



# The *Tamarix* feeding Leafhopper genus *Opsius* Fieber, 1866 (Hemiptera, Cicadellidae, Deltocephalinae, Opsiini) in the Kingdom of Saudi Arabia, with description of a new species

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<http://zoobank.org/DEEE35C5-0597-4778-840E-D3D9DA1F996E>

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Academic editor: D. Zimmermann ♦ Received 17 September 2019 ♦ Accepted 19 December 2019 ♦ Published 14 January 2020

## Abstract

The leafhopper genus *Opsius* Fieber, 1866 is revised for the Kingdom of Saudi Arabia. Seven species are treated, including three that previously were reported by Dlabola (1979), *O. pallasi* (Lethierry, 1874), *O. tigripes* (Lethierry, 1876), and *O. versicolor* (Distant, 1908). *Opsius heydeni* (Lethierry, 1876), *O. richteri* Dlabola 1960, and *O. scutellaris* (Lethierry, 1874) are reported for the first time from the Kingdom. A new species, *O. wilsoni* El-Sonbati, **sp. nov.** is described from the southwestern region of the Kingdom of Saudi Arabia. A key to the species of *Opsius* of the Kingdom is also provided.

## Key Words

Auchenorrhyncha, Cicadellidae, Deltocephalinae, distribution, Hemiptera, leafhopper, Opsiini

## Introduction

The Cicadellidae is the largest family of the suborder Auchenorrhyncha, and the Deltocephalinae is the largest leafhopper subfamily with more than 6,700 valid species (Zahniser and Dietrich 2013). The tribe Opsiini is divided into four subtribes including more than 300 species. Recently, the subtribe Opsiina has had additional genera (El-Sonbati et al. 2016, 2017) and species (El-Sonbati et al. 2015, 2018, 2019) added, doubling the known genera from the Arabian Peninsula.

The genus *Opsius* Fieber, 1866 (Opsiini; type species *Opsius stactogalus* Fieber, 1866) includes at least 20 valid species distributed worldwide. This study records seven species of *Opsius* from the Kingdom of Saudi Arabia (KSA), including three previously reported by Dlabola (1979, 1980). Three additional species are reported herein for the first time from KSA and a new species is also proposed from the southwestern region

of the country. This region has strong Afrotropical affinities (von Kéler 1955).

Among the 20 species of *Opsius*, 17 have been recorded from the Palaearctic Region, with only three shared with other regions, *O. stactogalus* Fieber, 1866, *O. versicolor* (Distant, 1908) and *O. cypriacus* Lindberg, 1958. Only *O. stactogalus* is considered cosmopolitan (Zahniser 2019). *Opsius* species are apparently restricted to moist habitats with *Tamarix* spp. (Tamaricaceae), and especially river valleys. *Tamarix* spp. are known to be salt tolerant (Newete et al. 2019) and are difficult to identify with many species known. KSA is the center of diversity of the *T. nilotica* (Ehrenb.) Bunge group and *T. aphylla* (L. Karst) (Guba and Glennie 1998). Due to their feeding activity, *Opsius* leafhoppers are well-known honeydew producers on *Tamarix* spp. (Wiesenborn 2004; Virla et al. 2010; Siemion and Stevens 2015).

The purpose of this study is to clarify the taxonomy of *Opsius* species of KSA. The morphological characters and global distributions of each species occurring in KSA are presented.

## Material and methods

The holotype and paratypes of the new species are deposited in King Saud University Museum of Arthropods (KSMA), College of Food and Agriculture Sciences, King Saud University, Riyadh, KSA and in the National Museum of Wales, Cardiff (NMWC). Other specimens examined are deposited in KSMA.

The morphological terminology follows Dietrich (2005). Measurements are given in millimeters (mm) and are the mean value of 20 specimens of each species; if

fewer than 20 specimens were available, all were measured. Genitalia preparations were made by soaking the terminalia in hot 10% KOH solution for 8–10 minutes, and then washed in distilled water. The cleared terminalia were transferred to glycerol for further dissection and examination. After examination, genitalia were moved to fresh glycerol and stored in a micro vial pinned below each specimen.

All specimens were examined with a Leica LABOPHOT-2 stereomicroscope. Illustrations of the male genitalia were prepared using a NIKON microscope with a drawing tube attachment. Images were taken with a Canon 70D DSLR attached to a Leica Z6 microscope. Individual source images were then stacked using Helicon Focus v. 6.22 software, with calibrated scale bars added using Syncrosopy Automontage v. 5.4. The maps (Figs 75, 76) were created using ArcGIS 10.3 software.

## Key to males of *Opsius* species in the Arabian Peninsula

- 1 Aedeagus and phallobase with two pairs of processes ..... *O. stactogalus* Fieber\*
- Aedeagus and phallobase with one pair of processes ..... 2
- 2 Aedeagal shafts substantially shorter than basal appendages ..... *O. pallasi* (Lethierry)
- Aedeagal shafts and basal appendages equal or only slightly different lengths ..... 3
- 3 Process branches almost contiguous, processes and aedeagal shafts distant from each other (Fig. 32) .....  
..... *O. versicolor* (Distant)
- Process branches parallel or divergent, processes and aedeagal shafts close to each other ..... 4
- 4 Aedeagal shafts and basal process distinctly divergent throughout its length ..... 5
- Aedeagal shafts and basal process parallel or slightly divergent throughout its length ..... 6
- 5 Aedeagal shafts and basal processes distinctively curved backward to connective; apex of processes arched to base, close to each other, longer than aedeagal shafts (Fig. 26) ..... *O. richteri* Dlabola
- Aedeagal shafts and basal process slightly curved but not backward; apex of process curved outward, distant from each other, shorter than aedeagal shafts; apex of aedeagus forming a hump or lamellate (Fig. 29).... *O. scutellaris* (Lethierry)
- 6 Aedeagal shafts and basal process parallel throughout its extent, aedeagal shafts equal to basal process (Fig. 35) .....  
..... *O. wilsoni* sp. nov.
- Aedeagal shafts and basal process slightly divergent throughout its extent, aedeagal shafts shorter than basal process ...7
- 7 Basal process straight but without any curvature (Fig. 23) ..... *O. heydeni* (Lethierry)
- Basal process not straight, curved preapically ..... *O. tigripes* (Lethierry)

## Results and discussion

### Genus *Opsius* Fieber

*Opsius* Fieber 1866: 505 (Type: *Opsius stactogalus* Fieber, 1866)

*Cestius* Distant 1908: 309 (Type: *Cestius versicolor* Distant, 1908)

*Opsius* Dlabola 1981: 247; Khatri and Webb 2010: 14

**Description.** The genus *Opsius* can be recognized by the following combination of features:

**Head.** Head as wide as or slightly wider than pronotum; crown parallel in length or slightly produced, more than or equal to two times the width of eye; ocelli on crown posterad of anterior margin and close to eyes; gena slightly

incised; antenna short, near upper corner of eye; Frontoclypeus shorter than wide, with fine erect seta on gena close to lateral frontal suture; lateral frontal suture reaching ocellus, shorter than clypeogenal suture, toward middle of ocelli; ratio of frontoclypeal loral suture to clypellar loral suture more than  $\frac{1}{2}$ ; lorum extended nearly to genal margin, wider than clypellus at base; clypellar suture complete and arcuate; clypellus, not inflated, expanded apically ovoid, not protruding beyond the curve of gena, straight or convex apically.

**Thorax.** Thorax yellowish green in colour, pronotum more than two times the length of vertex, wider than long, short lateral margin, anterior margin convex, posterior margin concave or slightly straight, about two times as long as scutellum; scutellum wider than long.

\* *O. stactogalus* Fieber and *O. cypricus* Lindberg are not known from the Arabian Peninsula but known from neighboring countries and are potential species of the region

**Wings.** Forewings more than three times as long as wide, appendix restricted to anal margin with A veins gently curved distally, A1 crossvein present or absent, A1–A2 crossvein present or absent, two closed anteapical cells, inner anteapical cell open. Hind wing submarginal vein complete.

**Legs.** Legs generally yellowish green with brown spots, with brown setal areolae; profemur row AM with AM1, profemur with two dorsoapical setae; intercalary row with 8 fine scattered setae gradually reduced apically; AV row with numerous long setae. Protibia dorsal margin rounded, AD row with 1 macrosetae, PD row with 4 macrosetae, AV row with numerous macrosetae, PV row with 1 to 4 macrosetae. Mesofemur AV row with numerous setae, two dorsoapical seta, short and reduced. Metafemur setal formula 2+2+1, setae of penultimate pair set close to each other. Metatibia arched throughout its length, PD row with long and short macrosetae alternating or subequal in length, AD row with macrosetae and one smaller intercalary seta between each pair, AV row with numerous macrosetae and extending nearly to base, gradually increasing in size apically. Metatarsomere I length equal or shorter to tarsomeres II and III combined.

