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Harpacticoïdes (Crustacea, Copepoda) de la mer Égée (plages de Kavala, Grèce du nord)

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APOSTOLOV A. Harpacticoïdes (Crustacea, Copepoda) de la mer Égée (plages de Kavala, Grèce du nord). – Historia naturalis bulgarica, **19**: 5-33.

Abstract. The results of the investigations on the copepod fauna from subterranean littoral waters and algae of the Kavala beaches (Aegean Sea, Northern Greece) are reported. Eight copepod harpacticoid species have been identified and brief systematical, ecological and biogeographical notes are given. These first results are of great interest to the biogeography of mesopsammal harpacticoids in the Aegean Sea.

Key words: Copepoda, Harpacticoida, subterranean littoral, Kavala, Greece.

Introduction

En automne 2004, j'ai eu l'occasion de séjourner dans la ville de Kavala (Grèce du Nord). Pendant ce séjour, j'ai effectué un nombre de prélèvement de la faune interstitielle littorale et des algues côtières, sur les plages de la ville de Kavala, de la mer Égée.

Nos connaissances actuelles, en ce qui concerne la faune harpacticoïdienne de cette région, sont incomplètes. Aucune prospection taxonomique et écologique de la faune mésopsammique n'a encore été entreprise dans cette région de la Grèce.

Dix échantillons ont été réalisés en dix stations localisées sur la plage principale de la ville de Kavala. Leur examen a révélé l'existence de huit espèces appartenant à huit familles et huit genres, et dont la présence n'avait pas encore été reconnue dans la faune de la mer Égée et de la Grèce. Parmi ces espèces, une est nouvelle pour la science – *Pseudonychocamptus kolarovi* n. sp.

Dans la présente note, nous donnons quelques remarques sur la systématique, l'écologie et la zoogéographie des espèces trouvées et la description de la nouvelle espèce.

Matériel et Méthodes

Le matériel provient de dix stations situées sur la plage principale de Kavala à une distance de 0.20 m de la mer et à une profondeur de 0.15-0.20 m.

Les prélèvements ont été effectués par la méthode des sondages de Karaman-Chappuis, à l'aide d'un filet de 40 μ de vide de maille. Le matériel récolté a été fixé sur place au formol à 4%

et plus tard, en laboratoire, transféré dans l'alcool à 70° pour conservation.

Les espèces trouvées ont été étudiées selon la méthode classique, en utilisant la glycérine. Pour l'étude, les harpacticoïdes ont été dessinés à l'aide d'un microscope à contraste de phase, équipé d'un tube à dessin.

Remarques taxonomiques, écologiques et zoogéographiques

Fam. CANTHOCAMPTIDAE Lang, 1948

Genre *Brianola* Monard, 1926
***Brianola* sp.**

(Fig. 1-2)

Discussion. Parmi les harpacticoïdes des algues littorales, nous avons eu la possibilité de trouver seulement un exemplaire femelle du genre *Brianola*. Malheureusement, l'exemplaire trouvé était mort, ce qui n'a pas permis une détermination exacte. D'après la structure de P1, des branches furcales et l'aire génitale, cette espèce est très proche de l'espèce *Brianola stebleri*. La vaste répartition géographique de cette espèce, sur la côte française atlantique (Cette, Roscoff), dans la partie du Nord de la côte africaine méditerranéenne (Castiglione, Algérie et Salammbô, Tunisie) et au Portugal, nous permet de considérer la possibilité de trouver cette espèce dans la mer Égée (Grèce du Nord).

La rareté du matériel ne nous autorise cependant pas à tirer de conclusion en ce qui concerne la position systématique de l'exemplaire trouvé.

Fam. DIOSACCIDAE G. O. Sars, 1906

Genre *Schizopera* Sars, 1905, sensu Apostolov, 1982
***Schizopera* (*Schizopera*) *brusinae* Petkovski, 1954**

(Fig. 3-5)

Matériel examiné: 4 femelles adultes et 2 mâles, algues vertes dans la zone littorale, plage centrale de la ville de Kavala, le 25 septembre 2004.

Le *Schizopera* (*Schizopera*) *brusinae* Petkovski est une espèce très abondante dans les eaux souterraines littorales des plages de Kavala. Il s'agit d'un représentant des eaux interstitielles du littorale, décrit par PETKOVSKI (1954) pour la mer Adriatique (côte près Dubrovnik). Signalé dans la mer Noire par APOSTOLOV (1973) et MARINOV (1973), APOSTOLOV & MARINOV (1988). KUNZ (1974) trouve à son tour cette espèce dans les eaux interstitielles près de Banuls, sur la côte française méditerranéenne. Le même auteur constate une différence avec la description originale. Celle-ci concerne la forme de l'épine externe de la furca. Les exemplaires provenant des eaux interstitielles près d'Arago porte une soie normale au lieu d'épine externe. D'après Kunz, dans ce cas on peut considérer l'existence de deux formes chez cette espèce. FIERS (1986) trouve cette espèce dans les eaux saumâtres du Nord de la Papouasie-Nouvelle-Guinée. La seule femelle trouvée par FIERS correspond parfaitement à la description originale donnée par PETKOVSKI (1954). FIERS constate une unique différence

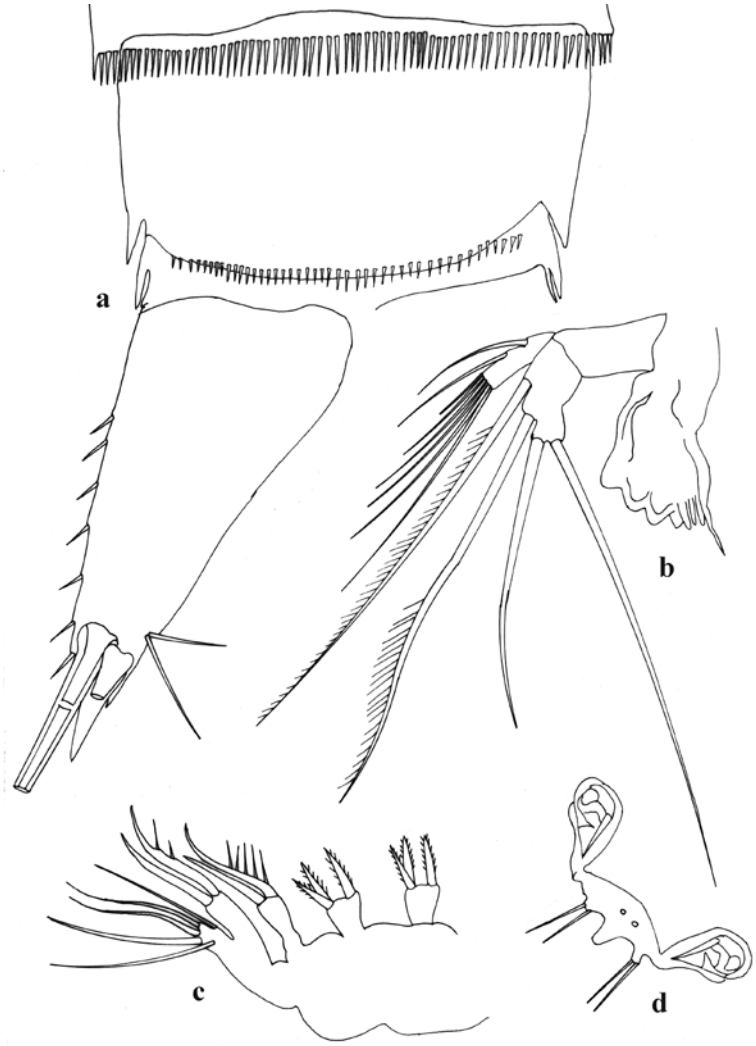

Fig. 1. *Brianola* sp. ♀: a – dernier somite et furca, vue dorsale; b – mandibule; c - maxille ; d – aire génital.

: la relation longueur / largeur de la furca. Chez la femelle de Papoua, cette relation est 1,5 : 1, tandis que chez les exemplaires trouvés par PETKOVSKI (1954), MARINOV (1973), APOSTOLOV (1973) et KUNZ (1975) elle est 2 : 1.

D'un point de vue morphologique, le *Schizopera* (*Schizopera*) *brusinae* Petkovski de la mer Égée présente tous les caractères donnés par PETKOVSKI (1954).

Discussion. Le genre *Schizopera* a été décrit par SARS (1905), avec l'espèce *Schizopera longicauda* Sars comme génotype du genre. Après la création de ce genre, un grand nombre d'espèces sont décrites. La description incomplète de la plupart des espèces fait la systématique et la phylogénie du genre très difficiles.

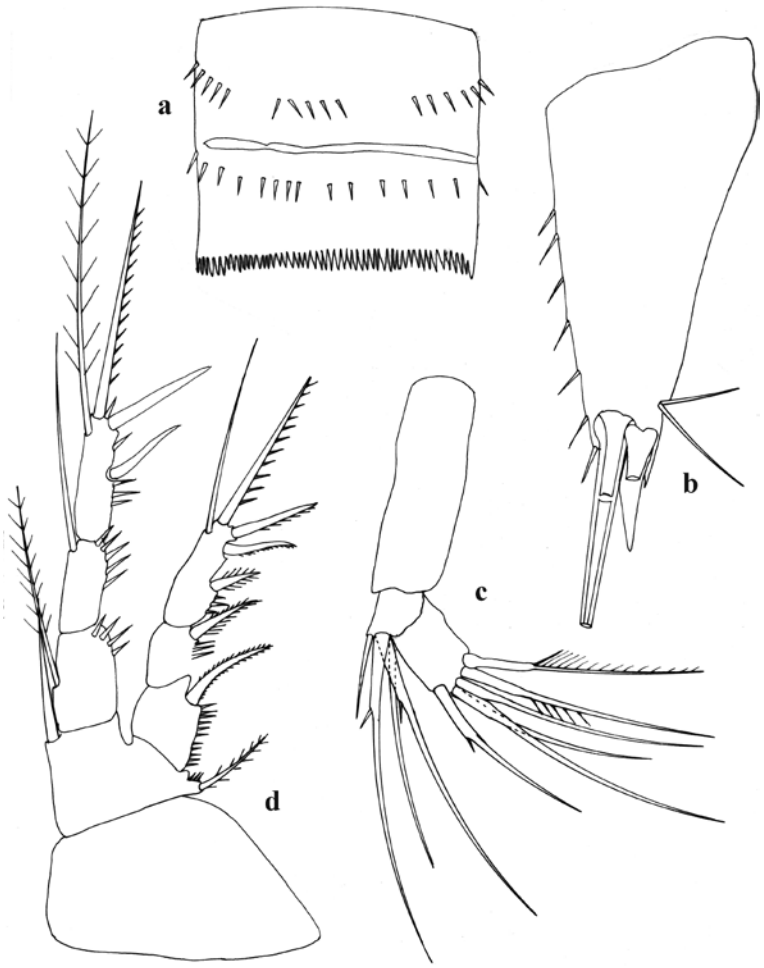

Fig. 2. *Brianola* sp. ♀: a – somite génitale; b – furca, vue dorsale; c – A2; d- P1

Le genre *Schizopera* Sars compte à l'heure actuelle un nombre très remarquable d'espèces. Ce sont des formes colonisent, différents types d'habitats – marins et saumâtres. Parmi les espèces du genre, certaines habitent les eaux douces.

D'après CHAPPUIS (1954) les espèces de ce genre ont émigré de la mer dans les eaux saumâtres ou douces. Il s'agit d'un genre dont la plupart des espèces présentent un endémisme.

LANG (1948) dans la diagnose du genre, mentionne que le caractère plus important du genre est une épine interne transformée sur le troisième article de l'exopodite de P3 chez le mâle. LANG (1965) dans sa deuxième monographie donne une clé de 46 espèces et sous espèces valides.

WELLS & RAO (1976) discutent la relation parmi le genre *Schizopera* et la famille Diosaccidae et décrivent un genre nouveau de l'Îles Andaman – *Eoschizopera.* Dans cet article, on donne

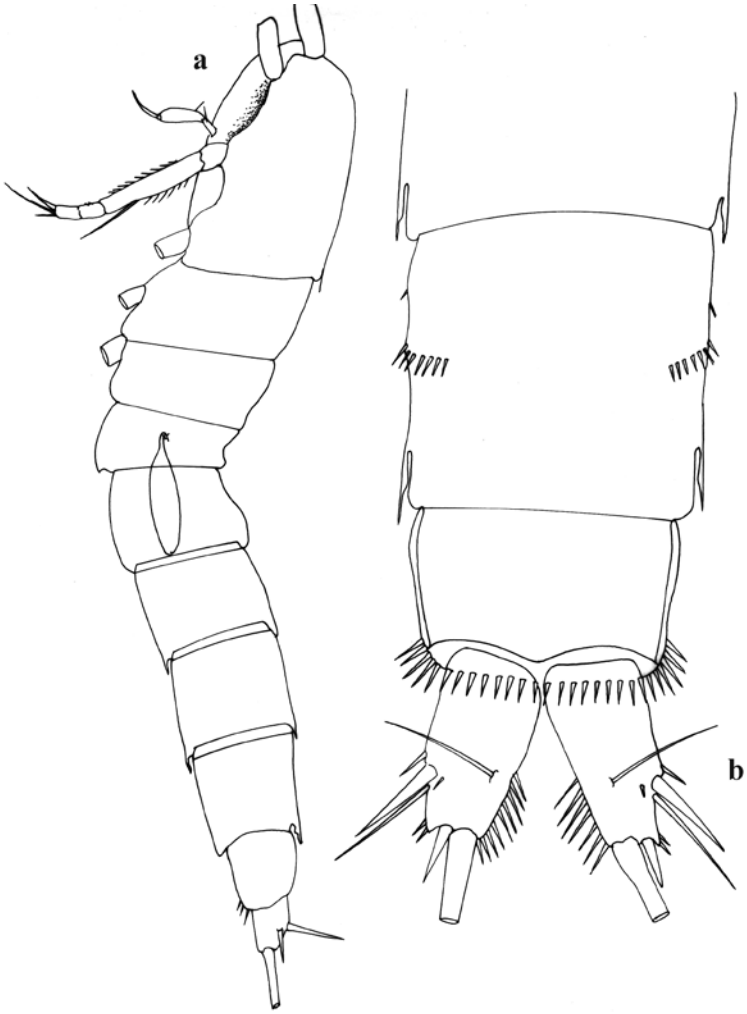

Fig. 3. *Schizopera* (*Schizopera*) *brusinae* Petkovski ♀: a – Habitus; b – somites abdominaux, vue ventrale

information pour 22 espèces du genre *Schizopera* et leurs très importants caractères. Les deux auteurs proposent de séparer du genre *Schizopera* les espèces *crassipinata, gligici, indica* et *syltensis* et les placer au genre *Eoschizopera*.

Jusqu'à présent le genre *Eoschizopera* à sept espèces : *Eoschizopera* (*Eoschizopera*) *chiloensis* Mielke, *E.* (*E.*) *nicoyana* Mielke, *E.* (*E.*) *reducta*, *E.* (*E.*) *syltensis* (Mielke), *E.* (*Praeoschizopera*) *crassispinata* (Chappuis), *E.*(*P.*) *gligici* (Petkovski), *E.* (*P.*) *indica* (Rao & Ganapati).

APOSTOLOV (1982) sépare du genre *Schizopera* deux sous-genre: *Schizopera* s.str. et *Neoschizopera* Apostolov et un genre nouveau *Schizoperopsis* Apostolov avec deux sous-genres *Schizoperopsis* s. str. et *Psammoschizoperopsis* Apostolov. Du genre *Eoschizopera* Wells & Rao, le même auteur sépare deux sous-genres: *Eoschizopera* s. str. et *Praeoschizopera* Apostolov. MIELKE (1992) rejette cette classification, mais plus tard lui-même (MIELKE, 1995) décrivant des nouvelles

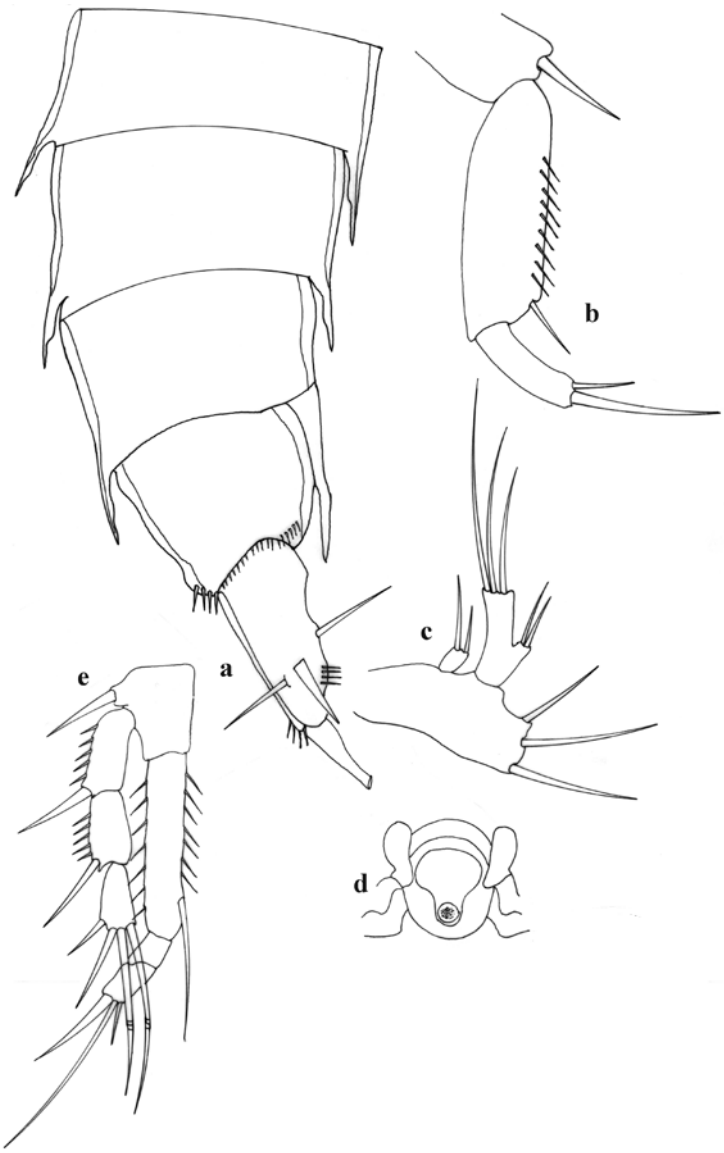

Fig. 4. *Schizopera* (*Schizopera*) *brusinae* Petkovski ♀: a – somites abdominaux, vue latéral ; b – Maxillipède, c – mandibularpalpus; d – aire génitale; e - P1

espèces de Costa Rica, propose de la rétablir pour "faciliter la détermination des espèces".

KARANOVIC (2004) à son tour discute la position systématique du genre et décrit cinq espèces nouvelles d'Australie.

Écologie. Sauf sur la côte dalmatienne de la mer Adriatique, le *Schizopera* (*Schizopera*) *brusinae* Petkovski est connue aussi sur la côte bulgare de la mer Noire, en Méditerranée française et

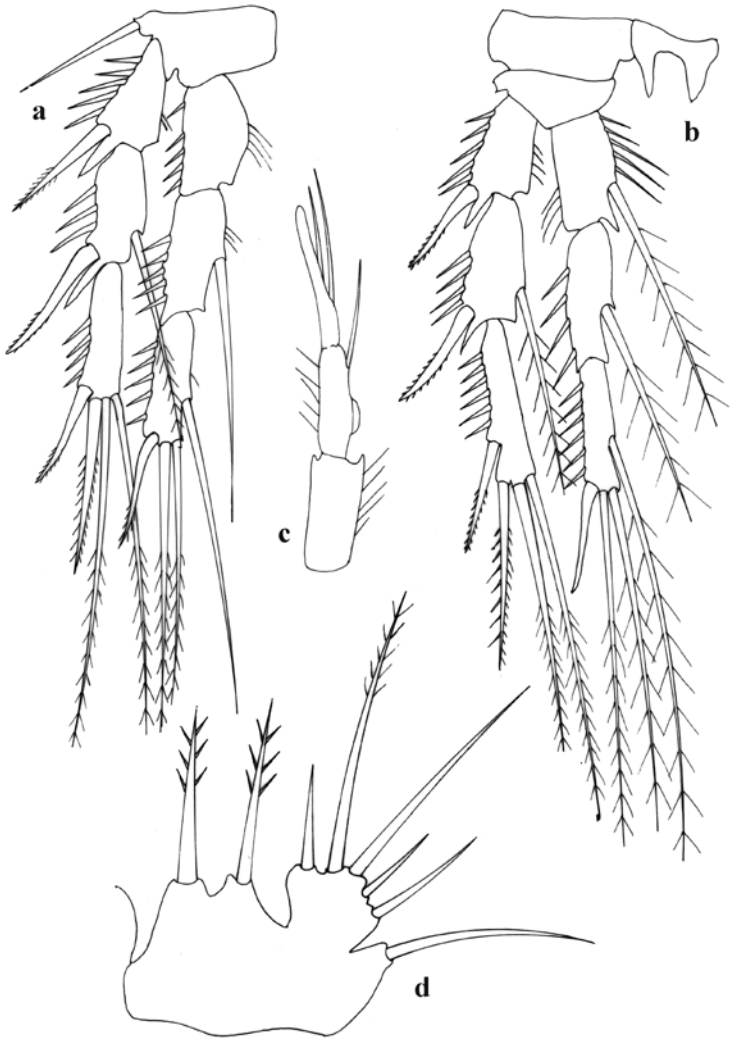

Fig. 5. *Schizopera* (*Schizopera*) *brusinae* Petkovski ♀, ♂: a – P2 ♀; b – P3 ♀; c – endopodite P2 ♂; d – P5 ♂

dans les eaux saumâtres de la côte de Papouasie-Nouvelle-Guinée (Océan Indien). Cette espèce habite principalement les eaux interstitielles littorales. Elle a colonisé avec succès des habitats souterrains. Comme le soulignent APOSTOLOV & MARINOV (1988), on la trouve dans la région de la côte bulgare de la mer Noire, dans les fonds sableux à petite profondeur. On peut considérer cette espèce comme une forme psammophile et mésopsammique.

Répartition. D'un point de vue de la répartition zoogéographique, *Schizopera* (*Schizopera*) *brusinae* est signalée dans la mer Adriatique (PETKOVSKI, 1954, 1955), dans la mer Méditerranée (KUNZ, 1975), et dans la mer Noire (MARINOV, 1973), APOSTOLOV & MARINOV, 1988) et de l'Océan Indien – Papouasie-Nouvelle-Guinée (FIERS, 1986).

Fam. HARPACTICIDAE Sars, 1904

Genre *Harpacticus* Milne-Edwards, 1840
***Harpacticus littoralis* Sars, 1910**

(Fig. 6-7)

Matériel examiné: 3 femelles, eaux interstitielles littoralles; plage de la ville de Kavala, le 26 septembre 2004.

Discussion. *Harpacticus littoralis* Sars est une forme inconnue pour la mer Égée et pour la faune harpacticoïdienne de la Grèce. L'espèce se rencontre partout dans les algues marines du littoral. Elle a aussi colonisé successivement différents biotopes: algues et fond sableux.

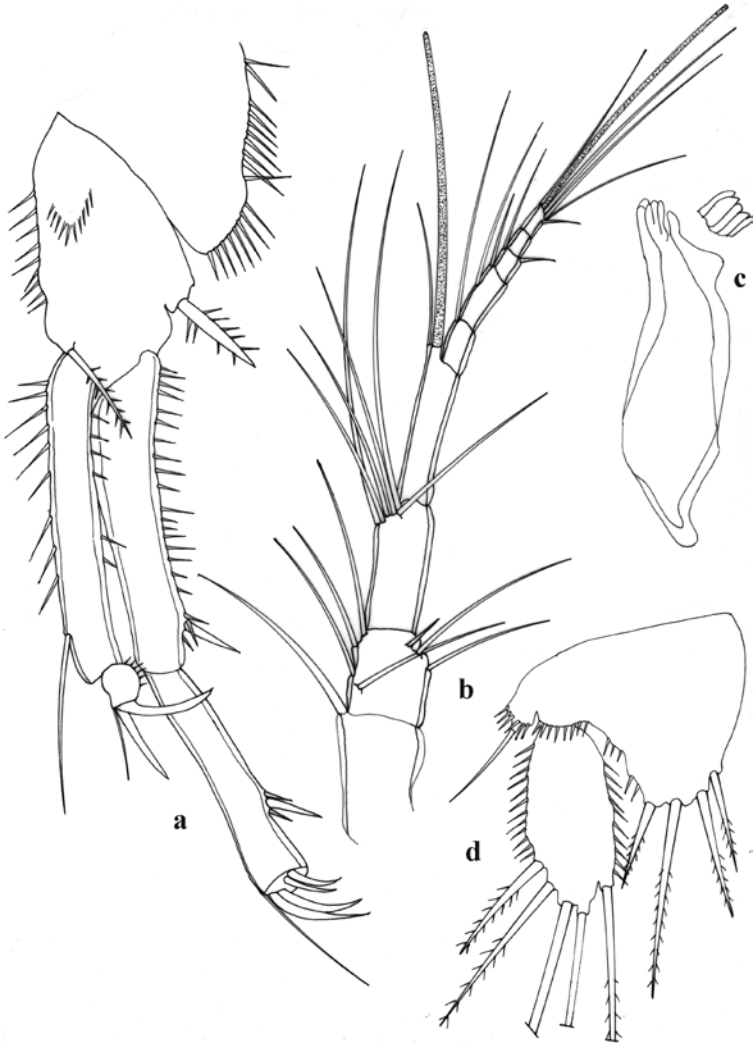

Fig. 6. *Harpacticus littoralis* Sars ♀: a – P1; b – A1; c – mandibule; d – P5

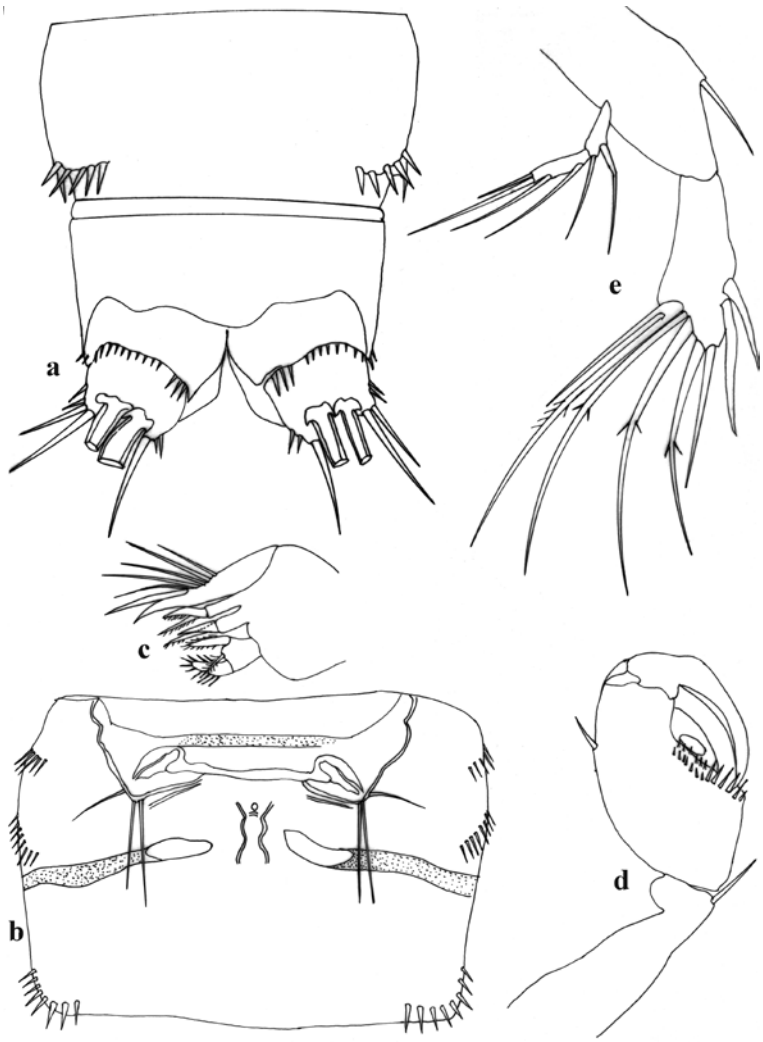

Fig. 7. *Harpacticus littoralis* Sars ♀: a – somites abdominaux, vue ventrale; b – somite génital et aire génitale; c – maxille; d – maxillipède; e – A2

JAKUBISIAK (1938) signale également la présence de cette espèce dans les sables du littoral du Cap Midia de la côte romaine de la mer Noire.

Nous avons trouvé cette espèce dans les eaux interstitielles littorales et parmi les algues vertes tout près de la station de la plage marine. D'après nous, l'espèce *H. littorales,* qui est une phytophile, se trouve peut être dans les eaux interstitielles de la plage marine suite à une tempête marine ou suite à une agitation de la mer.

Écologie. L'espèce habite les algues marines et les fonds sableux de la zone littorale (LANG, 1948; APOSTOLOV & MARINOV, 1988) La présence de l'espèce *Harpacticus littoralis* dans les eaux souterraines des plages marines peut s'expliquer par leur large tolérance écologique ainsi

que par la structure granulométrique du sable.

L'espèce marine *Harpacticus littoralis* est meiomésohaline et eurytherme.

Répartition. La péninsule Scandinave, Îles Britanniques, Allemagne, Hollande, Méditerranée (France, Algérie, Tunisie, Italie); mer Noire (Roumanie, Bulgarie); mer Adriatique; Océan Atlantique (Amérique du Nord).

Fam. LAOPHONTIDAE T. Scottm, 1904

Genre *Pseudonychocamptus* Lang, 1948
Pseudonychocamptus kolarovi sp. n.

(Fig. 8-12)

Matériel examiné: 2 mâles, le 26 septembre 2004.

Localité – type: eaux interstitielles de la plage principale de la ville de Kavala.

Holotype: un mâle.

Paratype: un mâle.

L'ensemble du matériel étudié est conservé dans la collection zoologique à l'Université de Bourgas.

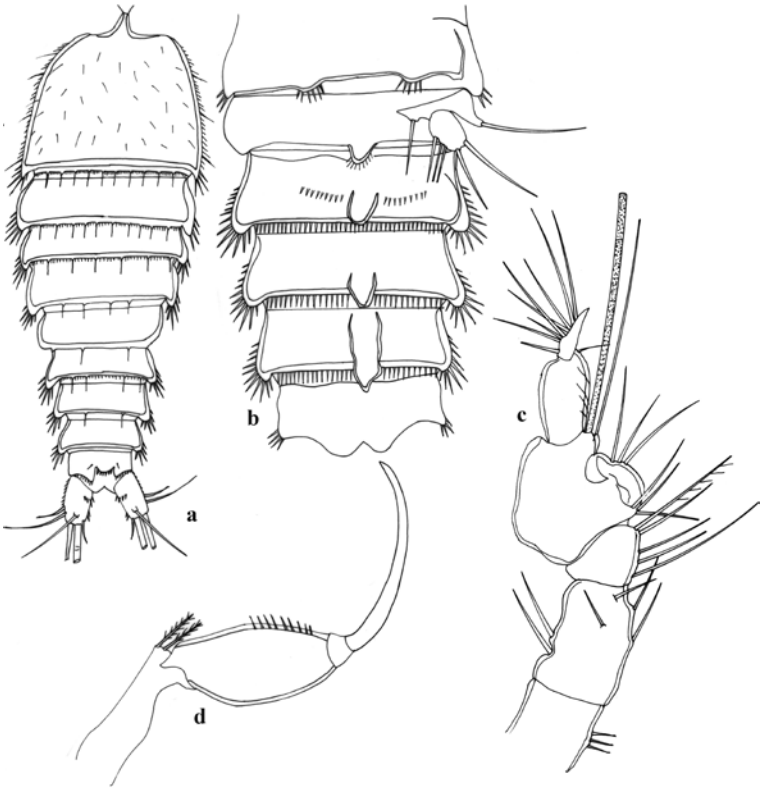

Fig. 8. *Pseudonychocamptus kolarovi* sp. n. ♂: a – Habitus, vue dorsal; b – somites abdominaux, vue ventrale; c – A1; d – Maxillipède

Faune associée: Ostracodes, Acariens.

Description: Mâle. Bord postérieur des somites du corps avec une rangée ininterrompue d'épines dorsalement et latéralement (Fig. 8a). Dernier somite sur la face ventrale avec une rangé de courtes spinules à la base de chaque branche furcale.

Dorsalement, l'opercule anal est bien marqué; son bord libre est frangé d'une rangée de nombreuses petites épines.

Branches furcales (Fig. 8a): une fois et demi plus longue que large. Elles portent deux longues soies apicales; deux soies longues latérales et une soie au coin apical interne dont la base est entourée de deux courtes épines. Une soie à base articulé, est implantée dorsalement. Dorsalement, les branches furcales portent au coin interne deux rangées de spinules. Latéralement, les branches furcales sont frangées d'une rangée de spinules.

Rostre (Fig. 9b): court, non articulé, atteignant le milieu du premier article de l'antennule.

Antennule (Fig. 8c, 9b): haplocère, composé de six articles. Les deux premiers articles sont allongés. La chétotaxie des articles est comme suit : 0, 6, 5, 7 + Ae, 1, 8. Aesthétasque principale et soie accompagnatrice portés sur le quatrième article.

Antenne (Fig. 9c): coxa courte et nue. Exopodite d'un seul article, armé de quatre soies barbelées. Allobasis plus long que l'endopodite. Endopodite armé de spinules, de trois forts crochets, et de quatre soies géniculées.

Maxillipède (Fig. 8d): basis allongé, portant à son apex deux soies barbelées. Premier article

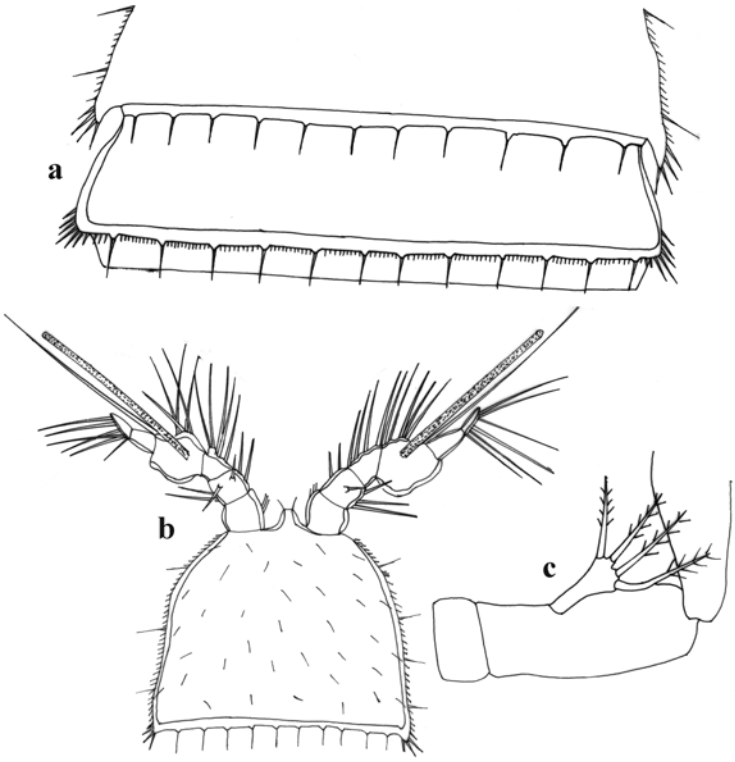

Fig. 9. *Pseudonychocamptus kolarovi* sp. n. ♂: a – premier somite de céphalothorax, b – A1; c – exopodite A2

de l'endopodite avec le bord interne garni d'une rangée de fines spinules. Second article avec un crochet fort, égal au premier article de l'endopodite.

P1 (Fig. 10a): Basis portant une épine au coin interne, non transformé, et une épine plus longue au coin externe. La partie interne est armée d'une rangée de longues spinules. Exopodite composé de trois articles; les deux premiers articles sans soie interne, l'article distal avec deux épines externes et deux soies géniculées apicales. Endopodite biarticulé. Premier article allongé, dépassant l'extrémité du second article de l'exopodite. Deuxième article court, avec une rangée de fines spinules au coin interne et une forte épine apicale.

P2 (Fig. 10b): basipodite avec une longue soie externe; partie externe armée d'une rangée de spinules. Exopodite triarticulé. Premier article allongé, sans soie interne; l'article médian porte

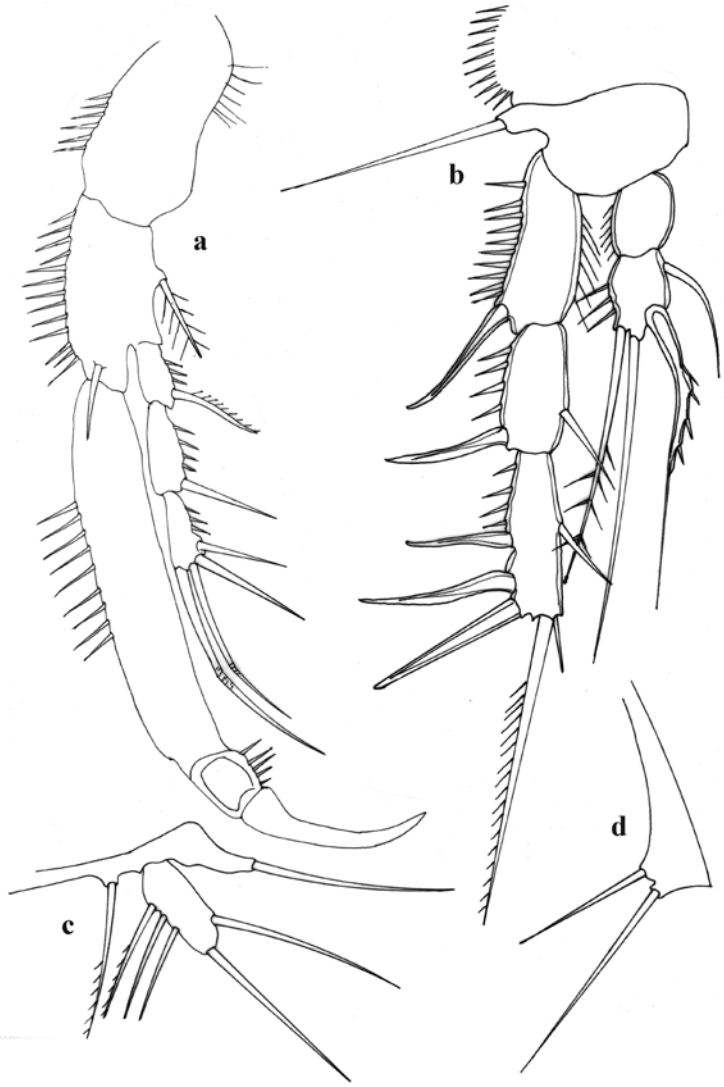

Fig. 10. *Pseudonychocamptus kolarovi* sp. n. ♂: a –P1; b – P2; c – P5; d – P6

une soie interne et le troisième article porte six soies et épines dont une courte soie interne, une fine et courte soie apicale; une longue soie apicale et trois épines externes. Endopodite biarticulé, atteignant l'extrémité de l'article basale de l'exopodite. Article basal sans soie interne; second article avec quatre soies dont une soie courte interne, une soie transformée en longue épine et deux longues soies apicales. L'article apical de l'endopodite porte une rangée de spinules au coin externe.

P3 (Fig. 11b): basipodite avec une longue soie au coin externe. L'article basal de l'exopodite allongé, avec une épine et une rangée de spinules sur le bord externe; le deuxième article porte

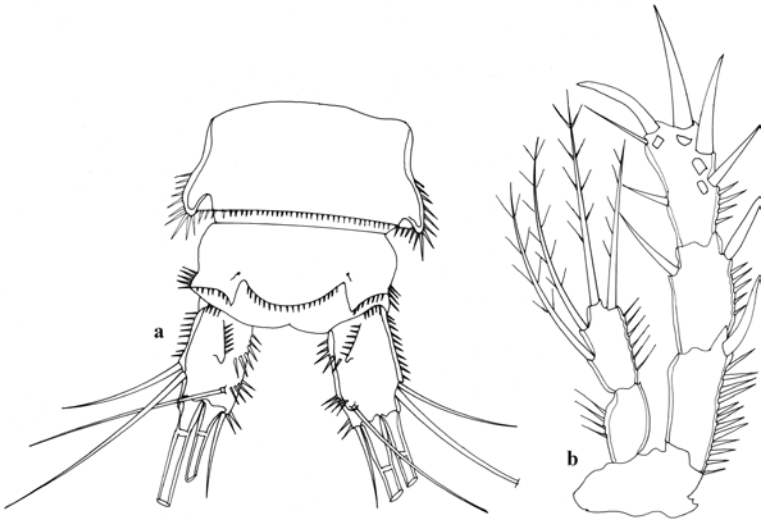

Fig. 11. *Pseudonychocamptus kolarovi* sp. n. ♂: a – anal somite et furca, vue dorsal; b – P3

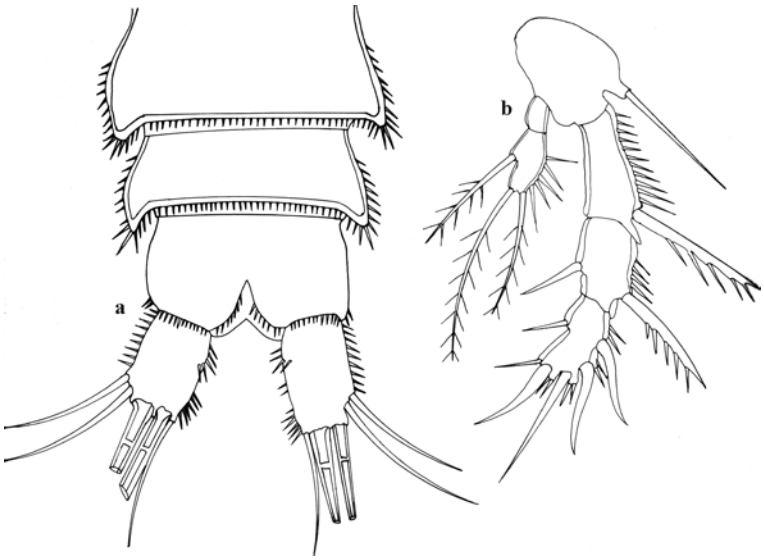

Fig. 12. *Pseudonychocamptus kolarovi* sp. n. ♂: a – somites abdominaux et furca, vue ventrale; b – P4

une soie interne courte; l'article distal avec une soie interne, une soie fine apicale et quatre fortes épines dont une apicale et trois externes. Endopodite biarticulé. Premier article sans soie interne et quelques fines soies au coin interne; le second article dépasse le milieu du deuxième article de l'exopodite, avec quatre soies barbelées.

P4 (Fig. 12b): basipodite avec une soie longue externe. L'endopodite atteignant l'extrémité du premier article de l'exopodite, avec trois soies dont une interne barbelée et deux apicales aussi barbelées. L'article apical de l'endopodite porte une rangée de cinq spinules longues au coin externe. Exopodite triarticulé. L'article basal allongé, portant une longue et forte épine et une rangée de spinule sur le bord externe; article médian plus court que précédant, avec une soie interne et une épine longue externe; l'article apicale porte six soies et épines dont une soie interne courte, une soie apicale courte et quatre fortes épines.

P5 (Fig. 10c): avec exopodite bien développé, portant cinq soies inégales dont une apicale, une externe et trois internes. Basoendopodite réduit, portant une longue soie.

P6 (Fig. 10d): en plaque, triangulaire, portant deux soies inégales.

Longueur du mâle: 0.52 mm.

Femelle. Inconnue

Étymologie. Cette espèce est respectueusement dédiée à Prof. Peter Kolarov, de l'Institut de Pêche à Varna, auteur de nombreux ouvrages scientifiques sur la faune de la mer Noire.

Écologie. Il s'agit d'une espèce interstitielle et mésopsammique.

Position systématique. Le genre *Pseudonychocamptus*, revu par LANG (1948), comprend à notre connaissance huit espèces: *Pseudonychocamptus abbreviatus* (SARS,1920); *P. carthyi* Hamond, 1968; *P. colomboi* Ccecherelli, 1988; *P. koreni* (Boeck, 1873); *P. marinovi* Apostolov & Petkovski, 1989; *P. proximus* (Sars, 1908); *P. paraproximus* Lang, 1965; *P. spinifer* Lang, 1965.

Pseudonychocamptus kolarovi sp. n. prend une place particulière parmi les huit espèces connues du genre *Pseudonychocamptus* en raison de la structure des branches furcales, de la configuration des péreiopodes cinq et la structure des pattes natatoires.

Il est évident que cette description devra être complétée dès que possible par l'examen des exemplaires femelles.

Fam. LATIREMIDAE Bozic, 1969

Genre *Delamarella* Chappuis, 1954
Delamarella karamani Petkovski, 1957

Matériel examiné: 2 femelles adultes; eaux interstitielles de la plage près de la ville de Kavala, le 26 septembre 2004.

Les exemplaires examinés proviennent de l'eau souterraine des sables grossiers. *Delamarella karamani* Petkovski ne montre aucune différence avec l'espèce décrite de la mer Adriatique. Elle est une des espèces fréquentes dans les eaux interstitielles littorales, facile à distinguer par sa taille et par son aspect.

Discussion. Le genre *Delamarella* a été décrit par CHAPPUIS (1953) sur la base des exemplaires trouvés dans les eaux souterraines de la plage Roussillon, au sud de France. De la même station, Chappuis décrit une nouvelle espèce sous le nom *Delamarella arenicola*. Dans les suivantes publications consacrées à l'étude des copépodes psammiques, CHAPPUIS (1954, a, b) considère cette espèce comme *incerta sedis*. D'après cet auteur, la nouvelle espèce se diffère des espèces connues par la structure et la modification atypique de la P4 chez le mâle.

Quatre années plus tard, après la description du genre *Delamarella*, Petkovski (1957) décrit une autre nouvelle espèce de la mer Adriatique (Croatie) – *D. karamani.*

La découverte de la deuxième espèce du genre, pose à nouveau la question de la position systématique du genre *Delamarella.*

BOZIC (1969) décrit un genre nouveau et une espèce nouvelle pour la Science – *Latiremus eximius,* de l'île de la Reunion, et qui diffère des espèces connues. Le nouveau genre Bozic attribut à une famille nouvelle, monotypique - Latiremidae.

Pendant l'investigation de la faune harpacticoïdienne de la mer Noire (côte bulgare) APOSTOLOV (1969,1971) communique la deuxième trouvaille à l'espèce *D. karamani.* La première trouvaille de cette espèce dans la mer Noire est au sud de Varna, dans les eaux interstitielles des plages du cap Galata. La deuxième place où est signalé *Delamarella karamanie,* sur la côte bulgare, est en milieu interstitiel au bord de la rivière Rezovska, près de la frontière turque.

En 1971, le nombre des espèces de ce genre augment après la description de Sardine (mer Méditerranée) par Cottarelli d'une nouvelle espèce - *D. galateae.*

A son tour KUNZ (1984) décrit *Delamarella phyllosetosa* de l'Afrique du Nord.

HUYS et al. (2005) décrivent une autre nouvelle espèce de la mer Noire, de ce genre- *Delamarella obscura,* de l'ouest côte de Turquie.

Le genre *Latiremus* Bozic est resté discutable longtemps. KUNZ (1977) fait une comparaison des deux genres *Delamarella* et *Latiremus,* et conclu qu'ils sont très proches en ce qui concerne la structure des branches furcales, mandibules, pattes natatoires et principalement la structure de la P4 chez le mâle. D'après cet auteur, le genre *Latiremus* est synonyme au genre *Delamarella.* En même temps, il conserve la famille Latiremidae, qui n'est pas une contradiction avec le Code International de la Nomenclature Zoologique.

BOZIC (1978) accepte l'opinion de plusieurs auteurs (WELLS, 1976, BODIN, 1976, KUNZ, 1977) pour conserver le genre *Delamarella* comme génotype de la famille des Latiremidae. WELLS (1976) préfère conserver les deux genres. BODIN (1976) et KUNZ (1977), au contraire, considèrent le genre *Latiremus* comme un synonyme du genre *Delamarella.*

HUYS & KUNZ (1988) font une autre révision de la famille Latiremidae. D'après eux, la famille Latiremidae inclue des espèces interstitielles marines qui doivent être groupées en trois genres. Le genre *Latiremus* est re-institué. Il comprend aujourd'hui une seule espèce - *Latiremus eximius* Bozic. Le deuxième genre est *Delamaralla,* qui comprend trois espèces méditerranéennes - *Delamarella arenicola* Chappuis, *D. karaman*i Petkovski et *D. galatea*e Cottarelli.

ITÔ (1974) a créé un genre nouveau *Protolatiremus* avec une seule espèce- *Protolatiremus sakaguchii.* Le nouveau genre est incertainement attribué à la famille Thalestridae. Mai BODIN (1976, a, 1979, 1988) n'est pas de cet avis. Il continue à inclure ce genre dans la famille Latiremidae, indépendamment de l'opinion de Itô, qui propose une ligne d'évolution de *Protilatiremus* vers *Latiremus* et *Delamarella.* La plus grande partie de copépodologistes rejettent la liaison entre le genre *Protolatiremus* et le genre *Latiremus* (BOZIC, 1978; KUNZ, 1984; HUYS & KUNZ, 1988). D'après HUYS & KUNZ (1988), le genre *Protolatiremus* ne possède pas les indices caractèristiques de la famille Latiremidae. Malgré l'opinion de ces deux copépodologistes, BODIN (1997), dans la nouvelle édition de son Catalogue, range ce genre comme *genre incertae sedis* de la famille Latiremidae.

D'après WILLEN (2000), le genre *Protolatiremus* appartient à un groupe soeur de Thalestridimorpha, dans laquelle entrent aussi les familles Thalestridae, Diosaccidae, Parastenheliidae et Miraciidae.

HUYS & KUNZ (1988), sur la base des différences entre les deux genres – *Delamarelle* et *Latiremus,* retirent du genre *Delamarella* l'espèce *Delamarella phyllosetosa* Kunz, 1984, et l'attribue comme espèce type à un genre nouveau *Arbutifera.*

Récemment, HUYS et al., (2005) décrivent une autre espèce de la mer Noire (côte turque), du genre *Delamarella – D. obscura.* Comme le soulignent ces auteurs, la découverte de cette espèce confirme les différences parmi le genre *Delamarella* et le genre *Latiremus.*

Écologie. Il s'agit d'une espèce interstitielle des plages marines. La plupart des espèces méditerranéennes habitent les eaux interstitielles des plages littorales sous l'influence d'eau douce continentale. Comme on peut le remarquer, la salinité de l'eau interstitielle peut varié de façon non- négligeable pour les harpacticoïdes habitant des plages littorales. On peut constater la salinité extrêmement faible près du bord des rivières et des lacs côtiers. En certains points du littoral marin, la salinité peut s'abaisser plus ou moins brutalement. La salinité des eaux interstitielles tout près de la mer dépend peu des arrivées d'eau douce. Plus loin de la mer par contre, la salinité des eaux interstitielles est dû à l'apport d'eau douce du continent. Ces variations de salinité sont suffisamment importantes pour expliquer la répartition des peuplements de Copépodes Harpacticoïdes. En ce qui concerne les représentants du genre *Delamarella,* comme espèces mésopsammique vivant dans les eaux interstitielles des plages littorales, elles sont évidemment adaptées à une salinité variable. Comme on le voit il s'agit là d'espèces qui colonisent successivement les eaux oligochalines.

La répartition de cette espèce dans la mer Noire peut s'expliquer par leur large tolérance écologique et par la structure granulométrie du sable.

Répartition. D'un point de vue géographique le genre *Delamarella* est un genre ponto-méditerranéen, signalé en France, Espagne, Italie, Algérie, Croatie et en mer Noire (côte bulgare).

Fam. LONGIPEDIIDAE Sars, Lang

Genre *Longipedia* Claus, 1863
Longipedia minor T. & A. Scott, 1893

(Fig. 13)

Matériel examiné: 5 exemplaires femelles, algues vertes du littoral de la plage principale de Kavala, 26 septembre 2004.

Discussion. Nouvelle espèce de la mer Égée et pour la faune harpacticoïdienne de Grèce. Découverte pour la premières fois par notre équipe dans les algues vertes de la plage principale de Kavala.

Longipedia minor est une forme à large variabilité morphologique. Leur statut taxonomique est parfois peu clair et leur détermination présente des difficultés. WELLS (1980) fait une révision du genre *Longipedia.* Les exemplaires que nous avons étudiés sont conformes à ceux décrits par WELLS (1980).

Écologie. Le *Longipedia minor* habite divers biotopes. Plus souvent, on peut le rencontrer parmis les algues côtières. Dans les fonds sableux, l'espèce a été trouvée à une profondeur allant de 10 à 30 m. Plus rarement, on la trouve dans le fond limoneux, d'une profondeur de 52 à 100 m, et dans le plancton (APOSTOLOV & MARINOV, 1988).

Répartition. Il s'agit d'une espèce cosmopolite.

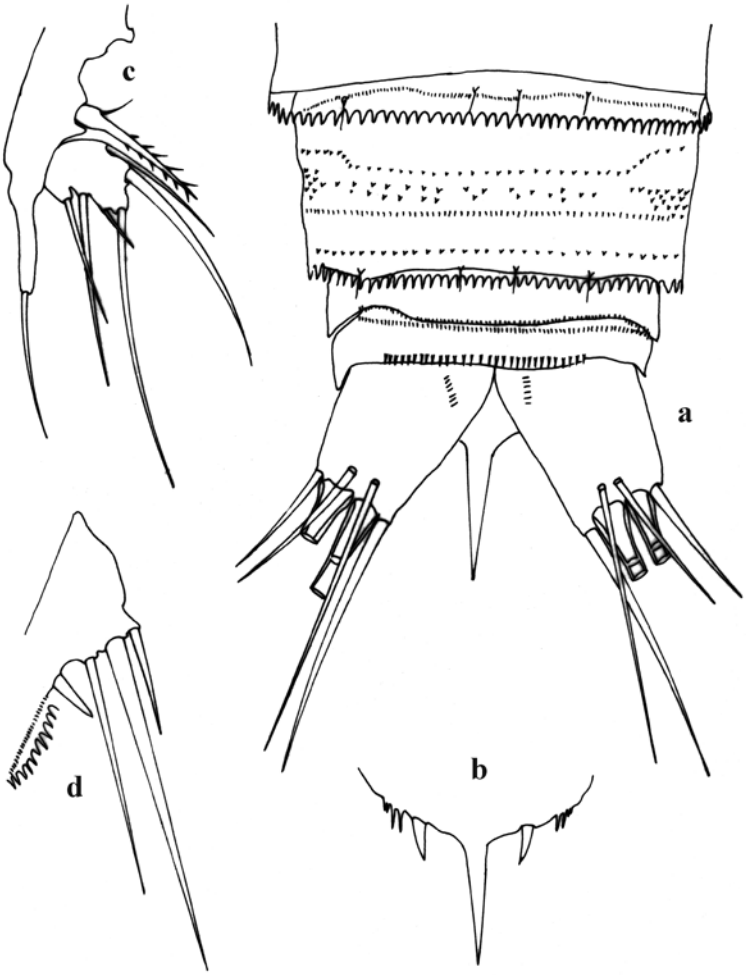

Fig. 13. *Longipedia minor* T. & A. Scott ♂: a – anal somite et furca, vue ventral; b – opercule anal; c – P5; d – P6

Fam. TETRAGONICIPITIDAE Lang, 1944

Genre *Phyllopodopsyllus* T. Scott, 1906
Phyllopodopsyllus briani Petkovski, 1955

(Fig. 14-19)

Matériel examiné: 3 femelles adultes et quatre mâles; eaux interstitielles de la plage principale de Kavala; 24 septembre 2004.

Nouvelle espèce pour la mer Égée et la faune harpacticoïdienne de la Grèce. L'espèce a été décrite par PETKOVSKI (1955) de Budva et Hercegnovi pour la mer Adriatique. En mer Noire (côte bulgare), cette espèce est citée par MARINOV (1971) et par APOSTOLOV (1973). En 1957 Petkovski trouve cette espèce dans les eaux souterraines de la plage Robinson (mer

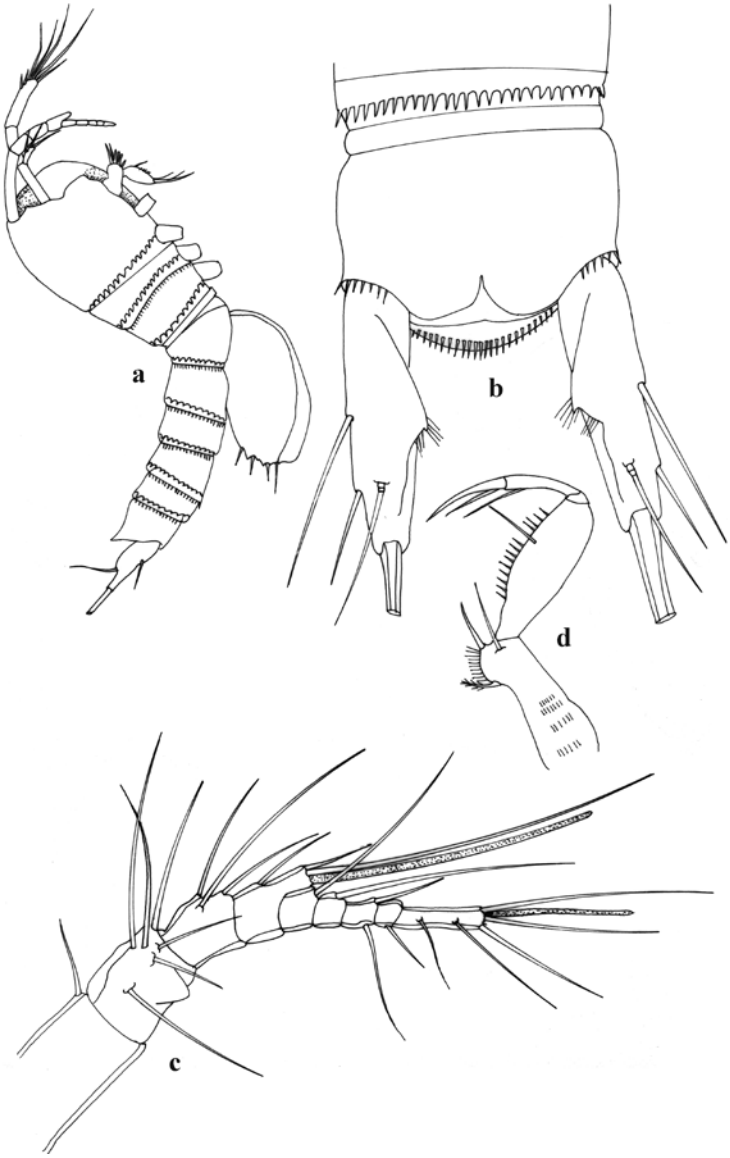

Fig. 14. *Phyllopodopsyllus briani* Petkovski ♀: a – Habitus, vue latérale; b – somite anal et furca, vue dorsale; c – A1; d – maxillipède

Adriatique). Il constate la présence d'une soie interne sur article apical de l'exopodite de P3 au lieu de deux soies interne chez les exemplaires de Budva et Hercegnovi.

KUNZ (1974) la signale dans les eaux interstitielles de la côte de Le Racou et d'Arago, France.

Les exemplaires de la Grèce correspondent bien à la description originale, donnée par PETKOVSKI (1955).

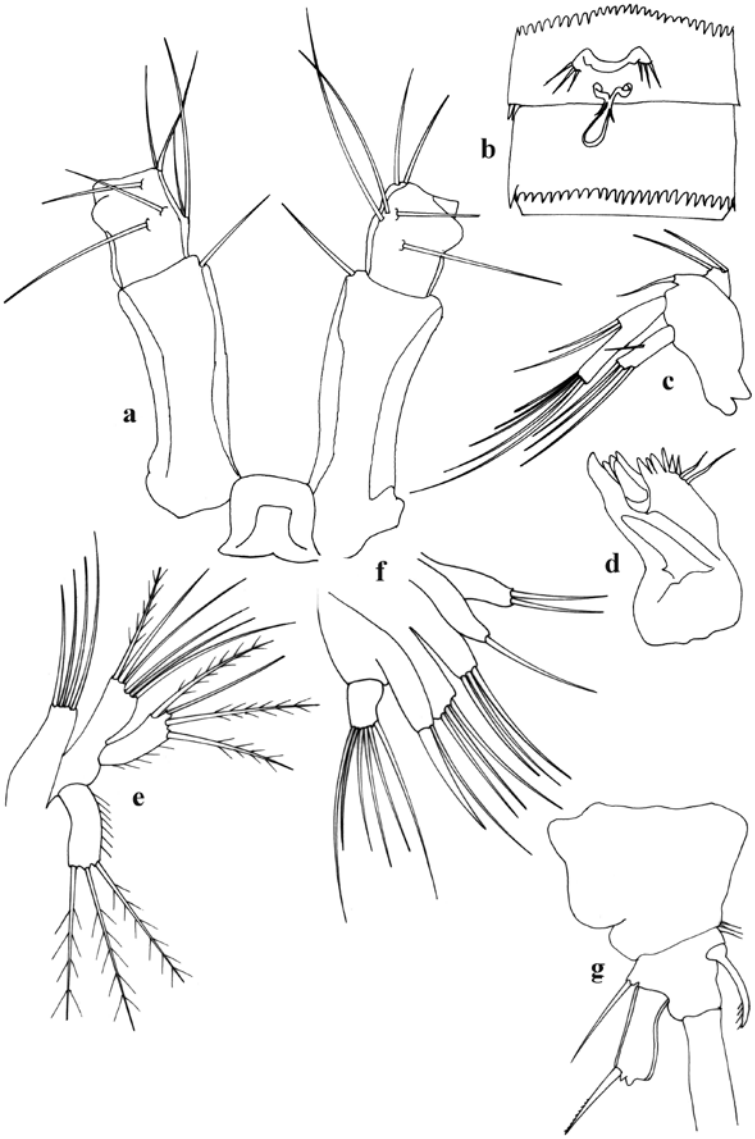

Fig. 15. *Phyllopodopsyllus briani* Petkovski ♀: a – R et A1; b – aire génitale; c – palpus mandibulaire; d – mandibule; e – maxillule; f – maxille; g – protopode P1

Discussion. Le genre *Phyllopodopsyllus* a été créé par SCOTT (1908). LANG (1944) divise ce genre en deux : *Phyllopodopsyllus* et *Paraphyllopodopsyllus*. Lang fait cette séparation sur la base de la présence ou de l'absence d'une excroissance chitineuse sur le deuxième article de l'antennule, ainsi qu'en fonction de la sétation de la deuxième et de la troisième patte natatoire chez les femelles.

