

**A NEW SPECIES OF DRAGONFLY, *GOMPHUS (GOMPHURUS)*  
*LYNNAE* SPEC.NOV., FROM THE YAKIMA RIVER, WASHINGTON,  
WITH NOTES ON PRUINOSITY IN GOMPHIDAE (ANISOPTERA)**

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*G. lynnae* sp.n. (♂ holotype, ♀ allotype: Yakima River, 9 mi. N Benton City, Benton Co., Washington; deposited in Florida State Collection of Arthropods, Florida Department of Agriculture and Consumer Services, Gainesville, Florida) is the only species of Odonata presently known to be restricted to the Columbia River Basin and is the only member of the subgenus *Gomphurus* known from west of the Rocky Mountains. It is a dark-colored species related to *G. externus* but differing from that species and other *Gomphurus* in numerous structural and color-pattern features. It is peculiar in having abundant pruinosity on the head, thorax, legs and base of abdomen and is perhaps the most pruinose gomphid. Relationships among the species of *Gomphurus* are discussed and species pairs suggested. *G. lynnae* inhabits a large, rocky to muddy river in sagebrush steppe and is known to fly from 2 June to 18 July. It may be threatened because of its restricted range and the considerable human alteration of rivers in the Columbia Basin.

INTRODUCTION

Although the Odonata of North America are reasonably well known, new species are still being described at a moderate rate, and this is especially true for the Gomphidae. Of 12 valid species of Odonata described from North America in the last 3 decades (1951-1980), 7 are gomphids, including 2 in the subgenus *Gomphurus* (WESTFALL, 1956, 1975). Nevertheless, I was surprised to examine a series of specimens of an undescribed *Gomphurus* from the Yakima River in south-central Washington. *Gomphurus* is basically a group of eastern and central North American species, although one described species is known as far west as Montana and Utah.

I examined specimens of all the North American species of this subgenus except *ozarkensis* Westfall and *ventricosus* Walsh, which are well described in the literature (WESTFALL, 1975; WALKER, 1958). I have discounted '*Gomphurus*' *adelphus* Selys entirely in all the following discussions, as it is now known that it is not a valid species (M.J. Westfall, Jr., pers. comm.), and it and all Old World species are excluded when I refer to 'all *Gomphurus*.'

### *GOMPHUS (GOMPHURUS) LYNNAE* SP.N.

Figures 1 a-f

Material (all from Benton County, Washington). — **Holotype:** Yakima River, 9 mi. N Benton City, 17 July 1971, Dennis and Mary Lynn Paulson. **Allotype:** same locality, 12 July 1971, Mary Lynn Paulson. **Paratypes:** 24, including 9 males and 3 females, same data as allotype (1-12); 5 males and 1 female, same data as holotype (13-18); 1 female, same locality as holotype, 18 July 1971, Dennis and Mary Lynn Paulson (19); 1 male, Yakima River at Kiona, 18 July 1971, Dennis and Mary Lynn Paulson (20); 2 males and 1 female, same locality as holotype, 5 July 1972, Mary Lynn Paulson (21-23); 1 male, Richland, 2 June 1967, E. Gage (24).

Specimens deposited as follows: Holotype and allotype to Florida State Collection of Arthropods, Florida Department of Agriculture and Consumer Services, Gainesville, Florida; Paratypes to National Museum of Natural History, Washington, D.C. (4, 10); Museum of Zoology, University of Michigan, Ann Arbor, Michigan (5, 12); Central Washington State University, Ellensburg, Washington (24); and the private collections of Frank L. Carle, Blacksburg, Virginia (7), Carl Cook, Center, Kentucky (8), Thomas W. Donnelly, Binghamton, New York (21, 23), Sidney W. Dunkle, Gainesville, Florida (9), Rosser W. Garrison, Azusa, California (13), Kenneth W. Knopf, Gainesville, Florida (14), and Kenneth J. Tennesen, Florence, Alabama (15). The remainder of the paratypes are retained in my own collection.

