

***Idiotrephes maior* sp. n., a new species of water bug from Vietnam
with morphological notes on *I. chinai* (Heteroptera: Helotrephidae)**

MIROSLAV PAPÁČEK

Department of Biology, Pedagogical Faculty, University of South Bohemia, Jeronýmova 10,
371 15 České Budějovice, Czech Republic

**Heteroptera, Helotrephidae, *Idiotrephes maior* sp. n., *I. chinai* Lundblad, classification, ecology,
morphology, Oriental region**

Abstract. A new helotrephid, *Idiotrephes maior* sp. n. (Helotrephinae: Limnotrephini), is described (male, female) from North Vietnam and compared with the sympatric and widely distributed Oriental species *I. chinai* Lundblad, 1933. Description of macropterous morph and ovipositor of *I. chinai* is added to Lundblad's diagnosis of this species. Diagnosis of the genus *Idiotrephes* is expanded. Some morphological features of this genus are compared briefly with the same of related genera of Limnotrephini and two genera of Helotrephini (*Hydrotrephes*, *Esakiella*).

INTRODUCTION

Helotrephidae is a small and poorly known family of water bugs, with a cephalothorax, living in assorted and mostly tropical habitats. Originally monotypic, the Oriental genus *Idiotrephes* was established by Lundblad (1933: 120, type species *I. chinai* from Sumatra). This species is known from Indonesia (Sumatra), Malaysia and Vietnam (Polhemus, 1990). Many specimens of *Idiotrephes* were collected during Czechoslovak-Vietnamese entomological expeditions to Vietnam in 1984–1989. In determining this Vietnamese material, I found four specimens to be more robust and morphologically distinct from the others. Consequently, this paper is intended to establish a new species of the genus and to complete original Lundblad's (1933) description of the type species.

Idiotrephes maior sp. n.
(Figs 1–4, 5, 7, 9–13, 17–19)

ETYMOLOGY: *maior* (lat.), comparative of *magnus* (lat.) = greater. Named after its more robust body in comparison with that of *I. chinai*.

MATERIAL EXAMINED: Holotype: micropterous ♀, N Vietnam, Hanoi, Temple of Literature and Pagoda (Temple) on Islet in Hoan Kiem Lake, 30.x.1985, leg. T. Soldán; paratypes: 1 micropterous ♂ (legs missing), 1 brachypterous ♀, N Vietnam, Hanoi, 19.xi.1989, leg. T. Soldán; 1 micropterous ♀, N Vietnam, Hanoi, 30.ix.1985, leg. M. Tonner (parts of holotype and two paratypes – ♂ and brachypterous ♀ – on slides). All material deposited in the author's collection, in Pedagogical Faculty, University of South Bohemia, České Budějovice.

Body length: 1.5–1.6 mm (for further morphometric data see Table 1.). Body shape as in *Idiotrephes chinai*.

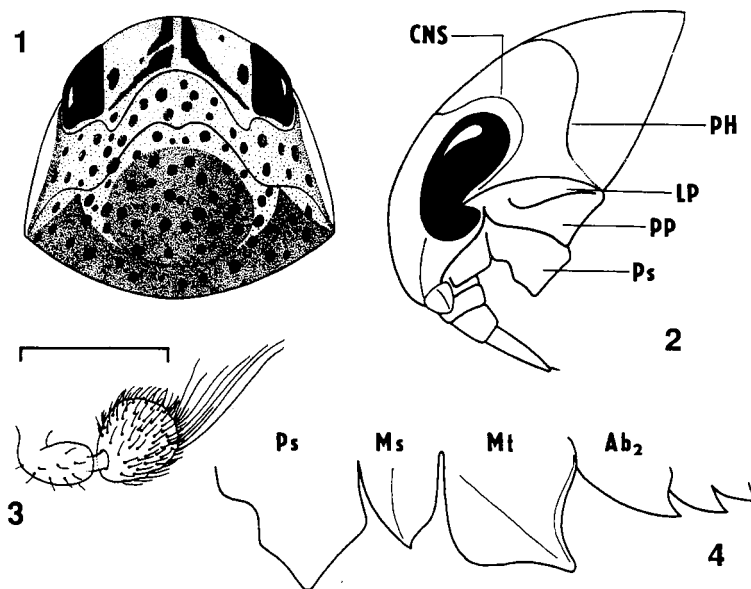
Basic colour yellow to yellow-brown; colour patterns variable: the oldest adults darker, their basic colour yellow-brown with dark brown patterns. Venter and legs yellow to yellow-brown.

