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A STUDY ON *HESPERINUS* WALKER WITH DESCRIPTION OF A NEW SPECIES (DIPTERA: HESPERINIDAE)

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An overview of the family Hesperinidae is given and differentiating morphology is summarised. The morphological differences in male genitalia of some European populations of *Hesperinus imbecillus* (LOEW) are demonstrated and all the locality data (Europe) are revised. A second European species, *Hesperinus graecus* sp. n. (Greece) is described. The specimens from the North Caucasus (Krasnaya Polyana) represent a third species, described elsewhere. With 60 original figures + 2 photos.

Key words: Hesperinidae, *Hesperinus*, taxonomy, new species, Palaearctic region

INTRODUCTION

Hesperinidae is an anisoneurine dipterous family with a single genus and low number of species. KRIVOSHEINA (1997) named it as "a relict group of Diptera", and indeed, its limited number of species has a special pattern of distribution (see below).

Formerly some authors (DUDA 1930, HARDY 1981, HARDY & TAKAHASHI 1960, etc.) treated it as a subfamily of Bibionidae. However, a majority of the authors hitherto considered it as a family from HENDEL (1928) to the modern handbooks (e.g. KRIVOSHEINA 1997) and most recent taxonomical analyses (AMORÍM & RINDAL 2007, BERTONE, COURTNEY & WIEGMANN 2008). KRIVOSHEINA (1997) thought Hesperinidae closest to the families Cramptonomyiidae, Pachyneuridae and Pleciidae. KRIVOSHEINA and MAMAEV (1967) found synapomorphies for the larvae and pupae of Hesperinidae and Pachyneuridae against other families of Bibionomorpha.

Hesperinids are rare in collections, and as for the more widespread European species, *Hesperinus imbecillus* (LOEW, 1858), distribution data have formerly been unusually dubious. Actually this last situation was the most important reason, why I engaged in their study.

MATERIALS AND METHODS

Most of the material in this study is in the Diptera Collection of the Hungarian Natural History Museum (HNHM). In the last couple of years my colleagues collected specimens – usually while collecting other insects along mountain streamlets – in Croatia, Serbia and Greece. Also I managed to capture three male specimens of *Hesperinus* in the Tordai-hasadék (NW Romania, W Transsylvania), which is the northernmost occurrence in Europe (see below).

The author borrowed a male from a locality close to the type locality of *H. imbecillus* (LOEW), through the courtesy of Dr. J. ZIEGLER (Zoologisches Museum, Humboldt Universität zu Berlin, Germany). We received males also from the Naturhistorisches Museum Wien and from the Muséum d'Histoire Naturelle Neuchâtel, Switzerland (see below).

A thorough study of all those specimens revealed that their characters vary strongly, particularly so for the male genitalia.

Below label data are quoted letter by letter; hand-written label data are given in quotation marks, whereas my annotations of label data are in square brackets; labels are separated by a "–" character.

The holotype specimen of *H. graecus* sp. n. and specimens of *Hesperinus imbecillus* (if not otherwise stated) are in the Diptera collection of the Hungarian Natural History Museum, Budapest.

Hesperinus WALKER, 1848

Type species: *Hesperinus brevifrons* WALKER, 1848 (orig. des., mon.).
Gender: masculine.
Spodius LOEW, 1858; a junior subjective synonym. Type species: *Spodius imbecillus* LOEW, 1858 (orig. des., mon.).

This is the only genus of the family Hesperinidae, consequently its features are characteristic also for the family.

The terminology for the structure of the head follows MATILE (1990). For detailed morphology of the family (i.e. for the only genus *Hesperinus*) see KRIVOSHEINA (1997).

Head comparatively small, frons broad also in males, eyes oval, dichoptic, ocelli comparatively large, each on small tubercles. Eye facets of equal size. Scape and pedicel sub-globular (only slightly longer than broad) or pedicel cylindrical. Antenna with 10 flagellomeres (Fig. 43, photo) in *H. imbecillus*, and also in *H. brevifrons* (see HARDY 1981: fig. 2). Tenth flagellomere rounded (*H. imbecillus*, Figs 2–3) or elongated. Distal dorsal corners of first flagellomere and that of the next ones are distinct (*H. imbecillus*, Fig. 1) or indistinct (*H. graecus*, Fig. 45). Flagellomeres longer (male) or short (female).

Mouth parts distinct, comparatively well-developed. Palpus usually longer than head, four-segmented (see e.g. MOHRIG *et al.* (1975): figs 2c, 3b, 4b,c): basal segment being the shortest in male, comparatively longer in female, second seg-

ment the thickest in female, elongated in male, third and fourth segments elongated, particularly so for the fourth.

Pronotal lobes of thorax small but prescutum separated from mesoscutum by a distinct though shallow transverse groove behind head. Scutellum small, subscutellum indistinct (contrary to *Pachyneura*).

Wing membrane not patterned but with distinct or indistinct pterostigma. No strong costal fringe. Costa reaches 1/3 to 1/2 of distance between R_5 and M_1, in cases ends not far from R_5 (wing vein terminology follows KRZEMIŃSKI & EVENHUIS 2000). Radial veins R_1 and R_5 dorsally with long setae. Vein R_4 long and sinuous (KRIVOSHEINA 1997: fig. 4), with some dorsal setae (seldom bare). M_1, M_2, M_3 with dorsal setae, more rarely setae also on apical part of Cu_1. Cross-vein M_3-Cu_1, M_3 longitudinal vein and basal part of M_3 meet in a point, where smallest angle is on M_3, largest angle formed by the basal part and cross-vein. M_1-M_2 and R_5 (more precisely: Rs) rather far from each other, i.e. R-M cross-vein long. Cu_2 distinct and runs rather far from Cu_1 and ends at the strongest curvature of Cu_1. A_1 long, reaching wing margin but A_2 indiscernible(reduced to alar base). No alula, sub-basal edge of wing bears long setulae.

Halter long, stalk of halter with hair all along. Knob flattened.

Legs long, coxae medium-long, subequal. Femoral and tibial setulae fine and dense, and not arranged in rows. Tibial spurs 1+2+2, more or less developed and hairy. Fore tibia without an emarginated area. Metatarsi long, almost as long as other tarsomeres combined. No anterior or posterior combs of small thornlets at apices of tibiae. Tarsal claws simple, short, pulvilli and empodium minute.

Abdomen very long with 8 normal abdominal segments, the 8th can be named as postabdominal. In each segment tergite and sternite almost meet laterally, i.e. intervening membranous area rather small. Spiracle pairs 1–7 are situated in membrane. Tergite 8 and sternite 8 have species-specific shape and setosity. Epandrium (Figs 6, 14, etc.) usually simple but may be species-specific. Left and right gonocoxites fused medially (Figs 18, 36, 52) into a ventral scoop-shaped structure, whose ventral caudal edge dorsally curved and so closing genital cavity caudally. The dorsal part of gonocoxites with the medio-cranial gonocoxal apodemes, under the epandrium (gonocoxal apodemes are linked to the inner genitalia through connections to parameres). Dorso-caudally gonocoxites form a pair of closed sclerites with a hole, which embrace base of gonostyli (Figs 18, 36, 52). Gonostylus is shoe-lift–shaped, i.e. concave except for a basal part proximal to sub-basal process; the concavity is more or less strong in males of the different populations of *H. imbecillus*. Dorsal edge with a subapical usually broad medial lobe and a sub-basal process (Figs 8, 15, etc.). The latter seems double in cases, when ventral edge of gonostylus bulging below the process. Parameres, phallus and ejaculatory apodeme form the intricate inner genitalia, where phallus is minute

(see also SINCLAIR 2000: figs 2.8–11 for *H. brevifrons* WALKER). Also the form and setosity of the cerci and hypoproct may show specific features.

The larvae and pupae of *H. rohdendorfi* KRIVOSHEINA et MAMAEV, 1967 were found in decaying wet logs of deciduous trees in the Russian Far East. This is the only reliable record of their life habits. The adults of *H. imbecillus* were found close to mountain streamlets (its flightless female on soil only) during spring months.

No described fossil of Hesperinidae has been found until rather recently. SKARTVEIT (2009) described three species of *Hesperinus* from Baltic amber (early Eocene) but the minimum age of the stem species has not been known. For instance, that of the Pachyneuridae is from the Upper Jurassic (Tithonian) (EVENHUIS 1994). There is a single genus known in the family; hitherto six species of peculiar distribution have been known.

There is one species each in the Nearctic and the Neotropical regions, incl. the type species, *H. brevifrons* WALKER, 1848 (Canada and U.S.A. (incl. Alaska)), and *H. conjungens* SCHINER, 1968 (Brazil). In the Palaearctic region there is one species *H. imbecillus* (LOEW, 1858) in Europe, see below. In addition, several specimens of a *Hesperinus* species were captured in the North Caucasus (Krasnodarskiy kray). The identity of the latter specimens was established now: those represent another (i.e. a new) species (see PAPP & KREIVOSHEINA 2010).