**Male genitalia.** Pygofer broadly rounded posteriorly, without process, and with well differentiated macrosetae into several rows; valve triangular, laterally, short and pointed articulation with pygofer and free to subgenital plates; subgenital plates triangular, with one row of macrosetae laterally, apex often fingerlike, membranous, with rounded, stout or tapered end; style broadly bilobed basally, with preapical lobe, apophysis not elongate; connective anterior arms linear, contiguous, Y- or U-shaped, not fused, articulated with aedeagus; abdominal apodemes broad, narrow, or tiny, extended to 1<sup>st</sup>, 2<sup>nd</sup> visible segments, with distance between two branches, posterior margin angled, acute rounded, gradually tapering externally and gradually tapering or tapered internally; aedeagus not hinged at base, with atrium not extending ventrad of shafts, with basal process, basal processes diverging or slightly diverging or parallel or converging, close to each other or distant, arising from socle, divided near base or from middle, aedeagal shafts parallel or diverging or converging or a hump or lamellate, with or without pair of ventral processes at base, aedeagal socle swollen and bulbous.

**Female genitalia.** Pygofer with scattered macrosetae, ovipositor not protruding far beyond pygofer apex; first valvula convex; second valvula broad, gradually tapered or slender throughout, teeth on apical 1/3 or more, regularly or irregularly shaped, large and prominent.

**Distribution.** Palaearctic, Oriental (Oman et al. 1990), Afrotropical (Lindberg 1958; Metcalf 1967) (Figs 75, 76), Nearctic (adventive) (Metcalf 1967), Neotropic (adventive) (Virla et al. 2010).

**Diagnosis.** The genus *Opsius* can be distinguished by general colour pattern often greenish brown patches, anterior margin of head without carinae, not angularly curved to the face, face convex, and neither horizontal nor concave, face not elongate; pronotum without longitudinal dark bands or transverse dark markings; aedeagus not

hinged at base, with atrium not extending ventrad of shafts, with basal process, basal processes diverging or slightly diverging or parallel or converging, close to each other or distant, arising from socle, divided near base or from middle, aedeagal shafts parallel or diverging or converging or a hump or lamellate, with or without pair of ventral processes at base, aedeagal socle swollen and bulbous.

**Comment.** *Opsius* was described by Fieber (1866) with *O. stactogalus* designated as a type species. Species have been subsequently described, but unfortunately several species have been described only from females, with descriptions often incomplete, lacking illustrations, and without the examination of types of other species. In our examination of available material of the genus, the following morphological characters in males can be used to characterize the genus: the relative lengths of the pairs of basal processes; and the relative lengths of the pair of aedeagal shafts; the relative lengths and distance between aedeagal shafts and pairs of processes at mid-length and tip length. A comprehensive revision of the genus is required to develop a key for all *Opsius* species.

### *Opsius heydeni* (Lethierry)

Figs 1–4, 23–25, 38–40, 53–57

*Opsius heydeni* Lethierry and Puton 1876: 51

*Athysanus heideni* de Bergevin 1931: 429

*Euscelis heydeni* Lindberg 1936: 2

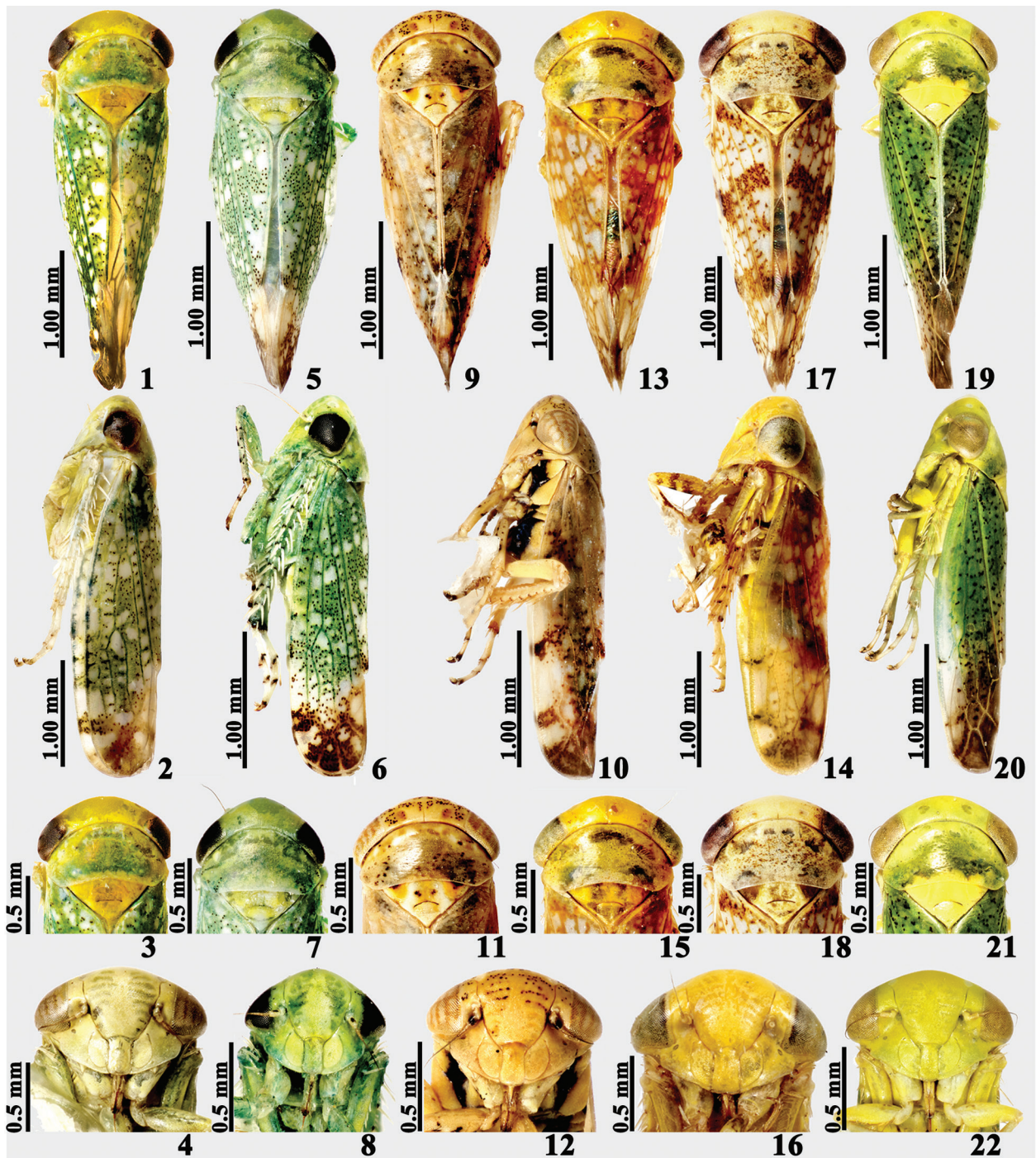
*Opsius lethierryi* Wagner 1942: 121

**Description.** In addition to generic characters, with the following characteristics.

**Male genitalia.** Subgenital plates with rounded apex (Fig. 38); connective linear, contiguous (Fig. 40); apodemes broad, extending to mid-length or the end of second abdomen segments, apodeme width 1.5 times the distance between each apodeme, posterior margin angled externally and tapered internally (Fig. 54); aedeagus with only dorsal process, both slightly curved inward preapically but not bent, aedeagal shafts with diverging branches, ratio of distance between two shafts at mid-length to tip length 5/9, straight, shorter than basal process, as wide as basal process, basal process extending close to shafts branches, pointed; phallobase not inflated (Figs 23, 24).

**Female genitalia.** Female 7<sup>th</sup> sternite 2.5 times as broad at base as long medially, posterior margin concave, acutely sinuous with V-shaped notch in middle, posterolateral angles rounded (Fig. 55); first valvula slightly convex; second valvula gradually tapered apically with rather small and serrate teeth on dorsal surface (Figs 56, 57).

**Measurement.** ♂ 3.6 mm; ♀, 4 mm; pygofer, 0.70 mm; valve, 0.26 mm; subgenital plate, 0.55 mm; style, 0.33 mm; connective, 0.39 mm; apodemes, 0.33 mm; aedeagus to process, 0.51 mm; aedeagus to shaft, 0.48 mm; distance at top of aedeagal shafts, 0.14 mm; distance at mid-length of aedeagal shafts, 0.08 mm; female 7<sup>th</sup> sternite, 0.47 mm.



