



Ephedraphis Hille Ris Lambers (Hemiptera: Aphididae), with a key to species and one new species from Mongolia

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Abstract

The aphid genus *Ephedraphis* Hille Ris Lambers is reviewed. The genus is represented by four species, including *Ephedraphis mongolica* sp. n. on *Ephedra* sp. from Umnogovi Province, Mongolia. A key to the known species of *Ephedraphis* is provided. Diagnostic characters of all species are given. All specimens studied, including type specimens are deposited in the National Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences, Beijing, China.

Key words: *Ephedraphis*, Aphididae, taxonomy, new species, key, distribution

Introduction

The aphid genus *Ephedraphis* Hille Ris Lambers is a small genus in Aphidini (Aphididae), comprising three species and one subspecies, *E. ephedrae* (Nevsky), *E. gobica* Szelegiewicz, *E. haloxylon* Qiao, Jiang & Zhang and *E. gobica xinjiangica* Kadyrbekov, Ren & Shao. Most individuals are dark brown or almost black in life, and feed on Chenopodiaceae and Ephedraceae. They are distributed in the Palaearctic region, mainly in the Middle East, Central Asia and Europe.

Ephedraphis was erected by Hille Ris Lambers (1959) with *Anuraphis ephedrae* Nevsky as type species. Subsequently, Szelegiewicz (1963) described the second species, *E. gobica* from Dornogovi, Mongolia. Mamontova-Solukha (1963) described a subspecies, *E. ephedrae taurica* on *Ephedra* sp. from Ukraine, but variation in some morphological characters is within the range of *E. ephedrae* (Blackman and Eastop 2006). Qiao & Zhang (2002) recorded this genus and *E. gobica* for the first time in China. Kadyrbekov *et al.* (2002) described a new subspecies of *Ephedraphis*, *E. gobica xinjiangica* on *Ephedra* sp. from Xinjiang-Uygur Autonomous Region, China. Qiao *et al.* (2006) reviewed the genus and described the third species, *E. haloxylon* on *Haloxylon ammodendron* from Ningxia Autonomous Region, China, and provided a key to all known species.

Here, a new species, *E. mongolica* is described on *Ephedra* sp. from southwest Mongolia. The other three species, *E. ephedrae* (Nevsky), *E. gobica* Szelegiewicz and *E. haloxylon* Qiao, Jiang & Zhang are re-illustrated, and a key is provided to apterous viviparous females.

Material and methods

Specimen depositories: the holotype and paratypes of the new species and other specimens examined are deposited in the National Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences, Beijing. Collectors of specimens are mentioned in the content.

Aphid terminology in this paper generally follows Szelegiewicz (1963) and Qiao, Jiang & Zhang (2006). The unit of measurements in this paper is millimeters (mm).

The following abbreviations have been used in descriptions and table: Ant., antennae; Ant.I, Ant.II, Ant.III, Ant.IV, Ant.V, Ant.VI, and Ant.VIb, antennal segments I, II, III, IV, V, VI, and the base of segment VI, respectively; Ant.IIIBD, basal diameter of antennal segment III; PT, processus terminalis; URS, ultimate rostral segment; BW URS, basal width of ultimate rostral segment; MW hind tibia, mid-width of hind tibia; 2HT, second hind tarsal segment; SIPH, siphunculi; BW SIPH, basal width of siphunculus; DW SIPH, distal width of siphunculus; BW Cauda, basal width of cauda; GP, genital plate.

Ephedraphis Hille Ris Lambers

Ephedraphis Hille Ris Lambers, 1959: 279. Type-species *Anuraphis ephedrae* Nevsky, by original designation.

Ephedraphis Hille Ris Lambers: Szelegiewicz 1963:125; Eastop 1979: 384, 386; Remaudière & Remaudière 1997: 57; Qiao & Zhang 2002: 544; Qiao, Jiang & Zhang 2006: 105; Blackman & Eastop 2006: 1154.

Diagnosis. *Apterous viviparous female*: Body small, slender, 1.6–2.4 mm long and 1.0–1.3 mm wide. Median frontal tubercle and antennal tubercles developed, front shallowly “W-”shaped. Rostrum rostrate with microtrichia covering surface. First tarsal chaetotaxy 3, 3, 3. Antennae usually 6-segmented, processus terminalis longer, about 1.2–2.6 times as long as base of the segment. Siphunculi short to long cylindrical -shaped, about 1.3–2.3 times as long as cauda. Cauda usually short tongue-shaped, occasionally taper-shaped, rarely elongated, with 5–8 short setae on apex. Genital plate transversely oval, with 2–3 anterior setae and 8–27 posterior setae.

Alate viviparous female: Antennal segment III with 9–13 small and round secondary rhinaria, other segments without secondary rhinaria.

Remarks. This genus is related to *Aphis* Linnaeus, but differs in having rostrum rostrate bearing apical microtrichia, cauda usually short and small with sparse setae, and first tarsal chaetotaxy 3, 3, 3.

Distribution. Central Asia, East Asia, Middle East and Europe.

Host plants. *Ephedra* spp. (Ephedraceae), and *Haloxylon ammodendron* Bunge (Chenopodiaceae).

Key to species of *Ephedraphis*—apterous viviparous females

1. Cauda (Figures 16, 38) taper-shaped, distinctly elongated, 1.5–2 times as long as its basal width; siphunculi long, 1.4–1.6 times as long as cauda. *E. gobica*
- Cauda short tongue-shaped, slightly longer than a half of its basal width; siphunculi long, about 2 times as long as cauda . . . 2
2. Median frontal tubercle (Figures 3, 27) poorly developed, antennal tubercles slightly developed; abdominal tergite VIII with 2 setae. *E. ephedrae*
- Median frontal tubercle and antennal tubercles well developed; abdominal tergite VIII with 4–6 setae, occasionally 2 or 3. . . 3
3. Median frontal tubercle (Figures 43, 52) slightly higher than antennal tubercles; processus terminalis (Figure 54) 1.4–1.8 times as long as base of the segment; siphunculi (Figures 46, 59) short and small, only 1.1–1.6 times as long as their basal diameter, 1.3–1.9 times as long as cauda; genital plate (Figures 51, 61) with 8–12 posterior setae *E. mongolica* sp. n.
- Median frontal tubercle (Figures 21, 29) slightly lower than antennal tubercles; processus terminalis (Figure 32) 1.2–1.4 times as long as base of the segment; siphunculi long (Figures 24, 34) about 1.8–2.1 times as long as their basal diameter, 1.7–2.4 times as long as cauda; genital plate (Figures 26, 41) with 17–27 posterior setae *E. haloxylon*

Ephedraphis ephedrae (Nevsky)

(Figures 1–9, 27, 30, 33, 36, 39)

Anuraphis ephedrae Nevsky, 1929: 273.

