
***Artinska ovata* (Sellards) 1909 and *Paraprisca fragilis* (Sellards) 1909 (Insecta: Polyneoptera: Lemmatophoridae) newly reported from the Lower Permian of Noble County, Oklahoma, with notes on Wellington Formation Lemmatophoridae**

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The extinct polyneopterous family Lemmatophoridae Sellards, 1909 includes eight species found in the Wellington Formation of Kansas. Tasch and Zimmerman (1962) had previously reported the presence of *Lemmatophora typa* Sellards, 1909, *Artinska clara* Sellards, 1909, and *Lisca minuta* Sellards, 1909, from the Oklahoma Wellington Formation. One specimen each of the species *Artinska ovata* (Sellards, 1909) and *Paraprisca fragilis* (Sellards, 1909) have been found in the Wellington Formation deposits of Noble County Oklahoma, bringing to five the number of known species of lemmatophorids common to the Oklahoma and Kansas Permian deposits.

Keywords: fossil insects, Lemmatophoridae, Oklahoma, Noble County, Polyneoptera

INTRODUCTION

The Lower Permian entomofauna of the Kansas and Oklahoma Permian Wellington Formation consists of some 200 species, with Polyneoptera comprising a large portion (47%) of the total (Beckemeyer and Hall, 2007). The polyneopterous family Lemmatophoridae is represented in the Wellington Formation by only 8 species, but they are abundantly represented, with 4 species from this family among the six species of insects represented by 100 or more specimens in the extensive Harvard Museum of Comparative Zoology (MCZ) and Yale Peabody Museum (YPM) collections from the Elmo, Kansas deposits (Beckemeyer and Hall, 2007). Tasch and Zimmerman (1962) listed three species of Lemmatophoridae from Oklahoma; they were the same species that were most abundantly represented in Kansas (Appendix 1): *Lemmatophora typa*, *Artinsk clara*, and *Lisca minuta* (all authored by Sellards, 1909). Tasch and Zimmerman noted that *Lisca minuta* was the only lemmatophorid that was at all

abundant in the Oklahoma deposits. In several years of sporadic collecting, the author and Joseph Hall of Tulsa, Oklahoma, have collected these same species of Lemmatophoridae, together with specimens of the species *Artinska ovata* and *Paraprisca fragilis* bringing the Oklahoma Wellington Formation count up to five species.

It should be noted that, of the extensive Oklahoma Wellington Formation collections of Carpenter and Raasch, housed at the MCZ, only the Palaeoptera had been surveyed in the literature (Raasch, 1946; Carpenter, 1947, 1979). In addition to Tasch and Zimmerman (1962), Béthoux and Beckemeyer (2007) have also reported on Kansas and Oklahoma Wellington Formation Neoptera. This latter survey, however, covered only new and rare Oklahoma orthopterous and “protorthopterous” Polyneoptera; although specific specimens from the MCZ, Peabody and KU collections were included, the study was not a comprehensive survey of the collections.

The Lemmatophoridae have been treated by various authors as either a stem group of the Plecoptera (Grimaldi and Engel, 2005; Arillo and Engel, 2006), a family within the “Protorthoptera” of Carpenter (1992) or the “Gryllobattida” of Storozhenko, 1997, 1998, and Rasnitsyn and Quick, 2001. Since both the latter two groups are polyphyletic, I have chosen here to specifically follow the higher order classification of the Polyneoptera put forward by Grimaldi and Engel (2005) and Arillo and Engel (2006).

SPECIES OF LEMMATOPHORIDAE NEWLY REPORTED FROM THE OKLAHOMA WELLINGTON FORMATION

Systematic Paleontology

POLYNEOPTERA Martynov, 1925

Order Incertae sedis

(primitive stem group allied to Plecoptera)

Family Lemmatophoridae Sellards, 1909

Subfamily Lemmatophorinae Carpenter, 1935

Artinska Sellards, 1909

A. ovata (Sellards, 1909)

(Figure 1a,b,c)

Diagnosis – Venational nomenclature as indicated in Figure 1c. Ratio of wing length to width less than 3 (wing length 5.9 mm; wing width 2.1 mm; ratio of length to width 2.81); RP forked; ScP terminating beyond midwing; wing length less than 8.5 mm.

Description - Complete wing with extreme basal portion obscured; all longitudinal veins except A2 clearly visible; some cross veins poorly preserved; ScP terminates on costal margin well beyond midwing (3.9 mm or 2/3 of length); RP and MA well separated; R forks 1.7 mm from wing base; M forks 1.9 mm from wing base; RP forks 4.2 mm from wing base; MP forks 5.4 mm from wing base; CuA and M coalesce 0.9 mm from wing base; CuA separates from M 1.2 mm from wing base; A2 nearly completely obscured.

Material – Specimen KU-R4-09-20-03-xa,b comprises the first specimen of *Artinska ovata* (Sellards) 1909 to be documented from the Oklahoma Wellington Formation deposits. **Part** (-xb, Figure 1a): complete forewing in dorsal aspect less the extreme base of wing. **Counterpart** (-xa, Figure 1b), wing in ventral aspect. Collected 20 September, 2003 by Joseph Hall and Michael Montgomery and donated to the author for deposition in the KUNHM Entomology Division fossil insect collection.

Locality – Oklahoma: Noble County: Raasch 4 locality (Raasch 1946); Lower Permian: Wellington Formation: Artinskian.

Discussion – In addition to the three species of *Artinska* from the North American Wellington Formation (*Artinska clara* Sellards, 1909, *Artinska ovata* (Sellards, 1909) and *Artinska sellardsi* Tillyard, 1928), there are two species from Tshekarda (*Artinska larissae* Novokshonov, 1999 and *Artinska infigurabilis* Aristov, 2004), and one from the Pechora Basin (*Artinska vortukensis* Aristov in Rasnitsyn et al., 2005) of European Russia.