TABLE 1. *Idiotrephes maior* and *Idiotrephes chinai*. Comparison of some somatic measurements (in mm).

Esaki & China's (1928) symbols	Range				
	<i>I. maior</i>		<i>I. chinai</i>		
	♂ (1)	♀ ♀ (2)	♂ ♂ (8)	♀ ♀ (12)	
Total length	A–B	1.52	1.57, 1.60	1.24–1.33	1.29–1.38
Humeral width	L–M	1.02	1.04, 1.05	0.87–0.91	0.89–0.94
Minimum interocular width	G–H	0.50	0.50	0.37–0.42	0.38–0.46
Maximum transocular width	F–K	0.78	0.80	0.70–0.71	0.70–0.74
Basal width of mesoscutellum	P–Q	0.55	0.55	0.42–0.44	0.43–0.46
Medial length of mesoscutellum	N–O	0.55	0.58	0.42–0.47	0.44–0.49
Legs of females					
Fore leg					
		0.39–0.40		0.36–0.38	
		0.32–0.33		0.28–0.30	
		0.13		0.12	
Middle leg					
		0.42		0.35–0.37	
		0.28		0.26	
		0.15		0.14	
Hind leg					
		0.44–0.45		0.37–0.39	
		0.48–0.49		0.39–0.41	
		0.20		0.19	
		0.20		0.16	

Cuticle semitransparent and lustrous; cephalonotum and hemielytra with shallow pits and fine short pilosity. Legs with spiniform and pectinate setae.

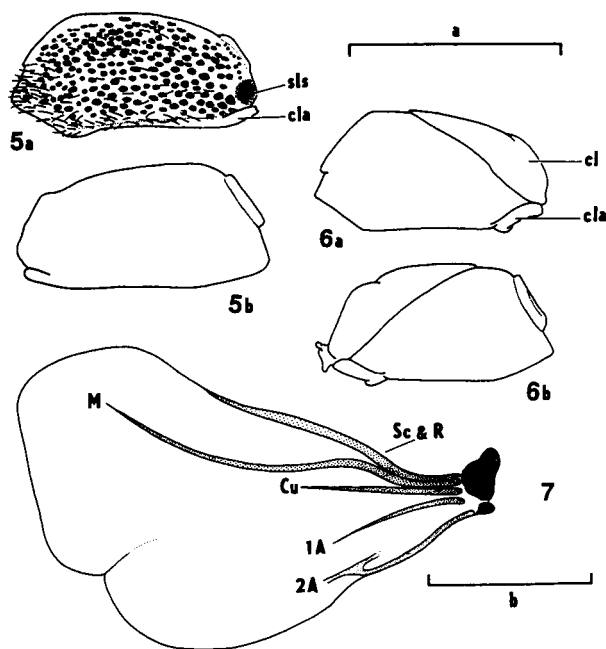
Cephalonotum (Figs 1, 2) approximately as broad as long in dorsal view; yellow with irregularly Y-shaped brown reticular spot on frontoclypeal region between the eyes and with two small spots (1+1) near inner margins of eyes. Dorsal part of cephalonotum (originally prothoracic part) with sparsely distributed small spots in pits. The mesonotal part dark, brown to black sclerites – medial discoidal praemesoscutum and the more caudally transversally localized mesoscutum – showing through the pronotal part of cephalonotum (Fig. 1). Medial part of cephalonotal W-shaped suture (= anterior line) extending anteriorly (frontally) to the level of hind margin of eyes in frontal or dorsofrontal view; the medial arch greater than 1/3 of the maximal width of cephalonotum. Posterior transversal W-shaped liniform structure (= boundary between pro- and mesothorax; = 1st phragma) more distinct than anterior; its lateral arms extend to the posterolateral angles of cephalonotum. Lateral carina of the pronotal part of cephalonotum slightly broader and laminar, light yellow, distinct in dorsal, ventral and lateral views, penetrating onto ocular space; its inner border mesally concave and outer margin laterally convex from dorsal view. Lateral pronotal plate and propleural plate as in generic