VERVOORT (1964) donne une clé des espèces du genre *Phyllopodopsyllus*. D'après cet auteur, le genre *Paraphyllopodopsyllus* est synonyme du genre *Phyllopodopsyllus*.

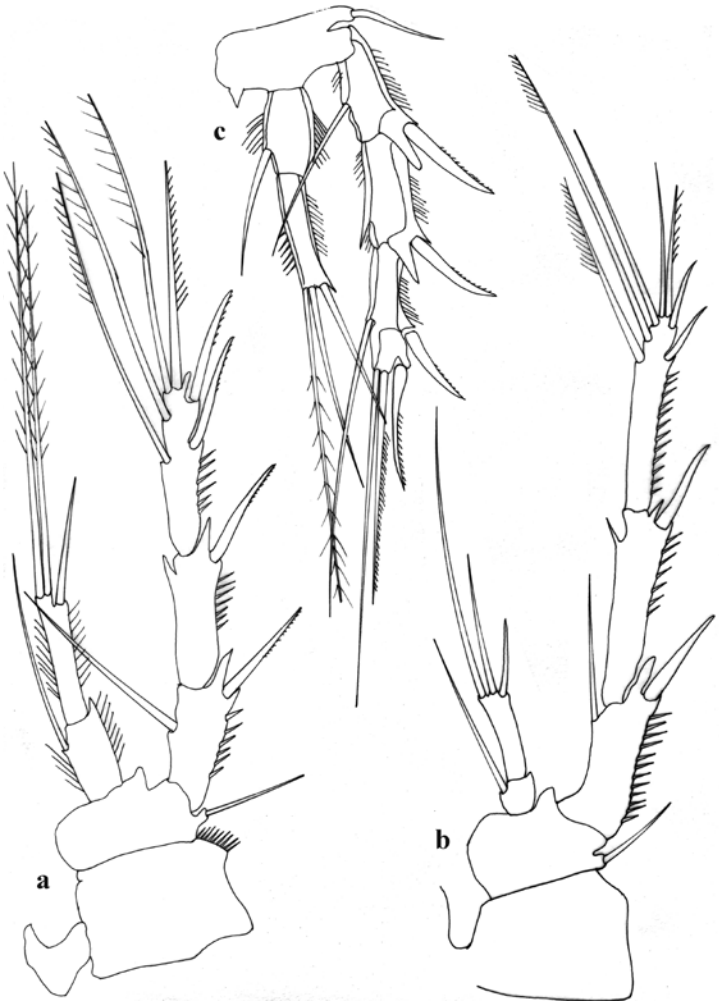

Fig. 16. *Phyllopodopsyllus briani* Petkovski ♀: a – P3; b – P4; c – P2

LANG (1965) à son tour prend l'opinion d'autres copépodologistes et considère comme synonyme les genres *Paraphyllopodopsyllus* et *Phyllopodopsyllus*. Il décrit deux espèces nouvelles pour la science, qui portent les caractères intermédiaires parmi les deux genres. Cet auteur donne une clé pour la détermination de 21 espèces connues jusqu'à ce moment.

Plus détaillé, le genre est discuté par COULL (1973). Il donne une clé pour la détermination de 33 espèces et décrit les caractéristiques morphologiques des espèces connues.

D'après BODIN (1997), le genre *Phyllopodopsyllus* est un genre typiquement marin, qui inclus 65 espèces et sous-espèces.

KUNZ (1984) fait une révision profonde de ce genre et de leur phylogénétique. Il propose de former quelques différents groupes: *brady, furciger, borutzkyi, pauli, opistoceratus, aegipticus, mossmani, xenu*s et *longipalpatus* à la base de l'oligomérisation et la sétation des antennes, antennules et des

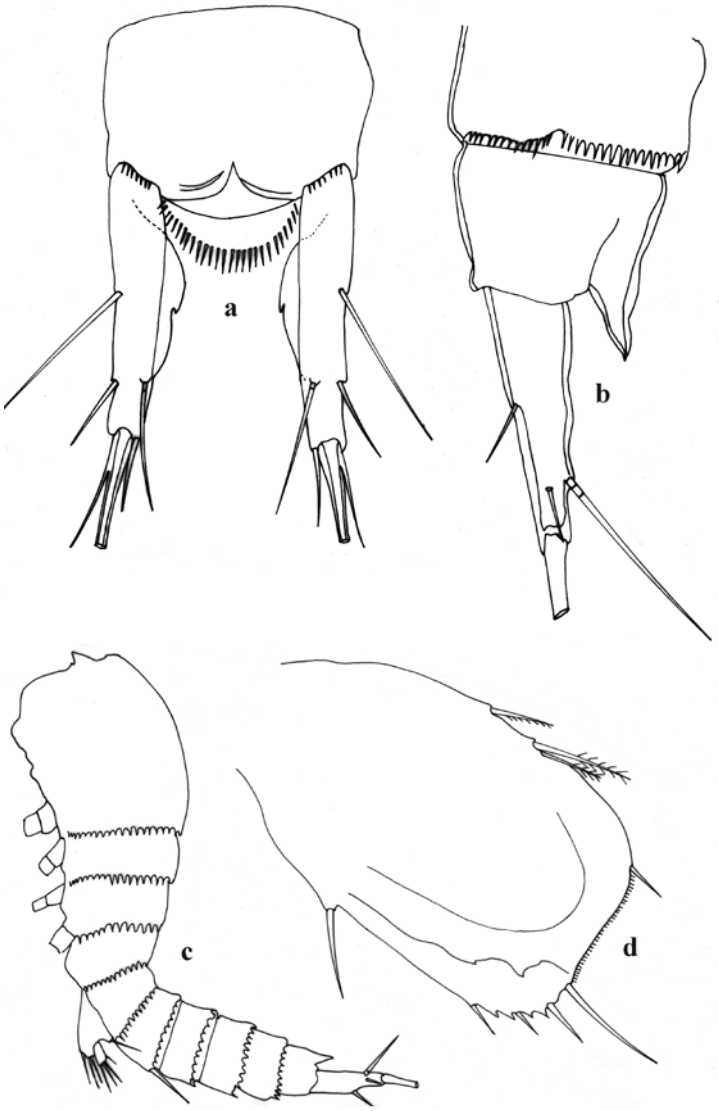

Fig. 17. *Phyllopodopsyllus briani* Petkovski ♀, ♂: a – anal somite et furca, vue dorsale ♂, b – anal somite et furca, vue latérale ♂, c – habitus ♂, d – P5 ♀

pattes natatoires de P2 à P4.

BODIN (1988) et MIELKE (1989) accepte cette subdivision proposée par Kunz. FIERS (1995) critique la subdivision du genre en différents groupes et leur nature, mais accepte d'utiliser cette structure pour facilité la détermination des espèces du genre.

Écologie. Il s'agit d'une espèce interstitielle qui habite le mésopsammal des plages côtières.

Répartition. Mer Adriatique, mer Noire, mer Méditerranée.

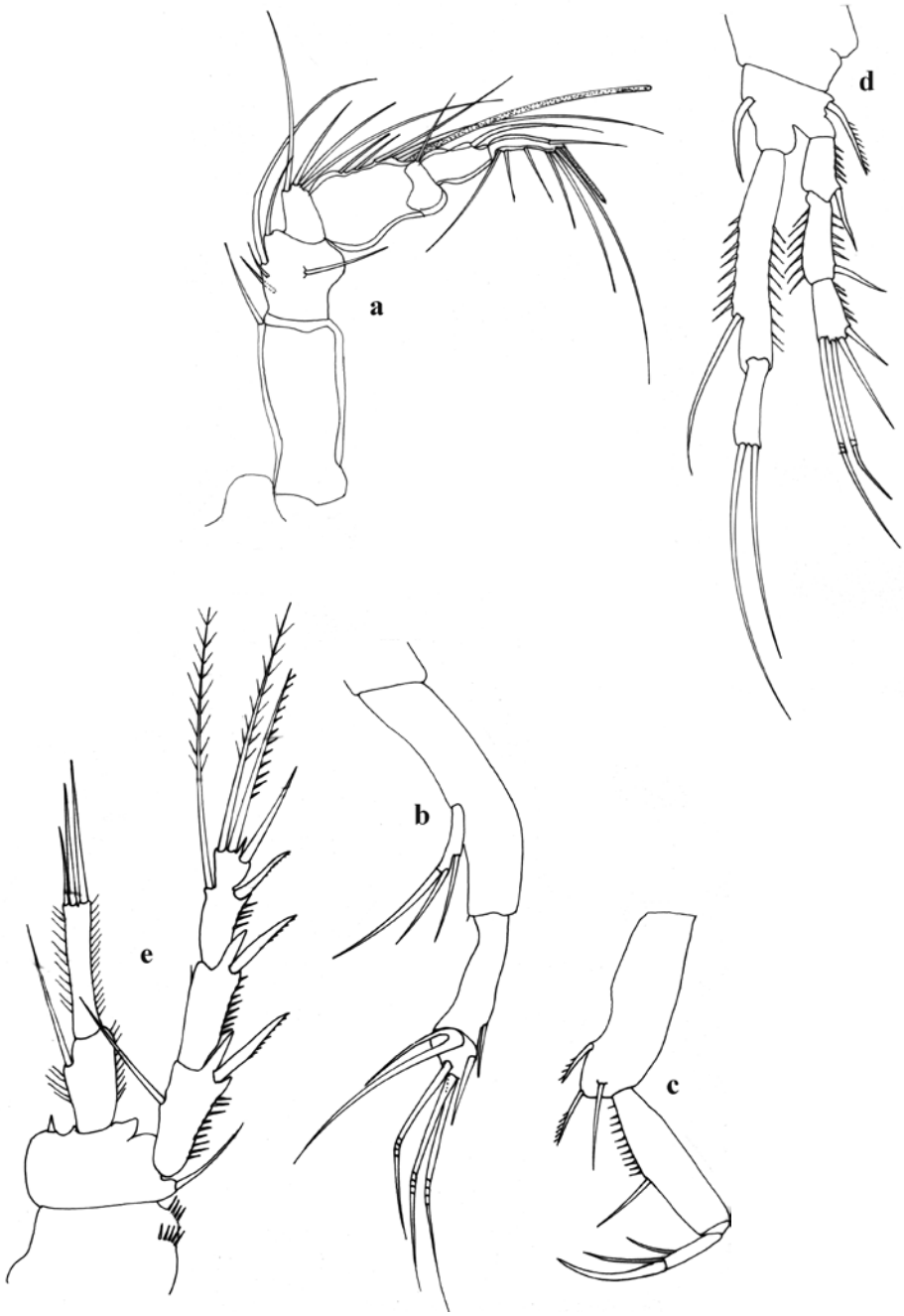

Fig. 18. *Phyllopodopsyllus briani* Petkovski ♂: a – A1, b – A2, c – maxillipède, d – P1, e – P2

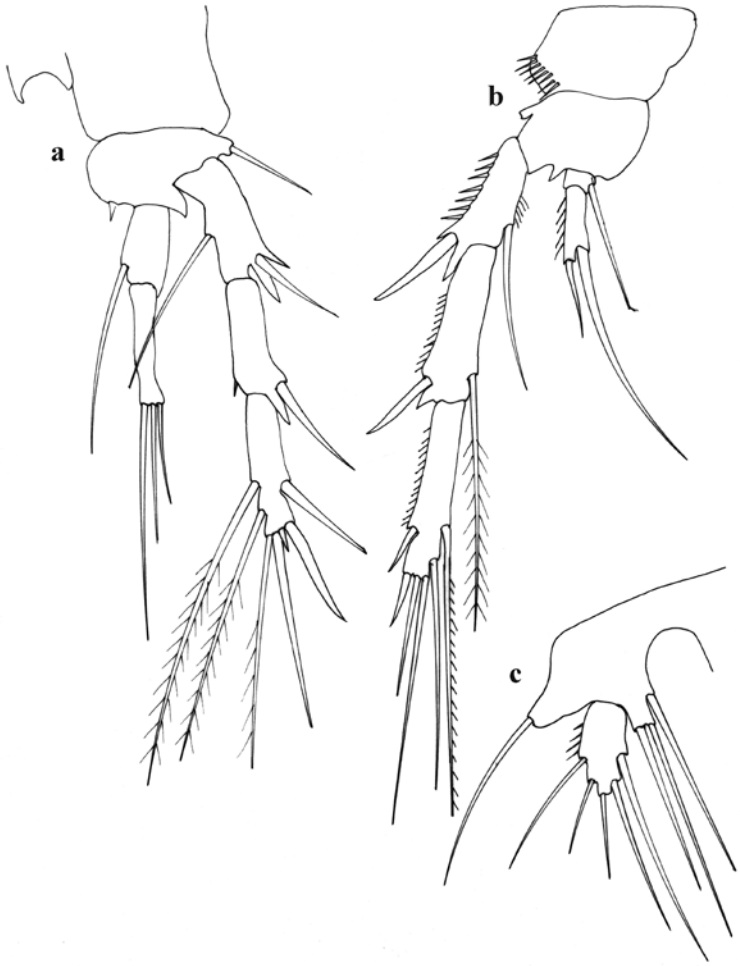

Fig. 19. *Phyllopodopsyllus briani* Petkovski ♂: a – P3, b – P4, c – P5

Fam. THALESTRIDAE G. O. Sars, 1905, Lang, 1948

Genre *Dactylopusia* Norman, 1903
***Dactylopusia tisboides* (Claus, 1863)**

(Fig. 20-22)

Matériel examiné: 6 exemplaires femelles adultes; algues côtières de la plage principale de Kavala; 23 septembre 2004.

Discussion: Espèce nouvelle pour la faune harpacticoïdienne de la mer Égée et de la Grèce.

Le nom du genre est très discutable. VERVOORT (1964) conteste à LANG (1948) la création d'un nouveau nom générique *Dactylopodia*. D'après Vervoort il est nécessaire d'employer le nom

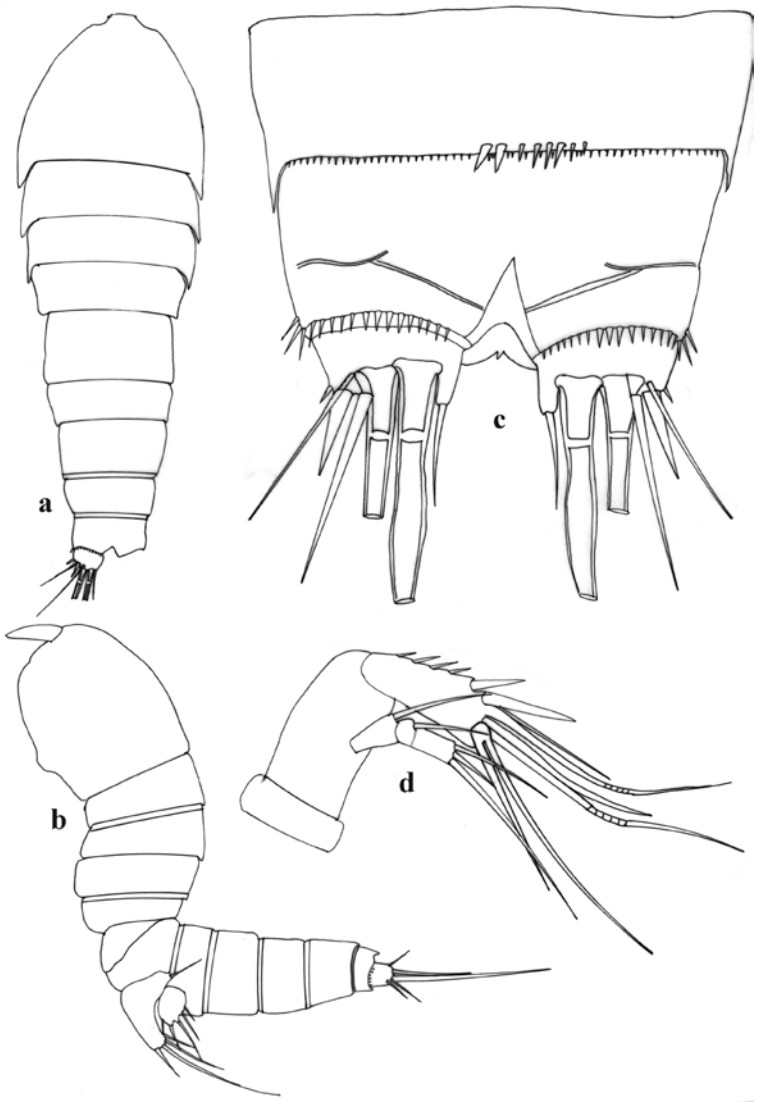

Fig. 20. *Dactylopusia tisboides* (Claus) ♀ : a – Habitus, vue dorsale, b – habitus, vue latérale, c – anal somite et furca, vue ventrale, d – A2

Dactilopusia, proposé par NORMAN (1903). Dans son livre remarquable sur les harpacticoïdes de la côte pacifique de Californie, LANG (1965) utilise le nom *Dactilopodia.*

Nous acceptons la proposition de VERVOORT (1964), et dans le présent article nous rétablirons le nom générique de Norman. Le nom *Dactilopusia* est utilisé aussi dans "*European register of marine species*". D'après ce registre, le nom générique est *Dactilopusia*, contenant 11 espèces.

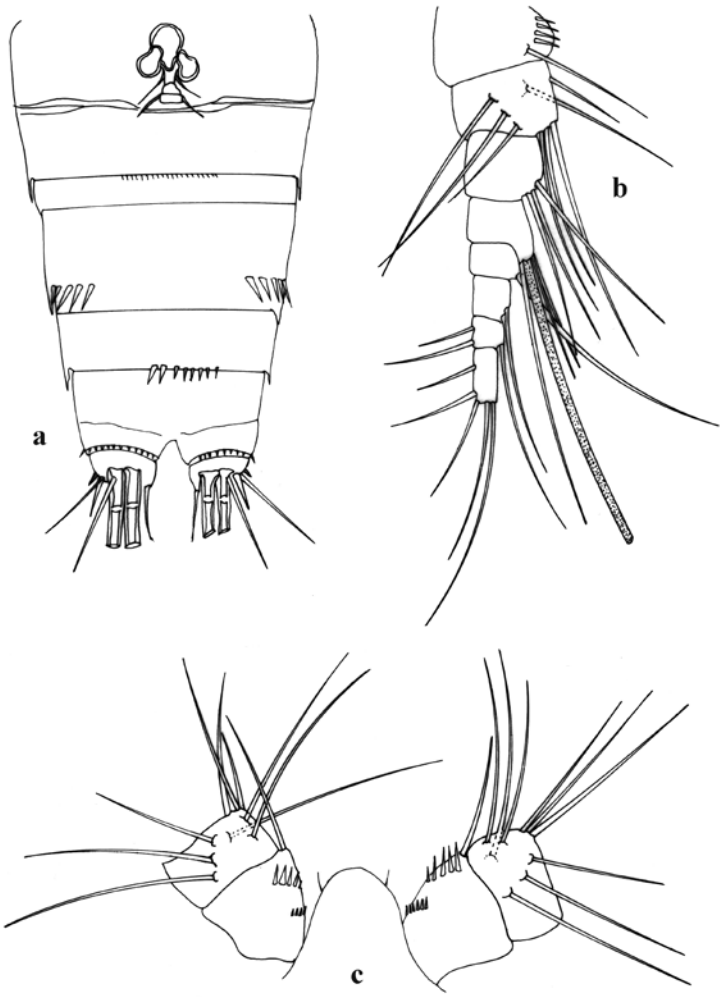

Fig. 21. *Dactylopusia tisboides* (Claus) ♀ : a –somites abdominaux, vue ventral, b – A1, c – R et deux premiers articles de l'Antennule

Les exemplaires de Kavala sont conformes à la diagnose de l'espèce et à la description donnée par les auteurs de divers biotopes marines du monde.

Écologie. Cette espèce est phytophile. Plus souvent, elle habite les eaux souterraines des plages côtières. Dans ce biotope, elle est trouvée par MARINOV (1974) près du cap Galata (au sud de la ville de Varna). Les exemplaires isolés de l'espèce sont trouvés dans les fonds sableux, mélangés avec des coquillages, à une profondeur de 15 m. GRIGUA (1964) mentionne cette espèce à une profondeur de 30 m dans les fonds limoneux.

Dactilopusis tisboides est une espèce eurytope et pleyomésohaline.

Répartition: Cosmopolite.

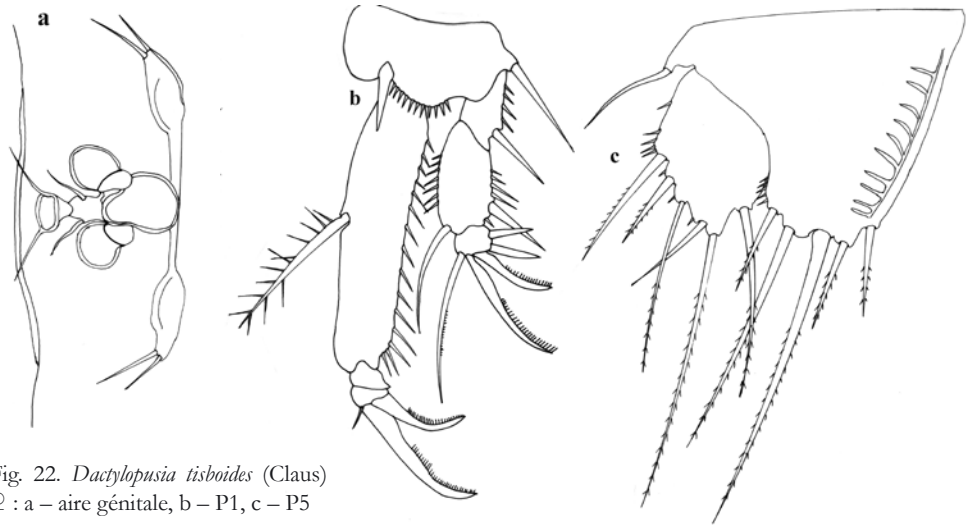

Fig. 22. *Dactylopusia tisboides* (Claus)
♀ : a – aire génitale, b – P1, c – P5

Conclusion

Les eaux interstitielles des plages de la ville de Kavala, Grèce du Nord, sont peuplées par des harpacticoïdes ayant une vaste répartition géographique ou des espèces rares. Cependant, il faut remarquer l'absence de certaines espèces spécialisées aux eaux interstitielles littorales.

Les espèces du genre *Schizopera*, ont colonisé tous les types d'habitat, marins, saumâtres et dulçaquicoles.

Les genres *Delamarella* et *Phyllopodopsyllus* réunissent des espèces psammophiles, généralement mésopsammique. Les espèces de ces genres montrent une répartition très vaste dans les eaux interstitielles littorales. Le genre *Delamarella* et le genre *Phyllopodopsyllus* sont connus de la région ponto-méditerranéenne.

Les Thalestridae étaient représentés par un genre *Dactylopusia*. Une seule espèce a été trouvée, bien distribuée dans les algues côtières de la zone littorale.

Les espèces *Harpacticus littoralis, Longipedia minor* et *Dactylopusia tisboides* sont cosmopolites.

D'un point de vue zoogéographique, nos recherches dans les eaux interstitielles de la plage près de la ville de Kavala sont encore sommaires pour qu'il soit possible de déterminer les affinités de la faunule interstitielle de la mer Égée.

Références bibliographiques

APOSTOLOV A. 1969. Harpacticoiden (Crustacea Copepoda) von bulgarischen Küste. – Zoologischer Anzeiger, **183** (3/4): 260-267.

APOSTOLOV A. 1971. Ein Beitrag zur Kentnis der Harpacticoidenfauna Bulgariens. – Zoologischer Anzeiger, **187** (5-6): 345-356.

APOSTOLOV A. 1973. Le genre *Schizopera* G.O. Sars (Copepoda: Harpacticoida) de la Mer Noire. – Acta Musei Macedonici Scientiarum naturalium, Skople, **13** (5): 81-107.

APOSTOLOV A. 1982. Genres et sous-genre nouveaux de la famille Diosaccidae Sars et Cylindropsylidae Sars, Lang (Copepoda, Harpacticoidea). – Acta Zoologica Bulgarica, **19**: 37-42.

APOSTOLOV A., MARINOV T. 1988. Copepoda Harpacticoida – Fauna Bulgarica, **18**: 1-384.

BODIN P. 1976. Catalogue des nouveaux Copépodes Harpacticoïdes marins. – Additif 2, Thetys, **7** (2-3): 265-278.

BODIN P. 1979. Catalogue des nouveaux Copépodes Harpacticoïdes (nouvelle édition) Université Bretagne Occidentale, Brest, 1-228.

BODIN P. 1988. Catalogue des nouveaux Copépodes Harpacticoïdes (Edition 1988). Université Bretagne Occidentale, Brest, 1-288.

BODIN P. 1997. Catalogue of the new marine Harpacticoid Copepods (1997 Edition). – Documents du travail de l`Institut Royal des Sciences Naturelles de Belgique, **8**: 1-304.

BOZIC B. 1969. *Latiremus eximius* n. gen., n. sp. à position systématique incertain (Copepode Harpacticoïde): données pour une nouvelle famille. – Bulletin de la Société Zoologie de France, **94** (2): 309-316.

BOZIC B. 1978. Le genre *Delamarella* Chappuis et le problème de son statut systématique (Crustacea, Copepoda, Harpacticoida). – Bulletin du Muséum National d'Histoire naturelle, Paris, 3ème série, 513, Zoologie, **352**: 153-155.

CHAPPUIS P. A. 1953. *Delamarella arenicola* n.g. n.sp. Copépode interstitiel des plages du Roussillon (Note préliminaire). – Vie et Milieu, **4** (1):111-113.

CHAPPUIS P. A. 1954a. Copépodes psammiques des plages du Roussillon. – Archive Zoologique Experimentale et Generale (Biospéologie 74), **91** (1): 35-50.

CHAPPUIS P. A. 1954b. Harpacticoïdes psammiques récoltés par Cl. Delamare Debouteville en Méditerranée. – Vie et Milieu, **4**: 254-276.

COTTARELLI V. 1971. *Delamarella galateae* n.sp. nuovo harpacticoide di aque sotterrannee littorali di Sardegna (Crustacea, Copepoda). – Fragmenta Entomologica, **7**: 289-301.

COULL B. C. 1973. Harpacticoid copepods (Crustacea) of the family Tetragonicipitidae Lang: a review and revision, with keys to the genera and species. – Proceedings of the Biological Society of Washington, **86** (2): 9-24.

FIERS F. 1986. New and interesting copepods (Crustacea, Copepoda) from brackish waters of Laing Island (Northern Papua New Guinea) Léopold III Biological Station, Laing Island - Contribution n 96. – Bulletin de l'Institut Royal des sciences naturelles de Belgique: Biologie, **96**: 99-120.

FIERS F. 1995. New Tetragonicipitidae (Copepoda, Harpacticoida) from the Yucatan continental shelf (Mexico), including a revision of the genus *Diagoniceps* Willey. – Koninklijk Belgisch Institut Natuurwetenschappen, **65**: 151-236.

GRIGA R. 1964. Copepoda of the benthonic biocenoses in the region of Eupatoria of the Black Sea. – Trudy Sevastopolskoi Biologiceskoi Stancii, **15**: 101-117. (In Russian).

HUYS R. KUNZ H. 1988. On the generic boundaries within the marine interstitial Latiremidae (Copepoda: Harpacticoida). – Stygologia, **4** (3): 292-305.

HUYS R., KARAYTUG S., COTTARELLI V. 2005. On the synonymy of *Delamarella* Chappuis and *Latiremus* Bozic (Copepoda, Harpacticoida, Latiremidae), including the description of *D. obscura* sp. nov. from the Black Sea. – Zoological Journal of the Linnean Society, **145**: 263-281.

ITÔ T. 1974. Descriptions and records of marine harpacticoid copepods from Hokkaido, V. – Journal of the Faculty of Science, Hokkaido University, Zoology, **19**: 546-640.

JACUBISIAK S. 1938. Les harpacticoides de la Mer Noire (côte roumaine). – Annales Scientifiques de l'Université de Jassy., **24** (2): 387- 402.

KARANOVIC T. 2004. Subterranean copepods from arid Western Australia. – Crustaceana Monographs, **3**: 366 p.

KUNZ H. 1974. Harpacticiden (Crustacea Copepoda) aus dem Küstengrundwasser der Französischen Mittelmeerküste. – Zoologica Scripta, **3**: 257-282.

KUNZ H. 1975. Copepoda Harpacticoidea aus den Litoral des südlichen Africa. Teil I. – Kieler Meeresforschungen, **31**: 179-212.

KUNZ H. 1977. Zur Kenntnis der Gattungen *Delamarella* Chappuis und *Latiremus* Bozic (Copepoda Harpacticoida, fam. Latiremidae Bozic). – Crustaceana, **32** (2): 210-211.

KUNZ H. 1984. Systematik der Familie Tetragonicipitidae Lang (Crustacea Harpacticoida). – Mitteilungen aus dem Zoologishen Museum der Universität Kiel., **2** (2): 33-46.

LANG K. 1948. Monographie der Harpacticiden. – Haken. Ohlsson, Lund, **2**: 1-1682.

LANG K. 1965. Copepoda Harpacticoidea from the Californian coast. – Kungliga Svenska Vetenskapsakademiens Handlingar, **10** (2): 1-566.

MARINOV T. 1971. Harpacticoids of the Bulgarian Black Sea coast. – Proceedings of the Institute of Oceanography and Fisheries, Varna, **11**: 43-87.

MARINOV T. 1973. Quelques Harpacticoïdes psammophiles inconnus pour le bassin de la Mer Noire. – Vie et Milieu, **23** (2A): 309-326.

MARINOV T. 1974. Supplement to the study of the harpacticoid fauna from the Bulgarian Black Sea coast. – Proceedings of the Institute of Oceanography and Fisheries, Varna, **8**: 77-92.

MIELKE W. 1989. Interstitial Fauna von Galapagos. XXXVI. Tetragonicipitidae (Harpacticoida). – Microfauna Marina, **5**: 95-172.

MIELKE W. 1992. Description of some bentic Copepoda from Chile and a discussion on the relationships of *Paraschizopera* and *Schizopera* (Diosaccidae). – Microfauna Marina, **7**: 79-100.

MIELKE W. 1995. Species of the taxon *Schizopera* (Copepoda) from the Pacific coast of Costa Rica. – Microfauna Marina, **10**: 89-116.

PETKOVSKI T. 1954. Harpacticoiden des Grundwasser unserer Meeresküste. – Acta Musei Macedonici Scientiarum Naturalium, **3** (5): 93-123.

PETKOVSKI T. 1955. IV Beitrag zur Kenntnis der Copepoden. – Acta Musei Macedonici Scientiarum Naturalium, **3** (3): 71-104.

PETKOVSKI T. 1957. VI Beitrag zur Kenntnis der Grundwasser - Copepoden unserer Meeresküste. – Izdanija Institut de Pisciculture de la R. P. Macedonie, **2** (1):1-16.

VERVOORT W. 1964. Free-living Copepoda from Ifaluk Atoll, in the Carolina Islands. – United States National Museum Bulletin, **236**: 1-431.

WELLS J. B. J. 1976. Keys to aid in the identification of marine harpacticoid copepods. – Department Zoology University Aberdeen, U. K., 1-215.

WELLS J. B. J. 1980. A revision of the *Longipedia* Claus (Crustacea: Copepoda: Harpacticoida).– Zoological Journal of the Linnean Society, **70**: 103-189.

WELLS J. B. J., RAO G. C. 1976. The relationship of the genus *Schizopera* Sars within the family Diosaccidae (Copepoda: Harpacticoida). – Zoological Journal of the Linnean Society, **50** (1): 79-90.

WILLEN E. 2000. Phylogeny of the Thalestridimorpha Lang, 1944 (Crustacea, Copepoda). – Göttingen: Cuvillier Verlag, 1-233.

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Харпактикоиди (Crustacea, Copepoda) от Егейско море (плажовете на Кавала, Северна Гърция)

Апостол АПОСТОЛОВ

(Р е з ю м е)

Изследвана е мейофауната на интерстициалните води и водорасловите обраствания по плажовете на град Кавала, Северна Гърция. Установени са 8 вида харпактикоиди, принадлежащи към 8 семейства и 8 рода. От тях типични интерстициални видове са *Schizopera (Schizopera) brusinae* Petkovski, *Phyllopodopsyllus briani* Petkovski, *Delamarella karamani* Petkovski и *Pseudonychocamptus kolarovi* sp. n. Останалите 4 вида – *Brianola* sp., *Harpacticus littoralis* Sars, *Longipedia minor* T. & A. Scott и *Dactylopusia tisboides* (Claus) – са фитофили.

Всички намерени видове се съобщават за първи път за Бяло море и са нови за хидрофауната на Гърция. Един вид – *Pseudonychocamptus kolarovi* sp. n. е нов за науката.

Подробно са разгледани родовете *Schizopera* Sars, *Delamarella* Chappuis и *Phyllopodopsyllus* T. Scott с оглед изясняване на тяхното систематично положение. За всички видове се дават рисунки на важните от таксономична гледна точка части от тялото, екологични бележки и разпространение.

Книга за бозайниците в България

Алекси ПОПОВ

ПОПОВ В., СПАСОВ Н., ИВАНОВА Т., МИХОВА Б., ГЕОРГИЕВ К. 2007. Бозайниците, важни за опазване в България. Dutch Mammal Society VZZ, София. 328 с.

В тази книга читателят може да намери важна информация за видовете български бозайници, чиито популации у нас имат световно и европейско значение по отношение на тяхното опазване. Съвсем правилно д-р Петър Берон в предисловието си я нарича "книга, която прави чест на България" и "в много отношения необикновена книга". Написана е с вдъхновение. Изпълнена е с оригинални наблюдения и заключения. Съдържа осъвременени сведения за разпространението и опазването на видовете. Интерпретира таксономичната и екологичната информация според последните данни. Други достойнства на книгата са богатото илюстриране със снимки и карти и добрият печат. Тя се явява плод на усилията на много хора, които са предоставили собствени данни или са помогнали със съвети. Така от първоначалния ръкопис до окончателния вариант за отпечатване е изминат дълъг път.

Безспорни са качествата на авторите д-р Васил Попов (дребни бозайници), д-р Николай Спасов (едри бозайници) и д-р Теодора Иванова (прилепи), които са най-опитните специалисти по групата у нас. Инициативата, изготвянето и издаването е по проект на Холандското териологично дружество (Zoogdiervereniging VZZ) в сътрудничество с Националния природонаучен музей и Института по зоология при БАН. Спонсори на изданието са две други холандски организации: Prins Bernhard Cultuurfonds и Van Tienhoven Stichting.

От всичко 100 вида бозайници в България (95 от тях автохтонни) в книгата са разгледани около половината или 49 вида. При избора на видове е даден превес на редките видове, относително скоро установените у нас видове и уязвимите видове. Най-много са включените видове прилепи, гризачи и хищници, а по относителен брой – китоподобните (всички видове). Най-слабо са представени в книгата по абсолютен и относителен брой чифтокопитните и насекомоядните. Особено ценна е частта за методите за изследване, описани и дадени прегледно в таблица. Такива сведения липсваха досега в българската литература. Подробно е разгледана историята на формирането на комплекса бозайници по нашите земи, при това написана от най-добрите специалисти у нас едновременно по рецентни и фосилни видове. Не отстъпва на нея и зоогеографската част, която анализира бозайната фауна по ландшафтни райони и подрайони.

Националният природонаучен музей беше домакин на представянето на книгата, защото в него работят двама от авторите, един от редакторите и четири други участници в създаването на книгата. Освен това Холандското териологично дружество VZZ финансира проект с НПМ за изготвяне на ръководство за включване на прилепите в оценките за въздействие върху околната среда. Музеят цени високо това сътрудничество с холандското дружество и резултатите от него. Разпространението на книгата е поето от Българска фондация Биоразнообразие, на която пожелаваме успех, за да може тази интересна книга да достигне до повече читатели.

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Spiders from the Skopje Region: a faunistic and zoogeographical analysis

Dusica STEFANOVSKA, Maria NAUMOVA, Dana PRELIK, Christo DELTSHEV, Stoyan LAZAROV

STEFANOVSKA D., NAUMOVA M., PRELIK D., DELTSHEV C., LAZAROV S. 2008. Spiders from the Skopje Region: a faunistic and zoogeographical analysis. – Historia naturalis bulgarica, **19**: 35-49.

Abstract. 118 species from 67 genera and 17 families have been found in the region of Skopje City. 31 species are new for the spider fauna of Macedonia. The spiders are classified into 16 zoogeographical categories combined in 5 chorological complexes. The faunal composition shows a Palearctic and European character for the Skopje region spider fauna. Endemics and Southeast European species emphasise the local character of this fauna, but its low percentage suggests an important process of colonization.

Key words: spiders, faunistic, zoogeography, urban fauna

Introduction

No detailed study of spiders in the Skopje region has been published so far. The first information can be found in the papers of STOJIĆEVIĆ (1907; 1929) and DRENSKY (1924; 1929; 1935; 1936). Some recent publications add data concerning the spiders of Skopje region (BLAGOEV, 2002; ĆURČIĆ et al., 2000, DELTSHEV et al., 2000, KOMNENOV 2006).

The present study is a result of collecting and processing of original materials and observations during 2005, in the frame of the project GLOBENET (Global network for monitoring biodiversity changes across urban-rural landscapes).

Study area and methods

The survey of spiders inhabiting the region of Skopje comprises 3 study sites (Fig. 1.):

Urban – U:

U I – Skopje (240 m), region Karpos, grass vegetation dominated by *Hordeum murinum*.

U II, III – Skopje, region Karpos (240 m), grass vegetation dominated by *Onopordon acanthium*, *Verbascum phlomoides*, *Melilotus officinalis*, *Echium vulgare*, *Reseda lutea*, *Dipsacus silvestris*, *Sisymbrium officinale*, *Hordeum murinum*, *Bromus sterilis*, *Sonchus oleraceus*.

Suburban – SU:

SU I – Skopje, (240m), region Maxari, grass vegetation dominated by *Elymus repens*, *Lepidium draba*, *Bromus inermis*, *Bromus sterilis*, *Bromus tectorum*, *Ballota nigra*.

SU II, III – Skopje (240m), region Maxari, grass vegetation dominated by *Petrorhagia saxifraga*, *Medicago minima*, *Poa bulbosa f. vivipara*, *Chondrila juncea*.

Rural – R:

R I, II, III – Skopje (240m), Mralino village, grass vegetation dominated by *Plantago lanceolata*, *Poa pratensis*, *Achillea millefolium*, *Trifolium repens*.

The exploration includes only stationary methods: pit-fall traps. The study lines served by pitfall traps include 9 points (Urban – 3; Suburban – 3; Rural – 3). Ten pitfall traps (mouth diameter 6 cm) with 125 ml formalin + 875 ml vine vinegar were placed in a line, about 10 meters apart from each other, at each study point. The traps were emptied once in month and operated during the period 01.02. – 01.07.2005.

Fig. 1. Localities where spiders were collected, Skopje region (see text)

Results and discussion

Species composition

118 species of 16 families: Dysderidae – 4; Theridiidae – 7; Linyphiidae – 36; Tetragnathidae – 1; Araneidae – 1; Lycosidae – 18; Pisauridae – 1; Zoridae – 1; Agelenidae – 1; Dictynidae – 1; Liocranidae – 4; Corinidae – 2; Zodariidae – 2; Gnaphosidae – 22; Philodromidae – 4; Thomisidae – 5; Salticidae – 9 (Table 1). 31 species are new for the spider fauna of Macedonia (marked in the text by an asterisk).

Most numerous are the families: Linyphiidae (36) – 30.25 %, Gnaphosidae (22) – 18.5 %, Lycosidae (18) – 15.1 %, Salticidae (9) – 7.5 % and Theridiidae (7) – 5.9 %. The presence of species of families such as Dysderidae, Araneidae, Linyphidae, Theridiidae, Agelenidae, Liocranidae and Gnaphosidae in the urban parts of the region is due to the eu- and hemisynanthropic representatives (SACHER, 1983). The genera *Pardosa* (9) and *Zelotes* (8) are the most numerous.

Interesting new faunistic and taxonomic records:

Dysdera granulata – hitherto known from the Adriatic coast of the Balkan Peninsula. The new localities in the region of Skopje extend its range in eastern direction. The information is in concordance with a record by HANSEN (1995) who reported *D.* cf. *granulata* from an urban park in Venice, Italy.

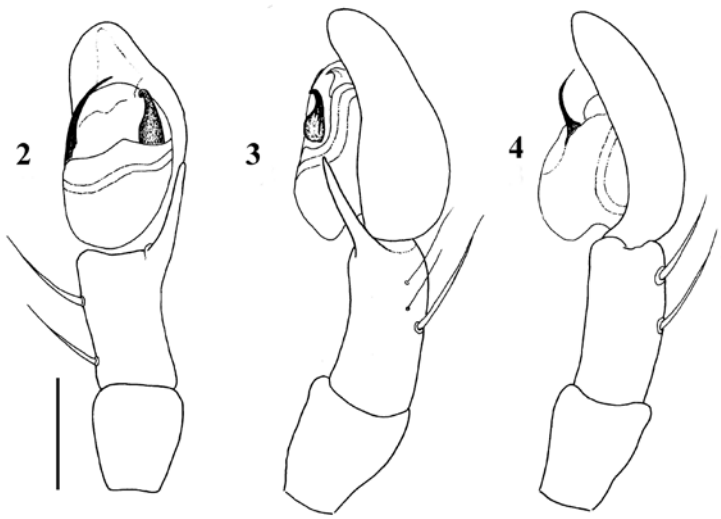
Harpactea samuili – described and hitherto known only from Southwest Bulgaria (LAZAROV, 2006). The new record supports its distribution as a Balkan endemic.

Palliduphantes byzantinus – hitherto known from European Turkey and Bulgaria. The new record supports its distribution as a Balkan endemic.

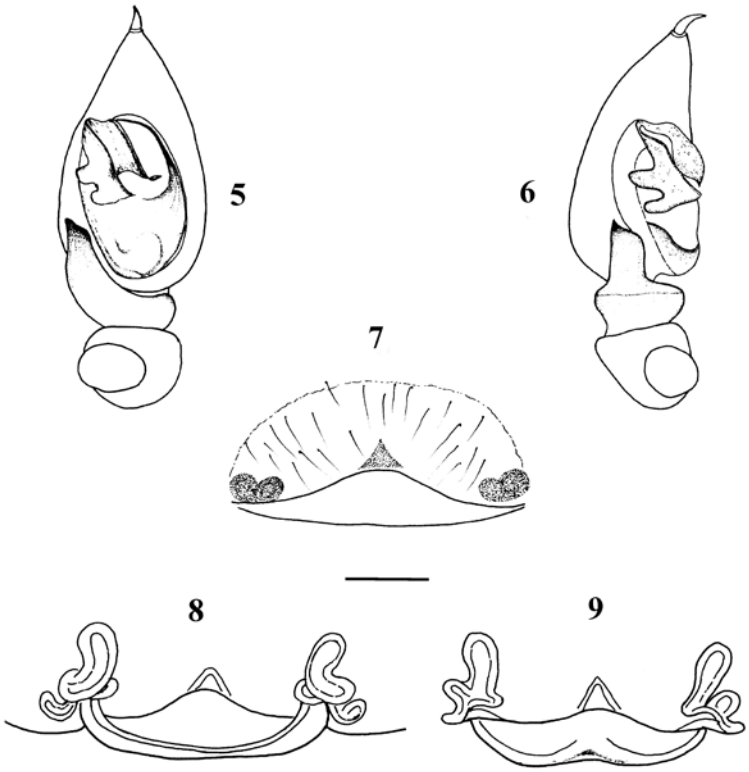
Agraecina pr. *bodna* – the species *A. bodna* was described and so far known from a single locality in North Algeria (Mergueb) (BOSMANS, 1999). The material collected in the Skopje region is very close to figured specimens of *A. bodna*, but has a thinner and longer embolus (Figs. 2-4).

Zodarion hauseri – described only by a female and hitherto known only from Central Greece (Monte Elicon) (BRIGNOLI, 1984). The new material, including the previously unknown male, contribute to the taxonomic characteristics of the species (Figs. 5-9). The new localities indicate that the species may be widespread on the Balkan Peninsula.

Haplodrassus bohemicus – described and hitherto known only from single localities in Northwestern Bohemia and Southeastern Moravia (MILLER & BUCHAR, 1977; BUCHAR & RŮŽIČKA, 2002). The new locality extends its range in southern direction. The specimens of the Skopje population are either identical with, or closely related to *Haplodrassus bohemicus*. The male palps and female epigyne and vulva agree in more respects with the figures and description of the species presented by MILLER & BUCHAR (1977). The new materials contribute to the taxonomic characteristics of the species (Figs. 10-15).



Figs. 2-4. *Agroecina* pr. *bodna* (Bosmans, 1999): 2 – male palp, ventral view; 3 – male palp, retrolateral view; 4 – male palp, prolateral view. Scale lines: 0.3 mm



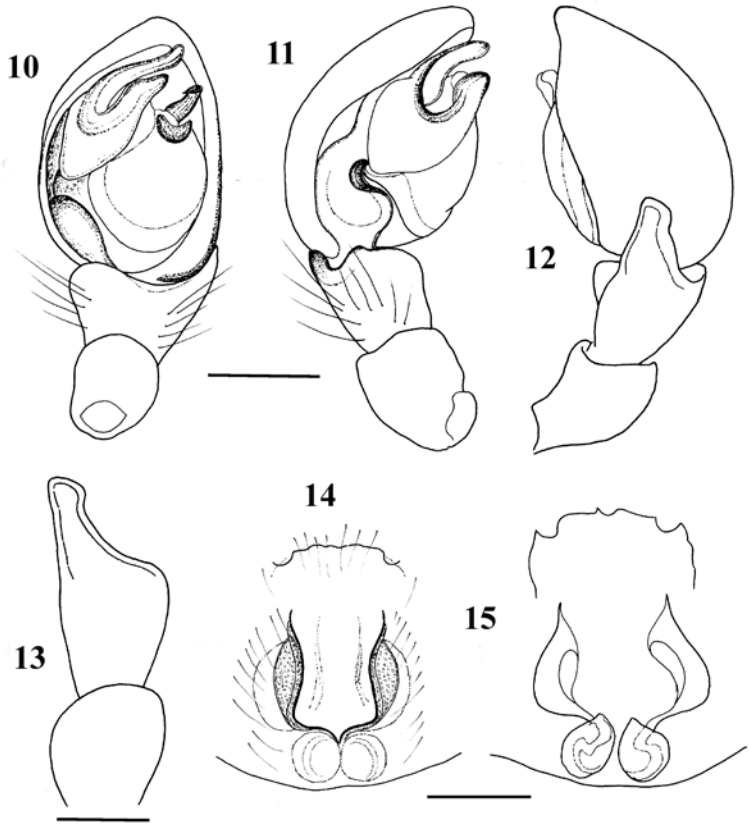
Figs. 5-9. *Zodarion hauseri* (Brignoli, 1984): 5 – male palp, ventral view; 6 – male palp, retrolateral view; 7 – epigyne; 8, 9 – vulva, dorsal view. Scale lines: 0.1mm

Zoogeographical analysis

According to their current distribution the established 118 species can be classified in 16 zoogeographic categories, grouped into 5 chorological complexes (I, Cosmopolitan; II, widely distributed in Holarctic; III, European; IV, Mediterranean; V, Endemics) (Table 1, Fig. 16). Data on general distribution and chorological classification of spiders are taken from PLATNICK (2007) and TAGLIANTI et al. (1999).

Cosmopolitan species complex (COS, 1.7 %) includes only the species *Dysdera crocota* and *Steatoda albomaculata*. The first species is found in urban and suburban and the second in suburban and rural regions.

Complex of species widely distributed in the Holarctic Region (HOL + PPT + PAL + WPA + EMC + ECA + EUS, 60.9 %) is best represented and comprises 72 species widespread in Macedonia. Palearctic species s. l. are dominant (40, 33.9 %), followed by European-Central Asian species (13, 10.9 %), Holarctic species (10, 7.6 %) and West Palearctic species (5, 4.2 %). The remaining chorotypes are represented by single species.



Figs. 10-15. *Haplodrassus bohemicus* (Miller & Buchar, 1977): 10 – male palp, ventral view; 11 – male palp, retro-lateral view; 12 – male palp, dorsal view; 13 – male palp, tibial apophysis; 14- epigyne; 15 – vulva, dorsal view. Scale lines: 0.1mm

The complex includes widespread species associated mainly with lowlands and xenotopic elements, which can reach the highest summits in the mountains. Most numerous species are: *Acartauchenius scurrilis*, *Meioneta rurestris*, *Microlinyphia pussilla*, *Trichoncoides piscator*, *Pardosa hortensis*, *P. proxima*, *Trochosa ruricola*, *Haplodrassus signifer*, *Thanatus arenarius*, and *Xysticus kochi*. They are best presented also in the urban territory.

European chorological complex (EUR + MEE + MSEE, 21.1 %) comprises 25 species widespread on the territory of Europe. European species s. l. are dominant (16 %); followed by Middle and Southeast European species (4 %); Well presented in the urban sites are: *Mecopisthes peussi, Sintula retroversa*, *Trichoncus hackmani*, *Trichopterna cito*, *Micaria guttulata*, and *Zelotes gracillis.*

Mediterranean species complex (MCA + MED + EME + NEM, 10.1 %) includes 12 species widespread in Mediterranean (*Trochosa hispanica*, *Trachyzelotes lyonneti*, *Euophrys rufibarbis*), Mediterranean and Middle Asia (*Alopecosa albofasciata*, *Hogna radiata*, *Drassodes lutescens*) and North Mediterranean (*Dysdera granulata*, *Maimuna vestita*, *Trachyzelotes malkini*, *Pellenes brevis*) region. Most of them are found in urban territory.

Table 1

Species composition and distribution of the spiders in the Skopje region

Zoogeographic categories: COS – Cosmopolitan, HOL – Holarctic, PPT – Palearctic-Paleotropic, PAL – Palearctic, WPA – West Palearctic, EMC – European-Mediterranean-Central Asian, ECA – European-Central Asian, EUR – European, MEE – Middle and East European, MSEE – Middle and Southeast European, MCA – Mediterranean and Central Asia, MED – Mediterranean, EME – East Mediterranean, NEM – Northeast Mediterranean, BALK – Balkan Endemic

	TAXA	U	II	III	IV	V	VI	SU	II	III	IV	V	VI	R	II	III	IV	V	VI	ZOOG
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	DYSDERIDAE																			
	Dysdera crocata C.L. Koch, 1838	+				5	5	+			4	1	1							COS
*	*Dysdera granulata* Kulczyński, 1897	+					1													NEM
	Dysderocrates storkani (Kratochvíl, 1935)	+			1	1														BK
*	*Harpactea samuili* Lazarov, 2006	+			1	5	8	+				2	3							BK
	THERIDIIDAE																			
	Enoplognatha thoracica (Hahn, 1833)	+				1	1	+				1	1							HOL
*	*Phycosoma inornatum* (O.P.-Cambridge, 1861)	+					1													EUR
	Robertus arundineti (O.P.-Cambridge, 1871)	+	1											+	3					PAL
	Steatoda albomaculata (De Geer, 1778)							+					1	+			1			COS
	Steatoda bipunctata (Linnaeus, 1758)	+	1	2				+		1										HOL
	Steatoda paykulliana (Walckenaer, 1806)	+	1					+			1									EMC
	Steatoda phalerata (Panzer, 1801)													+				1		PAL
	LINYPHIIDAE																			
*	*Acartauchenius scurrilis* (O.P.-Cambridge, 1872)	+	4	7	20	8	13	+		2		2	3	+	1		1			PAL
	Araeoncus humilis (Blackwall, 1841)	+	1					+	1					+	2					PAL
	Bathiphanthes nigrinus (Westring, 1851)													+	1					PAL
*	*Centromerus brevivulvatus* Dahl, 1912													+	2					PAL
*	*Centromerus dilutus* (O. P.-Cambridge, 1875)							+		1										EUR

Table 1
Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Centromerus lakatnikensis (Drensky, 1931)	+	1	1																BK
*	*Centromerus semiater* (L. Koch, 1879)	+		1																WPA
	Diplostyla concolor (Wider, 1834)	+					1	+					1		1	3	1			HOL
	Dicymbium nigrum (Blackwall, 1834)							+		1						1				PAL
	Erigone dentipalpis (Wider, 1834)	+	8	2				+	5					+	10	5				HOL
	Lepthyphantes quadrimaculatus (Kulczyński, 1898)													+		6	1			EUR
*	*Mecopisthes peusi* (Wunderlich, 1872)	+	10	15	3			+	18	4				+	2	1				EUR
	Meioneta fuscipalpa (C.L. Koch, 1836)	+				1	2							+		13	6			PAL
	Meioneta mollis (O.P.-Cambridge, 1871)													+			1			PAL
	Meioneta rurestris (C.L. Koch, 1836)	+		17	4			+	13	2		1	2	+	8	11	4		6	PAL
	Microlinyphia pusilla (Sundevall, 1830)	+	40					+	1											HOL
	Oedothorax fuscus (Blackwall, 1834)													+		1				WPA
*	*Palliduphantes byzantinus* (Fage, 1931)	+	10	9	1	8	7	+	12	4	8	1	3	+	14	4	7	2	4	BK
	Pelecopsis krausi Wunderlich, 1980	+				1		+				1	1							BK
*	*Pelecopsis parallela* (Wider, 1834)							+	15	3	4	7	3							PAL
*	*Pocadicnemis juncea* Locket & Millidge, 1953													+		1				EUR
	Porrhomma convexum (Westring, 1851)													+	2	3				PAL
*	*Porrhomma microphthalmum* (O.P.-Cambridge, 1871)													+	17	10	4		3	PAL
	Prinerigone vagans (Audouin, 1826)	+	1											+	1					PPT
*	*Sintula retroversus* (O.P.-Cambridge, 1875)	+	9	1				+	4											EUR
	Stemonyphantes lineatus (Linnaeus, 1758)													+	1					PAL

Table 1
Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Styloctetor romanus (O.P.-Cambridge, 1872)	+		1				+	1	1										PAL
*	*Tallusia vindobonensis* (Kulczyński, 1898)													+	15					MEE
*	*Tapinocyba pallens* (O.P.-Cambridge, 1872)	+	2																	EUR
	Tenuiphantes tenuis (Blackwall, 1852)							+	6					+	1	4	1			WPA
*	*Trichoncoides piscator* (Simon, 1884)	+	4	28										+	4	3				ECA
*	*Trichoncus hackmani* Millidge, 1956	+		1	6	2	3	+	3	4	3	6	7	+	2		31	1	9	EUR
	Trichoncus saxicola (O.P.-Cambridge, 1861)							+				4	4	+		1				EUR
*	*Trichopterna cito* (O.P.-Cambridge, 1872)	+	8	24	2		1	+	1	3				+	6	14	3	2		EUR
*	*Walckenaeria vigilax* (Blackwall, 1853)													+	1	1	1			HOL
	TETRAGNATHIDAE																			
	Pachygnatha degeeri Sundevall, 1830	+		1	1	1		+	13	8	16			+	3	9	40	3	1	PAL
	ARANEIDAE																			
	Mangora acalypha (Walckenaer, 1802)							+			1									PAL
	LYCOSIDAE																			
	Alopecosa albofasciata (Brullé, 1832)	+		3	1	8	7	+			2	3	4							MCA
	Alopecosa cuneata (Clerck, 1757)							+			1									PAL
	Alopecosa pulverulenta (Clerck, 1757)							+		2		2	2	+			6	10	6	PAL
	Arctosa leopardus (Sundevall, 1833)													+				1	6	PAL
	Aulonia albimana (Walckenaer, 1805)	+			1									+				1		PAL
	Hogna radiata (Latreille, 1817)	+				22	61	+		1		20	26	+					8	MCA
	Pardosa agrestis (Westring, 1861)													+			1			PAL
	Pardosa agricola (Thorell, 1856)	+				1		+					1	+			5	3	5	ECA
	Pardosa hortensis (Thorell, 1872)	+			13			+		2	1			+	5					PAL

Table 1
Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Pardosa monticola (Clerck, 1757)	+				1	1							+				25	20	PAL
	Pardosa paludicola (Clerck, 1757)													+			18	1	1	PAL
	Pardosa prativaga (L. Koch, 1870)													+				1	4	EUS
	Pardosa proxima (C.L. Koch, 1847)	+	2	12	4	11	7	+	42	32	39	9	10	+	66	24	137	37	43	PAL
	Pardosa pullata (Clerck, 1757)													+				3	11	ECA
	Pardosa vittata (Keyserling, 1863)													+					3	EUR
	Trochosa hispanica Simon, 1870	+				1	2							+		12	21	12	5	MED
	Trochosa ruricola (De Geer, 1778)	+		6	16			+			8			+		30	3			PAL
	Xerolycosa miniata (C.L. Koch, 1834)													+				4	62	PAL
	PISAURIDAE																			
	Pisaura mirabilis (Clerck, 1757)	+	1	1				+	3					+	2					PAL
	ZORIDAE																			
	Zora silvestris Kulczyński, 1897	+				1														ECA
	AGELENIDAE																			
*	*Maimuna vestita* (C.L. Koch, 1841)							+		2	1									EME
	DICTYNIDAE																			
	Argenna subnigra (O.P.-Cambridge, 1861)							+				1	1							EUR
	LIOCRANIDAE																			
	Agroeca cuprea (Menge, 1873)	+		1			1	+	1	2	1			+	2	1				ECA
*	*Agroeca lusatica* (L. Koch, 1875)													+		2		1		EUR
*	*Agroeca proxima* (O.P.-Cambridge, 1871)							+			1			+	2	1				EUR
	Agroecina pr. hodna Bosmans, 1999	+					1													MED
	CORINNIDAE																			
	Phrurolithus festivus (C.L. Koch, 1835)							+				1	1	+		1	2	2	6	PAL

Table 1
Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
*	*Phrurolithus szilyi* Herman, 1879							+				14	23	+		1			1	WPA
	ZODARIIDAE																			
*	*Zodarion hauseri* Brignoli, 1984	+			2	3	9	+			3	1	1							BK
	Zodarion ohridense Wunderlich, 1973	+			2															BK
	GNAPHOSIDAE																			
	Drassodes lapidosus (Walckenaer, 1802)							+				6	3	+					5	PAL
	Drassodes lutescens (CL Koch, 1839)	+					1													MCA
	Drassyllus praeficus (L. Koch, 1866)													+				27	73	ECA
	Drassyllus pusillus (C.L. Koch, 1833)													+			11	8	9	PAL
	Haplodrassus aenus Thaler, 1984							+				2	1							MSEE
*	*Haplodrassus bohemicus* Miller & Buchar, 1977	+				75	117	+				12	9	+			9	21	131	MSEE
	Haplodrassus dalmatensis (L. Koch, 1866)	+					1	+				4	2	+					2	PAL
	Haplodrassus minor (O.P.-Cambridge, 1879)							+				4	1	+		2				EUR
	Haplodrassus signifer (C.L. Koch, 1839)	+		19	3	15	2	+	10	8	18	30	39	+	1	2	71	59	13	HOL
	Micaria albovittata (Lucas, 1846)													+				1	6	PAL
	Micaria guttulata (C.L. Koch, 1839)	+			7		2													EUR
	Micaria pulicaria (Sundevall, 1832)													+			1			HOL
	Trachyzelotes lyonneti (Audouin, 1826)							+				1	3							MED
*	*Trachyzelotes malkini* (Platnik & Murphy, 1984)													+					1	NEM
*	*Zelotes atrocaeruleus* (Simon, 1878)							+				1	1							PAL
	Zelotes caucasius (L. Koch, 1866)							+				1	2							ECA
	Zelotes electus (C.L. Koch, 1839)	+			15	6	3	+			1									ECA
	Zelotes gracilis (Canestrini, 1868)	+					3							+					7	EUR
	Zelotes hermani (Chyzer, 1897)	+			1		1													EUR

Table 1
Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Zelotes longipes (L. Koch, 1866)	+		4	9		2	+		2	2	1	2							PAL
*	*Zelotes pygmaeus* Miller, 1943	+					14	+				8	6	+				10	26	ECA
	Zelotes subterraneus (C.L. Koch, 1833)							+				1	3							PAL
	PHILODROMIDAE																			
	Thanatus arenarius Thorell, 1872	+			42	43	10	+				3	4	+				2	1	ECA
	Thanatus pictus L. Koch, 1881							+				1	3							PAL
	Thanatus vulgaris Simon, 1870	+				11	17	+				1	2	+					1	HOL
	Tibellus oblongus (Walckenaer, 1802)													+					1	HOL
	THOMISIDAE																			
*	*Ozyptila* pr. *umbraculorum* Simon, 1932	+	1	3	3	1		+		2										NEM
	Xysticus acerbus Thorell, 1872	+		1			1							+			1			ECA
	Xysticus kempeleni Thorell, 1872	+			3			+		3	9									ECA
	Xysticus kochi Thorell, 1872	+			13	86	11	+		4	8	20	20	+			16	28	13	EMC
*	*Xysticus laetus* Thorell, 1875							+					1	+			3			ECA
	SALTICIDAE																			
*	*Ballus rufipes* (Simon, 1868)	+				1														WPA
	Chalcoscirtus infimus (Simon, 1868)	+					12							+					2	MSEE
	Chalcoscirtus nigritus (Thorell, 1875)							+				1	1							MSEE
	Euophrys frontalis (Walckenaer, 1802)							+			1	1	3							PAL
	Euophrys herbigrada (Simon, 1871)							+				1	1							EUR
	Euophrys rufibarbis (Simon, 1868)	+				2	1	+				2	2	+				2		MED
	Pellenes brevis (Wesolowska, 2003)							+		4										NEM
	Phlegra fasciata (Hahn, 1826)	+			4	7	4	+		2	3	13	17							PAL
	Talavera monticola (Kulczyński, 1884)	+					2													MSEE

Table 2
Zoogeographical composition of the spiders of Skopje region (abbreviations, see Table 1).