Figures 1–22. Habitus of *Opsius* spp. 1–4. *O. heydeni* (Lethierry), ♂, 1. dorsal view; 2. lateral view; 3. dorsal view of head and thorax; 4. face; 5–8. *O. richteri* Dlabola, ♂, 5. dorsal view; 6. lateral view; 7. dorsal view of head and thorax; 8. face; 9–12. *O. scutellaris* (Lethierry), ♂, 9. dorsal view; 10. lateral view; 11. dorsal view of head and thorax; 12. face; 13–18. *O. versicolor* (Distant), ♂, 13. dorsal view; 14. lateral view; 15. dorsal view of head and thorax; 16. face; 17. ♀, dorsal view; 18. ♀, dorsal view of head and thorax; 19–22. *O. wilsoni* sp. nov., ♂, 19. dorsal view; 20. lateral view; 21. dorsal view of head and thorax; 22. face.

**Specimens examined.** 21♀19♂, KSA: **Asir**: Wadi Qounonah: 19°24.67'N, 041°36.39'E, 348 m, Light trap, 11.III.2012, El-Sonbati, S. & Al Dhafer, H.; 1♂, same but Wadi Yabah: 19°20.52'N, 041°55.73'E, 411 m, 12.III.2012, Abdel-Dayem, M. & El Torqy, A.; 1♀, same but Wadi Targ: 19°37.38'N, 042°18.02'E, 1317 m, 14.III.2012, Fadl H., Setyaningrum H.; 2♀1♂, same but Wadi Baqrah: 18°47.48'N,

041°56.31'E, 331 m, 4.VI.2014, El-Sonbati, S.; 2♀1♂, same but Khamis Mushayt, Wadi Bisha: 18°20.02'N, 042°42.22'E, 1990m, Sweep net, 27.IV.2011, Sharaf, M., Al Ansi, A. & Setyaningrum, H.; 1♀1♂, KSA: **Bahah**, Shada, Wadi Neera: 19°44.87'N, 041°20.01'E, 471 m, Vacuum, 10.XII.2014, Al Dhafer, H., Fadl, H., Abdel-Dayem, S. & El Torqy, A.; 1♀, KSA, **Riyadh**, Al Ammariyah:

24°40.00'N, 043°40.00'E, Beating, 22.II.2012, Drayhim, Y., Al Dhafer, H., El-Gharbawy, A. & El-Sonbati, S.

**Distribution.** Azores, Armenia, Austria, Belgium, Canary Islands, Egypt, European Russia, France, Germany, Italy, Kazakhstan, Kyrgyzstan, Libya, Morocco, Sardinia, Sweden, Tadjikistan, Turkmenistan, Uzbekistan (Metcalf 1967); Saudi Arabia (present study) (Figs 75, 76).

**Ecology and biology.** This species is widespread and common in southwestern KSA and is often associated with the wadies of Asir Province, a habitat that has one of the most diverse floras of the region. In five of these Asir wadies and also in Baha Province, KSA, *O. heydeni* became common in March, particularly in Wadi Qounonah. Although *Opsius* is host-specific on *Tamarix* spp., this species was collected from other plants at these sites including *Acacia* spp. (Fabaceae) (Figs 77–79).

**Diagnosis.** *Opsius heydeni* is similar to *O. wilsoni* sp. nov. but males of the species can be distinguished easily by the aedeagus and dorsal process slightly curved inward preapically, aedeagal shafts with diverging branches and straight, shorter than basal process, as wide as the basal process, ratio of distance between two shafts at mid-length to tip length 5/9; and the basal process extending close to shafts branches.

### *Opsius pallasii* (Lethierry)

*Athysanus pallasii* Lethierry 1874: 449

*Opsius pallasii* Lethierry 1874: 449

*Athysanus pallasii* Puton 1875: 138

*Opsius pallasii* Dlabola 1979: 131

*Opsius distantiatius* Dlabola 1960a: 2

**Specimens examined.** No specimens were examined from KSA. Several specimens of this species from Iran were studied but not illustrated.

**Distribution.** European Russia, Tajikistan (Dlabola 1960a; Metcalf 1967) Algeria, Armenia, Azerbaijan, France, Georgia, Greece, Kazakhstan, Kyrgyzstan, Spain, Tadjikistan, Tunisia, Turkey, Turkmenistan, Uzbekistan (Metcalf 1967); Saudi Arabia (Dlabola 1979); Iran (Dlabola 1981) (Figs 75, 76).

**Diagnosis.** The males of this species can be easily distinguished from all other members of the genus by the aedeagus and phallobase with one pair of processes; and the aedeagal shafts substantially shorter than the basal appendages.

### *Opsius richteri* Dlabola

Figs 5–8, 26–28, 41–43, 58–62

*Opsius richteri* Dlabola 1960b: 15

**Description.** In addition to generic characters, with the following characteristics.

**Male genitalia.** Pygofer slightly angled posteriorly (Fig. 58); subgenital plates with rounded apex (Fig. 41); connective linear, contiguous (Fig. 43); apodemes nar-

row, extend to mid-length or the end of first abdomen segments, apodeme width three times as distance between each apodeme, posterior margin angled externally and tapered internally (Fig. 59); aedeagus with only dorsal process, both distinctively curved or bent inward at base, aedeagal shafts with diverging branches, ratio of distance between two shafts at mid-length to tip length 5/11, bent inward at base, shorter than basal process, two times as wide as basal process, basal process extending close to shaft branches, distinctively curved to form distinctive inward pointed tips; phallobase not inflated (Figs 26, 27).

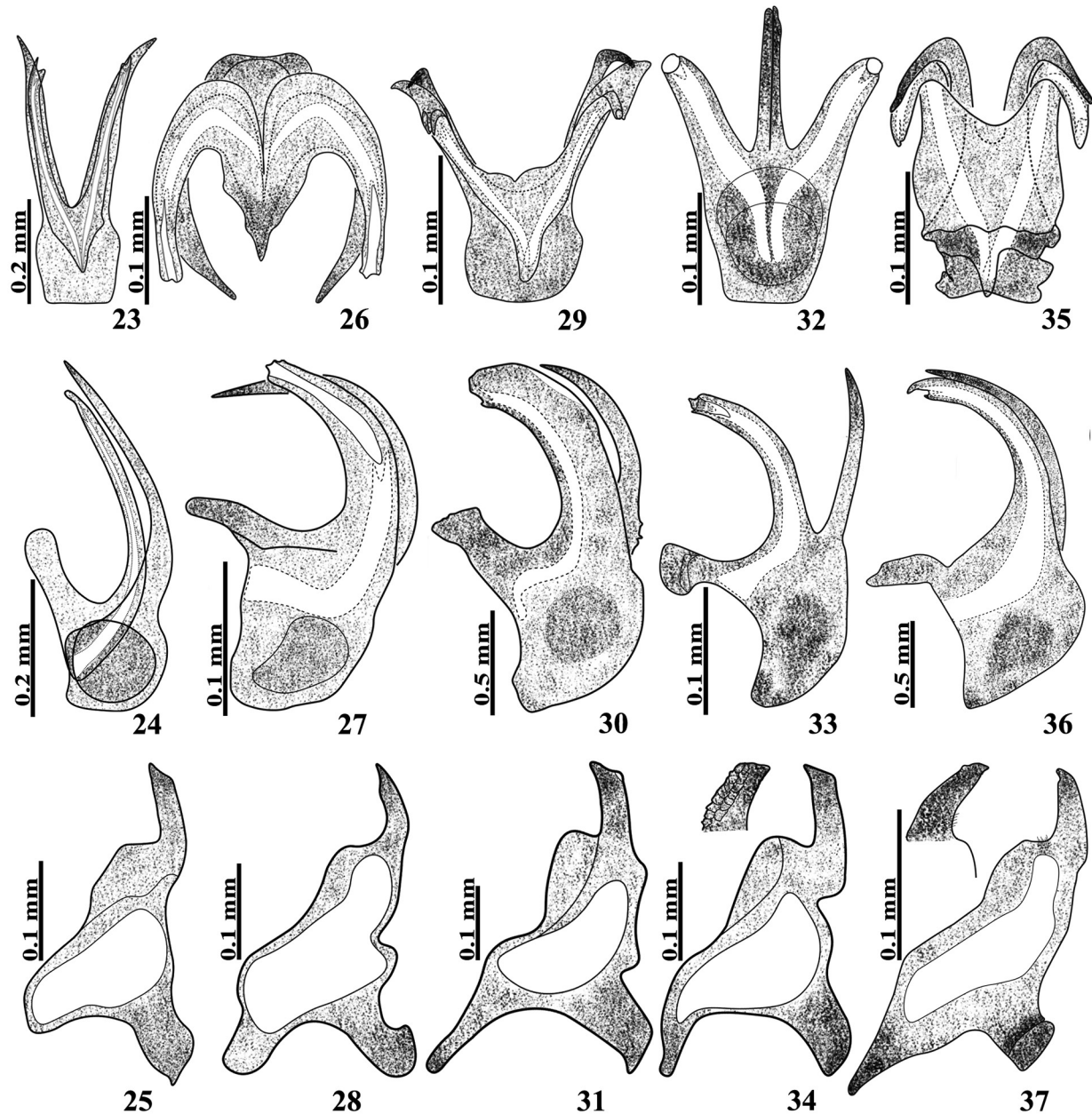
**Female genitalia.** Female 7<sup>th</sup> sternite three times as broad at base as long medially, posterior margin concave, slightly produced with V-shaped notch in middle, posterolateral angles acutely rounded (Fig. 60); first valvula slightly convex; second valvula slender throughout their length with rather small and serrate teeth on dorsal surface (Figs 61, 62).