Ephedraphis ephedrae (Nevsky): Hille Ris Lambers 1959: 279; Remaudière & Remaudière 1997: 57; Qiao, Jiang & Zhang 2006: 107; Blackman & Eastop 2006: 1154.

Diagnosis. *Apterous viviparous female*. Median frontal tubercle (Figures 3, 27) poorly developed, antennal tubercles slightly developed, slightly higher than median frontal tubercle. Processus terminalis (Figure 30) 1.6–1.8 times as long as base of segment. Siphunculi (Figures 6, 33) long cylindrical-shaped, 1.2–1.4 times as long as its basal diameter, apical width 0.3–0.4 times as long as basal width, 2–2.3 times as long as cauda. Cauda (Figures 7,

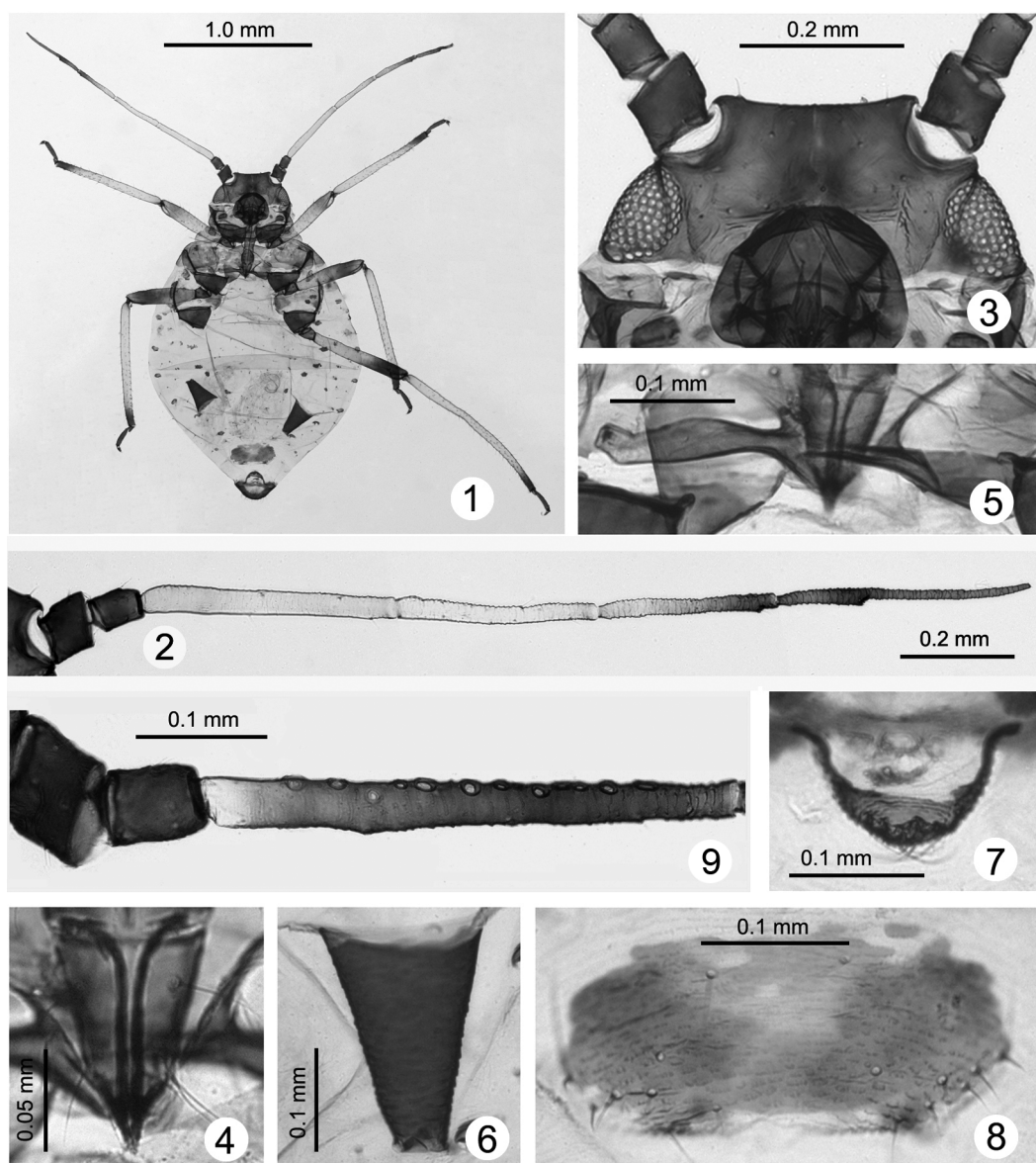
36) short tongue-shaped, constricted at base, 0.5–0.6 times as long as basal width. Genital plate (Figures 8, 39) with 12–14 posterior setae distributed in two groups on posterior margin.

Alate viviparous female. Antennal segment III (Figure 9) with 12–13 small and round secondary rhinaria, other segments without secondary rhinaria.

Specimens examined. PAKISTAN: Mariltan, altitude 2800 m, 1 alate viviparous female and 3 apterous viviparous females, on *Ephedra* sp., 14.viii.1991, coll. G. Remaudière.

Distribution. India, Iran, France, Kazakhstan, Spain, Tajikistan, Turkmenistan, Turkey, Ukraine and Uzbekistan (Map 1).

Remark. This is a very widely distributed species in the Palaearctic region (from western Europe to central Asia). *E. ephedrae* resembles *E. haloxylon* morphologically, but differs in having median frontal tubercle poorly developed (*E. haloxylon*: median frontal tubercle well developed); processus terminalis 1.6–1.8 times as long as base of the segment (*E. haloxylon*: 1.2–1.4 times); siphunculi 1.2–1.4 times as long as its basal diameter (*E. haloxylon*: 1.8–2.1 times) and genital plate with 12–14 posterior setae, and distributed in two groups on posterior margin (*E. haloxylon*: genital plate with 17–27 posterior setae, uniformly distributed on posterior margin).