Figs 1–4. *Idiotrephes maior*. 1, 2 – cephalonotum: 1 – dorsal view, 2 – lateral semi-schematic view; 3 – left antenna, anterior face; 4 – sternal carina, lateral view from left. Abbreviations: AB₂ – sternal carina of abdominal sternum 2, CNS – cephalonotal suture (or sulcus), LP – lateral pronotal plate, Ms – mesosternal carina, Mt – metasternal carina, PH – W-shaped line indicating a course of 1st phragma, PP – propleural plate, Ps – prosternal carina. Figs 1, 2, 4 – schemes without scale. Scale bar: 0.1 mm (3).

diagnosis (see Lundblad, 1933; Polhemus, 1990). Prosternal medial carina (Figs 2, 4) with irregularly triangular apex. Antenna (Fig. 3) two-segmented, with distinct internodal structure. Distal segment flattened, round, with minimally 4 long apical setae. Ratio of rostral segments: 4 : 2.5 : 1.5 : 1. For measurement of fore legs of females see Table 1. Procoxa distally with 2–3 long setae.

Pterothorax. Mesoscutellum approximately as broad as long (see Table 1); its base with transversal smooth yellow area without pits. Hind 3/4 of mesoscutellum with pits, insertions of setae situated mainly in pits. Meso- and metasternal carina as illustrated (Fig. 4). Hemielytra (Figs 5a,b) of both sexes of both morphs slightly asymmetrical; the right hemielytron distally overlapping the left. Right costal lobe well developed in females. Basal part of claval region with scale-like sculpture (= part of stridulatory apparatus: see Polhemus, 1990). Clavulus (= embolium) delimited only in its proximal part by medial fracture. Costal margins and costal lobe of female right hemielytron smooth, light yellow; remaining area with brown pits, insertions of setae situated mainly outside the pits, sporadically inside them. Brachypterous morph with hind wings reaching the hind margin of abdominal tergum 4. Hind wing with basal remnants of veins (Fig. 7). Micropterous morph with remnants of hind wings reaching the anterior margin or the area of abdominal tergum 2. Wing-anchoring apparatus of both morphs (cf. Papáček et al., 1989: pp. 112–113) distinct. For measurement of middle- and hind legs of females see Table 1. First tarsal segment of hind leg as long as the second.



Figs 5–7. Wings of *Idiotrephes maior* and *Idiotrephes chinai*. 5, 6 – hemielytra: 5 – brachypterous *I. maior*, right (a) and outline of left (b) hemielytron; 6 – macropterous *I. chinai*, right (a) and left (b) hemielytron (semi-schematic views). 7 – left hindwing of brachypterous *I. maior*. Abbreviations: 1A, 2A – 1st and 2nd anal vein respectively, cl – clavus, cla – clavulus (= embolium), Cu – cubital vein, M – medial vein, Sc & R – subcosta & radial vein, sls – scale-like sculpture. Scale bars: a – 1.0 mm (5, 6); b – 0.2 mm (7).

Abdomen. Dorsum sclerotized. Dorsal laterotergites (DLTG) 2–4 separated distinctly from mediotergites (MTG) and from ventral laterotergites (VLTG). DLTGs 5 and 6 fused. Sternum (S) 2–4 with medial carina (Fig. 4).

Male pregenital modifications (Figs 9, 10). Segments 6–8 asymmetrical. Left VLTG 7 irregularly trapezoidal with small anterior tubercle-like process. Right VLTG 7 smaller than left, ovably rhomboid. S 8 with more than ten campaniform sensilla; covered in the anterior half of S 7. Right VLTG 8 long and narrow, club-shaped. Left VLTG 8 triangular.

Female pregenital modifications (Figs 17a,b). Segment 7 asymmetrical, with numerous trichoid setae and sparse campaniform sensilla (distribution individually variable). Posterior margin of MTG 7 deeply triangularly excised. Both DLTGs 7 tongue shaped. S 7 markedly asymmetrical, with longitudinal, anteriorly right curved, black pigmented break in the right side; hind margin shaped irregularly (somewhat individually variable) (see Figs 17a,b). Part of S 7 to the right of the longitudinal break extremely thin. Both VLTGs 7 irregularly rhomboidal. Left VLTG 7 somewhat shorter than right one.