**Measurement.** ♂ 2.8 mm; ♀, 3.2 mm; pygofer, 0.39 mm; valve, 0.25 mm; subgenital plate, 0.46 mm; style, 0.32 mm; connective, 0.39 mm; apodemes, 0.22 mm; aedeagus to process, 0.16 mm; aedeagus to shaft, 0.16 mm; distance at top of aedeagal shafts, 0.17 mm; distance at mid-length of aedeagal shafts, 0.08 mm; female 7<sup>th</sup> sternite, 0.61 mm.

**Specimens examined.** 74♀57♂, KSA: **Asir**, Wadi Qounonah: 19°24.67'N, 041°36.39'E, 348 m, Light trap, 11.III.2012, El-Sonbati, S., Al Dhafer, H., Fadl, H., Abdel-Dayem, M., El-Torky, A. & Al-Ansi, A.; 1♀1♂, same but Al Mandaq, Wadi Tourabah: 20°14.37'N, 041°15.23'E, 1757 m, 9.III.2012; 7♀2♂, same but Thalooh Al Mandhar, Wadi Baqrah: 18°47.98'N, 042°01.38'E, 425 m, 4.VI.2014, El-Sonbati, S.; 1♀, same but Al Dhafer H. & Fadl H.; 17♀ 3♂, KSA: **Jazan**, Baish, Wadi Baish: 17°22.46'N, 042°32.24'E, LT, 30.I.015, Mashry, H. & Iftekhhar, R.; 1♂, same but Abo Arish Road, Al Ariyadah: 17°02.39'N, 042°58.47'E, sweep net, 12.II.2010, Al Dhafer, H. & A. El-Gharbawy; 7♂, same but Wadi Jizan: 17°01.28'N, 042°59.19'E, 158 m, Vacuum, 16.III.2014, El-Sonbati, S.; 1♂, same but Al-Dayer: 17°20.39'N, 043°07.86'E, Vacuum, 1.V.2014, Al Dhafer, H. & El-Sonbati, S.; 3♂, KSA: **Bahah**, Shada, Wadi Neera: 19°44.87'N, 041°20.01'E, 471 m, vacuum, 10.XII.2014, Al Dhafer, H., Fadl, H., Abdel-Dayem, S. & El-Torky, A.; 2♀, **Oman**: Samad Ashan Arrwdha: 22°53.33'N, 058°13.83'E, 20–30.X.2017, A. Al-Jahdami.

**Distribution.** Iran (Dlabola 1960b); Oman, Saudi Arabia (present study) (Figs 75, 76).

**Ecology and biology.** The abundance of this species varied phenologically between areas of the southwestern region of KSA. Peak abundance in Asir Province occurred in March, whereas in Jazan Province, the peak abundance occurred in January. Most specimens were collected by using light traps, but numerous specimens were also collected in Jazan Province from *Tamarix* spp. with a sweep net and by a portable vacuuming device. *Opsius richteri* comprised approximately 36% of the total number of specimens of this genus examined from KSA. This species was especially abundant at Wadi Qounonah, Asir Province, KSA (Figs 77–79).



**Figures 23–37.** Male genital structures of *Opsius* spp. 23–25. *O. heydeni* (Lethierry). 23. Aedeagus dorsal view; 24. Lateral view; 25. Style; 26–28. *O. richteri* Diabola. 26. Aedeagus dorsal view, 27. Lateral view; 28. Style; 29–31. *O. scutellaris* (Lethierry). 29. Aedeagus dorsal view, 30. Lateral view; 31. Style; 32–34. *O. versicolor* (Distant). 32. Aedeagus dorsal view, 33. Lateral view; 34. Style; 35–37. *O. wilsoni* sp. nov. 35. Aedeagus dorsal view, 36. Lateral view; 37. Style.

**Diagnosis.** The aedeagus of *O. richteri* is similar to *O. scutellaris* with the aedeagal shaft branches diverging but can be distinguished by produced crown, aedeagal shafts and dorsal process distinctively curved or bent inward at base, and shaft branches two times as wide as basal process.

#### *Opsius scutellaris* (Lethierry)

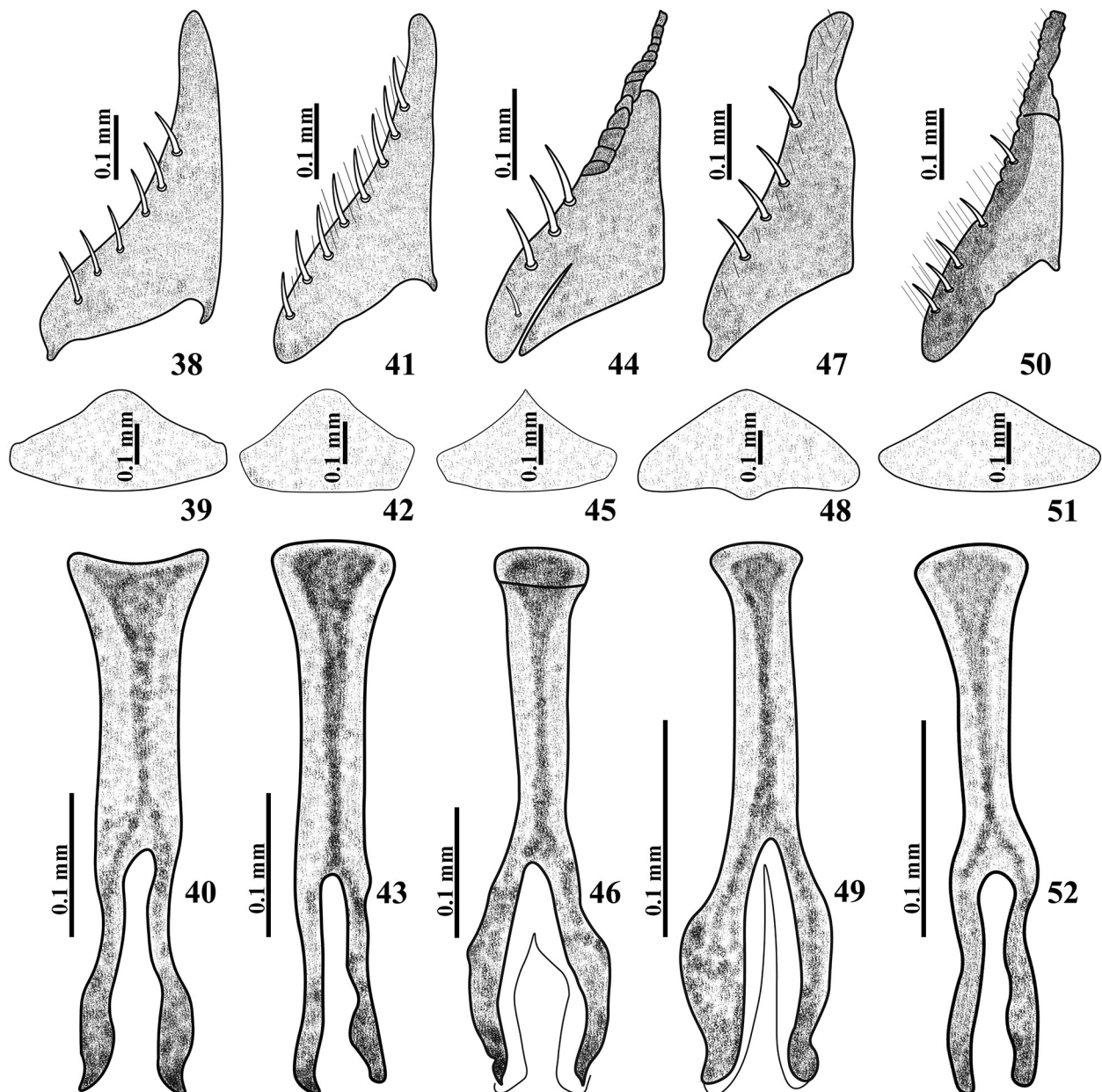
Figs 9–12, 29–31, 44–46, 63, 64

*Athysanus scutellaris* Lethierry 1874: 449

*Opsius scutellaris* Lethierry 1874: 449; Lindberg 1954: 227

**Description.** In addition to generic characters, with the following characteristics.

**Male genitalia.** Pygofer slightly angled mid-posteriorly (Fig. 63); subgenital plate with gradually tapered apex (Fig. 44); connective Y-shaped (Fig. 46); apodemes narrow, extending to end of second abdominal segments, apodeme width three times as distance between each apodeme, posterior margin angled externally and tapered internally (Fig. 64); aedeagus with only a dorsal process, both distinctively curved inward at mid-length, aedeagal shafts with diverging branches, ratio of distance between two shafts at mid-length to tip length 5/11, curved inward



**Figures 38–52.** Male genital structures of *Opsius* spp. 38–40. *O. heydeni* (Lethierry). 38. Subgenital plate, 39. Valve; 40. Connective; 41–43. *O. richteri* Dlabola. 41. Subgenital plate, 42. Valve; 43. Connective; 44–46. *O. scutellaris* (Lethierry). 44. Subgenital plate, 45. Valve; 46. Connective; 47–49. *O. versicolor* (Distant). 47. Subgenital plate, 48. Valve; 49. Connective; 50–52. *O. wilsoni* sp. nov. 50. Subgenital plate, 51. Valve; 52. Connective.

at mid-length, longer than basal process, three times as wide as basal process, forming a hump or lamellate, basal process extending close to shaft branches, pointed; phallobase not inflated (Figs 29, 30).