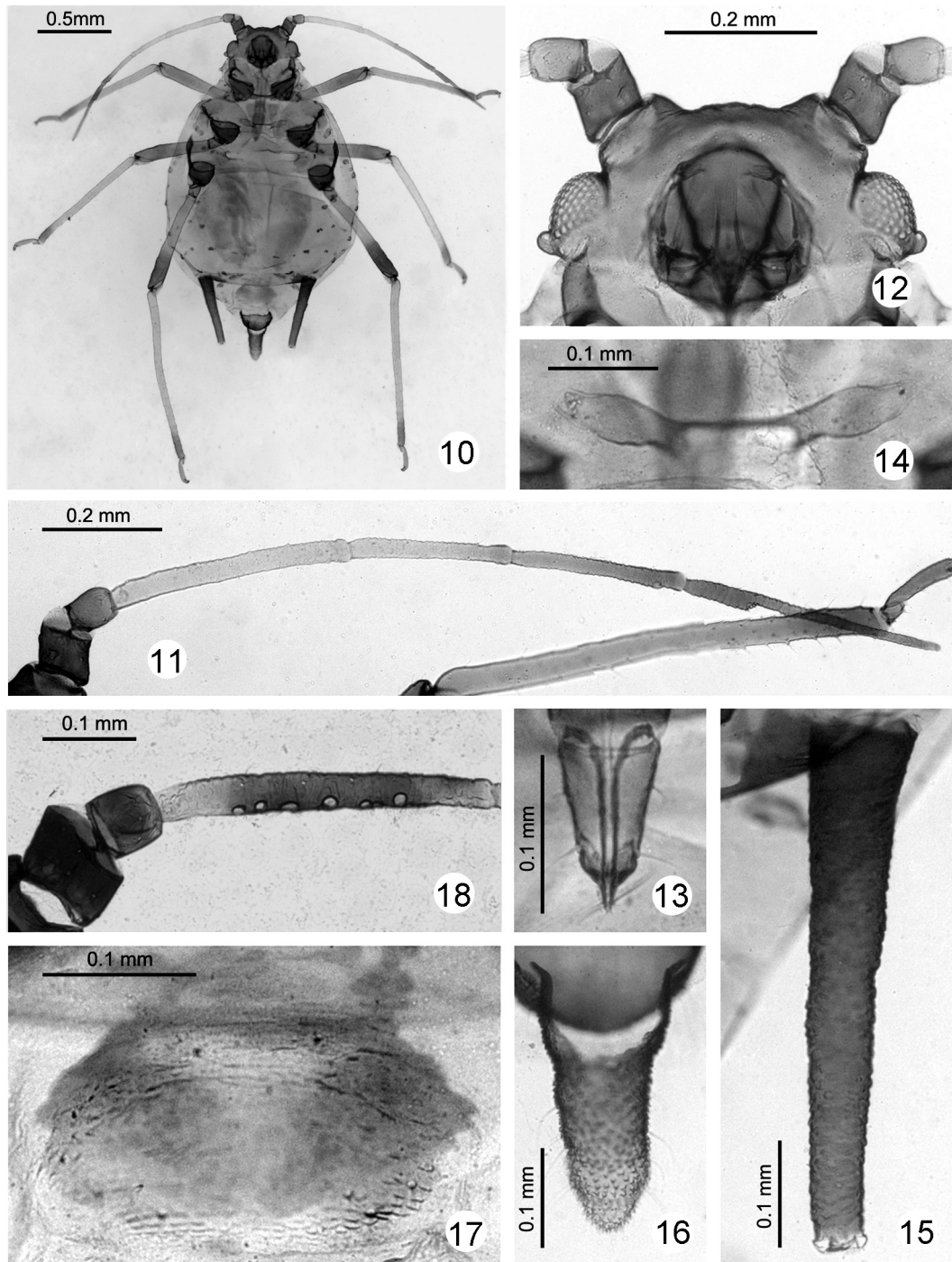
FIGURES 1–9. *Ephedraphis ephedrae*. Apterous viviparous female: 1. Body; 2. Antenna; 3. Dorsal view of head; 4. Ultimate rostral segment; 5. Mesosternal furca; 6. Siphunculus; 7. Cauda; 8. Genital plate; 16. Dorsal view of head; Alate viviparous female: 9. Antennal segments I–III.

Ephedraphis gobica Szelegiewicz

(Figures 10–18, 28, 31, 35, 38, 40)

Ephedraphis gobica Szelegiewicz, 1963: 125.

Ephedraphis gobica Szelegiewicz: Remaudière & Remaudière 1997: 57; Kadyrbekov 2002: 16; Qiao & Zhang 2002: 545; Qiao, Jiang & Zhang 2006: 105; Blackman & Eastop 2006: 1154.



FIGURES 10–18. *Ephedraphis gobica*. Apterous viviparous female: 10. Body; 11. Antenna; 12. Dorsal view of head; 13. Ultimate rostral segment; 14. Mesosternal furca; 15. Siphunculus; 16. Cauda; 17. Genital plate; Alate viviparous female: 18. Antennal segments I–III.

Diagnosis. *Apterous viviparous female.* Median frontal tubercle (Figures 12, 28) slightly developed, antennal tubercles well developed, slightly higher than median frontal tubercle. Processus terminalis (Figure 31) 2.5 times as

long as base of the segment. Siphunculi (Figures 15, 35) long, cylindrical, 4.7–5.1 times as long as its basal width, 1.41–1.61 times as long as cauda. Cauda (Figures 16, 38) elongated, finger-shaped, distal part stout, basal 1/3 slightly constricted, 1.6–1.7 times as long as its basal width.

Alate viviparous female. Antennal segment III (Figure 18) with 9–11 small and round secondary rhinaria, other segments without secondary rhinaria.

