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Three new species of Limnotrephini (Heteroptera, Nepomorpha, Helotrephidae) from Peninsular Malaysia and Thailand

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A b s t r a c t : Three new species of Helotrephidae from the tribe Limnotrephini (Heteroptera: Helotrephidae) are described: *Distotrephes zetteli* sp. n. from West Malaysia and Thailand, *Idiotrephes mazzoldii* sp. n., and *Limnotrephes thermophilus* sp. n. from Thailand. *L. thermophilus* sp. n. is the first record of the genus *Limnotrephes* from Southeast Asia. This species was found on wet rocks at a waterfall and in warm water near two hot springs (water temperature up to 43.5 °C). The variability of aedeagus and parameres in *Distotrephes pavelstysi* ZETTEL from Thailand is discussed and some notes on the biology of the described species are presented too.

K e y w o r d s : Helotrephidae, Limnotrephini, *Distotrephes*, *Idiotrephes*, *Limnotrephes*, new species, new record, taxonomy, variability, ecology, hot springs, waterfall, Southeast Asia, West Malaysia, Thailand.

Introduction

The Southeast Asian genera of the tribe Limnotrephini, *Distotrephes* Polhemus 1990, *Idiotrephes* LUNDBLAD 1933, *Limnotrephes* ESAKI & CHINA 1928, *Mixotrephes* PAPÁČEK, ŠTYS & TONNER 1989, and *Tiphotrephes* ESAKI & CHINA 1928, each, are represented only by few known species of minute helotrephids.

The genus *Distotrephes* includes seven species occuring in China, Thailand, Laos, Vietnam and Borneo (ZETTEL 1999, presented paper). *Distotrephes* species are confined to brooks and streams and inhabit stone or gravel sediments, accumulated plant material in the currents or submerged rootlets of trees (ZETTEL 1995, 1999, own observations). In contrast to all other Limnotrephini, *Distotrephes* species are plastron breathers and do not need to get fresh oxygen at the water surface (D. Kovac, unpublished results).

Ten species of the genus *Idiotrephes* were yet known from Sumatra, Malaya, Thailand, Vietnam, and China (Hainan). Species of this genus invade lentic areas of streams or rivers, stagnant waters including periodical (lithotelms) as well as arteficial water bodies (ceramics bowls, tanks) (see PAPÁČEK & ZETTEL 2000; presented paper). The relatively minute *Idiotrephes* species are extremely uniform in their external appearance. They are not readily distinguishable from each other by morphological characters of the head, dorsum or basal abdominal part , by colour pattern or by body size (PAPÁČEK & ZETTEL 2000). This is the reason why the description of new *Idiotrephes* species presented here is concentrated especially on reliable diagnostic characters.

Species of *Limnotrephes* were known from India, Nepal, and South Africa only (ZETTEL 1997). The fifth species of the genus described here is the first record from Southeast Asia. *Limnotrephes* species occur at margins of streams as well as in stagnant water (ESAKI & CHINA 1928; own observations). The new species was found on wet rocks at a waterfall and in warm water near two hot springs.

Terminology, measurements, figures and abbreviations

Terminology follows ZETTEL (1997, 1999) and PAPÁČEK & ZETTEL (2000). All measurements are in millimetres. All available specimens were measured to get the information about the ranges maximum medial body length and width (width across base of cephalonotum). Figures were prepared with using of camera lucida. Because the structures of male genitalia and female abdominal sternum 7 are most essential for the identification of species, these structures were figured in the same orientation by both dissected terminalia studied in ethanol fixed or dry material and terminalia mounted in slides. All figures of aedeagi and parameres represent morphologically left (ventral) view. Data about examined material are presented here in the same way as they are given on the labels in the specimens' depositories.