**Measurement.** ♂ 2.8 mm; pygofer, 0.41 mm; valve, 0.26 mm; subgenital plate, 0.39 mm; style, 0.42 mm; connective, 0.43 mm; apodemes, 0.45 mm; aedeagus to process, 0.17 mm; aedeagus to shaft, 0.10 mm; distance at top of aedeagal shafts, 0.17 mm; distance at mid-length of aedeagal shafts, 0.08 mm.

**Specimens examined.** 2♂, KSA: Abha Province, Sad Abha: 18°19.32'N, 042°31.00'E, vacuum, 23.III.2014, El-Sonbati, S. A.

**Distribution.** Algeria, Canary Islands, China, Libya (Metcalf 1967); Saudi Arabia (present study) (Figs 75, 76).

**Ecology and biology.** Two males of *O. scutellaris* were collected at Sad Abha (dam of Abha) from weedy plants surrounding a large pool in Abha Al Jadidah Park located in the central part of the city. This species is considered uncommon, with only two specimens collected during extensive sampling not only in southwestern region of KSA but also in Abha Al Jadidah Park (Figs 77–79).

**Diagnosis.** Males of *O. scutellaris* can be distinguished from all members of the genus by subgenital apex with a lobe-like process; aedeagal shafts three times as wide as basal process, forming a hump or lamellate.

***Opsius tigrripes* (Lethierry)***Athysanus tigrripes* Lethierry 1876a: 87; Lethierry 1876b:15*Opsius tigrripes* Vilbaste 1962: 140; Nast 1972: 325; Dlabola 1979: 131

**Specimens examined.** KSA. Wadi Al Ammariyah; Hofuf, 8.IV.–23.V.77. Büttiker, 15Ex. (examined but not available to be illustrated in present study)

**Distribution.** Afghanistan, Iran, Russia (Metcalf 1967); Saudi Arabia (Dlabola 1979) (Figs 75, 76).

**Diagnosis.** This species is similar to *O. heydeni* but the males can be distinguished by the aedeagal shafts and basal process slightly divergent throughout its length, with the aedeagal shafts being shorter than the basal process, and the basal process not straight and curved preapically.

***Opsius versicolor* (Distant)**

Figs 13–18, 32–34, 47–49, 65–69

*Cestius versicolor* Distant 1908: 310*Opsius dissimilis* Vilbaste 1961: 43*Hishimonus tamaricus* Ishihara 1972: 84*Cestius sakroensis* Ahmed and Sultana 1994: 126

**Description.** In addition to generic characters, with the following characteristics.

**Male genitalia.** Pygofer slightly angled posteriorly (Fig. 65); subgenital plates with stout apex (Fig. 47); connective Y-shaped (Fig. 49); apodemes tiny, not exceeding the first segment; apodeme width three times as distance between each apodeme, posterior margin gradually tapering, concave at preapical margin (Fig. 66); aedeagus with only a dorsal process, both straight or slightly curved inward preapically but not bent, aedeagal shafts with diverging branches, ratio of distance between two shafts at mid-length to tip length 5/11, straight, shorter than basal process, two times as wide as basal process, basal process extending narrower to each other, pointed; phallobase not inflated (Figs 32, 33).

**Female genitalia.** Female 7<sup>th</sup> sternite 2.5 times as broad at base as long medially, posterior margin with median lobe-like projection with V-shaped notch in middle, posterolateral angles conically rounded (Fig. 67); first valvula convex; second valvula gradually tapered apically with rather small and serrate tooth on dorsal surface (Figs 68, 69).

**Measurement.** ♂ 3.3 mm; ♀, 3.7 mm; pygofer, 0.65 mm; valve, 0.31 mm; subgenital plate, 0.46 mm; style, 0.31 mm; connective, 0.26 mm; apodemes, 0.10 mm; aedeagus to process, 0.26 mm; aedeagus to shaft, 0.17 mm; distance at top of aedeagal shafts, 0.17 mm; distance at mid-length of aedeagal shafts, 0.08 mm; female 7<sup>th</sup> sternite, 0.80 mm.

**Specimens examined.** 10♀9♂, KSA: **Jazan**, Baish, Wadi Baish: 17°22.46'N, 042°32.24'E, Light trap, 30.I.2015, Mashry, H. & Iftekhhar, R.; 1♀1♂, same but AlAriyadah, Jizan Dam: 17°02.62'N, 042°98.36'E, 187 m, Beating, 21.V.2012, Al Ansi, A.; 1♀, same but Wadi Jizan: 17°01.28'N, 042°59.19'E, 158 m, Sucking, 16.III.2014, El-Sonbati, S.; 1♀, same but Fifa, AlAbsia: 17°15.83'N, 043°06.49'E, 1770 m, 17.III.2014; 27♀118♂, KSA: **Asir**,

Wadi Qounonah: 19°24.67'N, 041°36.39'E, 348 m, Light trap, 11.III.2012, El-Sonbati, S. & Al Dhafer, H.; 1♀, same but Wadi Al Talalea: 19°02.90'N, 041°58.17'E, 242 m, Sweep net, 1.V.2012, Al Dhafer, H., Abdeldayem, S., Al Ansi, A. & Al Othman, A.; 2♀3♂, same but Wadi Namar: 24°34.04'N, 046°40.59'E, Sweep net, 29.II.2012, Al Ansi, A., Al Harbi, M. & Al Othman, A.; 1♂, same but Wadi Targ: 19°37.39'N, 042°18.02'E, 1317 m, Light trap, 14.III.2012, Fad, H. & Setyaningrum, H.; 1♀1♂, same but Wadi Tourabah: 20°14.37'N, 041°15.23'E, 1757 m, Light trap, 9.III.2012, Al Dhafer, H., Fadl, H., Abdel-Dayem, S., El Torkey, A. & Al Ansi, A.; 2♀1♂, same but Khamis Mushayt, Wadi Bisha: 18°20.02'N, 042°42.22'E, 1990 m, Sweep net, 27.IV.2011, Sharaf, M., Al Ansi, A. & Setyaningrum, H.; 2♀2♂, same but Al-Hubail, Wadi Reem, 9.II.2016, Vacuum, 18°06.98'N, 042°13.94'E, 451 m, A. Ansi.; 22♀33♂, KSA: **Bahah**, Shada, Wadi Neera: 19°44.87'N, 041°20.01'E, 471 m, Vacuum, 10.XII.2014, Al Dhafer, H., Fadl, H., Abdel-Dayem, S., El Torkey, A.; 1♀, KSA: **Najran**, Hubuna, Al Dhahiqah: 17°50.71'N, 044°15.83'E, 1228 m, Sweep net, 14.I.2013, AlAnsi, A., Rasool, I. & Khan, S.; 1♀, KSA, **Muzahimiyah**, Al Khararah: 24°24.35'N, 046°14.67'E, Light trap, 17.IV.2012, Al Dhafer, H., Fadl, H., Abdel-Dayem, S., El Torkey, A. & AlAnsi, A.; 1♀, KSA, **Riyadh**, Al Ammariyah: 24°40.00'N, 043°40.00'E, Beating, 22.II.2012, Al Drayhim, Y., Al Dhafer, H., El-gharbawy, A. & El-Sonbati, S.; 2♀4♂, **Oman**: Samad Ashan, Aswareeg, 1–10.X.2017, 22°49.50'N, 058°09.12'E, A. Al-Jahdhami; 1♂, same but, 9–10.VIII.2017; 1♀5♂, Muscat (Seeb), Botanic Garden, 5–8.XI.2017, Light trap, 23°33.59'N, 058°07.79'E, A. Al-Jahdhami.

**Distribution.** European Russia (Dlabola 1961), India, Indonesia (Metcalf 1967), Pakistan (Ahmed and Sultana 1994), Saudi Arabia (Dlabola 1979); Oman (present study) (Figs 75, 76).