**Etymology.** — This species is named after Lynn Erckmann (formerly Mary Lynn Paulson), who discovered it, knew it was something interesting, and shared my excitement when I realized it was undescribed. She also produced the fine illustrations reproduced herein and furnished the moral support necessary to embark on my first description of a new species of dragonfly.

#### DESCRIPTION OF HOLOTYPE MALE

General color brownish-black and yellow, thorax and base of abdomen pruinose; abdomen slender with conspicuously expanded tip.

**Head.** — Frons, clypeus, labrum and labium yellow. Vertex dark brown with narrow rings around the antennae and ocelli and the ends of the transverse ridge yellow. Transverse ridge on vertex grayed by pruinosity. Occiput yellow, its edge convex. Rear of head black for upper 1/5, mottled yellow and brown below.

**Prothorax.** — Anterior lobe of pronotum dark brown, its anterior edge yellow. Medial 2/3 of posterior lobe dark brown with dull yellow paired median tubercles, lateral 1/3 yellow, posterior edge yellowish-brown. Proepimeron dark brown with yellow lower 1/5.

**Pterothorax (Fig. 1a).** — Basically dark with three prominent yellow stripes equidistantly spaced on each side, but to follow the custom in describing gomphids, the yellow will be taken as the ground color, interrupted by the

following dark brown stripes: (1) middorsal stripe diverging below, where it is about 1.5 times as wide as at its upper end; (2) antehumeral and humeral stripes fused throughout their length into a wide stripe, the upper end of the antehumeral separated from the antealar carina by an offshoot from the yellow stripe between it and the middorsal stripe; (3) the interpleural and metapleural stripes fused at their lower ends and near their upper ends, separated by a fairly diffuse dull tan stripe in their middle thirds and a similarly colored dot at their upper ends; the metapleural stripe forks and surrounds the supracoxal plate, which is yellow, and contacts the next dark stripe at its lower end; (4) another dark stripe crosses the posterior part of the metepimeron, parallel to the preceding stripes. All dark stripes overlain by grayish pruinosity.

Legs. — All coxae yellow. Legs dark brown, the femora overlain by grayish pruinosity, the inner surfaces of the front trochanters and femora yellowish-tan.

Wings. — Venation typical of *Gomphurus*, basically the same as illustrated for *G. dilatatus* Rambur by NEEDHAM & WESTFALL (1955: 180). Veins brownish-black except the yellow costa. Pterostigmas brown above, brownish-cream below, bordered strongly by black. Wing membrane hyaline. Antenodal crossveins 12-12, 8-9; postnodal crossveins 9-10, 10-9. Bridge crossveins 5-5, 3-3; crossveins under pterostigma 3-3, 3-3; paranal cells 6-6, 4-4.

Abdomen (Fig. 1a). — Dark brown, heavily overlain by gray pruinosity on segments 1-2, the following areas yellow in lateral view: underside and posterolateral margin of 1; lower half of 2, including auricle; large, posterior-pointing triangle at anterior edge of 3; similar but much smaller triangle on 4-6; anterior square, central blotch and posterior spot on lower edge of 7; extensive anterior and tiny posterior spots on lower half of 8; and much of lower edge of 9. In addition a dorsal yellow stripe, fairly broad on 1 and tapering to a point at rear on 2; similarly tapering on 3, almost reaching its end, and on 4-6, reaching 3/4 of length of each segment; slightly wider on 7 and reaching 3/4 length, shaped rather like an ice-cream cone; still wider on 8, much less tapered, reaching 2/3 length; and almost rectangular on 9, reaching 7/8 length.

Appendages (Figs 1b, 1c) dark brown, the superiors sharply pointed, slightly inclined upward at tip, diverging from one another, a slight angular bump on the outer edge at 2/3 length, a mesoventral ridge with minute denticles extending from a prominent angle at almost 1/2 length to another slight angle at 5/6 length. Posterior edge of inferior appendage very slightly convex (incorrectly shown as straight in Fig. 1c), its widely separated branches just outside superiors in dorsal view, diverging at the same angle. Each inferior branch in lateral view 5/6 length of superiors, slightly upcurved and with a small dorsal prickle at tip.