Pygophore and male genitalia (Figs 11–13). Pygophore as in generic diagnosis (see Lundblad, 1933: 122–123). Phallus (Fig. 11) longer than both parameres. Phallosoma sclerotized, produced apically into a rounded hoof-shaped process (directed towards head in situ); ejaculatory reservoir subspherical; conjunctiva smooth, with distinct lobes; vesica produced into a thin processus gonopori (shorter than phallosoma). Right (dorsal) paramere (Fig. 12) with long dorsocaudally directed apical projection. Left (ventral) paramere (Fig. 13) longer than right, with distinctly semicircular crooked apex (anterior surface of apex shaped as semicircular incision). Shape and pilosity of parameres as illustrated.

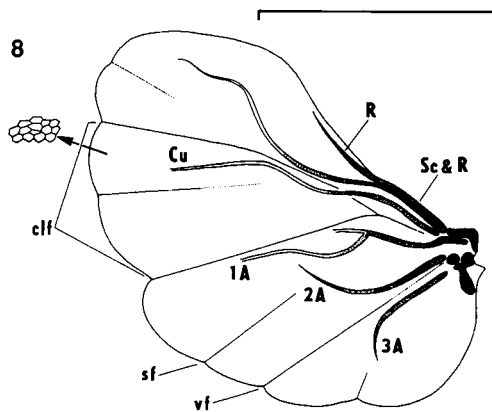


Fig. 8. Left hindwing of macropterous *Idiotrephes chinai*. Abbreviations: 1A, 2A, 3A – 1st, 2nd and 3rd anal vein respectively, clf – claval furrows, Cu – cubital vein, M – medial vein, R – radial vein, Sc & R – subcostal & radial vein, sf – secondary fold, vf – vanal fold. Scale bar: 1.0 mm.

Ovipositor (Fig. 18) moderately asymmetrical; its axis diverging by about 10° dextrocaudally from the body axis. VLTG 8 free, not fused with valvifers, bearing spiracles. Valvifers 1 irregularly subtrapezoidal. Valvulae 1 plate shaped, flat, irregularly triangular, with rounded hind angles; each valvula posteromedially with 14–16 robust distally slightly curved setae and anterolaterally with at least 3 straight, spiniform setae; longitudinal moulding of inner margin produced into an anteromesally directed apodeme; bases distinct from S 8 but fused in part with them. Valvulae 2 fused in an arc with pointed apex; subapically with two groups of spiniform curved setae (5+5). Gonostyloids associated with lateral arms of arc; broadly styliform to triangular, with trichoid setae. Valvifers and 1st valvulae yellow; apodeme, 2nd valvulae and gonostyloids brown.

Spermatheca (Fig. 19) typical pleoid or notonectid type respectively, with long spirally coiled (1.5 ×) spermiduct and spherical terminal bulb.

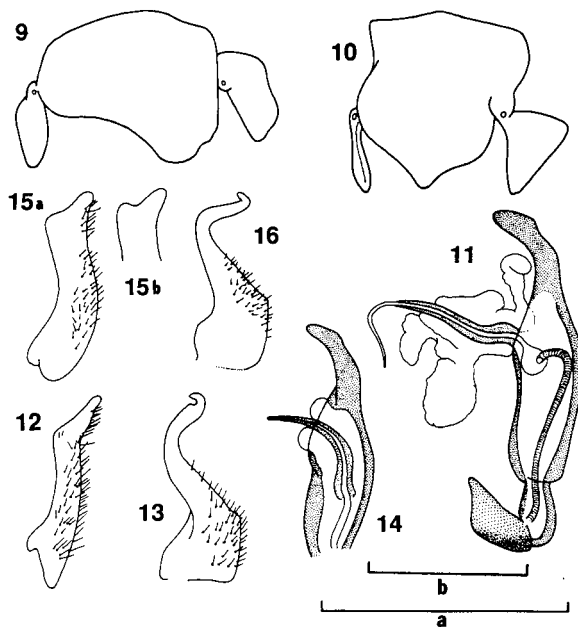
Additional notes to Lundblad's (1933) description of *I. chinai*

Macropterous morph

Lundblad (1933: 121) stated that all specimens of *I. chinai* are micropterous (“Sämtliche Exemplare sind kurzflügelig”). However it appears that both macro- and micropterous populations exist; to be precise populations with all macropterous specimens (e.g., that from Nam Cat Tien – see “Material”) or micropterous populations without or with rare macropterous specimens (e.g., Sumatra – cf. Lundblad, 1933; Hanoi – see “Material”).

This morph was suggested, incorrectly, as “a probably new species” in a previous paper (Papáček & Tonner, 1991).