**Ecology and biology.** *Opsius versicolor* was the most common species collected during this study comprising approximately 50% of the total number of specimens examined. Relative abundances varied, with numbers peaking in March in Asir Province, peak abundance in January in Jazan Province, and in November in Baha Province, KSA (Figs 77–79).

**Diagnosis.** Males of *O. versicolor* can be distinguished by tiny apodemes not exceeding the first segment, aedeagal shafts with diverging branches, and the basal process contiguous or coherent to each other. This species dimorphic, with the crown of males being slightly produced (Figs 13–16), and that of females parallel (Figs 17, 18).

***Opsius wilsoni* El-Sonbati, sp. nov.**

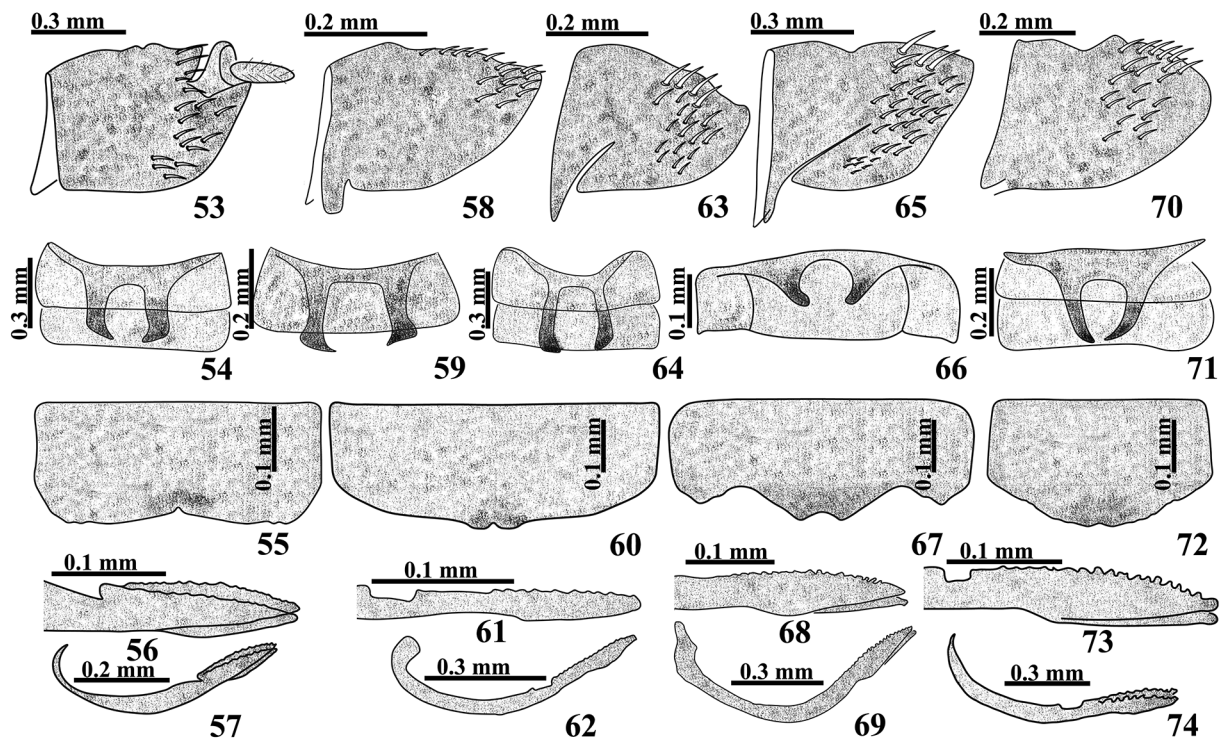
http://zoobank.org/FEFF6893-1486-4728-9455-AABB9A0B5B94

Figs 19–22, 35–37, 50–52, 70–74

**Description.** In addition to generic characters, with the following characteristics.

**Coloration.** General coloration light yellow whitish, greenish brown, with black punctation on forewings (Figs 19–22). Face and vertex yellowish. Pronotum with





**Figures 53–74.** Male/Female genital structures of *Opsius* spp. 53–57. *O. heydeni* (Lethierry). 53. ♂, Pygofer, 54. ♂, Apodeme; 55. ♀, 7<sup>th</sup> sternite; 56–57. ♀, Ovipositor. 58–62. *O. richteri* Dlabola. 58. ♂, Pygofer, 59. ♂, Apodeme; 60. ♀, 7<sup>th</sup> sternite; 61, 62. ♀, Ovipositor. 63, 64. *O. scutellaris* (Lethierry). 63. ♂, Pygofer, 64. ♂, Apodeme; 65–69. *O. versicolor* (Distant). 65. ♂, Pygofer, 66. ♂, Apodeme; 67. ♀, 7<sup>th</sup> sternite; 68, 69. ♀, Ovipositor. 70–74. *O. wilsoni* sp. nov. 70. ♂, Pygofer, 71. ♂, Apodeme; 72. ♀, 7<sup>th</sup> sternite; 73, 74. ♀, Ovipositor.

light yellow anterior margin, and with light green posterior margin. Scutellum light yellow whitish. Forewings greenish brown, with scattered black punctation, transparent at the outer edge, with brownish apical and subapical cells, with some dense brown stripes inside. Legs yellow with brown setal areolae, apices of tarsomeres and claws from brown to dark brown.

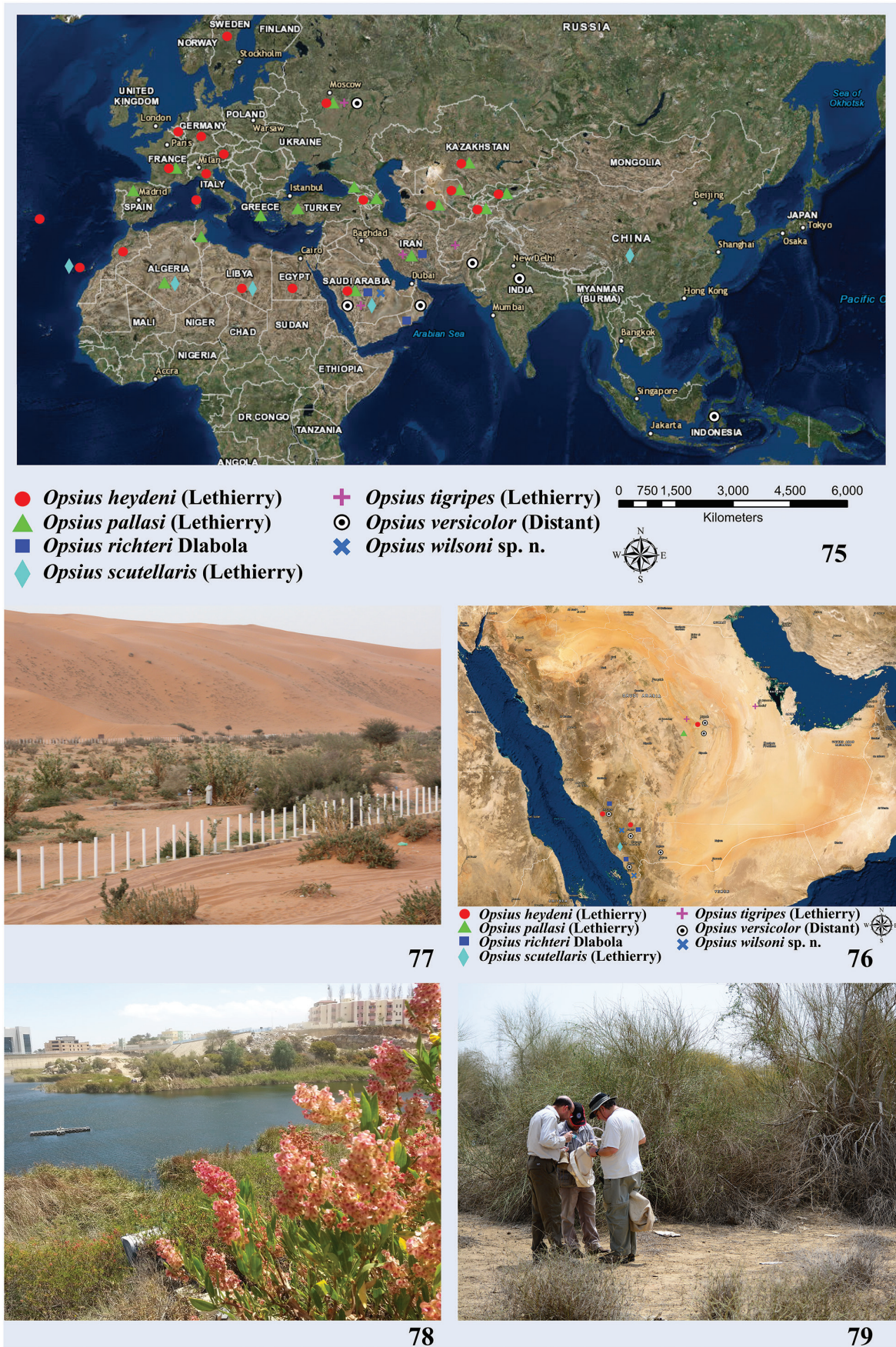
**Head.** Head slightly wider than pronotum. Crown parallel in length, slightly more than two times the width of compound eye, with tiny median groove, with round apex. Ocelli on crown posterad of anterior margin and close to eyes. Gena slightly incised with small projection. Antenna short, near upper corner of eye. Antennal ledge weakly carinate. Frontoclypeus anterodorsal part inflated, posteroventral part not inflated, shorter than wide, with fine erect seta on gena close to lateral frontal suture. Lateral frontal suture reaching ocellus, shorter than clypeogenal suture, toward middle of ocelli, ratio of frontoclypeal loral suture to clypellar loral suture more than  $\frac{1}{3}$ . Lorum extended nearly to genal margin, wider than clypellus at base. Clypellar suture complete and arcuate. Clypellus, not inflated, expanded apically ovoid, not protruding the curve of gena, straight or convex apically.

