



## **SEPEDON LATREILLE, 1804 (DIPTERA, SCIOMYZIDAE): REVIEW OF ASIAN FAUNA AND NOTES ON TAXONOMY OF ASIAN AND NEARCTIC SPECIES**

## **SEPEDON LATREILLE, 1804 (DIPTERA, SCIOMYZIDAE): PRZEGLĄD FAUNY AZJI Z UWAGAMI TAKSONOMICZNYMI NA TEMAT AZJATYCKICH I NEARKTYCZNYCH GATUNKÓW**

DOI: 10.5281/zenodo.3252595

<http://zoobank.org/References/42362F51-0D7A-476A-8032-D2F0B1D92D92>

NIKITA VIKHREV<sup>1</sup>, MARIA YANBULAT

<sup>1</sup> Zoological Museum of Moscow University,  
Bolshaya Nikitskaya 2, Moscow 125009, Russia,  
e-mail: nikita6510@ya.ru

**ABSTRACT.** A revised key for Asian species of *Sepedon* is presented. Taxonomic problems discussed include: 1) suitability of the shape of the internal genitalia (hypandrium and aedeagus) as a diagnostic character, 2) colour variability boundaries in *Sepedon*, and 3) general approaches to species delimitation. Following new synonymies are proposed: *Sepedon neanias* HENDEL, 1913 = *S. noteoi* STEYSKAL, 1980, Syn. nov. and *Sepedon tenuicornis* CRESSON, 1920 = *S. gracilicornis* ORTH, 1986, Syn. nov. The taxonomic status of *Sepedon aenescens* WIEDEMANN, 1830 is discussed and the species is downgraded to subspecies rank as *Sepedon sphegea aenescens* WIEDEMANN, 1830. A new hypothesis on the taxonomy of Nearctic *Sepedon* that contradicts the generally accepted point of view has been proposed.

**KEY WORDS:** Diptera, Sciomyzidae, *Sepedon*, taxonomy, new synonymies, key, Asia, Nearctic Region

## **INTRODUCTION**

While most species of Sciomyzidae [541 species in 63 genera in the world (LI *et al.*, in press)] prefer regions with a temperate to cold climate, the natural habitat of species of the genus *Sepedon* LATREILLE, 1804 is more diverse. They occur in suitable habitat from tropical lowlands to north of the taiga. *Sepedon* flies have a very predictable behavior and are easy to collect. Usually they are found sitting on the grass that surrounds or is emerging from small

lentic water bodies: ponds, lakes, inundated meadows, and rice fields. Because entomologists have been collecting them for more than 150 years, we suppose it possible that no additional species of *Sepedon* will be found in Asia.

The primary studies of Asian *Sepedon* species include those YANO (1978); KNUTSON & ORTH (1984); ELBERG *et al.* (2009); ROZKOŠNÝ *et al.* (2010); LI & YANG (2017). Drawings of genitalia of Asian *Sepedon* were presented in: YANO (1978), KNUTSON & ORTH (1984), ELBERG *et al.* (2009), and ROZKOŠNÝ *et al.* (2010), and photos in: KNUTSON & ORTH (1984) and LI & YANG (2017).

We believe it is time to summarize the data on the Asian *Sepedon* fauna. Initially this task seemed an easy one because of the recent publication on Chinese *Sepedon* (LI & YANG 2017) in which all Asian species (except for one species, *S. hecate*, not recorded from China) were adequately considered and illustrated with detailed photos. [For that reason we present here only those illustrations necessary for understanding the text; we do not include images of such easily identified species as *S. lobifera* and *S. spegea*, which already were illustrated by LI & YANG (2017)].

We initially planned to publish a short paper in which we would 1) include *S. hecate*, 2) provide new records, 3) revise the key to species, and 4) try to resolve several minor taxonomic problems. This data is presented in **Part 1.1** of the present paper. However, the northeast Asian species of *Sepedon* posed three problems for us:

- 1) Which species inhabits northeastern Asia, *S. spinipes* or *S. americana*?
- 2) How can Asian *S. hecate* be distinguished from related Nearctic species?
- 3) How can eastern Asian *S. neanias* and *S. noteoi* be distinguished?

In the extensive literature on northern Asian and Nearctic *Sepedon*, the taxonomy is based largely upon the fine structure of the internal genitalia of males. In our research we tried to apply the characters used by the major authors, but we found that identification made on the basis of the internal genitalia often was irreproducible and unreliable. We discuss our reasons and conclusions in **Part 1.2**.

We also came to a hypothesis on taxonomy of Nearctic *Sepedon* which entirely contradicts the generally accepted point of view. We suppose that all species of N American *Sepedon* described after CRESSON (1920) are groundless and should be synonymized. The taxonomy of Nearctic *Sepedon* is discussed in **Part 2** of this paper.

## MATERIAL AND METHODS

The specimens examined during this study are deposited in the Zoological Museum of Moscow University, Russia (ZMUM) and the Zoological Institute, St. Petersburg, Russia (ZIN).

Localities (where possible) are given in the following order: country, region, locality, and geographical coordinates (in decimal-degree format).

The following abbreviations for morphological structures are used: *f1*, *t1*, *f2*, *t2*, *f3*, *t3* = fore-, mid-, hind femur or tibia; *dc* = dorsocentral setae. The abbreviation for the tarsi as *tar* followed by a pair of digits separated by a hyphen was proposed by VIKHREV (2011): the first digit (1–3) indicates the leg number and the second digit (1–5) the number of the tarsal segment. For example, *tar2-4* = 4th segment of midtarsus; *tar3-1* = hind basitarsus. The illustrations are original unless otherwise indicated.

**PART 1.1.**  
**REVIEW OF ASIAN *SEPEDON***

***Sepedon ferruginosa* WIEDEMANN, 1824**

(Figs. 6, 33–34)

**MATERIAL EXAMINED:**

**INDIA:** *Andhra Pradesh* st.: Samalkot env., pasture-garden, 16.99°N 82.27°E, K. Tomkovich, 30–31.01.2014, 1♂; Bapatla env., freshwater pond, 15.92°N 80.47°E, K. Tomkovich, 19.10.2014, 1♂; *Orissa* st., Chilika Lake, 19.681°N 85.183°E, K. Tomkovich, 4–9.02.2014, 2♂ (all ZMUM).

**THAILAND:** *Chonburi* prov., Jomtien env., 12.87°N 100.90°E: N. Vikhrev, 14.11.2006, 1♂, 4♀; 17.11.2006, 2♂, 3♀; 25.11.2006, 1♀; 26.11.2006, 1♂; 14.12.2008, 1♂; 30.11.2011, 1♂; A. Ozerov, 17.11.2006, 1♂; 26.11.2006, 1♀ (all ZMUM).

**DISTRIBUTION.** Reliably known from western India to Hainan Island. The northernmost records are from 25°N.

***Sepedon hecate* ELBERG, ROZKOŠNÝ & KNUTSON, 2009**

(Figs. 3, 15, 18–24)

**MATERIAL EXAMINED:**

**PARATYPES** *S. hecate*: **RUSSIA:** *Amur* reg., Zeya (53.7°N 127.2°E), A. Shatalkin: 16.07.1981, 1♀; 12–13.09.1981, 2♂, 5♀ (all ZMUM); 40 km W of Svobodny, Klimoutsy (51.46°N 127.59°E), A. Zinovjev, 27.07.1958, 1♂; *Khabarovsk* reg., P. Osipenko vill. (52.4°N 136.5°E), K. Elberg, 29.07.1973, 1♂; *Magadan* reg., Seimchan (62.9°N 152.4°E), K. Elberg, 16.08.1972, 1♀ (all ZIN).

**OTHER MATERIAL EXAMINED:**

**MONGOLIA:** *Khentii* prov., Bayan-Ardaga (≈48.57°N, 111.06°E), E. Narchuk, 26.07.1975, 2♀ (ZIN);

**RUSSIA:** *Amur* reg., Zeya (53.7°N 127.2°E), A. Shatalkin: 12.09.1981, 1♀ (ZMUM); *Khabarovsk* reg., Bikin env., 15 km north to Bikin (≈46.98°N 134.33°E), A. Zinovjev, 1.06.1983, 1♂, 1♀ (ZIN); *Novosibirsk* reg., Academy town, 54.8°N 83.1°E, O. Kosterin, 18.06.2009, 1♂; *Primorsky* reg., Kedrovaya Pad Nat. Res., Primorsky cordon, 43.05°N 131.33°E, I. Gomyranov, 29.07 — 1.08.2013, 1♂ (all ZMUM); *Sakha (Yakutia)* reg.: 9 km W of Zyryanka (65.7°N 150.7°E), lake shore, K. Gorodkov, 10.07.1974, 1♂, 1♀; Verkhoyansk distr., Stolby env., Yana R. (≈67.54°N 134.09°E), A. Ovchinnikov, 28.07.2008, 1♂, 1♀ (all ZIN).