Genitalia of second segment as illustrated (Fig. 1d). Anterior hamules flat on outer surface and somewhat concave on inner, the tips rolled over mesad and provided with a series of short, tooth-like projections with one much larger one at anterior end of series — the typical 'thumb-and-knuckle' arrangement of

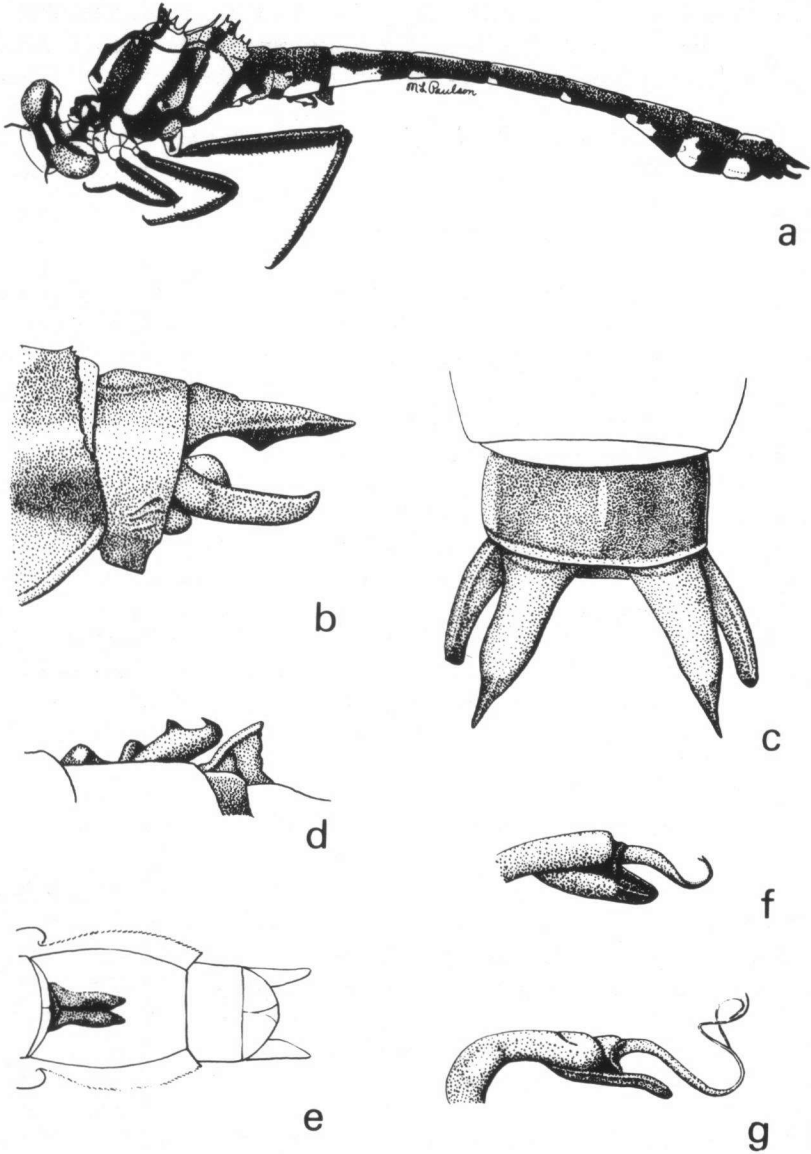


Fig. *Gomphus lynnae* sp.n.: (a) Holotype male; — (b) Lateral view of terminal appendages of holotype; — (c) Dorsal view of terminal appendages of holotype; — (d) Hamules of holotype; — (e) Vulvar lamina of female paratype; — (f) Penis of a paratype; — (g) Penis of *Gomphus extemus*.