Specimens examined. CHINA, Ningxia: Yanchi, on *Ephedra sinica*, 4 alate viviparous females, 4 apterous viviparous females and 3 alate nymphs, No. Y8324, 20.v.1998, coll. C. X. Yang; on *Ephedra sinica*, Yinchuan, 2 alate viviparous females and 4 apterous viviparous females, No. Y8499, 12.vi.2001, coll. J. Chen, 5 apterous viviparous females and 1 alate viviparous female, No. Y8569, 20.v.2001, coll. Y. W. Chen.

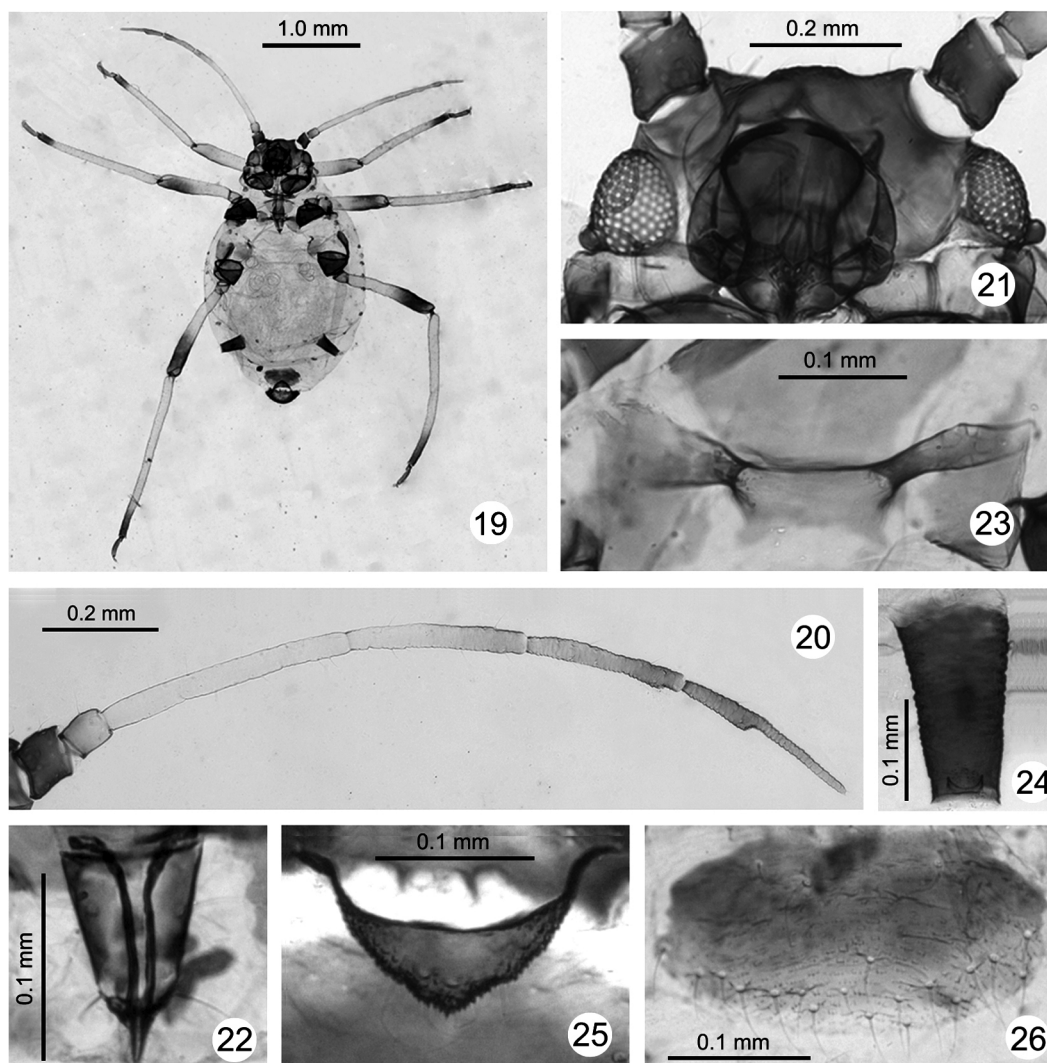
Distribution. China: Ningxia (Yanchi, Yinchuan), Xinjiang; Mongolia (Saynshand) (Map 1).

Remark. This species is distributed in Northern China and Mongolia. It can be distinguished from other species of *Ephedraphis* by the siphunculi and cauda strongly elongated, lateral margin of cauda with 8 long setae, and genital plate with sparse setae.

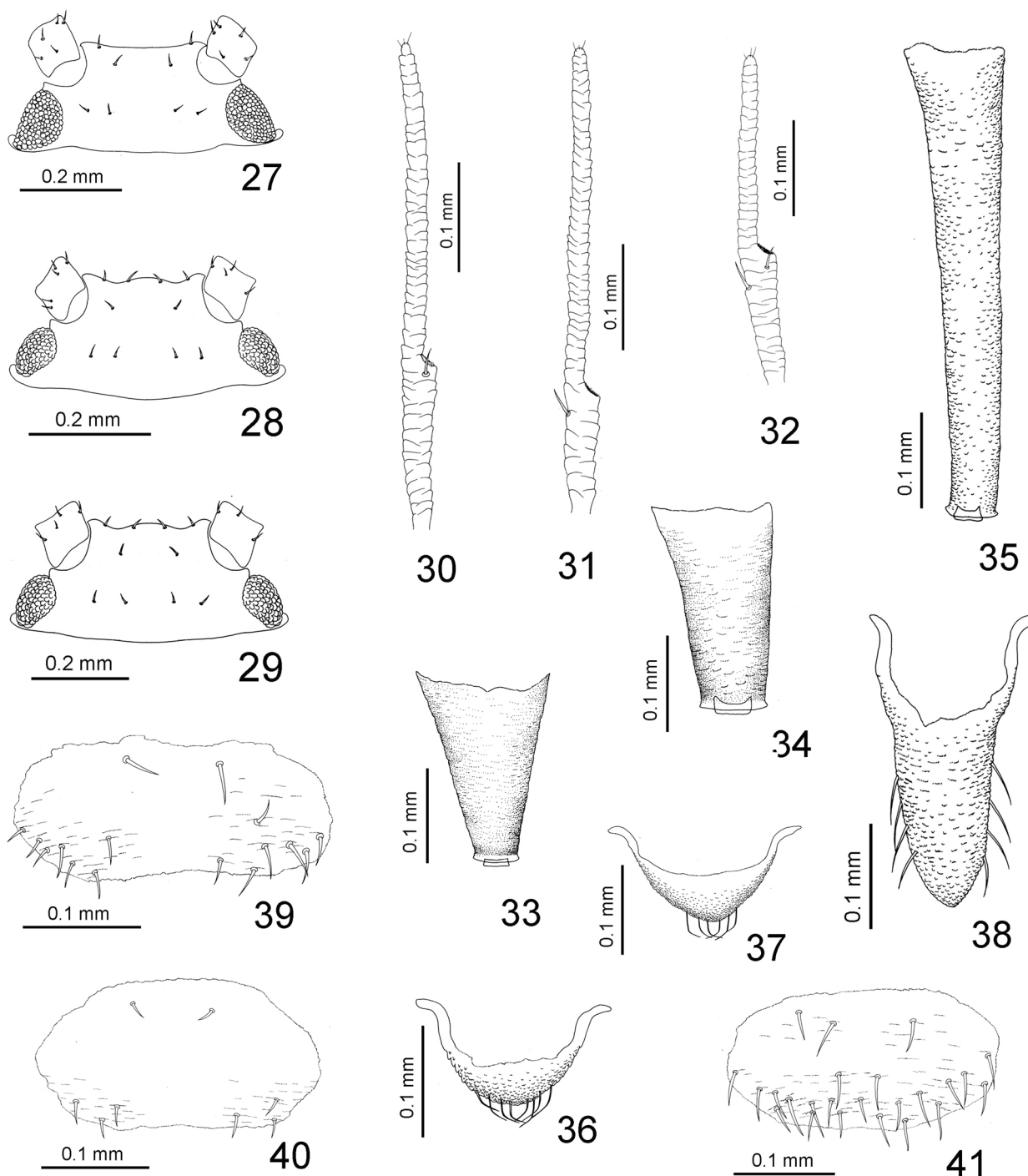
Ephedraphis haloxylon Qiao, Jiang & Zhang