**DISTRIBUTION.** An uncommon eastern Palaearctic species. Known from Russia (Far East and Siberia) and Mongolia. Seems to be the northernmost distributed species of *Sepedon*, known from 68°N to 43°N. There is a single European record from Germany (Upper Bavaria); a check of Scandinavian material might reveal more specimens. Jere Kahanpaa (pers. comm.) kindly checked more than 200 specimens of yellow *Sepedon* collected in Finland and stored in the Finnish Museum of Natural History (Helsinki), all specimens appeared to be *S. spinipes*.

*Sepedon lobifera* HENDEL, 1911

**MATERIAL EXAMINED:**

**INDIA:** *Uttarakhand* st.: 30.31°N 78.34°E, 1040 m, K. Tomkovich, 3–5.05.2012, 3♂ 2♀; Haridwar env., 29.95°N 78.18°E, 322 m, K. Tomkovich, 7–9.05.2012, 1♂ (all ZMUM);  
**THAILAND:** *Mae Hong Son* prov., Pai env., 19.36°N 98.47°E, 560–600 m, stream-forest, O. Mosolov, 28.04–08.05.2013, 1♀ (ZMUM);  
**VIETNAM:** *Láo Cai* prov., Sapa env.: 22.33°N 103.83°E, 1284 m, A. Ozerov, 09.04.2012, 1♂; 22.31°N 103.88°E, 1000 m, N. Vikhrev, 21.03.2019, 3♂ 3♀; *Lai Châu* prov., 10 km WNW of Sapa, 22.37°N 103.76°E, 1810 m: A. Ozerov, 26.05.2014, 1♂, 1♀; 1788 m, D. Gavryushin, 26.05.2014, 1♂ (all ZMUM).

**DISTRIBUTION.** From Pakistan in the west to Hainan Island in the east. Very narrow latitudinal distribution from 30°N to 19°N, that is southern slope of the Tibetan highland.

*Sepedon neanias* HENDEL, 1913

(Figs. 2, 7–8)

*Sepedon noteoi* STEYSKAL, 1980 (ROZKOŠNÝ *et al.* 2010)

*Sepedon oriens* STEYSKAL, 1980, **Syn. nov.**

**MATERIAL EXAMINED:**

**JAPAN:** Honshu isl.: *Fukushima* pref., Asakawa, 37.08°N 140.42°E, Zhenzhurist, 25.09.1933, 1♂ (ZMUM); *Gifu* pref., Gifu (≈35.42°N 136.77°E), V. Tanasiychuk: 13.10.1981, 1♀; 26.10.1981, 2♂; 12.11.1981, 1♂ (ZIN);  
**RUSSIA:** *Khabarovsky* reg.: Khabarovsk, 48.6°N 135.1°E, N. Vikhrev: 2–6.06.2014, 1♀; 13.06.2014, 2♂, 1♀; Lidoga env., 49.45°N 136.78°E, N. Vikhrev, 7.06.2014, 1♂ (all ZMUM); *Primorsky* reg.: Anuchino, 43.95°N 133.05°E, N. Vikhrev, 20–21.06.2014, 2♀; Khanka L., 45.06°N 131.99°E, N. Vikhrev: 15–19.06.2014, 1♂; 4–6.07.2014, 2♂, 1♀; Kedrovaya Pad Nat. Res., 43.1°N 131.5°E, S. Churkin, 5.09.1924, 1♀; Lotos L., 42.46°N 130.64°E, N. Vikhrev, 1–3.07.2014, 3♂, 1♀; Gornye Klyuchi, 45.25°N 133.50°E, N. Vikhrev, 6–7.07.2014, 1♀; Kamenushka: 43.6°N 132.2°E: A. Antropov, 25.08.1990, 1♂; A. Ozerov: 6–13.08.1983, 2♀; 7.07.1984, 1♂; A. Shatalkin: 12.06.1984, 1♀; 3–4.09.1987, 2♀; 13.09.1987, 1♂; 4.06.1989, 1♂ (all ZMUM); S. Belokobylsky, 9.09.1989, 1♀ (ZIN);  
**VIETNAM:** *Láo Cai* prov., Sapa env.: 22.341°N 103.851°E, 1525 m, A. Ozerov: 29.03.2011, 1♂; 4.04.2011, 1♀; 9.04.2012, 1♂; 22.31°N 103.88°E, 1000 m, N. Vikhrev, 21.03.2019, 7♂ 4♀ (all ZMUM).

**DISTRIBUTION.** Eastern Asian species. From northern Vietnam (22°N) in the south to the Khabarovsk region (49°N) in the north. This species inhabits Taiwan, the Philippines, and the Japanese islands. The easternmost record is from Yunnan Province, 100°E (LI & YANG 2017).

***Sepedon plumbella* WIEDEMANN, 1830**

(Figs. 31–32)

**MATERIAL EXAMINED:**

**AUSTRALIA:** *QLD* st., Gladstone env., 23.82°S 151.15°E, N. Vikhrev, 26–27.01.2013, 1♂, 1♀ (ZMUM);

**INDIA:** *Goa* st., Calangute, 15.57°N 73.75°E, N. Vikhrev, 17–21.01.2008, 5♂, 5♀ (ZMUM);

**INDONESIA:** *Aceh* prov., Sumatra Isl., Alas R., 3.68°N 97.65°E, V. Melnik, 1–7.12.2014, 1♂; *Bali* prov.: Sanur beach env., 8.70°S 115.26°E, O. Kosterin, 15–19.02.2014, 1♂; D'Sawah Villa, 8.609°S 115.087°E, N. Vikhrev, 11–16.12.2016, 1♂, 2♀; Buyan L., 8.24°S 115.14°E, 1220 m, N. Vikhrev, 27.12.2016, 1♂, 2♀; Badung, Mengwi, Desa Sembung, 8.478°S 115.181°E, 270 m, D. Gavryushin, 17.08.2018, 1♀; Tabanan, Kediri, Pantai Kedungu env., 8.608°S 115.083°E, D. Gavryushin, 31.08.2018, 1♂, 3♀; *Papua* prov., New Guinea: Merauke env., 8.55°S 140.43°E, N. Vikhrev, 9–15.12.2014, 5♂, 1♀; Wamena env., 4.17°S 138.99°E, 1700 m, N. Vikhrev, 5–9.12.2017, 5♂, 4♀ (all ZMUM);

**PHILIPPINES:** *Laguna* prov., Luson Isl., Los Baños env. (≈14.14°N 121.20°E), 02.1914, 1♂ (ZMUM);

**THAILAND:** *Chonburi* prov., Jomtien, 12.87°N 100.90°E: A. Ozerov: 14.11.2006, 1♀; 17.11.2006, 1♀; 26.11.2006, 1♂, 1♀; N. Vikhrev, 25.11.2006, 1♂; *Kanchanaburi* prov., Sai Yok NP, 14.44°N 98.86°E, N. Vikhrev, 1–4.02.2014, 4♀; *Mae Hong Son* prov., Pai env., 580–600 m, stream-forest, 19.363°N 98.466°E, O. Mosolov, 28.04–8.05.2013, 1♀; *Phuket* prov., 8.088°N 98.302°E, N. Vikhrev: 14–17.02.2009, 1♂, 1♀; 21–26.02.2009, 2♂, 2♀; 30.11.2011, 1♂ (all ZMUM).

**DISTRIBUTION.** Widespread from western India to eastern Australia. The highest latitude records are from 25°N or 25°S.

***Sepedon senex* WIEDEMANN, 1830**

(Fig. 5)

**MATERIAL EXAMINED:**

**CAMBODIA:** *Siem Peap* prov.: Beng Mealea env., 13.475°N 104.23°E, N. Priydak, O. Kosterin, 27.02.2017, 1♂; *Siem Peap* env., 13.3°N 103.8°E, N. Priydak, O. Kosterin, 21–28.02.2017, 2♂ (all ZMUM);

**CHINA:** *Guandong* prov.: Tsisin'yan' (≈23°N 113°E), 29.11.1959, B. Rodendorf, 5♂, 7♀; Ven'tsuan' (≈23°N 113°E), 1.12.1959, B. Rodendorf, 1♂, 5♀ (all ZIN);

**MALAYSIA:** *Pahang* st., Temerloh, 3.46°N 102.42°E, N. Vikhrev, 25–30.11.2014, 2♂ (ZMUM);

**MYANMAR:** *Shan* st., Nyaungshwe env., 20.66°N 96.96°E, N. Vikhrev, 26–30.11.2009, 1♂ (ZMUM);

**THAILAND:** *Chanthaburi* prov., Khao-Khitchakut NP, Krating resort, 12.82°N 102.13°E, N. Vikhrev, 22.11.2006, 1♂, 3♀; *Chonburi* prov., Jomtien, 12.87°N 100.90°E: N. Vikhrev: 17.11.2006, 2♂, 4♀; 25.11.2006, 1♂; 26.11.2006, 2♀; 13–15.12.2008, 4♂, 2♀; 31.12.2008, 1♂, 2♀; 30–31.12.2009, 4♂, 1♀; 30.11.2011, 1♂; *PhangNga* prov., Khok Kloi env., 8.3°N 98.3°E, N. Vikhrev, 23.02.2009, 1♂; *Phuket* prov., 8.088°N 98.302°E, N. Vikhrev, 24.02.2009, 5♂; *Sa Kaeo* prov., 13.77°N 102.07°E, N. Vikhrev, 09.02.2009, 1♂ (all ZMUM).

