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Revision, phylogeny and classification of the genus *Dorylomorpha* (Diptera, Pipunculidae)

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The World fauna of *Dorylomorpha* Aczél is revised. Keys, descriptions (including early stages), distribution maps and information on habitats, hosts and phenology are presented. Discussions of the reconstruction of phylogenetic relationships and on classifications are included, as well as a phylogeny hypothesis reached by a new method based on repeated compatibility analyses, where non-homoplastic characters are detected by means of clique intersections and character compatibility probabilities, and a classification based on anagenetic analysis.

New subgenera: *Dorylomima*, *Dorylomyia*, *Dorylomyza* and *Pipunculina*.

New species and subspecies: *Dorylomorpha aberrans*, *alaskensis*, *amurensis*, *burmanica*, *dispar*, *extricatoides*, *flavolateralis*, *flavoscutellaris*, *fulvitarsis*, *hardyi*, *improvisa*, *indica*, *kambaitiensis*, *koreana*, *lautereri*, *malaisei*, *neglecta*, *onegensis*, *orientalis*, *sachalinensis*, *semiclavata*, *shatalkini*, *similis*, *simplex*, *spinosa* ssp. *kamchatkensis*, *subclavata* and *tanasijtshuki*.

New combinations: *Dorylomorpha montivaga* (Hardy), *Eudorylas angustipennis* (Kertész), *E. confusoides* (Lamb), *E. lini* (Hardy), *E. nitidifrons* (Becker), *E. quartarius* (Brunetti), *Tomosvaryella helwanensis* (Collin) and *T. pterae* (Kapoor & Grewal).

New synonyms: *Tomosvaryella intermedia* (Aczél) → *Dorylomorpha imparata* (Collin), *Dorylomorpha ornata* Hardy → *Dorylomorpha albitarsis* (Zetterstedt), *Dorylas strandi* (Duda) → *Dorylomorpha borealis* (Wahlgren) and *Dorylomorpha uncinata* Hardy → *Dorylomorpha caudelli* (Malloch).

Neotypes are designated for *Dorylomorpha beckeri* (Aczél) and *aczeli* Hardy, and lectotypes for *Dorylomorpha caudelli* (Malloch), *borealis* (Wahlgren), *strandi* (Duda), *albitarsis* (Zetterstedt), *imparata* (Collin), *confusa* (Verrall) and *extricata* (Collin).

Fig. 59. *D. xanthocera*, flight period, Central Europe ($n = 56$).

Distribution: Map 3. Palaearctic. Austria, Belgium, Czechoslovakia, Denmark, Finland, FRG, GDR, Hungary, Italy, Poland, Romania, ?Sweden (Ringdahl 1951), Switzerland, USSR (Leningrad region, Moscow region, Ukrainian SSR), Yugoslavia. Temperate-Southern Boreal, Montane.
Phenology: Fig. 59. Univoltine. The late flight period suggests that overwintering within the host might be possible.
Biology: In S. Finland, I have collected a few specimens with a flight trap in a herb-rich forest edge meadow. Ott's (1900) account of the puparium is hardly likely to be a pipunculid at all.

Hosts unknown.

D. (Dorylomyia) shatalkini n. sp.

Figs. 56 sha, 60, Map 2

Type locality: USSR, Amur region, Zeya.

Type material: Holotype: ♂, Амурск обл., г. Зея [Amursk obl., g. Zeya], 3.VII.1979, A. Шаталкин [A. Shatalkin] (ZMM. Paratypes: Same locality and collector as the holotype: 1♂ 12.07.78, 1♀ 14.VIII.1981 (ZMM).

Diagnosis

Tibiae entirely yellow. Surstyli with a dilated, knob-like apical part. Ovipositor with piercer shorter than basal part, almost straight, with indications of lateral flanges, basal part longer than wide, distinctly narrowing towards distal end.

Description

Male

Head: Frons almost twice as wide as anterior ocellus. Antennal segment 3 yellow.

Thorax black; humerus brownish-black; haltere brownish-yellow; hairs rather short, about 1/3 as long as height of humerus.
Wing 5.6–5.7 mm ($n = 2$).
Legs: Coxae blackish with rather broadly yellowish tips. Trochanters brown, slightly darkened. Femora black with apical 1/5–1/4 yellow. Tibiae brownish-yellow, sometimes slightly discoloured. Tarsi brownish-yellow, apical segments slightly darkened. Hind tibia mid-anteriorly at most with indistinctly outstanding bristly-hairs.
Abdomen (Fig. 60 abd) rather elongate, membranous area of sternite 8 large, irregularly oval or subtriangular.
Genitalia (Fig. 60): Surstyli almost identical, apical part dilated, knob-like; outer lobe without a lateral projection; ventral projection of inner lobe large, elongate, lingulate. — Aedeagal setae: Internals strongly reduced (?or absent); about 7 dorsals and 2–3 laterals present. — Ejaculatory duct with long and slender tubules (as in *D. xanthocera*, Fig. 58.