(Figures 19–26, 29, 32, 34, 37, 41)

Ephedraphis haloxylon Qiao, Jiang & Zhang, 2006: 107.



FIGURES 19–26. *Ephedraphis haloxylon*. Apterous viviparous female: 19. Body; 20. Antenna; 21. Dorsal view of head; 22. Ultimate rostral segment; 23. Mesosternal furca; 24. Siphunculus; 25. Cauda; 26. Genital plate.



FIGURES 27–41. Apterous viviparous female: 27–29. Dorsal view of head; 30–32. Processus terminalis, 33–35. Siphunculus, 36–38 Cauda, 39–41, Genital plate. *Ephedraphis ephedrae*: 27, 30, 33, 36, 39; *Ephedraphis gobica*: 28, 31, 35, 38, 40; *Ephedraphis haloxylon*: 29, 32, 34, 37, 41.

Diagnosis. Median frontal tubercle (Figures 21, 29) slightly developed, antennal tubercles developed, slightly higher than median frontal tubercle. Processus terminalis (Figure 32) 1.2–1.4 times as long as base of the segment. Abdominal tergite VIII with 4–6 setae. Siphunculus (Figures 24, 34) 1.8–2.1 times as long as its basal diameter, 1.7–2.4 times as long as cauda; genital plate (Figures 26, 41) with 18–22 posterior setae, uniformly distributed on posterior margin.

Specimens examined. CHINA, Qinghai: Dagur, 7 apterous viviparous female and 2 apterous nymphs No. 11411-1-1-2, 10.vi.1997, on *Haloxylon ammodendron* (Chenopodiaceae), coll. X. L. Chen; on *Haloxylon ammodendron*, Golmud, 3 apterous viviparous females and 4 nymphs, No. 11418, 17.vi.1997, coll. X. L. Chen.

Distribution. China: Qinghai (Dagur, Golmud) (Map 1).

Remark. *E. haloxylon* is similar to *E. mongolica* sp. n., but can easily be distinguished by characters given in the above key.

***Ephedraphis mongolica* sp. n.**

(Figures 42–61, 64)

Description. *Apterous viviparous female.* **Color.** Body (Figure 64) dark to black brown in life. Mounted specimens: body pale. Dorsum of head brown. Antennal segments I–II dark brown, distal half of segments III–V and the base of segment VI brown, others pale. Pronotum pale, marginal tubercles pale brown. Mesosternal furca brown. Legs with trochanters, distal 1/2–2/3 of femora, distal 1/5 –1/3 of tibiae, and tarsi brown, other parts pale. Second tarsal segments with transverse imbrications. Dorsum of abdomen pale. Spiracles pale brown, spiracular plates brown. Siphunculi, cauda, anal plate and genital plate brown. For morphometric data see Table 1.

TABLE 1. Biometric data (mean, range and standard deviation) of *Ephedraphis mongolica* sp. n. (Apterous viviparous females in mm).

Part (for abbreviations see Materials and Methods)		Apterous viviparous females <i>n</i> = 13		
		Mean	Range	STDEV
Length (mm)	Body length	1.64	1.56–1.70	0.041
	Body width	1.04	1.02–1.05	0.009
	Antenna	1.25	1.17–1.30	0.041
	Ant.I	0.07	0.07–0.08	0.003
	Ant.II	0.06	0.06–0.07	0.001
	Ant.III	0.32	0.29–0.34	0.018
	Ant.IV	0.24	0.22–0.27	0.018
	Ant.V	0.22	0.20–0.24	0.013
	Ant.VIb	0.13	0.12–0.14	0.005
	PT	0.21	0.19–0.21	0.007
	Length of setae on Ant. III	0.02	0.017–0.02	0.001
	Ant.IIIBD	0.04	0.03–0.04	0.002
	URS	0.10	0.09–0.10	0.003
	BW URS	0.06	0.05–0.06	0.003
	Hind femur	0.50	0.44–0.54	0.027
	Hind tibia	0.85	0.75–0.91	0.048
	MW hind tibia	0.04	0.04–0.05	0.002
	2HT	0.13	0.12–0.15	0.035
	Length of setae on hind tibia	0.03	0.03–0.04	0.003
	SIPH	0.11	0.08–0.12	0.012
	BW SIPH	0.08	0.07–0.10	0.015
	DW SIPH	0.05	0.05–0.06	0.002
	Cauda	0.06	0.06–0.07	0.003
	BW cauda	0.13	0.12–0.14	0.005
	Length of cephalic setae	0.04	0.03–0.04	0.003
	Length of marginal setae on tergum I	0.04	0.03–0.04	0.004
	Dorsal setae on tergum VIII	0.04	0.04–0.05	0.002