**Thorax.** Pronotum wider than long, with convex anterior margin and concave posterior margin, short lateral margin, more than two times the length of vertex, about two times as long as scutellum. Scutellum wider than long.

**Wings.** Macropterous, forewings more than three times as long as wide, appendix restricted to anal margin, without reflexed costal veins, with A veins gently curved distally, A1 crossvein absent, A1–A2 crossvein absent, two closed anteapical cells, inner anteapical cell open. Hind wings not visible, submarginal vein complete.

**Legs.** Profemur and mesofemur inflated. Profemur row AM with AM1, profemur with two dorsoapical setae; intercalary row with eight fine scattered setae gradually reduced apically; AV row with numerous long setae. Protibia dorsal margin rounded, AD row with one macrosetae, PD row with four macrosetae, AV row with numerous macrosetae, PV row with 1–4 macrosetae. Mesofemur AV row with numerous setae, two dorsoapical seta, short and reduced. Metafemur setal formula 2+2+1, setae of penultimate pair set close to each other. Metatibia arched throughout its length, PD row with long and short macrosetae alternating or subequal in length, AD row with macrosetae and one smaller intercalary seta between each pair, AV row with numerous macrosetae and extending nearly to base, gradually increasing in size apically. Protarsomere and mesotarsomere I length shorter than tarsomeres II and III combined. Metatarsomere I length equal or slightly shorter to tarsomeres II and III combined.

**Male genitalia.** Pygofer slightly angled mid-posteriorly (Fig. 70); subgenital plates with gradually tapered apex (Fig. 50); connective linear (Fig. 52); apodemes narrow, extending to the apex of second abdomen segments, apo-



**Figures 75–79.** 75, 76. Distribution of *Opsius* spp. 75. World distribution (point indicates presence in the country). 76. Local distribution; 77–79. Habitats of *Opsius* spp. 77. Locality: Muzahimiyah, Al Khararah: 24°24.35'N, 46°14.67'E; 78. Locality: Abha, Sad Abha: 18°19.32'N, 42°31.00'E; 79. Type locality: Jazan, Wadi Jazan: 17°01.275'N, 42°59.187'E.

deme width three times as distance between each apodeme, posterior margin a cute rounded externally and gradually tapered internally (Fig. 71); aedeagus with only dorsal process, both curved or bent inward at mid-length, aedeagal shafts with diverging branches, ratio of distance between two shafts at mid-length to tip length 1/3, bent inward at mid-length, as long as basal process, two times as wide as basal process, basal process extending narrow to shafts branches, pointed; phallobase not inflated (Figs 35, 36).

**Female genitalia.** Female 7<sup>th</sup> sternite 1.5 times as broad at base as long medially, posterior margin with median lobe-like projection with V-shaped notch in middle, posterolateral angles conically rounded, narrowed (Fig. 72); first valvula convex; second valvula gradually tapered apically with rather small and serrate tooth on dorsal surface (Figs 73, 74).

**Measurement.** ♂ 3.1 mm; ♀, 3.4 mm; pygofer, 0.47 mm; valve, 0.25 mm; subgenital plate, 0.50 mm; style, 0.21 mm; connective, 0.26 mm; apodemes, 0.28 mm; aedeagus to process, 0.20 mm; aedeagus to shaft, 0.19 mm; distance at top of aedeagal shafts, 0.09 mm; distance at mid-length of aedeagal shafts, 0.03 mm; female 7<sup>th</sup> sternite, 0.81 mm.

**Type specimens.** *Holotype* ♂, KSA: **Jazan**, Wadi Jazan: 17°05.58'N, 043°02.17'E, 158 m, vacuum, 16.III.2014, El-Sonbati, S. (KSMA). *Paratypes*: 7♀8♂, same locality as Holotype; 1♀, KSA: Jazan, Fifa, Al Absia: 17°28.85'N, 043°14.30'E, VC, 20.III.2014, El-Sonbati, S. A.; 1♂, KSA: Najran, Hubuna, Wadi Hubuna: 17°55.40'N, 044°24.47'E, 1244, beating, 14.I.2013, Ansi, A.; Rasool, I.; Khan, S. (KSMA); 6♀3♂, **Asir**, Abha, Al-Hubail, Wadi Reem, 9.II.2016, vacuum, 18°06.98'N, 042°13.94'E, 451 m, A. Ansi (NMWC).

**Distribution.** Saudi Arabia (Jazan, Wadi Jazan; Jazan, Fifa, Al Absia, Najran, Hubuna, Wadi Hubuna) (present study) (Figs 75, 76).

**Ecology and biology.** *Opsius wilsoni* appeared to reach peak abundance in March. Most specimens were collected from *Tamarix* spp. (Figs 77–79) by using a vacuum device.

**Diagnosis.** Females and males of *O. wilsoni* can be recognized by a slightly incised gena with small projection. Additionally, males can be distinguished by aedeagal shafts with diverging branches at apex, ratio of distance between two shafts at mid-length to tip length 1/3, bent inward at mid-length.

**Etymology.** This species is named in honour of Dr Michael R. Wilson, Department of Natural Sciences, National Museum of Wales, Cardiff, Wales, United Kingdom.

## Conclusions

Seven species of *Opsius* present in KSA were revised including including the description of a new species, and three new species records for KSA. A key of species based on males is presented that includes new characters for separation of KSA species. Our study also provides maps

of the known geographical distribution of the genus and provides examples of typical habitats of the genus. Further study is needed to evaluate the variation in the species of the genus across their entire geographical range.

## Acknowledgements

The authors are grateful to John Deeming (NMWC) for valuable suggestions, to Boris Kondratieff (Colorado State University) and James Zahniser (APHIS) for reading and improving the manuscript, to Dominique Zimmermann for her helpful editorial comments, and to Ali Al-Jahdhami (ONHM) for his assistance and loan of specimens. The authors would like to express their sincere appreciation to the Deanship of Scientific Research at King Saud University for funding their research group (no. RGP-1437–009).

## References

- Ahmed M, Sultana Z (1994) Grassland leafhoppers (Cicadellidae: Homoptera) of Karachi, Pakistan. Records Zoological Survey of Pakistan 12: 125–133.
- de Bergevin E (1931) “Résultats Hemiptérologiques.” In Spedizione Scientifica all’Oasi di Cufra (Marzo-Luglio 1931). Annali del Museo civico di Storia Naturale di Genova. Genova 55: 422–430.
- Dietrich CH (2005) Keys to the families of Cicadomorpha and subfamilies and tribes of Cicadellidae (Hemiptera: Auchenorrhyncha). Florida Entomologist 88: 502–517. [https://doi.org/10.1653/0015-4040\(2005\)88\[502:KTTFOC\]2.0.CO;2](https://doi.org/10.1653/0015-4040(2005)88[502:KTTFOC]2.0.CO;2)
- Distant WL (1908) Rhynchota. IV. Homoptera and appendix (Pt.). The fauna of British India, including Ceylon and Burma. Taylor & Francis, London, XV+501 pp.
- Dlabola J (1960a) Einige neue Zikaden aus Dagestan und Zentralasien (Homoptera). Stuttgarter Beiträge zur Naturkunde aus dem Staatlichen Museum für Naturkunde in Stuttgart 40: 1–5.
- Dlabola J (1960b) Iranische Zikaden (Homoptera, Auchenorrhyncha): Ergebnisse der entomologischen Reisen Willi Richter, Stuttgart, im Iran 1954 und 1956—Nr. 31. Stuttgarter Beiträge zur Naturkunde aus dem Staatlichen Museum für Naturkunde in Stuttgart 41: 1–24.
- Dlabola J (1961) Die Zikaden von Zentralasien, Dagestan und Transkaukasien (Homopt. Auchenorrhyncha). Acta Entomologica Musei Nationalis Pragae 34: 241–358.
- Dlabola J (1979) Insects of Saudi Arabia. Homoptera. Fauna of Saudi Arabia 1: 115–139. [https://doi.org/10.1007/978-1-349-03214-3\\_1](https://doi.org/10.1007/978-1-349-03214-3_1)
- Dlabola J (1980) Insects of Saudi Arabia. Homoptera: Auchenorrhyncha (Part 2). Fauna of Saudi Arabia 2: 74–94.
- Dlabola J (1981) Ergebnisse der Tschechoslowakisch-Iranischen entomologischen Expeditionen nach Iran (1970 und 1973). Acta Entomologica Musei Nationalis Pragae 40: 127–311.
- El-Sonbati SA, Wilson MR, Al Dhafer HM (2015) A new species of the leafhopper genus *Naevus* Knight, 1970 (Hemiptera: Cicadellidae: Deltocephalinae: Opsini), from Saudi Arabia. Zootaxa 4059: 393–400. <https://doi.org/10.11646/zootaxa.4059.2.10>
- El-Sonbati SA, Wilson MR, Al Dhafer HM (2016) *Paraorosius*, a new genus of leafhopper (Hemiptera: Cicadellidae: Deltocephalinae:

- Opsiini), with description of a new species from the Middle East. *Zootaxa* 4150: 581–590. <https://doi.org/10.11646/zootaxa.4150.5.5>
- El-Sonbati SA, Wilson MR, Al Dhafer HM (2017) A new leafhopper genus with two new species related to *Masiripius* Dlabola, 1981 (Hemiptera, Deltocephalinae, Cicadellidae, Opsiini). *European Journal of Taxonomy* 308: 1–24. <https://doi.org/10.5852/ejt.2017.308>
- El-Sonbati SA, Wilson MR, Al Dhafer HM (2018) Contribution to the knowledge of selected genera of the tribe Opsiini (Hemiptera: Cicadellidae: Deltocephalinae) from the Kingdom of Saudi Arabia. *Acta Entomologica Musei Nationalis Pragae* 58(1): 257–266. <https://doi.org/10.2478/aemnp-2018-0023>
- El-Sonbati SA, Wilson MR, Al Dhafer HM (2019) Revision of the leafhopper genus *Orosius* Distant, 1918 (Hemiptera: Cicadellidae: Deltocephalinae: Opsiini) in the Arabian Peninsula with the description of a new species. *Zootaxa* 4565(1): 37–48. <https://doi.org/10.11646/zootaxa.4565.1.2>
- Fieber FX (1866) Neue Gattungen und Arten in Homoptern (Cicadina Bur.). *Verhandlungen der Kaiserlich-Königlichen Zoologisch-botanischen Gesellschaft in Wien*. Wien 16: 497–516. <https://doi.org/10.5962/bhl.title.9291>
- Guba I, Glennie K (1998) Geology and geomorphology. In: Ghazanfar SA, Fisher M (Eds) *Vegetation of the Arabian Peninsula*. Springer, Dordrecht, 39–62. [https://doi.org/10.1007/978-94-017-3637-4\\_3](https://doi.org/10.1007/978-94-017-3637-4_3)
- Ishihara T (1972) A valid genus, *Hishimonus* Ishihara, 1953 (Hemiptera, Euscelidae). *Transactions of the Shikoku Entomological Society* 11(3): 84.
- Khatri I, Webb MD (2010) The Deltocephalinae leafhoppers of Pakistan (Hemiptera, Cicadellidae). *Zootaxa* 2365: 1–47. <https://doi.org/10.11646/zootaxa.2365.1.1>
- Lethierry LF (1874) Hémiptères nouveaux. *Petites Nouvelles Entomologiques*. Paris 1: 449.
- Lethierry LF (1876a) Homoptères nouveaux d'Europe et des contrées voisines. *Annales de la Société Entomologique de Belgique* 19: lxxvi–lxxxviii.
- Lethierry LF (1876b) Homoptères nouveaux d'Europe et des contrées voisines. *Compte Rendu des Séances de la Société Entomologique de Belgique* 19: 5–17.
- Lethierry LF, Puton A (1876) Faunule des hémiptères de Biskra. *Annales de la Société Entomologique de France (Serie 5)* 6: 19–56.
- Lindberg H (1936) Die Cicadinen der Kanarischen Inseln. *Commentationes Biologicae. Societas Scientiarum Fennica. Helsingfors* 4(9): 1–19.
- Lindberg H (1954) Hemiptera Insularum Canariensium. *Systematik, Ökologie und Verbreitung der Kanarischen Heteropteren und Cicadinen. Commentationes Biologicae. Societas Scientiarum Fennica* 14(1): 1–304.
- Lindberg H (1958) Hemiptera Insularum Caboverdensium. *Systematik, Ökologie und Kapverdischen Inseln. Ergebnisse der Zoologischen Expedition von Professor Hakan Lindberg nach den Kapverde-Inseln im Winter 1953–1954, Nr. 22. Commentationes Biologicae Societas Scientiarum Fennica* 19(1): 1–246.
- Metcalfe ZP (1967) *General Catalogue of the Homoptera. Fascicle VI: Cicadelloidea. Part 10: Euscelidae. Section I. United States Department of Agriculture, Agriculture Research Service, Washington, DC, v + 1077 pp.*
- Nast J (1972) *Palaeartic Auchenorrhyncha (Homoptera). An annotated check list. Polish Scientific Publishers, Warszawa, 550 pp.*
- Newete SW, Allem SM, Venter N, Byrne MJ (2019) *Tamarix* efficiency in salt excretion and physiological tolerance to salt-induced stress in South Africa. *International Journal of Phytoremediation* 22(1): 3–9. <https://doi.org/10.1080/15226514.2019.1633997>
- Oman PW, Knight WJ, Nielson MW (1990) *Leafhoppers (Cicadellidae): A bibliography, generic check-list and index to the world literature 1956–1985.*
- Puton A (1875) *Homoptera. Am. Serv. (Gulaerostria. Zett. Fieb.) Sect. I. Auchenorrhyncha. Dumer. (Cicadina. Burm.). Catalogue des Hémiptères (Hétéroptères, Cicadines et Psyllides) d'Europe et du Bassin de la Méditerranée 2e ed. Deyrolle, Paris, 165 pp.*
- Siemion GM, Stevens LE (2015) Interactions among *Tamarix* (Tamaricaceae), *Opsius stactogalus* (Cicadellidae), and litter fungi limit riparian plant establishment. *Advances in Entomology* 3(2): 65–81. <https://doi.org/10.4236/ae.2015.32008>
- Vilbaste J (1961) New species of cicadellids (Homoptera: Jassidae). *Uzbekskii Biologicheskii Zhurnal* 1: 42–50.
- Vilbaste J (1962) *Über die Zikadenfauna des östlichen Teiles des Kaspischen Tieflandes. Eesti NSV Tead. Akademia J.L.S.A., Tallinn* 55: 129–151.
- Virla EG, Logarzo GA, Paradell SL (2010) Occurrence of the tamarix leafhopper, *Opsius stactogalus* Fieber (Hemiptera: Cicadellidae), in Argentina. *Journal of Insect Science* 10(1): 23. <https://doi.org/10.1673/031.010.2301>
- von Kéler SV (1955) *Entomologisches Wörterbuch mit besonderer Berücksichtigung der morphologischen Terminologie. Akademie Verlag, Berlin, 679 pp.*
- Wagner W (1942) *Beitrag zur Kenntnis der italienischen Zikaden. Bollettino del Laboratorio di Zoologia Generale e Agraria della R. Scuola Superiore d'agricoltura in Portici* 32: 118–124.
- Wiesnborn WD (2004) Mouth parts and alimentary canal of *Opsius stactogalus* Fieber (Homoptera: Cicadellidae). *Journal of the Kansas Entomological Society* 77(2): 152–155. <https://doi.org/10.2317/0307.28.1>
- Zahniser JN, Dietrich CH (2013) A review of the tribes of Deltocephalinae (Hemiptera: Auchenorrhyncha: Cicadellidae). *European Journal of Taxonomy* 45: 1–211. <https://doi.org/10.5852/ejt.2013.45>
- Zahniser JN (2019) An online interactive key and searchable database of Deltocephalinae (Hemiptera: Cicadellidae). <http://zahniser.speciesfile.org> [Accessed on: 2019-7-7]

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Jahr/Year: 2020

Band/Volume: [NF\\_67](#)

Autor(en)/Author(s): El-Sonbati Saad A., Wilson Michael R., Al Dhafer Hathal M.

Artikel/Article: [The Tamarix feeding Leafhopper genus Opsius Fieber, 1866 \(Hemiptera, Cicadellidae, Deltocephalinae, Opsiini\) in the Kingdom of Saudi Arabia, with description of a new species 1-12](#)