Morph-specific characters of the macropterous morph are as follows: ground colour beige-brown, darker than in micropterous morph. Hemielytron (Figs 6a,b) of both sexes slightly asymmetrical, the right distally overlapping the left. Short clavus and clavulus well apparent. Wing-anchoring apparatus (hemielytron-pterothoracic pleura) in inner surface of clavulus very strongly developed, produced into “clavular marginal protuberance”. Right hemielytron of females with indistinct costal lobe (more precisely, costal angle or break). Hind wing (Fig. 8) well developed, twice as long as abdomen; in



Figs 9–16. Male terminalia of *Idiotrephes maior* (9–13) and *Idiotrephes chinai* (14–16). 9, 10 – outlines of (9) abdominal sternum 7 and (10) sternum 8 and its ventral laterotergites. 11, 14 – phallus (11 – inflated, 14 – non inflated). 12, 15 – right (dorsal) parameres (15a,b – alternative shapes in macropterous *I. chinai*). 13, 16 – left (ventral) parameres. All illustrations in the most exposed, i.e. topographically ventral view. Scale bars: a – 0.5 mm (9, 10); b – 0.2 mm (11–16).

resting animals folded in a dome covering the whole abdominal dorsum. Shape of the pleoid-type; surface large, with distinct primary and secondary folds; cuticle with hexagonal sculptures. Proximal parts of veins (R, M, Cu, 1A, 2A, 3A) pigmented.

MATERIAL EXAMINED: 1 ♂: N Vietnam, Hanoi, 30.ix.1985, leg. M. Tonner; 3 ♂, 3 ♀: S Vietnam, Nam Cat Tien, Dong Nai River, Nov. 1989, leg. T. Soldán.

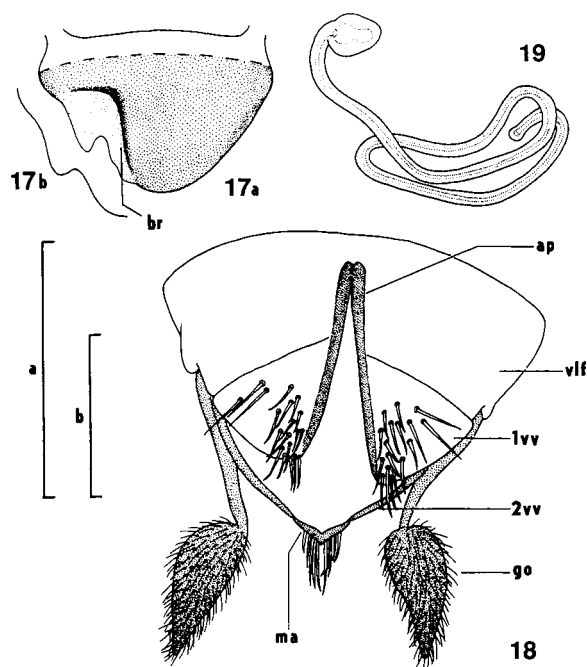
Variability of the right paramere of males

Most of males of *I. chinai* have the right (dorsal) paramere with one posteroapical projection (typical situation) (Fig. 15a) (see also Lundblad, 1933: 122, Fig. 40M). Right paramere of some macropterous males from Nam Cat Tien diagnosed as *I. chinai* have their apex with two projections – small anteroapical tubercle and longer posteroapical projection, a rare situation (Fig. 15b).

Ovipositor

Although Lundblad (1933) defined *I. chinai* very clearly, he did not describe ovipositor of this species. The ground plan of ovipositor of *I. chinai* is the same as that of *I. maior*. Specific characters of ovipositor of *I. chinai* (Fig. 21) are as follows: each caudal corner of 1st valvulae with short rounded lobes; at least 6 + 6 ventral spiniform setae; 12–14 more robust distally curved setae posteromesally; medial arch of fused 2nd valvulae somewhat separated from lateral arms, composed of two irregularly L-shaped sclerites; apex of medial arch with distal unpaired minute process.

MATERIAL EXAMINED: N Vietnam; 4 micropterous ♀: Hanoi, 30.ix.1985, leg. M. Tonner; 2 micropterous ♀: Ha Son Binh Prov., Suoi Xui stream, 17.xii.1984; S Vietnam; 3 macropterous ♀: Nam Cat Tien, Dong Nai River, Nov. 1989, leg. T. Soldán.