*Gomphurus* (NEEDHAM, 1948). Posterior hamules yellowish, with shoulder, tip and posterior edge dark brown; shoulder prominent in lateral view, apex with slender points bent cephalad. Penis not extruded (described below), its peduncle of the cleft pyramidal type, dark brown overlain by gray pruinosity.

Measurements. — Total length 57 mm with appendages, abdomen 40 mm, hind wing 32 mm, hind femur 10.5 mm.

#### DESCRIPTION OF ALLOTYPE FEMALE

As male but abdomen thicker and less expanded at tip. Coloration identical to that of male except very narrow brown lines along the sutures between the frons, anteclypeus and postclypeus; yellow dorsal stripe on abdomen narrower on segments 7-9 and with yellow posterolateral spots on segments 4-6. A prominent light brown spinelike structure at each end of the transverse ridge on the vertex adjacent to the eye, one of them almost straight and the other bent over, its tip touching the base of the ridge. Vulvar lamina (Fig. 1e) half as long as the 9th segment, divided medially in its distal 1/4, the branches diverging at an angle of 30°. A prominent ventral concavity in the lamina from its middle to the branching point; in side view it descends slightly from the base, then angles straight caudad at 2/5 length, and again angles up slightly at 7/8 length.

Wings as in male except pterostigma brownish-cream both above and below; antenodal crossveins 12-12, 8-7; postnodal crossveins 9-10, 9-8; bridge crossveins 5-5, 5-5; crossveins under pterostigma 3-4, 4-4; and paranal cells 6-5, 4-4.

Measurements. — Total length 58 mm with appendages, abdomen 41 mm, hind wing 34.5 mm, hind femur 11 mm.

#### VARIATION IN TYPE SERIES (ALL KNOWN SPECIMENS)

The holotype and allotype, chosen because they were good specimens and easily drawn, are among the darkest specimens of the series. In most other individuals of both sexes there is an additional poorly defined narrow, sinuous thoracic stripe just anterior to the mesopleural suture, its upper end just contacting the lateral hook of the antehumeral yellow stripe in those in which it is most conspicuous. In a few individuals, the pale stripe between the interpleural and metapleural stripes is somewhat more conspicuous than in the holotype and allotype and is as yellow as the other stripes. In one male paratype (No. 16) the yellow dorsal and lateral areas on segment 8 are almost continuous rather than well separated as they are on all other specimens. There is otherwise very little variation in the size and shape of the yellow abdominal markings.

In most individuals of both sexes there is a fine brown line along the frontoclypeal suture, but at a glance the specimens would be characterized as having unmarked faces. The spines at either end of the vertex ridge are yellow in 4

females (lighter than in the allotype) and dark brown in the other 2 (darker than in the allotype).

The penis was extruded from 3 paratypes (Fig. 1f is paratype No. 1). In lateral view the third segment bears no terminal spines; the prepuce is rather thick and rounded, with a prominent midventral ridge, and the fourth segment is bent toward the prepuce at just under half its length and split into 2 flagella that curl ventrally at  $2/3$  the length of the segment. In ventral view the third segment is club-shaped, about twice as wide in its distal as in its proximal half.

Measurements. — Males: abdomen 39-42.5 mm ( $\bar{x}$  40.3), hind wing 32-33.5 mm ( $\bar{x}$  32.8); females: abdomen 41-42.5 mm ( $\bar{x}$  41.8), hind wing 34.5-36 mm ( $\bar{x}$  35.1).

#### COLOR IN LIFE

Color photographs in life of 3 different males show a basically black and yellow dragonfly with light grayish-blue eyes. There is no trace of brown in the dark areas, although the dried specimens are clearly brown. In a young individual, there are some traces of pruinosity on the dark parts of the vertex, thorax, femora and 2 basal abdominal segments, and in 2 mature males those areas are quite blue-gray with pruinosity, contrasting strikingly with the rest of the abdomen. The dried specimens have retained the pruinosity, but it is not as conspicuous as in the photographs.