Three species (*H. cuspidistylus* HARDY et TAKAHASHI, 1960, *H. nigratus* OKADA, 1934 and *H. rohdendorfi* KRIVOSHEINA et MAMAEV, 1967) have been known in the Russian Far East (Primorskiy kray, Kuril Is.) and Japan (Hokkaido, Honshu) (see KRIVOSHEINA & MAMAEV 1986). Some specimens of the latter two species are preserved in the HNHM and have also been studied there.

Specific differentiating features are summarised in the key below.

Hesperinus imbecillus (LOEW, 1858)
(Figs 1–43)

Spodius imbecillus LOEW, 1858 was described from "Hungaria (Stein)" (p. 108), which did no specify the locality. However, on p. 108 (3rd par., 3rd line) LOEW fixed clearly Mehádia, as the locality, from where STEIN had the specimen (there is no reason to presume that there was more than one specimen at LOEW's disposal). THALHAMMER (1900) gave only Mehádia as its locality in Hungary, so he knew the original (type) locality only. As one can see below, I could not find evidence of the existence and whereabouts of the type specimen during this project.

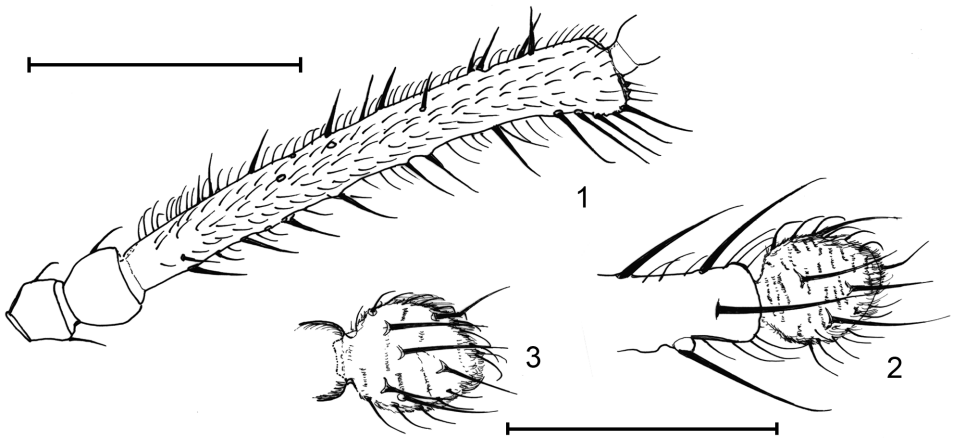
The earliest reliable occurrence data are in DUDA's (1930) monograph in LINDNER's series, under the family Bibionidae. He published "Im Ung. Nat. Mus.

1 ♂, 1 ♀ "Szirnka" und 1 ♂ aus Jasenak, 1 ♂ "Mehadia", 1 ♂ "Verestorony" [central South Carpathians near Turnu Roşu, Romania], 1 ♂ Karst; im Wien. Mus. mehrere ? aus Österreich, Styria inf., [later Yugoslavia, now Slovenia], Illyria Pashtrik (Albanien)".

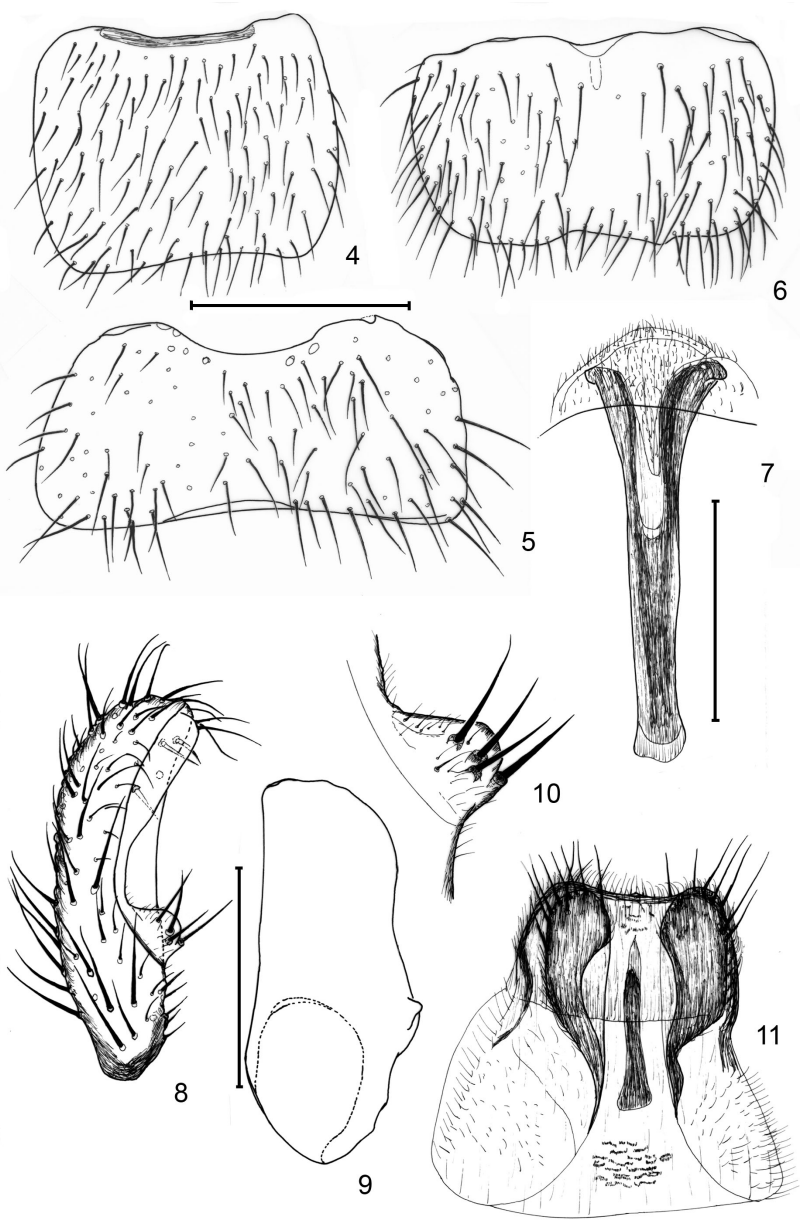
In the series Fauna Hungariae ZILAHI-SEBESS (1960) gave Jasenak [below the Great Kapela Mts, W Croatia], Mehádia [westernmost part of South Carpathians, Romania], Karszt-hegység [Italy, Slovenia or Croatia!], Szirnka, Verestorony as localities of occurrence in the south parts of the Carpathian Basin. Regretfully, I have to note also here that ZILAHI-SEBESS wrote all those from his memory, at most, based on his file, since all that material had been destroyed in November 1956 (FÖLDVÁRI & PAPP 2007).

KRIVOSHEINA and MAMAEV (1986) gave its distribution as "Central and South Europe (NL, D, DDR, A, CS, H, AL, R, YU); USSR: SET (Krasnodarskiy kray); mainly in mountain region". Actually it has never been reported from the Netherlands, and SCHUMANN's (1999: 54) item in the Diptera checklist for Germany is without a material base (no voucher specimen has ever been published from the territory of Germany). Their "CS" [Czechoslovakia)] is a consequence of a misbelieve/misunderstanding that one of the localities listed by DUDA (1930) and/or ZILAHI-SEBESS (1960) would have been a locality in Slovakia. Hungary might have been listed just based on the supposed location of the type locality.

Below I list and characterise the known populations of *H. imbecillus* by the specimens available for me, according to countries eastwards.



Figs 1–3. *Hesperinus imbecillus* (LOEW), antenna of a male specimen from the Tordai-hasadék: 1 = 1st flagellomere, 2 = terminal (10th) flagellomere, medial (inner) view, 3 = same, lateral (outer) view. Scales: 0.4 mm for Fig. 1, 0.2 mm for Figs 2–3



Figs 4–11. *Hesperinus imbecillus* (LOEW), postabdomen and genitalia of a male from "Styria inf.": 4 = tergite 8, 5 = sternite 8, 6 = epandrium, dorsal view, 7 = ejaculatory apodeme, dorsal view, 8 = gonostylus, in a subdorsal view, which is perpendicular to medial process, 9 = contours of gonostylus, in widest view, 10 = sub-basal process of gonostylus, in a view perpendicular to it, 11 = proctiger, dorsal view. Scales: 0.4 mm for Figs 4–6, 0.2 mm for Figs 8–9, 11, 0.1 mm for Figs 7, 10

Austria

FRANZ (1989, p. 103) repeated occurrence data of KRIVOSHEINA and MAMAEV (1986). However, he added "In cMW [Diptera collection of the Naturhistorisches Museum Wien] mehrere Ex. aus "Styr. inf.", heute Jugoslawien. Mir sind keine Funde aus Österreich bekannt." Either he or I regarded MOHRIG *et al.*'s (1975) wording "Österreich" as a publication of a true voucher specimen for Austria. However, at least one of the following three males, which I received from the Naturhistorisches Museum through the courtesy of Dr. PETER SEHNAL, may be accepted as voucher specimen(s) for its occurrence in Austria (southern parts of Austria (Steiermark) seems the most probable area for that):

1 male (NHM; only hind legs lost): Schiner 1869 – "Oesterreich" Alte Sammlung – "imbecillus" det. Schiner. This cannot be one of the four specimens (coll. H. v. Frauenfeld), which were mentioned by Schiner (1864) on his p. 639, since it was captured after the publication of Fauna Austriaca. This is the largest specimen of *H. imbecillus*, I have ever seen, body length 7.0 mm, wing length 7.7 mm.