Subfamily Parapriscinae Carpenter, 1935

Paraprisca Handlirsch, 1919

P. fragilis (Sellards, 1909)

(Figures 2a,b,c)

Diagnosis – Venational notation as in Figure 2c. Fore wing length much more than 3 times greater than width (3.5 for this specimen), RA straight, ScP parallel to RA; CuA entirely free from M.

Description – Nearly complete part and counterpart of forewing (Figure 2a, b) with small portion of wing basal to A2 missing; distal cross veins weak and poorly preserved; wing length 8.7 mm, width 2.5 mm; RP arises 3.4 mm from wing base, MA 2.8 mm from wing base, RP coalesces with MA 3.9 mm from wing base, departs 4.2 mm from wing base; MP forks at 4.9 mm from wing base,

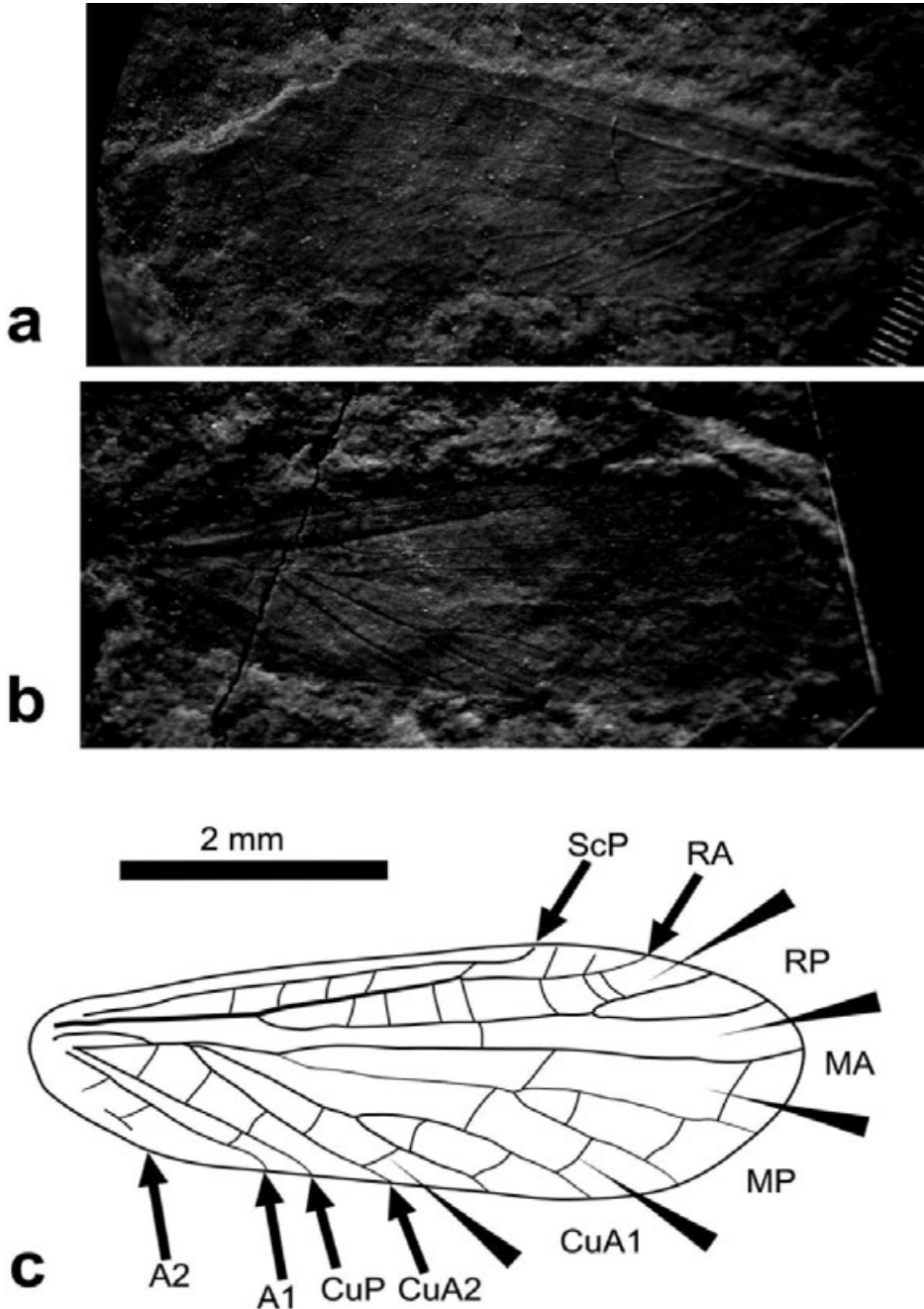


Figure 1. *Artinska ovata* (Sellards, 1909) from Noble County, Oklahoma. Specimen KU-R4-09-20-03-x. a) Part – dorsal aspect. b) Counterpart – ventral aspect. Scale divisions 0.1 mm for both photographs. c) Reconstruction of wing venation. Scale bar 2 mm. ScP = Posterior subcostal vein; RA = Anterior radial vein; RP = posterior radial vein; MA = anterior medial vein; MP = posterior medial vein; CuA1 – Anterior branch of anterior cubital vein; CuA2 = posterior branch of anterior cubital vein; CuP - posterior cubital vein; A1 = anterior anal vein; A2 = posterior anal vein.