#### COMPARISONS WITH OTHER *GOMPHURUS*

*G. lynnae* is closest to *G. externus* Hagen of any of the species of this subgenus. These 2 species are the only *Gomphurus* that have superior appendages basically straight above in lateral view, with a prominent ventral tooth near midlength. All other species of the subgenus have slightly to strongly arched superior appendages, with the ventral tooth, if present, well past midlength. The posterior hamules of the 2 species are virtually identical and in turn are much like those of several other *Gomphurus* species. Structural differences between *lynnæ* and *externus* are well marked, however: (1) branches of the inferior appendage of *lynnæ* do not diverge as much as those of *externus*, in which this attribute is extreme for the subgenus, the inferior appendage being almost twice as wide as the distance between the tips of the superiors; (2) the peduncle (basal segment of the penis) of *lynnæ* is smoothly rounded behind in ventral view, of *externus* distinctly emarginate; (3) the prepuce of the penis in *lynnæ* is rather thick, with a prominent ventral ridge (Fig. 1f), while that of *externus* is slender and slightly expanded at the tip, with a less prominent ridge (Fig. 1g); (4) the flagella on the terminal segment of the penis are much shorter in *lynnæ* than in *externus*.

Females of *lynnæ* are distinguished structurally from most other *Gomphurus* by the presence of a spine just behind each end of the transverse ridge on the

vertex. Only *externus*, *fraternus* Say and *hybridus* Williamson females otherwise bear spines in this exact place (cf. below), and from these species *lynnae* can be distinguished by color pattern in both sexes. The following discussion compares all 4 species.

(1) *lynnae* and *fraternus* have black tibiae, *hybridus* brown, and *externus* is unique in the subgenus in having a yellow stripe on the outer surface of all tibiae. (2) In *lynnae* and *hybridus* the dark middorsal thoracic stripe diverges anteriorly, while in *externus* and *fraternus* the outer edges of it are nearly parallel. (3) *lynnae* has at most a fine pale line separating the dark antehumeral and humeral stripes, while the other species have better-developed lines (*fraternus* from Kentucky and Minnesota, *hybridus*, *externus* from Ohio and Texas) or the 2 dark stripes completely separated above by a well-developed pale stripe (*fraternus* from South Dakota, *externus* from Nebraska and Utah). Two Texas females of *externus* have pale lines almost as indistinct as those of *lynnae* in which they are best developed, but there is no overlap. (4) In *lynnae* the interpleural and metapleural stripes are partially fused, as they are in Texas *externus*, whereas in *externus* from Ohio, Nebraska and Utah and in *fraternus* and *hybridus* these stripes are entirely separated by a yellow stripe. (5) *lynnae* has a prominent dark stripe at the posterior end of the metepimeron, completely lacking in the other 3 species.

*G. lynnae* averages slightly larger than the other 3 species. Male abdomen length averages 40.3 mm (range 39-42.5) versus 39.2 mm in *externus* (range 38-40, N=5), 37.3 mm in *fraternus* (range 37-38, N=4) and 37.5 mm in *hybridus* (N=1). Male hind wing length averages 32.8 mm in *lynnae* (range 32-33.5) versus 29.8 mm in *externus* (range 28-31, N=7), 29.3 mm in *fraternus* (range 28.5-30.5, N=4) and 28.5 mm in *hybridus* (N=1). The abdomen in *lynnae* is relatively shorter than in the other species, with the male abdomen/hind wing length ratio averaging 1.23 in *lynnae* (range 1.19-1.27, N=18), 1.31 in *externus* (range 1.28-1.36, N=5), 1.28 in *fraternus* (range 1.25-1.30, N=4) and 1.32 in *hybridus* (N=1). It would be of great interest to understand the adaptive significance of these differences.