Female

Similar to the male but abdomen more elongate and hind tibia mid-anteriorly with 2 (–3) bristly-hairs distinctly outstanding from the general pubescence.
Wing 5.4 mm ($n = 1$).
Ovipositor (Fig. 56 sha): Piercer shorter than basal part, almost straight, slightly bulbous at base, with a slight constriction near tip (dorsal view) and indications of lateral flanges. Basal part distinctly longer than wide, narrowing towards base of piercer. Anal opening far removed from the actual base of the piercer. Measurements ($n = 1$):

Ovl	0.96 mm	Bl	0.54 mm
Pl	0.42 mm	Bw	0.34 mm
Pl/Bl	0.78	Bl/Bw	1.59

Distribution: Map 2. Palaearctic. USSR (Amur region). Middle boreal.
Phenology: Adults in July and August.
Biology unknown.

Female
Similar to the male.
Wing 3.6–4.9 mm. Variation (range, mean±*SE*, *n*):

Northern Europe 4.0–4.6 mm (4.33±0.02, 39)
Central Europe 3.6–4.9 mm (4.38±0.02,107)

Ovipositor (Fig. 130 con): Piercer distinctly longer than basal part, distinctly upcurved, stout, almost circular in cross-section, its sides concave in distal part. Basal part widest near base, strongly constricted in distal part. Measurements (range, mean±*SE*):

Northern Europe (n = 30)

Ovl	1.06–1.18 mm	(1.105±0.006)
Pl	0.58–0.66 mm	(0.617±0.004)
Bl	0.44–0.54 mm	(0.488±0.004)
Bw	0.28–0.34 mm	(0.310±0.002)
Pl/Bl	1.16–1.41	(1.277±0.010)
Bl/Bw	1.37–1.80	(1.569±0.017)

Central Europe (n = 19)

Ovl	1.04–1.18 mm	(1.113±0.010)
Pl	0.58–0.66 mm	(0.632±0.005)
Bl	0.42–0.52 mm	(0.481±0.007)
Bw	0.30–0.34 mm	(0.314±0.003)
Pl/Bl	1.23–1.48	(1.319±0.018)
Bl/Bw	1.31–1.67	(1.535±0.021)

Distribution: Map 37. Palaearctic. Austria, Belgium, Bulgaria, Czechoslovakia, Denmark, Finland, France, FRG, GDR, Hungary, Italy, Netherlands, Norway, Poland, Sweden, Switzerland, UK, USSR (Estonian SSR, Karelian ASSR, Leningrad region, Moscow region, Sachalin region, Tomsk region, Ukrainian SSR). Temperate-Middle Boreal, Montane. Predominantly Temperate-Southern Boreal.
Phenology: Fig. 133. Apparently univoltine throughout its range. Probably overwinters in the pupal stage.
Biology: Lauterer (1981) gives the following account from Czechoslovakia: "Occurs in humid and dry woods, and at wood edges, rarely in mesic and humid meadows, fens and peat-bogs ... It was collected in various forest types, including lowland forests, oak-hornbeam and coniferous woods, in the subalpine zone as well as in avalanche slopes".

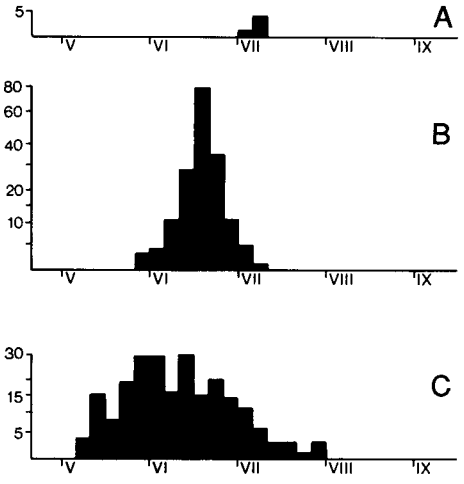

Fig. 133. *D. confusa*, flight period. A. North Fennoscandia (Norway) (n = 5), B. Central Fennoscandia (n = 180), C. Central Europe (n = 225).

In S. Finland, I have found *D. confusa* mostly in humid, herb-rich meadows along forest margins and in forest clearings, rarely in marshy biotopes, and only rarely in drier habitats such as road-side banks and dry meadows. I have also observed males of this species hovering low over dense stands of *Aegopodium podagraria* in gardens and deciduous forests, both in sunny and cloudy (but warm) weather.