Figs 17–19. Female terminalia and spermatheca of *Idiotrephes maior* (ventral views). 17 – abdominal sternum 7 (17a,b – possible alternative shapes of right lateroposterior margin). 18 – ovipositor. 19 – spermatheca. Abbreviations: ap – apodema, br – dextrocaudal break, go – gonostyloid, ma – medial arch of fused 2nd valvulae, vlf – valvifer, 1 vv, 2 vv – 1st and 2nd valvulae respectively. Broken line in Fig. 17 indicates the position of hind margin of the abdominal sternum 6 (in situ). Scale bars: a – 0.5 mm (17); b – 0.2 mm (18, 19).

DISCUSSION AND CONCLUSIONS

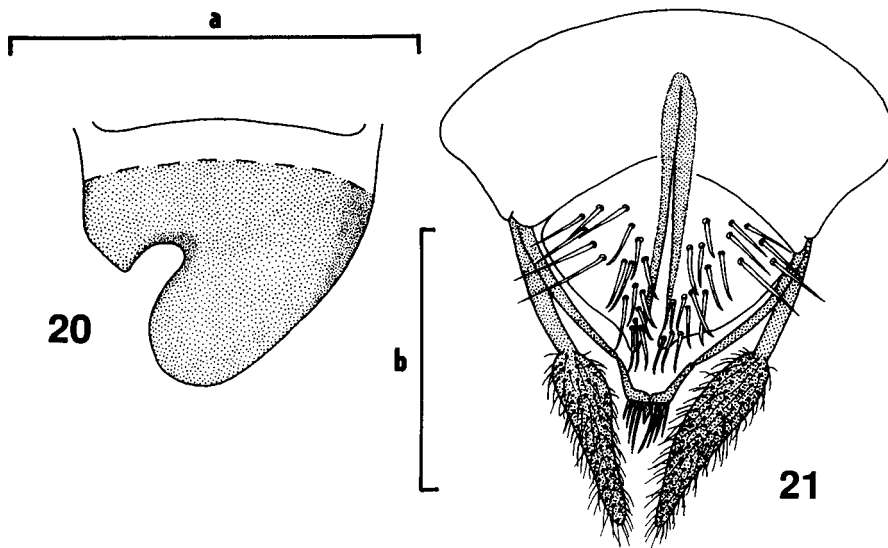
Habitat and distribution

I. chinai has been collected in a variety of habitats including ceramic bonsai-bowls, ponds, streams, hot springs (Miyamoto, 1952), rice field (M. Tonner, pers. comm.), lithotelms (T. Soldán, pers. comm.), seeping rocks and rock pools (Kovac & Yang, 1990). This shows that *I. chinai* is a eurytopical species with a relatively large vagility. *I. chinai* is distributed from Sumatra to N Vietnam. Three specimens of *I. maior* have been caught together with many specimens of *I. chinai* in bonsai-bowl (one) and small pond (two) only in Hanoi.

Cephalonotum, mesoscutellum and colour patterns

a) Intrageneric similarities: both species, *I. chinai* and *I. maior* are structurally closely related; structures of their cephalonotal dorsum, mesoscutellum and hemelytra do not have specific differential characters; colour patterns of dorsum are variable but very similar in both species.

b) Intergeneric similarities: Structures of cephalonotal dorsum of *Idiotrephes* differ strictly from those of *Distotrephes* (cf. Polhemus, 1990: 46, Figs 1, 3, 5), *Limnotrephes*, *Tiphotrephes* (cf. Esaki & China, 1928: 145, Figs 45b,c) and *Mixotrephes* (cf. Papáček et al., 1989: 108, Fig. 1) (*Paralimnotrephes* – ?). Inner border-line of lateral cephalonotal carina is mesally concave from dorsal view in *Idiotrephes* (Fig. 1) but laterally convex in *Distotrephes*, *Limnotrephes*, *Mixotrephes* and *Tiphotrephes* (see, e.g., Polhemus, 1990:



Figs 20, 21. Female terminalia of *Idiotrephes chinai* (ventral views). 20 – abdominal sternum 7; 21 – ovipositor. Broken line in Fig. 20 indicates the position of hind margin of the abdominal sternum 6 (in situ). Scale bars: a – 0.5 mm (20), b – 0.2 mm (21).