Abbreviations and depositories:

(micr.) ..... micropterous morph (with reduced hind wings and without claval suture of hemelytra)

(macr.) ..... macropterous morph (with well developed hind wings and with claval suture of hemelytra)

NHMW ..... Collection of Naturhistorisches Museum in Wien, Austria

SMF ..... Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main, Germany (collection of D. Kovac)

UBCB ..... University of South Bohemia, České Budějovice, Czech Republic (collection of M. Papáček)

The present paper is based: (1) on the field data and samples of *D. zetteli* sp. n. and *L. thermophilus* sp.n. collected by Damir Kovac during his expeditions and stays in Southeast Asia, and (2) on the sample of *I. mazzoldii* sp.n. collected by Paolo Mazzoldi in Thailand.

Distotrephes (s.str.) *zetteli* sp. n. (Figs 1-8)

Type material: holotype: (micr. ♂): W Malaysia, Selangor, Gombak River near Ulu Gombak Field Studies Centre of the University of Malaya (= FSC), c 30 km from Kuala Lumpur, between rootlets of a *Saraca* tree, Ph 1/6, 16.11.1995, leg. D. Kovac (SMF); paratypes: 1 ♀ (micr.), W Malaysia, Gombak FSC, tributary of the Gombak River, between rootlets of *Saraca*, Ph 1/9, 18.11.1995, leg. D. Kovac; 2♂♂ (micr.), 1 ♀ (micr.), W Malaysia, stream near Gombak FSC, between rootlets of *Saraca*, Ph 1/11, 19.11.1995, leg. D. Kovac; 3♂♂ (micr.), W Malaysia, stream near Gombak FSC, between rootlets of *Saraca*, Ph 1/19, 20.11.1995, leg. D. Kovac; 1 ♂ (micr.), Thailand, Khlong Lan Nat. Park, small stream near National Park Headquaters, between rootlets of a tree, A 80, 17.5.1998, leg. D. Kovac; 10♂♂ (micr.), 10♀♀ (micr.), Thailand, Khlong Lan Nat. Park, small stream near National Park Headquaters, between rootlets of a tree, Aq 81, 14.9.1998, leg. D. Kovac (all paratypes are deposited in SMF).

Description: Body length 1.32-1.46 mm in males, 1.36-1.56 mm in females,

respectively. Maximal width across base of cephalonotum 0.98-1.02 mm. Ground colour brown to blackish. Cephalonotum shining, yellow with yellow-brown, or with brown to blackish pattern with somewhat variable shape in different specimens. Obligate "F"-shaped dorsally directed extensions of the butterfly-like spot between eyes (see Figs 1 a, b). Frontal and posterior part of cephalonotum, scutellum and hemelytra with sparsely distributed setae. Scutellum brown, with few small yellow spots. Hemelytra dull brown to black, not shining, covered with a thin layer of contamination. Venter brown, legs and pronotal plate yellow. Propleural plate (Fig. 2) with rounded tip in posteromedial angle. Midsternal carina variable in different specimens, not diagnostic. All specimens examined with forewings of the brachypterous type (see PAPÁČEK et al. 1989).

Male: Aedeagus (Fig. 3, 4) with long posteriorly turned apex ("S"-shaped postero-apical part of pigmented cuticle). Both parameres variable in shape in different specimens and populations. Left (ventral) paramere with anterior "knife-like" carina in basal two third of length and pointed tip always bent anteriorly (Fig. 5). Right (dorsal) paramere relatively variable in shape and size in different specimens (see Figs 6 a, b, c); anteriorly turned and narrow in the half of its length; its apex anteriorly oriented, irregularly rounded.

Female: Subgenital plate (abdominal sternum 7) symmetrical, median lobe of hind margin with pointed tip (Fig. 7). Ovipositor with long valvulae of the same length as their apodemes (Fig. 8).

E t y m o l o g y : This species is named after Dr. Herbert Zettel from Vienna, in recognition of his contributions to the study of Helotrephidae.

H a b i t a t : Streams, between submerged rootlets of trees.

D i s t r i b u t i o n : W. Malaysia, Thailand.