In Finland it frequently occurs together with the following cicadellids: *Cicadula* spp., *Elymana sulphurella* (Zett.), *Lebradea flavovirens* (Gill. & Baker), *Macrosteles* spp., *Psammotettix confinis* (Dahlbom), *Sonronius dahlbomi* (Zett.), *Sorhoanus xanthoneurus* (Fieber) and *Verdanus abdominalis* (Fabr.).

Hosts unknown.

D. (Dorylomorpha) amurensis n. sp.

Figs. 130 amu, 134, 135, Map 34

Type locality: USSR, Amur region, Zeya.

Type material: Holotype: ♂, Амурская обл., г. Зея [Amurskaya obl., g. Zeya] 24.VI.1981, A. Озеров [A. Ozerov] (ZMM). Paratypes: Same locality as the holotype,

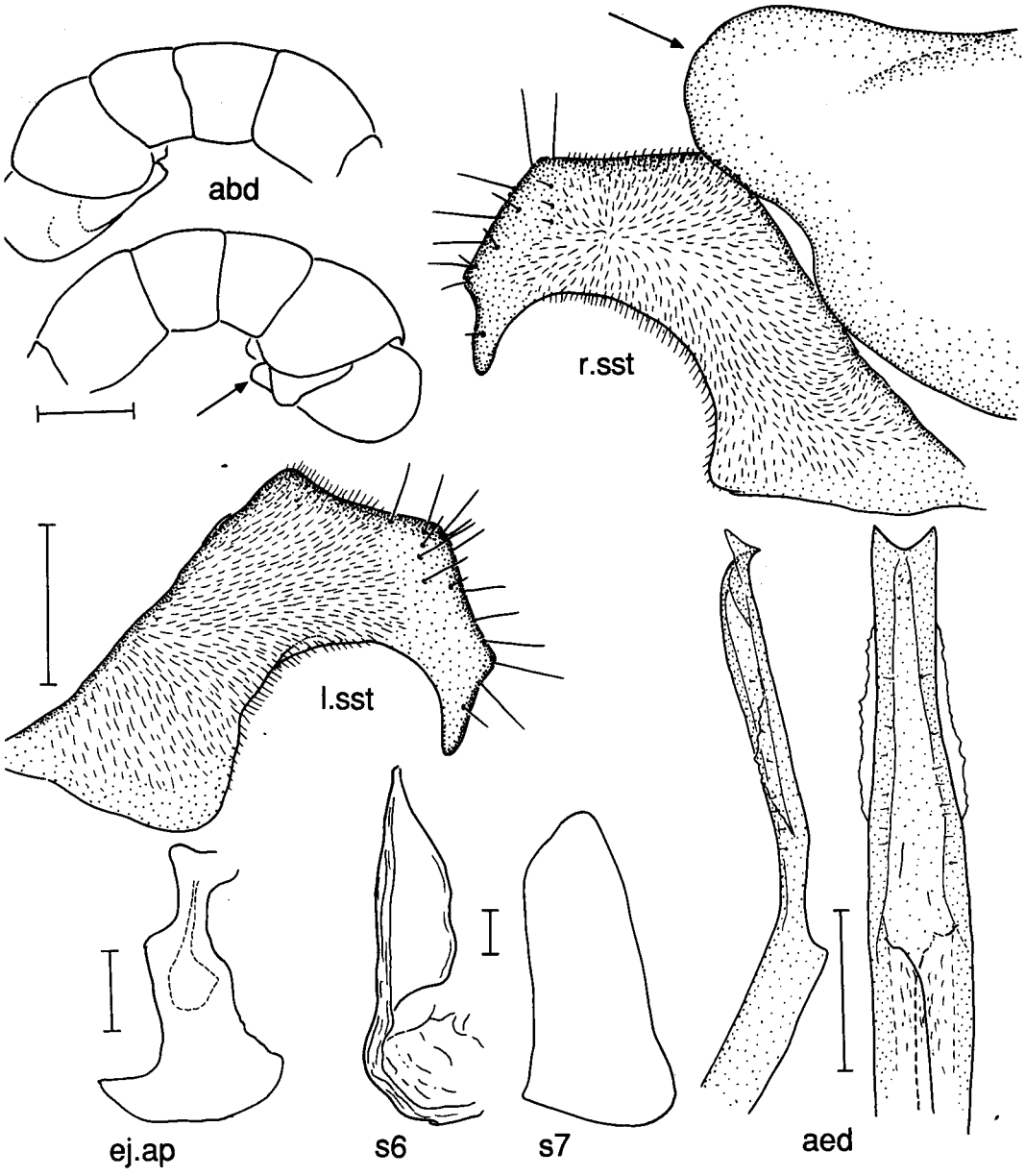

Fig. 134. *Dorylomorpha amurensis*, male abdomen and genitalia (holotype). Enlarged apical lobe of epandrium indicated by arrows. Scale: ≈ 0.5 mm for abd, ≈ 0.1 mm for the rest.