Complexes	Chorotypes	Code	species	%
Cosmopolitan	Cosmopolitan	COS	2	1.69
Holarctic	Total		2	1.69
	Holarctic	HOL	10	8.4
	Palearctic-Paleotropic	PPT	1	0.84
	Palearctic	PAL	40	33.9
	West Palearctic	WPA	5	4.2
	European-Mediterranean-Central Asian	EMC	2	1.69
	European-Central Asian	ECA	13	11.0
	European-Siberian	EUS	1	0.84
	Total		72	60.9
European	European	EUR	19	16.1
	Middle and East European	MEE	1	0.84
	Middle and Southeast European	MSEE	5	4.2
	Total		25	21.1
Mediterranean	Mediterranean and Central Asia	MCA	3	2.5
	Mediterranean	MED	4	3.4
	East Mediterranean	EME	1	0.84
	Northeast Mediterranean	NEM	4	3.4
	Total		12	10.1
Endemics	Balkan endemics	BALK	7	5.9
	Total		7	5.9

Complex of endemics (BALK, 5.9 %) comprises 7 species. All are presented in urban sites in small populations. They are known not only from Macedonia, but also from Bulgaria (*Harpactea samuili*, *Centromerus lakatnikensis, Pelecopsis krausi, Zodarion ochridense*), Greece (*Zodarion hauseri*) and Turkey (*Palliduphantes byzantinus*).

Conclusion

The faunistic diversity of the 118 spider species shows that the small region of Skopje is a territory of high species richness. This conclusion is supported also by the existence of seven endemic species.

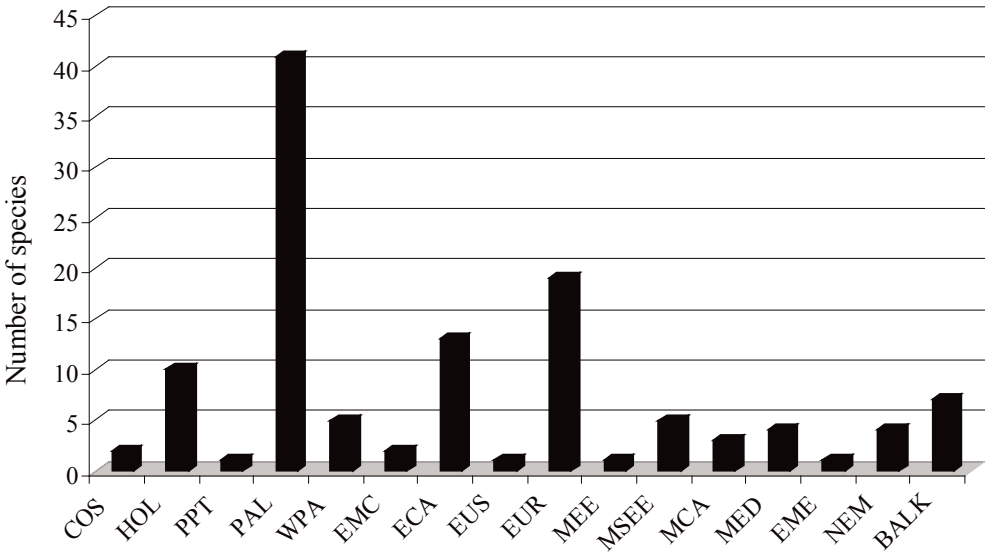


Fig. 16. Zoogeographical characteristics of spiders of Skopje region (abbreviations, see Table 1)

The outline of the spider fauna in Skopje region is determined by the Palearctic and European species. They are best presented also in the urban territory. The group of endemics is also presented in urban territory. Endemics and Southeast European species emphasize the local character of this fauna, but their low percentage suggests an important process of colonization.

Acknowledgements

We are especially indebted to our colleagues Aleksandra Cvetkovska-Gorgievska, Valentina Slavevska-Stamenković, Borce Strezovski and Aleksandar Stefanovski for the faunistic materials which they gave us.

References

BLAGOEV G. 2002. Check List of Macedonian Spiders (Araneae). – Acta zoologica bulgarica, **54**: 9-34.

BOSMANS R. 1999. The genera *Agroeca, Agraecina, Apostenus* and *Scotina* in the Maghreb countries (Araneae: Liocranidae). – Bulletin de l'Institut Royal des Sciences Naturalles de Belgique, **69**: 25-34.

BRIGNOLI P. M. 1984. Ragni di Grecia XII. Nuovi dati su varie famiglie (Araneae). – Revue Suisse de Zoologie, **92** (2): 281-321.

BUCHAR, RŮŽIČKA 2002. Catalogue of Spiders of the Czech Republic. Edited by P. Merret, Peres Publishers Praha, 149 p.

ĆURČIĆ B. P. M., ĆURČIĆ S. B., TOMIĆ V. T., MAKAROV S. E., BOŠKOVA T., STOJKOSKA E. A., STANKOVIĆ S. V. 2000. Further report on some leaf-litter and hypogean spiders (Araneae, Arachnida) from Macedonia. – Archives of Biological Sciences, Belgrade, **52** (4): 231-234.

DELTSHEV C., BLAGOEV G., STOJKOSKA E. 2000. A Contribution to the Study of the Spiders (Araneae) in Macedonia. – Archives of Biological Sciences, Belgrade, **52** (3): 179-183.

DRENSKY P. 1924. Referate und Berichte. – Mitteilungen der Bulgarischen Entomologischen Gesellschaft in Sofia, **1**: 20-22.

DRENSKY, P. 1929. Spinnen (Araneae) aus Mittel und Süd -West Mazedonien. – Journal of the Bulgarian Academy of Sciences, **39** (19): 1-76.

DRENSKY P. 1935. Über die von Dr. Stanko Karaman in Jugoslavien und besonders in Mazedonien gesammelten Spinnen (Araneae). – Mitteilungen aus den Königlichen Naturwissenschaftlichen Instituten Sofia, **8**: 97-110.

DRENSKY P. 1936. Katalog der echten Spinnen (Araneae) der Balkanhalbinsel. – Sbornik (Miscellany) of the Bulgarian Academy of Sciences, **32**: 1-223.

HANSEN H. 1995. Über die Arachniden-fauna von urbanen Lebensräumen in Venedig – III. Die epigäischen Spinnen eines Stadtparkes (Arachnida: Araneae). – Bolletino Museo civico di Storia Naturale di Venezia, **44:** 7-36

KOMNENOV M. 2005. New data of jumping spiders in the Republic of Macedonia with a complete checklist (Araneae: Salticidae). – In: Deltshev C., Stoev P. (eds.). European Arachnology 2005, Acta zoologica bulgarica, Supplement **1**: 301-314.

LAZAROV S. 2006. A new spider species, *Harpactea samuili* sp. n., from Bulgaria (Araneae: Dysderidae). – In: Deltshev C., Stoev P. (eds.). European Arachnology 2005, Acta zoologica bulgarica, Supplement **1**: 81-85.

MILLER, F., BUCHAR, J. 1977. Neue Spinnenarten aus der Gattung *Zelotes* Distel und *Haplodrassus* Chamberlin (Araneae, Gnaphosidae). – Acta Universitatis Carolinae – Biologica, **4**: 157-171.

PLATNICK N. 2007. The world spider catalog, version 9.0. American Museum of Natural History, online at http://research.amnh.org/entomology/spiders/catalog 81-87/index.html

SACHER P. 1983. Spinnen (Araneae) und Gebäuden. Versuch einer Analyse der synanthropen Spinnenfauna in der DDR. – Entomologische Nachrichten und Berichte, **27**: 97-204.

STOJIĆEVIĆ D. 1907. Study on the fauna of Old Serbia and Macedonia. IV. Spiders (Araneae). – Musée d'Histoire Naturelle de Beograd, **16**: 17-19.

STOJIĆEVIĆ D. 1929. Les Araignées de Serbie. – Musée d'Histoire Naturelle de Beograd, **19**: 1-65.

VIGNA TAGLIANTI A., AUDISIO P. A., BIONDI M., BOLOGNA M. A., CARPANETO G. M., DE BIASE A., FATTORINI S., PIATTELLA E., SINDACO R., VENCHI A., ZAPPAROLI M. 1999. A proposal for a chorotype classification of the Near East fauna, in the framework of the Western Palearctic region. – Biogeographia, **20**: 31-59.

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Паяците от района на Скопие: фаунистичен и зоогеографски анализ

Душица СТЕФАНОВСКА, Мария НАУМОВА, Дана ПРЕЛИК, Христо ДЕЛЧЕВ, Стоян ЛАЗАРОВ

(Р е з ю м е)

118 вида от 67 рода и 16 семейства са установени в района на Скопие. 31 от намерените видове са нови за аранеофауната на Република Македония. Видовете *Agraecina* pr. *hodna*, *Zodarion hauseri* и *Haplodrassus bohemicus* са дискутирани в таксономично отношение, като са представени и нови рисунки. В зоогеографско отношение паяците са разпределени в 16 зоогеографски категории, обединени в 5 ареалографски комплекса. Палеарктичните и европейските видове доминират и определят характера на аранеофауната и значението на колонизацията. Локалният характер на фауната се определя от ендемитите и югоизточноевропейските елементи.

Книга за основните райони за птици в България

Алекси ПОПОВ

КОСТАДИНОВА И., ГРАМАТИКОВ М. (ред.). 2007. Орнитологично важни места в България и Натура 2000. Българско дружество за защита на птиците, София, Природозащитна поредица, 11: 639 с.

Книгата представя резултатите от мащабно орнитологично изследване на значимата по отношение на опазването част от територията на България, продукт на над 4 милиона наблюдения, извършени от над сто любители и професионалисти. Определени са 114 орнитологично важни места (ОВМ), свързани с изграждането на мрежата НАТУРА 2000. Категоризирани са на три равнища: световно, европейско и на Европейския съюз, като по-голямата част от тях (87) са от световно значение. Те обхващат 26 000 кв. км или 23 % от българската територия. В тях се срещат 372 вида птици или 89 % от българските и 71 % от европейските видове, както и над половината от популациите на 45 вида със световно и европейско значение. С това тази книга съществено надгражда издадената преди 10 години книга със същото заглавие (КОСТАДИНОВА И., 1997, Природозащитна поредица, 1: 176 с.), в която има данни за 50 ОВМ. Резултатите ще предизвикат интереса на международната орнитологична общност, защото България е на второ място в Европа по богатство на орнитофауната (1 % от територията със 76 % от европейските видове). Затова е далновидно двуезичното издаване на новата книга (на български и английски). Подробно е разработена методиката на определяне на ОВМ и оценката им, разгледани са заплахите и уязвимостта на видовете и са препоръчани подходящи режими и ограничения за опазването на териториите.

Анализът на данните в книгата показва, че най-много ОВМ са дефинирани за *Phalacrocorax pygmaeus* (26) от световно застрашените видове и за *Buteo rufinus* и *Ficedula semitorquata* (10) от видовете с европейско значение, а само в по едно ОВМ се срещат 4 вида (орел, чучулига и 2 вида синигери). Ако сравним районите, виждаме, че най-големи са Централен Балкан, Западен Балкан, Рила, Сакар, Западни Родопи и Странджа, всеки с площ над 100 000 ха, а най-малък е язовир Конуш (38 ха). По богатство на орнитофауната начело се подреждат Атанасовско езеро (156 вида), Мандра – Пода (148), Дуранкулак (145), Шабла (141), Бургаско езеро (115) и Варненско – Белославско езеро (104 вида). На другия полюс са осем района в Западна и Северна България само с един вид (*Crex crex*).

Като незначителни недостатъци могат да се посочат пропускането на имената и кодовете на ОВМ за *Falco naumanni* в Приложение 9 (стр. 559) и погрешното означаване на сивия цвят в легендата в същото приложение (стр. 555) като "ОВМ, където видът се среща" вместо "ОВМ, където видът не се среща" (на български и английски). Не може да се разбере логиката, по която са подредени съкращенията на латиница (стр. 6). Би било по-прегледно те да се поставят на редовете срещу съответните съкращения на кирилица или обратно.

Новата книга е едно отлично постижение на Българското дружество за защита на птиците и на всички български орнитолози. Тя ще бъде ползвана като справочник и от други зоолози и природолюбители и представлява добра основа за сравнителен анализ на числеността на птиците в съответните райони в бъдеще.

Historia naturalis bulgarica, 19: 51-71, 2008

The subfamily Pselaphinae (Coleoptera: Staphylinidae) of Southwestern Bulgaria. I

Rostislav BEKCHIEV

BEKCHIEV R. 2008. The subfamily Pselaphinae (Coleoptera: Staphylinidae) of Southwestern Bulgaria. I. – Historia naturalis bulgarica, **19**: 51-71.

Abstract. So far 85 species of Pselaphinae have been established in Southwestern Bulgaria. The genera *Faronus* and *Reichenbachia*, 17 species and one subspecies are new to the Bulgarian fauna. For the first time in the same region records for 8 other species and data about Sandanski – Petrich Valley (31 species), Belasitsa Mts. (15 species), Malashevska Mts. (12 species) are reported. Species with Balkan, European and Southeast European distribution are the most numerous in Southwestern Bulgaria. The aedeagus and antennal base of *Bryaxis islamitus* are illustrated for the first time.

Key words: Coleoptera**,** Pselaphinae, Bulgaria, distribution, zoogeography, *Bryaxis islamitus*

Introduction

Formally, the Southwestern part of Bulgaria is defined as the valley of Struma River and the surrounding mountains belonging to the Plansko-Zavalska, Kraishtenska and Osogovo-Belasishka mountain chains, Rila Mountain and Pirin Mountain (Fig. 1).

This part of the country's territory is extremely interesting from faunistic and zoogeographical point of view. It includes parts of the South Bulgarian and the Mountainous biogeographical regions, in which there are established zones with a pronounced Mediterranean climatic influence, which decreases and disappears with increase of altitude in the mountains (GRUEV, 1988). That variety of climatic and biotic factors is a prerequisite for increase in biodiversity and provides grounds for a thorough investigation in regard to Pselaphinae. Such study has not been performed up to now. Nevertheless, in the course of time a significant amount of data of considerable faunistic and zoogeographical interest has been accumulated.

The present paper aims to summarize all available data on Pselaphinae found in these regions. All literature sources, as well as new and unpublished data coming from collections of different European natural history museums and private collections are presented. The information is also supplemented with author's personal collections from this region gathered in the period 2003-2007. This article does not include supertribi Batrisitae and Clavigeritae, which will be published elsewhere. The data for general geographic distribution of species is presented in alphabetical order after LÖBL & BESUCHET (2004).

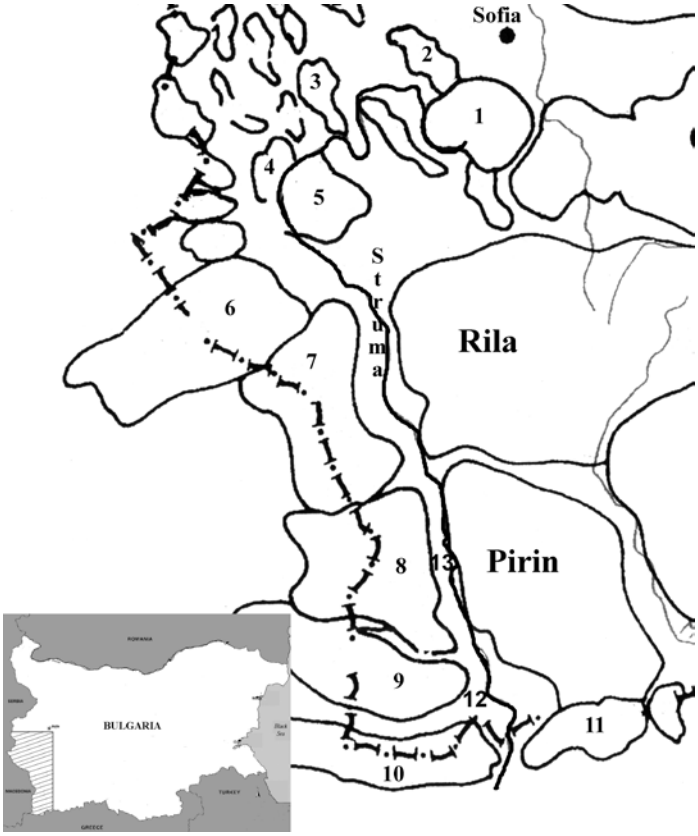


Fig. 1. Mountains and localities in Southwestern Bulgaria: 1 – Vitosha Mts.; 2. – Lyulin Mts.; 3 – Karvav Kamak Mts.; 4 – Zemen Mts.; 5 – Konyavska Mts.; 6 – Osogovska Mts.; 7 – Vlahina Mts.; 8 - Malashevska Mts.; 9 – Ograzhden Mts.; 10 – Belasitsa Mts.; 11 – Slavyanka Mts; 12 – Struma Valley, Rupite place; 13 – Kresna Gorge (after NIKOLOV & JORDANOVA (2002) with modifications).

Abbreviations: HNHM – Hungarian Natural History Museum, Budapest; MHNG – Muséum d'histoire naturelle, Genève; NMNHS – National Museum of Natural History, Sofia; ZMHB – Museum für Naturkunde der Humboldt Universität, Berlin; SNHM – Slovak National museum, Natural History Museum, Bratislava; DEI – Deutsches Entomologisches Institut, Eberswalde; PCPH – collection Peter Hlaváč, Košice; PCRB – collection Rostislav Bekchiev, Sofia; PCVB-collection Volker Brachat, Geretsried; * – new species for Bulgaria; ** – new genus for Bulgaria.

List of species

***Faronus parallelus* Besuchet, 1958**

Pirin Mts., near Kalimantsi, St. Ilya hill, 500 m, pitfall trap, 08 – 28.09.2002, 1 ♂, leg. M. Langurov; Ilindentsi, in leaf litter, 300 m, N 41°38'747" E 23°13'558", 08.09.2006, 1 ♀, leg. R. Bekchiev (PCRB).

Distribution: Croatia, Cyprus, Greece, Israel, Lebanon and Turkey. Mediterranean species.

***Euplectus kirbii* Denny, 1825**

Varna (KARAMAN, 1969), Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Sofia**, Borissova Gradina Park, 550 m, 16.03.2004, 4 ♂♂, 1 ♀; **Lozen Mts**., near St. Spas Monastery, under bark of *F. sylvatica*, 900 m, 02.04.2005, 1 ♀, leg. R. Bekchiev (PCRB); **Osogovo Mts**., 1 ♂, 1928, leg. Biro (HNHM); **Zemen gorge**, near Zemen, bank of Struma River, in old trunk, rotten wood, 570 m, 02.05.2004, 3 ♂♂, 3 ♀♀; **Kresna gorge,** near Kresna, bank of Vlahinska River, in rotten wood of *Populus* sp., 09.09.2006 , 2 ♂♂, 4 ♀♀; **Pirin Mts**., Ilindentsi, in rotten wood, 300 m, 08.09.2006, 1 ♂; **Petrich District**, Rupite, bank of Struma River, in rotten wood, 90 m, 15.04.2006, 1 ♂, 1 ♀; 06.09.2006, 6 ♂♂, 2 ♀♀; **Belasitsa Mts**., Klyuch, in rotten wood of *Platanus orientalis* L., 500 m, 07.07.2006, 1 ♂; 04.09.2006, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: entire Europe, Asia (Cyprus, Turkey and Russia – West Siberia). European-Siberian species.

***Euplectus nanus* (Reichenbach, 1816)**

Rila Mts. – Panichishte (LAPEVA-GJONOVA, 2004).

Distribution: common European species.

***Euplectus mutator* Fauvel, 1895**

German (RAMBOUSEK, 1909).

Distribution: entire Europe, Asia (Russia – Far East and East Siberia). European-Siberian species.

***Euplectus karstenii* (Reichenbach, 1816)**

Sliven (RAMBOUSEK, 1909), Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Sofia**, Borissova Gradina Park, 550 m, 16.07.2004, 2 ♂♂; 16.03.2005, 1 ♂; **Zemen gorge**, near Zemen, riverside Struma River, in old trunk, rotten wood, 570 m, 01.05.2004, 2 ♀♀; **Kresna gorge**, near Kresna, bank of Vlahinska River, in rotten wood of *Populus* sp., 08.07.2006, 2 ♀♀; 09.09.2006, 2 ♂♂, 5 ♀♀; **Petrich District**, Rupite, bank of Struma River, in rotten wood, 90 m, 15.04.2006, 11 ♂♂, 10 ♀♀, leg. R. Bekchiev (PCRB).

Distribution: Europe and Asia (Russia, Iran, Turkey) and North Africa (Algeria, Morocco). Cosmopolitan species, introduced in North America and Australia.

***Euplectus bonvouloiri naretinus* Reitter, 1882**

Bulgaria (LÖBL & BESUCHET, 2004).

Petrich District, Rupite, bank of Struma River, in rotten wood, 90 m, 15.04.2006, 4 ♂♂, 1 ♀, leg. R. Bekchiev (PCRB).

Distribution: Central and Southeast Europe. Central-South European species.

***Euplectus frater* Besuchet 1964**

Lozen Mts. (LAPEVA-GJONOVA, 2004)

New localities: **Vitosha Mts**., above Rudartsi, Tserova Polyana, in rotten wood of *Quercus* sp., 1100 m, 06.04.2005, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: Bulgaria, Croatia, Greece, Hungary, Montenegro, Italy, Romania, Slovakia, Ukraine, Serbia and Turkey. Southeast European species.

***Euplectus sanguineus* Denny 1825**

Bulgaria (LÖBL & BESUCHET, 2004).

Zemen gorge, near Zemen, bank of Struma River, in old trunk, rotten wood, 570 m, 27.09.2003, 2 ♀♀, leg. D. Gradinarov (PCRB).

Distribution: common and widespread species in almost entire Europe, Asia (Cyprus, Israel, Lebanon, Turkey) and North Africa (Canary Islands, Madeira Archipelago). European-Mediterranean species. Probably introduced in the Canary Islands and Madeira Archipelago.

***Euplectus signatus* Reichenbach 1816**

Vitosha Mts. (LAPEVA-GJONOVA, 2004).

New localities: **Zemen gorge**, near Zemen, bank of Struma River, 570 m, 27.09.2003, 1 ♂, 1 ♀; in nest of *Formica* sp., 02.05.2004, 2 ♂♂, leg. R. Bekchiev (PCRB).

Distribution: almost entire Europe and Asia (Russia – West Siberia and Far East, Israel, Kyrgyzstan). European-Siberian species.

***Euplectus brunneus* (Grimmer, 1814)**

Bulgaria (LÖBL & BESUCHET, 2004).

Lyulin Mts., near Sv. Kral Monastery, in leaf litter, 26.06.1943, 1 ex., (NMNHS); **Vitosha Mts**., above Knyazhevo, in rotten wood of *Pinus sylvestris* L., 660 m, 28.04.2005, 2 ♂♂; 13 - 15.05.2005, 3 ♂♂, 2 ♀♀; 14.07.2006, 1 ♂, 3 ♀♀; 28.04.2006, 3 ♂♂, 3 ♀♀, leg. R. Bekchiev (PCRB).

Distribution: entire Europe. European species.

***Euplectus frivaldszkyi* Saulcy, 1878**

Bulgaria (LÖBL & BESUCHET, 2004).

Belasitsa Mts., Klyuch, in rotten wood of *P. orientalis*, 500 m, 06.07.2006, 1 ♀; 08.08.2006, 4 ♂♂, 5 ♀♀; 04.09.2006, 3 ♂♂, 4 ♀♀, leg. R. Bekchiev (PCRB).

Distribution: Balkan Peninsula, Austria, Hungary, Slovenia, Slovakia and Ukraine. Southeast European species.

****Euplectus infirmus* Raffray, 1910**

Vitosha Mts., above Knyazhevo, in rotten wood of *P. sylvestris*, 700 m, N 42°39'062" E 23°14'347", 26.07.2005, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: entire Europe, North Africa (Canary Islands, Morocco). European-Mediterranean species.

***Plectophloeus fischeri* (Aubé, 1833)**

Rila Mts. – Borovets (RAMBOUSEK, 1909; KARAMAN, 1962), Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Vitosha Mts**., between Zlatnite Mostove and Vladaya, 1300 m, in rotten wood, 17.05.2005, 1 ♂, leg. R. Bekchiev (PCRB); **Rila Mts**., Borovets, 07.06.1967, 1 ♂, 2 ♀♀, leg. C. Besuchet (MHNG); **Belasitsa Mts**., Belasitsa Hut, in rotten wood of *Castanea sativa* Mill., 710 m, 23.08.2003, 4 ♀♀, leg. D. Gradinarov (PCRB).

Distribution: entire Europe. European species.

***Plectophloeus nitidus* (Fairmaire, 1858)**

Belasitsa Mts., Belasitsa Hut, in rotten wood of *C. sativa*, 710 m, 23.08.2003, 1 ♂, 4 ♀♀, leg. E. Chehlarov; between Yavornitsa and Klyuch, in rotten wood of old trunk, 400 m, 04.09.2006, 13 ♂♂, 14 ♀♀, leg. R. Bekchiev (PCRB).

Distribution: entire Europe, Asia (Iran and Turkey). European-Turanian species.

***Plectophloeus rhenanus* (Reitter, 1882)**

Vitosha Mts., above Knyazhevo, in rotten wood of *P. sylvestris*, 700 m, N 42°39'062" E 23°14'347", 14.07.2006, 1 ♂, 1 ♀, leg. R. Bekchiev (PCRB).

Distribution: The species is so far known from Austria, Bosnia and Herzegovina, Czech Republic, France, Germany, Greece, Romania, Slovakia and Switzerland. European species.

***Bibloporus bicolor* (Denny, 1825)**

Bulgaria (LÖBL & BESUCHET, 2004).

Vitosha Mts., near Selimitsa Hut, under bark of *Picea abies* L., 1450 m, 1 ♂, 1 ♀, leg. R. Bekchiev (PCRB); **Rila Mts**., Rila Monastery, 1929, 2 ♂♂, leg. Fodor (HNHM).

Distribution: entire Europe, Asia (Russia – Far East). European-Siberian species.

***Bibloporus minutus* Raffray, 1914**

Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Sofia**, Borissova Gradina Park, 550 m, 10.03.2002, 2 ♀♀; **Lozen Mts.**, near St. Spas Monastery, under bark of *F. sylvatica*, 02.04.2005, 1 ♀, leg. R. Bekchiev (PCRB)

Distribution: entire Europe, Asia (Russia – Far East). European-Siberian species.

***Bibloporus mayeti* Guillebeau, 1888**

Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Vitosha Mts**., above Knyazhevo, in rotten wood of *P. sylvestris* , 660 m, 22.08.2006, 1 ♂; Zheleznitsa, Brezite, under bark of *P. abies* L. 1200 m, 1 ♂; near Kamen Del Hut, under bark of *F. sylvatica* L., 1400 m, 16.07.2006, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: entire Europe. European species.

***Bibloplectus minutissimus* (Aubé, 1833)**

Konyavska Mts., near Choklyovo marsh, 12.05.2005, 1 ♀, leg. P. Mitov (PCRB).

Distribution: Central and North Europe. European species.

***Bibloplectus tenebrosus* Reitter, 1880**

German Monastery (RAMBOUSEK, 1909).

Note: Since Rambousek this species has not been found in Bulgaria. New material is needed to confirm its occurrence in the country.

***Bibloplectus parvulus* Besuchet, 1975**

Bulgaria (LÖBL & BESUCHET, 2004).

Petrich District, Rupite, bank of Struma River, in old alluvium, 16.05.2007, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: Bulgaria, Greece, Turkey. Ponto-Mediterranean species.

***Bibloplectus ambiguus* Reichenbach, 1816**

Sofia (BESUCHET, 1955).

Distribution: common species for Europe. European species.

***Trichonyx sulcicollis* (Reichenbach, 1816)**

Rila Mts. – Rila Monastery, Varna (KARAMAN, 1969), Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

Distribution: entire Europe and Asia (East Siberia). European-Siberian species.

***Amauronyx maerkelii* (Aubé, 1844)**

Bulgaria (LÖBL & BESUCHET, 2004).

Pirin Mts., Ilindentsi, in leaf litter, 300 m, 08.07.2006, 3 ♂♂, 1 ♀; 08.09.2006, 4 ♂♂, 2 ♀♀, leg. R. Bekchiev (PCRB).

Distribution: entire Europe. European species.

***Trimium puncticeps* Reitter, 1880**

Osogovo Mts., Rila Mts. – Samokov (KARAMAN, 1967), Vitosha Mts. (LAPEVA-GJONOVA, 2004; BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Zemen gorge**, near Zemen, riverside Struma River, in leaf litter of *F. sylvatica*/*Salix* sp., 570 m, 13.09.2002, 3 ♀♀; 02.05.2003, 2 ♂♂, 2 ♀♀; 02.05.2004, 3 ♂♂, 1 ♀; 26.07.2004, 2 ♂♂, 1 ♀; 13.09.2004, 2 ♂♂; **Konyavska Mts**., near Blateshnitsa, in leaf litter of *Quercus* sp., 02.07.2005, 1 ♂, 7 ♀♀, leg. R. Bekchiev (PCRB); **Sandanski**, 16.07.1971, 1 ♂, leg. Bohac (MHNG); **Petrich District**, Rupite, Kozhuh hill, 100 m, in leaf litter of *Quercus* sp., 15.05.2007, 1 ♂, 3 ♀♀; **Belasitsa Mts**., Klyuch, in leaf litter, 500 m, 06.07.2006, 1 ♂; 04.09.2006, 2 ♂♂, 1 ♀; between Yavornitsa and Klyuch, in leaf litter, 420 m, 08.08.2006, 10 ♂♂, 1 ♀; Kamena, in leaf litter, 430 m, 3 ♂♂, 6 ♀♀, leg. R. Bekchiev (PCRB).

Distribution: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Hungary, Macedonia, Moldavia and Romania. Carpathian-Balkan species.

***Trimium carpathicum* Saulcy, 1875**

Osogovo Mts., Sofia (KARAMAN, 1967), Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Malashevska planina Mts**., Gorna Breznitsa, pitfall trap in *P. orientalis* forest, 01.05 – 20.06.2002, 1 ♂, leg. B. Guéorguiev (NMNHS); **Belasitsa Mts**., Klyuch, in leaf litter, 500 m, 15.05.2007, 1 ♂, 1 ♀, leg. R. Bekchiev (PCRB).

Distribution: Southeast and Central Europe. Southeast European species.

***Trimium caucasicum* Kolenati, 1846**

Vitosha Mts. – Kniazhevo, Rila Mts. – Borovets, German (RAMBOUSEK, 1909).

New localities: **Vitosha Mts.,** in leaf litter of *F. sylvatica*, 27.08.1943, 1 ♂ (NMNHS); **Kresna gorge**, near Stara Kresna, bank of Struma River, in leaf litter, 05.06.2006, 1 ♂, 1 ♀; **Malashevska Mts**., between Mikrevo and Kamenitsa, in leaf litter, 250 m, in leaf litter of *Quercus coccifera* L., 03.06.2006, 5 ♂♂; **Petrich District**, Rupite, in rotten wood of *Populus* sp., 93 m, 07.05.2004, 1 ♂; **Belasitsa Mts**., Klyuch, in leaf litter, 500 m, 06.07.2006, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: The species is so far known from Armenia, Georgia, Greece, Russia – the Caucasus, and Turkey. Pontic species.

Note: Our suggestion (BEKCHIEV & SHISHINIOVA, 2007), that the species could not be found in Vitosha Mountain, turned out to be wrong. Although it had not been detected in our researches in the period between 2003-2007, a finding of one male specimen in the collection of the National Museum of Natural History, Sofia, backed up the possibility of the meeting of this species also in the north of the Kresna Gorge and confirmed the identification by RAMBOUSEK (1909).

***Trimium expandum* Reitter, 1884**

Malashevska planina Mts., near Kamenitsa, 200 m, in pitfall trap, 31.05 – 23.06.2002, 1 ♂, leg. M. Langurov ; **Pirin Mts**., near Kalimantsi, St. Ilya hill, 500 m, tree trap, 10.05 – 01.06.2002, 1 ♂, leg. M. Langurov (PCRB); MSS trap, 27.06.–07.12.2006, 1 ♂, leg. S. Lazarov (NMNHS).

Distribution: Greece and Macedonia. Balkan species.

***Trimium thessalicum* Karaman, 1967**

Pirin Mts., near Kalimantsi, St. Ilya hill, 500 m, tree trap, 10.05 – 01.06.2002, 1 ♂, leg. M. Langurov; pitfall trap, 23.06. – 06.08.2002, 1 ♂, leg. D. Chobanov (PCRB); **Petrich District**, Rupite, Kozhuh hill, 100 m, in leaf litter of *Quercus* sp., 15.05.2007, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: Greece and Macedonia. Balkan species.

***Bryaxis simoni* (Reitter, 1880)**

Rila Mts.(REITTER, 1880; RAMBOUSEK, 1909), Stara Planina Mts. (KARAMAN, 1957, 1969) Vitosha Mts. (RAMBOUSEK, 1909, BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Lyulin Mts.,** near Sv. Kral Monastery, in leaf litter, 26.06.1943, 3 ♂♂ (NMNHS); **Zemen gorge**, near Zemen, bank of Struma River, in leaf litter of *F. sylvatica/Salix* sp., 570 m, 02.05.2004, 1 ♂, leg. R. Bekchiev (PCRB); **Konyavska Mts**., near Dvorishte, in leaf litter *Quercus* sp., 02.07.2005, 1 ♂, leg. R. Bekchiev (PCRB); **Rila Mts**., Rila Monastery, 14.07.1927, 2 ♂♂, leg. Fodor (MHNG); Maliovitsa Hut, 2185 m, 24.06.1997, 2 ♂♂, 1 ♀, leg. Zerche & Behne; Macedonia Hut, north of Parangalitsa Reserve, 1 ♂, leg. Zerche & Behne (DEI); Parangalitsa Reserve, in leaf litter of *F. sylvatica/P. abies*, 1500 m, 23.11.2003, 1 ♂, leg. A. Gjonova (PCRB); **Pirin Mts**., Vihren Hut, 2080 m, 27.08.1979, 4 ♂♂, leg. P. Beron (NMNHS); Banderitsa Hut, in leaf litter, 1800 m, 9 ♂♂, 24 ♀♀, 13.06.1989, leg. C. Besuchet (MHNG); Banderitsa Hut, in moss, 27.06.1979, 1 ♂, leg. Muhlig (ZMHB).

Distribution: Bosnia and Herzegovina, Bulgaria, Greece, Macedonia, Montenegro and Serbia. Balkan species.

***Bryaxis carinula* (Rey, 1888)**

Shumen, Varna (KARAMAN, 1969, 1972a),Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Zemen gorge**, near Zemen, bank of Struma River, in leaf litter of *F. sylvatica/Salix* sp., 570 m, 14.10.2002, 4 ♀♀, leg. D. Gradinarov (PCRB); **Rila Mts**., Borovets mountain resort, 1911, 3 ♂♂, leg. M. Hilf (MHNG).

Distribution: Southeast and Central Europe. Southeast European species.

***Bryaxis puncticollis* (Denny, 1825)**

Rila Mts., Borovets mountain resort (= Chamkoriya) (RAMBOUSEK, 1909).

Note: The species is very similar to *Bryaxis carinula*, from which it differs solely in the morphology of the aedeagus. The presence of this species in the Bulgarian fauna needs to be confirmed.

***Bryaxis comita* (Rambousek, 1909)**

Osogovo Mts., 1928, 2 ♂♂, 1 ♀, leg. Biro (MHNG); **Malashevska Mts**., Gorna Breznitsa, pitfall trap, 700 m, 23.08 – 25.09.2002, 1 ♂, leg. B. Guéorguiev (PCRB).

Distribution: Albania, Greece, Macedonia, Montenegro and Serbia. Balkan species.

***Bryaxis curtisii orientalis* Karaman, 1952**

Rila Mts., Samokov (KARAMAN, 1957, 1969), Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Zemen gorge**, near Zemen, Struma riverside, in leaf litter of *F. sylvatica*/ *Salix* sp., 570 m, 04.09.2002, 3 ♀♀; 01-02.05.2003, 3 ♂♂, 1 ♀; 13.09.2004, 2 ♂♂; **Rila Mts**., Rila Monastery, 11.07.1957, 1 ♂, leg. N. Karnoschitzky (NMNHS); **Malashevska Mts**., Gorna Breznitsa, pitfall trap in *P. orientalis* forest, 700 m, 14.09-22.10.2003, 1 ♂; 02.10-04.11.2003, 3 ♂♂, 1 ♀, leg. B. Guéorguiev (NMNHS); **Belasitsa Mts**., Klyuch, in leaf litter, 500 m, 06.07.2006, 1 ♂; 08.08.2006, 1 ♂; Kamena, in leaf litter, 430 m, 14.04.2006, 4 ♂♂, 5 ♀♀, leg. R. Bekchiev (PCRB).

Distribution: Southeast and Central Europe. Southeast European species.

***Bryaxis bosnicus* (Ganglbauer, 1895)**

Vitosha Mts., near Bay Krastyo, in leaf litter of *F. sylvatica*, 1450 m, 24.04.2005, 1 ♂; 27.09.2005, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: Albania, Bosnia and Herzegovina, Greece, Macedonia, Montenegro and Serbia. Balkan species.

***Bryaxis convexus* (Kiesenwetter, 1858)**

Pirin Mts. – Smokovo (LÖBL, 1969).

New localities: **Malashevstka Mts**., Sedelets, pitfall trap in *Quercus* sp. forest, 680 m, 04.05-04.07.2003, 1 ♂, leg. S. Lazarov & T. Ljubomirov (NMNHS); between Mikrevo and Kamenitsa, in leaf litter, 170 m, 07.07.2006, 6 ♂♂; 10.08.2006, 2 ♂♂; **Pirin Mts**., Ilindentsi, in leaf litter, 300 m, 05.06.2006, 3 ♂♂, 7 ♀♀; 09.07.2006, 20 ♂♂, 12 ♀♀; 08.09.2006, 1 ♂, 2 ♀♀; near Kalimantsi, Malinova barchina, 350 m, in leaf litter, 01.04.2007, 6 ♂♂, 7 ♀♀, leg. R. Bekchiev (PCRB); **Petrich District**, Rupite, in rotten wood of *Populus* sp., 90 m, 07.05.2004, 2 ♂♂; **Belasitsa Mts**., Klyuch, in leaf litter, 500 m, 04.09.2006, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: Albania, Bulgaria, Greece and Macedonia. Balkan species.

***Bryaxis roumaniae* Raffray, 1904**

German (RAMBOUSEK, 1909), Vratsa, Burgas (KARAMAN, 1972a), Belasitsa Mts., near Belasitsa Hut (LAPEVA-GJONOVA, 2004), Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Rila Mts**., Parangalitsa Reserve, in leaf litter of *F. sylvatica/P. abies*, 1500 m, 23.11.2003, 1 ♀, leg. A. Gjonova (PCRB); **Malashevska Mts**., Gorna Breznitsa, pitfall trap, 700 m, 23.08 – 25.09.2002, 1 ♂; Nikudin, pitfall trap, 15.03 – 16.04.2003, 1 ♂, leg. B. Guéorguiev (NMNHS); **Petrich District**, Rupite, Pchelina hill, 71 m, 09.08.2006, 6 ♂♂, 8 ♀♀; bank of Sruma River, in leaf litter, 06.09.2006, 2 ♂♂; **Belasitsa Mts**., Klyuch, in leaf litter, 500 m, 14.04.2006, 4 ♂♂, 4 ♀♀; 02.06.2006, 1 ♀; 04.09.2006, 3 ♂♂, 1 ♀; Samuilovo, in leaf litter, 300 m, 15.04.2005, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: Bulgaria, Greece, Montenegro, Romania and Serbia. Balkan species.

***Bryaxis beroni* Karaman, 1969**

"Ječa Dupka, Shandalovo bei Kjustendil" = Mechata Dupka Cave, Stradalovo, Kustendil District (KARAMAN, 1972a).

Distribution: Bulgaria and Serbia. Balkan endemic species

****Bryaxis dalmatinus* (Reitter, 1881)**

Malashevstka Mts., Sedelets, pitfall trap in *Quercus* sp. forest, 680 m, 04.07 – 08.08.2003, 1 ♂, leg. T. Ljubomirov (NMNHS); between Mikrevo and Kamenitsa, in leaf litter, 170 m, N 41°38'569" E 23°10'167", 07.07.2006, 10 ♂♂; 10.08.2006, 3 ♂♂, leg. R. Bekchiev (PCRB)**;** **Pirin Mts**., near Kalimantsi, St. Ilya hill, 500 m, MSS trap, 27.06 – 07.12.2006, 1 ♂, leg. S. Lazarov (NMNHS); **Petrich District**, Rupite, Kozhuh hill, under stone, 195 m, N 41°27'632" E 23°15'351", 15.04.2006, 1 ♂, 1 ♀, leg. R. Bekchiev (PCRB).

Distribution: Albania, Bosnia and Herzegovina, Crete, Greece, Macedonia, Montenegro and Serbia. Balkan species.

****Bryaxis sarplaninensis* (Karaman, 1953)**

Belasitsa Mts., near Belasitsa Hut, Vodopada, 700 m, 04. 05. 2003, 1 ♂ leg. P. Mitov (MHNG); Kamena, bank of little river, in leaf litter of *Platanus orientalis*, 400 m, 15.04.2006, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: Macedonia, Serbia – Kosovo. Balkan endemic species.

***Bryaxis islamitus* (Reitter, 1885)**

Lyulin Mts., Vladaya gorge (DRENOVSKI, 1942).

New localities: **Vitosha Mts**., 1500 m, 25.07.1972, 1 ♂, leg. Rous (PCVB); Byala Voda, in leaf litter of *F.sylvatica/Salix* sp., 900 m, 28.04.2005, 2 ♂♂; 17.05.2005, 3 ♂♂; 23.06. 2005, 2 ♂♂; 21.07.2005, 1 ♂; 13.05.2006, 1 ♂; 26.06.2006, 1 ♂; above Knyazhevo, in leaf litter,13.05.2005, 1 ♂; 30.06.2005, 3 ♂♂; 26.07.2005, 1 ♂, 1 ♀; 13.05.2006, 2 ♂♂, 1 ♀; 14.07.2006, 3 ♂♂; Kladnitsa, bank of Kladnishka reka River, in leaf litter, 1100 m, 24.05.2005, 1 ♂; above Dragalevtsi, in leaf litter, 1000 m, 31.08.2005, 1 ♂; above Rudartsi, in leaf litter, 1000 m, 12.09.2006, 1 ♂, 6 ♀♀; 25.07.2006, 2 ♂♂; Marchaevo, in leaf litter, 1000 m, 25.04.2006, 1 ♂; **Konyavska Mts**., near Dvorishte, in leaf litter *Quercus* sp., 02.07.2005, 1 ♂, leg. R. Bekchiev (PCRB); **Pirin Mts**., Gotse Deltshev District, Musomishte, in leaf litter, 600 m, 12.06.1989, 1 ♂, leg. C. Besuchet (MHNG); **Belasitsa Mts**., Klyuch, in leaf litter, 500 m, 14.04.2006, 7 ♂♂, 3 ♀♀; 06.07.2006, 1 ♂, 1 ♀; 04.09.2006, 5 ♂♂, 3 ♀♀; Kamena, in leaf litter, 430 m, 14.04.2006, 3 ♂♂; Samuilovo, in leaf litter, 300 m, 15.04.2005, 2 ♂♂, 5 ♀♀, leg. R. Bekchiev (PCRB).

Distribution: the species is so far known from Bosnia Herzegovina, Bulgaria, Greece, Macedonia, Montenegro and Serbia. Balkan species.

Note: The species is widely distributed on the Balkans, but its aedeagus (Fig. 2 and 3) and antennal base (Fig. 4) have never been illustrated. We use the opportunity to correct that omission.

***Bryaxis bulbifer* (Reichenbach, 1816)**

Varna – Varna Lake, Kamchia River (KARAMAN, 1969).

New localities: **Vitosha Mts**., Zheleznitsa, in boggy meadow, 1200 m, 24.03.2007, 4 ♂♂, 7 ♀♀, leg. R. Bekchiev (PCRB); **Konyavska Mts**., near Choklyovo marsh, in leaf litter of *Salix* sp., 12.05.2005, 1 ♂, leg. P. Mitov (PCRB); **Sandanski**, 6-11.05.1984, 1 ♂, leg. Wrase (MHNG); **Petrich District**, Rupite, near Struma River, pitfall trap, 20.04 – 20.05.1996, 1 ♂, leg. B. Gueorguiev (NMNHS); near Struma River, under fallen bulrush, 90 m, 08.08.2006, 7 ♂♂, 2 ♀♀; 05.09.2006, 9 ♂♂, 2 ♀♀, leg. R. Bekchiev (PCRB); near General Todorov, 04.05.1984, 1 ♂, leg. Hieke (ZMHB).

Distribution: entire Europe, Asia (Russia – East and West Siberia, Turkey). European-Siberian species.

***Bryaxis ullrichii* Motschulsky, 1851**

Vitosha Mts. (RAMBOUSEK, 1909; BEKCHIEV & SHISHINIOVA, 2007).

Vitosha Mts., in leaf litter of *F. sylvatica*, 10.08.1943, 1 ♂ (NMNHS).

Distribution: Southeast and Central Europe. Southeast European species.

***Bryaxis longulus* Kiesenwetter, 1849**

German (RAMBOUSEK, 1909).

Note: The presence of this species in Bulgaria needs confirmation.

***Bryaxis nodicornis* Aubé, 1833**

German (RAMBOUSEK, 1909), Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

Distribution: entire Europe. European species.

***Bythinus acutangulus lunifer* Karaman, 1948**

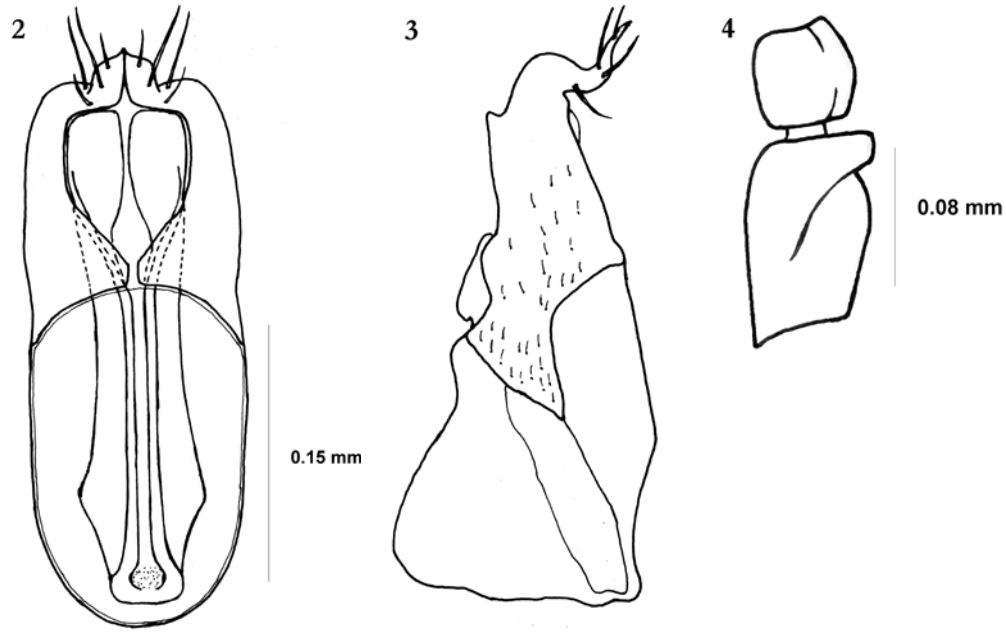
Rila Mts. - Samokov, Rhodopes Mts. - Bachkovo (KARAMAN, 1957, 1969), Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Pirin Mts.,** Ilindentsi, in leaf litter, 300 m, 05.06.2006, 2 ♂♂; 08.09.2006, 3 ♂♂; **Belasitsa Mts**., Klyuch, in leaf litter, 500 m, 14.04.2006, 9 ♂♂, 6 ♀♀; 07.07.2006, 4 ♂♂, 2 ♀♀; 08.08.2006, 2 ♂♂, 3 ♀♀, leg. R. Bekchiev (PCRB).

Distribution: The subspecies is so far known only from Bulgaria. Bulgarian endemic subspecies.

****Bythinus acutangulus skopljensis* (Karaman, 1948)**

Petrich District, Rupite, Kozhuh hill, 10.06.1983, at light, 6 ♂♂, leg. Hieke (ZMHB); bank of Struma River, in reed leaf litter, 94 m, 10.04.2005, 4 ♂♂; 03.06.2006, 2 ♂♂, 2 ♀♀; 08.08.2006, 3 ♂♂, 1 ♀; 06.09.2006, 3 ♂♂, leg. R. Bekchiev (PCRB).



Figs. 2-4. *Bryaxis islamitus*: 2 – aedeagus, dorsal view; 3 – same, lateral view; 4 – base of antenna.

Distribution: Bosnia Herzegovina and Macedonia. Balkan endemic subspecies.

***Bythinus mariovi* Karaman, 1969**

Pirin Mts., Gotse Deltshev District, Musomishte, in leaf litter, 600 m, 12.06.1989, 1 ♂, 1 ♀, leg. C. Besuchet (MHNG).

Distribution: The species is so far known only from Macedonia. Balkan species.

***Bythinus lunicornis* Reitter, 1884**

Rila Mts. - Borovets, Samokov (KARAMAN, 1954, 1957, 1969), Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Rila Mts**., Borovets mountain resort, 1911, 1 ♂; Samokov, 1911, 1 ♂, leg. Biro; Samokov, 1911, 1 ♂, 1 ♀, leg. M. Hilf (MHNG); **Malashevska Mts**., Breznitsa, pitfall trap in *P. orientalis* forest, 14.09-02.10.2003, 1 ♂, leg. B. Guéorguiev (NMNHS).

Distribution: Bosnia and Herzegovina, Bulgaria, Crete, Greece, Hungary, Macedonia, Montenegro, Romania and Serbia. Southeast European species.

***Bythinus macropalpus* Aubé, 1833**

Zemen gorge, near Zemen, bank of Struma River, in leaf litter of *Salix* sp., 570 m, 02.05.2004, 1 ♂, leg. R. Bekchiev (PCRB); **Petrich District**, Rupite, Kozhuh hill, 10.06.1983, at light, 1 ♂, leg. Hieke (MHNG).

Distribution: entire Europe and Asia (East Siberia). European-Siberian species.

***Bythinus leonhardinus* Reitter, 1882**

Samokov (KARAMAN, 1957, 1954), Pirin Mts. – Smokovo (LÖBL, 1969), Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Kresna gorge**, near Stara Kresna, bank of Struma River, in leaf litter, 05.06.2006, 3 ♂♂; 09.09.2006, Sheitan Dere, in leaf litter, 2 ♂♂, 9 ♀♀, leg. R. Bekchiev (PCRB); **Rila Mts**., Samokov, 1911, 1 ♂, leg. Biro (MHNG); **Pirin Mts**., Ilindentsi, in leaf litter, 300 m, 05.06.2006, 9 ♂♂, 56 ♀♀; 09.07.2006, 38 ♂♂, 107 ♀♀; 08.09.2006, 12 ♂♂, 35 ♀♀, leg. R. Bekchiev (PCRB); **Sandanski**, 28.08.1972, 1 ♂, leg. A. Sanglet (MHNG); **Malashevska Mts**., Gorna Breznitsa, pitfall trap, 01.06 – 20.07.2003, 1 ♂, leg. B. Gueorgiev (NMNHS); between Mikrevo and Kamenitsa, in leaf litter, 150 m, 03.06.2006, 2 ♂♂; 07.07.2006, 5 ♂♂, 13 ♀♀; 09.08.2006, 6 ♂♂, 8 ♀♀, leg. R. Bekchiev; **Petrich District**, Rupite, bank of Struma River, in reed leaf litter, 94 m, 06.09.2006, 3 ♂♂; **Belasitsa Mts**., Klyuch, in leaf litter, 500 m, 14.04.2006, 3 ♂♂, 2 ♀♀; Kamena, in leaf litter, 430 m, 14.04.2006, 2 ♂♂; Samuilovo, in leaf litter, 300 m, 15.04.2005, 2 ♂♂, 8 ♀♀, leg. R. Bekchiev (PCRB).

Distribution: Bulgaria, Greece and Macedonia. Balkan species.

***Bythinus seidli* Karaman, 1952**

Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

Distribution: Bulgaria, Montenegro, Romania and Serbia. Balkan species.

***Bythinus burellii* Denny, 1825**

German, Pancharevo (RAMBOUSEK, 1909).

Note: The presence of this species in Bulgaria needs confirmation.

***Bythinus securiger* Reichenbach, 1816**

German (RAMBOUSEK, 1909).

Note: The presence of this species in Bulgaria needs confirmation.

***Paratychus mendax* (Kiesenwetter, 1858)**

Bulgaria (LÖBL & BESUCHET, 2004).

Petrich District, Rupite, Kozhuh hill, 10.06.1983, at light, 1 ♀, leg. Hieke (ZMHB); in leaf litter of *Quercus* sp., 31.03.2007, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: Albania, Bulgaria, Cyprus, Greece, Macedonia and Turkey. Balkan species.

***Tychus dalmatinus* (Reitter, 1880)**

Varna – Varna Lake, Kamchia River (KARAMAN, 1969), Kranevo (HLAVÁČ 1997).

New localities: **Petrich District**, Rupite, Kozhuh hill 10.06.1983, at light, 5 ♂♂; near General Todorov, 06.05.1984, 3 ♂♂, leg. Hieke (ZMHB).

Distribution: Southeast and Central Europe. Southeast European species.

***Tychus aphelbecki* Karaman, 1955**

Bulgaria (LÖBL & BESUCHET, 2004).

Pirin Mts., near Gospodintsi, 585 m, MSS - trap, 07.09.2006 – 04.07.2007, 1 ♂, 1 ♀, leg. P. Stoev (NMNHS).

Distribution: Bosnia Herzegovina, Bulgaria, Croatia, Greece, Montenegro, Serbia, Turkey. Balkan-Anatolian species.

***Tychus anatolicus* Besuchet, 1964**

Bulgaria (LÖBL & BESUCHET, 2004).

Petrich District, Rupite, Kozhuh hill, 10.06.1983, at light, 10 ♂♂, 8 ♀♀, leg. Hieke (ZMHB); Rupite, under fallen bulrush, 94 m, 09.08.2006, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: Bulgaria, Greece, Russia – the Caucasus, Ukraine – Crimea and Turkey. Pontic species.

***Tychus niger* (Paykull, 1800)**

German (RAMBOUSEK, 1909), Razgrad (MARKOVITCH, 1909), Rila Mts. – Samokov (KARAMAN, 1955), Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Petrich District**, near General Todorov, 06.05.1984, 1 ♂, leg. Hieke (MHNG); **Pernik District**, Kovachevtsi, bank of Pchelina dam lake, in moss, 550 m, 17.04.2005, 1 ♂, 1 ♀, leg. R. Bekchiev (PCRB).

Distribution: entire Europe. European species.

***Tychus rufus* Motschulsky, 1851**

Vitosha Mts. (RAMBOUSEK, 1909; BEKCHIEV & SHISHINIOVA, 2007), Varna, Burgas – Banya, Sozopol, Shumen (Karaman 1969, 1972a, 1972b).

New localities: **Pernik District,** Kovachevtsi, bank of Pchelina dam lake, in moss, 550 m, 17.04.2005, 5 ♀♀, leg. R. Bekchiev (PCRB); **Rila Mts**., Rila Monastery, 11.07.1957, 1 ♂, leg. N. Karnoschitzky (NMNHS).

Distribution: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Hungary, Montenegro, Italy, Romania, Serbia and Slovenia. Southeast European species.

******Tychus laminiger* Besuchet, 1969**

Petrich District, Rupite, Kozhuh hill, 10.06.1983, at light, 1 ♂, leg. Hieke (ZMHB).

Distribution: Greece, Ukraine – Crimea, Israel, Turkey. Ponto-Mediterranean species.

******Tychus cordiger* Besuchet, 1969**

Petrich District, Rupite, Kozhuh hill, under stone, 16.03.2003, 1 ♂, leg. R. Bekchiev (PCRB).

Distribution: Bosnia and Herzegovina, Croatia, Greece, Macedonia, Montenegro, Serbia and Turkey. Balkan species.

***Tychus pullus* Kiesenwetter, 1858**

Varna (KARAMAN, 1969).

New localities: **Rila Mts**., Rila Monastery, 11.07.1957, 1 ♂, leg. N. Karnoschitzky (NMNHS).

Distribution: Albania, Bosnia Herzegovina, Bulgaria, Croatia, Greece, Hungary, Italy, Montenegro, Serbia, Slovenia, Slovakia and Turkey. Southeast European species.

***Brachygluta fossulata* (Reichenbach, 1816)**

German (RAMBOUSEK, 1909), Tarnovo (NETOLITZKY, 1912), Sofia, Maglizhe, (KARAMAN, 1961), Vitosha Mts. (BEKCHIEV & SHISHINIOVA, 2007).

Distribution: entire Europe, Asia (Russia – East and West Siberia, Turkey). European-Siberian species.

***Brachygluta sinuata* (Aubé, 1833)**

Bulgaria (LÖBL & BESUCHET, 2004).

Sandanski District, Strumyani, 15.06.1995, 1 ♂, leg. Prudek (PCPH).

Distribution: entire Europe, North Africa (Algeria). European-Mediterranean species.

***Brachygluta helferi longispina* (Reitter, 1884)**

Varna – Varna lake, Kamchia River (KARAMAN, 1969, 1972a).

New localities: **Petrich District**, Rupite, Kozhuh hill, 8-10.06.1983, at light, 4 ♂♂, leg. Hieke (ZMHB).

Distribution: Europe, Asia (Cyprus, Iran, Israel, Lebanon, Syria, Turkey). European-Mediterranean species

***Brachygluta haematica* (Reichenbach, 1816)**

Bulgaria (LÖBL & BESUCHET, 2004).

Petrich District, Rupite, Kozhuh hill, 8-10.06.1983, at light, 2 ♂♂, 3 ♀♀, leg. Hieke (ZMHB).

Distribution: entire Europe, Asia (Russia – East and West Siberia). European-Siberian species.

***Brachygluta spinicoxis fuchsii* (Paganetti-Hummler, 1899)**

Tryavna (KARAMAN, 1961).

New localities: **Kyustendil**, 1928, 1 ♂, leg. Biro (HNHM); **Pirin Mts.**, Dobrinishte, 1966, leg. Löbl (SNHM).

Distribution: Albania, Bulgaria, Crete, Greece, Montenegro, Serbia and Turkey. Balkan subspecies.

***Brachygluta paludosa* (Peyron, 1858)**

German (RAMBOUSEK, 1909).

Note: The species is halophilous and its finding in the neighbourhood of German Village is suspicious.

****Reichenbachia juncorum* (Leach, 1817)**

Vitosha Mts., Zheleznitsa, in boggy meadow, 1200 m, 21.01.2007, 2 ♂♂, 2 ♀♀, leg. R. Bekchiev (PCRB).

Distribution: Europe and North Africa (Algeria, Morocco, Tunisia). European-Mediterranean species.

***Rybaxis longicornis* (Leach, 1817)**

Varna – Varna Lake, Kamchia River (KARAMAN, 1969, 1972a).

New localities: **Petrich District**, Rupite, Kozhuh hill, 10.06.1983, at light, 1 ♂, leg. Hieke (ZMHB).

Distribution: Common species, known from Europe, North Africa (Algeria, Morocco, Tunisia) and Asia (Afghanistan, Russia- east Siberia, Iran, Iraq, Tadzhikistan, Turkmenistan, Turkey, Uzbekistan). Trans-Palaearctic species.

***Trissemus atennatus serricornis* (Shmidt-Göbel, 1838)**

Svilengrad (VŠETEČKA, 1959), Varna – Varna lake, Kamchia River (KARAMAN, 1969, 1972a).

New localities: **Malashevska Mts**., between Mikrevo and Kamenitsa, in leaf litter, 150 m, 07.07.2006, 1 ♀; 06.09.2006, 2 ♀♀; **Pirin Mts**., Ilindentsi, in leaf litter, 300 m, 08.09.2006, 1 ♂, leg. R. Bekchiev; 30.07.2007, at light, 10 ♂♂, leg. B. Zlatkov & O.Sivilov (PCRB); **Rila Mts.,** place Bachinovo, bank of Rilska Bistritsa river, pitfall trap, 19.06.2006, 2 ♂♂, 2 ♀♀, leg. L. Sekerelieva (NMNHS); **Sandanski**, 16 – 23.07.1985, 1 ♂, leg. M. Schülke; 6 – 11 05.1969, 1 ♂, leg. Wrase (ZMHB); **Petrich District**, Rupite, near Struma River, pitfall trap, 20.04 – 20.05.1996, 8 ♂♂, 15 ♀♀, leg. B. Gueorguiev (NMNHS); near General Todorov, 06.05.1984, 1 ♂, leg. Hieke (ZMHB); Rupite, near Struma River, in leaf litter, 94 m, 10.04.2005, 1 ♂; under fallen bulrush, 90 m, 08.08.2006, 14 ♂♂, 7 ♀♀; 05.09.2006, 9 ♂♂, 7 ♀♀, leg. R. Bekchiev (PCRB).

Distribution: Europe (Albania, Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Germany, Georgia, Greece, Hungary, Montenegro, Serbia, Slovenia, Russia – South European territory, Asia (Turkey). Southeast European subspecies.

***Trissemus montanus* (Saulcy, 1876)**

Bulgaria (LÖBL & BESUCHET, 2004).

Petrich District, Rupite, near Struma River, pitfall trap, 20.04 – 20.05.1996, 2 ♀♀, leg. B. Guéorguiev (NMNHS); under fallen bulrush, 90 m, 08.08.2006, 5 ♂♂, 3 ♀♀; 05.09.2006, 3 ♀♀, leg.R. Bekchiev (PCRB).

Distribution: Azerbaijan, Armenia, Bulgaria, Georgia, Greece, Iran, Turkmenistan and Turkey. Mediterranean-Turanian species.

***Centrotoma lucifuga* Hayden, 1849**

Gotse Delchev District, Petrelik (LAPEVA-GJONOVA, 2004)

Distribution: Southeast and Central Europe. Southeast European species.

***Ctenistes palpalis* Reichenbach, 1816**

Rila Mts. - Rila Monastery (KARAMAN, 1969)

New localities: **Pirin Mts**., Ilindentsi, in leaf litter, 300 m, N 41°38'747" E 23°13'558", 08.09.2006, 1 ♀, leg. R. Bekchiev (PCRB).

Distribution: entire Europe, Central Asia, Oriental region. Palaearctic-Palaeotropical species.

***Dicentrius fodori* Besuchet, 1999**

Rila Mts. - Borovets, Maliovitsa Hut, Pirin Mts. – Vihren (RAMBOUSEK, 1909; BESUCHET, 1999).