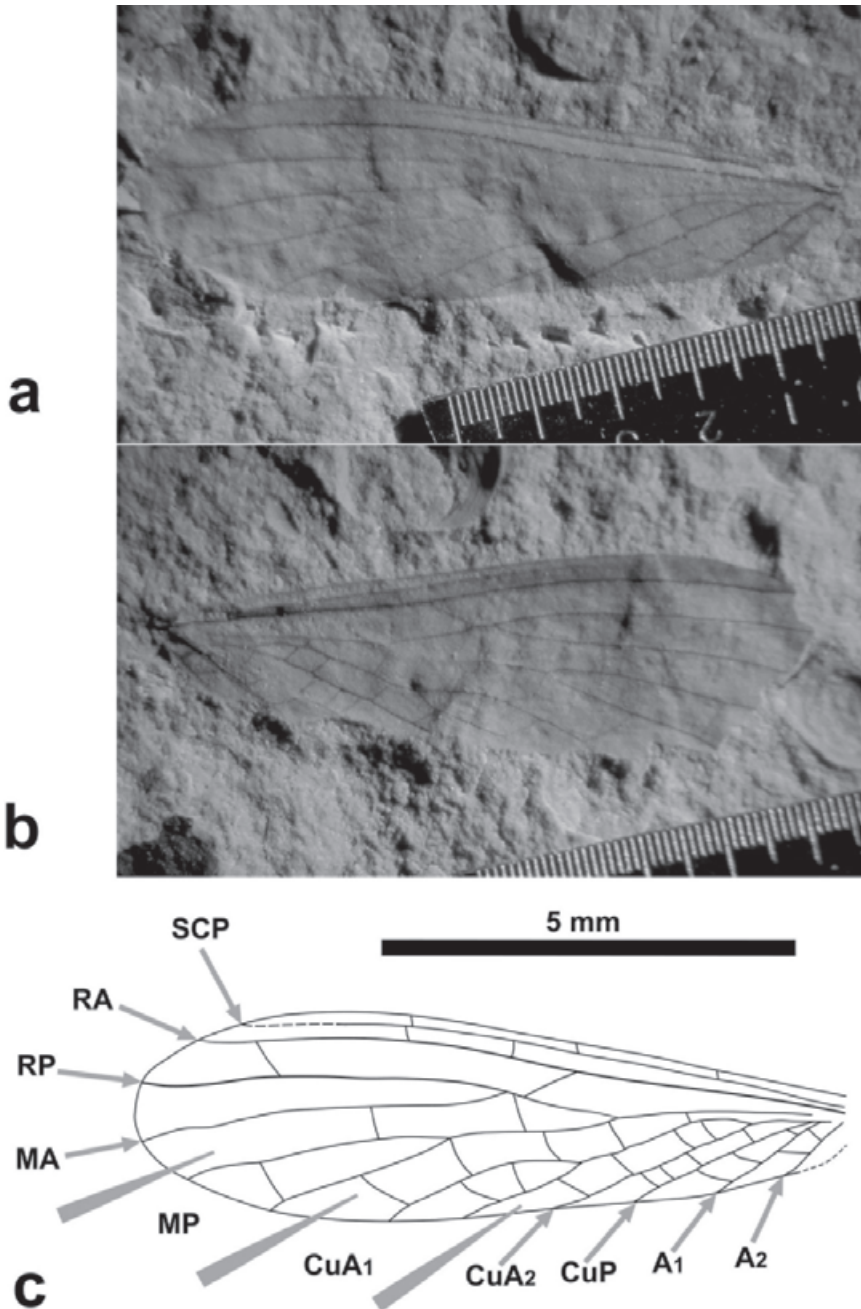


Figure 2. *Paraprisca fragilis* (Sellards, 1909) from Noble County, Oklahoma. Specimen KU-B3-9-11-04-001. a) Part – dorsal aspect. b) Counterpart – ventral aspect. Scale divisions 0.1 mm for both photographs. c) Reconstruction of wing venation. Scale bar 5 mm. ScP = Posterior subcostal vein; RA = Anterior radial vein; RP = posterior radial vein; MA = anterior medial vein; MP = posterior medial vein; CuA1 – Anterior branch of anterior cubital vein; CuA2 = posterior branch of anterior cubital vein; CuP = posterior cubital vein; A1 = anterior anal vein; A2 = posterior anal vein.

CuA1 forks 3.3 mm from wing base, CuA2 departs from CuA1 1.2 mm from wing base;

Material – Specimen KU-B3-9-11-04-001a, b, c, comprises the first specimen of *Paraprisca fragilis* documented from the Oklahoma Wellington Formation deposits. Part (-001b): Nearly complete *Paraprisca fragilis* forewing in dorsal aspect (Figure 2a) (1.6 mm to left of the *P. fragilis* wing on this fragment is the distal 60% of a hind wing of *Palaeomantis minutum* (Sellards, 1909) (Insecta: Miomoptera). The fossil is not pictured here, but is noted because Tasch and Zimmerman (1962) mentioned that *Delopteryx* (now synonymized with *Palaeomantis*) was one of the most abundant insect genera in the Oklahoma deposits.) Counterpart (001a): Nearly complete *Paraprisca fragilis* forewing in ventral aspect, posterior wing margin and distal margin missing (Figure 2b). The *Palaeomantis minutum* hind wing impression on the counterpart is nearly complete from base to tip and is in dorsal aspect. In addition to the insect wings on these two rock fragments, there are numerous impressions of conchostracan valves. A third fragment, 001c, contains the impression of a fragment of an unidentified wing, possibly odonatoid; the reverse of this fragment is missing from 001a. Specimen collected by Joseph Hall of Tulsa, Oklahoma on 11 September, 2004 and donated to the author for deposition in the Kansas University Natural History Museum Entomology Division (Paleoentomology) fossil insect collection.

Locality – United States: Oklahoma: Noble County: Billings 3 locality; Lower Permian: Wellington Formation: Artinskian.