.....continued on the next page

TABLE 1. (Continued)

Part (for abbreviations see Materials and Methods)		Apterous viviparous females $n = 13$		
		Mean	Range	STDEV
Ratios	Antenna/Body	0.76	0.71–0.83	0.034
	Hind femur/Ant.III	1.57	1.46–1.67	0.077
	Hind tibia/Body	0.49	0.44–0.54	0.028
	PT/Ant.VIb	1.60	1.41–1.77	0.098
	URS/BW URS	1.65	1.46–1.82	0.127
	URS/2HT	0.72	0.67–0.76	0.038
	SIPH/Body	0.07	0.05–0.07	0.007
	SIPH/Cauda	1.61	1.29–1.85	0.179
	SIPH/BW SIPH	1.29	1.09–1.55	0.143
	Cauda/BW Cauda	0.51	0.46–0.59	0.035
	Length of setae on Ant. III/Ant.IIIBD	0.56	0.50–0.65	0.042
	Cephalic setae/Ant.IIIWD	1.12	0.91–1.32	0.136
	Marginal setae on Tergum I/Ant.IIIBD	1.06	0.83–1.32	0.118
	Dorsal setae on Tergum VIII/Ant.IIIBD	0.87	0.67–0.98	0.083
	Setae on hind tibia/MW hind tibia	0.84	0.63–0.97	0.107
PT/SIPH	1.98	1.89–2.17	0.074	

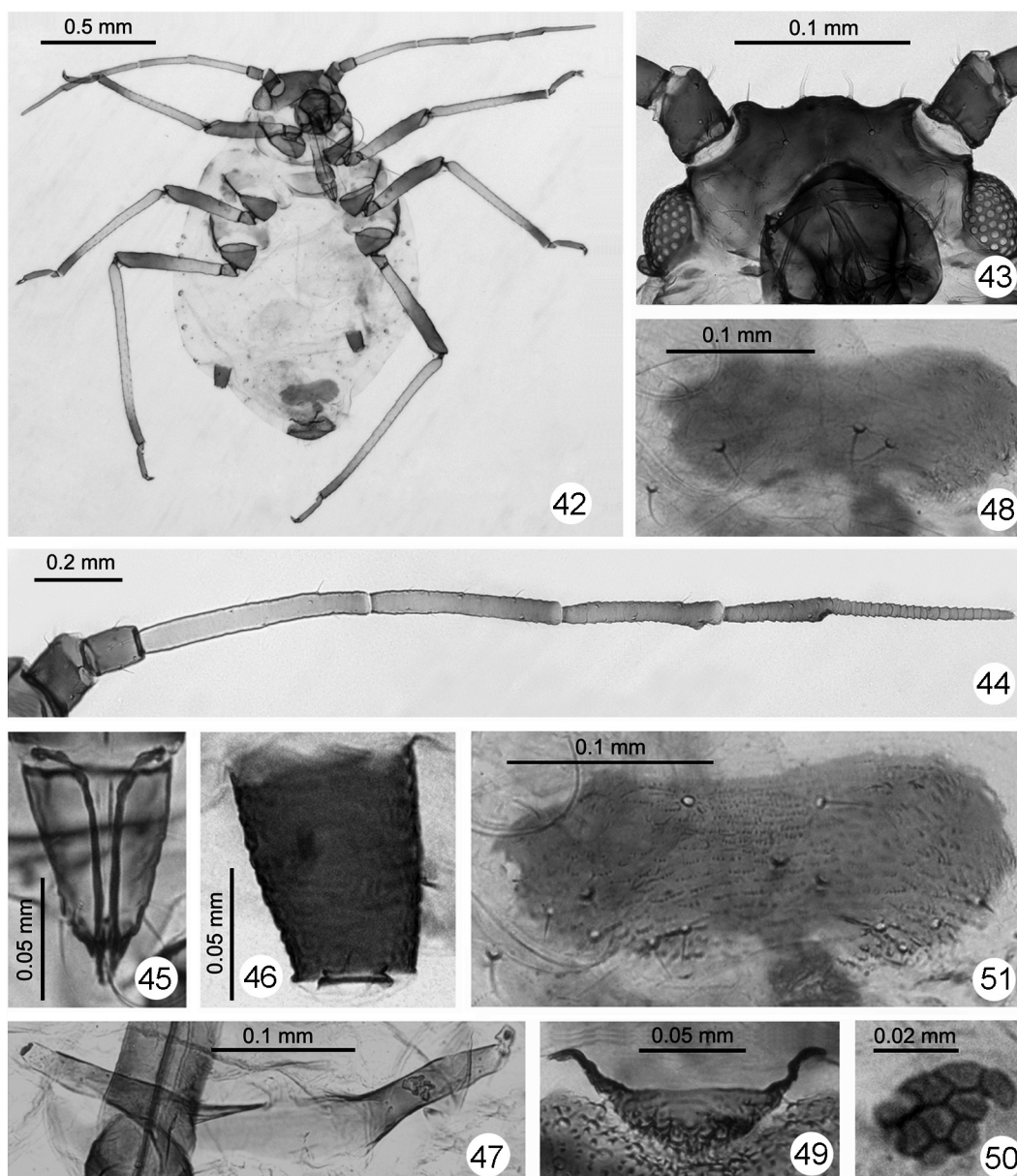
Head. Smooth dorsally, median frontal tubercle (Figure 43, 52) developed, slightly higher than antennal tubercles; head with 2 pairs of cephalic setae, 1 pair of dorsal setae between antennae, and 2 pairs of dorsal setae between eyes. Dorsal setae of body long and pointed, slightly longer than ventral setae. Antennae 6-segmented (Figures 44, 53, 54), segments III–IV with weak imbrications, segments V–VI with distinctly transverse imbrications; 0.71–0.83 times as long as body; length in proportion of segments I–VI: 14: 13: 64: 48: 44: 26 + 41, respectively. Antennal setae long and pointed, segments I–VI each with 4–5, 3–4, 6–7, 5–7, 4–5, 2–3+2, respectively, apex of processus terminalis with 3 or 4 setae. Rostrum (Figure 42) reaching mid-coxae; ultimate rostral segment (Figures 45, 55) thick wedge shaped, apical microsensillae placed laterally on a very acute beak-like processus; ultimate rostral segment 1.5–1.8 times as long as its basal width, 0.7–0.8 times as long as second hind tarsal segment, with 3 pairs of primary setae, and 1 pair of accessory setae.