1 male (NHM, an intact specimen): Raibl. 7.74. [blue letters by a typewriter] – "imbecillus" Bgst [Bergenstamm] – "Spodius imbecillus Lw".

1 male (NHM; both wings broken off, otherwise well-preserved): Mik. No more label data.

So I think, one must not exclude that even MIK's specimen is from a part of the modern Austria.

Italy

I have not managed to get any voucher specimen(s) from Italy. In the case that references would have only been based on the publication of the name "Karst", its Italian part is the least probable to have been the collection site. Fortunately, MOHRIG *et al.* (1975) published obviously valid voucher specimens for its occurrence in Italy: "zwei Höhlen in den Venetianischen Voralpen: Causiglio, Valmenera, 28. 6. 1970 (?) und Praderadego, 900 m, 21. 6. 1970 (♀)". They made figures of the male and female palpus and male gonostylus. Unfortunately, the delicacy of those figures does not allow a comparison to ours. We may note here that the occurrence in caves does not mean that the species is cavernicolous. Rather, this was due to aestivation as they found shelter there in the higher summer temperature (cf. PAPP 1982).

Slovenia

The Karst population is probably from a mountain in Slovenia. No specimen was available for me. I found a notice "Karst" in THALHAMMER's hand-written list of his collection (the specimen(s) destroyed in the HNHM in 1956). I think that is additional evidence that it was from the Slovenia part. But the specimens from "Styria inf." (NMW) represent in any case, a population of the species in Slovenia.

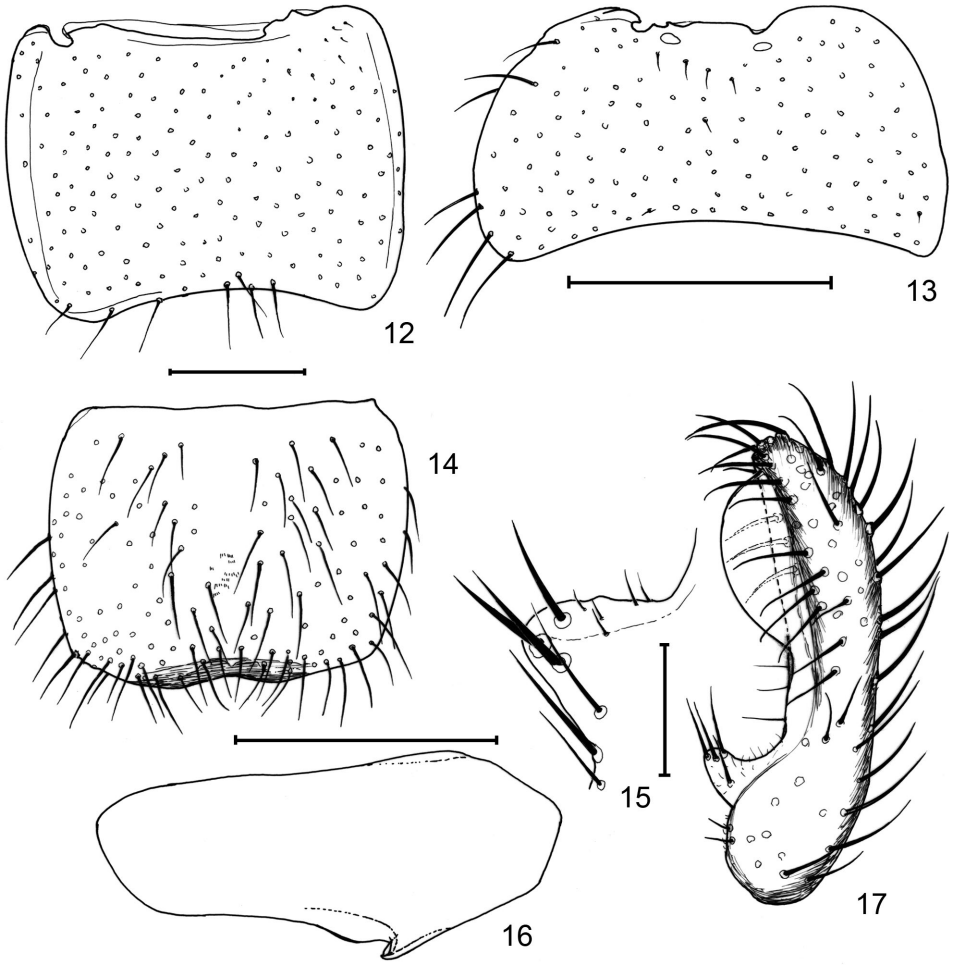
Material studied: 1 male (NHM; mid legs and all right legs lost, apex of right wing broken off, abdominal segments from 6th and genitalia prepared and preserved in a plastic microvial with glycerol): Styria inf., Wotsch, "22. 5. 17", Zerny. Its body length is 5.54 mm.

Male postabdomen and genitalia (Figs 4–11). Tergite 8 (Fig. 4) quadratic, almost evenly covered by setae. Sternite 8 (Fig. 5) characterised by the comparatively long setae. Epandrium (Fig. 6) rather short, without setae cranially and medially. Gonostylus (Figs 8–10) somewhat emarginate in its broadest view, subapical medial lobe long but narrow, sub-basal process rounded with 4 long setae. Hypandrial setae rather short (Fig. 11), cerci slightly narrower than in the eastern populations; membrane sagittally darkened. Ejaculatory apodeme (Fig. 7) straight with strong and comparatively broad cranial part.

Croatia

The Jasenak population was not available for study by me and the male specimen, which OSWALD DUDA had seen in the collection of the HNHM was destroyed here in 1956.

The Papuk population was formerly unknown. Material studied: 1 male (HNHM): CROATIA, Papuk Mts above Kutjevo, brook valley with Alnus, 20 Apr 2004, leg. D. Murányi. I prepared its postabdomen with the genitalia (Figs 12–21). Since it was captured only c. 35 km from the Hungarian



Figs 12–17. *Hesperinus imbecillus* (LOEW), a male from the Papuk Mts, Croatia. 12 = tergite 8, 13 = sternite 8, 14 = epandrium, dorsal view, 17= gonostylus, in a subdorsal view, which is perpendicular to medial process, 16 = contours of gonostylus, in widest view, 15 = sub-basal process of gonostylus, in a view perpendicular to it. Scales: 0.4 mm for Figs 12–13, 0.2 mm for 15–16, and Fig 14, respectively, 0.05 mm for Fig. 17

border, the occurrence of the species also in the Mecsek Mountains (S Transdanubia, Hungary) can be presumed.

Male tergite 8 (Fig. 12) quadrate, evenly covered by setae. Sternite 8 (Fig. 13) rather similar to that of the Styria inf. population. Epandrium (Fig. 14) much different from the above-mentioned populations, quadrate, cranially and medially bare. Gonocoxites (Fig. 18) with very distinct dorso-medial edge in dorsal view, medio-cranial gonocoxal apodemes large. Gonostylus (Figs 15–17) slightly narrowed apically in its widest extension, subapical medial lobe large, sub-basal lobe triangular, the arrangement of setae are different from that of the Slovenian population. Apex of phallus (Fig. 20) rather blunt. Setae on hypoproct weak, in contrast to the rather strong setosity of the cerci (Fig. 21); a thin sagittal area is darker. Ejaculatory apodeme (Fig. 19) probably broken (although I did not see uneven apical edge). If so, cranial part must be massive, broad (actually the broadest among the populations studied).

The "Szirnka" population is most obscure; not even the locality has been identified. My closest match is Srnetica Mts, in Bosnia.

Serbia

In Serbia Dr. DÁVID MURÁNYI and other colleagues captured the first voucher specimen, as follows: 1 female (with minute wing and halter rudiments only): "SERBIA: Surdulica E 6 km, 750 m, forest, 08. 04. 2006, N42°40.725' E22°16.399', Erőss, Fehér, Hunyadi, Murányi".