**DISTRIBUTION.** Reliably known from India (Karnataka State) in the west to China (Guangdong Province) in the east. The northern limit is at 22°N, and the southernmost record is from the Malaysian Peninsula at 3.46°N.

*Sepedon spangleri* BEAVER, 1974

**NO MATERIAL EXAMINED.**

**DISCUSSION.** *Sepedon spangleri* was described from 5♂, 1♀ collected in agricultural lowlands in Central Thailand in a triangle (Bangkok — Chiang Mai — Maha Sarakham) (BEAVER 1974). Since then, there has been no further mention of this species in the literature. According to the description, *S. spangleri* is intermediate between *S. senex* and *S. plumbella*:

- surstyli as in *S. senex* and *S. plumbella*;
- foretarsus not modified, simple as in *S. senex*;
- dorsal surface of abdominal tergites 1+2 and 3 not wrinkled, smooth as in *S. plumbella*;
- size smaller than that of *S. senex* and *S. plumbella*.

The type series is stored in U.S. National Museum of Natural History (Smithsonian Institution) in Washington, D.C. USA. We hope somebody will reexamine the types and clarify the situation with this doubtful species.

*Sepedon spehega* FABRICIUS, 1775

*Sepedon aenescens* WIEDEMANN, 1830

*Sepedon spehega spehega* FABRICIUS, 1775

*Sepedon spehega aenescens* WIEDEMANN, 1830

**MATERIAL EXAMINED:**

about 500♂♂, ♀♀ from:

**ABKHAZIA; ARMENIA; AZERBAIJAN; BELARUS; CHINA:** Beijing, Guangdong, Inner Mongolia reg.; **ESTONIA; FINLAND; HUNGARY; GERMANY; IRAN:** Sistan and Baluchestan reg.; **KAZAKHSTAN:** Akmola, Almaty, E-Kazakhstan, Jambyl, Karaganda, Kyzylorda, W-Kazakhstan reg.; **KYRGYZSTAN; LITHUANIA; MOLDOVA; MONGOLIA,** Khentii reg.; **NETHERLANDS; RUSSIA:** Amur, Astrakhan, Bashkiria, Chelyabinsk, Crimea, Dagestan, Irkutsk, Kalmykia, Khabarovsk, Komi, Krasnodar, Krasnoyarsk, Kursk, Moscow, North Ossetia — Alania, Novosibirsk, Orenburg, Perm, Primorsky, Rostov, Ryazan, Sakha (Yakutia), Sakhalin, Samara, St-Petersburg, Tver, Volgograd, Yaroslavl, Zabaykalsky reg.; **TAJIKISTAN,** Khatlon reg.; **THAILAND; TURKMENISTAN,** Ahal reg.; **UKRAINE:** Dnipro, Kiev, Kharkov, Kherson, Odessa, Poltava, Zakarpattia reg.; **UZBEKISTAN:** Khorezm, Samarkand, Tashkent reg.; **VIETNAM** (ZMUM and ZIN).

**DISTRIBUTION.** Eurasia, from Scandinavia in the northwest to Indochina in the southeast. Northern limit of distribution (in Asia) is about 60°N. The southern limit of distribution is 12°N (with a single record from Mindanao in the Philippines at 8.5°N). The border between the distributional ranges of *S. s. spehega* and *S. s. aenescens* lies north of the Russian Far East and southwestern China, south of Central Asia/Asia Minor.

## *Sepedon spinipes* SCOPOLI, 1763

(Figs. 1, 4, 9–14, 16)

*Sepedon spinipes americana* STEYSKAL, 1951

*Sepedon americana* STEYSKAL, 1951 (ROZKOŠNÝ *et al.* 2010)

### MATERIAL EXAMINED:

about 400 ♂♂, ♀♀ from:

**ABKHAZIA; ARMENIA; AZERBAIJAN; BELARUS; CANADA**, Ontario prov.; **ESTONIA; GERMANY; HUNGARY; IRAN**, Lorestan reg.; **KAZAKHSTAN**: Akmola, Aktyubinsk, Jambyl, Kustanay, Kyzylorda reg.; **KYRGYZSTAN; LITHUANIA; MONGOLIA**, Khentii reg.; **NETHERLANDS; RUSSIA**: Amur, Arkhangelsk, Astrakhan, Bashkiria, Belgorod, Crimea, Dagestan, Ekaterinburg, Irkutsk, Karachay-Cherkessia, Karelia, Khabarovsk, Khanty-Mansi, Krasnoyarsk, Kursk, Moscow, Novgorod, Novosibirsk, Omsk, Orenburg, Perm, Primorsky, Rostov, Sakha-Yakutia, Saratov, St-Petersburg, Tuva, Volgograd, Yaroslavl reg.; **SERBIA; TURKEY; UKRAINIA** (ZMUM and ZIN).

**DISTRIBUTION.** A Holarctic species. Northern limit of distribution (in Asia) is about 60°N; the southern limit of distribution is 35°N.

### IDENTIFICATION KEY FOR ASIAN *SEPEDON*

(♂♂ and ♀♀)

1. Two notopleural setae present. Katatergite with fine black hairs (except *S. hecate*). Face with a pair of black parafacial spots (in *S. sphegea* these spots are on a dark background but are still distinct)..... **2**  
— One notopleural seta (posterior) present. Katatergite always bare. Face always without black parafacial spots..... **5**
2. Head, thorax, and abdomen bluish black. Face with black orbitoantennal spot between eye and antenna. *dc* setae absent..... *sphegea* FABRICIUS  
— Head, thorax, and abdomen brownish yellow. Frons and face with dark spots. *dc* setae 0+1  
..... **3**
3. Lower 1/3–1/4 of mid face with several hairs. Posterior crossvein *m-cu* always straight. Gena distinctly narrower than short axis of the ellipsoid eye (Fig. 2). ♂: surstyli reduced to a pair of short protrusions; sternite 5 consisting of a pair of strongly sclerotized halves (Figs. 7–8) ..... *neanias* HENDEL  
— Lower 1/3 of face bare. Posterior crossvein *m-cu* arched. Gena as wide or wider than short axis of the ellipsoid eye (Fig. 1). ♂: surstyli well developed, distinct in caudal (Figs. 15–16) or lateral views; sternite 5 film-like, halves of it grow together (the difference from *S. neanias* is visible also on intact abdomen)..... **4**
4. Katatergite with several hairs. Orbital spots rounded and widely separated from eye margin (Fig. 4); frontal ridges nearer to midfrons than to eye margins. General colour of body yellow. ♂: surstyli weakly sclerotized and rounded at apex (Fig. 16); hypandrium small, not spanner-shaped in strictly lateral view (Figs. 9–12, 14); aedeagus simple..... *spinipes* FABRICIUS  
— Katatergite bare. Orbital spots elongate, touching eye margin or almost so (Fig. 3); frontal ridges much nearer to eye margin than to midfrons. General colour of body brown. ♂: surstyli with stronger sclerotization than in previous species and narrowed at apex (Fig. 15),

- hypandrium large and spanner-shaped in lateral view (Figs. 18–21); aedeagus with 2–3 characteristic short spines near middle of inner surface (Figs. 22–24) ..... *hecate* ELBERG, KNUTSON & ROZKOŠNÝ
5. Orbital setae and apical scutellar setae absent. Foretarsus modified: *tar1-2* to *tar1-5* widened; *tar1-2* to *tar1-4* dark, *tar1-5* whitish; in female these modifications also present but less distinct. (Frons with a pair of dark teardrop-shaped spots) ..... *lobifera* HENDEL
- Orbital and apical scutellar setae present. Foretarsus not modified as above ..... 6
6. Frons with a pair of dark teardrop-shaped spots (Figs. 33–34). Inner surface of basal 1/3 of postpedicel bright yellow. (Dorsal surface of abdomen smooth.) ♂: legs unmodified (Figs. 33–34); surstyli subtriangular in caudal view and with characteristic upwardly directed brush at apex in lateral view (Fig. 6) ..... *ferruginosa* WIEDEMANN
- Frons without spots. Inner surface of postpedicel more or less evenly grey. ♂: surstyli appearing as two halves of an anchor, central lobe rounded, lateral lobe sharpened at apices (Fig. 5) ..... 7
7. Dorsal surface of abdomen smooth. ♂: *tar1-1* distinctly twisted and grooved and with elongated curved hairs. ♀: Colour of face and scape ranging from yellow to black (Figs. 31–32) ..... *plumbella* WIEDEMANN
- Dorsal surface of abdominal tergites 1+2 and 3 transversely wrinkled. ♂: *tar1-1* unmodified. ♀: Colour of face and scape always yellow ..... *senex* WIEDEMANN

## PART 1.2.

### DISCUSSION ON TAXONOMY

#### 1.2.1.

*Sepedon spinipes*. In their review of the Holarctic *Sepedon fuscipennis* and *S. spinipes* groups, ELBERG *et al.* (2009) raised the status of *Sepedon spinipes americana* STEYSKAL, 1951 to the species level. This taxonomic act was based on the fine structure of the hypandrium and aedeagus. Neither STEYSKAL (1951) nor ELBERG *et al.* (2009) found any non-genitalic distinguishable characters. In the drawings provided in ELBERG *et al.* (2009), the hypandria of *S. americana* (Fig. 9) and *S. spinipes* (Fig. 10) look very similar. In a photo in LI & YANG (2017, after turning 180° clockwise), the hypandrium of *S. spinipes* looks more different (Fig. 11). We isolated the hypandrium of a typical male of *S. spinipes* from European Russia, put it on a slide in a drop of glycerol, and twice captured a lateral image of the same sclerite. In both cases we tried to lay the hypandrium flat on the slide, but because of minute changes in the position of the sclerite and consequently the angle of view, the hypandrium in Figs. 12 and 13 looks quite different. We also placed the semi-dry hypandrium on white paper, knowing that in such conditions the image quality deteriorates due to glare but that the position of the sclerite becomes more predictable (Fig. 14).