New localities: **Rila Mts**., Borovets, 08.08.1909, 1 ♂, leg. Rambousek (NMNHS); Parangalitsa Reserve, in leaf litter of *F. sylvatica*/*P. abies*, 1500 m, 23.11.2003, 1 ♂, 3 ♀♀, leg. A. Gjonova (PCRB).

Distribution: Bosnia and Herzegovina and Bulgaria. Balkan endemic species.

***Dicentrius balcanicus pirinensis* Besuchet, 1999**

Pirin Mts. – Banderitsa, Pirin Hut, Rila Mts. – Borovets, Blagoevgrad (BESUCHET, 1999).

Distribution: The subspecies is so far known only from Bulgaria. Bulgarian endemic subspecies.

***Dicentrius biroi* Besuchet, 1999**

Osogovo Mts., on the border between Bulgaria and Macedonia (BESUCHET, 1999).

Note: The species is so far known from Bulgaria and Macedonia. Balkan endemic species.

***Dicentrius discrepans* Besuchet, 1999**

Pirin Mts., Banderitsa (BESUCHET, 1999).

Distribution: The species is so far known only from Bulgaria. Bulgarian endemic species.

***Dicentrius rousi* Besuchet, 1999**

Vitosha Mts., (BESUCHET, 1999; BEKCHIEV & SHISHINIOVA, 2007).

New localities: **Vitosha Mts**., in leaf litter *F. sylvatica*, 08.1943, 5 ♂♂, 2 ♀♀ (NMNHS).

Distribution: The species is so far known only from Bulgaria. Bulgarian endemic species.

***Dicentrius zerchei* Besuchet, 1999**

Rila Mts. - Borovets, Belmeken, Pirin Mts.- Vihren (BESUCHET, 1999).

Distribution: The species is so far known only from Bulgaria. Bulgarian endemic species.

***Pselaphogenius bulgaricus* Löbl, 1969**

Pirin Mts. – Smokovo (LÖBL, 1969).

New localities: **Osogovo Mts**., 1928, 2 ♂♂, 1 ♀, leg. Biro (MHNG); **Karvav Kamak Mts**., west of Dragojchinovtsi, in leaf litter of *F. sylvatica*, 850 m, N 42°35'19" E 22°32'31", 04.05.2001, 1 ♂, leg. Zerche & Behne (DEI); **Rila Mts**., Bistritsa, in leaf litter of *F. sylvatica*, 780 m, N 42°02'38" E 23°13'31", 19.06.1997, 1 ♂,1 ♀, leg. Zerche & Behne (DEI); **Malashevska Planina Mts**., Gorna Breznitsa, in leaf litter of *F. sylvatica*, 885 m, N 41°44'31" E 23°04'27", 30.04.2001, 2 ♂♂, 1 ♀, leg. Behne (DEI); pitfall trap in *P. orientalis* forest, 15.06 – 10.07.2002, 1 ♂; 11.07 – 23.08.2002, 1 ♀; 01.05 – 19.06.2003, 1 ♂, 1 ♀, leg. B. Guéorguiev (NMNHS); **Belasitsa Mts**., 700 m, 17.10.1982, 1 ♀, leg. H. Delchev (MHNG), Belasitsa Hut, in leaf litter of *F. sylvatica*/*C. sativa*, 720 m, 5.05.2000, 1 ♂, 1 ♀; 4.05.2000, 1 ♀, leg. Behne (DEI); Yavornitsa, 400 m, 01 – 03.05.2003, 1 ♂, leg. P. Mitov; Samuilovo, in leaf litter, 300 m, 15.04.2005, 1 ♀, leg. R. Bekchiev (PCRB).

Distribution: The species is so far known from Bulgaria, Greece and Macedonia. Balkan endemic species.

***Pselaphaulax dresdensis dresdensis* (Herbst, 1792)**

Bulgaria (LÖBL & BESUCHET, 2004).

Petrich District, Rupite, Kozhuh hill, 10.06.1983, at light, 1 ♀, leg. Hieke (MHNG).

Distribution: entire Europe. European species.

***Pselaphus heisei* Herbst, 1792**

Varna, Kamchia River, Vidin (KARAMAN, 1969, 1972a).

New localities: **Vitosha Mts**., near Zheleznitsa, in fern litter, 1200 m, 15.05.2005, 1 ♂; under stone, 21.05.2006, 3 ♂♂, 1 ♀; **Pernik District**, Kovachevtsi, bank of Pchelina dam lake, in moss, 550 m, 17.04.2005, 1 ♀, leg. R. Bekchiev (PCRB).

Distribution: entire Europe, Asia (Russia – Far East, West and East Siberia). European-Siberian species.

***Pselaphus caucasicus* Motschulsky, 1845**

Rila Mts., Bachinovo, bank of Rilska Bistritsa River, pitfall trap, 19.06.2006, 3 ♂♂, 1 ♀, leg. L. Sekerelieva (NMNHS); **Sandanski**, 13-24.07.1985, 2 ♂♂, leg. Shülke (ZMHB); **Petrich District**, Rupite, near Struma River, under fallen bulrush, 90 m, N 41°28'138" E 23°16'176", 08.08.2006, 17 ♂♂, 9 ♀♀; 05.09.2006, 8 ♂♂, 4 ♀♀, leg. R. Bekchiev (PCRB).

Distribution: Azerbaijan, Armenia, Georgia, Greece, Macedonia, Montenegro, Serbia and Turkey. Ponto-Mediterranean species.

Conclusions

As a result of this study, 85 species of Pselaphinae are established in Southwestern Bulgaria. The genera *Faronus* and *Reichenbachia*, 17 species and one subspecies are new to the Bulgarian fauna. Here the 14 species included in "Catalogue of the Palearctic Coleoptera " (LÖBL & BESUCHET, 2004) are reported for the first time with detailed information for the records (date, place, etc.). For the firs time information about other 8 species in the region is reported, at the same time the knowledge about the local distribution of Pselaphinae is considerably bigger. Data about Sandanski – Petrich Valley (31 species), Belasitsa Mts. (15 species), Malashevska Mts. (12 species) has been given for the first time ever.

Thanks to the species diversity and the variety of habitats, Pselaphinae is a group with good potential for zoogeographical studies (NEWTON & CHANDLER, 1989). However, at this stage, specific analysis of the data is hindered by the fact that the general distribution and origin of many species is not sufficiently clear.

Despite the fairly limited amount of data and the lack of systematic investigations for a significant part of the territory of Southwest Bulgaria, the results obtained allow for analysis of some major trends in the zoogeography of Bulgarian Pselaphinae species (including subspecies) – Table 1. All species whose presence in the fauna of Bulgaria is controversial or not confirmed are excluded from the analysis.

Table 1
Zoogeographical structure of Pselaphinae fauna in South-West Bulgaria

Zoogeographical element	Number of species
Cosmopolitan	1
Palaearctic-Palaeotropical	1
Transpalearctic	1
European-Siberian	11
European-Turanian	1
European	11
Central-South European	1
Southeast European	12
Carpathian-Balkan	1
European-Mediterranean	5
Mediterranean	1
Ponto-Mediterranean	3
Pontic	2
Mediterranean-Turanian	1
Balkan	15
Balkan-Anatolyan	1
Balkan endemic	6
Bulgarian endemic	5

The largest percentage of species (34 %) belongs to the Balkan zoogeographical complex - Balkan, Balkan-Anatolyan, Balkan endemic, Bulgarian endemic categories, followed by the European species (32 %) – European, Southeast European and Carpathian-Balkan categories, the Northern and Western Palearctic species (18 %) – Transpalearctic, European-Siberian, European-Turanian categories, and the Mediterranean species (15%) – European-Mediterranean, Mediterranean, Pontomediterranean, Pontic, Mediterranean-Turanian categories. The prevalence of European and Palearctic species (considered together) is easily explained, having in mind the presence of massive high mountains in the investigated region, which are favourable to these species with their temperatures flexibility and high ecological plasticity. In parts of low altitude in the investigated region (mainly the valley of Sandanski-Petrich – 7 species and 1 subspecies), the number of Mediterranean species increases significantly. These results are easily explained by the fact that the valley of Sandanski-Petrich is situated within the range of the transitional Mediterranean climatic region, and the number of Mediterranean elements decreases north of the Kresna Gorge and towards the elevated parts of the mountains (GRUEV, 1988). The number of Balkan species is high and a major portion of them can be also considered as endemites; this applies especially to the pselaphids belonging to tribus Bythinini, in which many species have a fairly limited areal (KARAMAN, 1957). Only some species from the genus *Dicentrius* can be considered as typically Bulgarian endemites.

Even though the species listed in this article represent a considerably large percentage (70 %) of the ones reported for Bulgaria (LÖBL, BESUCHET, 2004), a significant increase in the number of species can be expected if a thorough investigation of Rila Mts., Pirin Mts., the mountains along the border and the valleys of Struma River and Mesta River is performed.

Additional thorough investigations of the territory of Bulgaria, as well as on the Balkan Peninsula, need to be performed in order to accomplish a comprehensive zoogeographical description.

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References

BESUCHET C. 1955. Monographie des *Bibloplectus* et *Pseudoplectus* paléarctiques (Col. Pselaphidae). – Mitteilungen der schweizerishen entomologichen Gesellschaft, **28** (2): 153-209.

BESUCHET C. 1999. Le genre *Dicentrius* (Coleoptera, Staphylinidae, Pselaphidae). – Mitteilungen der schweizerishen entomologichen Gesellschaft, **72**: 221-233.

BEKCHIEV R., SHISHINIOVA M. 2007. A Contribution to the Pselaphinae Fauna (Coleoptera: Staphylinidae) of the Vitosha Mountain. – Acta zoologica bulgarica, **59** (1): 33-39.

DRENOVSKI K. 1942. Vierter Beitrag zum Insektenfauna Bulgariens und Macedoniens (Apterygogenea und Käfer). – Mitteilungen der Bulgarischen Entomologischen Gesellschaft in Sofia., **12**: 1-14. (In Bulgarian with German abstract).

HLAVÁČ P. 1997. The first record of *Tychus dalmatinus dalmatinus* Reitter, 1880 for Slovakia (Coleoptera: Staphylinidae: Pselaphinae). – Klapalekiana., **33** (1-2): 7-9.

GRUEV B. 1988. General Biogeography. Nauka i izkustvo, Sofia, 396 pp. (In Bulgarian).

KARAMAN Z. 1954. Über einige neue Coleopteren der Balkanfauna. – Fragmenta balcanica, **1** (6): 45-55.

KARAMAN Z. 1955. Revision des Tribus Tychini (Col. Psel.) mit besonderer Berücksichtigung der balkanischen Arten. – Acta Musei Macedonici Scientarum Naturalium, **3** (4): 105-144.

KARAMAN Z. 1957. Die balkanischen Bythininen (Col. Pselaphidae). Ihre Systematik, Zoogeographie und Phylogenie. – Bioloski Glasnik (Periodicum biologorum), **10** (3-4): 161-208.

KARAMAN Z. 1961. Neue Gruppierung der Arten des Genus *Brachygluta* Thomson (Coleoptera Pselaphidae). – Acta Musei Macedonici Scientarum Naturalium, **7** (7): 127-174.

KARAMAN Z. 1962. Über das Genus *Plectophloeus* Reitter (Euplectini Psel. Col.). – Jahrbuch der Land- und Forstwirtschaftlichen Fakultät der Universität in Skopje., **15**: 145-153. (In Serbo-Croate with German abstract).

KARAMAN Z. 1967. Revision der Gattung *Trimium* Aubé (Coll. Pselph.). – Acta Musei Macedonici Scientarum Naturalium, **10** (6): 131-173.

KARAMAN Z. 1969. Über einige neue und interessante Pselaphiden Vertreter der Balkanhalbinsel. – Fragmenta balcanica., **7** (3): 9-20.

KARAMAN Z. 1972a. Vier balkanische und eine italienische neue Pselaphiden Arten. – Fragmenta balcanica., **9** (4): 37-51.

KARAMAN Z. 1972b. Neue *Tychus* Arten der Balkanhalbinsel (Col. Pselaphidae). – Nouvelle Revue d'Entomologie, **2** (1): 73-78.

LAPEVA-GJONOVA A. 2004. Pselaphinae (Col. Staphylinidae) from ant nest (Hym. Formicidae) in southwestern Bulgaria. – Acta zoologica bulgarica, **56** (1): 67 – 73.

LÖBL I. 1969. Beitrag zur Kenntnis der Pselaphiden Bulgariens. – Koleopterologische Rundschau, **46-47**: 13-15.

LÖBL I., BESUCHET C. 2004. Pselaphinae. – In: Löbl I., Smetana A. (eds.). Catalogue of the Palearctic Coleoptera, Vol. 2: Hydrophiloidea - Histeroidea - Staphylinoidea, Steenstrup, Apollo Books, 272-329.

MARKOVICH A. 1909. [Contribution for insect fauna in the neighborhood of Razgrad Town]. – Sbornik za umotvorenia, nauka i knizhnina, Sofia, **25**: 3-20. (In Bulgarian).

NETOLITZKY F. 1912. Eine Sammelreise nach Bulgarien. - Koleopterologische Rundschau, Bd. **1**: 156-163.

NEWTON A.F., JR. & CHANDLER D.S. 1989. World Catalog of the Genera of Pselaphidae (Coleoptera). Fieldiana, Zoology (N.S.), **53**: 93 p.

NIKOLOV V., JORDANOVA M. 2002. The mountains in Bulgaria. Prof Marin Drinov Academic Publishing House, Sofia, 266 pp. (in Bulgarian with English abstract).

RAMBOUSEK J. 1909. Příspěvek k poznaní bulharských Pselaphidů a Scydmaenidů. – Časopis československé společnosti entomologické., **6**: 16-24.

REITTER E. 1880. Beitrag zur Kenntnis europäischen Pselaphidae und Scydmaenidae. – Verhandlungen der Zoologische-Botanischen Gesellschaft in Wien, **29**: 533-542.

VŠETEČKA K. 1959. Wissenschaftliche Ergebnisse der zoologischen Expedition des National museums in Prag nach der Türkei (Coleoptera: Pselaphidae, Scydmaenidae). – Acta entomologica nationalis Pragae, **550**: 327-331.

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Подсемейство Pselaphinae (Coleoptera: Staphylinidae) на Югозападна България. I

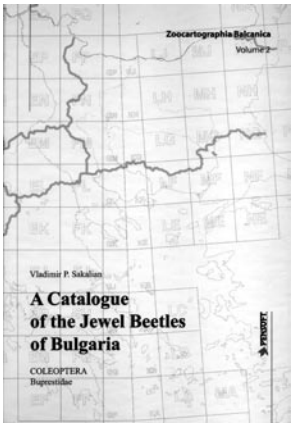
Ростислав БЕКЧИЕВ

(Р е з ю м е)

Настоящата работа има за цел да обобщи наличните данни за подсемейство Pselaphinae в Югозападна България. Включени са всички литературни и непубликувани данни от различни европейски природонаучни музеи и частни колекции. Резултатите са допълнени и от изследванията на автора, проведени в периода 2003-2007 година. Досега в Югозападна България са установени общо 85 вида от подсемейство Pselaphinae (без представителите на супертрибусите Batrisitae и Clavigeritae, които ще бъдат обект на отделна публикация). Родовете *Faronus* и *Reichenbachia*, 17 вида и един подвид са нови за фауната на България. В "Catalogue of the Palearctic Coleoptera" LÖBL & BESUCHET (2004) съобщават 14 вида за България, без да споменават точните им находища. Тук за първи път се публикуват конкретни данни за тях. Осем вида са нови за изследвания регион. За първи път се публикуват данни за Санданско-Петричката котловина (31 вида), Беласица (15 вида) и Малашевска планина (12 вида). Най-голям процент от видовете (34 %) принадлежът към Балканския зоогеографски комплекс, следвани от Европейския (32 %) Северно и Западно палеарктичния (18 %) и Медитеранския комплекс (15 %). Въпреки че изброените видове представляват сравнително голям процент (70 %) от съобщените за България (LÖBL & BESUCHET, 2004), може да се очаква значително увеличаване на техния брой при системно изследване на Рила, Пирин, пограничните планини, както и на котловините на р. Струма и р. Места.

Каталог на бронзовките (Coleoptera: Buprestidae) в България от Владимир Сакалян

Алекси ПОПОВ



SAKALIAN V. 2003. A Catalogue of the Jewel Beetles of Bulgaria (Coleoptera: Buprestidae). – Zoocartographia Balcanica, **2**: 246 pp.

Вторият том на очакваната с интерес поредица Zoocartographia Balcanica на издателство Pensoft е посветен на твърдокрилите насекоми от семейство Buprestidae. Видовото разнообразие на това семейство в България е в общи линии известно, макар че разпространението им в страната е все още недостатъчно проучено. Въпреки това д-р Владимир Сакалян е преценил, че изготвянето на такъв каталог е навременно.

В монографията са включени 198 вида. Броят на сигурно установените в България видове според д-р Сакалян е 180. Останалите 18 вида са публикувани за България, често без находища, а авторът не е виждал екземпляри от страната. Някои от тях може би ще бъдат намерени у нас, но повечето със сигурност не се срещат в България. Анализът на доказаните със сигурност у нас видове показва, че в каталога на OBENBERGER (1932, 1933, 1935, Изв. Цар. природон. инст., **5**: 15-66, **6**: 49-115, **8**: 23-96) и преди него от различни автори са установени 127 сегашни вида. В по-късни публикации на чуждестранни автори (включително и на Obenberger) са добавени 33 вида, а от български автори – още 3 вида. Авторът е публикувал за първи път за България (включително и в каталога) 17 вида.

Таксономичният принос се състои в няколко номенклатурни процедури. Статусът на *Anthaxia nitidula signaticollis* е повишен от подвидов на видов. По мое мнение има почти еднакво основание този таксон да се смята за подвид или за самостоятелен вид, защото *A. nitidula* по всяка вероятност е superspecies in statu nascendi, т.е. в момент на видообразуване. В монографията са обявени 8 синонима на 7 вида. Синонимизирани са 1 вид, 2 подвида и 5 вариетета. От тях 5 подвида и вариетета са от България, 1 вид от Албания, 1 подвид от Далмация и 1 вариетет от Крим. Всички те представляват индивидуални аберации и не излизат извън рамките на вариабилитета на съответния вид. Синонимизирането е извършено след изследване на типусите на вида и единия от подвидовете. Авторът дава таксономични, номенклатурни и фаунистични бележки за 44 вида, в това число и за съмнителните за България 18 вида.

Недостатък на монографията е липсата на пълни синонимни листи на видовете. В синонимните листи са дадени само невалидните имена, синонимите, погрешните определяния и старите комбинации, под които видовете са съобщени за България. Наистина за останалата литература за всеки вид за страната може да се съди по цитирането при изброяването на находищата, но и там липсват страниците на съответното съобщаване на вида. Би било информативно да се добави и една карта на всички находища на семейството в България, за да могат да се направят изводи кои са добре проучените и кои непроучените райони в страната.

Очакваме да бъдат предложени на издателство Pensoft за поредицата Zoocartographia Balcanica и разработки за групи животни в други балкански страни или в целия Балкански полуостров.

Historia naturalis bulgarica, 19: 73-92, 2008

New data on the ground beetles (Coleoptera: Carabidae) of Serbia

Borislav GUÉORGUIEV

GUÉORGUIEV B. 2008. New data on the ground beetles (Coleoptera: Carabidae) of Serbia. – Historia naturalis bulgarica, **19**: 73-92.
Abstract. The study reports 157 species of Carabidae from Serbia. Twenty species, five subgenera, two genera and one tribe are first reported for Serbia. Nine species are first recorded with exact data for the country, and other seven species – for a second time. Totally, 111 species are cited from the Vojvodina Province, 108 of them from the Fruška Gora Mt. as 56 species are first cited for the Vojvodina Province, and other 13 are first recorded for it with exact data.
Key words: Coleoptera, Carabidae, Serbia, Palaearctic region, faunistics, new records.

Introduction

Recently, ĆURČIĆ et al. (2007) took stock of the family Carabidae (excl. Cicindelinae) of Serbia. As a result the fauna of country seems well-studied as 576 species and 167 subspecies from 107 genera have been listed (ibid.). But, as the authors noted (ibid.), some areas as Vojvodina and the southeastern part of the country remain still inadequately studied. On the other hand, after the recent separation of Kosovo, the number of taxa inhabiting Serbia decreased on account of both local endemic taxa and such hitherto recorded only from the former Kosovo Province.

This article reports data about 157 species from the collections of several European museums. Twenty of the species are first established for Serbia, and a great deal of other species is first recorded for the Vojvodina Province.

Material and methods

The material in seven European museums has been investigated. Altogether 1887 specimens of 157 species originating from Serbia have been revised. It is worth noting that among the historical collections that of G. Paganetti-Hummler (1871 – 1949) preserved in MIZ and NMW is of importance for the fauna of the Vojvodina Province of Serbia.

The term "Central Serbia" (= Ужа Србија or Uža Srbija, in Serbian) is used for the region of Central Serbia, the main territory of present Serbia, and the term "Vojvodina Province" is used for the northern part of the country having territorial autonomy (Fig. 1).

Abbreviations used:

BMNH: Natural History Museum, London, United Kingdom

HNHM: Hungarian Natural History Museum, Budapest, Hungary

MNHN: Muséum National d´Histoire Naturelle, Paris, France

MIZ: Museum and Institute of Zoology, Polish Academy of Sciences, Warszawa, Poland

NMW: Naturhistorisches Museum Wien, Vienna, Austria

MNHUB: Museum fur Naturkunde der Humboldt Universität zu Berlin, Berlin, Germany

ZMAN: Zoölogisch Museum Amsterdam, Nederland

s. – specimen/s; m. – male/s; f. – female/s

Fig. 1. Administrative map of Serbia. The black rectangle indicates the position of the Fruška Gora Mt.

List of species

***Leistus* (*Leistus*) *ferrugineus* (Linnaeus, 1758)**

Material examined: "Fruska Gora", 4 s. (MIZ).

Notes. Species already noted for Vojvodina without exact data (ĆURČIĆ et al., 2007: 293). First exact record from the Vojvodina Province.

***Notiophilus biguttatus* (Fabricius, 1779)**

Material examined: "Fruška Gora Syrmien.", 27 s. (MIZ).

Notes. First record from the Vojvodina Province.

***Notiophilus palustris* (Duftschmid, 1812)**

Material examined: "Fruška Gora Syrmien.", 1 s. (MIZ).

Notes. Species already noted for Vojvodina without exact data (ĆURČIĆ et al., 2007: 302). First exact record from the Vojvodina Province.

***Elaphrus* (*Elaphroterus*) *aureus* P.W.J. Müller, 1821**

Material examined: "Jugoslavia Nis. 1957 V.", / "legit dr. Lenczy", 3 s. (HNHM); "Fruška Gora Syrmien.", 23 s. (MIZ).

Notes. First record from the Vojvodina Province.

***Aptinus* (*Aptinus*) *bombarda* (Illiger, 1800)**

Material examined: "Fruška Gora Syrmien", 61 s. (MIZ).

Notes. Species already reported from the Fruška Gora Mt. (ĆURČIĆ et al., 2007: 80).

Brachinus (***Brachinus***) ***elegans*** **Chaudoir, 1842** [= ***ganglbaueri*** **Apfelbeck, 1904**]
Material examined: "Bela Palanka Serbia" / "Coll. Apfelbeck", 1 syntype of *Brachinus ganglbaueri* Apfelbeck, 1904 (HNHM).

Brachinus (***Brachinus***) ***psophia*** **Audinet-Serville, 1821**
Material examined: "Fruska Gora", 1 s. (MIZ); "Fruška Gora Syrmien", 3 s. (MIZ).
Notes. First record from the Vojvodina Province.

Brachinus (***Brachinus***) ***crepitans*** **(Linnaeus, 1758)**
Material examined: "Fruska Gora", 9 s. (MIZ); "Fruška Gora Syrmien", 14 s. (MIZ).
Notes. Species already noted from the Fruška Gora Mt. (ĆURČIĆ et al., 2007: 81).

Clivina collaris **(Herbst, 1784)**
Material examined: "Fruska Gora", 4 s. (MIZ); "Fruška Gora Syrmien", 1 s. (MIZ).
Notes. First record from the Vojvodina Province.

Clivina fossor **(Linnaeus, 1758)**
Material examined: "Fruska Gora", 1 s. (MIZ); "Fruška Gora Syrmien.", 2 s. (MIZ).
Notes. ĆURČIĆ et al. (2007: 304) have already noted it for the Vojvodina Province.

Clivina laevifrons **Chaudoir, 1842**
Material examined: "Serbien Paracin 1918 Dr. Maertens", 2 s. (MNHUB).

Dyschirius (***Dyschiriodes***) ***aeneus*** **(Dejean, 1825)**
Material examined: "Fruska Gora", 4 s. (MIZ).
Notes. First record from the Vojvodina Province.

Dyschirius (***Dyschiriodes***) ***chalybaeus*** **Putzeys, 1846**
Material examined: "Dr. Hensch Ruma Slav.", 1 s. (MNHUB).
Notes. First record from the Vojvodina Province. The Balkan populations of species belong to ssp. *gibbifrons* Apfelbeck, 1899.

Dyschirius (***Dyschiriodes***) ***laeviusculus*** **Putzeys, 1846**
Material examined: "Tschatschak Serbia", 1 s. (MIZ).

Dyschirius (***Eudyschirius***) ***globosus*** **(Herbst, 1784)**
Material examined: "Fruska Gora", 5 s. (MIZ).
Notes. First exact data for Vojvodina. Recently, this species was cited for Vojvodina without exact data (ĆURČIĆ et al., 2007: 308).

Dyschirius (***Paradyschirius***) ***parallelus*** **Motschulsky, 1844**
Material examined: "Serbia, Salac", 2 s. (HNHM).
Notes. The Balkan populations of species belong to ssp. *ruficornis* Putzeys, 1846.

Dicropterus brevipennis **(J. Frivaldszky, 1879)**
Material examined: "Serbia Merkl, 1885", 2 **syntypes** (1 m., 1 f.) of *Scotodipnus serbicus* Ganglbauer (HNHM).
Notes. The Serbian population of species belongs to ssp. *serbicus* (Ganglbauer, 1900).

Asaphidion flavipes **(Linnaeus, 1761)**
Material examined: "Fruska Gora", 16 s. (MIZ); "Fruška Gora Syrmien.", 3 s. (MIZ).
Notes. ĆURČIĆ et al. (2007: 312) have mentioned it for Fruška Gora Mt.

Asaphidion nebulosum **(P. Rossi, 1792)**
Material examined: "Svrligska planina Serbie orientale", 1 s. (NMW).
Notes. The Balkan populations of species belong to ssp. *balcanicum* Netolitzky, 1918.

Asaphidion pallipes **(Duftschmid, 1812)**
Material examined: "Fruska Gora", 2 s. (MIZ); "Fruška Gora Syrmien.", 2 s. (MIZ).
Notes. Species already cited for the Fruška Gora Mt. (ĆURČIĆ et al., 2007: 313).

Bembidion **(*Bembidion*)** ***quadrimaculatum*** **(Linnaeus, 1761)**
Material examined: "Fruška Gora Syrmien.", 16 s. (MIZ); "Jugoslavia Arandjelovac 20.VII-2.VIII '35 H. J. Mac Gillavry", 1 s. (ZMAN).
Notes. ĆURČIĆ et al. (2007: 313) have noted it for the Vojvodina Province (Deliblato Sands).

Bembidion **(*Bembidionetolitzkya*)** ***concoeruleum*** **Netolitzky, 1943**
Material examined: "Serbien Paracin 1918 Dr. Maertens", 1 m. (MNHUB); "Jugoslavia Nis, 1957.III." / "legit Dr. Lenczy", 1 f. (HNHM).
Notes. New species for Serbia. *B. concoeruleum* has been cited for the former Kosovo Province (ĆURČIĆ et al., 2007: 314, as *B. coeruleum* Audinet-Serville, 1821). The previous data on *B. coeruleum* from the Balkan Peninsula concern *B. concoeruleum* (BONAVITA & VIGNA TAGLIANTI, 1993).

Bembidion **(*Bembidionetolitzkya*)** ***geniculatum*** **Heer, 1837**
Material examined: "Fruška Gora Syrmien.", 2 m., 2 f. (MIZ).
Notes. ĆURČIĆ et al. (2007: 314) have already noted it for the Vojvodina Province (Vršac).

Bembidion **(*Bembidionetolitzkya*)** ***tibiale*** **(Duftschmid, 1812)**
Material examined: "Fruška Gora Syrmien.", 4 m., 5 f. (MIZ).
Notes. ĆURČIĆ et al. (2007: 315) have listed it for the Fruška Gora Mt.

Bembidion **(*Bembidionetolitzkya*)** ***varicolor*** **(Fabricius, 1803)**
Material examined: "Fruška Gora Syrmien.", 12 s. (MIZ).
Notes. First record from the Vojvodina Province.

Bembidion **(*Bracteon*)** ***litorale*** **(Olivier, 1790)**
Material examined: "Jugoslavia Nis. 1957 V." / "legit dr. Lenczy", 1 f. (HNHM).
Notes. Species recorded from Niš (MATITS, 1922: 14).

Bembidion **(*Chlorodium*)** ***pygmaeum*** **(Fabricius, 1792)**
Material examined: "Serb. Hlf. Požarevac", 1 s. (NMW).

Bembidion **(*Chlorodium*)** ***splendidum*** **Sturm, 1825**
Material examined: "Serb. Hlf. Požarevac", 1 s. (HNHM).
Notes. Species has already been cited from Požarevac (ĆURČIĆ et al., 2007: 317).

***Bembidion* (*Diplocampa*) *assimile* Gyllenhal, 1810**
Material examined: "Fruška Gora Syrmien.", 1 s. (MIZ); "Jugoslavia Arandjelovac 20.VII-2.VIII '35 H. J. Mac Gillavry", 2 s. (ZMAN).
Notes. ĆURČIĆ et al. (2007: 317) have cited it for Vojvodina (Ruma; Deliblato Sands).

***Bembidion* (*Emphanes*) *latiplaga* Chaudoir, 1850**
Material examined: "Serb. Hlf. Požarevac", 1 s. (NMW).
Notes. Species already cited from Požarevac (ĆURČIĆ et al., 2007: 318).

***Bembidion* (*Eupetedromus*) *dentellum* (Thunberg, 1787)**
Material examined: At least 150 s. labeled "Fruska Gora" or "Fruška Gora Syrmien." (MIZ).
Notes. ĆURČIĆ et al. (2007: 317) have noted it for Vojvodina (Kupinski Kut; Deliblato Sands).

***Bembidion* (*Metallina*) *lampros* (Herbst, 1784)**
Material examined: "Fruška Gora Syrmien.", 37 s. (MIZ).
Notes. Species already cited from Fruška Gora Mt. (ĆURČIĆ et al., 2007: 322).

***Bembidion* (*Metallina*) *properans* (Stephens, 1828)**
Material examined: "Fruška Gora Syrmien.", 16 s. (MIZ).
Notes. ĆURČIĆ et al. (2007: 322) have listed it for Vojvodina (Srbobran; Novi Sad).

***Bembidion* (*Microserrullula*) *quadricolle* (Motschulsky, 1844)**
Material examined: "Serb. Hlf. Požarevac", 1 s. (NMW).
Notes. Species known only from Požarevac (ĆURČIĆ et al., 2007: 323).

***Bembidion* (*Notaphus*) *semipunctatum* (Donovan, 1806)**
Material examined: "Fruška Gora Syrmien.", 5 s. (MIZ); "Jugoslavia Arandjelovac 20.VII-2.VIII '35 H. J. Mac Gillavry", 1 s. (ZMAN).
Notes. ĆURČIĆ et al. (2007: 324) have noted it for Vojvodina (Deliblato Sands).

***Bembidion* (*Ocydromus*) *decorum* (Zenker in Panzer, 1799)**
Material examined: "Fruška Gora Syrmien.", 2 s. (MIZ).
Notes. First record from the Vojvodina Province.

***Bembidion* (*Peryphanes*) *brunnicorne* Dejean, 1831**
Material examined: "Fruška Gora Syrmien.", 2 s. (MIZ); "Jugoslavia Arandjelovac 20.VII-2.VIII '35 H. J. Mac Gillavry", 2 s. (ZMAN).
Notes. First record from the Vojvodina Province.

***Bembidion* (*Trepanes*) *articulatum* (Panzer, 1796)**
Material examined: "Fruška Gora Syrmien.", 8 s. (MIZ).
Notes. First record from the Vojvodina Province.

***Sinechostictus* (*Pseudolimnaeum*) *doderoi* (Ganglbauer, 1891)**
Material examined: "Fruška Gora Syrmien Er. Tippman", 1 s. (NMW).
Notes. First record from the Vojvodina Province and second one from Serbia.

***Sinechostictus* (*Sinechostictus*) *millerianus* (Heyden, 1883)**
Material examined: "Fruška Gora Syrmien.", 3 s. (MIZ).
Notes. First record from the Vojvodina Province. Species was until recently known only from Majdanpek and the Kopaonik Mt. (ĆURČIĆ et al., 2007: 335, as *Bembidion millerianum*).

***Sinechostictus* (*Sinechostictus*) *tarsicus* (Peyron, 1858)**
Material examined: "Tschatschak Serbia", 1 s. (MIZ).
Notes. Species cited from Čačak (ĆURČIĆ et al., 2007: 334, as *Bembidion elongatum* Dejean, 1831).

***Tachyta* (*Tachyta*) *nana* (Gyllenhal, 1810)**
Material examined: "Fruska Gora", 8 s. (MIZ); "Fruška Gora Syrmien.", 10 s. (MIZ).
Notes. First record from the Vojvodina Province.

***Tachyura* (*Tachyura*) *diabrachys* (Kolenati, 1845)**
Material examined: "Serbia", 1 s. (MNHUB); "Priboj", 1 s. (HNHM).
Notes. New species for Serbia.

***Duvalius* (*Duvalius*) *sturanyi* (Apfelbeck, 1904)**
Material examined: "Bobita pl. Serb. 1000 m Nonvill. 9.4.1980", 1 f. (HNHM).
Notes. Species already reported for Bobija Mt. (ĆURČIĆ et al., 2007: 342, as *Balkanoduvalius sturanyi*).

***Duvalius* (*Paraduvalius*) *stankovitchi* (Jeannel, 1924)**
Material examined: 4 s. (incl. 1 **syntype**) (NMW).
Notes. The material studied refers to ssp. *georgevitchi* (Jeannel, 1924).

***Pheggomisetes globiceps* Buresch, 1925**
Material examined: "Odžina rupa Odorovci" / "Serbia or. E. Pterner", 2 s. (HNHM).
Notes. The material studied refers to ssp. *ilandjievi* V.B. Guéorguiev, 1964.

***Pheggomisetes ninae* S.B. Ćurčić, Schönmann, Brajković, B.P.M. Ćurčić & Tomić, 2004**
Material examined: 1 m. **holotype** and 2 **paratypes** (NMW).

***Trechus* (*Trechus*) *cardioderus* Putzeys, 1870**
Material examined: "Fruska Gora", 6 s. (NMW).
Notes. Species reported for Vojvodina from the area of Banat (ĆURČIĆ et al., 2007: 353).

***Trechus* (*Trechus*) *constrictus* Schaum, 1860**
Material examined: "Fruska Gora", 1 m., 1 f. (MIZ); "Fruška Gora Syrmien", 2 f. (MIZ).
Notes. New species for Serbia. The aedeagus of one male has been studied (Figs. 2-3) and compared to that depicted by JEANNEL (1927: 387, Fig. 949). The new locality is interesting since it extends the known range of the species further in the east and adds new data on the species' vertical distribution.

***Trechus* (*Trechus*) *limacodes* Dejean, 1831**
Material examined: "Fruska Gora", 2 m., 1 f. (MIZ); "Fruška Gora Syrmien", 1 f. (MIZ).
Notes. New species for Serbia. The genitalia have not been studied due to absence of

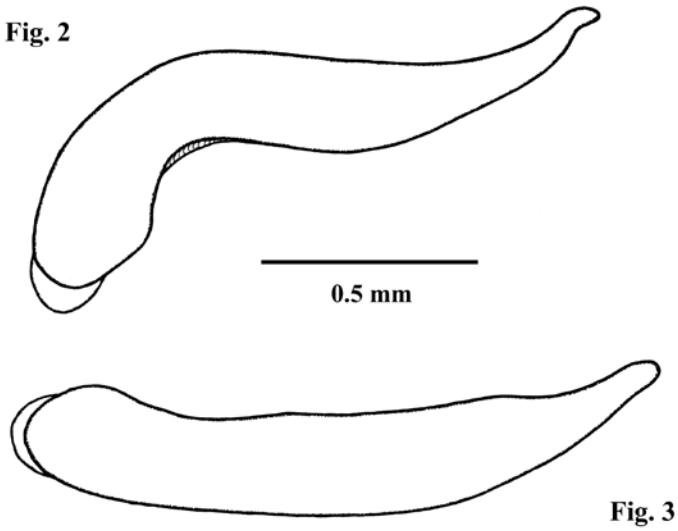


Fig. 2-3. Median lobe of aedeagus of *Trechus constrictus* Schaum (male from Fruška Gora Mt.): Fig. 2: lateral view; Fig. 3: dorsal view

sclerotised structures, and the series is thus provisionally referred to ssp. *jucundus* Csiki, 1912. The new data extend the known range of the species further in the east.

***Trechus* (*Trechus*) *priapus* K. Daniel, 1902**

Material examined: "Reiser 1899 Kopaonik" / "coll. Reitter", 4 **syntypes** (HNHM).

Notes. The population from Kopaonik Mt. forms endemic ssp. *serbicus* Apfelbeck, 1902.

***Trechus* (*Trechus*) *rotundipennis* (Duftschmid, 1812)**

Material examined: "Fruska Gora", 3 m., 1 f. (MIZ).

Notes. New species for Serbia. The aedeagus of one male has been studied (Fig. 4) and compared with that shown by JEANNEL (1927: 430, Fig. 1031). WINKLER (1936) has distinguished three races, and the series from Fruška Gora is thus referred to spp. *cordicollis* Winkler, 1936. The new data extend the range of the species further in the east.

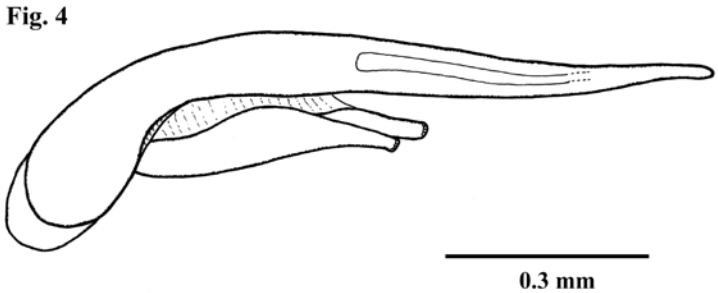


Fig. 4. Median lobe of aedeagus of *Trechus rotundipennis* (Duftschmid), lateral view (male from Fruška Gora Mt.)

Callistus lunatus **(Fabricius, 1775)**
Material examined: "Fruska Gora", 11 s. (MIZ).
Notes. ĆURČIĆ et al. (2007: 149) have listed it for Vojvodina (Morović; Kumane).

Chlaenius (***Chlaeniellus***) ***nigricornis*** **(Fabricius, 1787)**
Material examined: "Fruska Gora", 5 s. (MIZ); "Fruška Gora Syrmien.", 16 s. (MIZ).
Notes. ĆURČIĆ et al. (2007: 150) have cited it from the Vojvodina Province (Kumane).

Chlaenius (***Chlaeniellus***) ***olivieri*** **Crotch, 1871** [= *variegates* **(Geoffroy, 1785)**]
Material examined: "Serbien Paracin 1918 Dr. Maertens", 2 s. (MNHUB).
Notes. Second record from Serbia. Until recently, this species was known only from Dubravica (MATITS, 1922: 37, as *C. variegatus*).

Chlaenius (***Chlaenites***) ***spoliatus*** **(P. Rossi, 1792)**
Material examined: "Fruska Gora", 2 s. (MIZ); "Fruška Gora Syrmien.", 2 s. (MIZ).
Notes. First record from the Vojvodina Province.

Chlaenius (***Chlaenius***) ***festivus*** **(Panzer, 1796)**
Material examined: 45 s. from localities "Fruska Gora", "Fruska Gora Syrmien", and "Fruška Gora Syrmien." (MIZ).
Notes. First record from the Vojvodina Province.

Chlaenius (***Epomis***) ***dejeanii*** **(Dejean, 1831)**
Material examined: "Serbien Paracin 1918 Dr. Maertens", 2 s. (MNHUB); "Avala b. Beograd leg. Bischoff 1930", 11 s. (NMW; MNHUB); "Košutnjak b. Beograd leg. Bischoff 1930", 1 s. (NMW); "Beograd Kalemegdan" / "Scheibel 7.X.31", 4 s. (MNHUB).

Drypta (***Drypta***) ***dentata*** **(P. Rossi, 1790)**
Material examined: 13 s. labeled: "Fruska Gora", "Fruska Gora Syrmien", and "Fruška Gora Syrmien." (MIZ).
Notes. First record from the Vojvodina Province.

Anisodactylus (***Pseudanisodactylus***) ***signatus*** **(Panzer, 1796)**
Material examined: "Serb. Hlf. Požarevac", 1 s. (HNHM).
Notes. Species recorded from Požarevac (ĆURČIĆ et al., 2007: 156).

Diachromus germanus **(Linnaeus, 1758)**
Material examined: "Fruška Gora Syrmien.", 2 s. (MIZ).
Notes. First record from the Vojvodina Province.

Dixus clypeatus **(P. Rossi, 1790)**
Material examined: "Fruška Gora Syrmien.", 1 s. (MIZ).
Notes. ĆURČIĆ et al. (2007: 157) have reported it for Vojvodina (Kumane; Zrenjanin).

Harpalus (***Cryptophonus***) ***tenebrosus*** **Dejean, 1829**
Material examined: "Fruška Gora Syrmien.", 1 s. (MIZ).
Notes. Until recently, this species was known only from Majdanpek (ĆURČIĆ et al., 2007: 159). Second record from Serbia and first one from the Vojvodina Province.

***Harpalus* (*Harpalus*) *atratus* Latreille, 1804**

Material examined: "Fruska Gora Syrmien", 2 s. (MIZ); "Fruška Gora Syrmien.", 3 s. (MIZ).

Notes. First record from the Vojvodina Province.

***Harpalus* (*Harpalus*) *caspius* (Steven, 1806)**

Material examined: "Fruska Gora", 1 m., 2 f. (MIZ); "Fruska Gora Syrmien", 1 s. (MIZ); "Fruška Gora Syrmien.", 1 s. (MIZ).

Notes. ĆURČIĆ et al. (2007: 162) have listed this species for Serbia without exact locality. First exact data for Serbia and first record from the Vojvodina Province.

***Harpalus* (*Harpalus*) *cupreus* Dejean, 1829**

Material examined: "Fruska Gora Syrmien", 1 s. (MIZ).

Notes. Species already cited from the Fruška Gora Mt. (ĆURČIĆ et al., 2007: 163). The Balkan populations of species belong to ssp. *fastuosus* Faldermann, 1836.

***Harpalus* (*Harplaus*) *froelichii* Sturm, 1818**

Material examined: "Fruška Gora Syrmien.", 1 f. (MIZ).

Notes. Species already cited from the Fruška Gora Mt. (ĆURČIĆ et al., 2007: 166).

***Harpalus* (*Harpalus*) *honestus* (Duftschmid, 1812)**

Material examined: "Fruška Gora Syrmien.", 4 s. (MIZ).

Notes. First record from the Vojvodina Province.

***Harpalus* (*Harpalus*) *hospes* Sturm, 1818**

Material examined: "Sikora Serbien 1883.XI.", 1 s. (NMW); "Jugoslavia Nis 1957.IV" / "legit dr. Lenczy", 12 s. (HNHM).

Notes. Species already noted from the vicinity of Niš (ĆURČIĆ et al., 2007: 168).

***Harpalus* (*Harplaus*) *oblitus* Dejean, 1829**

Material examined: "Jamena a. Save leg. Bischoff 1930", 1 s. (MNHUB).

Notes. First record from the Vojvodina Province. The specimen bears a second label which erroneously indicates it as coming from Albania.

***Harpalus* (*Harpalus*) *servus* (Duftschmid, 1812)**

Material examined: "Fruska Gora", 1 f. (MIZ).

Notes. Until recently, this species was known only from Deliblato Sands, the Vojvodina Province (ĆURČIĆ et al., 2007: 174). Second record for Serbia.

***Harpalus* (*Harpalus*) *subcylindricus* Dejean, 1829**

Material examined: "Jugoslavia Nis, 1957 IV." / "legit dr. Lenczy", 2 s. (HNHM).

Notes. Until recently, this species was known only from the Kopaonik Mt. (ĆURČIĆ et al., 2007: 175). Second record for Serbia.

***Harpalus* (*Harpalus*) *taciturnus* Dejean, 1829**

Material examined: "Jugoslavia Nis, 1957.IV" / "legit. dr. Lenczy", 1 s. (HNHM).

Notes. New species for Serbia.

Harpalus (***Harpalus***) ***tardus*** **(Panzer, 1796)**
Material examined: "Fruska Gora", 3 s. (MIZ); "Fruška Gora Syrmien.", 4 s. (MIZ).
Notes. Species noted for the Vojvodina Province (ĆURČIĆ et al., 2007: 176).

Harpalus (***Pseudophonus***) ***calceatus*** **(Duftschmid, 1812)**
Material examined: "Fruska Gora", 2 s. (MIZ); "Fruška Gora Syrmien.", 1 s. (MIZ).
Notes. Species cited for the Vojvodina Province (ĆURČIĆ et al., 2007: 177).

Harpalus (***Semiophonus***) ***signaticornis*** **(Duftschmid, 1812)**
Material examined: "Jugoslavia Nis 1957.IV" / "legit dr. Lenczy", 1 s. (HNHM).
Notes. Species recorded from Niš (ĆURČIĆ et al., 2007: 180).

Ophonus (***Hesperophonus***) ***cribricollis*** **(Dejean, 1829)**
Material examined: "Fruška Gora Syrmien.", 1 s. (MIZ).
Notes. ĆURČIĆ et al. (2007: 181) have cited it for Vojvodina (Bečej; Zrenjanin).

Ophonus (***Metophonus***) ***brevicollis*** **(Audinet-Serville, 1821)**
Material examined: "Fruska Gora", 2 s. (MIZ); "Fruška Gora Syrmien.", 4 s. (MIZ).
Notes. New species for Serbia.

Ophonus (***Metophonus***) ***cordatus*** **(Duftschmid, 1812)**
Material examined: "Serb. Hlf. Ak-Palanka", 1 s. (HNHM); "Jugoslavia Nis, 1957.IV" / "legit dr. Lenczy", 1 s. (HNHM).
Notes. Species already cited from Bela Palanka (= Ak Palanka) (ĆURČIĆ et al., 2007: 182).

Ophonus (***Metophonus***) ***puncticeps*** **Stephens, 1828**
Material examined: "Serbia Vranja" / "Horváth Sept. 1902", 1 s. (HNHM); "Jugoslavia Arandjelovac 20.VII-2.VIII '35 H. J. Mac Gillavry", 9 s. (ZMAN).
Notes. First exact record for Serbia.

Ophonus (***Metophonus***) ***rupicola*** **(Sturm, 1818)**
Material examined: "Fruska Gora", 1 s. (MIZ).
Notes. ĆURČIĆ et al. (2007: 184) have cited it from Vojvodina (Kumane; Stara Pazova).

Ophonus (***Ophonus***) ***stictus*** **Stephens, 1828**
Material examined: "Fruška Gora Syrmien.", 3 s. (MIZ).
Notes. First exact data for both Serbia and the Vojvodina Province. Species noted only from the Vojvodina Province without exact locality (ĆURČIĆ et al., 2007: 186).

Parophonus (***Parophonus***) ***maculicornis*** **(Duftschmid, 1812)**
Material examined: "Fruska Gora", 1 s. (MIZ); "Fruška Gora Syrmien.", 1 s. (MIZ); "Jugoslavia Arandjelovac 20.VII-2.VIII '35 H. J. Mac Gillavry", 1 s. (ZMAN).
Notes. Species cited for Vojvodina only from Kumane (ĆURČIĆ et al., 2007: 187).

Trichotichnus (***Trichotichnus***) ***laevicollis*** **(Duftschmid, 1812)**
Material examined: "Fruska Gora", 1 s. (MIZ).
Notes. New species for Serbia. Species was noted from the former Kosovo Province (ĆURČIĆ et al., 2007: 188). First mention of genus *Trichotichnus* Morawitz, 1863 from Serbia.

***Acupalpus* (*Acupalpus*) *meridianus* (Linnaeus, 1761)**
Material examined: "Fruska Gora", 53 s. (MIZ).
Notes. First exact record from the Vojvodina Province. Species was noted from Vojvodina without exact data (ĆURČIĆ et al., 2007: 189).

***Bradycellus* (*Bradycellus*) *distinctus* (Dejean, 1829)**
Material examined: "Fruska Gora", 1 s. (MIZ).
Notes. New species for Serbia. The right elytron of studied specimen has single minute pore on interval 3, which is abnormal character for *B. distinctus*.

***Stenolophus* (*Stenolophus*) *abdominalis* Gené, 1836**
Material examined: 27 s. labeled "Fruska Gora", "Fruska Gora Syrmien", and "Fruška Gora Syrmien." (MIZ).
Notes. MATITS (1922: 35, as *S. teutonus* var. *abdominalis*) has cited it for the country without exact data. First exact record for Serbia and first one for the Vojvodina Province. The Balkan populations of species refer to ssp. *persicus* Mannerheim, 1844.

***Stenolophus* (*Stenolophus*) *discophorus* (Fischer von Waldheim, 1823)**
Material examined: "Fruška Gora Syrmien.", 2 s. (MIZ).
Notes. Species known from Vojvodina only from Zrenjanin (ĆURČIĆ et al., 2007: 193).

***Stenolophus* (*Stenolophus*) *mixtus* (Herbst, 1784)**
Material examined: "Fruška Gora Syrmien.", 1 s. (MIZ).
Notes. ĆURČIĆ et al. (2007: 193) have cited for Vojvodina (Crvenka; Deliblato Sands).

***Cymindis* (*Cymindis*) *humeralis* (Geoffroy, 1785)**
Material examined: "Fruška Gora Syrmien.", 1 s. (MIZ).
Notes. First record from the Vojvodina Province.

***Cymindis* (*Cymindis*) *lineola* L. Dufour, 1820**
Material examined: "Jugoslavia Nis, 1957.IV" / "legit dr. Lenczy", 3 s. (HNHM).
Notes. New species for Serbia.

***Cymindis* (*Tarsostinus*) *macularis* Fischer von Waldheim, 1824**
Material examined: "Serbien Bor", 1 m. (MNHUB).
Notes. New species for Serbia. First data of *Tarsostinus* Motschulsky, 1864 from Serbia.

***Lebia* (*Lamprias*) *chlorocephala* (J.J. Hoffmann, 1803)**
Material examined: "Fruska Gora", 1 s. (MIZ); "Fruska Gora Syrmien", 1 s. (MIZ).
Notes. First record from the Vojvodina Province.

***Lebia* (*Lebia*) *cruxminor* (Linnaeus, 1758)**
Material examined: "Fruska Gora", 2 s. (MIZ).
Notes. ĆURČIĆ et al. (2007: 203) have indicated it for Vojvodina (Morović; Višnjićevo).

***Badister* (*Badister*) *meridionalis* Puel, 1925**
Material examined: "Jamena a. Save leg. Bischoff 1930", 1 s. (MNHUB); "Jugoslavia Arandjelovac 20.VII-2.VIII '35 H. J. Mac Gillavry", 4 s. (ZMAN).
Notes. New species for Serbia.

***Badister* (*Badister*) *unipustulatus* Bonelli, 1813**

Material examined: 5 s. from localities "Fruska Gora" and "Fruška Gora Syrmien." (MIZ).

Notes. First record from the Vojvodina Province.

***Badister* (*Baudia*) *collaris* Motschulsky, 1844**

Material examined: 14 s. from localities "Fruska Gora", "Fruska Gora Syrmien", and "Fruška Gora Syrmien." (MIZ; NMW).

Notes. First exact data for Serbia and first one from the Vojvodina Province. ĆURČIĆ et al. (2007: 208) have indicated it for the country without exact locality.

***Badister* (*Baudia*) *peltatus* (Panzer, 1796)**

Material examined: "Fruška Gora Syrmien.", 1 s. (MIZ); "Fruskagora Syrmien Paganetti", 1 s. (NMW).

Notes. First exact record for both Serbia and the Vojvodina Province. So far, this species was noted only from Vojvodina without exact data (ĆURČIĆ et al., 2007: 208).

***Badister* (*Trimorphus*) *sodalis* (Duftschmid, 1812)**

Material examined: "Jugoslavia Beograd 23.X.1960 W. Bazyuk leg.", 1 m. (MIZ).

Notes. New species for Serbia. First report of *Trimorphus* Stephens, 1828 from Serbia.

***Omphreus* (*Omphreus*) *bischoffi* Meschnigg, 1934**

Material examined: "Mokra Pl." / "leg. Bischoff Montenegro 1933" / "*Omphreus bischoffi* n. m. type det. Ing. Meschnigg", 1 f. **syntype** (MNHUB).

***Oodes helopioides* (Fabricius, 1792)**

Material examined: "Fruska Gora", 7 s. (MIZ); "Fruška Gora Syrmien.", 5 s. (MIZ).

Notes. First record from the Vojvodina Province.

***Panagaeus cruxmajor* (Linnaeus, 1758)**

Material examined: "Fruska Gora", 8 s. (MIZ); "Fruška Gora Syrmien.", 12 s. (MIZ).

Notes. ĆURČIĆ et al. (2007: 212) have cited it for Vojvodina (Morović; Višnjićevo).

***Perigona* (*Trechicus*) *nigriceps* (Dejean, 1831)**

Material examined. "Jugoslavia Arandjelovac 20.VII-2.VIII '35 H. J. Mac Gillavry", 4 s. (ZMAN).

Notes. New species for Serbia. First report also of the taxa Perigonini G.H. Horn, 1881, *Perigona* Laporte, 1835, and *Trechicus* LeConte, 1853 from Serbia.

***Agonum* (*Agonum*) *sexpunctatum* (Linnaeus, 1758)**

Material examined: "Fruška Gora Syrmien.", 7 s. (MIZ).

Notes. First record from the Vojvodina Province.

***Agonum* (*Europhilus*) *micans* (Nicolai, 1822)**

Material examined: Around 90 s. from localities "Fruska Gora", "Fruska Gora Syrmien", and "Fruška Gora Syrmien." (MIZ).

Notes. First record from the Vojvodina Province.

Limodromus assimilis **(Paykull, 1790)**

Material examined: At least 150 s. from localities "Fruska Gora", "Fruska Gora Syrmien", and "Fruška Gora Syrmien." (MIZ).

Notes. First record from the Vojvodina Province.

Limodromus krynickii **(Sperk, 1835)**

Material examined: Around 90 s. from localities "Fruska Gora", "Fruska Gora Syrmien", and "Fruška Gora Syrmien." (MIZ); "Jamena a. Save leg. Bischoff 1930", 5 s. (MNHUB).

Notes. New species for Serbia.

Limodromus longiventris **(Mannerheim, 1825)**

Material examined: "Fruska Gora", 1 s. (MIZ); "Fruška Gora Syrmien.", 6 s. (MIZ).

Notes. First record from the Vojvodina Province.

Oxypselaphus obscurus **(Herbst, 1784)**

Material examined: 52 s. labelled "Fruska Gora", "Fruska Gora Syrmien", and "Fruška Gora Syrmien." (MIZ).

Notes. First record from the Vojvodina Province.

Platynus livens **(Gyllenhal, 1810)**

Material examined: 73 s. from localities "Fruska Gora", "Fruska Gora Syrmien", and "Fruška Gora Syrmien." (MIZ).

Notes. First record from the Vojvodina Province.

Platynus scrobiculatus **(Fabricius, 1801)**

Material examined: "Fruska Gora", 17 s. (MIZ; NMW); "Fruska gora Syrmien Paganetti", 2 s. (NMW); "Fruška Gora Syrmien.", 60 s. (MIZ).

Notes. ĆURČIĆ et al. (2007: 221) have noted it from Fruška Gora Mt.

Abax **(*Abacopercus*)** ***carinatus*** **(Duftschmid, 1812)**

Material examined: Around 50 s. labeled "Fruska Gora" and "Fruška Gora Syrmien." (MIZ).

Notes. Species cited from the Fruška Gora Mt. (ĆURČIĆ et al., 2007: 224).

Abax **(*Abax*)** ***parallelepipedus*** **(Piller & Mitterpacher, 1783)**

Material examined: "Fruska Gora Syrmien Paganetti", 2 s. (NMW); more than 110 specimens from localities "Fruska Gora" and "Fruška Gora Syrmien." (MIZ).

Notes. Species cited from the Fruška Gora Mt. (ĆURČIĆ et al., 2007: 225).

Abax **(*Abax*)** ***parallelus*** **(Duftschmid, 1812)**

Material examined: "Fruška Gora Syrmien.", 11 s. (MIZ).

Notes. Species cited from the Fruška Gora Mt. (ĆURČIĆ et al., 2007: 226).

Molops **(*Molops*)** ***apfelbecki*** **Ganglbauer, 1891**

- *Molops apfelbecki pseudoalpestris* Mlynář, 1977

Material examined: "Jugoslavia: nr. Belgrade. vi.1938. Grebenchikoff. B.M. 1958-569", 1 m. (BMNH).

- *Molops apfelbecki reiseri* Apfelbeck, 1904

Material examined: "Reiser 1899 Kopaonik" / "Coll. Apfelbeck", **lectotype** and 2 **paralectotypes** of *Molops reiseri* Apfelbeck, 1904 (HNHM); "Reiser 1899 Kopaonik", 1 m., 1 f. (MNHUB); "Yugoslavia: Kopaonik Mts., Subo Rudiste. 1800-2100m. 23-25.v.1936." / "V. & E. Martino. B.M.1938-733", 1 m., 1 f. (BMNH).

***Molops* (*Molops*) *elatus* (Fabricius, 1801)**

Material examined: "Fruska Gora", 1 m., 1 f. (MIZ); "Fruška Gora Syrmien.", 1 m. (MIZ).

Notes. First record from the Vojvodina Province. The population from Fruška Gora belongs to ssp. *plitvicensis* (Heyden, 1880).

***Molops* (*Molops*) *piceus* (Panzer, 1793)**

Material examined: "Fruska Gora", 1 s. (MIZ); "Fruška Gora Syrmien.", 2 s. (MIZ); "Serbia: Lipovica-Avala, 18 km S. of Belgrad. 20-22.iv.1936." / "V. Martino. B.M.1938-461.", 1 m. (BMNH).

Notes. Species cited from Avala and Fruška Gora (ĆURČIĆ et al., 2007: 232).

***Molops* (*Molops*) *rufipes* Chaudoir, 1843**

Material examined: "Yugoslavia: Kopaonik. 1600-1800m. 21.v.1936. K.Martino" / "V. & E. Martino. B.M.1938-733", 1 m. (BMNH).

***Poecilus* (*Poecilus*) *striatopunctatus* (Duftschmid, 1812)**

Material examined: "Serbia: Makis nr. Beograd. 29.iv.1936." / "E. Martino. B.M.1938-461", 2 s. (BMNH).

***Pterostichus* (*Argutor*) *cursor* (Dejean, 1828)**

Material examined: "Fruska Gora", 7 s. (MIZ); "Fruška Gora Syrmien.", 8 s. (MIZ).

Notes. First exact data for Serbia and first record from the Vojvodina Province. So far, it was noted for the country without exact locality (ĆURČIĆ et al., 2007: 243).

***Pterostichus* (*Argutor*) *vernalis* (Panzer, 1796)**

Material examined: "Fruska Gora", 3 s. (MIZ); "Fruška Gora Syrmien.", 4 s. (MIZ).

Notes. First exact record from the Vojvodina Province. Species was noted for Vojvodina without exact locality before (ĆURČIĆ et al., 2007: 244).

***Pterostichus* (*Bothriopterus*) *oblongopunctatus* (Fabricius, 1787)**

Material exmained. "Fruska Gora", 1 s. (MIZ).

Notes. First record from the Vojvodina Province.

***Pterostichus* (*Cheporus*) *burmeisteri* Heer, 1838**

Material exmained. "Fruska Gora", 5 s. (MIZ); "Fruška Gora Syrmien.", 6 s. (MIZ).

Notes. First record from the Vojvodina Province.

***Pterostichus* (*Cophosus*) *cylindricus* (Herbst, 1784)**

Material exmained. "Fruska Gora", 5 s. (MIZ); "Fruška Gora Syrmien.", 2 s. (MIZ).

Notes. Species cited from the Fruška Gora Mt. (ĆURČIĆ et al., 2007: 246).

***Pterostichus* (*Feronidius*) *hungaricus* (Dejean, 1828)**

Material exmained. "Fruska Gora", 6 s. (MIZ); "Fruška Gora Syrmien.", 9 s. (MIZ).

Notes. First record from the Vojvodina Province. It is worth mentioning that three related species, *P. hungaricus*, *P. incommodus* and *P. melas* s.l. inhabit Fruška Gora.

***Pterostichus* (*Feronidius*) *incommodus* Schaum, 1858**

Material exmained. "Serbien Paracin 1918 Dr. Maertens", 2 s. (MNHUB); "Jugoslavia Nis, 1957 III." / "legit dr. Lenczy", 18 s. (HNHM); "Jugoslavia Nis, 1957 IV." / "legit dr. Lenczy", 17 s. (HNHM); "Fruška Gora Syrmien.", 1 m. (MIZ).

Notes. New species for Serbia. Species was recently recorded for the former Kosovo Province (CSIKI, 1940: 216; ĆURČIĆ et al., 2007: 247).

***Pterostichus* (*Feronidius*) *melas* (Creutzer, 1799)**

- *Pterostichus melas melas* (Creutzer, 1799)

Material examined: "Fruska Gora", 32 s. (MIZ); "Fruška Gora Syrmien.", 48 s. (MIZ); "Yugoslavia Beograd, Topcider. 20-21.iii.1936 V. & E. Martino. B.M.1938-733", 1 m. (BMNH).

- *Pterostichus melas depressus* (Dejean, 1828)

Material exmained. "Jugoslavia Nis, 1957 IV." / "legit dr. Lenczy", 2 s. (HNHM); "Jugoslavia Nis, 1957 V." / "legit dr. Lenczy", 2 s. (HNHM).