Albania

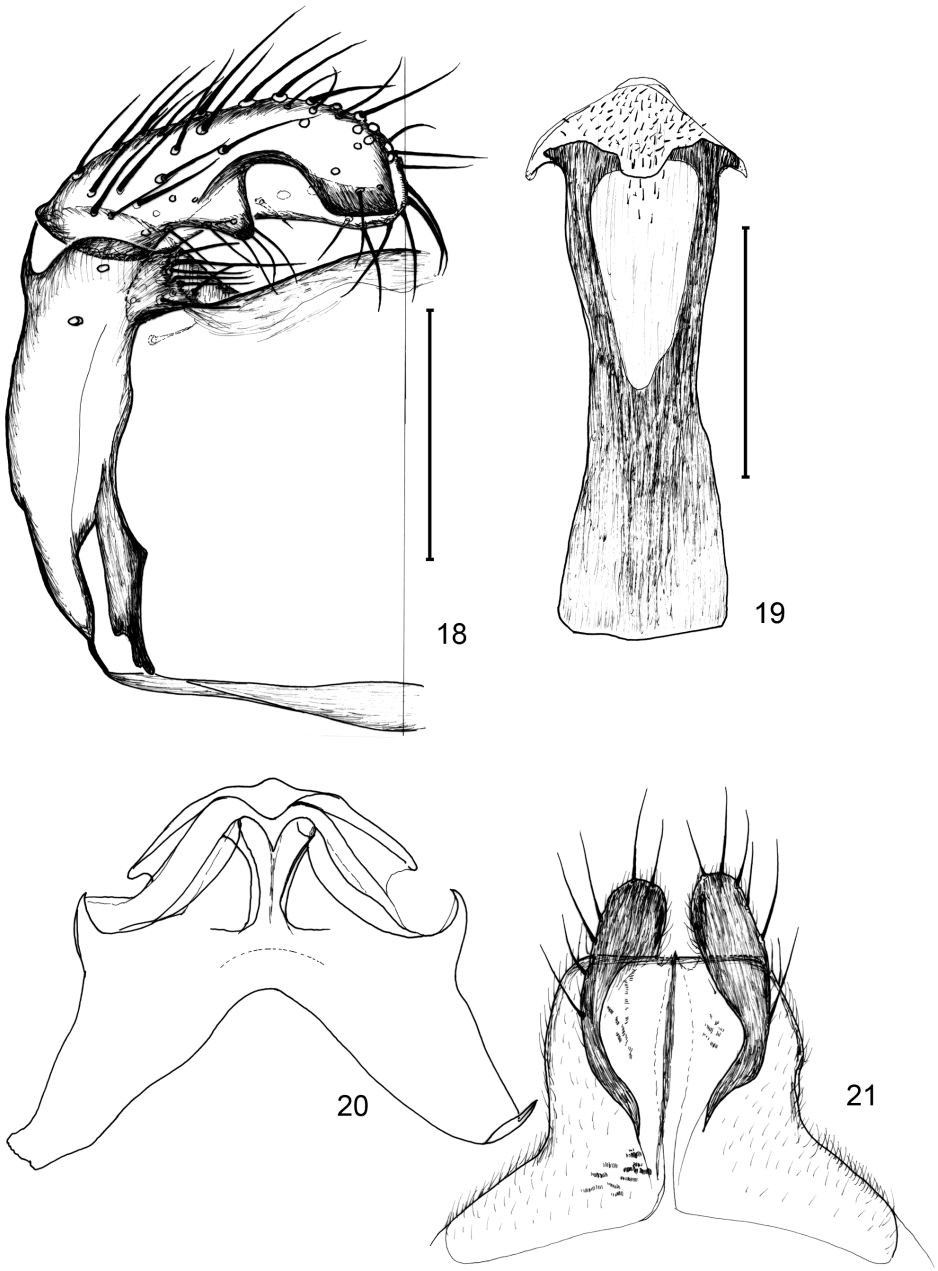
The population(s) in Albania is unknown to me. However, since it was DUDA (1930) who published about it, we should not question its validity as a *Hesperinus* species. The specific identity of the *Hesperinus* specimens in Albania is to be identified on the basis of newly collected material.

Romania

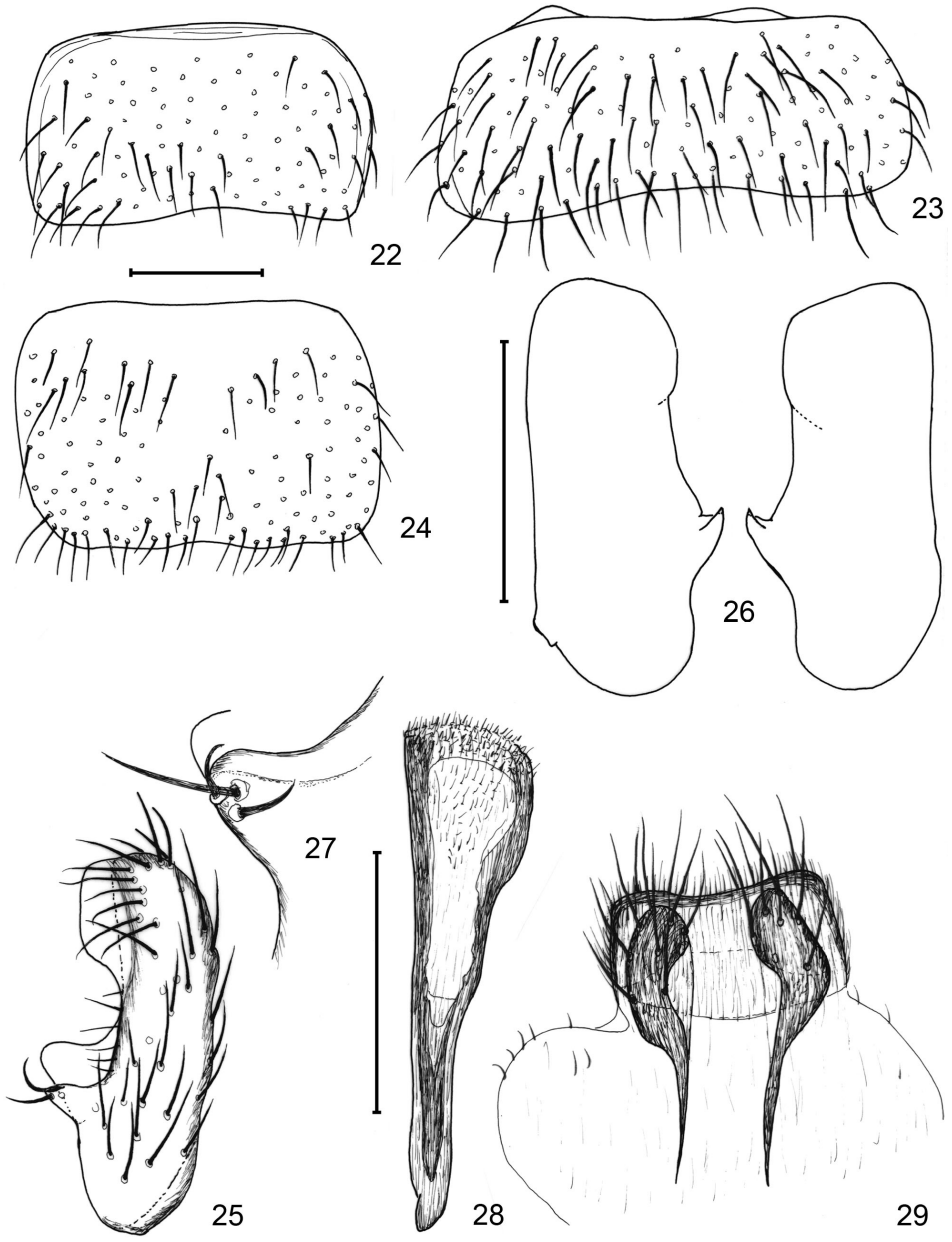
The Mehadia–Orsova population. Material studied: 1 male (Zoologisches Museum, Humboldt Universität zu Berlin): "Orsova, 13. 5. 11." – [second is a rectangular bluish grey label of 2.5*2 mm, without writing, ? coll. Oldenberg] – [red] Typus – Zool. Mus. Berlin. Its left fore leg and hind legs lost, left wing broken in the middle, flagellomeres wrinkled, so I think this is a freshly emerged fly. Abdominal segment 8 and genitalia are detached, prepared and dissected and now are kept in a plastic microvial with glycerol.

It is a matter of course that the above specimen is not the type of *H. imbecillus* (LOEW, 1858). There are rather numerous specimens in the Berlin Museum, which are mislabelled as such (it was Dr ENDERLEIN who labelled them, as far as I am informed). In any case, this specimen is from the type locality population (distance of Mehadia and Orsova is less than 30 km).

Tergite 8 (Fig. 22) of the Orsova male short, not quadrate. Sternite 8 (Fig. 23) short and broad, without strong cranial emargination, its setae rather long. Epandrium (Fig. 24) medium long with large bare cranial and medial parts. Gonostylus (Figs 25–27) with broad blunt apex in its widest vies, subapical medial lobe short but broad, sub-basal process obviously double and inner lobe larger, outer part with 3 setae only. Ejaculatory apodeme (Fig. 28) with massive broad body and narrowing apical part. Cerci comparatively long and narrow (Fig. 29), also hypoproct with long setae.