Our photos (Figs. 13–14) are taken from the outside, whereas the photo on Fig. 12 was taken from the inside. Comparison of Figs. 12 and 14 shows that in the case of the hypandrium of *S. spinipes*, it does not much matter. The results are summarized in Figs. 9–14, with the same processes marked here and below by use of the same numerals.

ELBERG *et al.* (2009: Figs. 22 and 26) asserted that *S. spinipes* and *S. americana* have very different aedeagi. Therefore we examined the aedeagi of European and Canadian specimens.



We found that the aedeagus of the Nearctic specimen is larger and less sclerotized than that of the Palaearctic specimens [of course the aedeagus in ELBERG *et al.* (2009: Fig. 22) should be turned 90° clockwise to put it in lateral view as with the other aedeagi]. It is possible that the difference is only an artifact of the specimen's having been stored for a long time in a vial with hypotonic solution, although it is possible that the size and degree of sclerotization really differ between Palaearctic and Nearctic specimens. The difference in sclerotization of the aedeagus might lead to reproductive isolation between Palaearctic and Nearctic populations, but we believe it does not. Unless proven otherwise, we recognize the existence of a single Holarctic species — *S. spinipes*.

### 1.2.2.

***Sepedon hecate*.** We reexamined the genitalia of the recently described *S. hecate*. Differences between *S. hecate* and *S. spinipes* are summarized in the key for Asian *Sepedon*.

In our opinion the species most closely related to *S. hecate* is the Nearctic *S. tenuicornis* CRESSON, 1920. These species differ as follows:

- Eastern Palaearctic. ♂: surstyli shorter, gradually narrowed at apex (Fig. 15); hypandrium spanner-shaped (Figs. 18–21); aedeagus with 2–3 characteristic short acute spines near middle of inner surface (Figs. 22–24). ..... ***hecate***
- Nearctic. ♂: surstyli longer, sharply pointed at apex (Fig. 17); hypandrium not spanner-shaped (Figs. 25–27, 29–30); aedeagus without spines, epiphallus thickened and bifurcated at apex (Fig. 28). ..... ***tenuicornis***

There are also some differences in colouration, but their reliability seems doubtful.

### 1.2.3.

***Sepedon tenuicornis*.** We decided to consider this Nearctic species here because it also illustrates our opinion expressed in 1.2.4 (below).

Figs. 29–30 show two views of the hypandrium of *S. tenuicornis* at slightly different angles; Figs. 25–27 show drawings of hypandrium of *S. gracilicornis* ORTH, 1986 and *S. tenuicornis* by ELBERG *et al.* (2009). We see that the same sclerite may look as proposed for *S. tenuicornis* or for *S. gracilicornis* depending upon minute changes in the angle of view. It shows again that small differences in the shape of the hypandrium cannot be used reliably as diagnostic characters.

The diagnostic use of the aedeagus has the same drawbacks, although the strictly lateral orientation of this sclerite usually is an easier task. The comparison of *S. gracilicornis* and *S. tenuicornis* again is illustrative. ORTH (1986) showed a pair of drawings and a pair of photographs without any verbal explanation. ELBERG *et al.* (2009) provided both drawings and a verbal explanation: epiphallus with a semicircular callus apically = *tenuicornis*; epiphallus bilobate apically = *gracilicornis*. In fact the epiphallus *S. tenuicornis* is apically both thickened and bilobate, as in Fig. 28.

Thus we found the proposed differences of internal genitalia between that of *S. tenuicornis* and that of *S. gracilicornis* to be nonexistent. The proposed non-genitalic character is pedicel index 4 or 5 (length compared to width). We found it to be variable and difficult to measure. We therefore propose the following synonymy: *Sepedon tenuicornis* CRESSON, 1920 = *S. gracilicornis* ORTH, 1986, **Syn. nov.**

#### 1.2.4.

Genitalic characters began to be used in the first half of the 20<sup>th</sup> Century, and since then they have evolved from an exotic method into a sacred cow of entomology. We consider both underestimation and overestimation of the value of the genitalic characters to be equally flawed. Let us discuss possible interpretations of the illustrations of genitalia given in the present paper as well as in the previous works [ELBERG *et al.* (2009), ROZKOŠNÝ *et al.* (2010), and LI & YANG (2017)].

In Sciomyzidae the surstyli are the most significant part of the genitalia that is responsible for the external contact between males and females. Being large, they may be examined without dissection in an intact, properly mounted specimen. The comparison of the caudal view of surstyli provided in different works [for example, the surstyli of *S. spinipes* in our Fig. 16 and in LI & YANG (2017: fig. 74)] shows that it is a reproducible and reliable character. In some cases (for example, *S. plumbella* and *S. senex*), the surstyli are undistinguishable, but the internal parts of genitalia are undistinguishable as well. The taxonomy of many Sciomyzidae genera [for example, Palaearctic *Tetanocera* (ROZKOŠNÝ 1987)] is based on the shape of the surstyli, and this approach works well for those genera, but in *Sepedon* the internal parts of genitalia (hypandrium and aedeagus) are widely used for diagnosis. Examination of the internal genitalia always requires dissection of the abdomen and isolation of the hypandrium and aedeagus.

An isolated hypandrium has a complex three-dimensional shape that poses a problem of correct orientation. For instance, a two-dimensional image of a cylinder may look like a circle or a rectangle. Figs. 9–14 show several of the many possible two-dimensional lateral projections of the hypandrium of *S. spinipes*. *Sepedon hecate* is an example of species with a characteristic spanner-shaped hypandrium (Figs. 18–21), but the hypandrium of *S. spinipes* also may look spanner-shaped, as in Fig. 13.

How is one to use the internal genitalia correctly for diagnoses? We prefer not to use it at all. All of the Asian *Sepedon* species reviewed here, in both sexes, may be distinguished by non-genitalic characters, with the shape of surstyli being used optionally as an additional character. If some taxonomist wants to use the internal genitalia diagnostically, he or she should first solve the problem of how to do it reproducibly and reliably. In *Sepedon*, if the surstyli are the same between two species, the internal genitalia are also the same in the vast majority of cases.

#### 1.2.5.

Non-genitalic characters used to distinguish *S. neanias* (as *S. noteoi*) from the sympatric *S. spinipes* were firstly offered by ROZKOŠNÝ *et al.* (2010). The diagnostic characters that we found to be reliable when examining our material are given in the key (couplet 3). The external similarity of *S. neanias* and *S. spinipes* is in contrast with the sharp differences in their respective male genitalia: structure of the surstyli and sternite 5 (also given in couplet 3). *Sepedon neanias*, described in 1913 from Taiwan, was for a long time “a forgotten species.” Then STEYSKAL (1980) described two more *Sepedon* from eastern Asia: 1) *S. noteoi* from “E. Kwantung, S. China” (actually northeastern China, Liaoning prov.,  $\approx 38.9^{\circ}\text{N}$   $121.6^{\circ}\text{E}$ ) and (eastern China) Zhejiang prov., Hangzhou, and 2) *S. oriens* from the Philippines, Luzon Isl.; Japan, Honshu Isl. and China, Sichuan prov. We quite agree with ROZKOŠNÝ *et al.* (2010) that STEYSKAL (1980) had no reason to describe *S. noteoi* and *S. oriens* as separate species. In the same paper (ROZKOŠNÝ *et al.* 2010), the authors reported on their reexamination of type material of *S. neanias*, provided drawings of the male terminalia of *S. neanias* and *S. noteoi*

(ROZKOŠNÝ *et al.* 2010: Figs. 7–11 and Figs. 2–6), and proposed that the two species are closely related but not the same. We do not at all share their caution on the synonymy of *S. noteoi*. We discussed above that fine differences in the shape of the hypandrium and aedeagus are not reliable. We are happy to restore justice and return its eldest name to the taxon: *Sepedon neanias* HENDEL, 1913 = *S. noteoi* STEYSKAL, 1980, **Syn. nov.**

### 1.2.6.

Colour varies widely in *Sepedon* and may be of significant diagnostic value. We hereby raise the question of whether color variations are taxonomically important or not. We would like to report several cases that we regard as mere intraspecific variability in the colouration.