***Pterostichus* (*Melanius*) *aterrimus* (Herbst, 1784)**

Material exmained. "Fruška Gora Syrmien.", 1 s. (MIZ).

Notes. New species for Serbia.

***Pterostichus* (*Melanius*) *elongatus* (Duftschmid, 1812)**

Material exmained. "Fruska Gora", 1 s. (MIZ).

Notes. First record from the Vojvodina Province.

***Pterostichus* (*Oreophilus*) *jurinei* (Panzer, 1803)**

Material examined: "Fruska Gora", 1 f. (MIZ); "Fruška Gora Syrmien.", 3 m., 6 f. (MIZ).

Notes. New species for Serbia. First report of *Oreophilus* Chaudoir, 1838 from Serbia.

***Pterostichus* (*Oreophilus*) *variolatus* (Dejean, 1828)**

Material examined: "dép. d'Užice Murtenica Planina Serbie occidentale" / "juin 1923 R. Jeannel, A. Magdelaine et A. Winkler", 2 s. (NMW).

Notes. New species for Serbia. The series from Murtenica Mt. is referred to ssp. *carniolicus* Ganglbauer, 1891.

***Pterostichus* (*Parahaptoderus*) *brevis* (Duftschmid, 1812)**

Material examined: "Yugoslavia: Kopaonik Mts., Subo Rudiste. 1800-2100m. 23-25.v.1936." / "V. & E. Martino. B.M.1938-733", 1 s (BMNH).

Notes. Species already recorded from the Kopaonik Mt. (ĆURČIĆ et al., 2007: 251).

***Pterostichus* (*Phonias*) *strenuus* (Panzer, 1796)**

Material exmained. "Fruška Gora Syrmien.", 1 s. (MIZ).

Notes. First exact record from the Vojvodina Province. Species was noted from Vojvodina without exact data (ĆURČIĆ et al., 2007: 252).

***Pterostichus* (*Pseudomaseus*) *gracilis* (Dejean, 1828)**

Material examined: "Fruska Gora", 1 s. (NMW).

Notes. First exact data from the Vojvodina Province. Species was cited for Vojvodina without exact data (ĆURČIĆ et al., 2007: 255).

***Pterostichus* (*Pseudomaseus*) *anthracinus* (Illiger, 1798)**

Material examined. SERBIA. "Jugoslavia Arandjelovac 20.VII-2.VIII '35 H. J. Mac Gillavry", 2 s. (ZMAN).

***Pterostichus* (*Pseudosteropus*) *illigeri* (Panzer, 1803)**

Material examined: "Fruska Gora", 1 s. (MIZ); "Fruška Gora Syrmien", 1 s. (MIZ).

Notes. New species for Serbia. First report of *Pseudosteropus* Chaudoir, 1838 from Serbia. Apart from the first and second specimens properly labeled from Fruška Gora, I have found 15 more specimens, which most probably come from the same locality.

***Pterostichus* (*Pterostichus*) *brucki* Schaum, 1859**

Material examined: "dép. d'Užice Murtenica Planina Serbie occidentale" / "juin 1923 R. Jeannel, A. Magdelaine et A. Winkler", 5 s. (MNHN).

***Pterostichus* (*Pterostichus*) *fasciatopunctatus* (Creutzer, 1799)**

Material examined: "Fruska Gora", 1 s. (MIZ); "Fruška Gora Syrmien.", 9 s. (MIZ).

Notes. Second data for Serbia and first one for the Vojvodina Province. This species was hitherto known only from the Lim River Valley (ĆURČIĆ et al., 2007: 256).

***Platyderus* (*Platyderus*) *rufus* (Duftschmid, 1812)**

Material examined: "Yugoslavia Beograd, Topcider. 20-21.iii.1936 V. & E. Martino. B.M.1938-733", 1 m. (BMNH).

***Laemostenus* (*Laemostenus*) *venustus* (Dejean, 1828)**

Material examined: "Fruska Gora", 1 s. (NMW).

Notes. First exact record for Serbia and first one from the Vojvodina Province. ĆURČIĆ et al. (2007: 268) have indicated it for the country without exact locality.

***Laemostenus* (*Pristonychus*) *punctatus* (Dejean, 1828)**

Material examined: "Fruška Gora Syrmien.", 4 s. (MIZ); "Tschatschak Serbia", 1 s. (NMW).

Notes. Species cited for Fruška Gora (ĆURČIĆ et al., 2007: 269, as *L. terricola* (Herbst, 1784)).

***Amara* (*Amara*) *anthobia* A. Villa & G.B. Villa, 1833**

Material examined: "Fruška Gora Syrmien.", 2 s. (MIZ).

Notes. First exact record from the Vojvodina Province. Species was noted for Vojvodina without exact data (ĆURČIĆ et al., 2007: 272).

***Amara* (*Amara*) *curta* Dejean, 1828**

Material examined: "Fruska Gora", 1 s. (MIZ).

Notes. First record from the Vojvodina Province.

***Amara* (*Amara*) *lunicollis* Schiødte, 1837**
Material examined: "Fruska Gora", 1 s. (MIZ).
Notes. Species cited only from Kruševac (ĆURČIĆ et al., 2007: 276). Second record from Serbia and first one from the Vojvodina Province.

***Amara* (*Amara*) *montivaga* Sturm, 1825**
Material examined: "Fruska Gora Syrmien", 1 s. (MIZ).
Notes. Species cited for the Fruška Gora Mt. (ĆURČIĆ et al., 2007: 276).

***Amara* (*Amara*) *nitida* Sturm, 1825**
Material examined: "Fruska Gora", 1 s. (MIZ).
Notes. First exact record from the Vojvodina Province. Hitherto this species was noted for Vojvodina without exact data (ĆURČIĆ et al., 2007: 277).

***Amara* (*Amara*) *ovata* (Fabricius, 1792)**
Material examined: "Fruška Gora Syrmien.", 6 s. (MIZ).
Notes. First exact record from the Vojvodina Province.

***Amara* (*Amarocelia*) *erratica* (Duftschmid, 1812)**
Material examined: "Serb. Kopaonik Suvo Rudište VII.10, Rambousek", 1 s. (MNHUB).
Notes. Species recorded from Fruška Gora Mt. (ĆURČIĆ et al., 2007: 282).

***Amara* (*Bradytus*) *fulva* (O.F. Müller, 1776)**
Material examined: "Fruska Gora", 6 s. (MIZ); "Fruška Gora Syrmien.", 2 s. (MIZ).
Notes. ĆURČIĆ et al. (2007: 281) have cited it for Vojvodina (Deliblato Sands; Dolovo).

***Amara* (*Curtonotus*) *aulica* (Panzer, 1796)**
Material examined: "Fruska Gora", 1 s. (MIZ); "Fruška Gora Syrmien.", 2 s. (MIZ).
Notes. ĆURČIĆ et al. (2007: 281) have cited it for the Vojvodina Province (Kumane).

***Amara* (*Paracelia*) *quenseli* (Schönherr, 1806)**
Material examined: "Kopaonik Serb. 27.8.24", 1 s. (MNHUB).
Notes. Species noted from the Kopaonik Mt. (ĆURČIĆ et al., 2007: 285).

***Amara* (*Paracelia*) *serdicana* Apfelbeck, 1904**
Material examined: "Serb. Hlf. Niš", 1 s. (MNHUB).
Notes. First exact record from the country.

***Amara* (*Xenocelia*) *ingenua* (Duftschmid, 1812)**
Material examined: "Fruska Gora", 1 s. (MIZ).
Notes. ĆURČIĆ et al. (2007: 283) have listed it for the Vojvodina Province.

***Zabrus* (*Pelor*) *rhodopensis* Apfelbeck, 1904**
Material examined: "Mazedonien Moravatal 3.9.1934 Zwick S.", 1 s. (MNHUB).
Notes. Species cited with exact record only from Surdulica (ĆURČIĆ et al., 2007: 290, as *Z. balcanicus rhodopensis*).

***Zabrus* (*Pelor*) *incrassatus* (Ahrens, 1814)**

Material examined: "Mazedonien Moravatal 3.9.1934 Zwick S.", 1 s. (MNHUB).

Notes. Species known only from South Serbia (ĆURČIĆ et al., 2007: 290).

***Zabrus* (*Zabrus*) *tenebrioides* (Goeze, 1777)**

Material examined: "Fruska Gora", 2 s. (MIZ).

Notes. ĆURČIĆ et al. (2007: 292) have cited it for the Vojvodina Province.

***Polystichus connexus* (Geoffroy, 1785)**

Material examined: "Fruška Gora Syrmien.", 6 s. (MIZ).

Notes. Species noted for Vojvodina without exact data (ĆURČIĆ et al., 2007: 293). First exact record from the Vojvodina Province.

Conclusion

This paper reports 157 species from Serbia. Twenty species, e.g. *Bembidion concoeruleum*, *Tachyura diabrachys*, *Trechus constrictus*, *T. limacodes*, *T. rotundipennis*, *Harpalus taciturnus*, *Ophonus brevicollis*, *Trichotichnus laevicollis*, *Bradycellus distinctus*, *Cymindis lineola*, *C. macularis*, *Badister meridionalis*, *B. sodalis*, *Perigona nigriceps*, *Limodromus krynickii*, *Pterostichus incommodus*, *P. aterrimus*, *P. jurinei*, *P. variolatus*, and *P. illigeri*, are first reported from Serbia. The tribe Perigonini, the genera *Perigona* and *Trichotichnus* as well as the subgenera *Tarsostinus*, *Trimorphus*, *Trechicus*, *Oreophilus*, and *Pseudosteropus* are also first reported for the country. Nine species, e.g. *Harpalus caspius*, *Ophonus puncticeps*, *O. stictus*, *Stenolophus abdominalis*, *Badister collaris*, *B. peltatus*, *Pterostichus cursor*, *Laemostenus venustus*, and *Amara serdicana*, are first reported for Serbia with exact data/localities. Other seven species (*Sinechostictus doderoi*, *Chlaenius olivieri*, *Harpalus tenebrosus*, *H. servus*, *H. subcylindricus*, *Pterostichus fasciatopunctatus*, and *Amara lunicollis*) are confirmed for the fauna, being noted for second time from Serbia. Finally, 111 species are recorded from the Vojvodina Province, as 108 of them come from the Fruška Gora Mt. 56 species are first cited for the Vojvodina Province, and 13 more are first recorded for it with exact data.

Notes on the forest carabid fauna of Fruška Gora Mt.

Fruška Gora is often treated as the northern- and easternmost branch of the Dinaric Mts. (CVETIĆ, SABOVLJEVIĆ, 2005). Based on an analysis of the ranges of 15 typical forest species (from *Leistus* Frölich, *Aptinus* Bonelli, *Trechus* Clairville, *Abax* Bonelli, *Molops* Bonelli, *Cheporus* Latreille, *Oreophilus* Chaudoir, *Pseudosteropus* Chaudoir, and *Pterostichus* Bonelli s.str.), we may conclude that Fruška Gora has played the role of a forest "island" in the South Pannonian Plane and acts as a refuge of East Alpine – West Dinaric forest fauna. The analysis shows that fourteen of the investigated species inhabit the Eastern Alps and the westernmost area of the Balkans but not the main area of the Balkan Peninsula. Most of these species are also distributed more or less widely in Central Europe from France to West Ukraine. This inference is similar to that of SÓLYMOS et al. (2004) that the forest snail fauna of Fruška Gora is composed of general Central European species.

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References

BONAVITA P., VIGNA TAGLIANTI A. 1993. Note sulle specie di *Ocydromus* (*Bembidionetolitzkya*) del gruppo *fasciolatus* (Coleoptera, Carabidae). – Fragmenta entomologica, Roma, **25** (1): 67-90.

CSIKI E. 1940. XVI. Coleopteren. – In: Explorationes zoologicae ab E. Csiki in Albania peractae. A Magyar Tudományos Akadémia Balkán-kutatásaiak Tudományos Eredményei, 208-288.

CVETIĆ T., SABOVLJEVIĆ M. 2005. A contribution to the bryophyte flora of Fruška Gora (Vojvodina, Serbia). – Phytologia balcanica, **11** (1): 35-43.

ĆURČIĆ S. B., BRAJKOVIĆ M. M., ĆURČIĆ B. P. M. 2007. The Carabids of Serbia. Institute of Zoology, Monographs, Vol. XI, Institute of Zoology – Faculty of Biology – University of Belgrade, Committee for Karst and Speleology – Serbian Academy of Sciences and Arts in Belgrade, Department of Conservation Biology, Vegetation- and Landscape Ecology, Faculty of Life Sciences, University of Vienna, and UNESCO MAB Committee Serbia in Belgrade, Belgrade-Vienna, 1083 p., 681 maps.

JEANNEL R. 1927. Monographie des Trechinae. Morphologie comparée et distribution géographique d'un groupe de coléoptères (Deuxième livraison). – L'Abeille, Journal d'Entomologie, **33**: 1-592.

MATITS S. K. 1922. Fauna Serbica. Coleoptera. I. part Pleme: Caraboidea. – Spomenik Srpske Kraljevske Akademije, **57**: 1-50.

SÓLYMOS P., GAUDÉNYI T., DELI T., NAGY A. 2004. Data on the land snail fauna of the Fruska Gora Mountain (Serbia) with some biogeographical remarks. – Malakológiai Tájékoztató Malacological Newsletter, **22**: 149-153.

WINKLER A. 1936. Neue Bembidiini, Trechini und Bathysciinae aus den Ostalpen und dem Balkan. – Koleopterologische Rundschau, **21**: 232-236.

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Нови данни за бръмбарите-бегачи (Coleoptera: Carabidae) на Сърбия

Борислав ГЕОРГИЕВ

(Р е з ю м е)

В колекциите на седем европейски музеи са установени 1887 екземпляра от 157 вида от семейство Carabidae от Сърбия. Двадесет вида, 5 подрода, 2 рода и 1 трибус са нови за фауната на страната, 9 вида са публикувани за първи път с точни находища, а други 7 вида – за втори път за страната. Общо 111 вида са съобщени за автономната провинция Войводина, като 56 вида са нови за нейната фауна, а други 13 са съобщени за нея за първи път с точни находки.

Historia naturalis bulgarica, 19: 93-97, 2008

Cucujidae (Coleoptera: Cucujoidea) – a new family to the fauna of Bulgaria

Borislav GUÉORGUIEV, Danail DOYCHEV, Dinko OVCHAROV

GUÉORGUIEV B., DOYCHEV D., OVCHAROV D. 2008. Cucujidae (Coleoptera: Cucujoidea – a new family to the fauna of Bulgaria. – Historia naturalis bulgarica, **19**: 93-97.
Abstract. The family Cucujidae Latreille, the genus *Cucujus* Fabricius, and the species *C. cinnaberinus* (Scopoli) are recorded for the first time in the fauna of Bulgaria.
Key words: Coleoptera, Cucujidae, *Cucujus*, first records, Bulgaria.

At least 119 families of Coleoptera, in the sense of the classifications of HANSEN (1991), BROWNE & SCHOLTZ (1995) and LAWRENCE & NEWTON (1995) inhabit Bulgaria. Until this communication we had no records for the country only for Cerophytidae, Phloiophilidae, Phloeostichidae, Cucujidae, Prostomidae, and Boridae.

The Cucujidae Latreille, 1802, sometimes called "flat bark beetles" are a family of distinctively flat beetles found worldwide under the bark of dead and living trees. The family is one of the smallest ones and consists of 47 species distributed in four genera (THOMAS, 1999; LEE & SATÔ, 2007). Cucujidae have elongate parallel-side bodies ranging from 6 to 25 mm in length. Most are brown colored, while others are black, reddish or yellow. Head is triangular in shape, with filiform antennae of 11 antennomeres, and large mandibles. The pronotum is narrower than the head. Both larvae and adults live under the bark, otherwise little is known of their habits. The family was formerly larger, with subfamilies Laemophloeinae, Silvanainae, and Passandrinae (and some tenebrionid genera to boot), but recent revision has raised the subfamilies to family status (PAKALUK et al., 1994; LAWRENCE & NEWTON, 1995).

Six species from two genera, e.g. *Cucujus* Fabricius, 1775 (with 2 spp.) and *Pediacus* Schuckard, 1839 (with 4 spp.) are known to inhabit Europe as one of the species is endemic to the Canary Islands (SLIPINSKI, 2004). A single species is reported below for the first time for Bulgaria (Fig. 1). The examined material is preserved in the collection of the National Museum of Natural History, Sofia.

Cucujus Fabricius, 1775

Cucujus cinnaberinus (Scopoli, 1763)

Material examined: Rila Mountain, Borovets (= Tcham Kuria), 30.VIII.1927, P. Drenski leg., 2 adults; Eastern Stara Planina Mt.: Longoza Place, Nova Shipka Village, 23.IX.1949, 2 specimens, under bark of fallen tree, N. Karnoschitzky leg.; Eastern Stara Planina Mt.: Longoza Place, 24.IX.1949, S. Kantardjieva-Minkova leg., 2 adults, under bark of trunks; Maleshevska

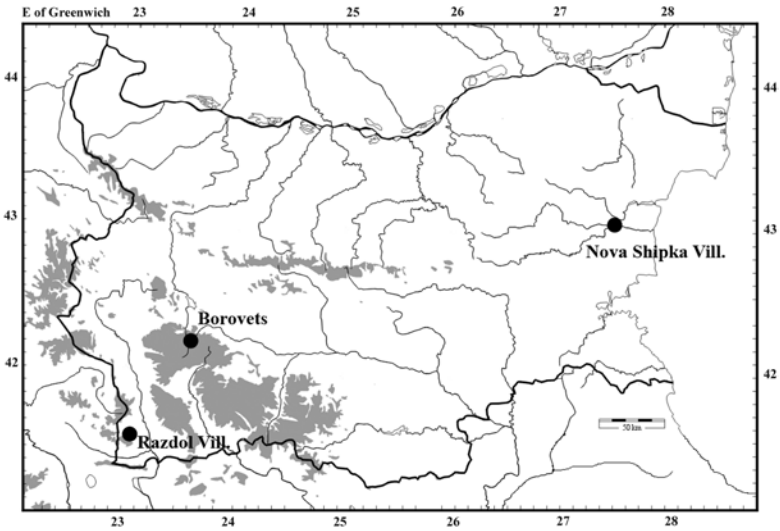

Fig. 1. Localities *Cucujus cinnaberinus*

Planina Mt., 1240 m, 1.7 km east of Razdol Village, 35-year old plantation of *Pinus sylvestris* L., 1 adult in bark beetles slit trap baited with pheromone dispenser for *Orthotomicus erosus* (Woll.) (Coleoptera: Curculionidae: Scolytinae), 11-19.V.2006, D. Doychev leg.; same locality, 2 adults and 10 larvae under bark of dead stem of P. *sylvestris* L., 28.III.2008, D. Doychev leg.; same locality, 1 adult in bark beetles slit trap baited with pheromone dispenser for *Ips sexdentatus* (Börner) (Coleoptera: Curculionidae: Scolytinae), 11-25.IV.2008, D. Doychev leg.; 1 adult, 1 pupa and 10 larvae under bark of dead stem of *P. sylvestris* L., 12.IX.2008, D. Doychev leg. in pupa chamber of *Rhagium inquisitor* L. (Coleoptera: Cerambycidae), the adult specimen was found in abandoned pupa chamber of *Rhagium inquisitor* L. (Coleoptera: Cerambycidae); Maleshevska Planina Mt., 950 m, 5 km E of Razdol Village, 35-year old plantation of *Pinus sylvestris* L., 1 larva and remains (heads, pronotums and elytrae) of adults under bark of dead stems of Scots Pine, 11.IV.2008, D. Doychev leg.; Maleshevska Planina Mt., 840 m, 7 km E of Razdol Village, 35-year old plantation of *Pinus sylvestris* L., 1 larva under bark of dead stems of Scots Pine, 25.IV.2008, D. Doychev leg.

Remarks: Most probably, the materials from the Longoza Place come from one and the same locality. The species is indicated to occur in Norway, Sweden, Finland, Estonia, Latvia, Lithuania, Germany, Poland, Belarus, Ukraine, Russia, France, Switzerland, Austria, Czech Republic, Slovakia, Hungary, Romania, former Yugoslavia (SLIPINSKI, 2004; IUCN, 2007). According to IUCN (2007) the species is treated as vulnerable (VU A1c) - considered to be facing a high risk of extinction in the wild. *C. cinnaberinus* is also included in the Annex II of the Natura 2000 (EC Habitats Directive, 2006) and in the Appendix II (strictly protected fauna species) of the Bern Convention (Convention on the conservation of European wildlife and natural habitats, 01.03.2002). The recently collected larvae, pupa and adults (Figs. 2-4) were found on standing dead trees which were dried two years ago because of attacks of *Ips acuminatus* (Gyll.) (Coleoptera: Curculionidae: Scolytinae).

Fig. 2

Fig. 3

Fig. 4

Figs. 2-4. Photos of larva, pupa, and adult of *Cucujus cinnaberinus*: Fig. 2. Larva, dorsal view; Fig. 3. Pupa, ventral view; Fig. 4. Adult, dorsal view

Another European species from the same genus, *Cucujus haematodes* Erichson, 1845, is recorded for Austria, Czech Republic, Estonia, France, Hungary, Italy, Poland, Romania, Slovakia, Spain, Sweden, Switzerland, Ukraine, Serbia (SLIPINSKI, 2004). According to DAJOZ (2000) this species has not been recorded in the last hundred years, and until now it is not recored from Bulgaria, too.

The species of *Cucujus* live under the decaying bark of deciduous trees, mainly elm, oak, beech, rarely coniferous (ZAHRADNÍK, 1999). The larvae are predators as their habitus resemble that of the larvae of the genus *Pyrochroa* Geoffroy, 1762 (Coleoptera: Pyrochroidae) (DAJOZ, 2000). They are on the way of extinction in Europe (ibid.). The adults of *Cucujus* can be distinguished from those of *Pediacus*, which is likely to be found in Bulgaria, by the characters shown in Table 1.

Table 1.

Status of several characters in the genera *Cucujus* and *Pediacus*

Character	***Cucujus***	***Pediacus***
Temporae	Highly protuberant	Not protuberant
Width of head	Wider than pronotum	Not wider than pronotum
Size of body	Longer than 10.0 mm	Less than 5.0 mm
Antennae	Without club	With 3-segmented club

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References

BROWNE D. J., SCHOLTZ C. H. 1995. Phylogeny of the families of Scarabaeoidea (Coleoptera) based on characters of the hindwing articulation, hindwing base and wing venation. – Systematic Entomology, **20** (3): 145-173.

DAJOZ R. 2000. Insects and forests. The role and diversity of insects in the forest environment. Intercept LTD, I-XII + 668 pp.

HANSEN M. 1991. The hydrophiloid beetles: Phylogeny, classification and a revision of the genera (Coleoptera, Hydrophiloidea). – Bioloske Skrifter, Kongelige Danske Videnskabernes Selskab, **40**: 1-367.

EC Habitats Directive (last update: 10/08/2006). http://ec.europa.eu/environment/nature/ nature_conservation/eu_nature_legislation/habitats_directive/index_en.htm.

IUCN 2007. 2007 IUCN Red List of Threatened Species (last updated: 30/09/2007). http://www.iucnredlist.org/.

LAWRENCE J. F., NEWTON A. F., JR. 1995. Families and subfamilies of Coleoptera (with selected genera, notes, references and data on family-group names). – In: Pakaluk J., Slipinski S. A. (eds.). Biology, Phylogeny, and Classification of Coleoptera: Papers Celebrating the 80th Birthday of Roy A. Crowson. Muzeum i Instytut Zoologii PAN, Warszawa: 779-1006 + 48 pp. of index in reprints.

LEE C.-F., SATÔ M. 2007. A Review of the Genus *Cucujus* Fabricius (Insecta: Cucujoidea: Cucujidae) from Taiwan, Japan and China, with Descriptions of Two New Species and the Larvae of *Cucujus mniszechi* Grouvelle. – Zoological Studies, **46** (3): 311-321.

PAKALUK J., SLIPINSKI S. A., LAWRENCE J. F. 1994. Current classification and family-group names in Cucujoidea (Coleoptera). – Genus, **5**: 223-268.

SLIPINSKI S. A. 2004. Fauna Europaea: Cucujidae. – In: Audisio P. (ed.). Fauna Europaea: Coleoptera 2, Beetles. Fauna Europaea, version 1.3., last update 19 April 2007. http://www.faunaeur.org.

THOMAS M. C. 1999. Family Cucujidae Latreille 1802 (Coleoptera: Cucujoidea). http://www.fsca-dpi.org/Coleoptera/Mike/cucujidae1.htm.

ZAHRADNÍK J. 1999. A field guide in colour to insects. Blitz Editions, 319 p.

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Cucujidae (Coleoptera: Cucujoidea) – ново семейство за фауната на България

Борислав ГЕОРГИЕВ, Данаил ДОЙЧЕВ, Динко ОВЧАРОВ

(Р е з ю м е)

Таксоните Cucujidae Latreille, *Cucujus* Fabricius и *C. cinnaberinus* (Scopoli) се съобщават за пръв път за фауната на България. Представени са белези, позволяващи ефикасно различаването на рода. Видът *C. cinnaberinus* е включен в Червения списък на Международния съюз за защита на природата (IUCN), приложение II на европейската мрежа Natura 2000 и приложение II на Бернската конвенция (Bern Convention). Част от резултатите са получени при работа по проект № ВУ-АН-01/2005 "Видов състав, стопанско значение и възможности за контрол срещу короядите (Coleoptera, Scolytidae), развиващи се в култури от бял бор (*Pinus sylvestris* L.) в района на ДЛ Струмяни, финансиран от Министерството на образованието и науката (МОН) на Република България.

Historia naturalis bulgarica, 19: 98, 2008

Зоологични проучвания в Тунис

Павел СТОЕВ

По покана на ръководителя на отдела за биоразнообразие и биология на популациите към Тунизийския институт за приложни биологични науки д-р Саид Ноуира през месец март 2008 г. пристигнах в Тунис за консултация на докторантката Несрин Акери. Освен обучение, посещението предвиждаше и теренни проучвания за събиране на материал за дисертацията ѝ на тема "Таксономични и биогеографски изследвания на мириаподите (Chilopoda, Diplopoda) на Тунис". Пътуването ми бе финансово подкрепено и от музея "Фийлд" в Чикаго.

В рамките на близо един месец с Несрин изминахме над 3700 km, събрахме материал в 80 работни площадки и изследвахме почвената фауна в различни местообитания: гори от дъб (*Quercus suber*, *Q. faginea*, *Q. ilex*), бор (*Pinus halepensis*), поляни от *Stipa tenacissima*, полупустини и пустини, оазиси с *Pheonix dactylifera*, градини от *Olea europaea*, скалисти морски брегове, пещери и др. Водач ни беше добрият полеви зоолог и запален природолюбител Рида Оуни. Въпреки че основно внимание бе отделено на многоножките, епруветките ни пълниха и паяци, скорпиони, охлюви, бръмбари и всякакви други безгръбначни животни. С помощта на спелеолога Мохамед Тиуери посетихме четири пещери в карстовия масив Заруен (Jebel Zaghouan). Особено интересна се оказа пропастта Сидибугабрин, в която уловихме нови за науката троглобионтен псевдоскорпион от род *Roncus* (Б. Петров, устно съобщение) и многоножка от род *Eupolybothrus*, а малко преди да отпътувам обратно за България от пещерата Грот де ла мин нашият гид донесе нов за науката бръмбар от род *Laemostenus* (Б. Георгиев, устно съобщение).

Специално внимание обърнахме на животните, живеещи в пустинята около Дуз и в оазисите в Тозур, Тамарза и Габес. Пустинята е нетипично местообитание за повечето многоножки, затова с голяма изненада установихме, че сколопендрата *Scolopendra canidens* живее в пясъка на места, където влагата е оскъдна или съвсем липсва. Същият вид установихме и край Доуарет, което представлява най-южната находка на Myriapoda в Тунис. В полупустинните и пустинните области често намирахме под камъни едрите скорпиони *Scorpio maurus* и *Androctonus* sp. Натъкнахме се и на някои африкански земноводни и влечуги – *Rana saharica*, *Tropiocoltes tripolitanus*, *Chalcides ocellatus*, *Acanthodactylus boskianus* и *Hemorrhois algirus*, част от които в момента попълват колекциите на музея.

Фиг. 1. *Macroprotodon cucullatus* в Природен парк Чамби.

Това пътуване в Тунис не бе първото за учени от НПМ. Тунизийската фауна е проучвана още от ст.н.с. д-р Стоице Андреев, който през 1973-1974 г. участва в подводна археологична експедиция, търсеща останки от пристанището на финикийския град Картаген, а през 2006 г. ст.н.с. д-р Стоян Бешков, съвместно с германски лепидоптеролози, колекционира насекоми в различни райони на страната. Освен добрите контакти, които установихме и значителния материал, които ще попълни музейните колекции, важно е да се отбележи, че през последните десетилетия учени от НПМ активно участват в изследването на африканската фауна и това трябва да продължи и занапред.

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Contribution to the taxonomy of *Dicyphus constrictus* (Boheman, 1852) (Heteroptera: Miridae)

Michail JOSIFOV, Nikolay SIMOV

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Abstract. *Dicyphus constrictus eduardi* ssp.n. is described from the high mountains in Bulgaria. The taxon is obligatory stuck to karst regions and is associated with *Geranium sylvaticum* var. *glanduligerum* and *Geranium macrorrhyzum*.

Key words: *Dicyphus constrictus eduardi* ssp.n., Heteroptera, Miridae, Bulgaria

In his work on the taxonomy of the genus *Dicyphus* the prominent European heteropterist Eduard Wagner supposed that the populations of *Dicyphus constrictus* (Boheman, 1852) from the mountains in Middle and Southern Europe most probably represent a separate subspecies (WAGNER, 1951). However, in the same work, or later in his monograph on Mediterranean mirids (WAGNER, 1974) he refrained from designating it as a subspecies, most probably because of lack of sufficient material.

During the investigation of true bug fauna in karst regions in Bulgaria, differences were found between the diagnostic characters mentioned in the description and the diagnosis of *Dicyphus constrictus* (WAGNER, 1952, 1961, 1974; WAGNER & WEBER, 1964) and the characters of Bulgarian specimens. To clarify whether these differences are reliable, we compared material from Northern Europe with material from the high Bulgarian mountains.

Abundant material of *Dicyphus constrictus* collected by the authors in Northern Europe (33 males and 48 females – Bornholm Island, Gudhjem, 20.08.1966, M. Josifov leg.) and in the high Bulgarian mountains, stored at the collections of the Institute of Zoology and National Museum of Natural History – BAS, was investigated. The indices published in Wagner's works (WAGNER, 1951, 1974), and Univariate Statistics – ANOVA test were used. The results give us reason to determine the populations of *Dicyphus constrictus* inhabiting the coniferous belt of high mountains in Bulgaria as a separate subspecies.

***Dicyphus constrictus eduardi* ssp. n.**

Holotype: 1 male, Bulgaria, Rila Mts., 1400 m a.s.l, village of Borovets, Varnika Site, 20.08.1971, leg. M. Josifov

Paratypes: 32 males and 24 females, same locality as holotype; 1 male Bulgaria, Rila Mts., 1400 m a.s.l, village of Borovets, Varnika Site, 31.07. – 03.08.1958, leg. M. Josifov; 5 males and 3 females Bulgaria, Rila Mts., 1400 m a.s.l, village of Borovets, Varnika Site, 06.09.1980, leg. M. Josifov; 7 males and 1 female Bulgaria, Rila Mts., 1400 m a.s.l, village of Borovets, Varnika Site,

16.08.1975, leg. M. Josifov; 13 males and 1 female Bulgaria, Slavyanka/ Alibotush Mts., 1600 m, 12.08.1979, leg. M. Josifov; 1 male and 8 females Bulgaria, Pirin Mts., 1800 m a.s.l, Bayuvi Dupki Reserve, 13.08.1980, leg. M. Josifov; 6 males and 13 females Bulgaria, Pirin Mts., 1800 m a.s.l, Bayuvi Dupki Reserve, 14.08.1979, leg. M. Josifov; 2 males Bulgaria, Pirin Mts., 1800 m a.s.l, near hut P. Yavorov, 30.08.2001, leg. N. Simov; 15 males and 6 females Bulgaria, Pirin Mts., 1800 – 1900 m a.s.l, Bayuvi Dupki Reserve, 31.08.2001, leg. N. Simov

The type material is deposited in the National Museum of Natural History, Sofia (NMNHS).

Diagnosis

Differs from *Dicyphus constrictus constrictus* (Boheman, 1852) by larger body size (Fig. 1 and 2), longer antennae and hind tibia, wider vertex, bigger value of the synthlipsis / eye width ratio, lower value of head width / length first antennal article ratio, bigger value of second antennal article length / head width ratio, bigger value of pronotum width / head width ratio, bigger value of hind tibia length / head width ratio and by differences in the curve of left paramere. For the levels of significance of the differences between the morphometric characters and the ratios used in the comparison of *Dicyphus constrictus eduardi* ssp.n. and *Dicyphus constrictus constrictus* (Boheman, 1852) see Table 4.

Description

Males

Predominantly macropterous. Greenish-yellow, dry specimens yellowish. Parallel. Body about 1.6 (macropterous) as long as hind tibia. Head brown to black. Longitudinal stripes on the frons and vertex, medial longitudinal stripe on the clypeus, spots on maxillary and mandibular

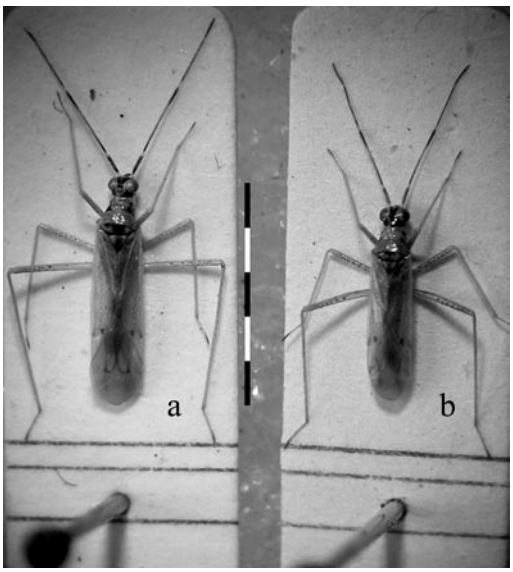

Fig. 1. Males – a: *Dicyphus constrictus eduardi* ssp.n.; b: *Dicyphus constrictus constrictus* (Boheman, 1852). (scale bar, 1mm)

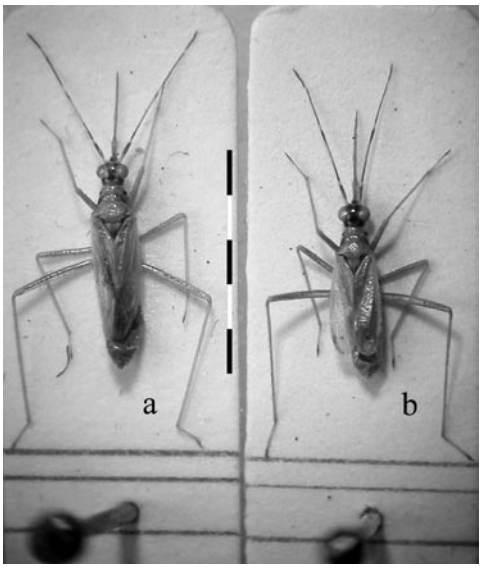

Fig. 2 Females – a: *Dicyphus constrictus eduardi* ssp. n.; b: *Dicyphus constrictus constrictus* (Boheman, 1852). (scale bar, 1mm)

plates (in pale specimens entire maxillary and mandibular plates), gula and bucculae yellowish. Synthlipsis about 1.13 (macropterous), 1.03 (brachypterous) as wide as eye. Head width is about 1.36 (macropterous), 1.77 (brachypterous) bigger than length of 1st antennal article. 1st antennal article reddish, in some dark specimens brown. 2nd antennal article yellowish with brownish apical and basal parts, about 3.14 (macropterous), 2.53 (brachypterous) as long as 1st antennal article and about 1.43 (macropterous), 1.58 (brachypterous) as long as 3rd antennal article. Length of 2nd antennal article about 2.3 (macropterous), 1.43 (brachypterous) bigger than head width and about 1.7 (macropterous), 1.29 (brachypterous) bigger than pronotum width. 3rd and 4th antennal article brownish, except for yellowish basal part of 3rd.

Collar white-grayish with brownish spots on lateral sides.

Pronotum white grayish on dorsal side, about 1.33 (macropterous), 1.11 (brachypterous) as wide as head. Calli yellowish-brown. Propleuron with big brown spots. Scutellum yellowish – brown with brown medial stripe and spots near basal corners.

Hemelytra slightly transparent, grayish-yellow with brownish spots on the apices of exocorium, corium, cuneus and posterior of claval commissure . Membrane transparent, light smoky. Veins yellowish to brown.

Legs yellowish. Femurs with reddish-brown spots on the dorsal side. Apical part of 3rd tarsal article brownish. Hind tibia length about 4.53 (macropterous), 3.36 (brachypterous) times bigger than head width.

Abdomen greenish, in dry specimens yellowish to brownish.

Male genitalia like in nominotypical subspecies with differences in curve of left paramere: see Figs. 3 and 4, see also fig. 12 A, B in WAGNER (1951).

Measurements. – see Table 1 and Table 3.

Females

Predominantly brachyprerous. Greenish-yellow, dry specimens yellowish. Parallel. Body about 1.4 (brachypterous), 1.7 (macropterous) as long as hind tibia. Head brown to black. Longitudinal stripes on the frons and vertex, medial longitudinal stripe on the clypeus, spots on maxillary and mandibular plates (in pale specimens entire maxillary and mandibular plates), gula and bucculae yellowish. Synthlipsis about 1.2 (brachypterous), 1.16 (macropterous) as wide

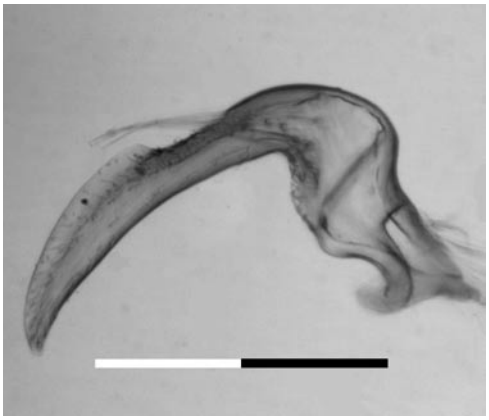

Fig. 3. Left paramere of *Dicyphus constrictus eduardi* ssp.n. (scale bar, 0,1mm)

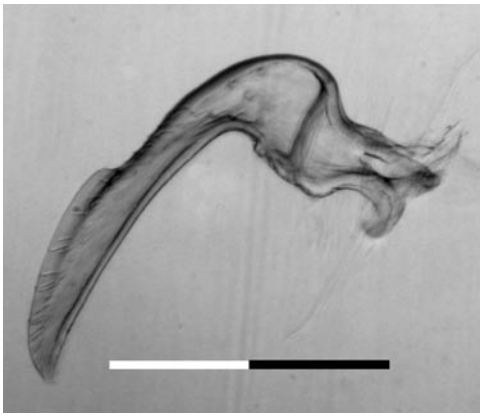

Fig. 4. Left paramere of *Dicyphus constrictus constrictus* (Boheman, 1852). (scale bar, 0,1mm)

Table 1

Measurements (in mm, dried specimens) of macropterous males of *Dicyphus constrictus eduardi* ssp.n. and *Dicyphus constrictus constrictus* (Boheman, 1852).

Males	*Dicyphus constrictus eduardi* ssp. n.					*Dicyphus constrictus constrictus*				
	Valid N	Mean	Min.	Max.	Std. Dev.	Valid N	Mean	Min.	Max.	Std. Dev.
Head width	32	0.691	0.65	0.737	0.025798	21	0.711	0.675	0.762	0.020918
Synthlipsis	32	0.250	0.225	0.275	0.012453	21	0.238	0.225	0.275	0.016527
Length 1st antennal article	32	0.512	0.45	0.575	0.033592	21	0.457	0.425	0.475	0.016091
Length 2nd antennal article	32	1.603	1.375	1.9	0.117217	21	1.482	1.3	1.675	0.093255
Length 3rd antennal article	30	1.123	1	1.3	0.072024	20	1.038	0.975	1.15	0.047642
Length 4th antennal article	32	0.505	0.4	0.6	0.042587	21	0.537	0.45	0.6	0.040788
Eye width	32	0.221	0.206	0.244	0.009971	21	0.237	0.225	0.244	0.006018
Pronotum width	32	0.920	0.85	1.05	0.062681	21	0.912	0.85	1.025	0.043746
Hind tibia length	32	3.139	2.82	3.47	0.141526	20	3.029	2.825	3.25	0.135305
Length 1st tarsal article	19	0.15	0.15	0.15	0	10	0.178	0.15	0.2	0.02189
Length 2nd tarsal article	19	0.480	0.45	0.525	0.022942	12	0.494	0.45	0.525	0.024133
Length 3rd tarsal article	19	0.243	0.225	0.275	0.014006	12	0.244	0.225	0.275	0.021651
Body length	32	5.04	4.5	5.6	0.240777	21	4.619	3.9	5	0.24004
Synthlipsis / eye width	32	1.134	0.974	1.273	0.065163	21	1.005	0.923	1.189	0.072716
Length 2nd antennal article / length 1st antennal article	32	3.136	2.773	3.389	0.13325	21	3.228	2.737	3.555	0.222891
Length 2nd antennal article / length 3rd antennal article	30	1.425	1.311	1.561	0.066049	20	1.436	1.268	1.561	0.069256
Head width / length 1st antennal article	32	1.357	1.227	1.472	0.062192	21	1.547	1.447	1.639	0.051209
Length 2nd antennal article / head width	32	2.301	2.115	2.571	0.10325	21	2.086	1.704	2.285	0.138485
Length 2nd antennal article / pronotum width	32	1.748	1.524	1.861	0.075742	21	1.625	1.268	1.765	0.102995
Pronotum width / head width	32	1.327	1.207	1.5	0.062918	21	1.283	1.214	1.357	0.046059
Body length / hind tibia length	32	1.606	1.446	1.742	0.057364	20	1.533	1.219	1.769	0.095795
Hind tibia length / head width	32	4.526	4.13	4.815	0.166209	20	4.260	3.705	4.536	0.191891

as eye. Head width is about 1.5 (brachypterous), 1.43 (macropterous) bigger than length of 1st antennal article. 1st antennal article reddish, in some dark specimens brown. 2nd antennal article yellowish with brownish apical and basal parts, about 2.68 (brachypterous), 2.81 (macropterous) as long as 1st antennal article and about 1.23 (brachypterous), 1.37 (macropterous) as long as 3rd antennal article. Length of 2nd antennal article about 1.78 (brachypterous), 1.96 (macropterous) bigger than head width and about 1.53 (brachypterous), 1.34 (macropterous) bigger than pronotum width. 3rd and 4th antennal article brownish, except for yellowish basal part of 3rd.

Collar white-grayish with brownish spots on lateral sides.

Pronotum yellowish, about 1.17 (brachyterous), 1.47 (macropterous) as wide as head. Calli yellowish – brown. Propleuron with big brown spots. Scutellum yellowish – brown with brown medial stripe and spots near basal corners.

Hemelytra slightly transparent, greyish – yellow with brownish spots on the apices of exocorium, corium, cuneus (macroperous) and posterior of claval commissure (macroperous). Membrane (macropterous) transparent, light smoky. Veins yellowish to brown.

Legs yellowish. Femurs with reddish-brown spots on the dorsal side. Apical part of 3rd tarsal article brownish. Hind tibia length about 4.03 (brachypterous), 4.2 (macropterous) times bigger than head width.

Abdomen greenish, in dry specimens yellowish to brownish. Dorsal side darker than ventral.

Measurements. – see Table 2 and Table 3.

Etymology

The new subspecies is dedicated to Eduard Wagner who first reported the differences between the populations of *Dicyphus constrictus* from Northern and Southern Europe.

Distribution

Up to now the new subspecies was known only from the Balkan Peninsula – Bulgaria: Rila, Pirin and Slavyanka/ Alibotush Mts. The records of *Dicyphus constrictus* for Bulgarian fauna (JOSIFOV, 1969, 1970, 1976, 1983, 1986, 1990; HEISS & JOSIFOV, 1990; GUEORGUIEV et al., 1998; KERZHNER & JOSIFOV, 1999) refer to new subspecies. Other records from the Balkan countries (Slovenia and Croatia) (GOGALA & MODER, 1960; GOGALA & GOGALA, 1986, 1989; HORVÁTH, 1900) are from territories outside of the Balkan Peninsula. The records from Slovenia (GOGALA & MODER, 1960; GOGALA & GOGALA, 1986, 1989) are erroneous, misidentifications with *Dicyphus stachidis wagneri* Tamanini, 1956 (GOGALA, 2006). The record from Croatia: Breze (Brezje) (HORVÁTH, 1900) is doubtful in the light of the above cited new results of the investigation of mirid fauna of Slovenia (GOGALA, 2006). The locality Brezje is close to Slovenian localities and is at a very low altitude (200 m a.s.l.) compared to the altitude preference of *Dicyphus constrictus* in Southern and Central Europe – above 1000 m (WAGNER, 1958 , 1961; WACHMANN et al., 2004; own data).

Biology

Dicyphus constrictus eduardi ssp. n. is obligatory stuck to karst regions and is associated with *Geranium sylvaticum* var. *glanduligerum* (Fig. 5) and *Geranium macrorrhyzum* (Fig. 6). Records of *Salvia* and *Digitalis* like food plants of *Dicyphus constrictus* in Bulgarian (JOSIFOV, 1969, 1983) are erroneous. In contrast to *Dicyphus constrictus eduardi* ssp. n., a nominotypical subspecies was recorded on *Stachys sylvatica*, *Stachys* sp., *Melandryum* sp., *Lychnis* sp., *Galeopsis*

Table 2

Measurements (in mm, dried specimens) of brachypterous females of *Dicyphus constrictus eduardi* ssp.n. and *Dicyphus constrictus constrictus* (Boheman, 1852).

Females	*Dicyphus constrictus eduardi* ssp. n.					*Dicyphus constrictus constrictus*				
	Valid N	Mean	Min.	Max.	Std. Dev.	Valid N	Mean	Min.	Max.	Std. Dev.
Head width	22	0.764	0.7	0.8	0.027359	19	0.758	0.725	0.775	0.018743
Synthlipsis	24	0.285	0.275	0.3	0.012032	19	0.274	0.25	0.3	0.015829
Length 1st antennal article	23	0.512	0.45	0.575	0.028072	19	0.453	0.425	0.475	0.016446
Length 2nd antennal article	24	1.366	1.25	1.475	0.063764	19	1.291	1.225	1.375	0.038379
Length 3rd antennal article	23	1.111	1.025	1.25	0.063437	19	1	0.95	1.05	0.026352
Length 4th antennal article	21	0.531	0.425	0.625	0.052384	17	0.543	0.475	0.6	0.035984
Eye width	22	0.239	0.212	0.25	0.011751	19	0.241	0.225	0.262	0.008928
Pronotum width	24	0.893	0.825	0.975	0.040027	19	0.825	0.775	0.875	0.028868
Hind tibia length	23	3.114	2.82	3.35	0.132964	19	2.909	2.65	3.075	0.107436
Length 1st tarsal article	11	0.166	0.125	0.2	0.02311	10	0.215	0.175	0.25	0.021082
Length 2nd tarsal article	13	0.481	0.45	0.525	0.020801	10	0.48	0.45	0.5	0.015811
Length 3rd tarsal article	13	0.254	0.225	0.3	0.022468	10	0.25	0.225	0.275	0.016667
Body length	19	4.389	3.7	5.1	0.417525	19	4.021	3.6	4.5	0.320727
Synthlipsis / eye width	22	1.196	1.1	1.333	0.072566	19	1.137	0.952	1.297	0.089193
Length 2nd antennal article / length 1st antennal article	23	2.667	2.523	2.83	0.07254	19	2.783	2.289	3.059	0.211188
Length 2nd antennal article / length 3rd antennal article	23	1.234	1.133	1.39	0.061544	19	1.291	1.219	1.368	0.038474
Head width / length 1st antennal article	22	1.498	1.391	1.67	0.074284	19	1.672	1.526	1.824	0.070613
Length 2nd antennal article / head width	22	1.783	1.645	1.896	0.073244	19	1.704	1.612	1.833	0.05947
Length 2nd antennal article / pronotum width	24	1.533	1.333	1.676	0.075934	19	1.571	1.485	1.67	0.059777
Pronotum width / head width	22	1.168	1.097	1.3	0.047453	19	1.089	1	1.206	0.051235
Body length / hind tibia length	18	1.415	1.209	1.738	0.148342	19	1.382	1.22	1.525	0.095825
Hind tibia length / head width	21	4.057	3.68	4.321	0.176267	19	3.84	3.548	4.103	0.13957

Table 3

Measurements (in mm, dried specimens) of brachypterous males and macropterous females of *Dicyphus constrictus eduardi* ssp.n.

	***Dicyphus constrictus eduardi* ssp. n. brachypterous males**			***Dicyphus constrictus eduardi* ssp. n. macropterous females**		
	Valid N	**Minimum**	**Maximum**	**Valid N**	**Minimum**	**Maximum**
Head width	1	0.663	0.663	1	0.75	0.75
Synthlipsis	1	0.225	0.225	1	0.275	0.275
Length 1st antennal article	1	0.375	0.375	1	0.525	0.525
Length 2nd antennal article	1	0.95	0.95	1	1.475	1.475
Length 3rd antennal article	1	0.55	0.55	1	1.075	1.075
Length 4th antennal article	1	0.35	0.35	1	0.475	0.475
Eye width	1	0.219	0.219	1	0.237	0.237
Pronotum width	1	0.737	0.737	1	1.1	1.1
Hind tibia length	1	2.23	2.23	1	3.15	3.15
Length 1st tarsal article	1	0.15	0.15	1		
Length 2nd tarsal article	1	0.425	0.425	1	0.5	0.5
Length 3rd tarsal article	1	0.225	0.225	1	0.25	0.25
Body length	1	3.7	3.7	1	5.4	5.4
Synthlipsis / eye width	1	1.029	1.029	1	1.158	1.158
Length 2nd antennal article / length 1st antennal article	1	2.533	2.533	1	2.81	2.81
Length 2nd antennal article / length 3rd antennal article	1	1.583	1.583	1	1.372	1.372
Head width / length 1st antennal article	1	1.767	1.767	1	1.428	1.428
Length 2nd antennal article / head width	1	1.434	1.434	1	1.967	1.967
Length 2nd antennal article / pronotum width	1	1.288	1.288	1	1.340	1.340
Pronotum width / head width	1	1.113	1.113	1	1.467	1.467
Body length / hind tibia length	1			1	1.714	1.714
Hind tibia length / head width	1	3.358	3.358	1	4.2	4.2

Table 4

Levels of significance of differences between morphometric characters and ratios used in comparison between *Dicyphus constrictus eduardi* ssp.n. and *Dicyphus constrictus constrictus* (Boheman, 1852).

***Dicyphus constrictus eduardi* ssp.n. / *Dicyphus constrictus constrictus* (Boheman, 1852)**		
	Males	Females
Head width	$p<0.01$	
Synthlipsis	$p<0.01$	$p<0.05$
Length 1st antennal article	$p<0.001$	$p<0.001$
Length 2nd antennal article	$p<0.001$	$p<0.001$
Length 3rd antennal article	$p<0.001$	$p<0.001$
Length 4th antennal article	$p<0.01$	
Eye width	$p<0.001$	
Pronotum width		$p<0.001$
Hind tibia length	$p<0.01$	$p<0.001$
Length 1st tarsal article	$p<0.001$	$p<0.001$
Length 2nd tarsal article		
Length 3rd tarsal article		
Body length	$p<0.001$	$p<0.01$
Synthlipsis / eye width	$p<0.001$	$p<0.05$
Length 2nd antennal article / length 1st antennal article		$p<0.05$
Length 2nd antennal article / length 3rd antennal article		$p<0.01$
Head width / length 1st antennal article	$p<0.001$	$p<0.001$
Length 2nd antennal article / head width	$p<0.001$	$p<0.001$
Length 2nd antennal article / pronotum width	$p<0.001$	
Pronotum width / head width	$p<0.05$	$p<0.001$
Body length / hind tibia length	$p<0.01$	
Hind tibia length / head width	$p<0.001$	$p<0.001$

sp., *Aconitum* sp., *Salvia* sp. and *Urtica* sp. (WAGNER, 1958, 1961, 1974; WACHMANN et al., 2004).

The new subspecies inhabits karsts regions in the coniferous belt (Fig. 7) of the above-cited mountains, between 1400 to 1900 m above sea level.

Fig. 5. *Geranium sylvaticum* var. *glanduligerum* – host plant of *Dicyphus constrictus eduardi* ssp.n.

Fig. 6. *Geranium macrorrhyzum* – host plant of *Dicyphus constrictus eduardi* ssp.n.

Fig. 7. Typical habitat of *Dicyphus constrictus eduardi* ssp.n.

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References:

GOGALA A. 2006. Heteroptera of Slovenia, III: Miridae. – Annales, Annals for Istrian and Mediterranean Studies, Series historia naturalis, **16** (1): 77-112.

GOGALA A., GOGALA M. 1986. Seznam vrst stenic, ugotovljenih v Sloveniji (Check list of bug species recorded in Slovenia) (Insecta: Heteroptera). – Biološki vestnik, **34**: 21-52.

GOGALA A., GOGALA M. 1989. True bugs of Slovenia (Insecta: Heteroptera). – Biološki vestnik, **37**: 11-44.

GOGALA M., MODER A. 1960. Prispevek k poznavanju favne stenic Slovenije (Hemiptera – Heteroptera). – Biološki vestnik, **7**: 85-99.

GEORGIEV V., BESHOVSKI V., RUSSEV B., KUMANSKI K., JOSIFOV M., V SAKALIAN V. 1998. Insects of Bulgaria, Part 1: Odonata, Ephemeroptera, Plecoptera, Homoptera (Auchenorrhyncha), Heteroptera, Coleoptera. – In: Meine C. (ed.). Bulgarian's Biological Diversity: Conservation Status and Needs Assessment, Vol. 1. Washington D. C: Biodiversity Support Program, 163-209.

HEISS E., JOSIFOV M.1990. Vergleichende Untersuchung über Artenspectrum, Zoogeographie und Ökologie der Heteropteren-Fauna in Hochgebirgen Österreichs und Bulgariens. – Berichte des Naturwissenschaftlich-Medizinischen Vereines in Innsbruck, **77**: 123-161.

HORVÁTH G. 1900. Ordo Hemiptera. – In: Paszlavszky, J. (ed.). A Magyar Birodalom Állatvilága (Fauna Regni Hungariae), III. (Arthropoda). A K. M. Természetudományi Társulat, Budapest, 1-72. [1897].

JOSIFOV M. 1969. Artenzusammensetzung und Verbreitung der Insekten von der Ordnung Heteroptera in Bulgarien, Teil III. – Bulletin de l'Institut de Zoologie et Musée, **29**: 29-82. (In Bulgarian with German Summary).

JOSIFOV M. 1970. Ergebnisse der Albanien-Expedition 1961 des Deutschen Entomologischen Institutes. 82. Beitrag. Heteroptera. – Beiträge zur Entomologie, **20** (7/8): 825-956.

JOSIFOV M. 1976. Artbildung bei den Heteropteren im Mittelmeerraum als Folge der postglazialen Disjunktion ihrer Areale. – Acta zoologica bulgarica, **4**: 11-19. (In Bulgarian with German Summary).

JOSIFOV M. 1983. Über die Verbreitung mancher Heteropterenarten auf der Balkanhalbinsel. II. – Acta zoologica bulgarica, **22**: 3-8.

JOSIFOV M. 1986. Verzeichnis der von der Balkanhalbinsel bekannten Heteropterenarten (Insecta, Heteroptera). – Faunistische Abhandlungen Staatliches Museum für Tierkunde in Dresden, **14** (6): 61-93.

JOSIFOV M. 1990. Heteroptera (Insecta, Heteroptera) in the belts of the beech, spruce and the subalpine belt of Vitoša. – Fauna of Southwestern Bulgaria, **3**: 88-101. (In Bulgarian with German Summary).

KERZHNER I. M., JOSIFOV M. 1999. Family Miridae Hahn, 1833 – In: Aukema, B., C. Rieger (eds.). Catalogue of the Heteroptera of the Palaearctic Region, The Netherlands Entomological Society, Amsterdam, Vol. **3**: 1-576.

WACHMANN E., MELBER A., DECKERT J. 2004. Wanzen 2 – Die Tierwelt Deutschlands, **75**: 1-294.

WAGNER E. 1951. Zur Systematik der Gattung *Dicyphus* (Hem. Het. Miridae) – Commentationes Biologicae, **12** (6): 1-36.

WAGNER E. 1952. Blindwanzen oder Miriden. – Die Tierwelt Deutschlands, **41**: 1-218.

WAGNER E. 1958. Deuxiéme contribution à la faune des Hémiptères Héteroptères de France. – Vie et Milieu, **9**: 236-247.

WAGNER E. 1961. Unterordnung: Ungleichflügler, Wanzen, Heteroptera (Hemiptera). – Die Tierwelt Mitteleuropas, **4**: 1-173.

WAGNER E. 1974. Die Miridae Hahn, 1831, des Mittelmeerraumes und der Makaronesischen Inseln (Hemiptera, Heteroptera). Teil 1. – Entomologische Abhandlungen Staatliches Museum für Tierkunde in Dresden, **37**, Suppl. (1970-1971): i-ii , 1-484.

WAGNER E., WEBER H. H. 1964. Héteroptères Miridae. – Faune de France, **67**: 1-592.

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Принос към таксономията на *Dicyphus constrictus* (Boheman, 1852) (Heteroptera: Miridae)

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(Р е з ю м е)

Описва се новия подвид *Dicyphus constrictus eduardi* ssp.n. от Рила, Пирин и Славянка планина. Новия подвид е калцифил, трофично свързан с *Geranium sylvaticum* var. *glanduligerum* и *Geranium macrorrhyzum*. Обитава карстови райони в иглолистния пояс на споменатите планини между 1400 и 1900 m надморска височина.

Historia naturalis bulgarica, 19: 111-114, 2008

First record of *Triturus macedonicus* (Karaman, 1922) (Amphibia: Salamandridae) in Bulgaria

Borislav NAUMOV, Nikolay TZANKOV

NAUMOV B., TZANKOV N. 2008. First record of *Triturus macedonicus* (Karaman, 1922) (Amphibia: Salamandridae) in Bulgaria. – Historia naturalis bulgarica, **19**: 111-114
Abstract. A record of *Triturus macedonicus* (Karaman, 1922) in Slavyanka Mt. (SW Bulgaria) from June 2007 is announced. This is a new species for Bulgarian fauna, and the locality is the easternmost for the species in general. A short description of the habitat and morphology are given.
Key words: *Triturus macedonicus*, distribution, morphology, Slavyanka mountain.

Tirturus cristatus superspecies includes five species which are similar in morphology, and distributed in Europe and West Asia. Two species were already mentioned as occurring in Bulgaria - *Triturus dobrogicus* (Kiritzescu, 1903) and *Triturus karelinii* (Strauch, 1870). The first occurs along the Danube River and the second inhabits the rest of the country. In 2005 *Triturus cristatus* (Laurenti, 1768) was found (TZANKOV & STOYANOV, 2008). In this publication we report an occurrence of the fourth species – *Triturus macedonicus* (Karaman, 1922). The species distribution area includes the western part of the Balkan peninsula (ARNTZEN, 2003). This taxon used to be treated as a subspecies of *Triturus carnifex* (Laurenti, 1768), occupying the eastern part of the distribution range, but was recently elevated to a species status (ARNTZEN et al., 2007). Species distribution of *T. dobrogicus* and *T. karelinii* in Bulgaria according to NAUMOV & STANCHEV (2004) is given in Fig. 1, as well as the known localities of *T. cristatus* and *T. macedonicus*.

During the zoological expedition to Slavyanka Mt. (SW Bulgaria) on June 9, 2007, one female *T. macedonicus* was caught in a small pond, and another 4-5 individuals were observed. The pond is situated in Livade place at 1650 m a.s.l. (UTM: GL18), in a vast meadow in a Bosnian pine (*Pinus heldreichii* Christ.) forest. The pond is approximately 27 x 13 m, with a maximum depth of 0,9 m. About 1/3 of the surface is occupied by *Typha* sp., and the rest by the attached and natant plants and duckweeds. On June 26, 2007, another 16 specimens (9 males and 7 females) were captured, and on August 1, 2007, one male was observed. The same pond is inhabited by *Salamandra salamandra* (Linnaues, 1758) (larvae), *Bombina variegata* (Linnaeus, 1758), *Bufo bufo* (Linnaeus, 1758), *Hyla arborea* (Linnaeus, 1758), *Rana dalmatina* Fitzinger in Bonaparte, 1838 and *Natrix natrix persa* Pallas, 1814.

Standard morphometric measurements were taken before releasing the specimens back. One male and one female were collected and are deposed in the collection of the National Museum of Natural History in Sofia (inventory numbers III-30-41 and III-30-42). Wolterstorff index

(WI) data (WI=100 x fore-limb length/inter-limb length) are presented in Table 1. Our data are in good agreement with the corrected values of WI (for *T. carnifex*), respectively 63.7-67.09 for males and 53.9-59.19 for females (ARNTZEN & WALLIS, 1999). Position of the palatine teeth and throat coloration were studied too. In most of the studied specimens, the two palatine tooth rows are nearly parallel, with a relatively large distance at the distal and proximal ends, and converging at the middle points (Fig. 2). For comparison, a *T. karelinii* specimen from Osogovo Mt. was studied (UTM: FM37). In this species, both rows are close to each other at their distal ends, and well separated at the proximal (BANNIKOV et al., 1977). In all observed specimens the throat coloration was nearly the same – orange/yellow with small dark grey spots. The coloration characteristics of *T. macedonicus* are particularly variable and individuals may resemble any member of the *Triturus cristatus* superspecies (ARNTZEN & WALLIS, 1999).