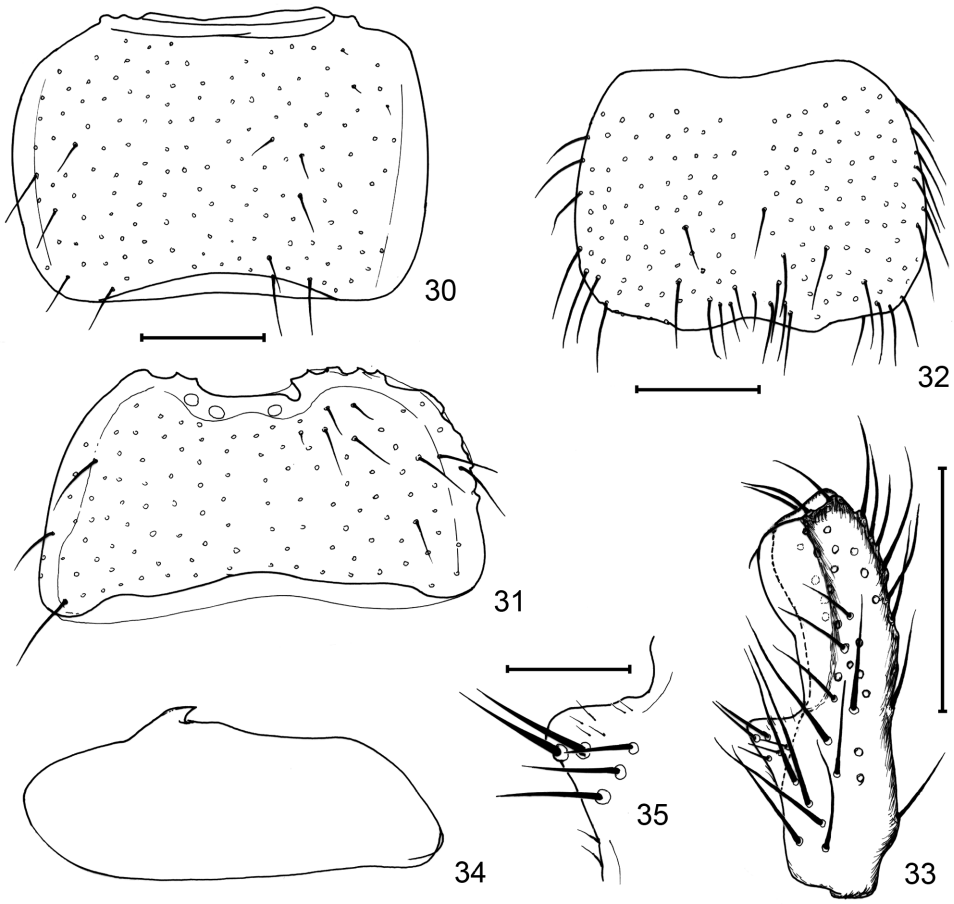
Figs 18–21. *Hesperinus imbecillus* (LOEW), a male from the Papuk Mts, Croatia. 18 = right gonocoxite and gonostylus in dorsal view, 19 = ejaculatory apodeme, dorsal view, 20 = inner genitalia with fused parameres, ventral view, 21 = proctiger, dorsal view. Scale: 0.2 mm for Figs 18, 20–21, 0.1 mm for Fig. 19



Figs 22–29. *Hesperinus imbecillus* (LOEW), a male from the topotypic population, Orsova, Romania. 22 = tergite 8, 23 = sternite 8, 24 = epandrium, dorsal view, 25 = gonostylus, in a subdorsal view, which is perpendicular to medial process, 26= contours of gonostylus, in widest view, 27 = sub-basal process of gonostylus, in a view perpendicular to it, 28 = ejaculatory apodeme, dorsal view, 29 = proctiger, dorsal view. Scales: 0.2 mm for Figs 22–24, 25–26 and 29, respectively, 0.1 mm for Figs 27–28

The "Verestorony", or Vöröstorony is a defile (pass) between the mountains of Szebeni-havasok and Fogarasi-havasok in the central South Carpathians. Its *Hesperinus* population is unknown to me since the specimen referred by DUDA (1930) was destroyed in the HNHM in 1956.

The "Tordai-hasadék" population. Tordai-hasadék is in the environs of Petreştii de Jos, Western Transsylvania, Romania. Material studied: 3 males (HNHM): ROMANIA: Jud. Cluj, Mihai Viteazu, Tordai hasadék, Hesdát-p. [patak, stream] mellett, 450–500 m, 2007. ápr. 30., leg. Papp L. Postabdomen with genitalia of two males have been prepared, figured (Figs 30–39) and kept in plastic microvial with glycerol.



Figs 30–35. *Hesperinus imbecillus* (LOEW), a male from the Tordai-hasadék, Romania. 30 = tergite 8, 31 = sternite 8, 32 = epandrium, dorsal view, 33 = gonostylus, in a subdorsal view, which is perpendicular to medial process, 34 = contours of gonostylus, in widest view, 35 = sub-basal process of gonostylus, in a view perpendicular to it. Scales: 0.2 mm for Figs 30–31, 33–34, and Fig 32, respectively, 0.05 mm for Fig. 35

First flagellomere (Fig. 1) with 4 + 1 long setae at distal dorsal apex. Terminal flagellomere is only slightly longer than broad, inner side with 4, outer side with 6 long setae (Figs 2–3). Its wing length is 6.4 mm. I made ten figures of male postabdomen and genitalia (Figs 30–39). Tergite 8 (Fig. 30) 0.7 times as long as its width, rather evenly setose. Sternite 8 (Fig. 31) nearly twice as broad as long, with uneven and emarginated cranial margin. Epandrium (Fig. 32) sub-quadrate with a bare cranial and a conspicuous medial bare area. Gonocoxites (Fig. 36) comparatively broad; medio-cranial gonocoxal apodemes smaller than in the Papuk population. Gonostylus (Figs 33–35) almost evenly broad in its widest view (except for sub-basal process). Subapical medial lobe of gonostylus long broad, its sub-basal process very large with 5 strong setae. Cerci comparatively small (Fig. 38), setae on hypoproct not weaker than those on cerci. No darker (more sclerotised) sagittal membrane was observed. Ejaculatory apodeme (Fig. 37) robust, also apical part long and broad, i.e. it is much different from that of the Orsova population. Phallus comparatively broadly rounded apically (Fig. 39, cf. Fig. 20: Papuk population, and Figs 56–57: *H. graecus*).

Crna Gora

The Durmitor population widens the known distribution to Crna Gora. Material studied: 1 male (HNHM): [Montenegro] Zabljak, Mont., 6. VII. 1958 – Podgora 1400 m, leg. Mihályi – "Hesperinus imbecillus Lw." det F. Mihályi. The genitalia of this male specimen were broken off (lost). This fact is much hindering this study. I cannot understand it, since as far as I know, nobody has formerly studied hesperinids in the HNHM.

Bulgaria

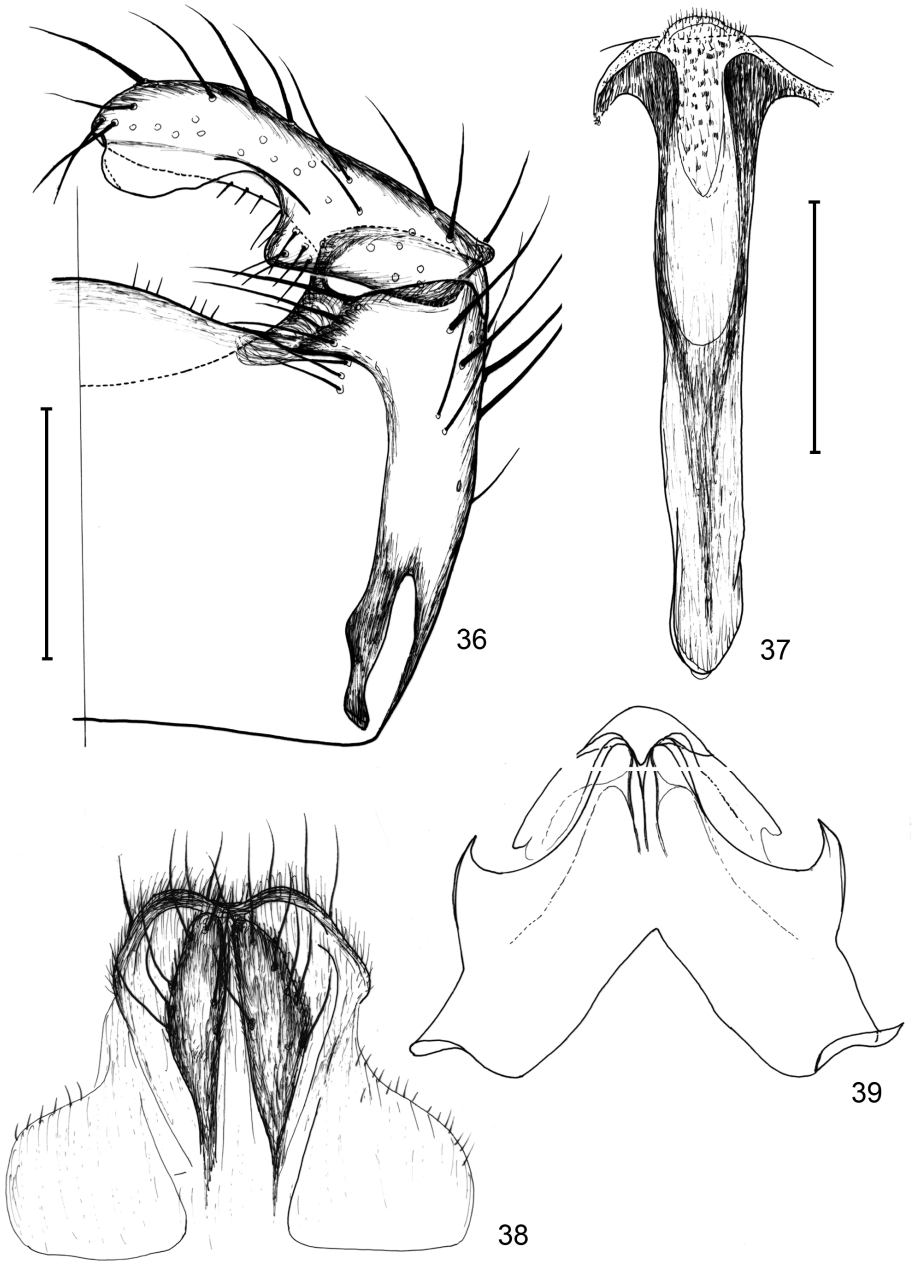
The population(s) in Bulgaria was discovered by the excellent late Czech dipterist, Dr J. MARTINOVSKÝ. "We have 11 specimens of *H. imbecillus* here in collection [MHNN, Neuchâtel], all originating from Bulgaria (most of them were formerly in the Martinovsky's collection" (J.-P. HAENNI, *in litt*.). Dr JEAN-PAUL HAENNI was kind enough to send me a male: 1 male: BULGARIA: 9. 5. 1988. Liljanovo, p. Sandanski (Martinovský) – Hesperinus imbecillus (Loew) ♂ Martinovský det., 1995 – base de données MHNN.