#### 1.2.6.1.

We have several specimens of *S. spinipes* in which the normally black frontal spots are represented by yellowish stains only. All such specimens are from the eastern Palaearctic: Mongolia, *Khentii* prov., Bayan-Ardaga ( $\approx 48.57^\circ\text{N}$ ,  $111.06^\circ\text{E}$ ), E. Narchuk, 26.07.1975, 3♀ (ZIN). Russia: *Amur* reg., Zeya (env.,  $53.7^\circ\text{N}$   $127.2^\circ\text{E}$ ), A. Shatalkin: 16.07.1981, 1♀; 12–14.09.1981, 4♂, 8♀, (ZMUM); *Sakha-Yakutia*, Olyokminsk env., Kyachchi, A. Ovchinnikov, 20.07.2008, 1♀; *Khabarovsk* reg., Bychikha ( $48.30^\circ\text{N}$   $134.82^\circ\text{E}$ ), K. Gorodkov, 16.05.1973, 4♂; *Primorsky* reg., Spassk-Dalny ( $44.6^\circ\text{N}$   $132.82^\circ\text{E}$ ), S. Belokobylsky, 20.08.1993, 1♂. Similar variability was reported for *S. fuscipennis* LOEW, 1859 (CRESSON 1920; ELBERG *et al.* 2009).

#### 1.2.6.2.

Two types of specimens are found in *S. plumbella*: those with a dark frons and those with a brownish-yellow frons. This variation was recorded first by YANO (1978). In our opinion it is better to use as a main distinguishing character the less variable colour of the face instead of the more variable colour of frons (though colouration of face and frons usually correlate well):

- face entirely (sometimes partly) black; scape dark, concolour with pedicel or almost so (Fig. 31); Thailand and China, Yunnan (LI & YANG 2017).....**dark form of *S. plumbella***
- face and scape always yellow (Fig. 32); Australia, India, Indonesia and Philippines .....**yellow form of *S. plumbella***

An interesting colour variation of *S. plumbella* was recorded from Papua prov. of Indonesia: specimens collected in the highlands (Wamena) were substantially darker than those collected in the lowlands (Merauke).

#### 1.2.6.3.

Colour variations in *S. ferruginosa* are even more significant than in the previously mentioned species. These variations were mentioned by YANO (1978) and LI & YANG (2017). Specimens examined by us differed as follows:

- thorax (both scutum and pleura) and abdomen black (Fig. 33); foretarsus, especially *tar1*–2 to *tar 1*–5 with dense dorsal hairs which are longer than tarsus width; China: Yunnan and Hainan (LI & YANG 2017); Thailand ..... **Indochinese form of *S. ferruginosa***

— thorax (both scutum and pleura) and abdomen yellow brown (Fig. 34); foretarsus without elongated dorsal hairs; India: Orissa and Andhra Pradesh.....**Indian form of *S. ferruginosa***

Possibly these forms have a higher taxonomic status than simply color variations. It would be very interesting to examine specimens from Bangladesh and Myanmar.

#### 1.2.6.4.

KNUTSON & ORTH (1984) revised the *Sepedon sphegea* complex. The synonymy of *S. aenescens* to *S. violacea* HENDEL, 1909 = *S. sauteri* HENDEL, 1911 = *S. sinensis* MAYER, 1953 was established and detailed distributional data were given. There is very little to add to this work. LI & YANG (2017: Fig. 79) reported that in the western and northeastern parts of China, *S. sphegea* and *S. aenescens* co-occur, and intermediate specimens show a brown scape. We also found intermediate specimens from other localities: Kyrgyzstan; Iran, Sistan and Baluchestan reg.; Moldova; Mongolia; Russia: Dagestan, Khabarovsk, Krasnodar reg.; Tajikistan, Khatlon reg.; Thailand; Turkey; Turkmenistan, Ahal reg.; Ukraine: Kharkov, Poltava reg.; Uzbekistan, Tashkent reg.; Vietnam.

Typical European *S. sphegea* and *S. aenescens* from southeastern Asia may be distinguished as follows:

- scape of antenna black; wing hyaline; larger ..... ***sphegea***
- scape of antenna yellow; wing darkened in distal half; smaller ..... ***aenescens***

Indeed, these differences are not convincing, especially compared to the colour variations in *S. plumbella* or *S. ferruginosa* considered above. We suppose that the best solution is to downgrade the taxonomic status of the considered species to subspecies rank. In the present paper we treat both subspecies as *S. sphegea* in the wide sense, but it would be possible to specify “*S. s. sphegea*” or “*S. s. aenescens*” if one found it necessary to do so.

#### 1.2.7.

What could be a reasonable approach to species delimitation? The compliance with the criterion of free crossbreeding is unknown for *Sepedon* and for the vast majority of other zoological cases. So taxonomists are restricted to using indirect indications, which are difficult to interpret. Let us consider a rare case where free crossbreeding is confirmed: the genus *Homo*, presently represented by only one species, *H. sapiens*. If some taxonomist were to examine only a few specimens of *H. sapiens*, he or she might conclude that there are several species of *Homo*. Only after examining a large number of specimens would that taxonomist determine that, despite the great differences between specimens from Iceland and Papua, there is a continuous row of intermediate forms between them. As in species of *Sepedon*, the shape and the size of human genitalia also varies widely.

We think that the following general recommendations could be useful for any taxonomic decision based on indirect indications:

**a.** If there are two explanations consistent with available data, then the simplest one is more preferable. This good old principle, known as the law of parsimony or Occam's presumption, is one of the basic principles of scientific knowledge.

Example. Is it possible that Taiwan is inhabited by one species (*S. neanias*), while all of eastern Asia (from the Khabarovsk region of Russia to Vietnam, including Honshu, Hainan, and the Philippines Islands) is inhabited by *S. noteoi*? Such a hypothesis may be proposed, but

it must have serious justification. The simpler hypothesis that *S. noteoi* is a synonym should be accepted by default.

**b.** Recommendations as to how to distinguish between two species should be comprehensible and reproducible among colleagues; if not, then these species should be regarded as synonyms unless otherwise (i.e. reproductive isolation) is proven.

Example. Despite some experience we have, we could not understand the difference between examined paratypes of *Sepedon neili* STEYSKAL, 1951 and *S. borealis* STEYSKAL, 1951. How can we expect students to understand this?

**c.** Only well-grounded changes in accepted taxonomy should be offered.

Example. Genus *Sepedonella* VERBEKE, 1950 was offered for small African species with reduced postocellar setae. Large Asian *Sepedon lobifera* with reduced frontal and scutellar setae is not placed in separate genus. We regard *Sepedonella* as a groundless taxon until the relationship of *Sepedon*-like Sciomyzidae is clarified.

**d.** It is advisable to be careful with descriptions of species in which females are indistinguishable. Of course, *S. pusilla* LOEW, 1859 with unmodified *f3* and *S. armipes* LOEW, 1859 with *f3* intricately modified are different species (unless we discover that females successfully copulate with both armed and unarmed males).

We realize that our position looks out of trend. Working on the Asian *Sepedon* fauna, we found that splitter's approach had become prevalent in Sciomyzidae and that such extremes had clearly become harmful. To illustrate the possible harm of oversplitting, we decided to present below our view of the taxonomy of the Nearctic species of *Sepedon*. We are ready for possible criticism as we only have limited material and have not examined the majority of type species. However, if our point of view turns out to be even partly correct, it will be a serious situation to ponder.

## PART 2. TAXONOMY OF NEARCTIC *SEPEDON*

### *Sepedon armipes* LOEW, 1859 (Fig. 35)

#### MATERIAL EXAMINED:

**CANADA:** *Alberta* prov., Banff env. (≈51.20°N 115.57°W), C. B. D. Garrett, 21.06.1922, 1♂, 1♀; *Saskatchewan* prov., Cypress Hills (≈49.66°N 109.50°W), A. R. Brooks, 4.06.1939, 1♂, 1♀; *Quebec* prov., Val-des-Monts mun., Perkins Mills (=Perkins) (≈45.60°N 75.62°W), G. E. Shevell, 14.08.1938, 1♂, 1♀ (all ZIN);

**USA:** *Iowa* st., Boone Co., Ledges State Park (≈42.00°N 93.87°W), Warters & Malcom, 19.05.1954, 1♂; *Minnesota* st., Houston Co. (≈43.78°N 91.57°W), C. L. Pederson, 26.05.1940, 1♀ (all ZMUM); *New York* st., Tompkins Co.: Ithaca env., Cascadilla Creek R. (≈42.44°N 76.50°W), C. O. Berg, 1.06.1954, 1♂; McLean Res. (≈42.55°N 76.30°W), C. O. Berg, 25.05.1954, 1♂ (all ZIN); *Rhode Island* st., Coventry, 41.69°N 71.55°W, A. Medvedev: 27–30.04.2017, 1♂; 1–7.05.2017, 4♂ (all ZMUM); *Texas* st., Harlingen (≈26.20°N 97.70°W), D. E. Hardy, V. L. Wooley, 31.03.1945, 1♂ (ZIN).