Unique and almost unique attributes of *lynnae* include the following: (1) The penis is the only one in *Gomphurus* with a combination of straight fourth segment with medium-length flagella and thick, round-tipped prepuce. (2) The superior appendages are duplicated only by *externus*. (3) The virtually complete fusion of the antehumeral and humeral stripes is duplicated only by *ozarkensis*, in which they are completely fused (WESTFALL, 1975). (4) The partial fusion of the interpleural and metapleural stripes is duplicated only by *externus* from Texas and exceeded only by *ozarkensis* (WESTFALL, 1975); *ozarkensis* is thus the only *Gomphurus* to have both of these pairs of stripes completely fused. (5) *lynnae* is the only *Gomphurus* with a dark stripe on the posterior part of the metepimeron, and this characteristic alone allows easy identification of any specimen of this species. Of the large genus *Gomphus* s.l. in North America (54 species), only 4

other species possess a comparable stripe (*exilis* Selys, *lividus* Selys, *oklahomensis* Pritchard and *spicatus* Hagen, all eastern species of the subgenus *Gomphus*). (6) *lynnae* is endowed with the most conspicuous pruinosity (on head, thorax, hind femora and 2 basal abdominal segments) of any member of its subgenus and in fact of any member of its family examined by me (cf. below).

#### LARVAL MORPHOLOGY

Although no description of the larva is presented herein, I have attempted to differentiate the 7 *Gomphurus* exuviae collected in July 1971 at the type locality of *lynnae* from published descriptions of *G. externus*, the closest-occurring species and presumed closest relative of *lynnae*. The exuviae are typical *Gomphurus*, but the spines on segment 9 of the abdomen fall short of or barely reach the hind margin of segment 10 and are thus shorter than the same spines on *G. externus* and all other *Gomphurus* (NEEDHAM & WESTFALL, 1955; WALKER, 1958; WESTFALL, 1974) except the small eastern *consanguis* Selys and *rogersi* Gloyd (WESTFALL & TROGDON, 1962). The larvae of *ozarkensis*, *septima* Westfall and *ventricosus* remain undescribed, but these are likewise eastern species.

#### DISTRIBUTION

So far *lynnae* has been taken only along a very small stretch of the Yakima River, from Kiona to Richland. Richland lies at the confluence of the Yakima and Columbia Rivers, and the specimen from there could have come from either of them. Almost surely this species will be found in similar situations over a larger area, at least through eastern Oregon and southern Idaho, both of which have been very little visited by Odonata collectors. The nearest species of *Gomphurus*, *G. externus*, has been found west to a line from Winnipeg, Manitoba (WALKER, 1958), through Big Horn County, Montana (BICK & HORNUFF, 1974), to Box Elder County, Utah (MUSSER, 1962). The nearest of these is about 800 km from the known range of *lynnae*, which is thus isolated from the other members of its subgenus. It is the first known species of *Gomphurus* to be restricted to western North America and may be a relict species of a once wetter period. However, I would have predicted such a relict to inhabit a more humid forested environment, and its presence in a typical western habitat (large, slow steppe river) may indicate it is a more recent offshoot of *G. externus*, which occurs in similar habitats.

#### PHENOLOGY

Known specimen dates for *G. lynnae* span the period 2 June to 18 July; the first



record involves a mature individual which must have emerged in May. Specimens were collected at the type locality from 11-18 July in 1971 and on 5 July in 1972. I visited the type locality in July in 2 additional years, on 13 July 1973 and 21 July 1981, and was unable to find *lynnae* on either date. In 1971 *Gomphus (Stylurus) olivaceus* Selys was common at the type locality on 16-17 August, after *lynnae* had disappeared, and it was also common on the July 1973 and 1981 visits. 1971 may have been a late year in that area, and I suspect the normal flight season for *lynnae* will be June to early July in most years. *G. externus*, with its wide latitudinal range, has been found in flight from 2 April to 10 August (NEEDHAM & WESTFALL, 1955, and additional specimens I have examined). Utah records extend from 12-30 July (MUSSER, 1962, and specimens in my collection).