Male genitalia (Figs 40–43). Gonostylus (Figs 40–42) very broad at the level of sub-basal process; subapical medial lobe long but not broad; subbasal process rather large with four strong setae. Ejaculatory apodeme (Fig. 43) robust, also its apical part rather broad.

European Russia (North Caucasus)

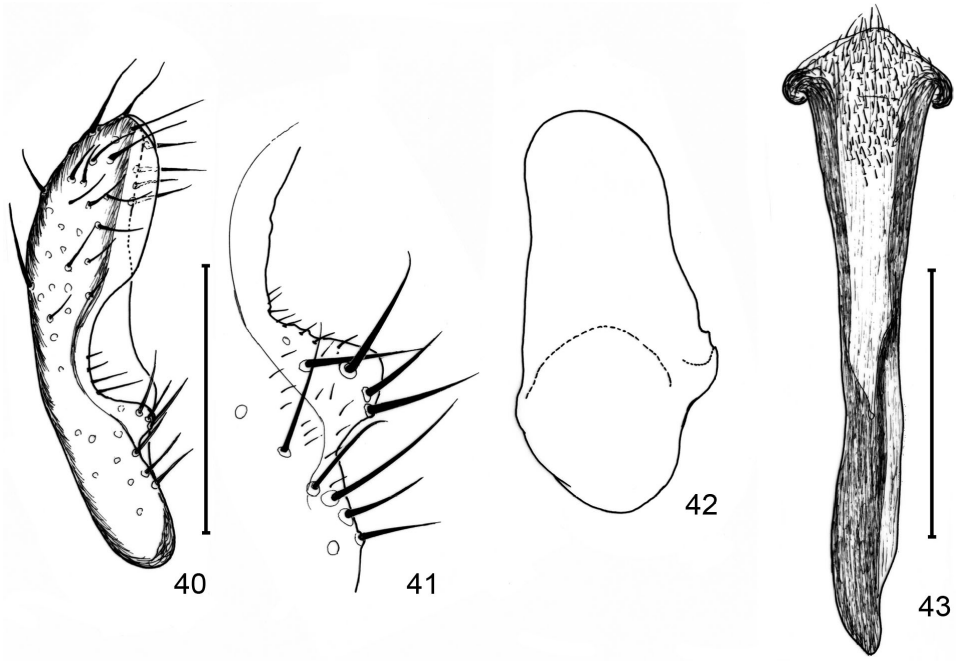
The Krasnodarskiy kray population must be most interesting, living so far from the other European populations. I would like to call attention (also for the users of the Fauna Europaea), that Krasnaya Polyana is in Europe, and within the Russian Federation. And it is not in an autonomous republic or autonomous district but within the Russian Republic itself, not far from Sochi.

In the course of this project I have had an opportunity to study a male from that locality. I can corroborate here that it is a separate species. MOHRIG *et al.* (1975) managed to depict gonostylus, and male palpus of this population. Those have shown definite differences from those of the Austrian and Italian populations. I publish three figures below (Figs 58–60) but the formal description will not be given in this paper (see PAPP & KRIVOSHEINA 2010).



Figs 36–39. *Hesperinus imbecillus* (LOEW), a male from the Tordai-hasadék, Romania. 36 = left gonocoxite and gonostylus in dorsal view, 37 = ejaculatory apodeme, dorsal view, 38 = proctiger, dorsal view, 39 = inner genitalia with fused parameres, ventral view. Scales: 0.2 mm for Figs 36, 38–39, 0.1 mm for Fig. 37

Discussion. If postabdominal and genital characters of the populations are compared, a strong variation is observable in almost all of the structures. These differences are not clinal or parallel. For me it seems probable that a species with larger range (distributed from the southern Alps to west coast of the Black Sea) during cooler and more wet period(s) of the Glacial Ages was broken into isolated populations in lower mountains of that belt in Europe. An assumption of a strong isolation is deeply underlined by the main feature of this species, the flightless female sex. Although some data hitherto, that the adult male is larger than the female in this species, may suggest an assumption that the male lifts female while in copula, the dispersal of the adults even through that method must be much restricted. The genetic transformations in the isolated populations are likely to be by chance. If I am right, all the isolated populations are on their way to become distinct species. Below I will describe the farthest isolated population in North Greece as a separate species, since also some body features have become different from those of the rest of the populations. The situation with *H. imbecillus* seems quite similar to that of the *Thaumalea* species in the middle belt of Europe (all the Alps to the



Figs 40–43. *Hesperinus imbecillus* (LOEW), a male from Bulgaria. 40 = gonostylus, in a subdorsal view, which is perpendicular to medial process, 41 = sub-basal process of gonostylus, in a view perpendicular to it, 42 = contours of gonostylus, in widest view, 43 = ejaculatory apodeme, dorsal view. Scales: 0.2 mm for Figs 40, 42, 0.1 mm for Figs 41, 43

Carpathians and on the other direction, to the Dinarian and the Balkan Mts). If one analyses genital features against distribution patters of the *Thaumalea* species groups in WAGNER's (2002) excellent book, one will find very closely related species with disjunct ranges, not far distant from each other. The isolation of the *Thaumalea* species is a consequence of their habits, that the adults do not move away from the water of streamlets not even a metre, they move along the streamlets only (up and down), while larvae are able to move only by the stream. And there are species, like *Thaumalea bezzii* EDWARDS, where although the differences among populations have also been detected in male genitalia, the species has not been split into nominate species.

The populations differ not only in male genital characters. Variations in size of body and wings, in setosity of the first flagellomere, in the colour of wing veins, in the length and curvature of vein R_4, in the setosity of the distal part of R_4, etc. have been observed also in the course of this project. MOHRIG *et al.* (1975) also found characters of male and female palpi that they considered usable for separating populations; unfortunately the delicacy of their figures is not convincing. Since I studied dry (pinned) material and I did not make palpal preparations, I did not use palpal features in characterising populations.

I am afraid this is the level of knowledge about the populations of *H. imbecillus*, which we can reach through studies on outer morphology. Some systematic collections of all populations and molecular methods analysing genetic composition of each population are necessary in order to go deeper into the relationships, incl. decisions on describing nominate species.