Thorax. Pronotum with 2 pairs of spinal and 1 pair of marginal setae, respectively. Mesosternal furca with a long stem. Hind femur 1.5–1.7 times as long as antennal segment III. Hind tibia 0.44–0.54 times as long as body. Setae on tibia long and point, length of setae on hind tibiae slightly longer than middle diameter of the segment. First tarsal chaetotaxy 3, 3, 3.

Abdomen. Abdominal tergites VII–VIII with spinulose transverse stripes. Dorsal setae of abdomen long and pointed, marginal setae with large scleroites. Abdominal tergites I, V–VII each with 1 pair of spinal and 1 pair of marginal setae, respectively; tergites II–IV each with 1 pair of spinal and 2 pairs of marginal setae, respectively; tergite VIII with 4 setae, occasionally 2 or 3. Marginal setae on tergite I 0.8–1.3 times as long as basal diameter of antennal segment III, dorsal setae on tergite VIII 0.7–1 times as long as basal diameter of antennal segment III. Spiracles round, closed; spiracular plates oval. Siphunculi (Figures 46, 59) short, cylindrical-shaped, with weak imbrications, 1.1–1.6 times as long as its basal width, 1.3–1.9 times as long as cauda. Cauda (Figures 49, 60) short, tongue-shaped, constricted at base, 0.5–0.6 times as long as basal width, with 6–8 long curved setae. Anal plate semi-circular, with 31–40 setae. Genital plate (Figures 51, 61) transversely oval, with 2 anterior setae, 8–12 posterior setae along margin and uniformly distributed.

Specimens examined. Holotype: apterous viviparous female, **MONGOLIA:** Umnogovi Province, Gurbantes (43.17529°N, 102.17463°E), altitude 1800 m, 28.viii.2012, No. 28899-1-1, on *Ephedra* sp., coll. B. Zhang.

Paratypes: 12 apterous viviparous females, the same data as holotype.



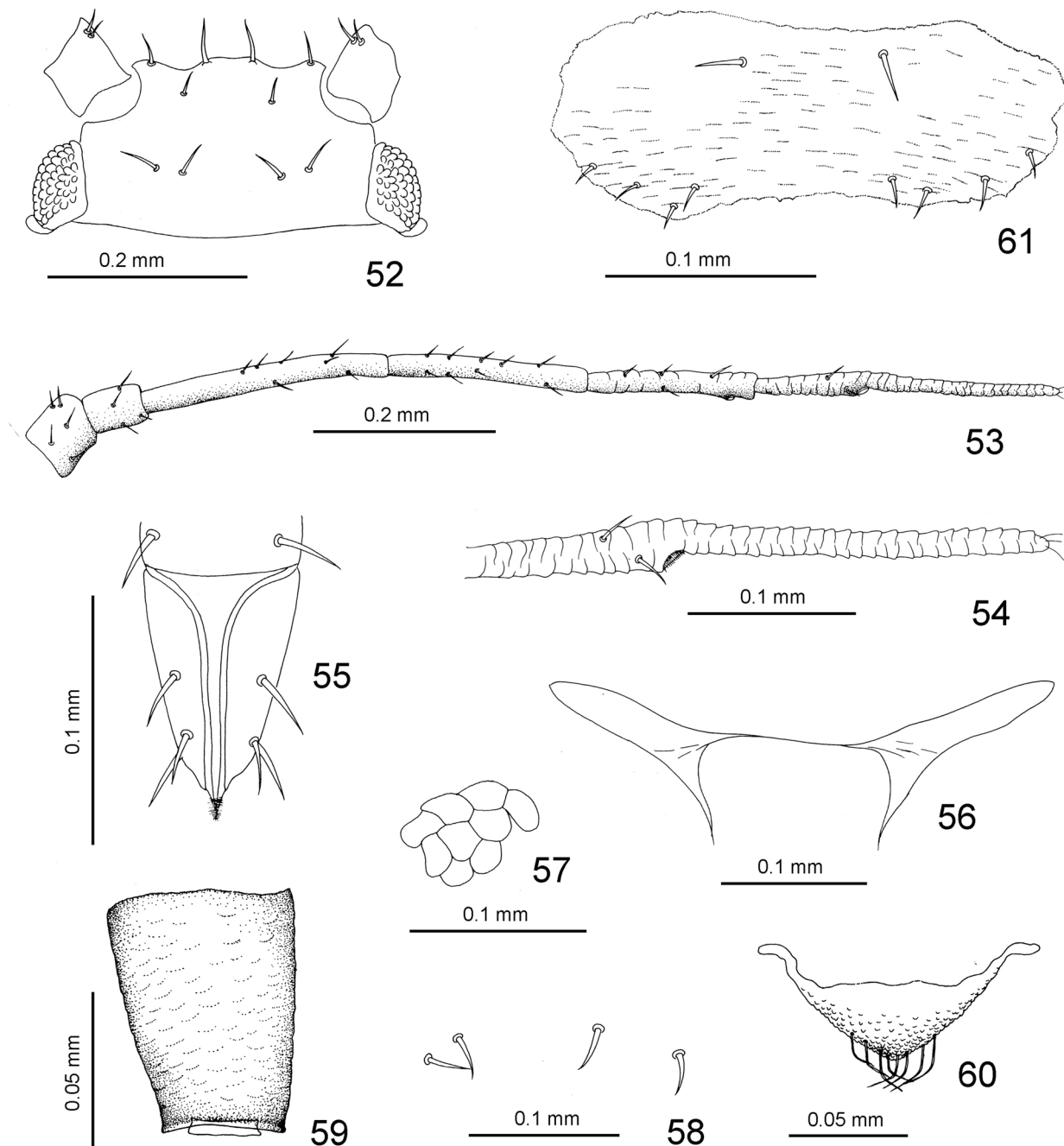
FIGURES 42–51. *Ephedraphis mongolica* sp. n. Apterous viviparous female: 42. Body; 43. Dorsal view of head; 44. Antenna; 45. Ultimate rostral segment; 46. Siphunculus; 47. Mesosternal furca; 48. Dorsal setae on abdominal tergite VIII; 49. Cauda; 50. Intersegmental sclerite; 51. Genital plate.