C o m p a r a t i v e n o t e s : *D. zetteli* differs from all other known *Distotrephes* species (cf. POLHEMUS 1990; ZETTEL 1995, 1999) by two "F"-shaped spots on frontal part of cephalonotum, "S"-shaped pigmented part of aedeagus, knife-like anteriorly oriented carina of left paramere in males, and by pointed hind margin of subgenital plate in females.

D. zetteli prefers oxygen-rich, fast-flowing water like the other species of *Distotrephes*. It is a plastron breather and gets its oxygen from the surrounding water. Specimens prevented from getting to the water surface for two weeks were not harmed.

Notes on the variability of aedeagus and parameres in *Distotrephes pavelstysi* ZETTEL 1999 (Figs 9-11)

M a t e r i a l e x a m i n e d : 3♂♂ (micr.), 3♀♀ (micr.), Thailand, south from Mae Sariang, Aq 62, 11.9.1998, leg. D. Kovac (SMF); 2♂♂ (micr.), 3♀♀ (micr.), Thailand, Khlong Lan, Aq 70, 12.9.1998, leg. D. Kovac (SMF).

ZETTEL (1999, Figs 19-21) described this species from Laos and Thailand, figured its aedeagus and parameres, and stated that there are small differences between the populations studied. We have studied material of the species from North- and West Thailand. In these specimens further aberrations of the shape of the tip of aedeagus, and parameres (in addition to the ones described by Zettel) were found (see Figs 9-11). Especially the right paramere can be reduced in size to a different degree. There are differences between populations from both mentioned localities as well as between individual male specimens from the same locality. Female terminalia seem to be uniform in different specimens.

While in most *Distotrephes* species the shape of aedeagus and parameres is constant,

both *D. pavelstysi* (see Figs 9-11) and *D. zetteli* (see Figs 4-6) are relatively variable in this respect.

Idiotrephes mazzoldii sp.n. (Figs 12-16)

Type material: holotype: (macr. ♂): E-THAILAND: Mukdahan\\ Phu Pha Thoep NP\\ 31.12.1999\\ leg. P. Mazzoldi (22) (NHMW); paratypes: 2♂♂ (macr.), 1♀ (macr.) (NHMW), 1♂ (macr.) (UBCB), same locality data as holotype.

Description: Body length 1.37-1.54 mm; maximal width across base of cephalonotum 0.92-0.96 mm. Ground colour yellowish brown. Cephalonotum yellow with brown spots, purely yellow behind eyes. Cephalonotal suture visible only medially, between eyes. Hemelytra yellow to beige, with brown spots in small pits. Mesoscutellum of the same appearance, somewhat darker. Venter: propleura, prosternum and legs yellow; basal part of metafemora yellow-brown; meso- and metapleura light brown; abdomen black. Ventral midsternal carina (Fig. 12): prosternal part with long, ventrally pointed denticle and posteroapical incision (diagnostic character); mesosternal carina high as metasternal one, pointing ventrally; metasternal part pointing caudally by rounded tip.

Male: Body length 1.37-1.54 mm; width across base of cephalonotum 0.92-0.96 mm. Aedeagus diagnostic with relatively short boot shaped, angle δ (see PAPÁČEK & ZETTEL 2000) = cca 65° (Fig. 13). Left paramere with oblongate base and simple round hook ("question mark") shaped apex (Fig. 14). Right paramere distally broad, apex obliquely truncate, somewhat variable (Figs 15a. b); relatively broad from anterior and anterolateral view too (see Fig. 15c).

Female: Body length 1.45 mm; width across base of cephalonotum 0.96 mm. Abdominal sternum 7 (= subgenital plate) with simple right side incision, longitudinal right side break and narow impression surrounding laterocaudal margin of incision (Fig. 16).