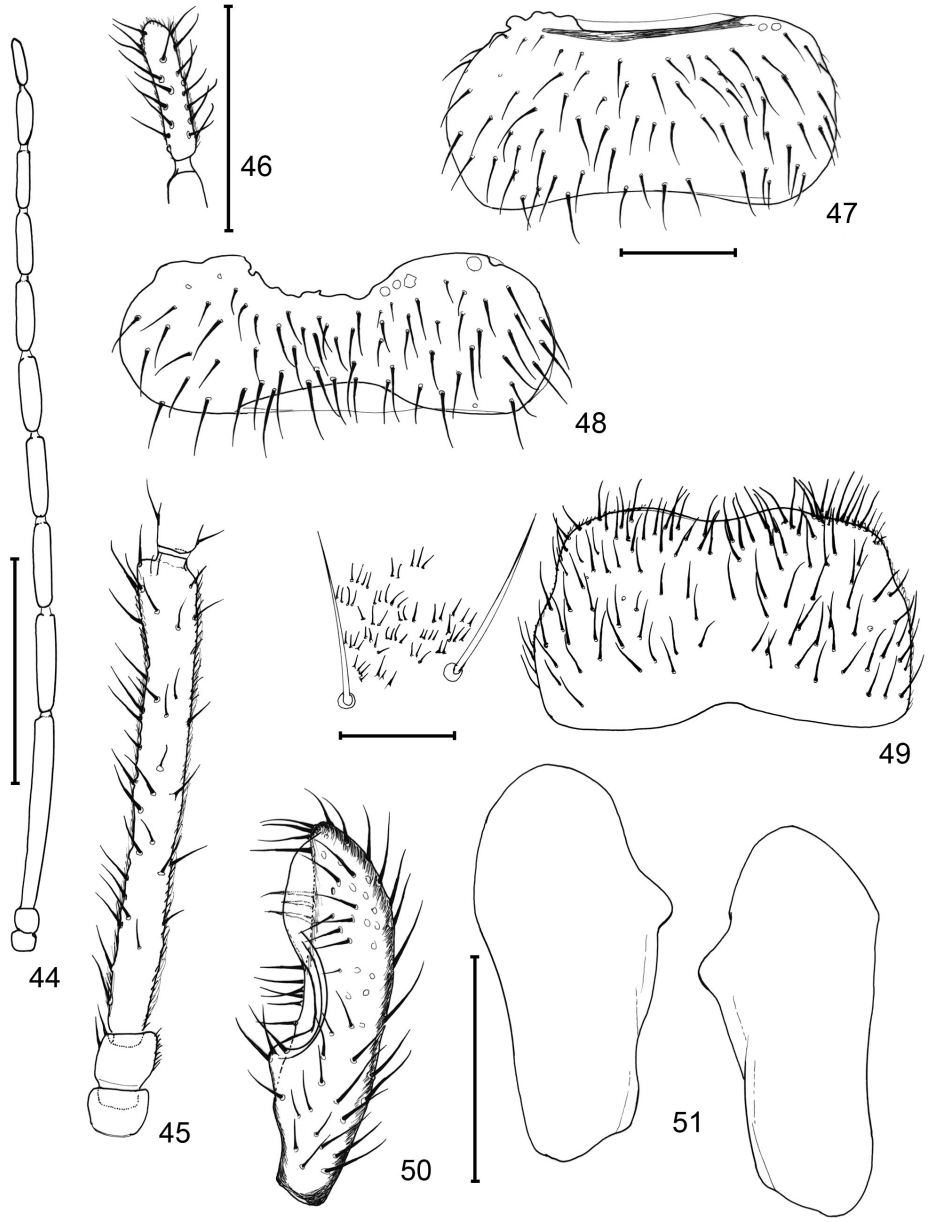
Hesperinus graecus L. PAPP, sp. n.
(Figs 44–51, 61, 62)

Holotype male (HNHM): Greece: Florina county [prefecture], Verno Mts, Pisoderi, stream in a beech forest, 3 km of the village, 15.05.2006 – N40°47'16.5" E21°13'26.7", 1317 m, leg. Dányi-Kontschán-Murányi [its abdomen with male genitalia is in a microvial with glycerol].

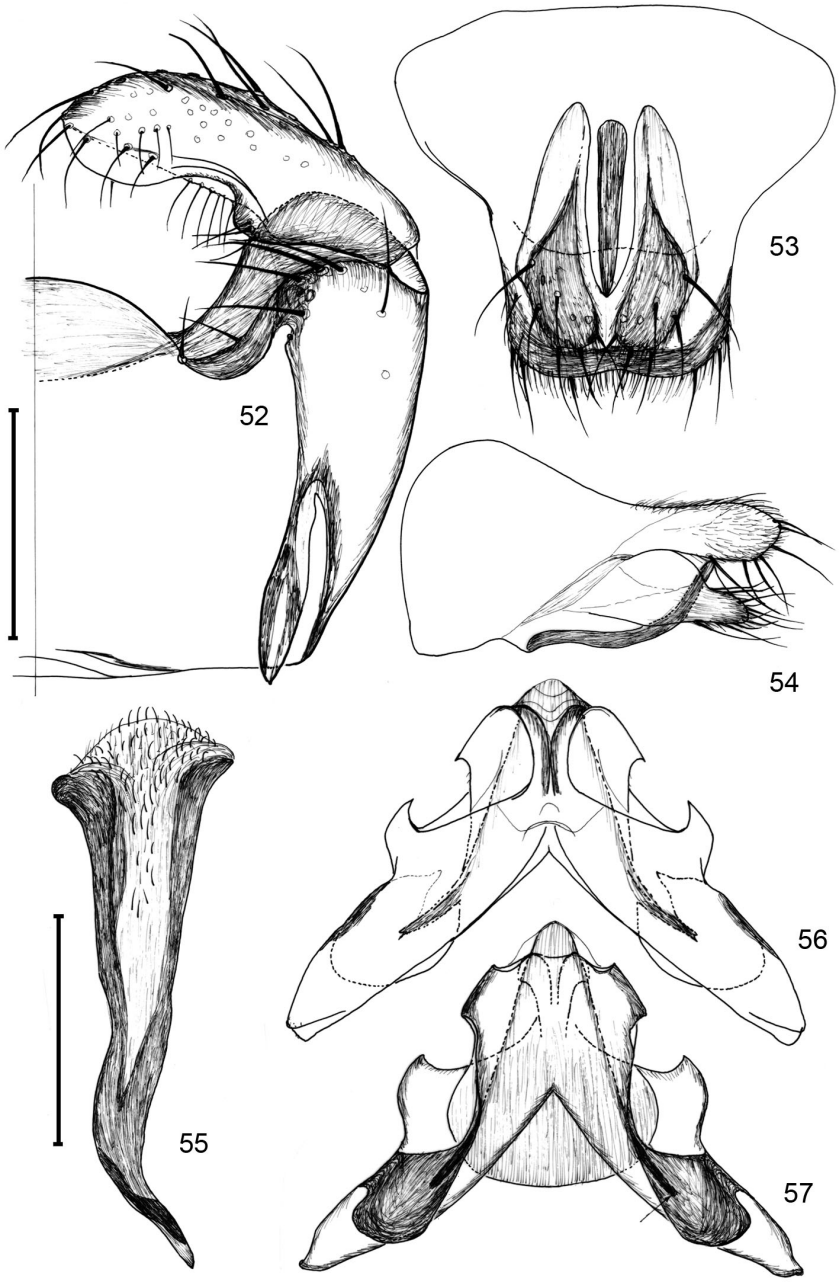
Measurements in mm: length of head plus thorax 1.48, of abdomen 3.13, total body length 4.51, wing length 4.74, wing width 1.92.

Body dark grey, covered by whitish grey microtomentum.

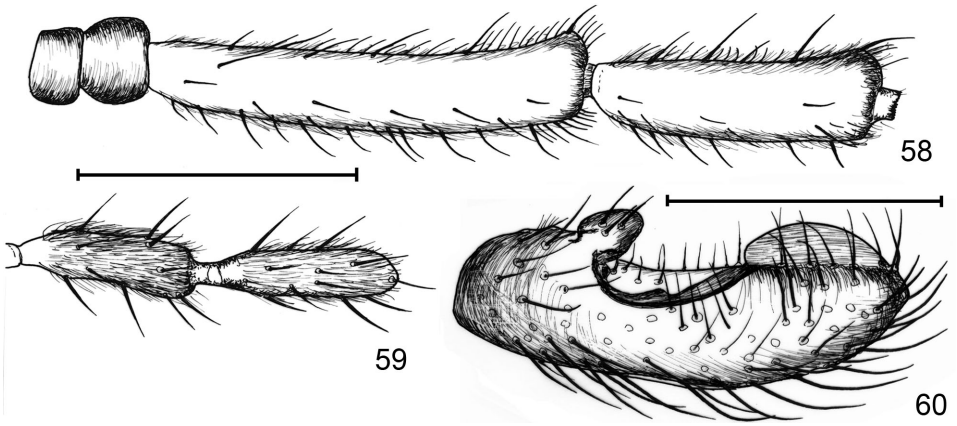
Ocelli form a triangle somewhat broader than an isosceles, occupying 1/3 of postfrons between eyes. Antenna comparatively longer than that of *H. imbecillus*, entire flagellum 3.9 mm long. Length of left flagellomeres of the holotype (without distal necks): 0.86, 0.44, 0.38, 0.36, 0.33, 0.235, 0.32, 0.27, 0.23, 0.25, width of 5th flagellomere 0.08 mm (Fig. 44). Distal dorsal corners of first flagellomere and that of the next ones indistinct (Fig. 45), contrarily to those on *H. imbecillus* (Fig. 1, fig. 2d,e). First flagellomere 0.08 mm thick at middle covered with fine microtrichia, and bears short