#### HABITAT AND BEHAVIOR

At the locality north of Benton City where most specimens were collected, the Yakima River is about 30 m wide, with a moderate current and bottom of small cobbles overlain in quieter areas by mud. Dense grasses grow from the muddy bank and in the water, and 1-2 m sagebrush (*Artemisia tridentata*) and tall clumps of ryegrass (*Elymus cinereus*) are scattered densely to thinly over the bottomland away from the river. The immediate bank supports thickets of *Clematis ligusticifolia* and *Rosa woodsii*, with scattered *Salix amygdaloides*.

*G. externus* has been recorded from rivers and canals (the latter probably muddy and slow-flowing) in Utah (MUSSER, 1962), and references to it usually involve 'larger streams' (NEEDHAM & WESTFALL, 1955), so the 2 species appear to have similar habitat preferences. *G. fraternus* breeds in a quiet river in Manitoba but in much more turbulent streams farther east (WALKER, 1958).

Individuals of both sexes of *lynnae* were found in numbers on both 12 and 17 July 1971, in shrubs or on cheat grass (*Bromus tectorum*) usually within 15 cm of the ground or on the ground between the shrubs. Most of them seemed mature, indicating emergence had occurred some time earlier, although one rather young individual was captured on 12 July. A few males flew over the river, but more of them perched on its bank, alert and with slightly elevated abdomen, and aggressively attacked other males that flew by them. No mating activity was observed except for one pair seen on 12 July. One individual captured a *Calopteryx aequabilis* Say that landed on the twig on which it was perched.

Other Odonata collected at the type locality in July or August that probably bred there included *Calopteryx aequabilis* (fairly common), *Argia emma* Kennedy (common), *Enallagma carunculatum* Morse (common), *E. cyathigerum* Charpentier (few), *Erpetogomphus compositus* Hagen (few), *Gomphus olivaceus* (common) and *Ophiogomphus occidentis* Hagen (very common).

## SPECIES STATUS

Known from such a small range, *Gomphus lynnae* should be considered a species of special concern. No other species of Odonata is restricted to Washington or even to the larger area of the Columbia River Basin. The Columbia River has been severely altered by human activities, primarily by damming it all along its length, and the same fate has befallen some of its tributaries and could befall others. Although I feel the species should not be classified as Endangered or Threatened at present, it should be considered a Species of Special Concern until it is definitely ascertained that it has a more extensive range than is now known.

SPECIES GROUPS IN *GOMPHURUS*

Females of *Gomphurus* separate into 4 distinct groups based on the vertex and structures surrounding it. (1) In *consanguis* and *rogersi* the transverse ridge on the vertex is shorter than the distance between the lateral ocelli and bent backwards at its ends, with no spines associated with it. (2) In *dilatatus*, *lineatifrons* Calvert, *modestus* Needham and *ventricosus* the ridge is longer, surpassing the interocellar distance and not bent backwards, and there are no spines. (3) In *crassus* Hagen, *ozarkensis*, *septima* and *vastus* Walsh the ridge is like that of the second group, but there is a short spine-line structure on a lower ridge between each ocellus and the adjacent compound eye, just lateral to the end of the vertex ridge. (4) In *externus*, *fraternus*, *hybridus* and *lynnae* there is a similar spine, but it is located slightly to the rear as well as lateral of the end of the vertex ridge.

Although the females of *Gomphurus* fall conveniently into these 4 groups, it is difficult to categorize groups by any other characteristics, with the exception of *consanguis* and *rogersi*, which stand well apart from the others in their small size and virtual lack of expansion of the seventh, eighth and ninth abdominal segments. They are included in this subgenus on the grounds of other characteristics, especially wing venation and the structure of the larva (WESTFALL & TROGDON, 1962). NEEDHAM (1948) placed the members of the fourth group (*externus*, *fraternus* and *hybridus*) together with *crassus* in a Fraternus Group, based on 'form of body, in certain minor features of both venation and genitalia and in depth of pigmentation in the coloration of the body' (p. 329), but *lynnae*, which is clearly related to this group, is a darker species like those in Needham's Dilatatus Group (*dilatatus*, *lineatifrons*, *modestus*, *vastus* and *ventricosus*). More recently described species such as *septima* (WESTFALL, 1956) and *ozarkensis* (WESTFALL, 1975) do not clearly fit into these groups, and anyone comparing specimens of *vastus* from central Texas with those from the Northeast (WESTFALL, 1974) would agree that 'depth of pigmentation' can hardly be used as a species-group character.