Discussion - There are two species of the genus *Paraprisca* known from each of two regions: the Wellington Formation of Kansas and Oklahoma and Tshekarda, in the Russian Urals. Both *P. fragilis* and *P. grandis* Carpenter, 1935 were described from the Wellington Formation at Elmo, Kansas. The two species from Tshekarda are *P. causeria* Novokshonov,

2000, and *P. uralica* Zalessky, 1952. Aristov (2004) lists *P. fragilis* from Tshekarda, citing Novokshonov (2000), but this is in error (Aristov, personal communication, 2009).

NOTES ON OTHER OKLAHOMA LEMMATOPHORIDAE

As noted previously, Tasch and Zimmerman (1962) reported the presence of *Lemmatophora tyla*, *Lisca minuta*, and *Artinska clara* in the Oklahoma Wellington Formation. As the current location of Tasch's specimens is uncertain, I have figured and briefly described at least one specimen of each of these species from material that Joseph Hall and I have collected and placed in the KUNHM Entomology Division fossil insect collection. Of the lemmatophorids present in the Oklahoma Wellington, *Lisca minuta* seems to be the most abundant, but nowhere in Oklahoma do any of the lemmatophorids appear to be at all common.

Lemmatophorinae Carpenter, 1935
Artinska Sellards, 1909
A. clara Sellards, 1909
 (Figure 3a,b,c)

Diagnosis – Venation as indicated in Figure 3c. Ratio of wing length to width less than three (estimated wing length 11.8 mm; estimated wing width 4.1 mm; ratio length to width 2.88). ScP parallels anterior margin, then distally bends more or less sharply away from costal margin before eventually intersecting it; RP forked; RA straight at separation of RP; RP separates from RA proximal to mid length of the wing (4.6 mm from base); CuA curves sharply towards M.

Material – Specimen KU-B3-09-18-04-002a, b. Nearly complete wing lacking anal region and basal 1/3 of posterior wing margin. a) Part (-002a, Figure 3a): Wing in dorsal aspect. b) Counterpart (-002b, Figure 3b): Wing in ventral aspect. Collected 18 September, 2004

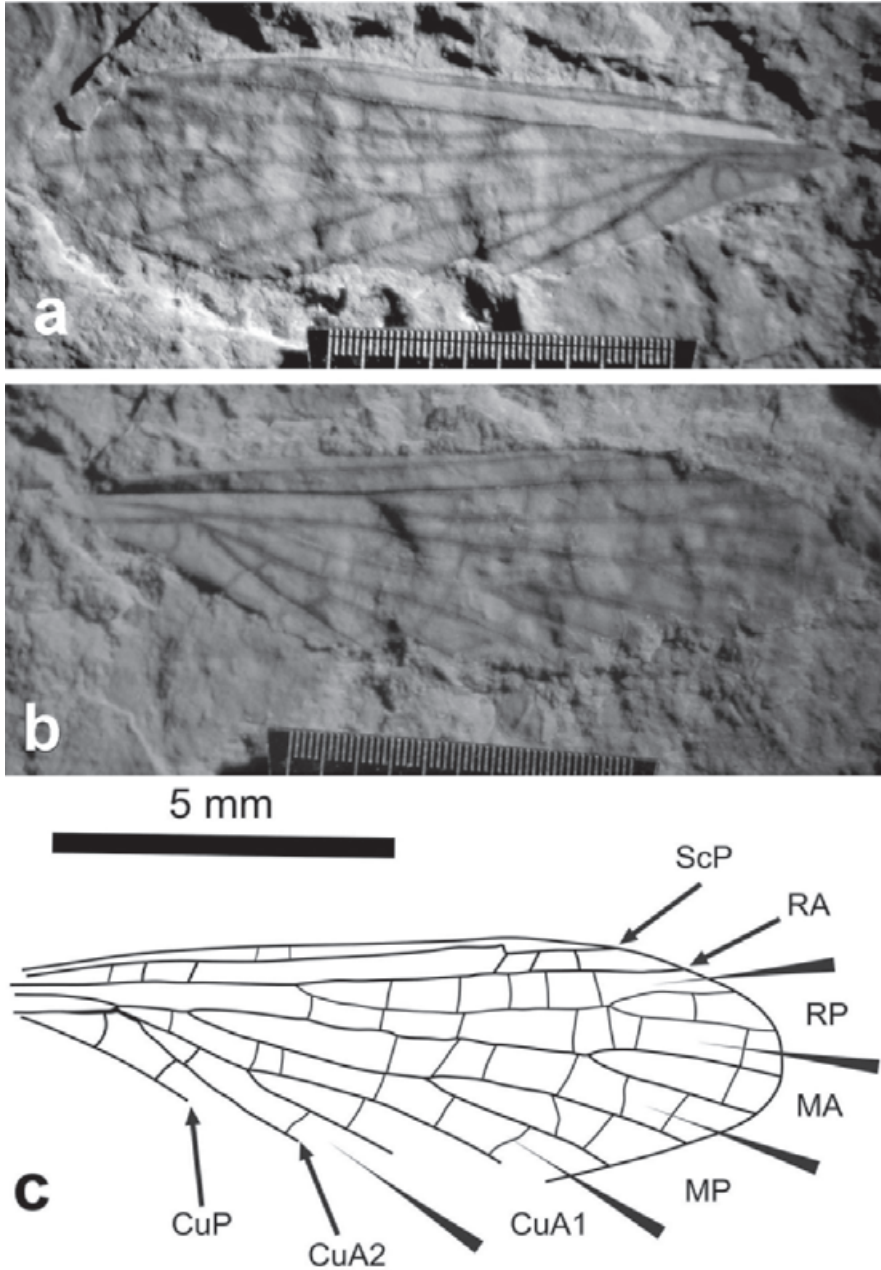


Figure 3. *Artinska clara* Sellards, 1909 from Noble County, Oklahoma. Specimen KU-B3-09-18-04-002. a) Part – Complete forewing less anal region in dorsal aspect. b) Counterpart – complete wing less anal region in ventral aspect. . Scale divisions 0.1 mm for both photographs. c) Reconstruction of wing venation. Scale bar 5 mm. ScP = Posterior subcostal vein; RA = Anterior radial vein; RP = posterior radial vein; MA = anterior medial vein; MP = posterior medial vein; CuA1 – Anterior branch of anterior cubital vein; CuA2 = posterior branch of anterior cubital vein; CuP = posterior cubital vein.

by Joseph Hall and donated for deposition in the KUNHM fossil insect collection.