Comparative notes: *Idiotrephes mazzoldii* sp. n. differs from all other known species of this genus by distinct ventrally pointing denticle of ventral prosternal carina, by short boot shaped apex of aedeagus in male, and by abdominal sternum 7 of female with simple right side incision and narrow incision. Females of all *Idiotrephes* species have relatively variable shape of right side icission of abdominal sternum 7. This is the reason why diagnostic value of last mentioned character is somewhat discutable.

Habitat: No data about habitat are available.

Distribution: East Thailand.

Etymology: This species is named after its collector, Italian coleopterist Dr. Paolo Mazzoldi.

Limnotrephes thermophilus sp. n. (Figs 17-24)

Type material: holotype: (micr. ♂), Thailand, Doi Inthanon region, seeping rock with microvegetation at a waterfall, D 36, 1.12.1996, leg. D. Kovac (SMF); paratypes: 5♂♂ (micr.), 5♀♀ (micr.) from the same locality as holotype; 1 ♂ (micr.), Thailand, Khlong Lan Nat. Park, on the moist rock at the Khlong Lan waterfall, D 27, 23.111996, leg. D. Kovac; 5♂♂ (micr.), 2♀♀ (micr.), Thailand, Pong Dueat Hot Springs, small pools near a hot spring, D 42, D 43, D 50, 2. and 3.12.1996, leg. D. Kovac; 1♂ (micr.), Thailand, San Kamphaet Hot Spring, small pool near a hot spring, D 51, 4. 12. 1996, leg. D. Kovac (all paratypes are deposited in SMF).

Description: Body length 1.17-1.28 mm; maximal width across base of cephalonotum 0.68-0.77 mm. Body only slightly dorsally vaulted. Ground colour yellow. Dorsal

surface of the body shining, with irregularly distributed small pits and brown circular spots covering these structures, and sparsely setaceous. Head anteromedially smooth, without pits and circular spots. Rest of cephalonotum with unconspicuous yellow-brownish irregularly shaped spots. Venter and hind femora yellow-brownish, rest of the legs and short rostrum yellow. Cephalonotal suture medially brown, laterally (behind eyes) yellow. Propleural plate simple, hooked-like triangular (Fig. 9). Scutellum longer than wide; with convex margins more or less of the same shape as the outer (lateral) contour of the body. Pro- and metasternal carinae higher than mesosternal one. All specimens examined with forewings of the brachypterous type.

Male: Aedeagus (Figs 10, 11 a, b) uvula-like, short and thick, with roundly pointed apex which is located in the longitudinal axis of the whole organ. Left (ventral) paramere (Fig 12) relatively short, irregularly triangular. Right (dorsal) paramere (Fig 13) somewhat reduced, straight, distally approximatelly as wide as proximally.

Female: Hind margin of abdominal sternum 7 with median, transparent short and wide lobe (Figs 14, 15). Two-lobate brownly pigmented "structure" (Figs 14, 15) is visible on the surface of this sclerite. Ovipositor with long triangular first valvulae of the same length as their apodemes (Fig. 16).

E t y m o l o g y : The name *thermophilus* is a combination of the Latin word of Greek nature"*thermae*" which means hot springs, and *"philus"* which is derived from latinized Greek word *"philologia"*, meaning affinity to sciences, and refering on the affinity to something.

H a b i t a t : Tiny lithotelms and surfaces of wet rocks at waterfalls, warm pools below hot springs, water temperature up to 43.5 °C.

D i s t r i b u t i o n : Thailand.

C o m p a r a t i v e n o t e s : Males of *L. thermophilus* differ from all other species of the genus by the shape of the aedeagus and parameres and the females by the shape of the hind margin of the abdominal sternum 7 (females of *L. minutissimus* unknown). Specimens of both sexes differ from other known *Limnotrephes* species by the relatively bigger body length, and by distribution in Thailand.

Species of *Limnotrephes* live in slow-flowing areas of streams and apparently also occur in stagnant water, since *L. campbelli* was collected from a freshwater tank in India (ESAKI & CHINA 1928). *L. thermophilus* occurs in tiny lithothelms or on the wet surface of rocks near waterfalls. This habitat is exposed to intensive sunshine, which may explain the occurrence of this species in relatively warm water near hot springs.