Biology. The species was collected from the stalks of *Ephedra* sp. (Ephedraceae) in a dry environment (Figures 63–64). Body dark brown in life, and the body dorsum of apterous viviparous female is densely covered with white transverse wax stripes. Not attended by ants.

Distribution. Mongolia (Umnogovi) (Map 1).

Etymology. The species is named after its type locality.

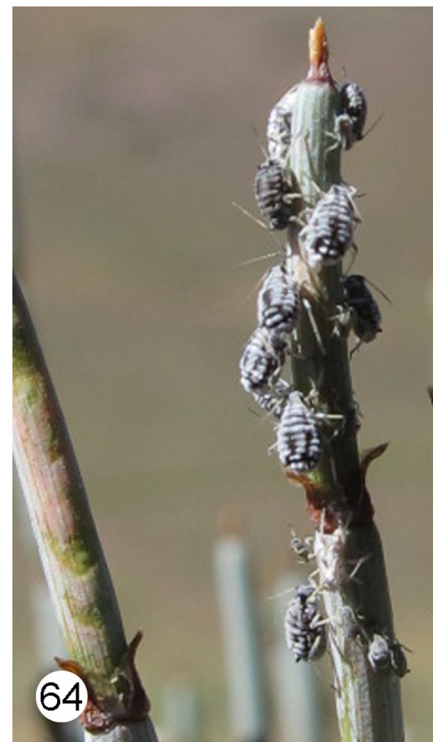
Remark. *E. mongolica* sp. n. shares similar characters with *E. ephedrae* and *E. haloxyton* on the rostrate rostrum and short cauda, but differs from *E. ephedrae* in the following respects: median frontal tubercle developed, and slightly higher than antennal tubercles (*E. ephedrae*: poorly developed, nearly straight); siphunculus short, only 0.08–0.12 mm long (*E. ephedrae*: 0.18–0.20). It differs from *E. haloxyton* in: median frontal tubercle slightly higher than antennal tubercles, processus terminalis 1.4–1.8 times as long as base of the segment (*E. haloxyton*: 1.2–1.4 times); genital plate with 8–12 posterior setae (*E. haloxyton*: with 18–22 posterior setae); siphunculi 1.3–1.9 times as long as cauda (*E. haloxyton*: 1.7–2.3 times).



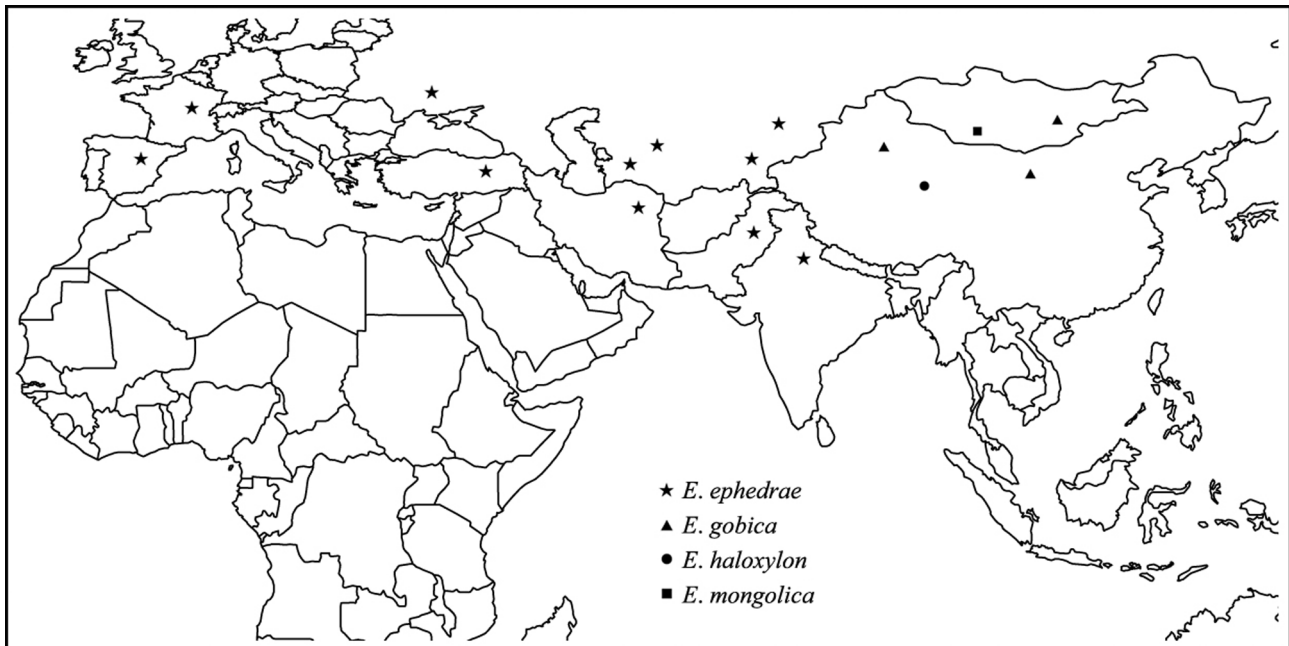
FIGURES 52–61. *Ephedraphis mongolica* sp. n. Apterous viviparous female: 52. Dorsal view of head; 53. Antenna; 54. Processus terminalis; 55. Ultimate rostral segment; 56. Mesosternal furca; 57. Intersegmental sclerite; 58. Dorsal setae on abdominal tergite VIII; 59. Siphunculus; 60. Cauda; 61. Genital plate.

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FIGURES 62–64. 62. The habitats of *Ephedraphis mongolica*; 63. Host plant of *Ephedraphis mongolica* **sp. n.**: *Ephedra* sp. (Ephedraceae); 64. Colony of *Ephedraphis mongolica* **sp. n.**



MAP 1. Geographical distribution of four species in the genus *Ephedraphis*.

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