I have tabulated characteristics of structure and color pattern for all *Gomphurus* species, and at present I can see no constellation of characters that allies any species in the subgenus together with others in a larger group, except for the distinct small group containing *consanguis* and *rogersi*. Certain species clearly should be associated as species pairs, as they are quite similar and are largely or entirely allopatric: *externus* and *lynnae*, *fraternus* and *hybridus*, and *dilatatus* and *modestus*.

### PRUINOSITY IN GOMPHIDAE

Members of several families of Zygoptera exhibit pruinosity (also called pruinescence), but it is a conspicuous feature of only one anisopteran family, the Libellulidae, in which males of many species develop a partial or complete powdery bloom that obscures the underlying pattern. This bloom produces a pale blue, pink, purple, gray or white coloration, which may be very conspicuous and an obvious indicator of sexual dimorphism. In some species females as well develop the pruinosity, usually when they are relatively old; they may then look virtually like males.

Although so well developed in the Libellulidae, pruinosity does not seem to be an important aspect of the coloration of other Anisoptera, so its conspicuousness in *Gomphus lynnae* is somewhat surprising. On examination of specimens of all the species of Gomphidae in my collection (197 species of 35 genera), I found that many specimens were distinctly pruinose on the ventrolateral portion of the thorax. In one or more species of 14 genera some pruinosity was present on the vertex, upper parts of the thorax, hind femora or abdomen base as in *G. lynnae*, but in no case was it so extensive and conspicuous. Interestingly, the species closest to *lynnae* in amount of pruinosity is the closely related *G. externus*, but even in this species it is much less conspicuous. I have photographs in life of 44 species of 13 genera of Gomphidae, and none of them but *lynnae* shows substantial or conspicuous pruinosity (no photographs available of *G. externus*).

The coloration of dragonflies is subject to evolutionary modification for thermoregulatory function, for example dragonflies of cold areas tend to be dark and those of hot, open areas pale, presumably for absorbing or reflecting sunlight respectively. In a number of species there is geographical variation in the proportion of dark and light coloration, with paler individuals occurring in hotter, more open areas (WESTFALL, 1974, for *Gomphus* spp.; my observation of other Gomphidae, *Cordulegaster* and *Macromia*). The same is true concerning pruinosity, with heavier deposits of this material in southwestern desert populations (GARRISON, 1976, for *Libellula luctuosa* Burmeister; my observations of other Libellulidae), and this suggests that pruinosity functions to reflect sunlight, as would be expected.

*Gomphus lynnae* is a dark species, its coloration more typical of gomphids

from the eastern forests than of other species of the arid West, and I speculate that the well-developed pruinosity is an adaptation for reflecting sunlight in the very hot environment the adults inhabit (midday summer temperatures regularly exceed 37°C). This is supported by the lack of pruinosity on the abdomen, which is easily moved to a position effective in either gaining or losing heat; this important difference between thorax and abdomen was mentioned by MAY (1978). The other gomphids sharing the Columbia Basin in June, July and August (*Gomphus olivaceus*, *Erpetogomphus compositus*, *Ophiogomphus occidentis* and *O. severus* Hagen) are considerably paler and show no indication of pruinosity, and it would be of interest to determine why *G. lynnae* has not followed the more common evolutionary route taken by its family to thermoregulatory success in an arid environment.

#### ACKNOWLEDGMENTS

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