Locality – United States: Oklahoma: Noble County: Billings 3 locality; Lower Permian: Wellington Formation: Artinskian.

Lemmatophora Sellards, 1909
L. typha Sellards, 1909
 (Figures 4a,b,c)

Diagnosis – See Figure 4c for venation nomenclature. Ratio of wing length to width less than or equal to three (estimated ratio of wing length to width: 3.0 (Estimated wing length 7.5 mm; estimated wing width 2.5 mm); RA has upward bend at separation of RP; ScP remote from costal margin at base of wing; anal veins divergent, connected by two cross veins, basal anal vein sigmoidal.

Discussion – Specimen comprised of basal 2/3 of forewing of *L. typha*. The dark markings on the wing are characteristic color patterns for the species that are sometimes preserved on these compression fossils. A portion of the posterior margin of the wing is obscured by a conchostracan.

Material – Specimen KU-B3-03-20-04-001a,b. a) (Figure 4a) Part in dorsal aspect. b) Counterpart in ventral aspect (Figure 3b). Collected 20 March, 2004 by Roy J. Beckemeyer and Joseph Hall. Placed in the KUNHM Entomology Division fossil insect collection.

Locality – United States: Oklahoma: Noble County: Billings 3 locality; Lower Permian: Wellington Formation: Artinskian.

Lisca Sellards, 1909
L. minuta Sellards, 1909
 (Figure 5a,b,c)

Diagnosis – Venation as indicated in Figure 5c. Ratio of wing length to width less than three (Estimated wing length 6.5 mm; wing width 2.2 mm; ratio length to width 2.95); RP

single; RP separates from RA 2.2 mm from wing base (well proximad to mid wing which is 3.25 mm); RA curves sharply toward costal margin at distal end.

Discussion – This is a nearly complete wing (lacking only the anal region). In this specimen, CuA coalesces with M 0.9 mm from the wing base and remains fused for 0.3 mm before separating. Carpenter (1935) noted that CuA and M and/or RP and MA may be free or alternately fused to varying degrees in the Lemmatophoridae.

Material – Specimen KU-R4-08-27-03-002a,b. a) Part (-002a, Figure 5a) – a fragment comprising approximately the distal third of the wing in dorsal aspect; b) Counterpart (-002b, Figure 5b) – nearly the entire wing (anal region missing) in ventral aspect. Collected 27 August, 2003, by Joseph Hall and donated for deposition in the KUNHM fossil insect collection.

Locality – United States: Oklahoma: Noble County: Raasch 4 locality (Raasch 1946); Lower Permian: Wellington Formation: Artinskian.

Discussion – Both Tillyard (1928a, b) and Carpenter (1935) have noted the variability of venation in the Lemmatophoridae. In addition to the varying degree of coalescence of CuA and M or of RP and MA, different longitudinal veins can have varying numbers of branches. As an example, Figure 6 illustrates a second specimen of *L. minuta* from the Billings 3 locality (specimen KU-B3-09-18-04-001a, b, collected by Joseph Hall from the Billings 3 locality on 18 September, 2004. The part (-001a, not pictured) is a fragment comprised of portions of the forewings and one hind wing. The counterpart (-002b, Fig. 6a) is comprised of the impression of both forewings, still articulated with the mesothorax). The wing membrane is lightly coriaceous, and most of the cross veins are indistinct, but the longitudinal veins are well-preserved. Figure