Figs 3, 5). Lateral arms of the more caudally localized W-shaped cephalonotal line (= 1st phragma, = border between pro- and mesothorax) are projected into posterolateral corners of cephalonotum. They are clearly visible in *Idiotrephes* (indistinct in other genera).

Wings and pterygopolymorphism

The following situation of pterygopolymorphism has been found in species studied:

- I. chinai*: (a) forewings (FW) – macropterous, hindwings (HW) – macropterous;
 (b) FW – brachypterous, HW – micropterous;
- I. maior*: (c) FW – brachypterous, HW – brachypterous;
 (b) FW – brachypterous, HW – micropterous.

Until now, a dimorphic condition [(a) and (c)] has been found solely in *Mixotrephes hoberlandti* (Papáček et al., 1989; see also definition of conditions). The trimorphic condition [(a), (b) and (c)] is here described for *Idiotrephes*. HW of macropterous *I. chinai* is similar to that of *Hydrotrephes bouvieri* (Helotrephini) (see Esaki & China, 1928: 130, Fig. 1d; cf. Polhemus, 1990: 60). Venation in *I. chinai* is more reduced than in *H. bouvieri*. Although the HW of brachypterous *I. maior* is distinctly smaller than in macropterous *I. chinai*, *H. bouvieri* and *Mixotrephes hoberlandti*, it has a similar shape as in macropterous morphs of the above mentioned species. HW of brachypterous morph differs from that of macropterous individuals by the absence of the vannal field and by more reduced distal parts of veins. HW of micropterous *I. chinai* and *I. maior* differs by a simple rounded shape from the HW of macro- and brachypterous morphs and is without any remnants of venation and folds.

It is possible that the macropterous HWs of *I. chinai* and *H. bouvieri* are plesiomorphic for all genera of the subfamily Helotrephinae.

Male pregenital modifications

a) Intrageneric similarities. The form of S 7 and S 8 found in *I. maior* differs from those of *I. chinai* by minute details only.

b) Intergeneric similarities. Abdominal segment 8 is of similar construction in many species of Helotrephinae, independent from their taxonomic position (cf., e.g., *Mixotrephes*, see Papáček et al., 1989: 112, Fig. 16), some *Helotrephes* and *Esakiella* species (see China, 1930: 171, Fig. 4 – cf. Polhemus, 1990: 59; China, 1935: 601, Fig. 4), *Hydrotrephes* (see China, 1930: 168, Fig. 2; cf. Polhemus, 1990: 60), *Limnotrephes* and *Tiphotrephes* (see Esaki & China, 1928: 158, Fig. 10).

Intergeneric similarities of female terminalia

S 7 is strictly asymmetrical in *Idiotrephes*, moderately asymmetrical in *Mixotrephes*, and symmetrical in other genera of Limnotrephini (cf. also Polhemus, 1990: 56, Tab. 2). The dextrocaudal pigmented break on S 7 in *I. maior* (see Fig. 17a, br) is of the same form as the right lateroposterior margin of S 7 in *Mixotrephes* (cf. Papáček et al., 1989: 115, Fig. 23). This exhibits some possibilities of a reductional transformation series of S 7 as follows: *I. chinai* (without break) → *I. maior* (with break) → ... *Mixotrephes* (reduction of a thin part of S 7 on the right of the break). This hypothesis might indicate a close relationship between *Idiotrephes* and *Mixotrephes*.

The ovipositor of *Idiotrephes* is similar to that of *Mixotrephes* (cf., Papáček et al., 1989). Papáček et al. (1989) discussed the similarities of the arc of fused 2nd valvulae in *Mixotrephes hoberlandti* with Trephotomasinae and Idiocorinae and suggested that the absence of the apical unpaired process might be a character common for all helotrephine genera belonging to the “*Limnotrephes* group” (= Limnotrephini sensu Polhemus, 1990). A medial process is lacking in *I. maior* as well. It exists in *I. chinai*, but is evidently of a different form than in *Esakiella* (cf., e.g., China, 1932: 272, Fig. 1). The unpaired process in *I. chinai* may represent only a remnant of proximal part of this structure in *Esakiella*. This fact illustrates very well that different genera of Helotrephidae are characterized mainly by a mosaic of often intergrading characters independently of their taxonomic position as suggested Papáček et al. (1989).

Differential characters

Valid differential characters of *I. maior* and *I. chinai* are illustrated in Figs 11–21 and summarized in Table 2.