The new locality in Slavyanka Mt. is the easternmost for the species. The closest known locality of *T. macedonicus* is Livadia at the foot of the mountain Belasitsa (northern Greece) (ARNTZEN & WALLIS, 1999), situated 50 km southwest of the new locality. In Bulgaria the nearby localities of *T. karelinii* are Melnik (UTM: GL09, GEISLER & BRÜHL, 1980) and Levunovo (UTM: FL99, N.Tzankov pers. obs.). From the closest regions in Northern Greece there are two more (Lake Kerkini and Vrodou Mts., reported by JERRENTRUP, 1990 and ASIMAKOPOULOS, 1994 respectively), but no information about the species status was given (*T. karelinii* or *T. macedonicus*). They are cited as *T. cristatus*.

Slavyanka Mt. together with southern Pirin Mt. were proposed for protected areas as part of the NATURA 2000 network. Furthermore, the largest part of the mountain falls within the already existing Alibotush reserve.

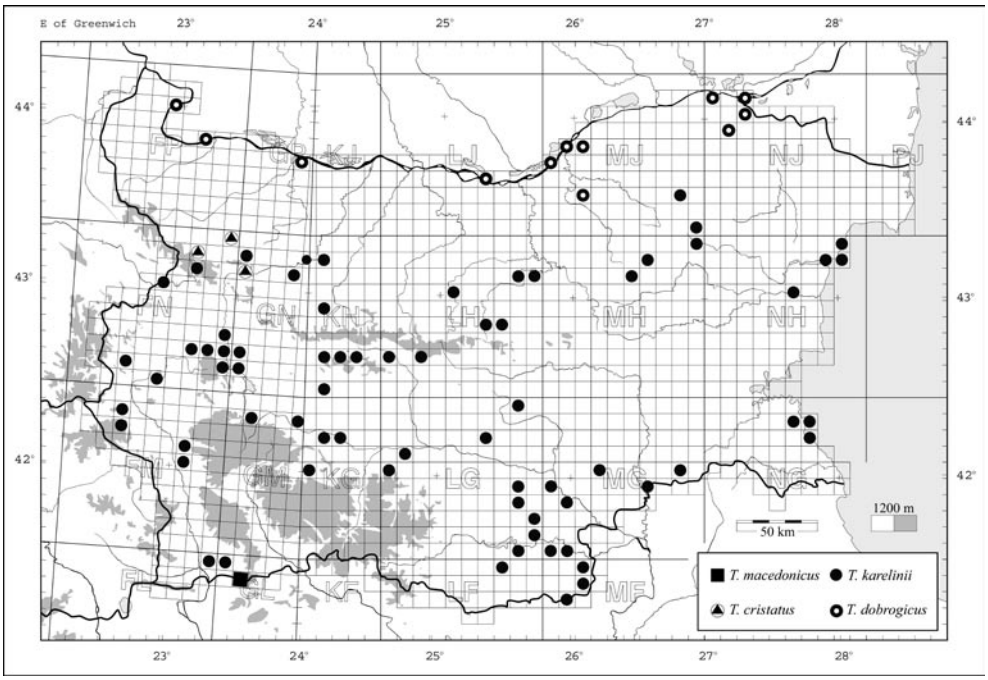

Fig. 1. Distribution of the *Triturus cristatus* superspecies in Bulgaria (UTM grid 10x10 km)

Table 1

Wolterstorff index in both sexes of *T. macedonicus* from Slavyanka Mts., sample size (n), minimum value (min), maximum value (max), arithmetic mean (mean), standard deviation (sd).

Sex	N	Min	Max	Mean	SD
♂♂	9	54.00	66.00	59.56	4.10
♀♀	8	49.00	56.00	52.63	2.50

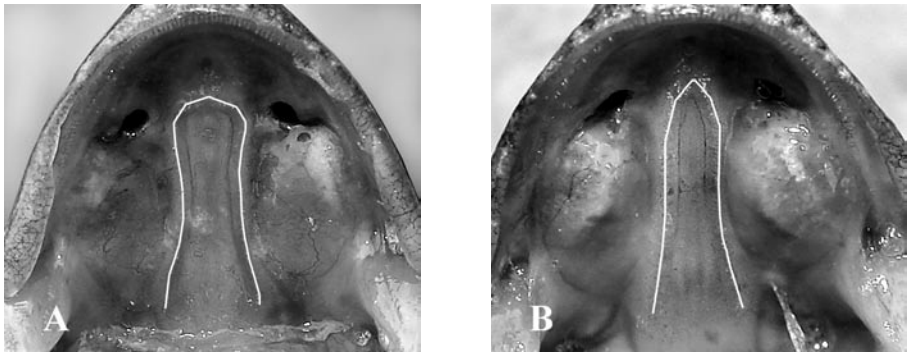

Fig. 2. Palatine teeth form in *T. macedonicus* (A) and *T. karelinii* (B)

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References

ARNTZEN J. 2003. *Triturus cristatus* Superspezies - Kammolch-Artenkreis. – In: Grossenbacher K., Thiesmeier B. (eds.). Handbuch der Reptilien und Amphibien Europas. Band 4/IIA. Schwanzlurche (Urodela) IIA, Aula-Verlag, Wiebelsheim: 421-514.

ARNTZEN J., WALLIS G. 1999. Geographic variation and taxonomy of crested newts (*Triturus cristatus* superspecies): morphological and mitochondrial DNA data. – Contributions to Zoology, **68** (3): 181-203.

ARNTZEN J. W., ESPREGUEIRA THEMUDO G., WIELSTRA B. 2007. The phylogeny of crested newts (*Triturus cristatus* superspecies): nuclear and mitochondrial genetic characters suggest a hard polytomy, in line with the paleogeography of the center of origin. – Contributions to Zoology, **76** (4): 261-278.

ASIMAKOPOULOS B. 1994. Distributional records for the amphibians of the Greek part of Rodope mountain range (east Macedonia and Thrace). – Biologia Gallo-Hellenica, **22**: 23-36.

BANNIKOV A., DAREVSKII I., ISHCHENKO V., RUSTAMOV A., SHCHERBAK N. 1977. Guide to the reptiles and amphibians of the fauna of the USSR. Moscow, Prosveshchenie. 414 p.

GEISSLER L., BRÜHL A. 1980. Zur Herpetofauna Südwest-Bulgariens 2. – Aquarien Terrarien, Leipzig, **27** (7): 246-247.

JERRENTRUP H. 1990. The fauna of Lake Kerkini wetland. – In: Gerakis P. (ed.). Conservation and menagement of Greek wetlands; The IUCN Wetlands Programme: 263-373.

NAUMOV B., STANCHEV M. 2004. Amphibians and reptiles in Bulgaria and Balkan Peninsula. An online edition of the Bulgarian Herpetological Society. Accessible at: www.herpetology.hit.bg

TZANKOV N., STOYANOV A. 2008. *Triturus cristatus* (Laurenti, 1768): a new species for Bulgaria from its southernmost known locality. – Salamandra, **44** (3): 153-162.

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Първо съобщение за намирането на *Triturus macedonicus* (Karaman, 1922) (Amphibia: Salamandridae) в България

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(Р е з ю м е)

Съобщава се за установяването на нов вид за фауната на България – македонски гребенест тритон (*Triturus macedonicus* (Karaman, 1922)). Видът е намерен от авторите в малък водоем в планината Славянка. Дадено е кратко описание на хабитата и морфологията на уловените екземпляри. Представена е карта на разпространението на надвида *Triturus cristatus* в България.

Historia naturalis bulgarica, 19: 115-127, 2008

The effects of a large-scale fire on the demographic structure of a population of Hermann's (*Testudo hermanni boettgeri* Mojsisovics, 1889) and Spur-thighed (*Testudo graeca ibera* Pallas, 1814) tortoises in Eastern Rhodopes Mountains, Bulgaria

Georgi POPGEORGIEV

POPGEORGIEV G. 2008. The effects of a large-scale fire on the demographic structure of a population of Hermann's (*Testudo hermanni boettgeri* Mojsisovics, 1889) and Spur-thighed (*Testudo graeca ibera* Pallas, 1814) tortoises in Eastern Rhodopes Mountains, Bulgaria. – Historia naturalis bulgarica, **19**: 115-127.

Abstract. The numerous fires during the last decade in the area of Eastern Rhodopes (Southeastern Bulgaria) led to large losses of habitat for the Hermann's (*Testudo hermanni*) and Spur-thighed (*Testudo graeca)* tortoises. The data from this study demonstrate that the fire in the vicinity of Kolets village, Haskovo district, has caused large negative impacts on the population of *T. hermanni* and slightly lower impacts on *T. graeca*. The average density of the populations of *T. hermanni* in the burned areas (D = 0.7 ind./ha) is 7.2 times lower than that of the control areas (D = 5.3 ind./ha). The differences in the population densities of *T. graeca* are smaller, but are still well pronounced – the density for the burned area (D = 0.5 ind./ha) is 4.2 times lower than that of the control area (D = 2.0 ind./ha). The recorded mortality due to fire for *T. hermanni* is 64.3 % (♂ = 58.4 %, ♀ = 73.5 %, juv. = 55.6 %) and for *T. graeca* is 18.4 % (♂ = 10.5 %, ♀ = 42.9 %, juv. = 6.3 %).

Key words: *Testudo graeca, Testudo hermanni*, fire, population density

Introduction

Habitat loss due to human activity is a major threat for most land tortoises (BESHKOV, 1984; CHEYLAN, 1984; LAMBERT, 1984; SWINGLAND & KLEMENS, 1989), in conjunction with international trade of these species (LAMBERT, 1980; CHEYLAN, 1984; LAWRENCE, 1987; PÉREZ et al., 2004; ZNARI et al., 2005).

The effects of fire on the biological diversity practically depend on the frequency, intensity, season, and time of day (GILL, 1975; LEMCKERT et al., 2003; WHELAN, 1995). The impacts of fire on vertebrate species (including land tortoises) include direct mortality of individuals (TEVIS, 1956; ERWIN & STASIAK, 1979; HEINRICH & KAUFMAN, 1985; WHELAN, 1995; DUCK et al., 1997; CHEYLAN & POITEVIN, 1998; ESQUE et al., 2003) or indirectly: changes in the vegetation structure (WHELAN, 1995; BROOKS & ESQUE, 2002); decreased refugia availability and subsequent increase in predation risk (EVANS, 1984; ESQUE et al., 2003) and increased daily temperature fluctuations (ESQUE et al., 2003).

The effects of fire on *Testudo hermanni* have been studied by CHEYLAN (1984) in France, STUBBS et al. (1981, 1985) in Greece, FÉLIX et al. (1989) in Spain and HAILEY (2000) in Greece, but we could not find similar studies for *Testudo graeca* in particular.

This research quantifies the effects of a large-scale fire on the demographic structure of populations of *Testudo hermanni boettgeri* and *Testudo graeca ibera* in the Eastern Rhodopes.

The significance of this study is due to the fact that the two tortoise species are of high conservation importance, but the numerous large-scale fires in Eastern Rhopodes during the years 1999-2008 have likely resulted in substantial decrease in their populations.

Materials and methods

The study site is situated in the Haskovo district and is part of the Haskovo and Mechkovo ridges (YORDANOVA, 2004), situated in the northwest of the Eastern Rhodopes, Bulgaria. According to LINGOVA (1981), the average solar radiation is 5500-6000 MJ / m^2 / y and is amongst the highest for the country. The average annual air temperature in the Haskovo region is 12.5 °C, and the average air temperatures in January and July are 0.2 °C and 23.6 °C, respectively. The average soil temperatures at a depth of 10 cm measured for the same region are: 13.9 °C annual, 2.2 °C for January, and 25.3 °C for July (KYUCHUKOVA, ed., 1983). The rainfall has a summer minimum of 146 mm and winter maximum of 186 mm, with average annual rainfall of 668 mm (KOLEVA & PENEVA, eds., 1990).

The fire next to Kolets village (WGS 84 coordinates N41 51.930 E25 20.995) started on 31.08.2003 and continued until 3.09.2003, burning a total area of 352.1 ha (data obtained from Regional Forestry Board, Kurdzhali; Fig. 1). This fire has been of high intensity in the core areas, and only in the periphery it has been of low intensity.

Transects were chosen in such a way as to allow sampling of different parts of the burned area (Fig. 1.). Transects 1 and 2 are located on the east and west side of stream I, which dries out during the summer months. The surrounding vegetation is comprised of single trees of *Quercus cerris, Q. frainetto, Fraxinus ornus,* and bushes of *Paliurus spina-christi*. The grass reaches heights of 30-40 cm, and green patches persist during the whole summer. Transect 3 is located next to stream II. The vegetation composition is analogous to the one found at the first two transects. Transect 4 is perpendicular to the stream and passes through a thin forest of *Q. cerris, Q. frainetto, F. ornus*, and single *P. spina-christi*. Grass cover attains heights of 30-40 cm and dries at the end of the spring. The fire is of high intensity at all these transects. Transect 5 is situated west of stream III. Vegetation is dominated by *P. spina-christi* and *Carpinus orientalis* shrubs, as well as single *F. ornus*, *Q. cerris and Q. frainetto* trees. The stream is dry during almost all months of the year. This transect falls at the edge of the fire, which has been of low intensity. Transect 6 is situated on both sides of a road, in an old-growth oak forest comprised of *Q. cerris, Q. frainetto*, and single *Cornus mas* and *Carpinus orientalis* bushes. During the summer of 2004 the burned wood has been cut down by Regional Forestry Board, Kurdzhali by hired foresters. Six transects were established in the control area as well. Transect 7 is situated east of stream III, sector A; transect 8 – in sector B, transects 9 and 10 are in sector C, and transects 11 and 12 are in sector D (Fig. 1). The vegetation is identical with the one found in the burn areas.

The study area was visited between 2004 and 2006, with one spring (April – May) and one summer visitation (August – September). Each captured individual was marked by a unique

Fig. 1. Map of the study site, indicating the location of Kolets village, the fire of 2003, and the control sample areas

combination of filed marginal notches (BURY & LUCKENBACH, 1977; STUBBS et al., 1984) using a hand saw. This method allows for 1499 different combinations. For each individual the following data were collected: date, precise time, location of the observation (using a Garmin eTrex Summit GPS, with a 5 m accuracy), surrounding vegetation, sex, age, mass to the nearest 0,5 g, straight carapace length (SCL), maximum height from the plastron to the highest point on the carapace, carapace width, and plastron length along the mid-body. Measurements were taken using calipers with 0,5 mm accuracy. Tortoises with SCL less than 10 cm were considered juvenile (STUBBS et al., 1984).

The relative density of the tortoises (D) was calculated based on the transect method (BUCKLAND et al., 1993) using program DISTANCE 5.0 Release 2 (THOMAS et al. 2006). The width of the transect was chosen to be 10 m (5 m on each side). In calculating the effective strip width (ESW), the precise distance to each found individual was measured. The average length of the transects in the burned area is 2500 m, and in the control it is 2000 m. The data were calculated using a confidence interval (CI) of 95 % and presented with coefficient of variation (CV %). The analysis includes a model of uniform key function, chosen based on the minimum value of Akaike's Information Criterion (AKAIKE, 1973).

The statistical calculations were performed using program Statistica for Windows, Release 5.1 (STATSOFT, Inc., 1996). Data were compared using a parametric t-test for independent variables. Data were analyzed for normality of the distribution using the Shapiro-Wilk test (SHAPIRO et al., 1968), and then normalized using the function log (x+1). Results were significant at $p<0.05$ and $\alpha = 5\%$.

Results

Population density

The total number of observations of live Hermann's tortoises in the burned areas was 77, while in the control area their number was 188. The total number of live Spur-thighed tortoises observed was 48 in the burned areas and 96 for the control. The effective strip width (ESW) for *T. hermanni* is 4 m in the burned area and 2.5 m in the control. For *T. graeca* ESW is 3.7 m for the burned area and 3.3 m for the control. The visibility in the burned area is greater than in the control due to the sparse vegetation resulting from the fire. The obtained data for the population density of *T. hermanni* show a major difference between burned and control areas for all years of the study (Tables 1 and 2). Averaged for the three years, the density of the Hermann's tortoise in the control area (D = 5.3 individuals per ha; CI = 4.2-6.7) was 7.2 times higher than the density for the burned area (D = 0.7 ind. / ha; CI = 0.4 – 1.2). This difference is supported by the results from the t-test – the average for all years t = 4.21 (p = 0.002; Table 3). *T. graeca* had a lower average density compared to *T. hermanni* in both study areas, but the difference between the relative density between burned / control for the different years is not so well pronounced. An overlap between the confidence intervals is observed (Table 1), but the average density for the three years is clearly distinct: $D_{(burn)} =$ 0.5 ind. / ha (CI = 0.3-0.9) and $D_{(contol)} =$ 2.0 ind. / ha (CI = 1.4-3.0). The only statistically significant difference from the t-test is for 2006 (t = 2.60, p = 0.026).

In the control area, the population density for both species was lower during 2004, compared to the densities for 2005 and 2006 (Table 1).

Comparing the effects of the fire on the density by sex (Table 2), for *T. hermanni* the most affected are the females ($D_{(burn)} =$ 0.2 ind. / ha and $D_{(control)} =$ 2.0 ind. / ha, t = 6.71 and p = 0,0001) and the juveniles ($D_{(burn)} =$ 0.1 ind. / ha and $D_{(control)} =$ 1.4 ind. / ha, t = 2.9 and p = 0.0158). For *T. graeca* the most significant is the difference for the females ($D_{(burn)}$ = 0.1 ind. / ha and $D_{(control)}$

Table 1

Tortoise population densities in the burned and control area. CV stands for coefficient of variation and CI for a 95 % confidence interval

Year	Area	Density of *Testudo hermanni* (n = 77 for burn and n = 188 for control).			Density of *Testudo graeca* (n = 48 for burn and n = 96 for control)		
		Ind./ha	CV (%)	95 % CI	Ind./ha	CV (%)	95 % CI
2004	Burn	0.6	36.7	0.3 – 1.2	0.5	34.5	0.3 – 1.1
2004	Control	3.5	22. 9	2.2 – 5.6	1.3	36.8	0.6 – 2.7
2005	Burn	1.2	27.1	0.7 – 2.1	0.5	31.1	0.3 – 1.1
2005	Control	7.5	15.8	5.4 – 10.4	2.1	42	0.9 – 5.0
2006	Burn	0.6	58	0.2 – 2.0	0.3	49.5	0.1 – 0.9
2006	Control	4.1	15.7	3.0 – 6.0	2.3	23.1	1.4 – 3.8
Avg.	Burn	0.7	25	0.4 – 1.2	0.5	26.9	0.3 – 0.9
Avg.	Control	5.3	11.9	4.2 – 6.7	2.0	18.7	1.4 – 3.0

Table 2

Tortoise population densities in the burned and control area, by sex. CV stands for coefficient of variation and CI for a 95 % confidence interval

Sex	Area	Density of *Testudo hermanni* (n = 77 for burn and n = 188 for control).			Density of *Testudo graeca* (n = 48 for burn and n = 96 for control)		
		Ind./ha	CV (%)	95 % CI	Ind./ha	CV (%)	95 % CI
♂	Burn	0.4	29	0.2 – 0.7	0.2	36.7	0.1 – 0.4
♂	Control	1.9	15.64	1.4 – 2.6	0.8	24.8	0.5 – 1.4
♀	Burn	0.2	39.9	0.1 – 0.5	0.1	43.8	0.05 – 0.3
♀	Control	2.0	16.38	1.4 – 2.7	0.7	28	0.4 – 1.2
Juvenile	Burn	0.1	69.4	0.01 – 0.4	0.2	43.1	0.1 – 0.5
Juvenile	Control	1.4	22.13	0.9 – 2.1	0.5	49	0.4 – 1.2

Table 3

Differences in tortoise abundance for 1000 meters by year and sex in burn / control (analyzed using a t-test for independent variables). * denotes significant results for p < 0.05, α=5%.

Control vs. burn	*Testudo hermanni*			*Testudo graeca*		
	Valid N (transects)	t-value	p	Valid N (transects)	t-value	p
2004 vs. 2004	6	2.61	0.0261*	6	1.38	0.1977
2005 vs. 2005	6	4.05	0.0023*	6	1.52	0.1590
2006 vs. 2006	6	2.81	0.0186*	6	2.60	0.0263*
Avg. (2004 -2006) vs. Avg. (2004 -2006)	6	4.21	0.0018*	6	1.92	0.0834
♂ vs. ♂	6	2.06	0.0665	6	2.33	0.0424*
♀ vs. ♀	6	6.71	0.0001*	6	2.33	0.0420*
Juvenile vs. Juvenile	6	2.90	0.0158*	6	0.22	0.8298

= 0.7 ind. / ha, t = 2.33 and p = 0.0420) and males ($D_{(burn)}$ = 0.2 ind. / ha and $D_{(control)}$ = 0.8 ind. / ha, t = 2.33 and p = 0.0424).

Sex and age structure

The total number of all *T. hermanni* (found both dead and alive) in the burn area was 199 individuals, males being more numerous (1.1:1; n = 199; ♂ = 89, ♀ = 83, juv. = 27). In the control the females are only slightly more numerous (1.04:1; n = 176; ♂ = 68, ♀ = 71, juv. = 37).

After the fire the ratio changes substantially: for the live individuals the males are more numerous (1.7:1; n = 71; ♂ = 37, ♀ = 22, juv. = 12; Table 4), and within the dead individuals the females are more numerous (1:1.2; n = 128; ♂ = 52, ♀ = 61, juv. = 15). The ratio adults : juvenile individuals before the fire is 6.4:1, and after the disaster this ratio is 4.9:1 for the live individuals and 7.5:1 for the dead ones. In the control area, the ratio is 3.4:1.

For *T. graeca*, before the fire the males are more numerous 1.4:1 (n = 49; ♂ = 19, ♀ = 14, juv. = 16), and in the control it is 1.32:1 (n = 77; ♂ = 37, ♀ = 28, juv. = 12). The live male individuals are more numerous after the fire as well (2.1:1; n = 40; ♂ = 17, ♀ = 8, juv. = 15). Within the found dead individuals, the females are more numerous (3:1; n = 9; ♂ = 2, ♀ = 6, juv. = 2). The ratio adult : juvenile *T. graeca* before the fire is 2.75:1, and after the fire this ratio is 1.7:1 for the live captures, and 4:1 for the dead individuals.

It should be noted that the age structure of *T. hermanni* has been impacted differently in the different burn areas. In the low intensity burn area (transect 5; Tables 4 and 5) the level of survival of juveniles is the highest – 41% (5 ind.) from all juveniles have been found there. No such relationship has been established for *T. graeca* however.

Mortality caused by fire

The total number of found dead individuals after the fire is 137: 128 *T. hermanni* and 9 *T. graeca*. From the data presented in table 4 it is clear that in both species the females had the highest mortality – 73.5 % for *T. hermanni* and 42.9 % for *T. graeca* (n = 199 and 49, respectively, including both live and dead individuals from the burn area). Considerable differences can be noted in mortality based on tortoise' size (Fig. 3 and 4). For *T. hermanni* the highest mortality was experienced by individuals with SCL ≤ 60 mm (66.7 % mortality) and those with the largest size of SCL between 180 and 200 mm (100 % mortality). The number of found dead individuals of *T. graeca* is insufficiently low (n = 9) to correlate size and mortality. The mortality was highest for individuals with SCL ≤ 40 mm (100 % mortality) and those with the largest size of SCL between 200 and 230 mm (50 % mortality).

The mortality of *T. hermanni* is highest in transect 4 – 92.6 % (situated in the middle of the burned area) and lowest in transect 5 – 12.5 % (situated on the edge of the burned area; table 4). The mortality of *T. graeca* is the highest in transect 1 – 27.3 % and lowest in transect 2 – 11.1 % (situated in the core of the burned area; table 5). Transects 4 and 6 were not considered because only one live individual was found in each.

From the surviving individuals after the disaster a large portion of the tortoises had body damaged caused by the fire: 21 % (n = 15) of *T. hermanni* and 22.5 % (n = 9) of *T. graeca*.

Natural mortality

From all found Hermann's tortoises in the control (n = 180) 4 individuals (♀ = 2, ♂ = 1, juv. = 1) were dead, a mortality of 2.2 %. For the Spur-thighed tortoise the total number of individuals found is 79. 2 of which were dead (♀ = 1, ♂ = 1), a mortality of 2.5 %. In the burn area old pieces were found of 4 Hermann's tortoises that died before the disaster, that have not been included in the above analyses. Other dead tortoises that died from natural causes during this study were not detected.

Table 4

Number of found individuals of *Testudo hermanni* and the ratio (%) dead : alive by transect. Recaptured individuals (n = 6) were excluded

Transect №	Alive individuals				Dead individuals				% mortality (dead : alive)			
	♂	♀	juv.	Total	♂	♀	juv.	Total	♂	♀	juv.	Total
1	5	4	1	10	10	13	3	26	66.7	76.5	75.0	72.2
2	7	4	1	12	5	14	3	22	41.7	77.8	75.0	64.7
3	7	2	2	11	19	9	6	34	73.1	81.8	75.0	75.6
4	0	1	1	2	10	13	2	25	100.0	92.9	66.7	92.6
5	13	10	5	28	1	2	1	4	7.1	16.7	16.7	12.5
6	5	1	2	8	7	10	0	17	58.3	90.9	0.0	68.0
Total:	**37**	**22**	**12**	**71**	**52**	**61**	**15**	**128**	**58.4**	**73.5**	**55.6**	64.3

Table 5

Number of found individuals of *Testudo graeca* and the ratio (%) dead: alive by transect. Recaptured individuals (n = 8) were excluded

Transect №	Alive individuals				Dead Individuals				% mortality (dead : alive)			
	♂	♀	juv.	Total	♂	♀	juv.	Total	♂	♀	juv.	Total
1	3	2	3	8	1	2	0	3	25.0	50.0	0.0	27.3
2	2	3	3	8	0	1	0	1	0.0	25.0	0.0	11.1
3	2	1	4	7	0	1	1	2	0.0	50.0	20.0	22.2
4	0	0	1	1	0	0	0	0	0.0	0.0	0.0	0.0
5	9	2	4	15	1	2	0	3	10.0	50.0	0.0	16.7
6	1	0	0	1	0	0	0	0	0.0	0.0	0.0	0.0
Total:	**17**	**8**	**15**	**40**	**2**	**6**	**1**	**9**	**10.5**	**42.9**	**6.3**	**18.4**

Discussion

Several studies demonstrate that some reptiles are able to survive fires, depending on the structure of the habitat, the season and time of day, the intensity and length of fire (KAHN, 1960; VOGL, 1973; ERWIN & STASIAK, 1979).

The data from this study demonstrate that fire had a strong negative effect on a population of *Testudo hermanni boettgeri* and a slightly lesser effect on a *Testudo graeca ibera* population. This is supported by the large differences in the mean density of populations of *T. hermanni* compared to a control – for the burned area the density is 7.2 times lower than that of the control. The differences in the density of *T. graeca* populations are smaller, but still well defined – the density in the burned area is 4.2 lower than that of the control.

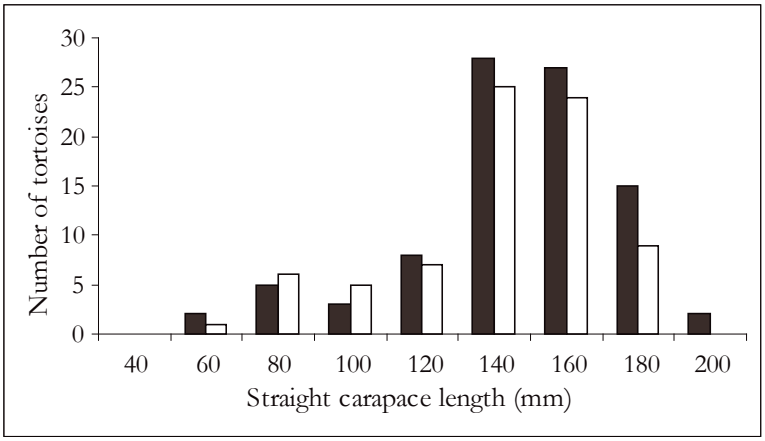

Fig. 2. Distribution of live and dead individuals based on carapace length (SCL) for *Testudo hermanni* in burned area. □ – live individuals; ■ – dead individuals

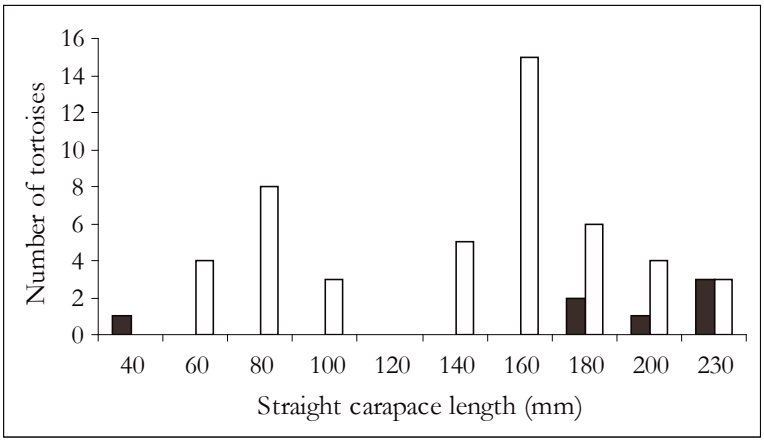

Fig. 3. Distribution of live and dead individuals based on carapace length (SCL) for *Testudo graeca* in burned area. □ – live individuals; ■ – dead individuals

It should be noted that the estimated densities in the control are lower during 2004 than during 2005 and 2006 (Tables 1 and 2). A possible reason is the sudden worsening of the weather conditions (heavy rains for a week in August) during the sampling in the control, while the burned area was sampled the day before. During a sampling after the weather improved the first week of September, tortoise activity was lower than expected for the season, compared to samples carried during the same season but different years.

Natural tortoise mortality in the control is low (2.2 % for *T. hermanni* and 2.5 % for *T. graeca*). The tortoise mortality (dead : alive), or reduction in the population due to fire was 64.3 % for *T. hermanni*, and 18.4 % for *T. graeca*. Comparable mortality rates for Hermann's tortoise are available for the region of the Alyki lake (North Greece), where the reduction of

the population caused by the fire was approximately 40 % (STUBBS et al., 1985; HAILEY, 2000), for a fire in South France – 85 % (CHEYLAN, 1984), and for the fire in Albéres Massif, Spain – 30 % (FÉLIX et al., 1989).

Fire impacts differently the sex structure of the populations. Among the discovered dead Hermann's tortoises (n = 128) almost half were females (47.6 %), males and juveniles were respectively 40.6 % and 11.7 %. This observation is further supported by the ratio of dead : live individuals – for the females it is 73.5 %, for the males it is 58.4 %, while before and after the fire the males were more numerous (respectively 1.1:1 and 1.7:1). Among the dead individuals females are more numerous (1.15:1). Higher female mortality was recorded in Greece (STUBBS et al., 1985) and in southern Spain, where the females outnumber the males 2.03:1, with females being predominant in the population before the fire as well – 1.2:1 (FÉLIX et al., 1989). The Spur-thighed female tortoises also had higher mortality than the males – the ratio dead : live for the females is 42.9 %, and for the males it is 10.5%. A possible reason for the higher female individuals mortality due to the fire is their lower activity during the summer months, when the disaster occurred (HAILEY et al., 1984; HAILEY & WILLEMSEN, 2000). Approximately 30% of the observed live females during the second half of the summer were found buried in leaf and grass litter, where they can be affected by fire much easier, while the more active males potentially can reach the streams or other moist places and are therefore able to avoid the flames. Furthermore, males and females have different capabilities for migration, the males being more mobile (CALZOLAI & CHELAZZI, 1991).

A major portion of the surviving individuals after the fire (21 % for *T. hermanni* and 22.5 % for *T. graeca*) have body damage from the fire. From the individuals that survived a fire in Spain 21.8 % had body damage and 21.4 % of these died from infections in the next 60 days (FÉLIX et al., 1989). It is difficult to assess the mortality of the injured individuals in this study because it was carried one year after the fire.

Juvenile individuals are one of the most difficult age classes for study within turtle populations due to their low activity level (KELLER et al., 1997) and their lower detectability in the field (DIEMER, 1991). The damage caused by fire to this segment of the population of *T. hermanni* have been defined as catastrophic by STUBBS et al. (1985), HAILEY (2000), and FÉLIX et al. (1989), and according to CHEYLAN & POITEVIN (1998) this applies to *Emys orbicularis* as well. In our case, the mortality (live : dead) of the juvenile individuals with SCL ≤ 10 cm is also high – 55.6 %, and for the individuals with SCL ≤ 6 cm it is even 66.7 %. The mortality is likely to be even higher than recorded, since due to the low body mass the juveniles might burn down completely and thus finding them is impossible. Comparing the average densities for juvenile individuals between burned and control areas for *T. hermanni* ($D_{(burn)}$ = 0.1 ind. / ha and $D_{(control)}$ = 1.4 ind. / ha, t = 2.9 and p = 0.0158) demonstrates that the reduction of the population is nearly 93 %, 82% for the males and 91 % for the females.

The vegetation cover, the intensity of the fire, and the time the fire starts, have different impacts on tortoise mortality due to fire. CHELYAN (1984) suspects that tortoise mortality in fires in pine woodlands is approximately 85%. Summer fires in grasslands with tall vegetation cover are extremely dangerous for tortoises, in contrast to fires occurring in habitats with low vegetation (HAILEY, 2000). The season also impacts the amount of damage from fire – VOGL (1973) reports a winter fire in Florida with low impacts on the herpetofauna. In this study, the highest mortality was measured for *T. hermanni* (92.6 %) in transect 4, situated perpendicular to the streams in a sparse oak forest composed of *Q. cerris, Q. frainetto, F. ornus*, single *P. spina-*

christi and grass cover with height of 30-40 cm that dries by the end of the summer. The lowest mortality (12.5 %) occurred in transect 5, situated on the outskirts of the burned area, where the fire was of low intensity. It is difficult to make specific conclusions for *T. graeca*, since the number of found dead tortoises is low and the values overlap.

Various taxa respond differently to disasters, for example, populations of the Green Lizard (*Lacerta viridis*) recover almost completely 7-8 years after a fire (POPGEORGIEV & MOLLOV, 2005), while turtle populations have low ability to recover after sudden disturbances (BROOKS et al., 1991). The restoration of the damaged tortoise populations depends either on individuals that survived the flames, or to immigrants from neighboring territories. Similar statement is made by ELBING (2000), who considers that immigration of individuals from neighbouring unburned territories is of high importance for the restoration of the populations of *L. viridis* in burned areas. In this study, tortoise movements were detected (based on mark-recapture) from the burn area to the control and vice versa. In the direction from the control to the burned area for *T. hermanni* were recorded movements of 2 ♂ individuals (1 ♂ captured in the control on 31.07.2005 and recaptured on 04.05.2006 at a distance of 51 m; 1 ♂ captured in the control on 31.07.2005 and recaptured on 03.05.2006 at a distance of 401 m). For *T. graeca*, movement of 2 ♀ from the control to the fire was detected (1 ♀ captured in the control on 19.04.2005 and recaptured on 09.08.2006 at a distance of 154 m; 1 ♀ captured in the control on 31.07.2005 and recaptured on 04.05.2006 at a distance of 100 m). In the direction from the fire to the control only movement for *T. graeca* was detected (1 ♀ captured in the control on 24.04.2004 and recaptured on 19.04.2005 at a distance of 105 m). The restoration of damaged populations is highly dependent on the densities in the neighboring territories (ELBING, 2000).

In conclusion, the fires that occur while *T. hermanni* and *T. graeca* are active have a negative effect on their populations. Most affected from the fire are the juvenile and the female individuals. The future recruitment of both species' populations depends on the surviving individuals and migrants from adjoining territories.

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References:

AKAIKE H. 1973. Information theory and an extension of the maximum likelihood principle. – In: Petran B., Csàaki F. (eds.). International Symposium on Information Theory, 2nd edn. Akadèemiai Kiadi, Budapest: 267-281.

BESHKOV V. 1984. On the Distribution, Relative Abundance and Protection of Tortoises in Bulgaria. – Ecology, **14**: 14-34. (In Bulgarian).

BROOKS M., ESQUE T. 2002. Alien plants and fire in desert tortoise (*Gopherus agassizii*) habitat of the Mojave and Colorado deserts. – Chelonian Conservation and Biology, **4**: 330-340.

BROOKS R., BROWN G., GALBRAITH D. 1991. Effects of a sudden increase in natural mortality of adults on a population of the common snapping turtle (*Chelydra serpentina*). – Canadian Journal of Zoology, **69**: 1314-1320.

BUCKLAND S., ANDERSON D., BURNHAM K., LAAKE J. 1993. Distance Sampling: Estimating Abundance of Biological Populations. Chapman and Hall, London. 446 p.

BURY R., LUCKENBACH R. 1977. Censusing desert tortoise populations using a quadrat and grid location system. – In: Proceedings, 1977 Desert Tortoise Council Symposium, 169-178.

CALZOLAI R., CHELAZZI G. 1991. Habitat use in a central Italy population of *Testudo hermanni* Gmelin (Reptilia Testudinidae). – Ethology, Ecology and Evolution, **3** (2): 153-166.

CHEYLAN M. 1984. The true Status and Future of Hermann's Tortoise *Testudo hermanni robertmertensi* Wermuth 1952 in Western Europe. – Amphibia-Reptilia, **5**: 17-26.

CHEYLAN M., POITEVIN F. 1998. Impact of fire on a population of European pond turtles (*Emys orbicularis*) in southeastern France. – Mertensiella, **10**: 67-82.

DIEMER J., 1992. Demography of the tortoise *Gopherus polyphemus* in northern Florida. – Journal of Herpetology, **26**: 281-289.

DUCK T., ESQUE T., HUGHES T. 1995. Fighting wildfire in desert tortoise habitat: considerations for land managers. – In: Proceedings – fire effects on rare and endangered species and habitats conference. Coeur d'Alene, Idaho: 7-13.

ELBING K. 2000. Zur Wiederbesiedlung brandgeschädigter Teilhabitate durch Smaragdeidechsen (*Lacerta viridis*). – Salamandra, **36** (3): 175-184.

ERWIN W., STASIAK R. 1979. Vertebrate Mortality During the Burning Reestablished Prairie in Nebraska. – American Midland Naturalist, **101** (1): 247-249.

ESQUE T., SCHWALBE C., DEFALCO L., DUNCAN R., HUGHES T. 2003. Effects of desert wildfires on desert tortoise (*Gopherus agassizii*) and other small vertebrate. – Southwest Naturalist, **48** (1): 103-118.

EVANS E. 1984. Fire as a natural disturbance to grasshopper assemblages of tallgrass prairie. – Oikos, **43**: 9-16.

FÉLIX J., CAPALLERES X., BUDO J., FARRE M. 1989. Estructura de una población de tortuga mediterránea (*Testudo hermanni robertmertensi*, Wermuth), antes y después de un incendio forestal. – Treballs d'Ictiologia i Herpetologia, **2**: 210-223.

GILL A. 1975. Fire and the Australian flora: a review. – Australian Forestry, **38**: 4-25.

HAILEY A. 2000. The effects of fire and mechanical habitat destruction on survival of the tortoise *Testudo hermanni* in northern Greece. – Biology and Conservation, **92**: 321-333.

HAILEY A., PULFORD E., STUBBS D. 1984. Summer Activity Patterns of *Testudo hermanni* Gmelin in Greece and France. – Amphibia-Reptilia, **5**: 69-78

HAILEY A., WILLEMSEN R. 2000. Population density and adult sex ratio of the tortoise *Testudo hermanni* in Greece: evidence for intrinsic population regulation. – Journal of Zoology London, **251**: 325-338.

HEINRICH M., KAUFMAN D. 1985. Herpetofauna of the Konza Prairie Research Natural Area, Kansas. – Prairie Naturalist, **17**: 101-112.

KAHN W. 1960. Observation on the effect of a burn on a population of *Sceloporus occidentilis*. – Ecology, **41** (2): 358-359.

KELLER C., DIAZ-PANIAGUA C., ANDREU A. 1997. Post emergent field activity and growth rates of hatchling spur-thighed tortoises, *Testudo graeca*. – Canadian Journal of Zoology, **75**: 1089-1098.

KOLEVA E., PENEVA P. (eds.). 1990. Climatic reference book. Precipitation in Bulgaria. Publishing House of BAS, Sofia, 169 p. (In Bulgarian)

KYUCHUKOVA M. (ed.). 1983. Climatic reference book of Bulgaria. 3. Temperature of the air, temperature of the soil, hoar frost. Nauka i izkustvo, Sofia, 440 p. (In Bulgarian).

LAMBERT M. 1980. The Mediterranean spur-thighed tortoise, *Testudo graeca*, in the wild and in trade. – In: Corborn J. (ed.). European Herpetological Symposium Proceedings. Cotswold Wild Life Park, Burford, 17-23.

LAMBERT M. 1984. Threats to Mediterranean (West Palaearctic) tortoises and their effects on wild populations: an overview. – Amphibia-Reptilia, **5**: 5-15.

LAWRENCE K., 1987. The tortoise trade – mortality in transport: an analysis of 21 years of importations into the United Kingdom. – British Veterinary Journal, **143**: 432-438.

LEMCKERT F., BRASSIL T., HAYWOOD A. 2003. Effects of a low intensity fire on populations of pond breeding anurans in mid-northern New South Wales, Australia. – Applied Herpetology, **1**: 183-195.

LINGOVA S. 1981. Radiation and Light Regime in Bulgaria. Publ. House of BAS, Sofia, 227 p. (In Bulgarian with English summary).

PÉREZ I., GIMÉNEZ A., SÁNCHEZ-ZAPATA J., ANADÓN J., MARTÝNEZ M., ESTEVE M. 2004. Non-commercial collection of spur-thighed tortoises (*Testudo graeca graeca*): a cultural problem in southeast Spain. – Biology and Conservation, **118**: 175-181.

POPGEORGIEV G., MOLLOV I. 2005. A study on the effects of fires on the populations of the green lizard *Lacerta viridis* (Laurenti, 1768) in Eastern Rhodopes. – Scientific Studies of the University of Plovdiv – Animalia, **41**: 95-108.

SHAPIRO S., WILK M., CHEN H. 1968. A comparative study of various tests of normality. – Journal of the American Statistical Association, **63**: 1343–1372.

STATSOFT. 1996. STATISTICA 5.1 Data Analysis Software. StatSoft, Inc. http://www.statsoft.com/.

STUBBS D., HAILEY A., PULFORD E., TYLER W. 1984. Population ecology of European tortoises: review of field techniques. – Amphibia-Reptilia, **5**: 57-68.

STUBBS D., HAILEY A., TYLER W., PULFORD E. 1981. Expedition to Greece 1980. University of London Natural History Society.

STUBBS, D., SWINGLAND I., HAILEY A, PULFORD E. 1985. The Ecology of the Mediterranean Tortoise *Testudo hermanni* in Northern Greece (The Effects of a Catastrophe on Population Structure and Density). – Biology and Conservation, **31**: 125-152.

SWINGLAND I., KLEMENS M. (eds.). 1989. The conservation biology of tortoises. Occasional Papers of the IUCN Species Survival Commission, 5. IUCN, Gland, Switzerland. 202 p.

TEVIS L. 1956. Effect of a slash burn on forest mice. – The Journal of Wildlife Management, **20**: 405-409.

THOMAS L., LAAKE J., STRINDBERG S., MARQUES F., BUCKLAND S., BORCHERS D., ANDERSON D., BURNHAM K., HEDLEY S., POLLARD J., BISHOP J., MARQUES T. 2006. Distance 5.0. Release 2. Research Unit for Wildlife Population Assessment, University of St. Andrews, UK. http://www.ruwpa.stand.ac.uk/distance/

VOGL R. 1973. Effects of fire on the Plants and Animals of a Florida Wetland. – American Midland Naturalist, **89** (2): 334-347.

WHELAN R. 1995. The Ecology of Fire. Cambridge, Cambridge University. 346 p.

YORDANOVA M. 2004. Physical-Geographical characteristics of the Eastern Rhodopes. – In: Beron P., Popov A. (eds.). Biodiversity of Bulgaria. 2. Biodiversity of Eastern Rhodopes (Bulgaria and Greece). Pensoft & National Museum of Natural History, Sofia: 17-52.

ZNARI M., GERMANO D., MACE J. 2005. Growth and population structure of the Moorish Tortoise (*Testudo graeca graeca*) in Westcentral Morocco: possible effects of over-collecting for the tourist trade. – Journal of Arid Environments, **62**: 55-74.

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Влияние на мащабен пожар върху демографската структура на популациите на шипоопашатата сухоземна костенурка (*Testudo hermanni boettgeri* Mojsisovics, 1889) и шипобедрената сухоземна костенурка (*Testudo graeca ibera* Pallas, 1814) в Източни Родопи, България

Георги Попгеоргиев

(Р е з ю м е)

Многобройните пожари през последното десетилетие в района на Източни Родопи (Югоизточна България) доведе до висока загуба на местобитания за шипоопашатата (*Testudo hermanni*) и шипобедрената (*Testudo graeca*) сухоземни костенурки. Данните от проведеното проучване показват, че пожарът в района на с. Колец, Хасковска област, е оказал изключително негативно влияние върху популациите на *T. hermanni* и в по-ниска степен на *T. graeca*. Средната плътност на популациите на *T. hermanni* в пожара (D = 0,7 екз. / ha) е 7,2 пъти по-ниска от тази в контролата (D = 5,3 екз. / ha). Разликите в плътността на популациите на *T. graeca* са по-малки, но отново са ясно изразени – за пожара (D = 0,5 екз. / ha) плътността е 4,2 пъти по-ниска от тази за контролата (D = 2,0 екз. / ha). Отчетената смъртност на костенурките в следствие от пожара за *T. hermanni* е 64,3 % (♂ = 58,4 %, ♀ = 73,5 %, и млади = 55,6 %) и за *T. graeca* 18,4 % (♂ = 10,5 %, ♀ = 42,9 %, и млади = 6,3 %).

Historia naturalis bulgarica, 19: 128, 2008

Димитър Ковачев на 80 години

Николай СПАСОВ

Името на Димитър Ковачев е известно днес на всеки, който има отношение към развитието на палеонтологията на бозайниците в България. Като учител по биология в гимназията в Асеновград, той открива през 60-те години скелета на знаменития Езеровски динотерий. В началото на 70-те години започва редовни палеонтологични разкопки със своите най-добри ученици. По време на тези експедиции (над 30 на брой) биват открити нови палеонтологични находища. Дълги години ръководи разкопки в най-известното българско находище на миоценски бозайници край с. Калиманци и открива седем нови разкрития на изкопаема фауна. В началото на 80-те години Д. Ковачев открива със своите ученици находището Хаджидимово-Гиризите, едно от най-богатите известни на науката находища на "пикермийска" фауна.

Запознах се с Ковачев през 1984. Минавах през Асеновград на път за Дорково, където планирах първата си палеонтологична експедиция. Бях чул, че учителят Ковачев е изложил в местната гимназия богата палеонтологична колекция. Видяното надмина многократно очакванията ми. Казах си, че тази колекция има национално значение и трябва да бъде съхранена. Изключителната колекция на Ковачев даде основание през 1989 да бъде учреден, по инициатива на НПМ и с решение на БАН и общината в Асеновград, палеонтологичният музей в Асеновград като филиал на НПМ-БАН. За заслугите си Димитър Ковачев е назначен за уредник на този музей, какъвто е и до днес. Колекциите на Асеновградския музей са най-богатите на изкопаема гръбначна фауна у нас и наброяват към 40 000 инвентарни единици. Между тях са единствените в света почти пълни скелети от маймуната мезопитек; черепът на нов за науката род нечифтокопитно – *Kalimantsia*; най-богатата в Европа колекция от хипарионi; един от най-добре запазените известни черепи на саблезъбата котка *Machairodus giganteus*; единствените останки от птица-носорог в Европа (нов за науката род) и редица други важни за световната наука фосили. Благодарение на донесените в музея фосилоносни седименти от експедициите на Д. Ковачев, научната колекция продължава да расте. Днес филиалът в Асеновград е база за интензивни палеонтологични изследвания с международно участие. Множество статии върху описанието на асеновградската палеонтологична колекция бяха публикувани през последните години, с участието на самия Д. Ковачев (7 самостоятелни публикации и 9 в съавторство). Сред тях са описанието на нов вид мечка от род *Indarctos*, на уникалния скелет на голямата котка метайлурус, монографичната работа върху маймуните – мезопитеци и др. Трудовете, написани на основата на създадената от него колекция допринесоха много за нарежданото на българската палеонтологична наука между тези, които дават днес съществен принос в изучаването на природната обстановка на късномиоценската Балкано-Иранска зоогеографска провинция.

На 20.10.2008 Димитър Ковачев навършва 80 години. И през това лято той дойде на разкопки, този път в находището на първия открит в България неогенски хоминоид – Азмака, край Чирпан: все същият, ведър, в ръка с неизменната, изработена преди много години кирка за разкопки.

Да му пожелаем здраве и дълголетие! Нека неуморимият му дух да продължава да го води по припечните пътеки между хълмовете, в търсене на нови находки и на нови тайни от миналото!

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Discovery of a big hibernacula of Noctule bats, *Nyctalus noctula* (Schreber, 1774) (Chiroptera: Vespertilionidae) in the town of Plovdiv, Bulgaria

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Abstract. The current article presents data on the wintering colony of Noctule bats at a river bridge in the town of Plovdiv, Bulgaria. The data were obtained during a rescue operation aimed at saving the wintering colony threatened by repair works on the Gerdzhika bridge over the Maritza River in the centre of Plovdiv. The operation was carried out during the period 26.11.2005 – 31.11.2005 by volunteers from the Green Balkans Federation, and all activities were coordinated with representatives of the Regional Inspectorate of Environment and Waters – Plovdiv and the Wildlife Rehabilitation and Breeding Center – Stara Zagora. The bats were using the gaps of the bridge as a shelter for hibernation and the ongoing repair was threatening them by squeezing or burying them under the construction debris. During the rescue the bats were taken from their shelters and transported for a temporary stay to the Wildlife Rehabilitation and Breeding Center of Green Balkans – Stara Zagora. The reported minimal number of wintering *Nyctalus noctula* in the gaps of the Gerdzhika Bridge in Plovdiv is 1035 individuals, this is the most numerous colony registered in Bulgaria to date. The colony consists of 57 % female and 47 % male individuals. Cranio-mandibular measurements taken contribute to the data published in "Fauna of Bulgaria".

Key words: Noctule bat, *Nyctalus noctula*, sex structure, wintering colony, Bulgaria, bridge

Introduction

The Noctule bat *Nyctalus noctula* (Schreber, 1774) is distributed all over Europe, except for the northern and southernmost parts (DIETZ & VON HELVERSEN, 2004). The species is one of the most common and most reported bats in Bulgaria.

Almost all from a total of 92 known localities are in the lower parts of the country – up to 500 meters above sea level (BENDA et al., 2003). The species is semisynanthropic (PESHEV et al., 2004), often acting as synanthropic, common species in urbanized habitats for some countries (GAISLER et al., 1979; BIHARI, 1999; ALCALDE, 1999). This is related to the loss of natural habitats and to the presence of suitable conditions in some urbanized buildings, which makes them preferred shelters for the species. The density of the colonies in buildings in many cases is greater than that in natural wood habitats (BIHARI, 1999).

Despite the fact that according to our observations the species is numerous in the town of Plovdiv, no detailed data are published, except for a single observation of two individuals (BĂČVAROV, 1963).

The current article presents data on the wintering colony of Noctule bats at the Gerdzhika Bridge in Plovdiv. The colony was examined during the rescue operation of wintering bats, which were threatened by the construction works going on at the bridge.

Material and methods

The data were obtained during a rescue operation aimed at saving the wintering colony threatened by the repair works on the Gerdzhika bridge over the Maritza River (Fig. 1) in the centre of Plovdiv (elevation 163 meters above sea level, GPS-coordinates WGS 84: N 42º9'12,4", E 24º44'19,1"). The operation was carried out during the period 26.11.2005 – 31.11.2005 by volunteers from the Green Balkans Federation, and all activities were coordinated with representatives of the Regional Inspectorate of Environment and Waters – Plovdiv and the Wildlife Rehabilitation and Breeding Center – Stara Zagora.

The bats were using the gaps of the bridge as a shelter for hibernation and the ongoing repair was threatening them by squeezing or burying them under the construction debris. During the rescue the bats were taken from their shelters and transported for a temporary stay to the Wildlife Rehabilitation and Breeding Center of Green Balkans – Stara Zagora. A total of 977 bats were taken out alive and 59 corpses of dead individuals were found. Therefore the total number of wintering individuals of the same species found is 1035.

The sex of all live and dead individuals was determined (except for 2 individuals, whose body traumas made it impossible to identify their sex).

The weight of 41 individuals was measured (28 females and 13 males). Measurements were taken with digital scales TH-2000 with 1 gram precision.

The undamaged skulls (a total of 37-16 females and 21 males) of the dead individuals were separated, cleaned and measured. Body measurements were taken from 128 individuals (69 live and 59 dead). Measurements were taken by caliper with 0.1 mm precision after DIETZ & VON HELVERSEN (2004), recording the following measurements: length of forearm (LR), length of third finger (D3) and length of fifth finger (D5).

The abbreviations used in the present publication stand for: LR – length of forearm, D3 and D5 – length of third and fifth fingers, CBL – condylobasal length, CCL – condylocanine length of skull, LI^1-M^3 – length of upper dental row, LC-M^3 – length of upper dental row from the canine, ARW – anterior rostrum width, PRW – posterior rostrum width, IOW – interorbital width, ZW – zygomatic width, BCW – brain cavity width, MH – maximum height of skull, LMd – length of mandible, HPC – height of *proc. coronoideus*, LI_1-M_3 – length of lower dental row, LC-P_4 - length of C-P_4.

A total of 14 craniometric and mandibular characters were measured. The measurements were made with calipers with 0,2 mm accuracy.

The results were processed statistically in order to determine the minimum, maximum, and average values, as well as standard deviations. The characteristics for the two sexes were compared for identifications of such, indicative of sex affiliation. T-test was used for checking the equality

of two mathematical expectations of the two general populations at 95 % probability. After the examination of the bone material, it was deposited in the National Museum of Natural History, BAS, Sofia.

After a temporary stay in the Wildlife Rehabilitation and Breeding Center (from 1 to 6 days), a total of 973 individuals were released in the Devetashka cave (Northern Bulgaria), where there is a known wintering colony of the same species (Ivanova, pers. comm.; BENDA et al., 2003).

Four of the individuals had fractures and severe injuries and died during their stay in the Center.

Parasites were collected during the rescue operation, preserved in 70 % ethyl alcohol and sent to NMNH – BAS, Sofia for further analysis.

Results and discussion

The individuals, wintering in the bridge gaps, were considered a single colony. A total of 1035 were registered in this wintering colony. The observations show that a certain number of individuals had woken up from hibernation and left the shelter in the bridge due to extreme disturbance and despite their conservative preference to the shelters observed during the rescue operation. It is also possible that some dead individuals remained buried under the construction debris in the niches. The presence and number of suitable holes for sheltering, the presence of droppings as well as evidence of eyewitnesses show that the number of individuals inhabiting the bridge during the hibernation period was most probably significantly larger than the number of individuals found after the beginning of the bridge reconstruction.

According to BENDA et al. (2003) this makes the observed colony the biggest wintering colony of the species registered in Bulgaria.

During the rescue operation the Noctule bats were found in groups of 20 to 200 individuals in cavities, formed in gaps of the bridge (some of them partially filled with construction debris).

Two type of gaps were found in the bridge (Fig. 1), perpendicular to its longitudinal axis, with the following dimensions: length of 12.50 m, depth of 0.66 m in the middle part and 0.25 m in the terminal part and width of 3-4 cm. The gaps of type one (I) were located entirely over the river bed (water or bank). These gaps held low numbers of bats and were almost filled with construction debris. The gaps of type two (II), localized in the carrying pillars, not directly over the water, secured greater numbers of bats and were less filled with construction debris. A total of 13 gaps were found on the bridge – 5 from type I and 8 from type II. The gaps were 12,7 m and 7.7 m away from one another. The average density of population was 80 bats per gap.

The individuals that flew out of the gaps during the rescue operation returned to the other individuals which were enclosed in transport boxes meters away from their previous shelter. We consider this as evidence of the tight social relations among the individuals of the colony.

No other bat species were found in the colony during the whole examination.

Only two dead bats were found except for the individuals killed during the repair works.

Sex determination of 1033 individuals shows that 586 (57 %) of them were females and 447 (or 43 %) were males.

Fig. 1. Gerdzhika Bridge, over the Maritsa River, Plovdiv. Arrows indicate the location of the gaps, sheltering the wintering *Nyctalus noctula*: a – type I, b – type II. Photo: D. Georgiev

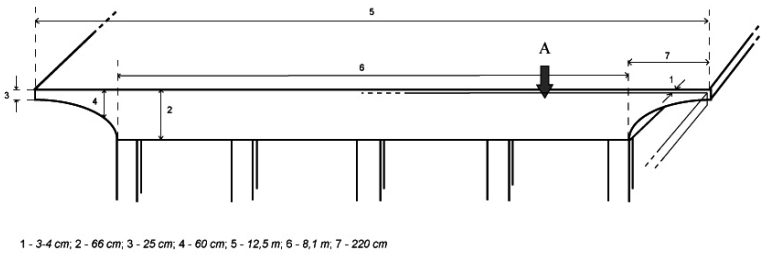

Fig. 2. Structure and dimensions of the bridge gaps, sheltering *Nyctalus noctula*. A indicates the gap inhabited by bats

The weight, as well as general craniometric data, were reported, contributing to the morphometry of the species in Bulgaria in comparison to the data published in "Fauna of Bulgaria", volume 27 (PESHEV et al., 2004).

The completed comparisons between the characteristics of both sexes (Table 1) show that the values of the particular characteristics are very close to one another.

General craniometric data on the species are presented in Table 2 and are close to the data reported for Bulgaria by other authors (BENDA et al., 2003; PESHEV et al., 2004).

According to SIMOV et al. (2006) the *Cimex dissimilis* (Horvath) (Insecta: Hemiptera: Cimidae) parasite was discovered in two individuals (a male and a female). The author states that the species can be considered a vagrant species that does not form a stable population on the local resident bat population, but arrives occasionally, transferred by migrating bats (mainly females, breeding in the northern parts of the breeding area).

Table 1

Weight and somatometric data of both sexes of *Nyctalus noctula* from the examined colony

Nyctalus noctula	**Weight (g)**			**LR**		**D5**		**D3**	
	Total	♀♀	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀	♂♂
Min	24	28	24	51.7	49.7	47.4	48.5	8.9	81.5
Max	38	38	35	58.4	57.4	58.6	56.7	98.35	95.3
$\overline{X}$	31.39	32.21	29.6	54.37	53.50	54.20	53.13	90.85	89.71
STD	2.96	2.50	3.18	1 566	1 752	2 097	1 930	10 043	2 922
RSD %	0.09 %	0.08 %	0.11 %	2.88 %	3.28 %	3.87 %	3.63 %	11.06 %	3.26 %
N	41	28	13	73	55	73	55	73	55

Table 2

Craniometric data of *Nyctalus noctula* from the examined colony

Nyctalus noctula		**Min**	$\overline{X}$	**Max**	**SD**	**N**	**RSD %**
CBL	♀♀	18.3	18.80	19.30	0.32	16	
	♂♂	18	18.81	19.30	0.33	21	
	Total, ♀♂	18.00	18.81	19.3	0.321	37	1.71 %
CCL	♀♀	18.6	19.18	19.70	0.28	16	
	♂♂	18.5	19.12	19.70	0.32	21	
	Total, ♀♂	18.50	19.15	19.7	0.302	37	1.58 %
LI1 - M3	♀♀	7.8	8.19	8.40	0.15	16	
	♂♂	8	8.21	8.40	0.15	21	
	Total, ♀♂	7.80	8.20	8.4	0.146	37	1.78 %
LC- M3	♀♀	7	7.29	7.50	0.12	16	
	♂♂	7.1	7.35	7.50	0.09	21	
	Total, ♀♂	7.00	7.33	7.5	0.110	37	1.50 %
ARW	♀♀	7	7.35	7.70	0.19	15	
	♂♂	7.1	7.38	7.60	0.17	21	
	Total, ♀♂	7.00	7.37	7.7	0.177	36	2.41 %
PRW	♀♀	8.4	8.86	9.30	0.22	16	
	♂♂	8.6	8.89	9.30	0.22	21	
	Total, ♀♂	8.40	8.88	9.3	0.216	37	2.44 %
IOW	♀♀	5	5.35	5.60	0.15	16	
	♂♂	4.8	5.29	5.50	0.15	21	
	Total, ♀♂	4.80	5.32	5.6	0.155	37	2.92 %
ZW	♀♀	12.8	13.25	13.60	0.27	13	
	♂♂	12.4	13.21	13.80	0.33	18	
	Total, ♀♂	12.40	13.23	13.8	0.303	29	2.29 %

Table 2
Continued

Nyctalus noctula		**Min**	$\overline{X}$	**Max**	**SD**	**N**	**RSD %**
BCW	♀♀	9.5	9.80	10.30	0.21	16	
	♂♂	9.2	9.72	10.20	0.25	21	
	Total, ♀♂	9.20	9.76	10.3	0.238	37	2.43 %
MH	♀♀	8.5	8.78	9.30	0.23	13	
	♂♂	8.4	8.72	9.20	0.18	20	
	Total, ♀♂	8.40	8.74	9.3	0.203	33	2.32 %
LMd	♀♀	13.5	14.06	14.60	0.28	16	
	♂♂	13.4	14.02	14.80	0.37	21	
	Total, ♀♂	13.40	14.04	14.8	0.329	37	2.34 %
HPC	♀♀	4.5	4.69	4.90	0.12	16	
	♂♂	4.4	4.68	5.00	0.15	21	
	Total, ♀♂	4.40	4.68	5	0.136	37	2.91 %
LI1-M3	♀♀	8.5	8.74	8.90	0.14	14	
	♂♂	8.5	8.80	9.10	0.15	21	
	Total, ♀♂	8.50	8.77	9.1	0.147	35	1.67 %
LC-M3	♀♀	7.6	7.83	8.00	0.14	15	
	♂♂	7.5	7.84	8.10	0.13	20	
	Total, ♀♂	7.50	7.84	8.1	0.135	35	1.73 %

Conclusion

1. The reported minimum number of wintering *Nyctalus noctula* in the gaps of the Gerdzhika Bridge in Plovdiv is 1035 individuals. This is the most numerous colony registered in Bulgaria to date.