***Sepedon fuscipennis* LOEW, 1859**

(Fig. 37)

**MATERIAL EXAMINED:**

**CANADA:** *Ontario* prov., Ottawa ( $\approx 45.25^{\circ}\text{N}$   $75.70^{\circ}\text{W}$ ), G. E. Shevell, 2.09.1947, 1♀; *Quebec* prov.: Abbotsford (=Saint-Paul-d'Abbotsford) ( $\approx 45.44^{\circ}\text{N}$   $72.90^{\circ}\text{W}$ ), G. E. Shevell, 26.06.1936, 1♂, 1♀; Bristol mun., Norway Bay ( $\approx 45.52^{\circ}\text{N}$   $76.41^{\circ}\text{W}$ ), G. E. Shevell, 9.09.1946, 1♂ (all ZIN);

**USA:** *Minnesota* st., Itasca State Park ( $\approx 47.19^{\circ}\text{N}$   $95.17^{\circ}\text{W}$ ), Entomology Class Collection, 18.06.1937, 1♂ (ZMUM); *New York* st., Tompkins Co., Ithaca env., Inlet Valley ( $\approx 42.41^{\circ}\text{N}$   $76.55^{\circ}\text{W}$ ), C. O. Berg 14.07.1954, 1♀ (ZIN); *Ohio* st., Jackson ( $\approx 39.06^{\circ}\text{N}$   $82.65^{\circ}\text{W}$ ), J. H. Hughes, 9.09.1940, 1♀; *Rhode Island* st., Coventry,  $41.69^{\circ}\text{N}$   $71.55^{\circ}\text{W}$ , A. Medvedev: 27–30.04.2017, 6♂, 6♀; 1–7.05.2017, 1♀ (all ZMUM); *South Dakota* st., Brookings ( $\approx 44.32^{\circ}\text{N}$   $96.80^{\circ}\text{W}$ ), J. M. Aldrich, n/d, 1♂; *Washington* st., Clark Co., Lacamas L. ( $\approx 45.62^{\circ}\text{N}$   $122.43^{\circ}\text{W}$ ), J. F. G. Clarke, 19.08.1940, 1♂ (all ZIN).

***Sepedon tenuicornis* CRESSON, 1920**

(Figs. 17, 25–30, 36)

**MATERIAL EXAMINED:**

**USA:** *New Jersey* st., Riverton ( $\approx 40.01^{\circ}\text{N}$   $75.02^{\circ}\text{W}$ ), 4.09.2005, 1♂; *Oklahoma* st., Broken Bow ( $\approx 34.03^{\circ}\text{N}$   $94.73^{\circ}\text{W}$ ), J. Stankavich, 19.06.1934, 1♀ (all ZIN); *Rhode Island* st., Coventry,  $41.69^{\circ}\text{N}$   $71.55^{\circ}\text{W}$ , A. Medvedev: 27–30.04.2017, 9♂, 16♀; 1–7.05.2017, 5♂, 6♀ (all ZMUM).

***Sepedon pacifica* CRESSON, 1914**

**MATERIAL EXAMINED:**

**USA:** *California* st., San Diego Co., Lakeside ( $\approx 32.86^{\circ}\text{N}$   $117.01^{\circ}\text{W}$ ), J. M. Aldrich, 8.04.1932, 1♂ (ZIN); *Utah* st., Trenton ( $\approx 41.92^{\circ}\text{N}$   $111.94^{\circ}\text{W}$ ), G. F. Knowlton, 10.06.1944, 1♂ (ZMUM); Uinta Mts. ( $\approx 40.88^{\circ}\text{N}$   $109.30^{\circ}\text{W}$ ), D. G. Hall, 18.08.1940, 2♂, 1♀ (ZIN).

***Sepedon pusilla* LOEW, 1859**

**MATERIAL EXAMINED:**

**PARATYPES** *S. borealis* STEYSKAL, 1951: CANADA, *Saskatchewan*, Waskesiu Lake ( $53.9^{\circ}\text{N}$   $106.1^{\circ}\text{W}$ ), 1♂, 1♀. USA, *Colorado* st., paratype № 60906, 1♀ (all ZIN);

**PARATYPE** *S. neili* Steyskal, 1951: USA, *New Hampshire* st., White Mts. ( $\approx 44.0^{\circ}\text{N}$   $71.5^{\circ}\text{W}$ ), Morrison, 1♀ (ZIN).

**OTHER MATERIAL EXAMINED:**

**CANADA:** *Newfoundland*, Harmon Field (= Stephenville) ( $\approx 48.56^{\circ}\text{N}$   $58.59^{\circ}\text{W}$ ), F. G. DiLabio, 2.06.1949, 1♂; *Ontario* prov., Jarvis L. ( $\approx 44.51^{\circ}\text{N}$   $77.57^{\circ}\text{W}$ ), C. Boyle, 8–14.08.1952, 2♂ (all ZIN);

USA: *Indiana* st., Lafayette ( $\approx 40.40^{\circ}\text{N}$   $86.91^{\circ}\text{W}$ ), J. M. Aldrich, 04.1928, 1♂, 1♀ (ZIN); *Minnesota* st., Itasca State Park ( $\approx 47.19^{\circ}\text{N}$   $95.17^{\circ}\text{W}$ ), H. R. Dodge, 11.06.1937, 1♂ (identified as *S. lignator* by L. KNUTSON) (ZMUM).

## DISCUSSION

### 2.1.

The synonymy of *S. f. fuscipennis* LOEW, 1859 and *S. fuscipennis nobilis* ORTH, 1986 was proposed by ELBERG *et al.* (2009). We quite agree with that. In the ZMUM collection we have a series of 6♂♂ and 7♀♀ *S. fuscipennis* from USA, RI, 1–7.05.2017. This series consists either of spotless specimens and specimens with dark frontal spots of various sizes and shapes.

### 2.2.

In subchapter 1.2.3 we discussed why we suppose that *S. tenuicornis* = *S. gracilicornis*.

### 2.3.

KNUTSON & ORTH (2001) gave recommendations how to distinguish *S. praemiosa* GIGLIO-TOS, 1893 and *S. pacifica* CRESSON, 1914. They are worth quoting:

“— Face yellowish to amber, with or without scattered fine black setae on mediafacies...

— Face amber to brownish, mediafacies with fine black setae scattered to moderately dense...”

Also overlapping size difference and incomprehensible difference in genitalia are proposed. We are convinced that it is one species, not two. FISHER & ORTH (1972) wrote that original description of *S. praemiosa* is useless; the type of *S. praemiosa* was not found and was never examined. Due to the lack of adequate information, the authors appointed the specimens of *Sepedon* collected in the same locality as *S. praemiosa*.

We believe that correct solution would be to regard *S. praemiosa* as a doubtful taxon; *S. pacifica* as a valid species; *S. pacifica* CRESSON, 1914 = *S. praemiosa* GIGLIO-TOS, 1893 (*sensu* FISHER & ORTH, 1972 and KNUTSON & ORTH, 2001).

### 2.4.

Dark frontal marks may vary widely from large black spots to no spots, as was discussed above for *S. fuscipennis* or *S. spinipes*. It would be quite natural to propose that the same continuous range of variability of frontal marks is present in *S. armipes*, so *S. armipes* LOEW, 1859 = *S. relictus* WULF, 1897 = *S. bifida* STEYSKAL, 1951 = *S. melanderi* STEYSKAL, 1951 = *S. anchista* STEYSKAL, 1956 = *S. capellei* FISHER & ORTH, 1969 = *S. pseudarmipes* FISHER & ORTH, 1969 = *S. cascadiensis* FISHER & ORTH, 1974.

### 2.5.

We examined paratypes of *S. borealis* and *S. neili* and specimens identified as *S. pusilla* by STEYSKAL and as *S. lignator* by KNUTSON. We found diagnostic characters for species related to *S. pusilla* difficult to apply, their gradual variability does not permit fixation of species

borders. So, *S. pusilla* LOEW, 1859 = *S. borealis* STEYSKAL, 1951 = *S. neili* STEYSKAL, 1951 = *S. lignator* STEYSKAL, 1951.

## 2.6.

*Sepedon floridensis* differs from *S. fuscipennis* and *S. mcphersoni* differs from *S. pusilla* by whitish ring in apical 3/4 of t3. We found the same whitish ring in most of Vietnamese specimens of *S. neanias*. We are convinced that in all mentioned cases it is intraspecific variability. So, *S. fuscipennis* LOEW, 1859 = *S. floridensis* STEYSKAL, 1951 and *S. pusilla* LOEW, 1859 = *S. mcphersoni* KNUTSON & ORTH, 2001.