А. Шаталкин [A. Shatalkin]: 1♂ 1♀ 7.VI.1978, 1♀ 8.VI.1978, 2♂ 1♀ 9.VI.1978, 2♂ 1♀ 10.VI.1978, 2♂ 12.VI.1978, 1♂ 15.VI.1978, 1♀ 16.VI.1978, 1♀ 19.VI.1978, 1♂ 24.VI.1978, 1♂ 26.VI.1978, 1♂ 27.VI.1978, 1♂ 4.VII.1978, 2♂ 7.VII.1978, 1♂ 8.VII.1978, 1♀ 14.VII.1978, 1♀ 26.VI.1979, All in ZMM; 1♂ Ю. Сахалинск [Yo. Sachalinsk], 13.06.1954, Н. Виолович [N. Violovich] (ZIL); 1♀ Ю. Сахалинск [Yo. Sachalinsk], 12.06.1954, Н. Виолович [N. Violovich] (ZIL).

Fig. 135. *D. amurensis*, flight period, Amur region, Sachalin region ($n = 26$).

Diagnosis

Antennal segment 3 brown. Femora mainly black.

Male easily separated from all other species by the enlarged apical lobes of the epandrium which conceal the cerci in lateral view (visible without dissection).

Female resembling *D. confusa* but coxae and third antennal segment paler and ovipositor smaller with piercer almost straight-sided and triangular in cross-section, and basal part at most very slightly constricted distally.

Description

Male

Head: Frons about 1 1/2 as wide as anterior ocellus. Antennal segment 3 rather pale brown.

Thorax black, haltere brownish-yellow.

Wing 4.1–5.1 mm ($\bar{x} = 4.65 \pm 0.06$, $n = 17$).

Legs: Coxae black with narrowly yellowish tips. Trochanters brownish-yellow to brown, sometimes slightly discoloured. Femora black with the extreme bases and apical 1/5 brownish-yellow. Tibiae brownish-yellow, sometimes slightly discoloured at middle. Tarsi brownish-yellow, apical segments darkened.

Abdomen (Fig. 134 abd): Sternite 8 about 1/2 as long as tergite 5 in dorsal view, regular, evenly rounded.

Genitalia (Fig. 134): Epandrium with apical lobes (those surrounding the cerci) enlarged, distinctly constricted from the rest of the epandrium, usually completely concealing the cerci in lateral view. — Surstyli short; apical part small, its ventral part narrowly subtriangular. — Aedeagus short, slightly upcurved; proximal membrane weak and narrow; projecting part of distal membrane small, almost triangular. Setae: 2–3 weak internals, 0–1 dorsals and 5–8 weak laterals.

Female

Similar to the male.

Wing 4.4–4.8 mm ($\bar{x} = 4.59 \pm 0.06$, $n = 9$).

Ovipositor (Fig. 130 amu): Piercer slightly longer than basal part, distinctly upcurved, triangular in cross-section, almost straight-sided. Basal part slightly widening towards base, straight-sided or slightly set-off in distal part. Measurements (range, mean±*SE*, $n = 8$):

Ovl	0.92–1.00 mm	(0.973±0.009)
Pl	0.50–0.54 mm	(0.526±0.003)
Bl	0.42–0.48 mm	(0.454±0.005)
Bw	0.26–0.30 mm	(0.283±0.005)
Pl/Bl	1.08–1.23	(1.167±0.016)
Bl/Bw	1.47–1.71	(1.595±0.032)

Distribution: Map 34. Palaearctic. USSR (Amur region, Sachalin region). Southern Boreal, Middle boreal.

Phenology: Fig. 135. Apparently univoltine. Probably overwinters in the pupal stage.

Biology unknown.

D. (Dorylomorpha) atramontensis (Banks in Cresson, 1911)

Figs. 136, 137 atr, 138, Map 40

Pipunculus atramontensis Banks in Cresson, 1911:312.

Dorylomorpha atramontensis: Hardy 1943:132; Aczél 1948:19; Hardy 1965:556.

Type locality: USA, North Carolina, Black Mountains, North Fork of Swannanoa River.

Type material studied: Holotype: ♂, Black Mt., N. C., N. Fork, Swannanoa, Coll. Banks / type No. 13562 (MCZM).

Other material: See Appendix 3.

Diagnosis

Antennal segment 3 yellowish. Femora mainly yellow.

For the differences between *D. atramontensis* and *D. improvisa*, see the diagnosis of the latter.

Description

Male

Head: Frons slightly narrower than anterior ocellus. Antennal segment 3 yellow to brownish-yellow.