2. The colony consists of 57 % female and 47 % male individuals.

3. Measurements taken contribute to the data published in "Fauna of Bulgaria" (PESHEV et al., 2004).

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References

ALCALDE J. 1999. New ecological data on the noctule bat (*Nyctalus noctula* Schreber, 1774) (Chiroptera, Vespertilionidae) in two towns of Spain. – Mammalia, **63** (3): 273-280.

BĂČVAROV G. K. 1963. Contribution à l'étude de la faune des helminthes chez les chauve-souris en Bulgarie. – Works of the Higher Pedagogical Institute Plovdiv, Biology, **1** (1): 99-101. (In Bulgarian with Russian and French summaries).

BENDA P., IVANOVA T., HORÁČEK I., HANÁK V., ČERVENÝ J., GAISLER J., GUEORGUIEVA A., PETROV B., VOHRALÍK V. 2003. Bats (Mammalia: Chiroptera) of the Eastern Mediterranean. Part 3. Review of bat distribution in Bulgaria. – Acta Societas Zoologicae Bohemicae, **67**: 245-357.

BIHARI Z. 1999. Examination of bats straying into rooms. – Myotis, **37**: 99-102.

DIETZ CH., VON HELVERSEN O. 2004. Illustrated identification key to the bats of Europe. – Electronic Publication, Version 1.0, 72 p.

GAISLER J., HANÁK V., DUNGEL J. 1979. A contribution to the population ecology of *Nyctalus noctula* (Mammalia: Chiroptera). – Acta Scientarum Naturalium Academie Scientarum Bohemoslovacae, Brno, **13** (1): 1-38.

PESHEV TZ., PESHEV D., POPOV V. 2004. Mammalia. – Fauna bulgarica, **27**: 1-632. (In Bulgarian).

SIMOV N., IVANOVA T., SCHUNGER I. 2006. Bat-parasitic *Cimex* species (Hemiptera: Cimicidae) on the Balkan Peninsula, with zoogeographical remarks on *Cimex lectularius* Linnaeus. – Zootaxa, **1190**: 59-68.

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Многочислена зимна колония на *Nyctalus noctula* (Schreber, 1774) (Chiroptera: Vespertilionidae) в град Пловдив (Южна България)

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(Резюме)

Представените данни са получени при спасяването на зимуващата колония на *Nyctalus noctula*, застрашена от ремонтните дейности на мост Герджика над река Марица, град Пловдив. Изследването е проведено в периода 26.11.2005 – 31.11.2005. Минималният регистриран брой зимуващи индивиди във фугите на моста е 1035 индивида, като това е най-многочислената колония, регистрирана досега в България. Средната установена гъстота на заселеност е 80 прилепа във фуга. Колонията се състои от 57 % женски и 47 % мъжки индивида. Изследваните сомато- и краниометрични признаци, както и получените тегловни данни, не могат да се използват за детерминиране на пола при вида от изследвания район.

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Fossil proboscideans (Mammalia) from the vicinities of Varna: a rare indication of middle Miocene vertebrate fauna in Bulgaria

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Abstract. Proboscideans from the area of Varna (NE Bulgaria) are discussed, with emphasis on two finds from Galata: an elephantoid molar mistakenly identified as *Tetralophodon longirostris* in earlier Bulgarian literature but actually belonging to an amebelodontid, and a previously unpublished premolar of *Deinotherium giganteum*. The proboscideans from the region of Varna are a rare example of pre-Turolian vertebrates from Bulgaria and might indicate middle Miocene fossiliferous outcrops in the area.
Key words: Proboscidea, Deinotheriidae, Elephantoidea, Amebelodontidae, middle Miocene, Bulgaria

Introduction

The vast majority of the ca. 400 fossil proboscidean specimens known from Bulgaria are of Turolian age or later (MARKOV, 2004a, 2004b). Proboscideans, and indeed any land vertebrates of pre-Turolian age are quite rare in the country. Several finds from the area of Varna (Northeast Bulgaria, Fig. 1) belong to taxa of certain pre-Turolian age. They are discussed below, particularly focusing on two finds from Galata, Varna, stored at the collections of the Sofia University. One is an elephantoid molar, mistakenly attributed by BAKALOW (1911) to *Tetralophodon longirostris* and referred by MARKOV (2004a, 2004b) to *Platybelodon* cf. *danovi*; the other is a hitherto unpublished premolar, attributed here to *Deinotherium giganteum*.

Institutional abbreviations:

HNHM: Hungarian Museum of Natural History, Budapest.
MNHN: Muséum National d'Histoire Naturelle, Paris.
NHM: Natural History Museum, London.
NMNH: National Museum of Natural History – BAS, Sofia.
SU: Palaeontology Museum of the Sofia University, Sofia.

Methods:

Dental nomenclature follows TASSY (1996a). Measurements in mm; estimated values designated by "e".

Fig. 1. Map of the localities in the vicinities of Varna mentioned in the text. 1: Galata; 2: Pochivka; 3: Aksakovo; 4: Yarebichna.

Systematic part:

Amebelodontidae Barbour, 1927

? *Platybelodon* cf. *P. danovi* Borissiak, 1928

Material: m3 sin (SU 230) from Galata, Varna.

Description and discussion. SU 230 was originally published by BAKALOW (1911, Pl. 8, Fig. 2) as m2 of *Mastodon longirostris*, an erroneous determination repeated by BAKALOV & NIKOLOV (1962, Pl. 64, Fig. 2, as m2 of *Tetralophodon longirostris*). The shape of the tooth (Fig. 2) however clearly demonstrates that the locus was misidentified by these authors: the narrowing posterior end of the tooth is typical for a third molar.

The molar is rather well preserved, with the crown almost entirely intact apart from the anterior cingulum. Currently, the anterior half of the tooth is covered with plaster of Paris, especially the second pretrite semilophid. There was no plaster on the specimen when it was figured by BAKALOW (1911) and BAKALOV & NIKOLOV (1962), and apparently it was broken along the second lophid at some later point and subsequently repaired.

The tooth has five lophids and a small, asymmetric talonid. (Both previous descriptions report the number as four plus a well-developed posterior talonid, but the fifth ridge is differentiated by an entoflexus, and followed by a talonid on the posttrite side). Occlusion on all lophids, dentine not yet revealed on the fifth posttrite semilophid. Posttrite conules are present in all interlophids except the fourth. On the pretrite side, mesoconelets are clearly separated from the anterior and posterior pretrite conules, forming a trefoil pattern. On the posttrite

Fig. 2. SU 230, m3 sin, Amebelodontidae indet. (? *Platybelodon* cf. *danovi*), Galata. Scale bar: 5 cm. Note the plaster of Paris on first and second lophids.

half, the main cones and the mesoconelets are not clearly distinguished, especially on the third and fourth posttrite semilophids where mesoconelets are reduced. Traces of cement in the interlophids are weak but visible. Length: 144; width: 61/66/62/54/41; enamel thickness: 3.5 mm.

The underdeveloped fifth lophid, the pronounced trefoil pattern and the posttrite ornamentation preclude relations to *Tetralophodon* or any other tetralophodont gomphothere. The combination of posttrite ornamentation, relatively narrow crown and cement deposits, as well as enlarged central pretrite conules, is characteristic for amebelodontids (see TASSY, 1984, 1986). Of the amebelodontids known from Europe, the late Miocene "*Mastodon*" *grandincisivus* differs significantly in dental morphology from SU 230, having large m3s with a fully developed fifth and even sixth lophid, and a complex crown showing pseudo-anancoidy. Two other European amebelodontids, *Archaeobelodon filholi* and *Platybelodon danovi*, although readily set apart by a number of cranio-mandibular characters and by the entirely different structure of the lower tusks, may have similar lower molars (TASSY, 1985) and the identification of an isolated m3 is difficult. Still, the size of SU 230 fits better with *Platybelodon danovi* rather than *Archaeobelodon filholi*. Smaller than the m3s in the type mandible of *P. danovi* from Belomechetskaya described by BORISSIAK (1928, 1929), SU 230 deviates from them within the range observed for the En Péjouan *G. angustidens* sample which includes female as well as male individuals, representing a good example of sexual dimorphism within a single population (TASSY, 1996b). Showing the same kind of sexual dimorphism, *A. filholi* on the other hand is a larger animal, with females matching the size of male *G. angustidens*, and males surpassing it (TASSY, 1985, 1996b). With the size of a female *G. angustidens*, SU 230 is below the known range for *A. filholi*.

With *Archaeobelodon filholi* ruled out, SU 230 was referred to *Platybelodon* cf. *danovi* by MARKOV (2004a, 2004b) who dismissed affinities with *Protanancus* (MARKOV, 2004b) on the base of differences with the two known species of the genus, *P. macinessi* and *P. chinjiensis*. Another possibility, not discussed by MARKOV (2004b), is that SU 230 might represent a *Protanancus* species different from both *P. macinessi* and *P. chinjiensis*. *Protanancus* probably occurs at the Turkish locality Yürükali at the Sea of Marmara coast (TASSY, 1983, 1984;

originally published as "*Amebelodon* (*Amebelodon*) cf. *fricki*" by GAZIRY, 1976). Judging from the morphology of the only molar from that locality, an M3 (GAZIRY, 1976, Pl. 4, Fig. 5), the Yürükali *Protanancus* seems to be more primitive than the two named species of the genus. With the Yürükali material in mind, presence of *Protanancus* at Galata would not be absurd from a geographical viewpoint; as for the morphology of SU 230, there are several similarities to *Protanancus*: some alternation of the semi-lophids, cross-contacts between the pretrite and posttrite halves, and reduction of the mesoconelets. On the other hand, these characters are simply insufficient for an unequivocal determination of an isolated lower molar.

Attribution of SU 230 to *Platybelodon* cf. *danovi* by MARKOV (2004a, 2004b) was additionally influenced by the reported occurrence of *Platybelodon* sp. at the nearby locality Pochivka, northern part of Varna, by NIKOLOV (1985). Unfortunately, this information is not very reliable. Nikolov's 1985 paper, a posthumously published catalogue of Bulgarian Tertiary mammal localities, provides little detail apart from faunal lists and assumed age, and includes unpublished material. This is exactly the case with the material from Pochivka: it was never published and its present location is unknown. According to N. Spassov (pers. comm. 2003), the material in question was a mandible, brought to I. Nikolov for determination and pictured in a newspaper in the 1970s, the preserved symphysis having the typical flat, wide *Platybelodon* lower tusks. A short newspaper note (*Trud*, 27.04.1977: personal archive of Prof. Z. Boev, NMNH) indeed includes a comment by I. Nikolov, who noted the shovel-like symphysis of the mandible and determined it as belonging to *Platybelodon*. Unfortunately, the symphysis is not shown on the newspaper photo, and while the mandible almost certainly belonged to a shovel-tusker judging from the brief interview, it must be remembered that the genus *Archaeobelodon* Tassy, 1984 was yet to be described, and that *A. filholi* was regarded as a subspecies of *P. danovi* by TOBIEN (1973), a work Nikolov was familiar with. Similarly, *Protanancus macinessi* material was most probably known to Nikolov as "*Platybelodon kisumuensis*" (again according to Tobien's concepts), so a determination as *Platybelodon* could actually also refer to two other genera, *Archaeobelodon* and *Protanancus*. If, nevertheless, Nikolov's determination (and Spassov's recollection of the shape of the symphysis and the lower tusks) is assumed to be correct, the occurrence of *Platybelodon* at the Black Sea coast would not be too surprising, especially with *Platybelodon* cf. *danovi* known from the middle Miocene locality Araplı, European Turkey, Marmara Sea coast (GAZIRY, 1976; TASSY, 1986).

Ranging from Africa through Eurasia to North America and from the early to the late Miocene (accepting synonymy with *Torynobelodon*), the amebelodontid genus *Platybelodon* is not known later than the middle Miocene (MN7/8) in the Old World. The earliest finds are *Platybelodon* sp. from Loperot, Kenya (MAGLIO, 1969: a single tusk fragment and the only *Platybelodon* find from Africa), and the recently described *Platybelodon dangheensis* Wang et Qiu, 2002 from the Danghe area, Gansu, China. The age of the Danghe *Platybelodon* is early Miocene, according to WANG & QIU (2002) (see also WANG X. et al., 2003 and WANG B. et al., 2003, for a detailed discussion of Danghe stratigraphy). The only European member of the genus is its type species[1], *P. danovi*, described by BORISSIAK (1928, 1929) from Belomechetskaya, Russia, the age of Belomechetskaya generally considered to be MN6 (see GÖHLICH, 1999; PICKFORD et al., 2000). A later and more derived species with complex dental morphology, *P. grangeri* occurred in the middle Miocene (MN7/8) of northern China

[1] *P. jamandzhalgensis* Belyaeva et Gabunia, 1960 from the area of Belomechetskaya was synonymized with *P. danovi* by TOBIEN (1973).

(it has also been reported from Kyrgyzstan: ALEXEEVA, 1957). The status of *P. belijaevae* Alexeeva, 1971, based on fragmentary material from Western Mongolia, is unclear.

So far, Araplı is the westernmost *Platybelodon* locality in the Old World (TASSY, 1986). However, two molars from Grivac – Slana Bara (Gruža Basin, Serbia), determined by MARKOVIĆ-MARJANOVIĆ & PAVLOVIĆ (1970, Pl. 1, 2) as M2-M3 of "*Bunolophodon angustidens*" deserve a brief comment. The first of the two molars is highly reminiscent of a *P. danovi* M2 from Belomechetskaya figured by BORISSIAK (1929, Pl. 2, Fig. 3). Posttrite ornamentation and symmetric pretrite trefoil rule out affinities with *G. angustidens*, and indicate an amebelodontid. The other molar (both from the same individual, according to the authors) has a somewhat unusual morphology for M3: the two last of the four lophs are of almost equal height, and the tapering of the posterior end of the crown, typical for third molars, is slight. Apart from the posttrite ornamentation and the trefoil pattern, the specimen resembles more a second molar of a tetralophodont gomphothere. On the other hand, it is very similar to an M3 of *Platybelodon tongxinensis* from China figured by TOBIEN et al. (1986, Fig. 15, as "*Gomphotherium* sp. ("*Gomphotherium tongxinensis*")") in almost every detail apart from the small posterior talon present in the Chinese specimen. *P. tongxinensis* (Chen, 1978) is a synonym of *P. danovi* according to GUAN (1996). If the molars from Serbia belong to *Platybelodon*, Grivac – Slana Bara would be the westernmost known locality of the genus.

Platybelodon sp. has been reported from yet another East European locality, namely Hirova in Moldova, by LUNGU & OBADĂ (2001) who claim a Vallesian (MN9) age for a mandible with preserved third molars. Such a late age is astonishing, since no *Platybelodon* finds are known anywhere in Eurasia after MN7/8. However, determination of the Hirova specimen cannot be taken at face value in the absence of data on diagnostic characters such as shape of the lower tusks if preserved (or of the alveoli if not), dentine structure if observable, structure of the molars (e.g. presence or absence of posttrite ornamentation, shape of pretrite trefoil). Without this information, the presence of *Platybelodon* at Hirova, and in the Vallesian, remains to be confirmed.

There are two named species of *Protanancus*, *P. macinessi* from (mainly) the middle Miocene of East Africa, and *P. chinjiensis* from the middle Miocene and possibly Vallesian of Indo-Pakistan (see TASSY, 1983, 1986), but the range of the genus was probably wider. Apart from Yürükali material, cf. *Protanancus* sp. was reported from the middle Miocene Turkish localities Çandır in Central Anatolia (GERAADS & GÜLEÇ, 2003) and Mordoğan in Western Turkey (KAYA et al., 2003). The middle Miocene proboscidean assemblage at Tha Chang sandpits, Northeast Thailand, includes *Protanancus* (SAEGUSA et al., 2005); in addition, the genus might have occurred in China: a lower tusk with concentric dentine from Gansu published by TOBIEN et al. (1986, Fig. 24) as *Amebelodon* sp. is, according to the authors, "very similar, if not identical with the lower incisor from Yürükali". Middle Miocene amebelodontid material published by GUAN (1988, 1996), or at least a part of it, might belong in *Protanancus* too. The M3 of *Serbelodon zhongningensis* figured by GUAN (1996, Pl. 13.4c) shows pseudo-anancoid contacts as well as the M2 figured by GUAN (1988, Pl. 2, Fig. 2); as far as can be judged from the photos (GUAN, 1988, Pl. 2, Fig. 2, and GUAN, 1996, Pl. 13.4a,b), this condition seems to be present also in the holotype, a palate with left and right M2-M3. North American *Serbelodon* (apart from referred Chinese material, the genus is not known in the Old World) lacks posttrite conules (TASSY, 1996c), a feature unique among amebelodontids. The presence of posttrite conules in the Chinese material casts doubts on its attribution to *Serbelodon*.

As can be seen, Western Turkey (and potentially the Eastern Balkans) was one of the areas where both genera occurred. Araplı and Yürükali in Western Turkey were used by TOBIEN et al. (1986) as an example of possible co-existence of *Platybelodon* and "*Amebelodon*" (i.e. *Protanancus*); thus any of these two genera, or both, could be present at the localities in and near Varna. Information on the unpublished mandible from Pochivka is simply insufficient to confirm the occurrence of *Platybelodon* sp. reported by NIKOLOV (1985), and characters observed in SU 230 do not rule out possible affinities with *Protanancus* as an alternative to the determination as *Platybelodon* cf. *danovi* by MARKOV (2004a, 2004b). Even so, the amebelodontids at Galata and Pochivka are certainly pre-Turolian, and might be regarded as an indication for middle Miocene fossiliferous layers in the area.

Deinotheriidae Bonaparte, 1841

***Deinotherium giganteum* Kaup, 1829**

Material: P4 sin (SU 305) from Galata, Varna.

Description. The tooth (Fig. 3) is relatively well preserved, with the ectoloph somewhat damaged at the metacone (a small enamel fragment preserved on the tooth's posterior wall permits an adequate measurement of the length). Between the proto- and hypocone, there is an additional cusp blocking the interloph. Lingually from the first, the base of another, damaged additional cusp is preserved. Marked anterior cingulum. Length: 65; width: 71/67e. (NB: a dental fragment from Hrabarsko near Sofia at the SU collections has the same number, obviously by mistake).

Discussion. Here, *Deinotherium giganteum* is considered a species separate from *D. gigantissimum*, the giant Turolian deinothere of Europe and Southwest Asia. Known mainly from Vallesian localities, *D. giganteum* appears in Europe as early as the middle Miocene (MN6: ANTOINE et al., 1997; DURANTHON et al., 2007), apparently migrating from the east: large deinotheres (genus *Deinotherium*) are known from the early Miocene of Saudi Arabia (TASSY *in* THOMAS et al., 1982). Earlier views (e.g. HARRIS, 1975) on *D. giganteum* as a direct descendant of *Prodeinotherium bavaricum*, evolving *in situ*, should be rejected (MARKOV, 2004b). The size of SU 305, surpassing maximum values for *P. bavaricum* (see GRÄF, 1957) but significantly smaller than Turolian *D. gigantissimum*, falls within the variation range for *D. giganteum*, a species occurring from MN6 to MN10. The specimen from Galata is a rare trace of *D. giganteum*'s presence in Bulgaria: almost all the material from the country published in earlier literature as *D. giganteum* belongs to *D. gigantissimum* (MARKOV, 2004b). The only exception is a molar from Yarebichna near Varna, published by BAKALOV (1949, Pl. 2, Fig. 2) as a right M2 of "*Dinotherium giganteum* Kaup, race minor" (i.e. *P. bavaricum*), and referred to *D. giganteum* by BAKALOV & NIKOLOV (1962, Pl. 44, Fig. 2: although figured, the specimen is not discussed in the text). The molar which, judging from the figures is rather a left M3, couldn't be found at the SU collections and seems to be lost. Drawing in BAKALOV (1949) and photo in BAKALOV & NIKOLOV (1962) are reproduced on Fig. 4. Measurements provided by BAKALOV (1949) are 86/96/84.5 but this is clearly a mistake. Taken from the natural-sized drawing (BAKALOV, 1949, Pl. 2, Fig. 2), length of the tooth is 84 – close enough to the published value, but widths of the first and second loph are 84 and 74, correspondingly, i.e. the width of the first loph equals the length of the tooth. It seems that an extra centimeter was added by mistake to both widths, and measurements in BAKALOV (1949)

Fig. 3. SU 305, P4 sin of *Deinotherium giganteum*, Galata. Scale bar: 5 cm.

Fig. 4. *Deinotherium giganteum* molar from Yarebichna (now lost), as figured by BAKALOV (1949, Pl. 2, Fig. 2) (left) and BAKALOV & NIKOLOV (1962, Pl. 44, Fig. 2) (right).

should read 86/86/74.5 instead. A deinothere ("*D. bavaricum*") listed from Pochivka, Varna, by NIKOLOV (1985) – together with the elephantoid mandible discussed above – might be indeed *P. bavaricum*, but also *D. giganteum*: earlier Bulgarian literature (e.g. BAKALOW, 1914; BAKALOV, 1949; BAKALOV & NIKOLOV, 1962) lumped together all deinotheres into *D. giganteum*, distinguishing between two "races", small and large. Later, they were equated to *P. bavaricum* and *D. giganteum* correspondingly; however, as virtually all finds of "large

deinotheres" from Bulgaria belong to the Turolian species *D. gigantissimum*, anything smaller than them ended up as "race minor" and then "*D. bavaricum*". An example is the *Deinotherium giganteum* molar from Yarebichna discussed above, listed as "*D. bavaricum*" by NIKOLOV (1985). Unfortunately, as with the elephantoid mandible, the present location of the deinothere material from Pochivka is unknown, and its determination is impossible.

Prodeinotherium bavaricum **(von Meyer, 1833)**

Material: M2 sin (cast, SU 193) from Aksakovo, Varna region.

Description. The cast (Fig. 5) represents a well preserved tooth with marked anterior and posterior cingula and a broad interloph. Dentine revealed on both lophs. Length: 72; width: 66/68. SU 193 was originally published by BAKALOV & NIKOLOV (1962, Pl. 43, Fig. 3), erroneously determined as m2 dext (I am grateful to Martin Pickford for pointing out this error).

Discussion. Prevailing opinion regards *Prodeinotherium bavaricum* as the only European prodeinothere species, ranging from MN3b (Lesvos, Greece: KOUFOS et al., 2003) to MN9. GASPARIK (1993, 2001) considered the species *P. hungaricum* Éhik, 1930 valid, with *P. petenyii*, a species described by VÖRÖS (1989) from the early Miocene (MN4) of Hungary its junior synonym. I agree with GASPARIK (1993, 2001) that early Miocene European prodeinotheres do not belong in *P. bavaricum*, but the taxonomical designation is somewhat problematic. The type mandible of *P. petenyii* differs from Astaracian mandibles referred to *P. bavaricum* to an extent granting its separate specific status (pers. observations, HNHM 2005). In addition to its significantly smaller size (even considering the ontogenetic age of the individual), the mandible's symphysis is only slightly curved downwards (this trait is visible despite some *post mortem* deformation), as could be expected in early deinotheres since their Paleogene ancestors must have had a straight, non-curved symphysis (MARKOV et al., 2001). The type mandible of *P. hungaricum* (pers. observations, NHM London, 2006: a cast; the original at HNHM Budapest was destroyed in 1956) is larger and more robust than the type of *P. petenyii*. Compared to the Hungarian finds, the type mandible of *P. cuvieri* (Kaup, 1832) (pers. observations, MNHN Paris, 2007) is more similar in its proportions to the type of *P. petenyii* – except for the apparently stronger curvature of the symphysis – rather than to the type of *P. hungaricum*. On the other hand, dental measurements in all three specimens are close enough to make conspecifity very likely (in that case, *P. cuvieri* would have priority)[2]. The skeleton from Langenau near Ulm (Southern Germany, MN4), referred by GÖHLICH (1999, Fig. 13.3) to *P.* cf. *bavaricum*, seems to provide additional support for the separate specific status of early Miocene prodeinotheres: differences in the postcranial morphology of that specimen and the *P. bavaricum* skeleton from Unterzolling (Southern Germany, MN6) were noted by HUTTUNEN & GÖHLICH (2002)[3]. The two species apparently differ in cranio-mandibular morphology too, e.g. in the shape of the mandibular angle – well developed in

[2] Subsequently, the type species of *Prodeinotherium* would be *P. cuvieri* (*P. hungaricum* being a synonym for *P. cuvieri* and not *P. bavaricum*).

[3] For dental measurements of prodeinotheres from Langenau and other German MN4 material, see SACH & HEIZMANN (2001).

Fig. 5. SU 193, M2 sin (cast) of *Prodeinotherium bavaricum*, Aksakovo. Scale bar: 5 cm.

P. bavaricum, weaker and more highly positioned in the Orleanian species[4]. Shape of mandibular angle is a useful differential character for the two European *Deinotherium* species (see MARKOV, 2008 for details), and a similarly different condition in the two *Prodeinotherium* species would not be surprising. Thus, the small early Miocene specimens from Europe (e.g. those from Lesvos and various European MN4 localities) should rather be assigned to a species different from *P. bavaricum*, as well as later Orleanian material: molars from Pontlevoy (France, MN5) are comparable in size to the earlier specimens (pers. observations, MNHN Paris, 2002, 2007)[5]. In that case, the time span of *P. bavaricum* would be from MN6 to MN9.

The larger size of SU 193 sets it apart from early Miocene material, and corresponds to *P. bavaricum* s. str., suggesting an age of MN6 or later. Together with two molars from the area of Pleven (NW Bulgaria) and two more from Sovolyano near Kyustendil (SW Bulgaria), SU 193 is one of the few finds of *P. bavaricum* from the country[6]. The species was mistakenly reported

[4] A potential falsifier of this observation is the skeleton from Franzensbad, described by HUTTUNEN (2004). Of supposed MN5 age, its mandible has a morphology corresponding to *P. bavaricum* and not the Orleanian species. However, although no dental measurements are provided, teeth dimensions of the Franzensbad prodeinothere closely match those of the MN6 Unterzolling specimen according to the author (HUTTUNEN, 2004, p. 347, Fig. 4). Thus, the Franzensbad skeleton most probably belongs in *P. bavaricum* s. str., and either this species appears in MN5, briefly co-existing with the earlier form (see also comment on Pontlevoy below), or, very probably, the age of Franzensbad is later than MN5.

[5] Part of the material from the Pontlevoy area reaches the size of *P. bavaricum* s. str.; this might be taken either as evidence for an early appearance of that species in MN5, or – more likely – imply the presence of fossils of different age.

[6] Two rather small, unpublished prodeinothere teeth from an unknown locality at the SU collections, SU 304 (P3d; L:53; W:48/50) and SU 309 (M2s; L:58; W:62/56), are comparable in their size to Orleanian material from Greece, Hungary, Germany, France and Spain, and might represent the only early Miocene faunal remains from Bulgaria – as well as a species new to the country's fossil fauna, *P. cuvieri*.

from Nessebar near Burgas (SE Bulgaria) by BAKALOW (1914), an error further repeated by BAKALOV & NIKOLOV (1962), KOJUMDGIEVA et al. (1984), NIKOLOV (1985), and later authors relying on Nikolov's 1985 catalogue – e.g. SPASSOV (2000, 2002), SPASSOV & KOUFOS (2002), KOUFOS (2006). In fact the Nessebar finds (two mandibles and a maxillary fragment) belong to juvenile *D. gigantissimum* individuals (MARKOV, 2004a, 2004b). Similarly, the "*P. bavaricum*" listed from Kalimantsi by NIKOLOV (1985), and subsequently by KOSTOPOULOS et al. (2001), is a deciduous tooth of *D. gigantissimum* (MARKOV, 2004b).

Stratigraphical and zoogeographical implications

Much of the information provided by NIKOLOV's (1985) summary of early 1980's knowledge on Tertiary large mammal localities in Bulgaria has been subsequently revised, especially regarding the Turolian localities (e.g. SPASSOV, 2000, 2002). The localities in and around Varna however have remained outside the scope of later revisions, no doubt due to the scarcity (and, alas, inaccessibility in several cases) of the material, consisting entirely of proboscideans. NIKOLOV's (1985) assumed ages for the localities discussed here are: Pochivka: "Miocene after mammals, Middle Karaganian after mollusks"; Yarebichna: "probably Sarmatian" (according to E. Kojumdgieva's foreword to Nikolov's catalogue, 'Sarmatian' in the text corresponds to MN9-10); Aksakovo: "Middle Miocene – Sarmatian after mammals". For unknown reasons, Galata is absent from the catalogue, although the elephantoid molar was published and discussed earlier, if misidentified.

Data on the proboscideans from Galata are indeed scarce and ambiguous, but the amebelodontid seems to imply a middle Miocene age for the locality, regardless of its determination. *Platybelodon* cf. *danovi* would imply MN6; the Yürükali *Protanancus* is most probably of similar age as the Araplı *Platybelodon*. The premolar of *Deinotherium giganteum* could be middle Miocene (MN6) to Vallesian (MN10). The age of the unpublished ?*Platybelodon* mandible from Pochivka should be MN6 if the determination by NIKOLOV (1985) was correct (and could be MN4 to Vallesian if it was not), and the unpublished deinothere material ("*D. bavaricum*" in NIKOLOV, 1985) could be anything from a small Orleanian prodeinothere to late Vallesian *D. giganteum* (the '*bavaricum*' designation meaning only that it was apparently smaller than the vast majority of deinothere finds from Bulgaria belonging to *D. gigantissimum*). Similarly, the isolated finds from Yarebichna (*D. giganteum*, despite being listed as "*D. bavaricum*" by NIKOLOV, 1985) and Aksakovo (*P. bavaricum* s. str.) could be middle Miocene to Vallesian. Bearing in mind the rarity of pre-Turolian localities in Bulgaria however, such a sudden concentration of variously aged fossiliferous outcrops in the small area in and around Varna seems unlikely. Making a bold assumption, a middle Miocene (?MN6) age for the whole fossiliferous area around Varna seems plausible, neither the amebelodontids nor the deinotheres contradicting it. Another possible middle Miocene locality from the region could be Balchik (north of Varna): NIKOLOV (1985) listed "*D. bavaricum*" (unpublished), estimating the age as "Middle Miocene – Sarmatian after mammals, Upper Sarmatian (Hersonian) after mollusks and ostracods". Conspicuously absent from Nikolov's catalogue is an elephantoid from the vicinities of Balchik referred by BAKALOW (1911, Pl. 3, Figs. 1, 2) to *Mastodon angustidens* (the same specimen is figured in a slightly different view by BAKALOV & NIKOLOV, 1962, Pl.

50, Fig. 3, as *Trilophodon angustidens*). As with the rest of the Bulgarian material referred in 20th century literature to *G. angustidens* (see MARKOV, 2007), the Balchik specimen is misidentified, its morphology fitting better with a choerolophodontid. The figures in BAKALOW (1911, Pl. 3, Figs. 1, 2) and BAKALOV & NIKOLOV (1962, Pl. 50, Fig. 3) show only a left m2 (SU 209, according to these authors; currently stored at SU under that number is a mammutid mandibular fragment with m3d from an unknown locality) but the original publication by BAKALOW (1911) describes a mandible which, according to the author, is "similar to the one found near Burgas", referred by BAKALOW (1911, Pl. 1) to *Mastodon angustidens* but actually representing *Choerolophodon pentelici*. BAKALOW (1911, p. 12) provided some measurements of the Balchik mandible but did not figure it; the text describes a third molar removed from its alveolus by the author but provides no measurements or figure. On the other hand, the description by BAKALOV & NIKOLOV (1962, p. 101) claims that "the mandible was completely destroyed during the excavations". The lack of any certain data on the morphology of the Balchik mandible (apart from Bakalow's vague allusion to the *Ch. pentelici* mandible from Burgas) is especially frustrating: it would permit a positive determination of the Balchik elephantoid (and thus the age of the locality); besides, if the age of Balchik is indeed middle Miocene as claimed by NIKOLOV (1985), and the specimen is a choerolophodontid, this would be the third find in the world of the middle Miocene *Ch. chioticus* (see below), and only the second mandible. The figured m2, however, is insufficient for a certain determination, adding to the list of potentially very interesting but lost, unpublished, or unidentifiable proboscidean specimens from the area of Varna. Again, the scarce information on Balchik does not contradict an assumed middle Miocene age for the whole fossiliferous area around Varna and again this cannot be proved with the available material.

The Orleanian/Astaracian transition was evidently a time of major proboscidean dispersals into Europe. TASSY (1990) drew attention to the Astaracian arrival of *Choerolophodon* and *Platybelodon* in the eastern Mediterranean, the former with *Ch. chioticus*, described by TOBIEN (1980) from Chios (MN6) and probably present at Sofça, Turkey (GAZIRY, 1976; TASSY, 1990), and the latter with *P.* cf. *danovi*. It seems that more proboscidean taxa took part in this event: apart from *Protanancus* which might or might not have entered the Balkans (but certainly reached Western Turkey), *Tetralophodon* and *Deinotherium* appear in Europe in MN6 (ANTOINE et al., 1997), apparently migrating from the east; *Gomphotherium angustidens*, too, might be an Astaracian immigrant (see TASSY, 1990). The Astaracian migration of several proboscidean groups to Europe is reminiscent of a similar event in the beginning of the Turolian, when *Deinotherium gigantissimum*, "*Mammut*" cf. *borsoni*, *Choerolophodon pentelici*, "*Mastodon*" *grandincisivus* and *Tetralophodon atticus* (the so-called "Pikermian proboscidean fauna": MARKOV, 2004a, 2004b) migrated to Europe. Incidentally, there are similarities in the ranges reached by different groups in the Astaracian and the Turolian: *Choerolophodon chioticus* is not known west of Chios, and *Ch. pentelici* west of Greece and Macedonia; the migration of *Platybelodon* cf. *danovi* was limited to the Balkans (Araplı in European Turkey, and possibly the localities in Bulgaria and Serbia discussed above) and that of "*M.*" *grandincisivus* to Central Europe; *Deinotherium* and *Tetralophodon*, on the other hand, reached Western Europe both in the Astaracian and in the Turolian (*D. gigantissimum* and *T. atticus* are present in Turolian localities from Western Europe to Iran: MARKOV, 2008).

Summary and conclusions

A molar from Galata (Varna) belongs to an amebelodontid, which could be *Platybelodon* cf. *danovi* as claimed by MARKOV (2004a, 2004b), or, alternatively, *Protanancus* sp. A deinothere premolar from Galata is attributed to *Deinotherium giganteum* and is one of the only two finds of this species in Bulgaria (the other, a molar from Yarebichna near Varna, seems to be lost). The reported occurrence of *Platybelodon* sp. at Pochivka (NIKOLOV, 1985), though quite likely, cannot be taken at face value. Another reported but unpublished find of unknown present location from Pochivka is a deinothere which could be either *Deinotherium giganteum* or *Prodeinotherium bavaricum*. Middle Miocene age can be assumed as a working hypothesis for the area, and *D. giganteum* at Yarebichna and *P. bavaricum* at Aksakovo, two localities near Varna, while not necessarily contemporaneous, do not contradict this. Pre-Turolian localities are rare in Bulgaria, and middle Miocene vertebrate faunas are virtually unknown. The vicinities of Varna, yielding faunal remains of possibly middle Miocene and certainly pre-Turolian age, are an area of potential interest for future research.

Platybelodon cf. *danovi* is known on the Balkans from Araplı on the Marmara Sea coast. Two molars from Grivac – Slana Bara, Serbia, referred to *Gomphotherium angustidens* by previous authors, probably belong to *Platybelodon* cf. *danovi* and would represent the westernmost known occurrence of the species. The dispersal of *Platybelodon* to the Balkans in MN6 seems to be a part of a larger proboscidean migration, including *Protanancus* (not known west of the Turkish Aegean coast), *Choerolophodon* (with *Ch. chioticus* known only from Chios and Western Turkey), *Deinotherium* and *Tetralophodon*, the latter two genera reaching Western Europe. This Astaracian migration is reminiscent of a similar event in the Turolian, the arrival in Europe of the five species of the so-called "Pikermian proboscidean fauna".

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References

ALEXEEVA I. 1957. Sur la trouvaille de *Platybelodon grangeri* en Kirghizie. – Vertebrata PalAsiatica, **1** (3): 215-222. (In Russian with French and Chinese summaries).

ANTOINE P.-O., DURANTHON F., TASSY P. 1997. L'apport des grands mammifères (rhinocérotidés, suoïdés, proboscidiens) à la connaisance des gisements du miocène d'Aquitaine (France). – In: Aguilar J.-P., Legendre S., Michaux J. (eds.). Actes du Congrès BiochroM'97. Mémoires et Travaux EPHE, Institut Montpellier, **21**: 581-590.

BAKALOW P. 1911. Beiträge zur Paläontologie Bulgariens. I. Mastodonreste aus Bulgarien. – Annuaire de l'Université de Sofia, **6**: 1-41. (In Bulgarian with German summary).

BAKALOW P. 1914. Beiträge zur Paläontologie Bulgariens. II. Dinotheriumreste aus Bulgarien. – Annuaire de l'Université de Sofia, **8-9**: 1-29. (In Bulgarian with German summary).

BAKALOV P. 1949. Einige neue Dinotheriumfunden in Bulgarien. – Annuaire de l'Université de Sofia, **46** (3): 99-106. (In Bulgarian with German summary).

BAKALOV P., NIKOLOV I. 1962. Les Fossiles de Bulgarie. X. Mammifères Tertiaires. BAS, Sofia, 162 p. (In Bulgarian with French summary).

BORISSIAK A. A. 1928. On a new mastodon from the Chokrak Beds (middle Miocene) of the Kuban region, *Platybelodon danovi* n. gen., n. sp. – Annuaire de la Société paléontologique de la Russie, **7**: 105-120. (In Russian with English summary).

BORISSIAK A. 1929. On a new direction in the adaptive radiation of Mastodonts. – Palaeobiologica, Wien & Leipzig, **2**: 19-33.

DURANTHON F., ANTOINE P. O., LAFFONT D., BILOTTE M. 2007. Contemporanéité de *Prodeinotherium* et *Deinotherium* (Mammalia, Proboscidea) à Castelnau-Magnoac (Hautes-Pyrénées, France). – Revue de Paléobiologie, **26** (2): 403-411.

GASPARIK M. 1993. Deinotheres (Proboscidea, Mammalia) of Hungary. – Annales historico-naturales Musei nationalis hungarici, **85**: 3-17.

GASPARIK M. 2001. Neogene proboscidean remains from Hungary; an overview. – Fragmenta Palaeontologica Hungarica, **19**: 61-77.

GAZIRY A. W. 1976. Jungtertiäre Mastodonten aus Anatolien (Türkei). – Geologisches Jahrbuch, **22**: 3-143.

GERAADS D., GÜLEÇ E. 2003. Proboscidea from the middle Miocene hominoid site of Çandır (Turkey). – In: Güleç E., Begun D., Geraads D. (eds.). Geology and Vertebrate Paleontology of the Middle Miocene Hominoid Locality Çandır (Central Anatolia, Turkey). Courier Forschungsinstitut Senckenberg, **240**: 235-239.

GÖHLICH U. 1999. Order Proboscidea. – In: Rössner G., Heissig K. (eds.). The Miocene Land Mammals of Europe. Verlag Dr. Friedrich Pfeil, München, 157-168.

GRÄF I. 1957. Die Prinzipien der Artbestimmung bei *Dinotherium*. – Palaeontographica, Abt. A, **108**: 131-185.

GUAN J. 1988. The Miocene Strata and Mammals from Tongxin, Ningxia and Guanghe, Gansu. – Memoirs of Beijing Natural History Museum, **42**: 1-21. (In Chinese with English abstract).

GUAN J. 1996. On the shovel-tusked elephantoids from China. – In: Shoshani J., Tassy P. (eds.). The Proboscidea. Evolution and Palaeoecology of Elephants and their Relatives. Oxford University Press, Oxford, New York, Tokyo, 124-135.

HARRIS J. M. 1975. Evolution of feeding mechanisms in the family Deinotheriidae (Mammalia: Proboscidea). – Zoological Journal of the Linnean Society, **56**: 331-362.

HUTTUNEN K. 2004. On a *Prodeinotherium bavaricum* (Proboscidea, Mammalia) skeleton from Franzensbad, Czech Republic. – Annalen des Naturhistorischen Museums in Wien, **105 A**: 333-361.

HUTTUNEN K., GÖHLICH U. 2002. A partial skeleton of *Prodeinotherium bavaricum* (Proboscidea, Mammalia) from the Middle Miocene of Unterzolling (Upper Freshwater Molasse, Germany). – Geobios, **35**: 489-514.

KAYA T., GERAADS D., TUNA V. 2003. A new Middle Miocene mammalian fauna from Mordoğan (Western Turkey). – Paläontologische Zeitschrift, **77** (2): 293-302.

KOJUMDGIEVA E. I., NIKOLOV I. M., MEIN P. 1984. Les associations des grands mammifères du miocène supérieur en Bulgarie et leur correlation avec l'echelle régionale de la Paratethys. – Comptes rendus de l'Académie bulgare des Sciences, **37** (3): 341-343.

KOSTOPOULOS D. S., SPASSOV N., KOVACHEV D. 2001. Contribution to the study of *Microstonyx*: evidence from Bulgaria and the SE European populations. – Geodiversitas, **23** (3): 411-437.

KOUFOS G. D. 2006 Palaeoecology and chronology of the Vallesian (late Miocene) in the Eastern Mediterranean region. – Palaeogeography, Palaeoclimatology, Palaeoecology, **234**: 127-145

KOUFOS G. D., ZOUROS N., MOUROUZIDOU O. 2003. *Prodeinotherium bavaricum* (Proboscidea, Mammalia) from Lesvos island, Greece; the appearance of deinotheres in the eastern Mediterranean. – Geobios, **36** (3): 305-315.

LUNGU A., OBADĂ T. 2001. New data on Early Vallesian fauna from Moldova. – Analele Ştiinţifice ale Universităţii de Stat din Moldova, seria " Ştiinţe chimico-biologice": 51-55.

MAGLIO V. J. 1969. A shovel-tusked gomphothere from the Miocene of Kenya. – Breviora, **310**: 1-10.

MARKOV G. N. 2004a. The fossil proboscideans of Bulgaria and the importance of some Bulgarian finds – a brief review. – Historia naturalis bulgarica, **16**: 139-150.

MARKOV G. N. 2004b. The Fossil Proboscideans of Bulgaria. – Unpubl. PhD Thesis, Sofia, 225 + 81 p. (In Bulgarian with English summary).

MARKOV G. N. 2007. *Gomphotherium angustidens* (Mammalia: Proboscidea) in Bulgaria. – Historia naturalis bulgarica, **18**: 167-171.

MARKOV G. N. 2008. The Turolian proboscideans (Mammalia) of Europe: preliminary observations. – Historia naturalis bulgarica, **19**: 153-178.

MARKOV G. N., SPASSOV N., SIMEONOVSKI V. 2001. A reconstruction of the facial morphology and feeding behaviour of the deinotheres. – In: Cavaretta G., Gioia P., Mussi M., Palombo M. R. (eds.). The World of Elephants. Proceedings of the 1st International Congress. Consiglio Nazionale delle Ricerche – Roma, 652-655.

MARKOVIĆ-MARJANOVIĆ J., PAVLOVIĆ M. 1970. Novo nalazište *Bunolophodon angustidens* Cuvier u Gružanskom basenu i značaj srodnih oblika za stratigrafiju neogena Srbije. – VII Kongres geologa Jugoslavije, 193-200.

NIKOLOV I. 1985. Catalogue of the localities of Tertiary Mammals in Bulgaria. – Paleontology, Stratigraphy and Lithology, **21**: 43-62.

PICKFORD M., GABUNIA L., MEIN P., MORALES J., AZANZA B. 2000. The middle Miocene mammalian site of Belometchetskaya, North Caucasus: An important biostratigraphic link between Europe and China. – Geobios, **33**: 257–267.

SACH V. J., HEIZMANN E. P. J. 2001. Stratigraphie und Säugetierfaunen der Brackwassermolasse in der Umgebung von Ulm (Südwestdeutschland). – Stuttgarter Beiträge zur Naturkunde, Serie B, **310**: 1-95.

SAEGUSA H., THASOD Y., RATANASTHIEN B. 2005. Notes on Asian stegodontids. – Quaternary International, **126-128**: 31-48.

SPASSOV N. 2000. The Turolian *Hipparion* – fauna and the character of the environment in the Late Miocene of West Bulgaria. – Review of the Bulgarian Geological Society, **61** (1-3): 47-59.

SPASSOV N. 2002. The Turolian Megafauna of West Bulgaria and the character of the Late Miocene "Pikermian biome". – Bollettino della Società Paleontologica Italiana, **41** (1): 69-81.

SPASSOV N, KOUFOS G. D. 2002. The first appearance of *Dinocrocuta gigantea* and *Machairodus aphanistus* (Mammalia, Carnivora) in the Miocene of Bulgaria. – Mitteilungen der Bayerischen Staatssammlung für Paläontologie und historische Geologie, **42**: 83-101.

TASSY P. 1983. Les Elephantoidea miocènes du plateau du Potwar, groupe de Siwalik, Pakistan. – Annales de Paléontologie (Vert.- Invert.), **69** (2): 99-136; (3): 235-297; (4): 317-354.

TASSY P. 1984. Le mastodonte à dents étroites, le grade trilophodonte et la radiation initiale des Amebelodontidae. – In: Buffetaut E., Mazin J.-M., Salmon E. (eds.). Actes du Symposium paléontologique Georges Cuvier, Montbéliard, 459-473.

TASSY P. 1985. La place des mastodontes miocènes de l'ancien monde dans la phylogénie des Proboscidea (Mammalia): hypothèses et conjectures. – Unpublished Thèse Doctorat ès Sciences, UPMC, Paris, 85-34, Volumes I-III.

TASSY P. 1986. Nouveaux Elephantoidea (Mammalia) dans le miocène du Kenya: essai de réévaluation systématique. – Cahiers de Paléontologie. Éditions du Centre National de la Recherche Scientifique (CNRS), Paris, 135 p.

TASSY P. 1990. The "proboscidean datum event": how many proboscideans and how many events? In: – Lindsay E. H., Fahlbusch V., Mein P. (eds.). European Neogene Mammal Chronology. Plenum Press, New York, 237-252.

TASSY P. 1996a. Dental homologies and nomenclature in Proboscidea. – In: Shoshani J., Tassy P. (eds). The Proboscidea. Evolution and Palaeoecology of Elephants and their Relatives. Oxford University Press, Oxford, New York, Tokyo, 21-25.

TASSY P. 1996b. Growth and sexual dimorphism among Miocene elephantoids: the example of *Gomphotherium angustidens*. – In: Shoshani J., Tassy P. (eds.). The Proboscidea. Evolution and Palaeoecology of Elephants and their Relatives. Oxford University Press, Oxford, New York, Tokyo, 92-100.

TASSY P. 1996c. Who is who among the Proboscidea? – In: Shoshani J., Tassy P. (eds.). The Proboscidea. Evolution and Palaeoecology of Elephants and their Relatives, Oxford University Press, Oxford, New York, Tokyo, 39-48.

THOMAS H., SEN S., KHAN M., BATTAIL B., LIGABUE G. 1982. The Lower Miocene Fauna of Al-Sarrar (Eastern province, Saudi Arabia). – "ATLAL" The Journal of Saudi Arabian Archaeology, **5** (3): 109-136.

TOBIEN H. 1973. On the Evolution of Mastodonts (Proboscidea, Mammalia). Part 1: The bunodont trilophodont Groups. – Notizblatt des Hessischen Landesamtes für Bodenforschung zu Wiesbaden, **101**: 202-276.

TOBIEN H. 1980. A note on the skull and mandible of a new choerolophodont mastodont (Proboscidea, Mammalia) from the Middle Miocene of Chios (Aegean Sea, Greece). – In: Jacobs L. L. (ed.). Aspects of Vertebrate History. Essays in Honor of E. H. Colbert. Museum of Northern Arizona Press, Flagstaff, 299-307.

TOBIEN H., CHEN G., LI Y. 1986. Mastodonts (Proboscidea, Mammalia) from the Late Neogene and Early Pleistocene of the People's Republic of China. Part 1: Historical Account; the Genera *Gomphotherium*, *Choerolophodon*, *Synconolophus*, *Amebelodon*, *Platybelodon*, *Sinomastodon*. – Mainzer geowissenschaftliche Mitteilungen, **15**: 119-181.

VÖRÖS I. 1989. *Prodeinotherium petenyii* sp. n. from the Lower Miocene at Putnok (North Hungary). – Fragmenta Mineralogica et Palaeontologica, **14**: 101-110.

WANG B.-Y., QIU Z.-X. 2002. A new species of *Platybelodon* (Gomphotheriidae, Proboscidea, Mammalia) from early Miocene of the Danghe area, Gansu, China. – Vertebrata PalAsiatica, **40** (4): 291-299. (In Chinese with English summary).

WANG B.-Y., QIU Z.-X., WANG X., XIE G.-P., XIE J.-Y., DOWNS W., QIU Z.-D., DENG T. 2003. Cenozoic stratigraphy in Danghe Region (Gansu Province) and uplift of Tibetan Plateau. – Vertebrata PalAsiatica, **41** (1): 66-75. (In Chinese with English summary)

WANG X.-M., WANG B.-Y., QIU Z.-X., XIE G.-P., XIE J.-Y., DOWNS W., QIU Z.-D., DENG T. 2003. Danghe area (western Gansu, China) biostratigraphy and implications for depositional history and tectonics of northern Tibetan Plateau. – Earth and Planetary Science Letters, **208**: 253-269.

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Фосилните хоботни от района на Варна: рядка индикация за средномиоценска гръбначна фауна в България

Георги Н. МАРКОВ

(Р е з ю м е)

Статията разглежда фосилните хоботни от района на Варна, по-специално две находки от Галата: молар на елефантоид, погрешно отнесен към *Tetralophodon longirostris* от предишни автори, но всъщност представляващ амебелодонтид, и един премолар на редкия за България вид *Deinotherium giganteum*. Разгледани в контекста на други находки от Варненско, материалите от Галата са индикация за възможни средномиоценски разкрития в района. Подобна индикация е от значителен интерес, тъй като средномиоценската гръбначна фауна на България е практически непозната. Изложена е хипотеза за миграция на няколко групи хоботни от Предна Азия към Европа през средния миоцен – събитие, наподобяващо разселването на пикермийската хоботна фауна в началото на турола.

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The Turolian proboscideans (Mammalia) of Europe: preliminary observations

Georgi N. MARKOV

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Abstract. The paper deals with six proboscidean species from the Turolian of Europe. Problems of their taxonomy, phylogeny, assumed geographic range and time span are discussed; an attempt is made to outline the most important localities and material for each of the six taxa. With the exception of *Anancus*, a later immigrant, the other five proboscideans seem to be part of the large-scale mammal migrations from West Asia into Europe around the Vallesian/Turolian transition.
Key words: Proboscidea, Late Miocene, Europe, taxonomy, dispersals

Introduction

The Turolian proboscideans of Europe are something of a paradox. On one hand, they are represented by abundant material from numerous localities (Fig. 1); on the other, virtually each of the species discussed in this paper has been, or still is, involved in controversies of taxonomy, phylogeny, geography and chronology. These problems are interrelated, since choice of taxonomy obviously influences assumed ranges in space and time; mixing the Turolian taxa with closely related but not identical species creates a false impression of Vallesian proboscidean relicts in the Turolian, or, in two cases, of early appearances of taxa typical for the Pliocene.

In this paper, some preliminary results from an ongoing research on the Turolian proboscideans of Europe and Southwest Asia are presented, with taxonomical notes and a brief outline of the most important localities and finds for each species.

Institutional abbreviations:

HGI: Hungarian Geological Institute, Budapest.
HNHM: Hungarian Natural History Museum, Budapest.
MMNH: Macedonian Museum of Natural History, Skopje.
MNHN: Muséum National d'Histoire Naturelle, Paris.
NHM: Natural History Museum, London.
NHMW: Naturhistorisches Musem Wien, Vienna.
NMNH: National Museum of Natural History – BAS, Sofia.
NMNHAs: Palaeontology Museum (Branch of NMNH – BAS), Assenovgrad.

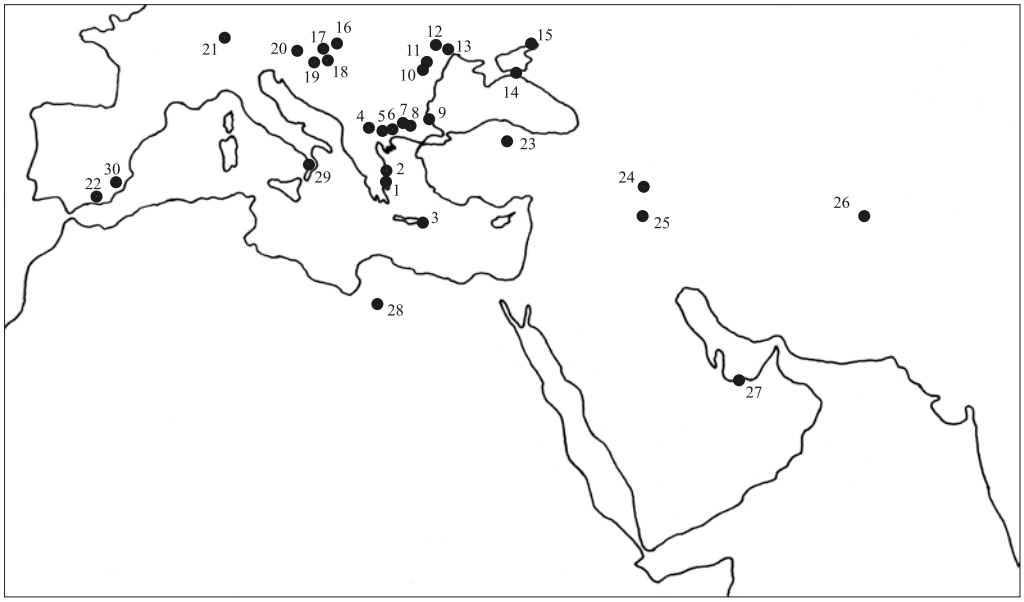

Fig. 1. Selected Turolian localities with proboscidean fauna in Europe and adjacent areas. 1: Pikermi; 2: Halmyropotamos; 3: Maronia/Siteia; 4: Dolni Disan; 5: Kalimantsi; 6: Hadzhidimovo; 7: Ahmatovo; 8: Ezerovo; 9: Burgas; 10: Cimişlia; 11: Taraklia; 12: Grebenniki; 13: Belka; 14: Kertch; 15: Morskaya 2; 16: Pestszentlörincz; 17: Csákvár; 18: Polgárdi; 19: Baltavár; 20: Kohfidisch; 21: Dorn-Dürkheim 1; 22: Alfacar; 23: Kayadibi; 24: Maragheh; 25: Injana; 26: Molayan; 27: Jebel Barakah; 28: Sahabi; 29: Cessaniti; 30: Crevillente 2.

RHMR: Regional History Museum, Russe.
SU: Palaeontology Museum of the Sofia University, Sofia.

Systematics and range:

Deinotherium gigantissimum Stefanescu, 1892 (= *D. proavum* Eichwald, 1835)

Taxonomical remarks:
Two problems concerning the Turolian deinotheres are whether or not they represent a species different from *D. giganteum* Kaup, and, if yes (the approach adopted here), what is the correct name to be used for that species. Following most of the authors who have discussed its status, I use the name *D. gigantissimum* Stefanescu, 1892. It was argued by CODREA (1994) that *D. proavum* Eichwald, 1835 has priority, and subsequently the name has been employed in recent literature (e.g. GASPARIK, 2001). The problem, however, is somewhat more complicated than a simple priority issue, and as suggested by M. Pickford (e-mail dated 19.07.2002), the case probably needs a ruling by the ICZN.

A century of debate on the status of the largest European deinotheres could be summarized thus: numerous authors have argued against separate specific status, pointing out that size alone is a weak criterion (several important finds from Eastern Europe showing morphological

differences, however, were unknown to them: see below); others (e.g. GRÄF, 1957; TOBIEN, 1988) were inclined to accept *D. gigantissimum* as a valid species – or at least the possibility that future finds might confirm its validity. A crucial point was made by TARABUKIN (1974), who noted the strongly developed mandibular angle present in all mandibles referable to *D. gigantissimum* but not in *D. giganteum*, and included this character in his revised diagnosis of the species. Tarabukin's observation was based on limited material (two mandibles from the Moldovan localities Pripiceni and Goleshty / Găleşti) but it is confirmed by the shape of the mandible in the skeleton from Ezerovo[1], Bulgaria, and the Turolian deinotheres from Alfacar (see BERGOUNOIUX & CROUZEL, 1959, Pl. 3). In all those specimens, the angle of the mandible is strongly developed, with its lowest point far below the ventral border of the horizontal ramus, unlike the state observed in *D. giganteum* (Fig. 2). This character, along with some aspects of cranial morphology[2], supports the separate status of *D. gigantissimum*, a species larger and later than *D. giganteum*.

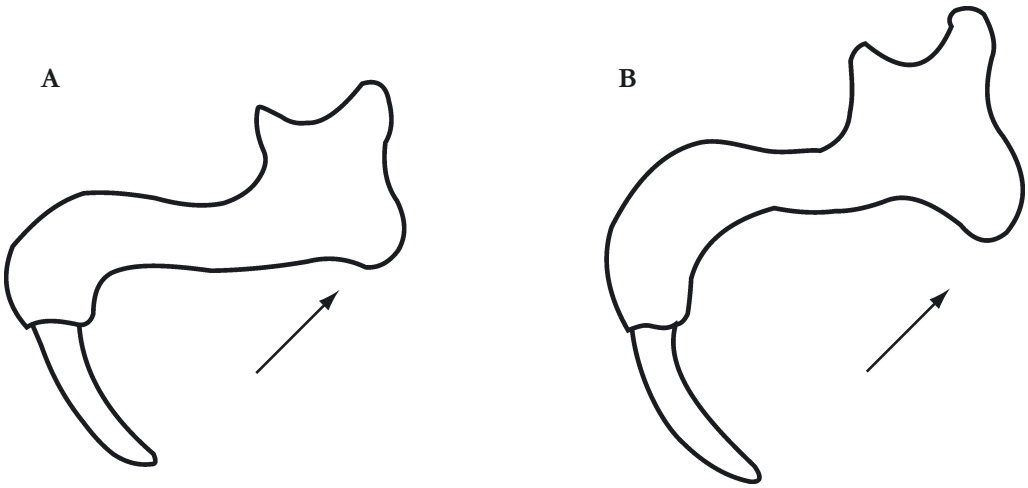

Fig. 2. Mandibular shape in *Deinotherium giganteum* (A) and *D. gigantissimum* (B), lateral view. Arrow marks angle of the mandible. Not to scale.

[1] The Ezerovo skeleton, stored at SU, remained unpublished for decades following the death of I. Nikolov in 1982 (photo and some metrical data were provided by TOBIEN, 1986, 1988; the specimen was briefly discussed by MARKOV et al., 2002, who referred it to *D. gigantissimum*. Aspects of its postcranial morphology were discussed by HUTTUNEN & GÖHLICH, 2002, and HUTTUNEN, 2004). The name "*D. thraciensis*" (in varying spellings) referring to the Ezerovo skeleton has been used in passim by I. Nikolov on several occasions, including posthumous publications, none of which, however, included a formal description of this "species". Quite recently, a description of the skeleton (as "*Deinotherium thraceiensis* sp. nov.") partially based on I. Nikolov's notes was published (KOVACHEV & NIKOLOV, 2008: although the paper is dated 2006 it actually appeared in 2008). The Ezerovo skeleton, however, is conspecific with the rest of the material referred to *D. gigantissimum* and certainly represents no new species. Proboscidean taxa from Ezerovo, *contra* KOVACHEV & NIKOLOV (2008), include *Deinotherium gigantissimum*, "*Mammut*" *obliquelophus*, *Choerolophodon pentelici*, *Tetralophodon atticus*, and *Anancus* sp. (MARKOV, 2004b).

[2] Briefly discussed by MARKOV et al. (2002); note, however, that premaxillaries in the Ezerovo skull are partially reconstructed and its marked shortness might be an artefact. Besides, although strongly developed, the angle of the mandible seems to be additionally "strengthened" with plaster.

Important localities and material[3]:
Material from the type locality of *D. gigantissimum*, Găiceana in Romania, is scarce (as is the material from the type locality of *D. proavum*, Rakhny Lesovye, or Rakhny Lisovi, now in Ukraine; spelt "Rachnow ljassowy" by EICHWALD, 1835). The most important finds referable to that species include a skeleton with partially preserved mandible from Mânzaţi (Romania), an almost complete skeleton with a fully preserved mandible from Pripiceni (Moldova), a skeleton with preserved mandible and skull from Ezerovo (Bulgaria), all belonging to adult individuals. Juvenile *D. gigantissimum* remains are known too: a maxillary fragment and two mandibles with deciduous dentition from Nessebar (Bulgaria), misidentified as *P. bavaricum* by previous authors (see MARKOV, 2004a, 2004b, 2008), deciduous dentition from Cimişlia in Moldova (misidentified as *D. giganteum* by SIMIONESCU & BARBU, 1939; permanent molars from the same locality were referred to *D. gigantissimum* by these authors), the nearby Moldovan locality Taraklia (or Taraclia) (KHOMENKO, 1914, Pl. 1, Fig. 16). From Pikermi in Greece, apart from postcranial adult remains (GAUDRY, 1860; pers. obs. MNHN, 2002), there is a palate with D2-D4 described by WAGNER (1857, Pl. 7, Fig. 15), and an unpublished D2 (NHM M10103, pers. obs. NHM, 2006), which, with its dimensions of 49.4 x 43.7 mm, is one of the largest deinothere D2's known so far. Deciduous premolars from Kayadibi, Turkey, published by GAZIRY (1976), most probably belong in *D. gigantissimum* too (I am grateful to M. Pickford for drawing my attention to the Kayadibi specimens). Deciduous premolars described by SANDERS (2003) from the middle member of the Sinap Formation in Turkey are, according to this author, of similar size to the Kayadibi sample[4]; with ages of late MN10 for the Sinap material and early MN11 for Kayadibi (SANDERS, 2003), the two might indeed be conspecific (in that case, Turkish material would mark one of the earliest occurrences of *D. gigantissimum*). In Western Europe, *D. gigantissimum* (published as *D. giganteum*) appears at several Spanish Turolian localities, e.g. Alfacar (BERGOUNIOUX & CROUZEL, 1959, 1962); Crevillente 2 and Crevillente 16 (MAZO & MONTOYA, 2003), and others, spanning from MN11 to MN12. Deinotheres from the German Turolian locality Dorn-Dürkheim 1 ("*Deinotherium* n. sp." of FRANZEN & STORCH, 1999) belong in this species too, as well as finds from the Austrian localities Kohfidisch (referred to *D. giganteum* by BACHMAYER & ZAPFE, 1969, 1972, who nevertheless noted that dimensions of Kohfidisch deinotheres surpassed known range for that species; formerly assumed to be Vallesian, the age of Kohfidisch is actually Turolian as demonstrated by VISLOBOKOVA & DAXNER-HÖCK, 2004), and, possibly, Prottes, Wilfersdorf, and others (pers. obs., NHMW, 2006; see also HUTTUNEN, 2002, for the large dimensions of some teeth attributed to *D. giganteum* by that author). Abundant material is known from numerous localities in Hungary (GASPARIK, 1993, 2001) and Bulgaria (MARKOV, 2004a, 2004b). The species is represented in Greece not only by finds from Pikermi but also Samos, Halmyropotamos, Kerassiá and Crete (see e.g. ATHANASSIOU, 2004 and references therein, as well as THEODOROU et al., 2003; Turolian material referred to *D. giganteum*), in Macedonia (LASKAREV, 1948; GAREVSKI, 1976a; and

[3] This is a brief outline of important localities and finds, not an exhaustive list, for *D. gigantissimum* as well as for the rest of the taxa discussed further.