Figs 44–51. *Hesperinus graecus* sp. n., holotype male. 44 = outline of antenna, 45 = 1st flagellomere, 46 = terminal (10th) flagellomere, 47 = tergite 8, 48 = sternite 8, 49 = epandrium, dorsal view (outset: its microtrichia in higher magnification), 50 = gonostylus, in a subdorsal view, which is perpendicular to medial process, 51 = contours of gonostylus, in widest view. Scales: 1.0 mm for Fig. 44, 0.4 mm for Figs 45–46, 0.2 mm for Figs 47–49, 50–51, respectively, 0.05 mm for the outset of Fig. 49



Figs 52–57. *Hesperinus graecus* sp. n., holotype male. 52 = gonocoxites and gonostyli, full dorsal view, 53 = proctiger, dorsal view, 54 = cercus, hypoproct and membranes, lateral view, 55 = ejaculatory apodeme, dorsal view, 56 = inner genitalia, ventral view, 57 = same, dorsal view (arrow: base of phallus). Scales: 0.2 mm for Figs 52–54, 56–57, 0.1 mm for Fig. 55



Figs 58–60. *Hesperinus* sp. n., N. Caucasus, male. 58 = scape, pedicel and flagellomeres 1–2, 59 = terminal (9th and 10th) flagellomeres, 60 = gonostylus, in a subdorsal view, which is perpendicular to medial process. Scales: 0.4 mm for Figs 58–59, 0.2 mm for Fig. 60

Fig. 61. Locus typicus of *Hesperinus graecus* sp. n.: forest stream W of Pisoderi, Verno Mts, Greece. Photo D. MURÁNYI

stiff spiniform setae. Tenth (terminal) flagellomere (Fig. 46) not globular but cylindrical, 0.25 mm long, five times longer than broad, with long setae all around.

Pronotum well visible in dorsal view. Mesoscutum with several not wholly arranged white setulae in acrostichal dorsocentral and intra-alar rows. Metanotum flat, insertion of abdomen is rather caudal and on a comparatively large surface of thorax.

Membrane of wing light brown, veins darker brown, pterostigma indistinct. Costa continued to slightly more than halfway on section of apices of R_5 and M_1. R_4 with 1 dorsal seta on both left and right side subapically. Costal sections (H to apex of Sc, to R_1, R_1-R_4, R_4-R_5): 222–95–24–110 (1 unit = 0.011 mm). R-M cross-vein 0.25 mm. Setae present on dorsal side of R_1, Rs, R_5, also on M_1, M_2, M_3 and some also on apical part of Cu_1. Halter dark, length (except for basal part) 0.96 mm, the longest setulae on stalk 0.09 mm.

Spur on fore tibia very short. Fore leg ratios: coxa 37, trochanter 28, femur 68, tibia 201, basitarsus 83, tarsomeres 2–5: 34, 26, 19, 21 units. Length of tarsomeres on mid leg: 74, 31.5, 25, 17, 22 units. Length of tarsomeres on hind leg: 100, 42, 31.5, 22, 22 units (1 unit = 0.011 mm).

Male postabdomen and genitalia are as given in Figs 47–57. Tergite 8 (Fig. 47) twice as broad as long, in contrast to the mostly quadrate tergite 8 of *H. imbecillus*. Sternite 8 (Fig. 48) very short, proximal (cranial) middle part strongly and unevenly emarginated. Epandrium (Fig. 49) somewhat longer than its median width (strongly varying in *H. imbecillus*), cranial part bare, setae on central part scattered. Microtrichia on epandrium are uneven, in-groups of 2–4 detectable at higher magnification (Fig. 49, cf. KRIVOSHEINA & MAMAEV 1967: fig. 3). Gonocoxites (Fig. 52) much broader than long, medio-cranial gonocoxal apodemes strong and thick. Gonostylus (Figs 50–52) rather broad in widest view, I saw them as slightly asymmetrical; subapical medial lobe long but not particularly broad, sub-basal process obviously double, but not much projecting. Cerci and hypoproct (Figs 53–54) structurally as in *H. imbecillus*, cerci rather broad with long setae, hypoproct with shorter and distinctly thinner setae. Ejaculatory apodeme (Fig. 55) asymmetrical, distal apex curved. Inner genitalia (Figs 56–57) largely triangular in dorsal and ventral view, phallus rather narrowly rounded at apex.

Fig. 62. The holotype male of *Hesperinus graecus* sp. n. Photo G. LENGYEL

Female unknown.

Etymology. The specific epithet of the new species refers to its type locality (Greece).

The differentiating features are given in the key below. Its terminal flagellomere elongate, five times longer than broad. Its male gonostylus is lon-

ger than broad, like in *H. ninae* but its first flagellomere is long and thin and evenly setose. Also male gonostylus is distinctly different with less projecting sub-basal gonostylar lobe (Figs 50, 52). This is the smallest *Hesperinus* fly, which I saw from Europe. Wing length of *H. imbecillus* in the males studied is from 6.5 to 7.7 mm.

Hesperinus sp. n. (Krasnaya Polyana; Figs 58–60). Its identity (i.e. that it is a distinct species) was established in the last phase of this study only. It was described in a separate paper as *H. ninae* L. PAPP et M. KRIVOSHEINA, 2010. Its main differentiating features are given in the key.

Extra-European species studied during this project

Hesperinus nigratus OKADA, 1934 – Material studied: 1 male: "(HONSHU) Kanayama YAMANASHI, 2. VI. 1975, T. SAIGUSA" – "Hesperinus nigratus OKADA, ♂" det. T. Saigusa, 19"87"; 2 males: "[KYUSHU] Shiratoriyama Kumamoto, Jun. 6. 1980/1988 T: SAIGUSA" – "Hesperinus nigratus OKADA, 1934" det T. Saigusa "2006".

Hesperinus rohdendorfi KRIVOSHEINA et MAMAEV, 1967 – Material studied: 1 male: "(S. PRIMOR'YE) Ussurijsk Res., W. border, 130 m, 22. V. 1992, T. Saigusa – "Hesperinus rohdendorfi Krivosheina et Mamaev, 1967" det. T. Saigusa "2006".

A KEY FOR THE IDENTIFICATION OF THE MALES OF PALAEARCTIC SPECIES OF *HESPERINUS* WALKER

1 Terminal flagellomere globular (Fig. 2). Male postabdomen and genitalia as depicted in Figs 4–39. A medium large species, male wing length 6.4 to 7.7 mm. Female wing reduced to a small scale. Central Europe from easternmost part of Italy, Austria and Slovenia to Bulgaria
H. imbecillus (LOEW, 1858)

– Terminal flagellomere elongate, at least twice longer than broad (Figs 46, 59, KRIVOSHEINA & MAMAEV 1997: fig. 1; this is valid also for *H. brevifrons* WALKER, see HARDY & TAKAHASHI 1960: fig. 1a). Female wing reduced or normal. 2

2 Smaller species, wing length 4.7–6.0 mm. Male gonostylus longer than broad. Female unknown or has not been described. 3

– Larger species, wing length 10–12 mm. Male genitalia with gonostylus about as long as broad or it has 2 apical lobes. Females fully winged. Russian Far East and Japan. 4

3 First flagellomere long and thin (Fig. 45), evenly setose. Wing length of the holotype 4.74 mm. Male postabdomen and genitalia (Figs 44–57) with less projecting sub-basal gonostylar lobe. Greece **H. graecus** sp. n.

– First flagellomere shorter and broader (Fig. 58), setose on dorsal and ventral surface but laterally and medially almost devoid of longer setae. Male wing length c. 6.0 mm. Male genitalia with projecting gonostylar lobe (Fig. 60). North Caucasus (Krasnaya Polyana)
Hesperinus ninae L. PAPP & M. KRIVOSHEINA, 2010

4 Gonostyli (KRIVOSHEINA & MAMAEV 1967: figs 1 and 4) with a narrow dorsal lobe and a long broad ventral lobe. Epandrium with a broad triangular caudal emargination. Russian Far East.
H. rohdendorfi KRIVOSHEINA & MAMAEV, 1967

– Gonostyli (HARDY & TAKAHASHI 1960: figs 1 b-e) about as long as broad, not bifid. Japan 5

5 Gonocoxites much shorter medially than laterally with a small sagittal incision (HARDY & TAKAHASHI 1960: fig. 1b). Gonostyli with a sharp apex (directed wholly medially), epandrium longer (HARDY & TAKAHASHI 1960: fig. 1c). *H. cuspidistylus* HARDY & TAKAHASHI, 1960

– Gonocoxites not much shorter medially than laterally without small sagittal incision (HARDY & TAKAHASHI 1960: fig. 1d). Gonostyli without a sharp apex but with a medially directed small tooth, epandrium shorter and broadly emarginated caudally (HARDY & TAKAHASHI 1960: fig. 1e).
H. nigratus OKADA, 1934

*

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