Zusammenfassung

Drei neue Helotrephiden-Arten aus dem Tribus Limnotrephini werden beschrieben: *Distotrephes zetteli* sp. n. aus West-Malaysia und Thailand, *Idiotrephes mazzodii* sp.n. und *Limnotrephes thermophilus* sp. n. aus Thailand. *L. thermophilus* sp. n. ist die erste aus Südostasien nachgewiesene *Limnotrephes*-Art. Sie wurde an nassen Felsen an einem Wasserfall und im warmen Wasser unterhalb von zwei heißen Quellen (Wassertemperatur bis zu 43,5 °C) gefunden. Die Variabilität des Aedeagus und der Parameren von *Distotrephes pavelstysi* ZETTEL aus Thailand wird diskutiert und einige Notizen zur Biologie der neue Arten wird auch führt an.

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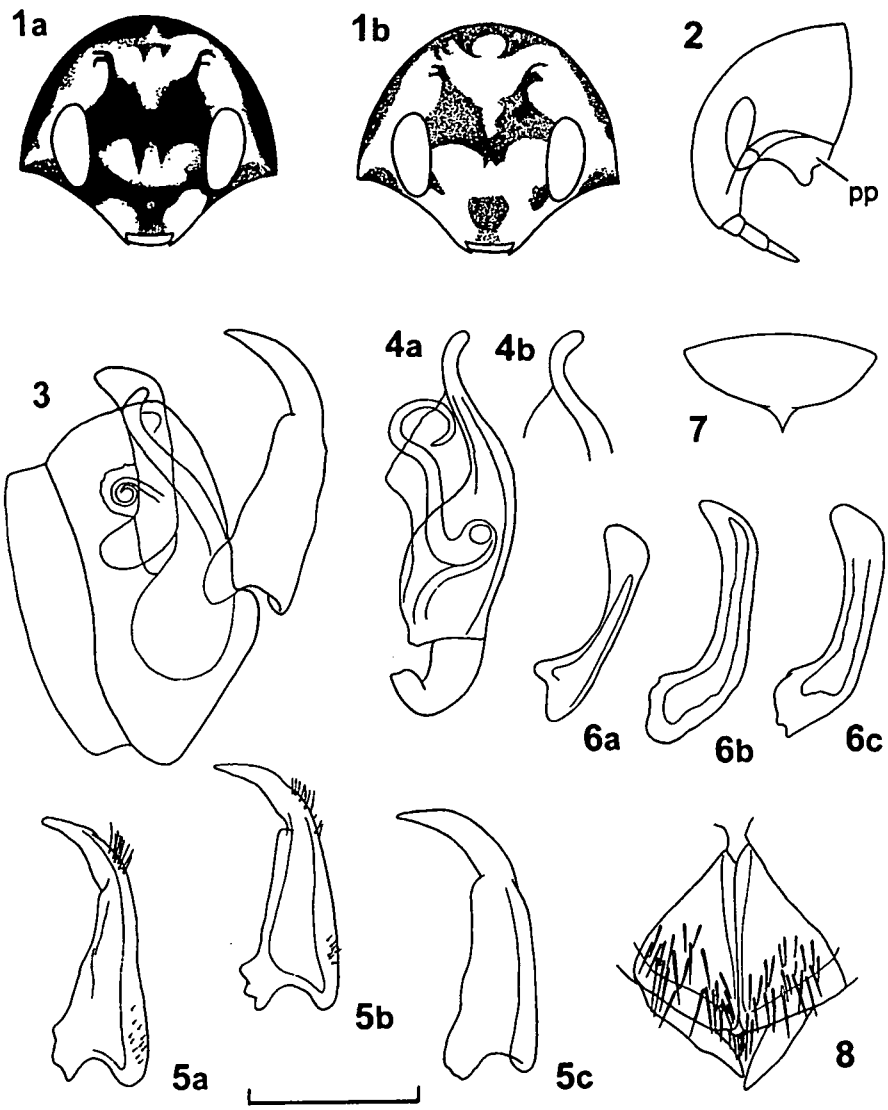
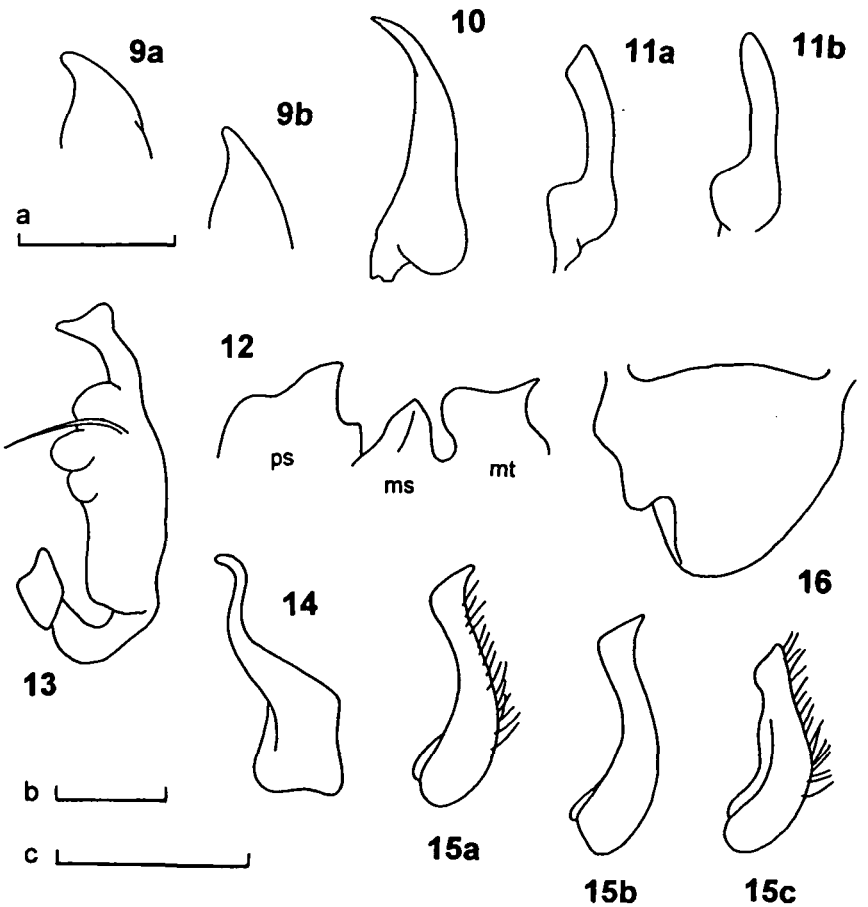
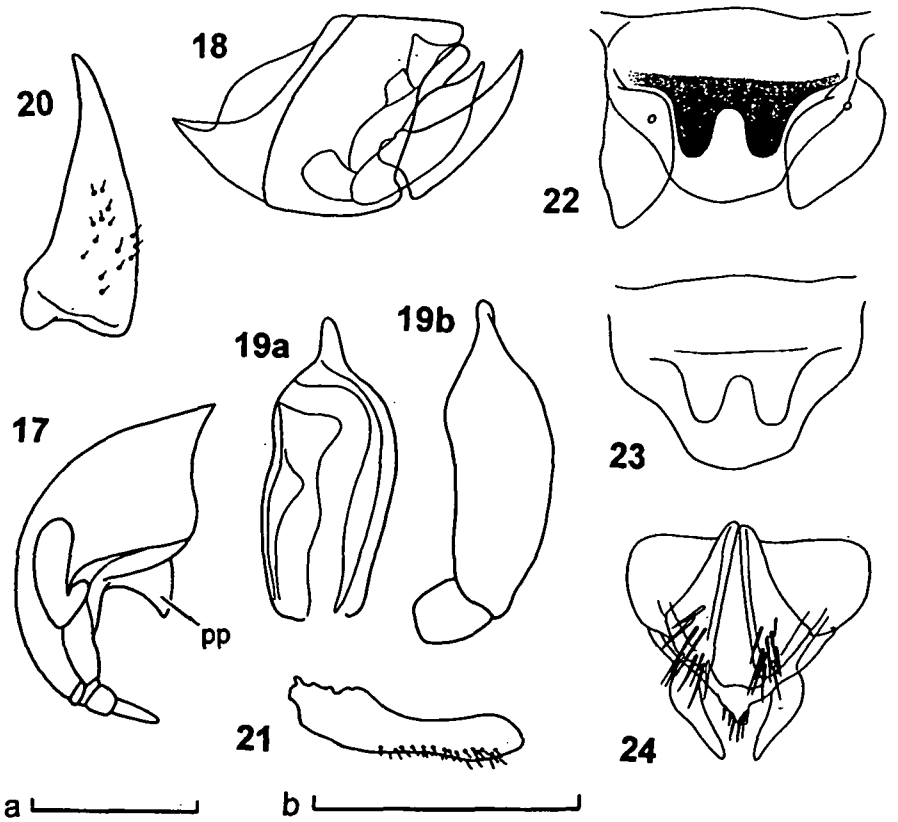