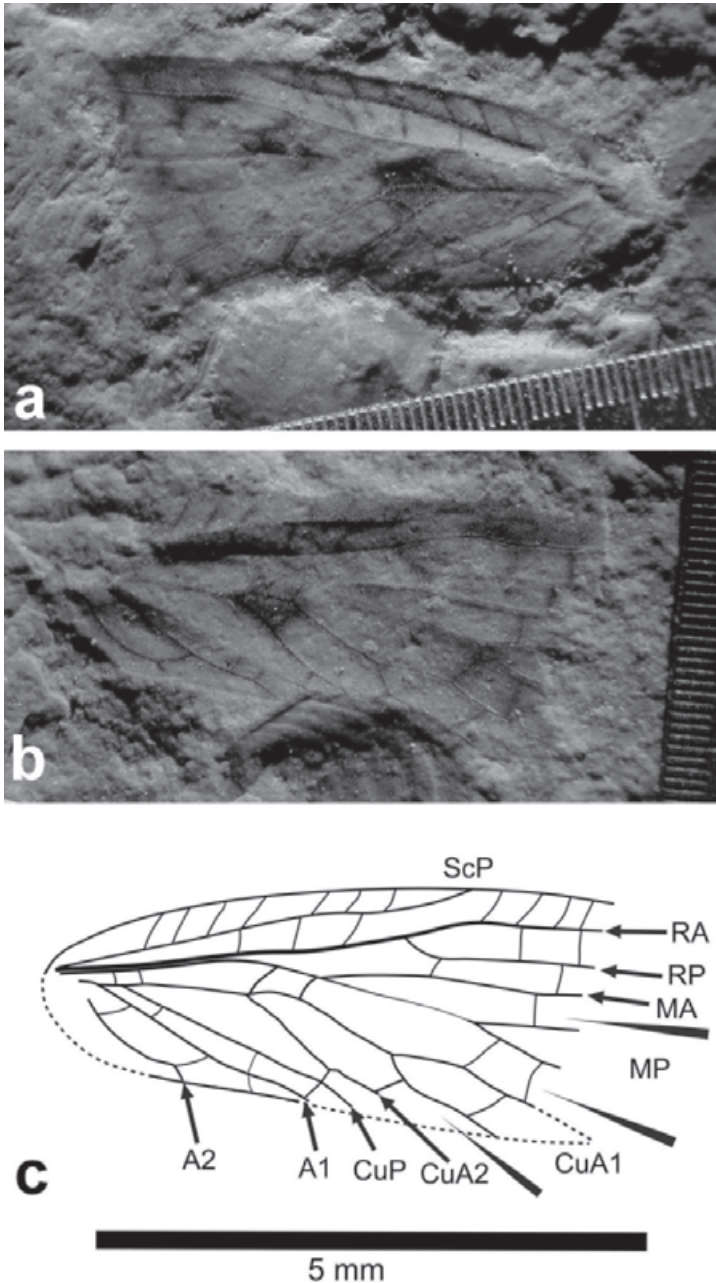


Figure 4. *Lemmatophora typa* Sellards, 1909 from Noble County, Oklahoma. Specimen KU- B3-03-20-04-001. a) Part – basal 2/3 of forewing in dorsal aspect. b) Counterpart – basal 1/2 of forewing in ventral aspect. . Scale divisions 0.1 mm for both photographs. c) Reconstruction of wing venation. Scale bar 5 mm. ScP = Posterior subcostal vein; RA = Anterior radial vein; RP = posterior radial vein; MA = anterior medial vein; MP = posterior medial vein; CuA1 – Anterior branch of anterior cubital vein; CuA2 = posterior branch of anterior cubital vein; CuP = posterior cubital vein; A1 = anterior anal vein; A2 = posterior anal vein.

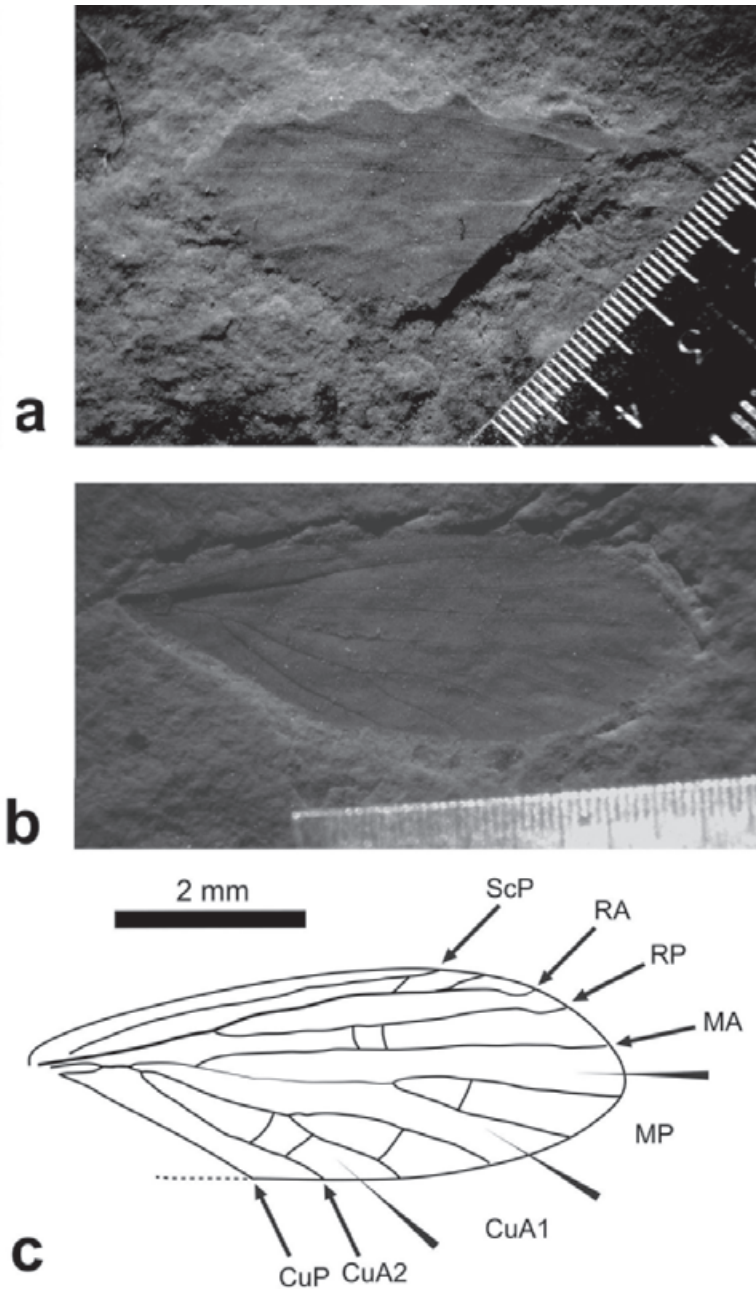


Figure 5. *Lisca minuta* Sellards, 1909 from Noble County, Oklahoma. Specimen KU-R4-08-27-03-002. a) Part – distal 1/3 of forewing in dorsal aspect. b) Counterpart – complete wing less anal region in ventral aspect. . Scale divisions 0.1 mm for both photographs. c) Reconstruction of wing venation. Scale bar 2 mm. ScP = Posterior subcostal vein; RA = Anterior radial vein; RP = posterior radial vein; MA = anterior medial vein; MP = posterior medial vein; CuA1 – Anterior branch of anterior cubital vein; CuA2 = posterior branch of anterior cubital vein; CuP = posterior cubital vein.