## 2.7.

If we assume that the synonymy offered above is correct, that means we are going 80 years back in time, from the key of KNUTSON & ORTH (2001) to a slightly modified concept of Nearctic *Sepedon* from CRESSON (1920):

1. Pedicel distinctly wider than scape (as in Fig. 37) ..... **2**  
 — Pedicel as wide as scape (as in Fig. 36) ..... **3**
2. Mid face and katatergite with hairs. Frontal ridges closer to mid frons than to orbits. ♂: t3 without elongated setulae ..... *pacifica* CRESSON  
 — Mid face and katatergite bare. Frontal ridges closer to orbits than to mid frons. ♂: t3 with a dense and complete row of *ad* setulae as long as width of tibia ..... *fuscipennis* LOEW
3. Mid face bare, katatergite bare or hairy. Larger species: wing length 5.0–7.3 mm (MURPHY *et al.* 2018) ..... **4**  
 — Both mid face and katatergite hairy. Smaller species: wing length 3.6–4.9 mm (MURPHY *et al.* 2018) ..... **5**
4. Katatergite with several hairs. *fl* without ventral spine(s) ..... *spinipes* FABRICIUS  
 — Katatergite bare. *fl* with 1–2 ventral spine(s) in apical 1/3 ..... *tenuicornis* CRESSON
5. ♂: f3 remarkably notched ventrally (Fig. 35) ..... *armipes* LOEW  
 — ♂: f3 unmodified ..... *pusilla* LOEW

## 2.8.

Let us assume that our hypotheses are (partly) correct. How could it happen that for a long time all Nearctic Sciomyzidae experts have been describing and keying so many groundless *Sepedon* species? We can offer the following scenario. After the change of generations in the second quarter of the 20<sup>th</sup> Century, GEORGE STEYSKAL, a splitter who described a lot of species which had been synonymized previously by different authors, becomes the main expert in Sciomyzidae. Afterwards, STEYSKAL's younger colleagues accepted his level of splitting as a matter of course. If our view on taxonomy of Nearctic *Sepedon* turns to be correct, it would not mean that we are smarter. Just we don't carry the burden of traditions, and we had a look from the outside.



## ACKNOWLEDGMENTS

We are grateful to WILLIAM MURPHY (USA) who kindly shared with us his extensive collection of literature on Sciomyzidae and for reviewing early drafts of this paper. We thank OLEG KOSTERIN (Novosibirsk) for critically reading the text and valuable discussion. We thank OLGA OVCHINNIKOVA and GALINA SULEYMANOVA (St-Petersburg) for access to ZIN collection.

## REFERENCES

- BEAVER O. 1974. A new species of *Sepedon* from Thailand. (Diptera: Sciomyzidae). Proceedings of the Entomological Society of Washington **76**(1), 86–88.
- CRESSON E.T., Jr. 1920. A revision of the Nearctic Sciomyzidae (Diptera, Acalyptratae). Transactions of the American Entomological Society **46**(799): 27–89.
- ELBERG K., ROZKOŠNÝ R., KNUTSON L. 2009. A review of the Holarctic *Sepedon fuscipennis* and *S. spinipes* groups with description of a new species (Diptera: Sciomyzidae). Zootaxa **2288**: 51–60.
- FISHER T.W. & ORTH R.E. 1972. Resurrection of *Sepedon pacifica* CRESSON and redescription of *Sepedon praemiosa* GIGLIO-TOS with biological notes (Diptera: Sciomyzidae). Pan-Pacific Entomologist **48**(1): 8–20.
- KNUTSON L.V. & ORTH R.E. 1984. The *Sepedon spegea* complex in the Palearctic and Oriental regions: Identity, variation, and distribution (Diptera: Sciomyzidae). Annals of the Entomological Society of America **77**: 687–701.
- KNUTSON L.V. & ORTH R.E. 2001. *Sepedon mcphersoni*, n. sp., key to North American Sepedon, groups in *Sepedon* s.s., and intra- and intergeneric comparison (Diptera: Sciomyzidae). Proceedings of the Entomological Society of Washington **103**: 620–635.
- LI Z. & YANG D. 2017. *Sepedon* (Diptera: Sciomyzidae) species from China, with notes on taxonomy and distribution. Zootaxa **4254**(3): 301–321.
- LI Z. & YANG D. & MURPHY W.L. (*In press*). Review of genera of Sciomyzidae (Diptera: Acalyptratae) from China, with new records, synonyms, and notes on distribution. Zootaxa.
- MURPHY W.L., MATHIS W.N. & KNUTSON L.V. 2018. Comprehensive taxonomic, faunistic, biological, and geographic inventory and analysis of the Sciomyzidae (Diptera: Acalyptratae) of the Delmarva region and nearby states in eastern North America Zootaxa **4430**(1): 001–299.
- ORTH R.E. 1986. Taxonomy of the *Sepedon fuscipennis* group (Diptera: Sciomyzidae). Proceedings of the Entomological Society of Washington **88**: 63–76.
- ROZKOŠNÝ R. 1987. A review of the Palearctic Sciomyzidae (Diptera). Folia Facultatis Scientiarum Naturalium Universitatis Purkynianae Brunensis, Biologia **86**: 1–100.
- ROZKOŠNÝ R., Knutson L. & Merz B. 2010. A review of the Korean Sciomyzidae (Diptera) with taxonomic and distributional notes. Acta zoologica Academiae scientiarum Hungaricae **56**(4): 79–90.
- STEYSKAL G.C. 1951. The genus *Sepedon* LATREILLE in the Americas (Diptera: Sciomyzidae). The Wasmann Journal of Biology **8**: 271–297.
- STEYSKAL G.C. 1980. Family Sciomyzidae. [*In*:] HARDY D.E. & DELFINADO M.D. (EDS.). Insects of Hawaii. Vol. 13. University Press of Hawaii, Honolulu, pp. 108–125.

- VIKHREV N. 2011. Review of the Palaearctic members of the *Lispe tentaculata* species-group (Diptera, Muscidae): revised key, synonymy and notes on ecology. *ZooKeys* **84**: 59–70.
- YANO K. 1978. Faunal and biological studies on the insects of paddy fields in Asia. Part I. Introduction and Sciomyzidae from Asia (Diptera). *Esakia* **11**: 1–27.

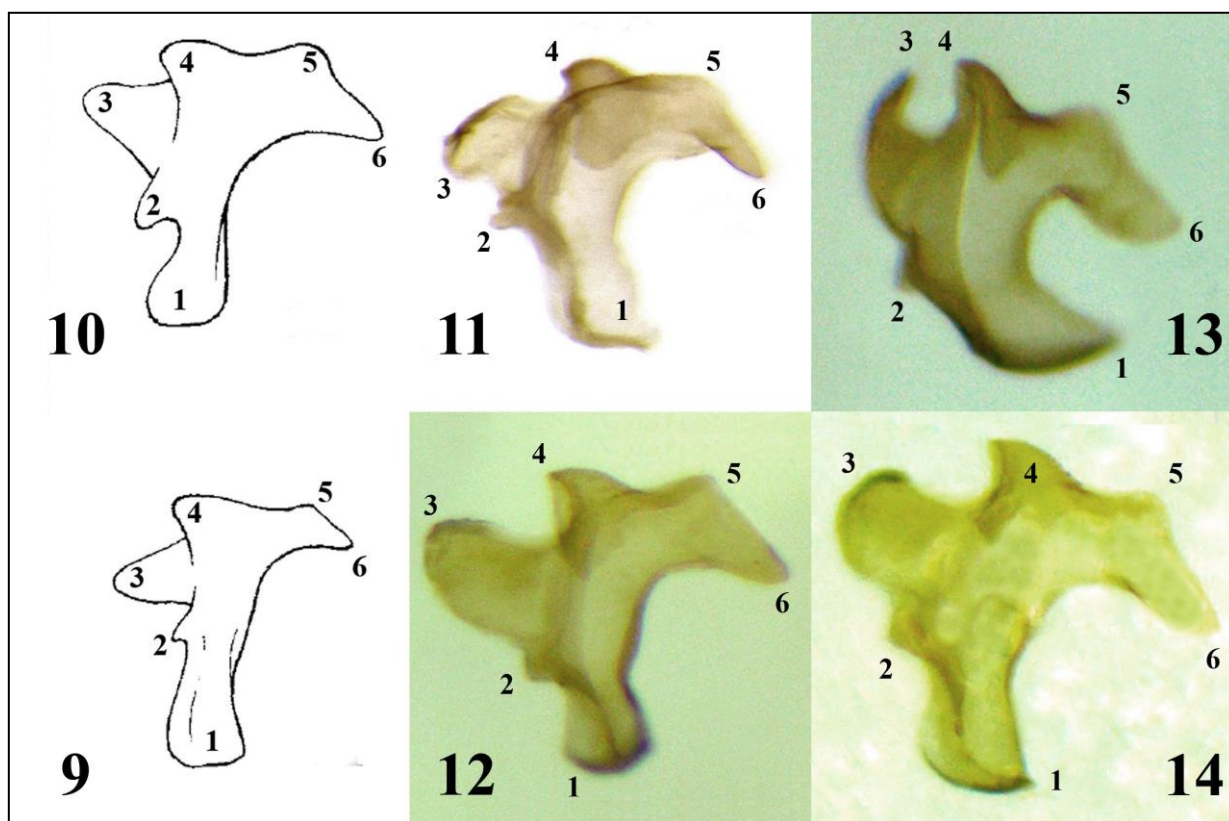
## FIGURES



**Figs. 1–4.** *Sepedon* spp, head: 1 — *S. spinipes*, lateral; 2 — *S. neanias*, lateral; 3 — *S. hecate*, dorsal; 4 — *S. spinipes*, dorsal.