Figs 1-8: *Distotrephes zetteli* sp. n. **1a, b** – colour pattern of cephalonotum, frontal view; examples of dark (a) and light (b) coloured specimens. **2** – cephalonotum, schematic lateral left side view (pp – propleural plate). **3** – male genital capsula. **4** – aedeagus (a) and possible alternative shape of its apex (b). **5** – left (ventral) parameres of males from West Malaysia (a) and from Thailand (b, c). **6** – right (dorsal) parameres of males from West Malaysia (a,b) (a – extremely aberant situation) and from Thailand (c). **7** – female abdominal sternum 7 (subgenital plate). **8** – ovipositor. Scale bar = 0.2 mm. Figs, 1, 2 – schemes without scale.



Figs 9-16: 9-11: *Distotrephes pavelstysi* ZETTEL 1999; male genitalia, ventral view. **9** – somewhat aberant shapes of apex of aedeagus in particular specimens from West Malaysia (a) and from Thailand (b). **10** – left (ventral) paramere of specimens from Thailand (Mae Sariang). **11** – right (dorsal) paramere of specimens from West Malaysia (Ulu Gombag) (a) and from Thailand (Mae Sariang) (b). — **12-16**: *Idiotrephes mazzoldii* sp.n.. **12**-ventral midsternal carina of thorax (ps - prosternum, ms - mesosternum, mt - metasternum). **13**-aedeagus. **14**-left (ventral) paramere. **15**-right (dorsal) paramere with somewhat variable shape of apex (a) (b); (b) - setae omited; (c) - anterolateral view. **16**-female abdominal sternum 7 (subgenital plate).

Scale bar = 0.2 mm (a = Figs 9-11; b = Fig. 16; c = Figs 13-15). Fig. 12 - scheme without scale.



Figs 17-24: *Limnotrephes thermophilus* sp. n. **17** – cephalonotum, schematic lateral left side view, (pp - propleural plate). **18-24**: terminalia, ventral view. **18** – male genital capsula. **19** – aedeagus; drawing with visible internal structures by permanent slide (a) and drawing by dry specimen (b). **20** – left (ventral) paramere. **21** – right (dorsal) paramere (figure twisted on the 90° on the right). **22** – female abdominal sternum 7 (subgenital plate) with laterosternites (doted area is strongly brownly pigmented). **23** – female abdominal sternum 7, outline. **24** – ovipositor. Fig. 17 - scheme without scale. Scale bar = 0.2 mm (a = Fig. 18; b = other Figs.)