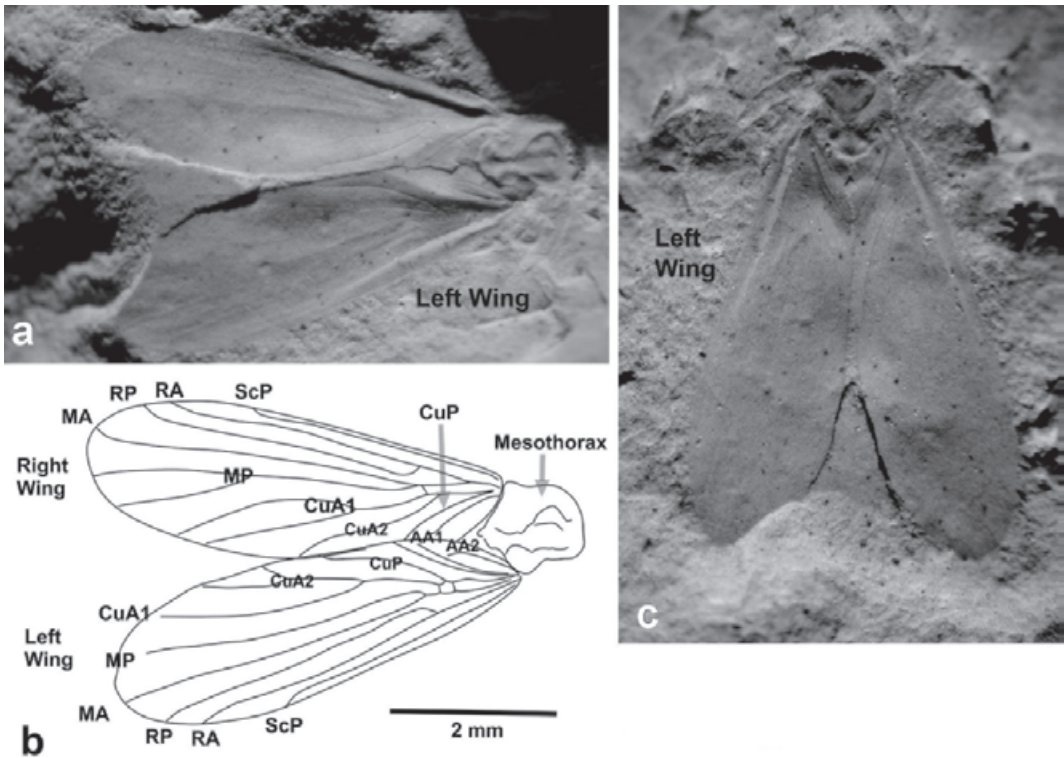


Figure 6. *Lisca minuta* Sellards, 1909 from Noble County, Oklahoma. Specimen KU-B3-09-18-04-001. a) Counterpart – Impression of dorsal surface of left and right forewings articulated with mesothorax. b) Reconstruction of wing venation. Scale bar 2 mm. ScP = Posterior subcostal vein; RA = Anterior radial vein; RP = posterior radial vein; MA = anterior medial vein; MP = posterior medial vein; CuA1 – Anterior branch of anterior cubital vein; CuA2 = posterior branch of anterior cubital vein; CuP - posterior cubital vein. c) Light-inverted and digitally-mirrored image of Counterpart showing appearance of wings and mesothorax in dorsal aspect.

6b shows a reconstruction drawing of the fossil; the right forewing has the same longitudinal vein branching as Specimen KU-R4-08-27-03-002a,b (Figure 5), without fusion of any of the longitudinal veins. The left wing also lacks fusion, but differs in the branching of CuA and MP; CuA1 is simple rather than branched, but CuA2 is distally forked rather than simple, and MP is simple rather than branched. Figure 6c is the Counterpart light-inverted and mirror-imaged to illustrate the wings and mesothorax as they would have appeared in dorsal aspect.

CONCLUSION

With the addition of *Paraprisca fragilis*, and *Artinska ovata*, five of the eight Wellington Formation Lemmatophoridae species have been documented to occur in both Kansas and Oklahoma. There are three additional lemmatophorid species found to date only in the Elmo, Kansas beds (Appendix 1). The lemmatophorids are among the most common taxa to be found at Elmo; conversely, with the exception of *Lisca minuta*, they are relatively infrequent in the Oklahoma Wellington Formation deposits. Tillyard (1928a, b) and Carpenter (1935) have discussed the variability

of venation in the Lemmatophoridae, and their work should be consulted when identifying these taxa.

