those of *G. externus*.

Habitat. *Gomphurus gonzalezi* appears to be an inhabitant of medium-sized to large rivers. Nymphs and exuviae were found in the Lower Rio Grande where the substrate was

predominately sand, but the fine, light-colored silt on the specimens indicates the silt load was significant. The water was murky (visibility *c.* 10 cm) and the flow was negligible near shore. Emergence to the adult stage in 2012 and 2013 took place from late February to the third week of March. Exuviae were found on logs or tree branches in the water, as well as logs, cattails, rocks and giant cane as much as 3 m from the water's edge, and the concrete wall of Anzalduas Dam. In 2013, nymphs and exuviae were particularly easy to observe because the water level of the Rio Grande was low, creating a "beach" that nymphs moved across and that was easily accessible on foot (Figure 13).

Numerous nymphs crawled across the beach, sometimes reaching the vegetation at the typical waterline (Figure 14), while others emerged on the beach itself. Emergence time was mostly between 1000 and 1400, CST. Few definitive data are available on the life cycle of *G. gonzalezi*, but the presence of small nymphs during the emergence period indicates that this species is semivoltine or quite possibly partivoltine.

## Acknowledgments

We thank Rick Nirschl for collecting nymphs and exuviae of emerging *G. gonzalezi* and for providing notes on habitat and emergence. We also thank Kendra Abbott and Bob DuBois for reviewing the manuscript and providing valuable comments.

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