**Figs. 5–8.** *Sepedon* spp, male terminalia: 5 — *S. senex*, postabdomen with surstyli, caudal; 6 — *S. ferruginosa*, postabdomen with surstyli, caudal and lateral; 7 — *S. neanias* (as *S. noteoi*), postabdomen with surstyli, caudal; 8 — *S. neanias* (as *S. noteoi*), 5 sternite [all from (LI & YANG 2017)].

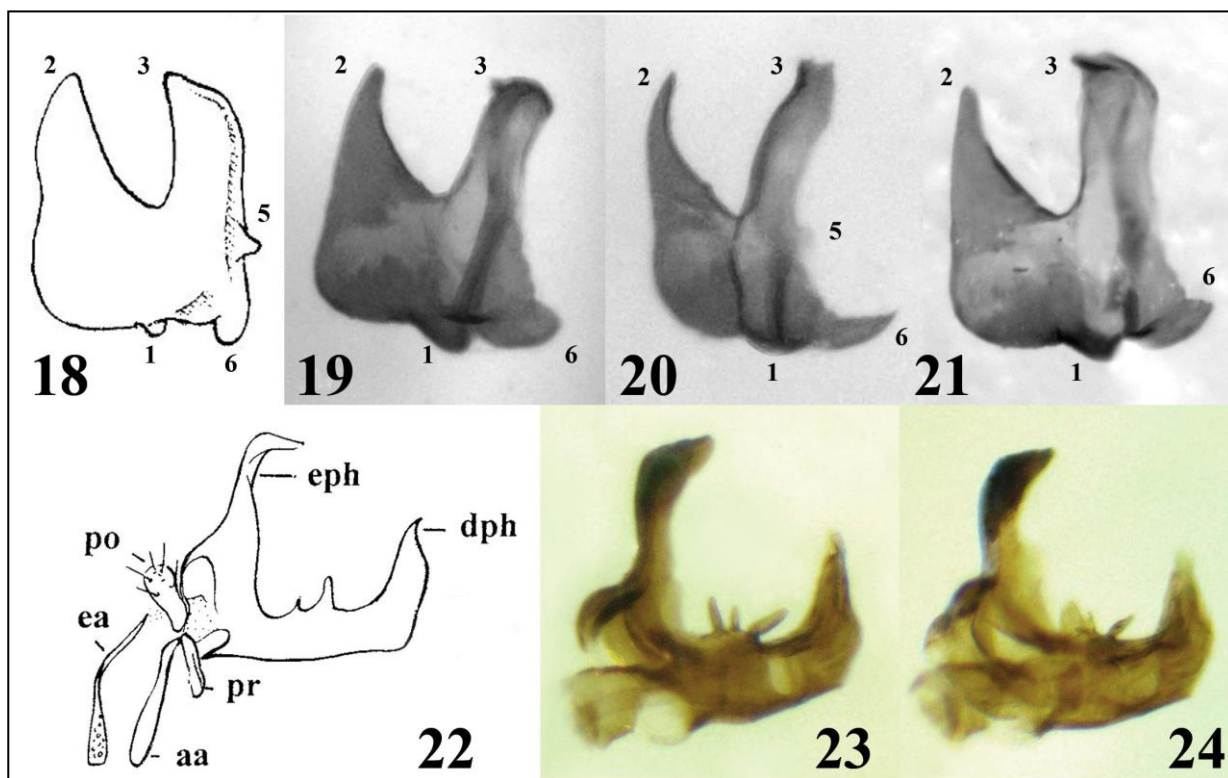


**Figs. 9–14.** Hypandrium of *S. spinipes*, lateral: 9 — Canadian specimen (as *S. americana*) from ELBERG *et al.* (2009); 10 — Palaearctic specimen from ELBERG *et al.* (2009); 11 — Chinese specimen from LI & YANG (2017); 12–14 — European specimen from different angles of view (more detailed explanations are in the text above).

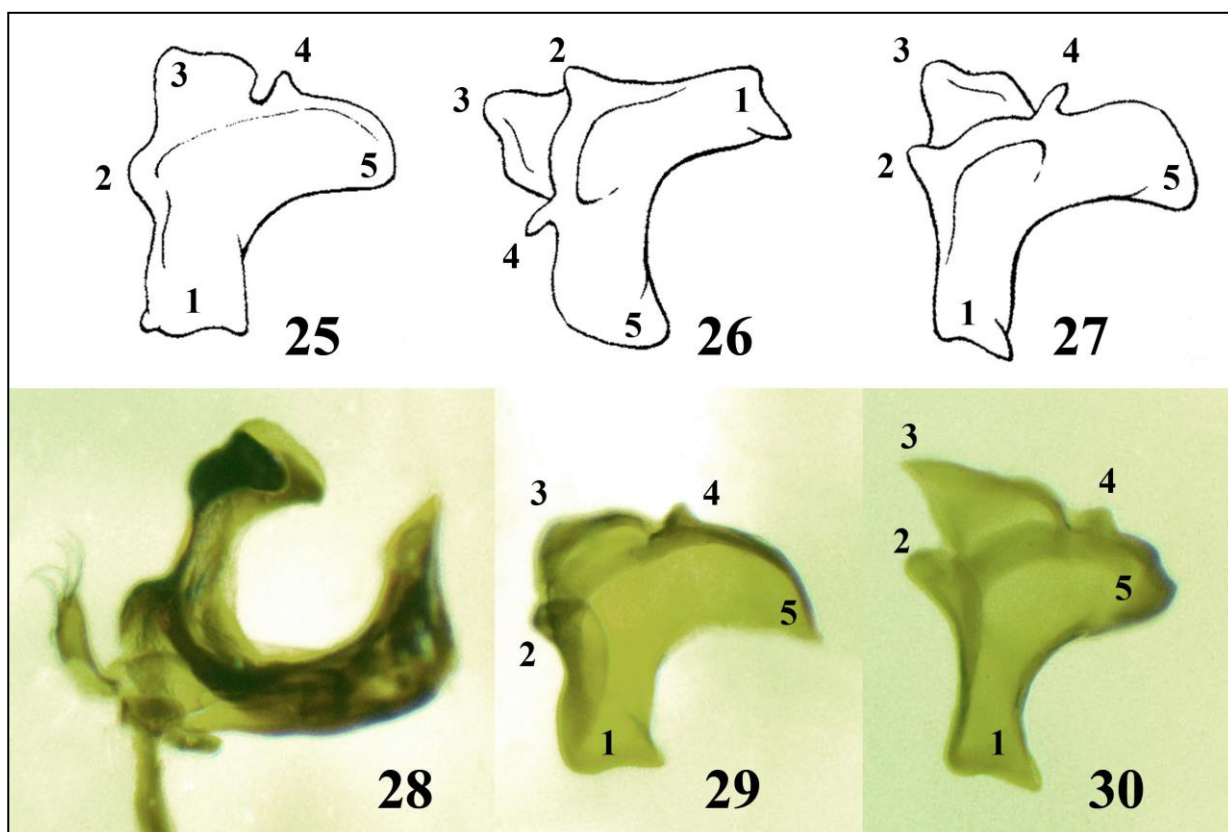


**Figs. 15–17.** *Sepedon* spp, male postabdomen with surstyli, caudal view: 15 — *S. hecate*; 16 — *S. spinipes*; 17 — *S. tenuicornis*.





**Figs. 18–24.** *S. hecate*, lateral: 18 — hypandrium [drawing from ELBERG *et al.* (2009)]; 19–21 — hypandrium, outer view of the same sclerite under different angles; 22 — aedeagal complex [drawing from ELBERG *et al.* (2009)]; 23–24 — aedeagus, the same sclerite under different angles.



**Figs. 25–30.** *S. tenuicornis*, inner genitalia, lateral: 25 — hypandrium [from ELBERG *et al.* (2009), as *S. gracilicornis*]; 26 — hypandrium [from ELBERG *et al.* (2009)], original image except for numerals; 27 — hypandrium [from ELBERG *et al.* (2009)], the same image correctly turned; 28 — aedeagus, lateral view; 29–30 — hypandrium, outer view of the same sclerite under different angles.



**Figs. 31–32.** Males *S. plumbella*: 31 — dark form (Thailand, Phuket prov.); 32 — yellow form (India, Goa st.).



**Figs. 33–34.** Males *S. ferruginosa*: 33 — dark form (Thailand, Chonburi prov.); 34 — yellow form (India, Orissa st.).



**Figs. 35–37.** Nearctic *Sepedon* spp: 35 — *S. armipes*, ♂; 36 — *S. tenuicornis*, head and antenna, lateral; 37 — *S. fuscipennis*, head and antenna, lateral.