Expansion of generic diagnosis

The original diagnosis of the genus *Idiotrephes* by Lundblad (1933) can be expanded as follows:

Cephalonotum. Medial arch of W-shaped cephalonotal suture is longer than one-third of the maximal width of cephalonotum and extending anteriorly to the level of hind margin of eyes, in frontal view. Outer border of lateral cephalonotal carina is laterally convex; inner border-line distinct and mesally concave in dorsal view.

TABLE 2. *Idiotrephes maior* and *Idiotrephes chinai*. Major differential characters.

Character	<i>I. maior</i>	<i>I. chinai</i>
body length	more than 1.4 mm	less than 1.4 mm
prosternal carina	triangular, with tip in the middle of its anteroposterior length (Fig. 4)	rounded, with tip made by posterior break of ventral margin (see Lundblad, 1933, Figs 40A,D)
distal antennal segment	length and width equal (Fig. 3)	longer than broad (see Lundblad, 1933, Fig. 40B)
males:		
right paramere	slender, with long posteroapical projection (Fig. 12)	robust, with short posteroapical projection or with this projection and small anteroapical tubercle (Figs 15a,b)
females:		
sternum 7	with dextrocaudal break and irregularly shaped right half of the lateroposterior margin (Figs 17a,b)	without break, with one rounded incision in the right half of the lateroposterior margin (Fig. 20)
posteromesal corner of 1st valvulae	rounded (Fig. 18)	with small lobules (Fig. 21)
medial arch of fused 2nd valvulae	simple, without unpaired process (Fig. 18)	composed of two L-shaped sclerites, with small unpaired process (Fig. 21)

Ovipositor is moderately asymmetrical. Valvifer 1 broad and partly fused with first valvulae. Valvulae 1 plate-like, flat, irregularly triangular, with anteromesally directed slim apodeme. Valvulae 2 fused into an arc with partly separated medial arch. Gonostyloids associated with lateral arms of the arc.

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REFERENCES

- ESAKI T. & CHINA W.E. 1928: A monograph of the Helotrephidae, subfamily Helotrephinae (Hem., Heteroptera). *Eos* **4**: 129–172.
- CHINA W.E. 1930: Three new species of the genus Helotrephes (Hemiptera – Heteroptera). *Ann. Mag. Nat. Hist. (Ser. 10)* **5**: 164–172.
- CHINA W.E. 1932: Notes on the African Helotrephidae (Hemiptera, Heteroptera). *Entomologist* **65**: 270–273.
- CHINA W.E. 1935: New and little-known Helotrephidae (Hemiptera – Heteroptera). *Ann. Mag. Nat. Hist. (Ser. 10)* **15**: 593–614.
- KOVAC D. & YANG C.M. 1990: A preliminary checklist of the semiaquatic and aquatic Hemiptera (Heteroptera: Gerromorpha and Nepomorpha) of Ulu Kinchin, Pahang, Malaysia. *Malay. Nat. J.* **43**: 282–288.
- LUNDBLAD O. 1933: Zur Kenntnis der aquatilen und semiaquatilen Hemipteren von Sumatra, Java und Bali. *Arch. Hydrobiol. (Suppl. Bd. 12, Trop. Binnengewässer)* **4**: 1–195, 263–498.
- MIYAMOTO S. 1952: Biology of Helotrephes formosanus Esaki et Miyamoto, with descriptions of larval stages. *Sieboldia* **1**(1): 1–10, 3 Pls.
- PAPÁČEK M., ŠTYS P. & TONNER M. 1989: A new genus and species of Helotrephidae from Afghanistan and Iran (Heteroptera: Nepomorpha). *Věst. Čs. Spol. Zool.* **53**: 107–122.
- PAPÁČEK M. & TONNER M. 1991: An annotated list of aquatic bugs (Heteroptera: Nepomorpha) of the Nam Cat Tien National Park. In Spitzer K., Lepš J. & Zacharda M. (eds): *Nam Cat Tien. Czechoslovak Vietnamese Expedition. November 1989*. Inst. Entomol., Czech. Acad. Sci., České Budějovice, pp. 11–15.
- POLHEMUS J.T. 1990: A new tribe, a new genus and three new species of Helotrephidae (Heteroptera) from Southeast Asia, and a world checklist. *Acta Entomol. Bohemoslov.* **87**: 45–63.

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