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LITERATURE CITED

- Arillo, A. and Engel, M.S. 2006. Rock crawlers in Baltic amber. *American Museum Novitates*. No. 3539, American Museum of Natural History, New York, 10 pp.
- Aristov, D.S. 2004. The fauna of grylloblattid insects (Grylloblattida) of the Lower Permian locality of Tshkarda. *Paleontological Journal* 38 (Suppl. 2):S80-S145.
- Beckemeyer, R.J. 2000. The Permian Insect Fossils of Elmo, Kansas. *The Kansas School Naturalist* 46(1):1-16.
- Beckemeyer, R.J. and Hall, J.D. 2007. The entomofauna of the Lower Permian fossil insect beds of Kansas and Oklahoma, U.S.A. *African Invertebrates* 48(1):23-39.
- Béthoux, O. and R.J. Beckemeyer. 2007. New and rare species from the Wellington Formation (Orthoptera, Grylloblattodea; Lower Permian, USA). *Alavesia* 1:49-61.
- Boudreaux, H.B. 1979. *Arthropod Phylogeny: With special reference to insects*. John Wiley & Sons; New York. viii + 32 pp.
- Carpenter, F.M. 1935. The Lower Permian insects of Kansas. Part 7. The order Protoperlaria. *Proceedings of the American Academy of Arts and Science* 70:103-146 + plates 1-2.
- Carpenter, F.M. 1947. The Lower Permian insects from Oklahoma. Part 1. Introduction and the orders Megasecoptera, Protodonata, and Odonata. *Proceedings of the American Academy of Arts and Science* 76:24-54.
- Carpenter, F.M. 1979. The Lower Permian insects from Oklahoma. Part 2. Orders Ephemeroptera and Palaeodictyoptera. *Psyche* 86:261-290.
- Carpenter, F.M. 1992. Superclass Hexapoda. pp. xxi + 1-277 in Kaesler, R. L. (ed.), *Treatise on Invertebrate Paleontology. Part R. Arthropoda 4. Vol. 3*. The Geological Society of America and The University of Kansas; Boulder - Lawrence.
- Grimaldi, D. and Engel, M.S. 2005. *Evolution of the Insects*. Cambridge University Press, New York. xv + 755 pp.
- Handlirsch, A. 1919. Revision der palaeozoischen Insekten. *Denkschriften der Kaiserlichen Akademie der Wissenschaften. Wien, mathematisch-naturwissenschaftliche Klasse* 96:511-592.
- Martynov A.V. 1925. To the knowledge of fossil insects from Jurassic beds in Turkestan. *Bulletin de l'Academie des sciences de l'URSS* 19:233-246, 569-598, 753-762.
- Novokshonov, V.G. 1999. A new grylloblattid from the Lower Permian of Ural (Insecta: Grylloblattida: Lemmatophoridae). *Neues Jahrbuch für Geologie und Palaeontologie Monatshefte*. 1999(11):641-646.
- Novokshonov, V.G. 2000. New Fossil Insects (Insecta) from Kungurian Deposits of the Central Urals. *Paleontological Journal* 5:42-47.

- Raasch, G.O. 1946. The Wellington Formation in Oklahoma. PhD Thesis. University of Wisconsin. Madison, Wisconsin i + 157 pp.
- Rasnitsyn, A.P. and Quicke, D.L.J. (eds.). 2002. History of Insects, Kluwer Academic Publishers, Dordrecht, The Netherlands. xii + 517 pp.
- Rasnitsyn, A.P., Sukacheva, I.D. and Aristov, D.S.. 2005. Permian insects of the Vorkuta Group of the Pechora Basin and their stratigraphic implications. *Paleontological Journal* 39(4):404-416.
- Sellards, E.H. 1909. Types of Permian insects. Part III. Megasecoptera, Orycroblatinidae and Protorthoptera. *American Journal of Science* (ser. 4) 27:151-173.
- Storozhenko, S. Yu. 1997. Classification of order Grylloblattida (Insecta), with description of new taxa. *Far Eastern Entomologist* 42:1-20.
- Storozhenko, S. Yu. 1998. Sistematika, filogenia i evolyutsiya grilloblatidovskh nasekomykh (Insecta: Grylloblattida). [Systematics, phylogeny and evolution of Grylloblattid insects.] *Dal'nauka*; Vladivostok. 207 pp.
- Tasch, P. and Zimmerman, J.R. 1962. The *Asthenohymen-Delopterum* Bed—a new Leonardian insect horizon in the Wellington of Kansas and Oklahoma. *Journal of Paleontology* 36:1319-1333.
- Tillyard, R.J. 1928a. Kansas Permian Insects. Part 10. The new Order Protoperlaria: A study of the typical genus *Lemmatophora* Sellards *American Journal of Science* (ser. 5) 16:185-220.
- Tillyard, R.J. 1928b. Kansas Permian Insects. Part 11. Order Protoperlaria: Family Lemmatophoridae (continued). *American Journal of Science* (ser. 5) 16:185-220.
- Zalessky, G.M. 1952. O predvesnyankakh iz permskikh otlozhenij Urala [Protoperlaria from the Permian of the Urals]. *Doklady akademii nauk SSSR* 82:985-988.

Appendix 1. Species of Wellington Formation Lemmatophoridae, Specimen abundance in the Elmo, Kansas deposits, and Species presence in the Oklahoma deposits.

Taxon	Specimen Abundance at Elmo, Kansas	Species presence in Oklahoma
Lemmatophoridae Sellards, 1909		
Lemmatophorinae Carpenter, 1935		
<i>Artinska</i> Sellards, 1909		
<i>clara</i> Sellards, 1909	388 ¹	Yes ^{2,3}
<i>ovata</i> (Sellards, 1909)	127 ¹	Yes ³
<i>sellardsi</i> Tillyard, 1928	2 ¹	No
<i>Lemmatophora</i> Sellards, 1909		
<i>typa</i> Sellards, 1909	392 ¹	Yes ^{2,3}
<i>Lisca</i> Sellards, 1909		
<i>minuta</i> Sellards, 1909	256 ¹	Yes ^{2,3}
Parapriscinae Carpenter, 1935		
<i>Lecorium</i> Sellards, 1909		
<i>elongatum</i> Sellards, 1909	66 ¹	No
<i>Paraprisca</i> Handlirsch, 1919		
<i>fragilis</i> (Sellards, 1909)	64 ¹	Yes ³
<i>grandis</i> Carpenter, 1935	6 ¹	No

1. Specimen abundance tabulated by Beckemeyer and Hall (2007) from the publications of Tillyard (1928a,b) and Carpenter (1935) on the Kansas Lemmatophoridae.

2. Reported by Tasch and Zimmerman (1962).

3. This paper. Specimens deposited in the fossil insect collection of the Entomology Division, University of Kansas Natural History Museum.