[4] Actually, they are even larger (see SANDERS, 2003, Fig. 10.2). D2 is practically of the same size as NHM M10103, and size of D3 is close to the teeth in MMNH 2740, an unpublished palate with D2-D4 from the area of Veles, Macedonia (pers. obs. MMNH 2003), SU 301, unpublished D3 from Rogozen, Bulgaria, and the material from Cimişlia, Moldova, discussed above.

pers. obs., MMNH, 2003), Romania (apart from Găiceana and Mânzaţi, also at Verneşti and others: see ATHANASIU, 1907), Moldova (Pripiceni, Găleşti, Cimişlia, Taraklia, and others: see quoted works by KHOMENKO, 1914; SIMIONESCU & BARBU, 1939; TARABUKIN, 1974, as well as PAVLOW, 1907), Ukraine (Novaya Emetovka, Belka and others: see e.g. KOROTKEVICH, 1988), and South Russia: Novocherkassk (BAJGUSHEVA & TISHKOV, 1998), Obuhovka sand pit near Rostov (BAJGUSHEVA & TITOV, 2006), Kossyakino and Armavir (see VISLOBOKOVA & SOTNIKOVA, 2001). For the last two localities, the age was given as Ruscinian by VISLOBOKOVA & SOTNIKOVA (2001) but this is not convincing: fauna is apparently of mixed age, including Turolian as well as Villafranchian elements; on problems concerning the correlation of these two localities (including with each other) see ALEXEEVA (1959). There is not a single locality yielding *Deinotherium gigantissimum* that can be positively dated to the Pliocene (frequent reports of "Pliocene" deinotheres in Europe in older literature refer to Pliocene in an older sense, i.e. the Late Miocene of present-day concepts).

The easternmost occurrences of *D. gigantissimum* seem to be marked at (Upper) Maragheh (Iran: "*Deinotherium* sp.", ERDBRINK et al., 1976; BERNOR, 1986)[5], Injana (Iraq: "*Deinotherium* sp. / *Prodeinotherium* sp.", THOMAS et al., 1980 – a crenulated loph, probably from a deciduous tooth, hence the uncertain determination), and Molayan (Afghanistan: "*Deinotherium* sp. of very large size", BRUNET et al., 1984).

In summary, *D. gigantissimum* is represented in Turolian localities ranging from Spain through Central and Eastern Europe to Turkey, Iran, Iraq and Afghanistan. Material includes several skeletons (one preserving the skull and mandible), several mandibles of adult individuals, deciduous dentition, mandibles and maxillary fragments of juvenile individuals, and numerous isolated dental and postcranial finds. Known time span is MN11 – MN12, with possible occurrences in MN13 and probable first appearance in the latest Vallesian. Reported Ruscinian age for deinothere remains from two localities in Russia is most probably erroneous (the fauna in these localities seems to be a heterogeneous assemblage of different age).

"*Mammut*" *obliquelophus* (Mucha, 1980)

Taxonomical remarks:

Quite a number of finds demonstrate the occurrence in the Turolian of a mammutid close to "*Mammut*" *borsoni* but differing from it in the longer mandibular symphysis. This species has been confused both with *Zygolophodon turicensis*[6] and with the Pliocene mammutid "*M.*" *borsoni*, some finds have been incorrectly referred to "*Mammut praetypicum*" (a name that should not be used for the Turolian mammutids: see below). To further complicate the situation, both "*M.*" *borsoni* and the Turolian species most probably belong to a separate, yet unnamed genus, differing from *Zygolophodon* as well as *Mammut* (MARKOV, 2004a, 2004b).

Decades ago, it was noted by ALEXEEVA (1965) that most probably two different mammutids are mixed under the name "*M.*" *borsoni*: the brevirostrine "*M.*" *borsoni* s. str. from

[5] Notably, DE BONIS et al. (1994) listed *D. giganteum* from Upper Maragheh – thus accepting, the employed taxonomy notwithstanding, the conspecifity of deinotheres at U. Maragheh, Pikermi, Samos and Halmyropotamos.

[6] TASSY (1985) demonstrated both the similarity of the Turolian form to "*M.*" *borsoni* (and not to *Z. turicensis*, a species not known from the Turolian), and its distinctiveness, using the designation *Zygolophodon* cf. *borsoni*.

the Pliocene, and a closely related late Miocene form with a longer symphysis. This, I believe, remains a correct opinion, supported by numerous finds. Ironically, the situation around the Turolian species has been obscured by some unfortunate taxonomic decisions, and the uncertain stratigraphy for several important finds. Central to the taxonomical problem is a publication by KUBIAK (1972), describing a mandible and skull fragment of unknown exact locality but probably from the so-called Balta Sands in Podolia, nowadays in the Ukraine. KUBIAK (1972) referred the material to "*Mammut praetypicum* (Schlesinger, 1919)", elevating Schlesinger's "*Mastodon* (*Mammut*) *americanus* forma *praetypica*" to a specific rank and basing his determination on dental similarities between Schlesinger's material and the find from Podolia. This, however, is unwarranted. The material described by Kubiak certainly differs from "*M.*" *borsoni*, but this is not the case with Schlesinger's taxon. "Types" of "*M. praetypicum*" cited by KUBIAK (1972) were in fact chosen as lectotypes by OSBORN (1936) – an unfortunate decision, since it is evident from the work by SCHLESINGER (1922) that he regarded as type specimen a hemimandible from Ajnácskö (now Hajnáčka in Slovakia). The paper by SCHLESINGER (1919) appeared earlier, but was written later, than his 1922 work, being a summary of his two monographs on the elephantoids stored at the museums in Vienna (SCHLESINGER, 1917) and Budapest (SCHLESINGER, 1922). Apparently, it was not supposed to be published before the 1922 volume – the 1919 paper treats "forma *praetypica*" as a name already published, and so does not name a type or use the designation "nova forma" (which appears in the 1922 monograph). Osborn's lectotypes (probably of Pliocene age), are not informative: as said, dental morphology in "*M.*" *borsoni* and the Turolian species is practically identical, and the only reliable character permitting to distinguish between the two is the symphyseal length. Thus, if Osborn's "types" are considered, "*M. praetypicum*" is a *nomen vanum*. If the species is treated as based on the hemimandible from Hajnáčka – as apparently was Schlesinger's intention – then it falls into synonymy with "*M.*" *borsoni*: the hemimandible is clearly brevirostrine (SCHLESINGER, 1919, 1922), and the locality is of early Villafranchian (MN16a) age. In both cases, "*M. praetypicum*" is not a name to be used for the Turolian longirostrine species. KUBIAK (1972) speculated that symphyseal length might vary in "*Mammut praetypicum*" (since the symphysis is long in the mandible from Podolia but obviously short in Hajnáčka); in my opinion, this is not the case. Rather, the Hajnáčka hemimandible and the Podolia elephantoid belong to two different species – the first to "*M.*" *borsoni* and the second to a species which, by the time of Kubiak's publication, was nameless[7]. Thus, KUBIAK (1972) was perfectly correct in his opinion that the Podolia material is earlier and more primitive than "*M.*" *borsoni* – but not in his choice of taxonomy.

The only taxon based on a mandible with unequivocally long symphysis (though unfortunately the age is speculative), is *Mastodon obliquelophus*, described by MUCHA (1980), from Romanovka, Ukraine, and although a taxon based on a well dated specimen would be preferable, the longirostrine[8] Turolian mammutids should be referred to Mucha's species. As noted, dental morphology in "*M.*" *obliquelophus* and "*M.*" *borsoni* is practically identical, and the only reliable character that helps distinguishing between the two is the symphyseal length (Fig. 3): symphysis longer than the tooth row and bearing well developed tusks in

[7] *Mastodon pavlowi* Osborn, 1936, based on upper M1-M3 from Pestchana, Podolia, is – similarly to "*M. praetypicum*" – either *nomen vanum* or, more probably, a junior synonym of "*M.*" *borsoni*: according to PAVLOW (1894), these molars were found together with a mandible with short symphysis.

[8] That is, longirostrine in comparison with "*M.*" *borsoni*; compared to the more primitive genus *Zygolophodon*, the symphysis in "*M.*" *obliquelophus* is reduced.

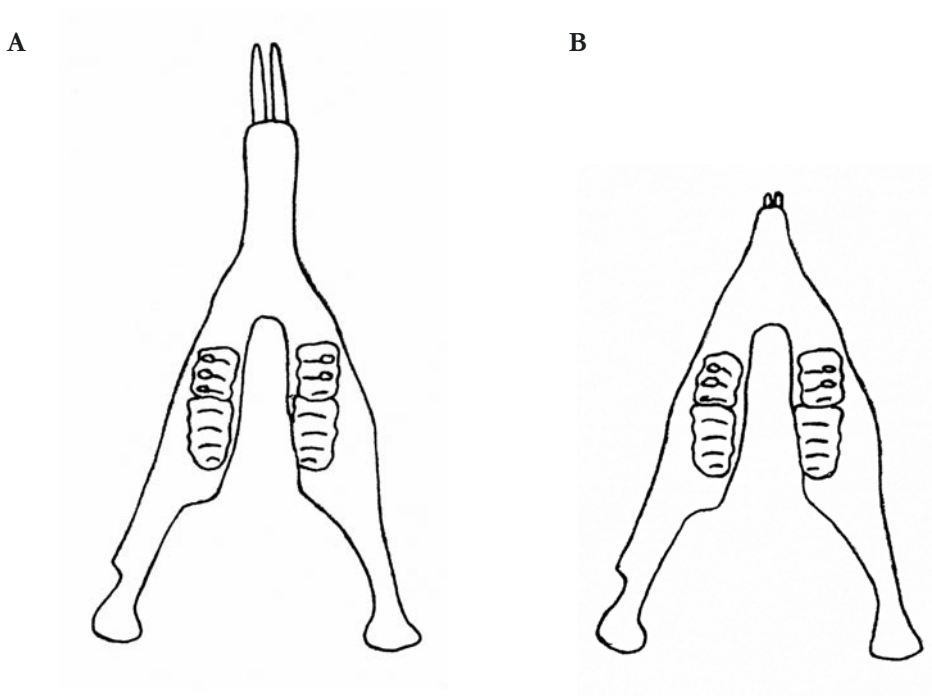

Fig. 3. Symphyseal length and shape in "*Mammut*" *obliquelophus* (A) and "*M.*" *borsoni* (B), occlusal view. Not to scale.

"*M.*" *obliquelophus*, significantly reduced (shorter than the tooth row) and with small vestigial tusks in "*M.*" *borsoni*. Note that in both species, the symphysis is deflected, *contra* TOBIEN (1976). Various published mandibles of "*M.*" *borsoni* – e.g. BAKALOV & NIKOLOV (1962, Pl. 53), seem to lack the easily breakable tip of the symphysis; the actual symphyseal shape in "*M.*" *borsoni* can be observed in the specimens from Bossilkovtsi in Bulgaria (CHALWADŽIEV, 1986, Pl. 1)[9], and Milia (Grevena, Greece) published by TSOUKALA (2000, Fig. 7).

Worth mentioning is a left hemimandible of a juvenile mammutid from Shanxi (or Shansi), China, originally published by HOPWOOD (1935, Pl. 6, Fig. 5) as *Mastodon americanus* and referred by TOBIEN et al. (1988) to *Mammut borsoni*. The specimen, a cast of which is stored at NHM (coll. number M14825), has a longer symphysis than the two juvenile mandibles from Pikermi (see below), judging both from the preserved part of the symphysis and the shape of the horizontal ramus which is narrower and higher than the Pikermi specimens (pers. obs. NHM, 2006). In this aspect, the Shanxi specimen is more primitive than the Pikermi material and conspecifity with "*M.*" *obliquelophus* is far from granted (not to mention "*M.*" *borsoni*). From Shanxi, the species *Zygolophodon shansiensis* was described by CHOW & CHANG (1961) (synonymized with *Mammut borsoni* by TOBIEN et al., 1988). The holotype of *Z. shansiensis* is an isolated m3 (CHOW & CHANG, 1961, Pl. 1, Figs. 2, 2a), so, first, there is no information on the symphyseal length in this taxon and, second, in the absence of comparable material it

[9] The tip of the symphysis of the Bossilkovtsi specimen, stored at RHMR, has later been slightly damaged. Currently it is restored in plaster, obscuring its original deflected shape (pers. obs.).

is impossible to prove or reject conspecifity between the type of *Z. shansiensis* and the juvenile hemimandible described by HOPWOOD (1935). Thus, the problem of the synonymy between *Z. shansiensis* and "*M.*" *borsoni* remains unclear, as well as the taxonomic position of the juvenile specimen from Shanxi – which could represent yet another (unnamed) species of the unnamed genus including "*M.*" *borsoni* and "*M.*" *obliquelophus*.

Important localities and material:
In addition to Romanovka and the unknown precise locality of the Balta Sands already mentioned, mandibles with a long symphysis and *borsoni*-like teeth are known from Ferladany in Moldova (PAVLOW, 1894, Pl. 3, Fig. 5, 5a, as *Mastodon borsoni*), and Ahmatovo in Bulgaria (NIKOLOV & KOVAČEV, 1966, Pl. 2, Fig. 1, as *Zygolophodon borsoni*). Juvenile remains are known from Pikermi in Greece (mandible and palate stored at MNHN: GAUDRY, 1862; see also TASSY, 1985; unpublished skull with mandible at NHM: TASSY, 1985; pers. obs. NHM, 2006), "RZO-24" in Greece (unpublished skull: KOUFOS, 1980, as *Mammut tapiroides*), Belka in Ukraine (skull with mandible: KOROTKEVICH, 1988, Pl. 25b, as *Turicius turicensis*; only a photo is provided). Deciduous dentition from Halmyropotamos (Greece) published by MELENTIS (1967) as *Mastodon* (*Zygolophodon*) *tapiroides* is another example, as well as unpublished remains from Hadzhidimovo at NMNHAs, and the area of Veles at MNMH (pers. obs., MNMH, 2003). A d4 from the Turolian locality Csákvár (Hungary), referred by GASPARIK (2001) to *Z. turicensis* has a morphology close to "*M.*" *borsoni* (pers. obs., HNHM, 2005) and thus most probably belongs to "*M.*" *obliquelophus* too, as well as the mammutids from other Turolian localities in Hungary (see GASPARIK, 2001). Similarly, the M1 from the Turolian locality Las Pedrizas (Teruel, Spain), referred by MAZO (1996) to *Z. turicensis* should rather be attributed to "*M.*" *obliquelophus*, as well as the material from "RZO 5" in Greece (DE BONIS et al., 1992a) and the Turolian (MN12) locality Morskaya 2 in South Russia (Sea of Azov region), attributed by TITOV et al. (2006) to *Mammut borsoni*. Another possible locality of "*M.*" *obliquelophus* in Eastern Europe is Curtea de Argeş in Romania with material described by ATHANASIU (1907)[10]. Also, the Italian locality Gravitelli, MN13 (ROOK, 1992: "*Z. borsoni* and *Z. turicensis*") might mark the occurrence of "*M.*" *obliquelophus* in the country.

Worth mentioning is a skull from Topoľčani in Slovakia, published by SCHMIDT (1963) as "*Tetralophodon grandincisivus*" but, as noted by TOBIEN (1978), actually belonging to a mammutid. Without direct observations of the material I wouldn't venture a more precise determination but the specimen is important in any case, being only the third adult mammutid skull from the Old World known so far. (The Topoľčani skull was referred to *Mammut borsoni* by ČERŇANSKÝ, 2006, who seemed to be unaware of Tobien's comment).

In summary, "*Mammut*" *obliquelophus* is present in Spain, several localities in Hungary, Bulgaria, Macedonia, Greece, ? Romania, Moldova, Ukraine and southern Russia (e.g. mainly in Central and Eastern Europe). Material includes mandible and skull fragment of an adult individual, several adult mandibles, three skulls with mandibles of juvenile individuals (all of them unpublished), a juvenile mandible and palate, deciduous dentition, and numerous isolated teeth that can only tentatively be attributed to the species basing on their Turolian age. Known time span: MN11 – MN12, with possible later occurrences.

[10] Thus, while Schlesinger's choice of taxonomy and concepts on mammutid evolution might be outdated, his suggestion (SCHLESINGER, 1922, p. 136) that mammutids from Curtea de Argeş, Ferladany, Pikermi and other "Pontian" localities belong to the same form seems to remain perfectly valid.

***Choerolophodon pentelici* (Gaudry et Lartet, 1856)**

Taxonomical remarks:
Far less problematic compared to the rest of the taxa discussed here, the most important issue concerning *Choerolophodon pentelici* is the status of the Vallesian choerolophodons from Turkey which in turn influences the species' assumed time span. I regard *Ch. pentelici* as a Turolian species, characterized by a straight mandibular symphysis and strongly redressed perinasal area of the skull (see TASSY, 1985). I follow the suggestion made by TASSY (1985, p. 633, 646) that Vallesian material, and especially the skull from Akın in Turkey, described by GAZIRY (1976, Pl. 6, Fig. 1-5), represents a different, and more primitive, species. Thus, I agree with SANDERS (2003) that the Vallesian species, referred to as *Choerolophodon anatolicus* (Ozansoy, 1965) by that author[11], includes "*Choerolophodon pentelici lydiensis*" described by TASSY et al. (1989); unlike SANDERS (2003), however, I am not convinced that MN11 material from the lower levels of Kemiklitepe (KTD66), referred to *Choerolophodon pentelici* ssp. indet. by TASSY (1994), should be excluded from *Ch. pentelici*. Rather, judging from the straight ventral border of the symphysis in KTD66 (see TASSY, 1994, Pl. 1), this specimen seems indeed to represent early *Ch. pentelici*. In addition, accepting the separate specific status of Vallesian choerolophodonts does not necessarily mean that any Vallesian find should be automatically excluded from *Ch. pentelici*: it is possible that the replacement of the earlier and more primitive species by *Ch. pentelici* took place as early as the latest Vallesian.

Important localities and material:
Pikermi, the type locality, has yielded mandibles and skulls of juvenile individuals. Craniomandibular finds of adults are rare – several mandibles and hemimandibles from the area of Burgas in Bulgaria (see BAKALOW, 1911; BAKALOV & NIKOLOV, 1962 – misidentified as "*Trilophodon*" *angustidens*: TASSY, 1983; APOSTOLOV & NIKOLOV, 1985, as *Choerolophodon* (*Synconolophus*) *serridentinoides*; unpublished material at NMNH), an unpublished mandible with both third molars from Ezerovo and an unpublished skull with damaged teeth from Ahmatovo (both at NMNHAs) are among the few specimens known so far. The species is known from Macedonia (the area of Veles: ĆIRIĆ, 1957; pers. obs., MNHN, 2003) which seems to mark the limit of its distribution in the west, from Bulgaria, Greece (Pikermi, Samos, Halmyropotamos etc.: DE BONIS et al., 1994), Turkey (GAZIRY, 1976; TASSY, 1994, 2005), Moldova (localities listed by LUNGU & OBADA, 2001 but also Lozovo: PIDOPLICHKO, 1956, Pl. 15, Fig. 3, misidentified as *A. arvernensis*), Ukraine (localities listed by KOROTKEVICH, 1988 and KRAHMALNAYA, 1996 but also Grebenniki: BURCHAK-ABRAMOVICH, 1940, Fig. 2, misidentified as *T. longirostris*: P. Tassy, pers. comm. 2002), possibly Romania (ŞTIUCA, 2003)[12], Iran (Maragheh: SCHLESINGER, 1917; DE MECQUENEM, 1924, etc.), and Iraq (Injana: see THOMAS et al., 1980).

In summary, *Choerolophodon pentelici* seems to be confined to the area from present-day Macedonia and Greece in the west, through Bulgaria, Romania, Moldova, Ukraine and Turkey to Iran and Iraq in the east. Material includes skulls and mandibles of juvenile as well as adult

[11] It is possible that *Choerolophodon serridentinoides* (Viret et Yalçinlar, 1952) is a senior synonym for *Ch. anatolicus*.
[12] The hemimandible (of unclear precise age) from Bacău in Romania, referred by RĂDULESCU & ŞOVA (1987, Pl. 1, Fig. 1) to *Ch. pentelici*, seems to have a deflected symphysis, judging from the photo, and more probably belongs in the Vallesian species of *Choerolophodon*.

individuals, isolated dental and postcranial remains. Assumed time span depends on adopted taxonomy (i.e. status of Vallesian and MN11 choerolophodons) and is most probably MN11 – MN12, with reported presence in MN13 needing further evidence.

"*Mastodon*" *grandincisivus* Schlesinger, 1917

Taxonomical remarks:
Attributed by previous authors to *Tetralophodon* and *Stegotetrabelodon*, "*Mastodon*" *grandincisivus* is actually an amebelodontid, as demonstrated by TASSY (1985) and belongs to a yet undescribed genus, diagnosis of which was practically provided by TASSY (1985, 1999). In this paper, Tassy's provisional designation as "*Mastodon*" (in quotation marks) is followed (another provisional solution, attributing the species to *Amebelodon* was employed by GERAADS et al., 2005; in my opinion, tetralophodont intermediary teeth and tubular dentine of the lower tusks are too important differences, preventing attribution to *Amebelodon*).

Important localities and material:
The uncertain taxonomic position of "*M.*" *grandincisivus* is mostly due to the scarcity of known material (or, more precisely, of published material). The holotype from Maragheh, Iran, is a lower tusk (SCHLESINGER, 1917). Mandibles of adult individuals lacking symphyses are known from Pestszentlörincz in Hungary (SCHLESINGER, 1922, Pl. 2- 3) and Oryahovo in Bulgaria (BAKALOV & NIKOLOV, 1962, Pl. 66). It is important to note that photo of the Oryahovo mandible in BAKALOV & NIKOLOV (1962) is extremely misleading since it is taken after a "reconstruction" of the specimen: the whole symphysis is rebuilt (pers. obs., SU), obviously following the reconstruction in SCHLESINGER (1922, Pl. 1); parts of the mandibular branches are reconstructed too. The real shape of the symphysis in "*M.*" *grandincisivus* is observable in a unique juvenile mandible from Hadzhidimovo, Bulgaria (unpublished), stored at NMNHAs (coll. no. HD38029). At Pestszentlörincz, as well as Oryahovo, mandibles are associated with lower tusks matching the type specimen from Maragheh (thus permitting their attribution to "*M.*" *grandincisivus*), upper tusks and third molars, and, in the Hungarian locality, with postcranial remains. The only known skull of the species is from the mine Maritza – Iztok in Bulgaria and was recently published by KOVACHEV (2006) (as *Stegotetrabelodon grandincisivus*; note that despite being dated 2004 this work appeared in 2006).

Apart from these, isolated finds attributable to "*M.*" *grandincisivus* are known from Kertch in the Ukraine, Amasya in Turkey (GAZIRY, 1976), the area of Burgas in Bulgaria (MARKOV, 2004b) and several localities in Hungary (GASPARIK, 2001; pers. obs. HNHM, 2005). The species (or a closely related form) seems to be present at Cherevichnoe and Novoukrainka in the Ukraine (KOROTKEVICH, 1979), Sahabi in Libya[13] and Jebel Barakah, UAE (TASSY, 1999), and possibly in the Indo-Pakistan region as well (TASSY, 1983, 1985). For Pakistan, another find deserves a brief comment: U.Z. 69/636, left and right m3 from Lehri (Punjab), published by SARWAR (1977, Figs. 48 and 49) as "*Anancus osborni*". It was suggested by TASSY (1983) that U.Z. 69/636 might belong to *Paratetralophodon hasnotensis*. Lophid number and structure, however,

[13] The hypodigm of "*Amebelodon cyrenaicus*", described by GAZIRY (1987) from Sahabi seems to be heterogeneous: judging from the collection numbers, referred specimens are from several different localities and none of them is in any way associated with the type. The type might belong to "*M.*" *grandincisivus* as suggested by TASSY (1999), as well as part of the material referred to *Stegotetrabelodon lybicus* (e.g. GAZIRY, 1987, Fig. 11).

speak against this (H. Saegusa, pers. comm. 2007)[14]. U.Z. 69/636, while certainly no *Anancus*, apparently represents a new elephantoid taxon that could be related to "*M.*" *grandincisivus* (H. Saegusa, G. N. Markov, unpublished data). Further east, an incomplete third upper molar from Shanxi, China, holotype of *Gomphotherium changzhiensis* Zhai, 1963, resembles "*M.*" *grandincisivus* in the significant amounts of cement and the morphology of the lophs ("L-shaped", after the original description by ZHAI, 1963, and mesio-distally compressed). The specimen was referred to *Choerolophodon* sp. by TOBIEN et al. (1986, p. 144) but the morphology of the preserved lophs is not typically choerodont, and the enamel is smooth. The presence of *Choerolophodon* in China is far from certain (TASSY, 1994), and the Shanxi molar is worth having in mind as a possible indication for the occurrence of a *grandincisivus*-like elephantoid in East Asia.

Another European locality yielding "*M.*" *grandincisivus* seems to be Pikermi: unpublished juvenile lower tusks stored at MNHN – Paris and NHM – London probably belong to that species (pers. obs. MNHN, 2004, NHM, 2006), and a maxillary fragment with D2-D4 figured by MARINOS & SYMEONIDIS (1974, Pl. 7) and misidentified as *Ch. pentelici* by these authors is either *Tetralophodon atticus* or "*Mastodon*" *grandincisivus* (since geographic and chronological distribution of these two taxa overlap, determination cannot be certain). Note that while BERNOR et al. (1996) listed "*Stegotetrabelodon grandincisivus*" from Pikermi, the taxon they had in mind is *Tetralophodon atticus*: TASSY (2005).

In addition, material from the Vallesian locality Yulaflı in Turkey was referred to *Amebelodon grandincisivus* by GERAADS et al. (2005), who hinted that Vallesian "grandincisivus" might differ at the specific level from Turolian "*M.*" *grandincisivus* proper. Bearing in mind that this is precisely the case with Vallesian vs. Turolian *Deinotherium*, *Choerolophodon* and *Tetralophodon*, this is a very plausible suggestion. Moreover, according to GERAADS et al. (2005), Oryahovo material has the closest morphology to Yulaflı, and since the Oryahovo find is isolated it might actually represent this Vallesian form and not "real" "*M.*" *grandincisivus*. This might also be the case with material from Austria: two second upper molars from Belvedere described by SCHLESINGER (1917, p. 100) and referred by that author to *T. longirostris*, are very similar to the M2 from Yulaflı figured by GERAADS et al. (2005, Fig. 4E), their complex morphology – double trefoil pattern with additional heavy posttrite ornamentation (pers. obs., NHMW, 2006; on loph(id) structure of *Tetralophodon* see SAEGUSA et al., 2005) fitting better with an identification as "*M.*" *grandincisivus* or a closely related form. Other Austrian material possibly belonging in that taxon (Mannersdorf bei Angern, Haag and Fischamend) was discussed by TOBIEN (1978) who suggested a Turolian age for it. Considering Turkish Vallesian material, however, this need not necessarily be the case.

In summary, albeit rare, the known finds of "*Mastodon*" *grandincisivus* seem to give a fairly correct idea of its distribution area: from Central Europe (Hungary and possibly Austria) through the Balkans (Bulgaria, ?Greece) and Ukraine to Iran. The species seems to have occurred in Libya and the United Arab Emirates too; Vallesian finds from Turkey, as well as late Miocene material from Indo-Pakistan might represent close but not necessarily identical taxa. Material includes a skull, two fragmented mandibles of adult individuals, one mandible of a juvenile individual, postcranials and isolated teeth. The few Turolian localities of known precise age are all MN12; the species must have appeared in Europe in MN11 or even earlier, if the Turkish

[14] Incidentally, NHM M18670, an unpublished right m3 from the Middle Siwaliks, has the morphology that could be expected for lower third molars in *P. hasnotensis* (pers. obs. NHM, 2006).

MN10 material is conspecific with the rest. Similarly, if the Sahabi material belongs to "*M.*" *grandincisivus*, it might mark one of the last appearances of the species, in MN13.

Tetralophodon atticus (Wagner, 1857)

Taxonomical remarks:

Apart from treatment by OSBORN (1936) of *Mastodon atticus* as a mammutid, there seems to be no particular controversy about the name and phylogeny of this species. TASSY (1996) suggested that *T. atticus* might be a primitive *Stegotetrabelodon*. To some extent, this is a matter of terminology (considering the likely descent of elephants from a derived African *Tetralophodon*, the distinction between "derived *Tetralophodon*" and "primitive *Stegotetrabelodon*" is becoming increasingly technical). Still, if a line must be drawn between derived tetralophodont gomphotheres and primitive elephants, a useful criterion would be the occlusal motion as discussed by SAEGUSA (1996). If propalinal motion is taken to be a trait defining elephantids (and stegodontids) but not tetralophodont gomphotheres, *T. atticus* – judging from the few known permanent molars – should rather be assigned to tetralophodont gomphotheres, i.e. to *Tetralophodon*.

Important localities and material:

Very few remains have been referred to *T. atticus* in the literature, either originally or by subsequent revisions: two palatal fragments and a hemimandible of juvenile individuals from Pikermi, Greece, upper third molar from the same locality, and juvenile remains from Taraklia, Moldova, originally published by KHOMENKO (1914) which might be *T. atticus* but also "*M.*" *grandincisivus* (see TASSY, 1985 for details), as well as new material from Akkaşdagı, Turkey (TASSY, 2005)[15]. The material, however, seems to be a lot richer than that, including specimens referred to other taxa (mostly *T. longirostris*, but also *Ch. pentelici* and others) as well as unpublished finds. Among the most important are a skull with M1-M2 and M3 erupting, from Dolni Disan in Macedonia, published by GAREVSKI (1976b) (as *Bunolophodon longirostris*; this is the only adult skull of *T. atticus* known so far), juvenile mandible with skull fragment from Cimişlia in Moldova (SIMIONESCU & BARBU, 1939), unpublished juvenile mandible from Hadzhidimovo in Bulgaria, and an unpublished juvenile skull from Kalimantsi (also in Bulgaria; the skull might alternatively belong to "*M.*" *grandincisivus*) (MARKOV, 2004a, 2004b). Similarly, the maxillary fragment from Pikermi figured by MARINOS & SYMEONIDIS (1974) is either *Tetralophodon atticus* or "*Mastodon*" *grandincisivus* as said above.

In Western Europe, *T. atticus* seems to be present at the Turolian locality Dorn-Dürkheim 1 in Germany with material figured by GAZIRY (1997, Pl. 1, Fig. 1; Pl. 4, Fig. 1-3; and Pl. 5) and

[15] A right M3 from Belvedere (Vienna, Austria) referred by SCHLESINGER (1917, Pl. 17, Fig. 3) to "forma *attica*" (i.e. *T. atticus*) is indeed similar to the Pikermi M3 published by VACEK (1877, Pl. 7, Fig. 1) in its number of lophs (six); this number, however, is known to occur in *T. longirostris* too (see TASSY, 1985, Fig. 292 C: morphe complexe). The complex morphology of the Belvedere third molars (a left M3, apparently from the same individual as the figured M3d, is stored at NHMW: pers. obs., 2006) differs from the Turolian material from SE Europe but also from "*M.*" *grandincisivus* (which might be present at Belvedere: see above). Tetralophodons from the late Miocene of Austria are problematic in general: derived characters displayed by specimens from e.g. Mannersdorf bei Angern, Stettenhof, Belvedere (SCHLESINGER, 1917) and Hohenwarth (ZAPFE, 1957) show evolutionary tendencies in a rather different direction than those in *T. atticus*. Equivocal information on the precise age of some of the Austrian localities further obscures the mechanism of replacement of *T. longirostris* by *T. atticus* around the Vallesian / Turolian transition. A brief co-existence of different species of *Tetralophodon* in the latest Vallesian / earliest Turolian cannot be ruled out entirely.

attributed by this author to several different taxa; in my opinion, the only other elephantoid at Dorn-Dürkheim 1, co-occurring with *T. atticus*, is *Anancus* (see below). A posterior third molar fragment from the surroundings of Teschen in Silesia (now Cieszyn and Český Těšín in Poland and the Czech Republic) figured by SCHLESINGER (1917, Pl. 17, Fig. 2, as "*M.* (*B.*) *longirostre* forma *sublatidens* nova forma") is very similar in its morphology (lophs compressed mesio-distally, reduced accessory conules, cementodonty) to Turolian material referred by MARKOV (2004b) to *T. atticus* and might belong to that species. Finds from the Turolian of Hungary (Gubacs, Baltavár, Polgárdi, Csákvár: SCHLESINGER, 1922; GASPARIK, 2001) belong, I believe, to *T. atticus*, as well as material from Taraklia in Moldova described by RIABININ (1929), the Ukrainian localities Grebenniki (BURCHAK-ABRAMOVICH, 1940), and Novaya Emetovka – Kostev Ovrag (KOROTKEVICH, 1988, Pl. 25; only a photo is provided). Tetralophodons reported from the Turolian of Greece (e.g. Kerassiá: "*Tetralophodon* cf. *longirostris*", THEODOROU et al., 2003) more probably belong in *T. atticus* and not *T. longirostris*. The juvenile skull fragment from Maragheh, Iran, attributed by SCHLESINGER (1917, Pl. 11) to *T. longirostris* might belong to "*M.*" *grandincisivus* as noted by TASSY (1986), but three deciduous premolars from Maragheh stored at MNHN and erroneously referred to *Ch. pentelici* by DE MECQUENEM (1924, Pl. XIX, Figs. 6, 9) match closely the type of *T. atticus* from Pikermi (pers. obs., MNHN 2005) and, in my opinion, demonstrate that *T. atticus* and "*M.*" *grandincisivus* co-occur at Maragheh[16]. Finally, the "tetralophodont gomphotheriid indet." reported by BRUNET et al. (1984) from Molayan in Afghanistan, should, if tetralophodont indeed, belong either to *T. atticus* or to "*M.*" *grandincisivus*.

Worth noting is the material from Crevillente 2 (Spain, MN11), described by MAZO & MONTOYA (2003) as "*Tetralophodon* cf. *longirostris* 'grandincisivoid form'". The *Tetralophodon* from Crevillente 2 has a similar development of the mandibular symphysis as that observed in *T. atticus* (see TASSY, 1985 on that character) but is significantly more derived in its dental morphology and probably represents a new species (H. Saegusa, G. N. Markov, unpublished data). The presence in the early Turolian (MN11) of Spain of a *Tetralophodon* species more derived than *T. atticus* (the type locality of which is MN12), together with the evolutionary tendencies observed in the Austrian specimens mentioned above, aptly demonstrates the complex history of European tetralophodons and, in my opinion, supports the idea that Turolian tetralophodons were new immigrants to Europe rather than descendants of the Vallesian species.

In summary, *Tetralophodon atticus* is known from Turolian localities ranging from Germany in the west through Central Europe, the Balkans (Greece, Macedonia, Bulgaria), Turkey, Moldova and Ukraine, to Iran in the east. Material includes an adult skull, several juvenile mandibles and maxillary fragments, deciduous and permanent teeth, and probably a skull of a juvenile individual (which, alternatively, could belong to "*M.*" *grandincisivus*). Known time span is MN11 – MN12, with possible occurrences in MN13.

***Anancus* sp.**

Taxonomical remarks:

While there seems to be a consensus on the occurrence of anancines in the Turolian of Europe, differing from *Anancus arvernensis*, numerous problems remain unresolved, including the name to

[16] Co-occurrence of *Tetralophodon* and "*M.*" *grandincisivus* or a related species seems to have been anything but exceptional, with Yulaflı being one of the earliest examples, as well as probably Belvedere and Mannersdorf bei Angern. The genus represented by "*M.*" *grandincisivus* apparently coexisted with members of the TGSE clade throughout its entire distribution area, from North Africa to Pakistan and (possibly) China.

be used. TASSY (1986) employed the name cf. *Anancus* sp. (suggesting that this species, together with Indian *A. perimensis* and Chinese *A. cuneatus* / *paisuyensis*, belongs to the stem-group of *Anancus*), and two decades later *Anancus* sp. remains the least controversial designation. A key issue is the material from Dorn-Dürkheim 1, attributed by GAZIRY (1997) to four different taxa – *Tetralophodon longirostris*, *Anancus arvernensis turoliensis*, *Stegotetrabelodon lehmanni* and *Stegolophodon caementifer* (the latter three being newly erected by GAZIRY, 1997). METZ-MULLER (2000) revised the material and acknowledged the presence of two elephantoid taxa – *Tetralophodon longirostris* and an unnamed *Anancus* species, (appearing as "*Anancus* sp. 2 de Dorn-Dürkheim" on e.g. Fig. 91; her "*Anancus* sp. 1 de Hohenwart" is based on material that belongs in *Tetralophodon*: H. Saegusa, pers. comm.). At first glance, Metz-Muller's decision not to name what she apparently recognized as a new species is justified, since the quoted source (METZ-MULLER, 2000) is an unpublished PhD thesis, and any new name provided would technically be a *nomen nudum*. However, the material referred to *Anancus* sp. by METZ-MULLER (2000) includes the holotype of *Stegotetrabelodon lehmanni* Gaziry, 1997, so Metz-Muller's conclusion that the species *Stegotetrabelodon lehmanni* is not valid is erroneous: following her arguments, the name *Anancus lehmanni* (Gaziry) should be adopted for the Turolian anancine present at Dorn-Dürkheim 1. This would seem to solve the name problem but several more points must be considered: Agreeing with METZ-MULLER (2000) that the genera *Tetralophodon* and *Anancus* co-occur at Dorn-Dürkheim 1, I think that the first is represented not by *T. longirostris* but by *T. atticus*, the Turolian species of the genus (including holotype as well as figured referred specimens of "*Stegolophodon caementifer*" – a taxon not discussed at all by METZ-MULLER, 2000, and part of the hypodigm of "*Stegotetrabelodon lehmanni*?"). The holotype of *Anancus arvernensis turoliensis*, referred by METZ-MULLER (2000) to *T. longirostris*, does not, in my opinion, belong either to that species or to *T. atticus* but to *Anancus*. If I am correct, the binomen *Anancus turoliensis* Gaziry, 1997 needs discussion as a possible alternative to *Anancus lehmanni* (Gaziry, 1997). According to Article 24.1 of the International Code of Zoological Nomenclature (providing synonymy between *A. turoliensis* and *A. lehmanni* is accepted), the name *A. lehmanni* should take precedence, being initially proposed at higher rank (see also Article 61.2.1 of The Code). The problem, however, is if the two types are indeed conspecific, and if DD 3151 (M3d, type of "*St.*" *lehmanni*) adequately demonstrates morphological differences between the Turolian species and *A. arvernensis*.

Adequacy of type specimens is a problem affecting two potential senior synonyms too (although these names are obscure, rarely used, and generally considered to be synonymous with *A. arvernensis*, none of them is technically *nomen oblitum* and thus a short discussion is necessary): *Mastodon intermedius* Eichwald from the area of Kremenetz in Volhynia, then Russian Empire (now Kremenets, western Ukraine) is based on a hemimandible with worn m2-m3 and thus is *nomen dubium* at best, displaying general anancine morphology. Eichwald changed more than once his opinion whether the specimen represents an upper or a lower jaw fragment; while it is evident from his works – e.g. EICHWALD (1835, 1853) – that both designations refer to the same specimen, OSBORN (1936) apparently did not notice that and considered the "type" (a maxilla that never existed) lost, designating the hemimandible as paralectotype). The find comes from an area that has yielded mainly Turolian taxa and thus could theoretically belong to the Turolian anancine species but usage of the name is certainly not to be recommended[17].

[17] To further complicate things, *Mastodon intermedius* Teilhard et Trassaert, 1937, type species of *Sinomastodon* Tobien, Cheng et Li, 1986, is a junior primary homonym of *Mastodon intermedius* Eichwald, 1831. Obviously, suppressing the name *Sinomastodon intermedius* (Teilhard et Trassaert), would be a particularly bad decision.

Mastodon arvernensis var. *progressor* Khomenko, 1912, is based on a mandible from Gavanosy, Bessarabia (now Gavanoasa, Moldova) which displays no clear morphological differences compared to *A. arvernensis*, apart from a slightly longer mandibular symphysis. Anyway, lower molars with anancine affinities from Dorn-Dürkheim 1 differ little from *A. arvernensis*, and it seems that any taxon based on lower teeth would be of doubtful position.

Thus, although it seems that – for the time being at least – the appropriate name for the Turolian *Anancus* of Europe is *Anancus lehmanni* (Gaziry), I adopt a more cautious approach and use the name *Anancus* sp., considering that relations to (and possible synonymy with) other primitive anancines from Asia, such as *A. cuneatus* / *paisuyensis* remain unresolved. In addition, some of the Turolian finds from Europe do not differ drastically from the type specimen of *Anancus osiris*, described by ARAMBOURG (1946, Pl. 9, Fig. 1) from the area of Giza in Egypt (the precise age of the locality is unknown). While not necessarily conspecific with the Turolian anancines of Europe, *A. osiris* might be their descendant, evolving in Africa in parallel with *A. arvernensis* (*A. osiris* and *A. arvernensis* were considered sister taxa by TASSY, 1986). Finally, lumping all Turolian *Anancus* finds from Europe into one species might be over-simplistic but available material is insufficient, in my opinion, for any less vague conclusions.

Important localities and material:
Material consists of isolated dental remains (and several mandibles or mandibular fragments), making the Turolian anancines the most problematic of all taxa discussed here. Apart from Dorn-Dürkheim 1, type locality of *Anancus lehmanni*, Turolian anancines occur at localities in Spain (e.g. Alfacar: BERGOUNOIUX & CROUZEL, 1958; TASSY, 1986), Hungary (GASPARIK, 2001; pers. obs. HNHM and HGI, 2005), Bulgaria (e.g. Ezerovo, Ahmatovo: MARKOV, 2004a, 2004b).

In summary, Turolian anancines are known from localities in Spain, Germany, Hungary and Bulgaria, and might be present at other Central and Eastern European localities too. The available material is scarce, consisting almost entirely of isolated molars. Compared to *A. arvernensis*, differences in the morphology of lower molars are subtle, so the determination even of a preserved mandible can only be tentative, and influenced by assumed Turolian age: a result that is far from satisfactory. The material permits no definite conclusions even on the number of anancine species (one or more) in the Turolian of Europe, leaving problems of taxonomy, range and time span open. The first appearance of *Anancus* seems to have been not earlier than MN12 (although Dorn-Dürkheim 1 is supposed to be of MN11 age, it seems to contain reworked fossils, and both GAZIRY, 1997, and METZ-MULLER, 2000, assumed a MN12 age for the proboscideans). *Anancus* is notably absent from early MN12 localities such as Pikermi or Hadzhidimovo, and while having in mind possible gaps in the fossil record, it seems plausible that the first occurrences of the genus in Europe were indeed in late MN12.

Discussion, summary and conclusions

The picture emerging from this overview could be summarized thus: at the beginning of the Turolian, an association of five proboscidean species (each representing a different clade) appears in Europe, apparently migrating from the east. The idea of faunal migrations from

West Asia to Europe around the Vallesian / Turolian transition is certainly not new, and neither is the observation on taxa shared by e.g. Balkan and Iranian Turolian localities (see for example DE BONIS et al., 1992a, 1992b, 1994, and sources therein) but analyses often either omit proboscideans, or employ inaccurate taxonomy. Choice of taxonomy can obviously influence – and influence heavily – conclusions on migrations, faunal composition and diversity, regionality, etc. Some examples: BERNOR et al. (1996) listed, as said above, "*Stegotetrabelodon grandincisivus*" from Pikermi actually meaning *Tetralophodon atticus*. At the generic level, this results in a taxon shared by Sahabi (type locality of *Stegotetrabelodon syrticus*) and Pikermi for entirely wrong reasons (ironically, Sahabi and Pikermi seem to share a taxon indeed: "*M.*" *grandincisivus*, which however has nothing to do with *Stegotetrabelodon*). If, on the other hand, *T. atticus* is regarded as a primitive *Stegotetrabelodon* as suggested by TASSY (1996), Sahabi and Pikermi appear to share another taxon. If the mammutid occurring at the Turolian Hungarian locality Hatvan is attributed to *Zygolophodon*, this results in the apparent presence of a primitive relict taxon (see discussion in BERNOR et al., 2003); referring it to "*Mammut*" *borsoni* (GASPARIK, 2001) implies an early appearance of a Pliocene species; a determination as "*M.*" *obliquelophus*, on the other hand, adds another "typical Pikermian element" (in the expression of BERNOR et al., 2003) to the Hatvan fauna. Thus, choice of taxonomy could (and does) create the impression of Vallesian relicts in the Turolian (if *D. giganteum* and *D. gigantissimum*, or *T. longirostris* and *T. atticus* are lumped together, or "*M.*" *obliquelophus* confused with *Z. turicensis*), or of early appearances of Pliocene taxa such as "*Mammut*" *borsoni* and *Anancus arvernensis*, if their late Miocene congenerics are not recognized as separate species.

In my opinion, the five proboscideans that appear in the early Turolian of Europe (being part of the "Pikermian biome", a convenient label would be the "Pikermian proboscidean fauna", or PPF) are all immigrants, part of the large-scale late Miocene faunal migrations, and not Vallesian relicts, nor species evolving gradually in Europe from Vallesian ancestors. Three of the five PPF species ("*Mammut*" *obliquelophus*, *Choerolophodon pentelici*, and "*Mastodon*" *grandincisivus*) have no closely related forms in the Vallesian of Europe and their origins are most probably Asiatic. "*Mammut*" *obliquelophus* seems to be a descendant of Asiatic zygolophodons (see TASSY, 1985, and SAUNDERS & TASSY, 1989 on the origins of "*M.*" *borsoni*). Choerolophodons are generally an Afro-Asiatic group, and "*Mastodon*" *grandincisivus*, although of obscure origins, has no similarities to earlier European taxa. There is no evidence of direct relation between *Tetralophodon atticus* and *T. longirostris* (rather, judging from opposite tendencies in the mandibular morphology of these two taxa, they are not closely related). As for *Deinotherium gigantissimum*, a gradual evolution from *D. giganteum* in Europe is unlikely (as is generally the isolated gradual evolution of "lineages" within the small area of Europe). More probably, as with the other PPF species, *D. gigantissimum* is an immigrant displacing the earlier local species. (A useful parallel is the pattern of mammoth evolution in Eurasia as presented by LISTER & SHER, 2001; LISTER et al., 2005). Such a major proboscidean migration into Europe is not unprecedented: a similar event seems to have taken place in the middle Miocene, with the Astaracian arrival of *Choerolophodon* and *Platybelodon* (confined to the Eastern Mediterranean), and *Deinotherium* and *Tetralophodon* reaching Western Europe (see MARKOV, 2008). As with the Astaracian proboscideans, ranges reached by different PPF taxa vary: *Deinotherium gigantissimum*, "*Mammut*" *obliquelophus* and *Tetralophodon atticus* spread across Western Europe but "*Mastodon*" *grandincisivus* was apparently confined to Central Europe and *Choerolophodon pentelici* is not known west of Greece and Macedonia.

On a larger scale, the PPF model seems to be generally operational, but perhaps over-simplistic, omitting several important details. One, distribution areas for each of the five PPF species do not overlap entirely ("*M.*" *grandincisivus* and *Ch. pentelici* confined to Central and Eastern Europe respectively; mammutids are so far absent from the Turolian localities of Turkey, Iran and Iraq). In fact, the only localities so far that have yielded all five PPF species (see Table 1) are Hadzhidimovo, Pikermi and Taraklia (presence of "*M.*" *grandincisivus* at the latter two is not entirely certain). Two, at least one of the PPF taxa, "*M.*" *grandincisivus*, might have been spread in territories beyond the PPF area – Sahabi in Libya, Jebel Barakah (UAE) and possibly Indo-Pakistan as well. It is very probable, however, that – as with the Vallesian and Turolian "grandincisivoids" – we are actually mixing different species due to scarcity of material, and it is the unnamed genus represented by "*M.*" *grandincisivus*, rather than the species itself, that occurs at the African and SW Asian localities. Last but not least, apparently more than the five PPF species (and, with *Anancus* sp., the six species) discussed here were present in the Turolian of Europe: as said, the *Tetralophodon* from Crevillente 2 probably represents a new species and not *T. atticus*; in addition, FERRETTI et al. (2003) reported *Stegotetrabelodon syrticus* from Cessaniti in Calabria, Italy. Although these are isolated occurrences so far, finds from Crevillente 2 and Cessaniti demonstrate that proboscidean diversity in the Turolian was even higher – and further emphasize how different, and novel, the Turolian proboscidean fauna of Europe has been compared to the Vallesian.

As noted in the Introduction, these are preliminary results from an ongoing research. A thorough revision of the rich material stored at various collections in Moldova, Ukraine and Russia would doubtlessly add to the general picture outlined here, and – hopefully – permit providing revised diagnoses for the taxa discussed above (which, I believe, would be premature at present). Our knowledge on the five PPF species is gradually increasing, with new or revised finds providing additional information on various aspects of their morphology, status, and span. Turolian anancines, on the other hand, remain poorly known, and apart from a name (*A. lehmanni*) that might or might not be appropriate for them, little can be added to the discussion by TASSY (1986). Two more taxa, so far represented by isolated finds (*Tetralophodon* sp. at Crevillente 2 and *Stegotetrabelodon* at Cessaniti), provide a good example for the complex pattern of proboscidean evolution and dispersals in the late Miocene.

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Table 1

Proboscidean taxa at selected Turolian localities in Europe and Southwest Asia. *Type locality. The type locality of "*M.*" *obliquelophus*, Romanovka, is not included due to its uncertain age. Dorn-Dürkheim 1 is type locality of *Anancus lehmanni*.

	Deinotherium gigantissimum	"*Mammut*" *obliquelophus*	*Choerolophodon pentelici*	"*Mastodon*" *grandincisivus*	*Tetralophodon atticus*	*Anancus* sp.	*Tetralophodon* sp.	*Stegotetrabelodon syriacus*
Găiceana	+*							
Mânzaţi	+							
Pikermi	+	+	+*	?	+*			
Maragheh	+		+	+*	+			
Injana	?		+					
Hadzhidimovo	+	+	+	+	+			
Kalimantsi	+		+	?	+			
Burgas	+		+	+	?			
Cimişlia	+				+			
Taraklia	+	+	+	?	+			
Belka	+	+						
Grebenniki	+		+		+			
Csákvár		+			+			
Baltavár	+	+			+			
Polgárdi	+	+			+			
Pestszentlörincz	+			+		?		
Maritza-Iztok				+		+		
Ahmatovo	+	+	+		+	+		
Ezerovo	+	+	+		+	+		
Dolni Disan	+				+	+		
Dorn-Dürkheim 1	+				+	+		
Alfacar	+					+		
Crevillente 2	+						+	
Cessaniti								+

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References

ALEXEEVA L. I. 1959. Significance of the mammals of the Armavyr formation for the stratigraphy of the continental deposits on North Caucasus. – Trudy GIN AN SSR, **32**: 185-191. (In Russian).

ALEXEEVA L. I. 1965. Stratigraphical review of the proboscideans of Eopleistocene (according to the materials of the European South of the USSR). – In: Quaternary Period and its History. Nauka, Moscow, 69-90. (In Russian).

APOSTOLOV A., NIKOLOV I. 1985. Neue Funde von Tertiären und Quartären Säugetieren im Bezirk von Burgas (VR Bulgarien). – Geologica Macedonica, **2** (1): 121-145.

ARAMBOURG C. 1946. *Anancus Osiris*, un Mastodonte nouveau du Pliocéne inférieur d'Égypte. – Bulletin de la Société géologique de France (5), **15**: 479-495.

ATHANASIU S. 1907. Contribuţiuni la studiul faunei terţiare de mamifere din România [Beiträge zur Kenntnis der Tertiären Säugetierfauna Rumäniens]. – Anuarul Institutului Geologic al României, **1** (1): 9-214.

ATHANASSIOU A. 2004. On a *Deinotherium* (Proboscidea) finding in the Neogene of Crete. – Carnets de Géologie / Notebooks on Geology, Brest, Letter 2004/05 (CG2004_L05): 1-7.

BACHMAYER F., ZAPFE H. 1969. Die Fauna der altpliozänen Höhlen- und Spaltenfüllungen bei Kohfidisch, Burgenland (Österreich). – Annalen des Naturhistorischen Museums in Wien, **73**: 123-139.

BACHMAYER F., ZAPFE H. 1972. Die Fauna der altpliozänen Höhlen- und Spaltenfüllungen bei Kohfidisch, Burgenland (Österreich). Proboscidea. – Annalen des Naturhistorischen Museums in Wien, **76**: 19-27.

BAJGUSHEVA V. S., TISHKOV M. Y. 1998. About the find of *Deinotherium giganteum* KAUP skeleton near Novocherkassk town of Rostov Region. – In: Kiyashko V. Y. (ed.). Historical and archeological researches in Azov and on the Lower Don in 1995-1997, 15, Azov, 305-311. (In Russian).

BAJGUSHEVA V. S., TITOV V. V. 2006. About teeth of *Deinotherium giganteum* Kaup from eastern Paratethys. – Hellenic Journal of Geosciences, **41**: 177-182.

BAKALOW P. 1911. Beiträge zur Paläontologie Bulgariens. I. Mastodonreste aus Bulgarien. – Annuaire de l'Université de Sofia, **6**: 1-41. (In Bulgarian with German summary).

BAKALOV P., NIKOLOV I. 1962. Les Fossiles de Bulgarie. X. Mammifères Tertiaires. BAS, Sofia, 162 p. (In Bulgarian with French summary).

BERGOUNIOUX F.-M., CROUZEL F. 1958. Les Mastodontes d'Espagne. – Estudios Geológicos, **14**: 223-365.

BERGOUNIOUX F.-M., CROUZEL F. 1959. *Dinotherium giganteum* à Alfacar (Granada). – Estudios Geológicos, **15**: 55-62.

BERGOUNIOUX F.-M., CROUZEL F. 1962. Les Déinothéridés d'Espagne. – Bulletin de la Société géologique de France, **7**: 394-404.

BERNOR R. L. 1986. Mammalian biostratigraphy, geochronology, and zoogeographic relationships of the late Miocene Maragheh fauna, Iran. – Journal of Vertebrate Paleontology, **6** (1): 76-95.

BERNOR R. L., FEIBEL C., VIRANTA S. 2003. The Vertebrate Locality of Hatvan, Late Miocene (Middle Turolian, MN12), Hungary. – In: Petculescu A., Ştiucă E. (eds.). Advances in Vertebrate Paleontology "Hen to Panta", Bucharest, 105-112.

BERNOR R. L., SOLOUNIAS N., SWISHER C. C. III, VAN COUVERING J. A. 1996. The correlation of three classical "Pikermian" mammal faunas – Maragheh, Samos, and Pikermi – with the European MN unit system. – In: Bernor R. L., Fahlbusch V., Mittmann H.-W. (eds.). The Evolution of Western Eurasian Neogene Mammal Faunas. Columbia University Press, New York, 137-154.

BRUNET M., HEINTZ E., BATTAIL B. 1984. Molayan (Afghanistan) and the Khaur Siwaliks of Pakistan: an example of biogeographic isolation of Late Miocene mammalian faunas. – Geologie en Mijnbouw, **63**: 31-38.

BURCHAK-ABRAMOVICH N. 1940. Contribution to the Study of the Hipparionfauna of South Ukraine. I. Proboscidea from the Meotic Deposits of the Village Grebenniki, Tiraspol District (Moldavian SSR). – AN URSR Geologichnii Zhurnal, **7** (1-2): 27-52. (In Ukrainian with English summary).

ČERŇANSKÝ A. 2006. Revision of a mastodon find from the Neogene at Kuzmice near Topoľčany (Slovakia). – Slovak Geological Magazine, **12** (1): 57-62.

CHALWADDŽIEV M. 1986. Über einen Fund von *Zygolophodon borsoni* (Hays) bei dem Dorf Bossilkowzi, Bezirk Russe. – Jahrbuch der Museen in Nordbulgarien, **12**: 261-271. (In Bulgarian with German summary).

CHOW M., CHANG Y. 1961. New Mastodonts from North China. – Vertebrata PalAsiatica, **5** (3): 245-262. (In Chinese with English summary).

ĆIRIĆ A. 1957. Pikermiska fauna iz okoline Titovog Velesa. – Glasnik Prirodniackog Muzeja Srpske Zemlje (Bull. Mus. Hist. Nat. du Pays Serbe), Série A, **8**: 1-82.

CODREA V. 1994. A priority issue: *Deinotherium proavum* Eichwald or *Deinotherium gigantissimum* Ştefănescu? – In: The Miocene from the Transylvanian Basin – Romania, Cluj-Napoca, 105-110.

DE BONIS L., BOUVRAIN G., GERAADS D., KOUFOS G. 1992a. Diversity and paleoecology of Greek late Miocene mammalian faunas. – Palaeogeography, Palaeoclimatology, Palaeoecology, **91**: 99-121.

DE BONIS L., BRUNET M., HEINTZ E., SEN S. 1992b. La province greco-irano-afghane et la répartition des faunes mammaliennes au Miocène supérieur. – Paleontologia i Evolucio, **24-25**: 103-112.

DE BONIS L., BOUVRAIN G., GERAADS D., KOUFOS G. D., SEN S., TASSY P. 1994. Les gisements de mammifères de Miocène supérieur de Kemiklitepe, Turquie: 11. Biochronologie, paléoécologie et relations paléobiogéographiques. – Bulletin du Museum d'Histoire Naturelle, Paris, série 4, section C, **16** (1): 225-240.

DE MECQUENEM R. 1924. Contribution à l'étude des fossiles de Maragha. – Annales de Paléontologie, **13**: 135-60.

EICHWALD E. 1835. De pecorum et pachydermorum reliquiis fossilibus in Lithuania, Volhynia et Podolia repertis. – Nova acta Academiae Caesareae Leopoldino-Carolinae Germanicae Naturae Curiosorum, **17**: 677-780.

EICHWALD E. 1853. Lethaea Rossica ou Paléontologie de la Russie. Troisième volume. Schweizerbart, Stuttgart, 533 p.

ERDBRINK D. P., PIEM H. N. A., HEBEDA E. H., CUP C., DANKERS P., CLOETINGH S. A. P. L. 1976. The bone bearing beds near Maragheh in N. W. Iran. – Proceedings Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam, Series B, **79**: 97-113.

FERRETTI M.P., ROOK L., TORRE D. 2003. *Stegotetrabelodon* (Proboscidea, Elephantidae) from the Late Miocene of Southern Italy. – Journal of Vertebrate Paleontology, **23** (3): 659-666.

FRANZEN J. L., STORCH G. 1999. Late Miocene mammals from Central Europe. – In: Agusti J., Rook L., Andrews P. (eds.). Hominoid Evolution and Climatic Change in Europe. Volume 1, The Evolution of Neogene Terrestrial Ecosystems in Europe, Cambridge University Press, Cambridge, 165-190.

GAREVSKI R. 1976a. Ein weiterer Beitrag zur Kenntnis der Pikermifauna Mazedoniens. Die Dinotherienreste von der Umgebung T. Veles. – Fragmenta Balcanica Musei Macedonici Scientiarum Naturalium, **10** (3): 21-25.

GAREVSKI R. 1976b. Weiterer Beitrag zur Kenntnis der Pikermifauna Mazedoniens. Der Mastodonschädel von der Umgebung des Dorfes Dolni Disan (Negotino). – Posebno Izdanie Musei Macedonici Scientiarum Naturalium, **7**: 21-26.

GASPARIK M. 1993. Deinotheres (Proboscidea, Mammalia) of Hungary. – Annales historico-naturales Musei nationalis hungarici, **85**: 3-17.

GASPARIK M. 2001. Neogene proboscidean remains from Hungary; an overview. – Fragmenta Palaeontologica Hungarica, **19**: 61-77.

GAUDRY A. 1860. Résultats des fouilles exécutées en Grèce sous les auspices de l'Académie. – Comptes rendus hebdomadaires des séances de l'Académie des sciences, **51**: 802-804.

GAUDRY A. 1862. Animaux fossiles et Géologie de l'Attique. Savy, Paris, 476 p.

GAZIRY A. W. 1976. Jungtertiäre Mastodonten aus Anatolien (Türkei). – Geologisches Jahrbuch, **22:** 3-143.

GAZIRY A. W. 1987. Remains of Proboscidea From the Early Pliocene of Sahabi, Libya. – In: Boaz N. T., El- Arnauti A., Gaziry A. W., de Heinzelin J., Boaz D. D. (eds.). Neogene Paleontology and Geology of Sahabi, Alan Liss Inc., New York, 183-203.

GAZIRY A. W. 1997. Die Mastodonten (Proboscidea, Mammalia) aus Dorn-Dürkheim 1 (Rheinhessen). – In: Franzen J. L. (ed.). Die Säugetiere aus dem Turolium von Dorn-Dürkheim 1 (Rheinhessen, Deutschland). Courier Forschungsinstitut Senckenberg, **197**: 73-115.

GERAADS D., KAYA T., MAYDA S. 2005. Late Miocene large mammals from Yulafl1, Thrace region, Turkey, and their biogeographic implications. – Acta Palaeontologica Polonica, **50** (3): 523-544.

GRÄF I. 1957. Die Prinzipien der Artbestimmung bei *Dinotherium*. – Palaeontographica, Abt. A, **108**: 131-185.

HOPWOOD A. T. 1935. Fossil Proboscidea from China. – Palaeontologica Sinica, Series C, **9** (3): 1-108.

HUTTUNEN K. 2002. Deinotheriidae (Proboscidea, Mammalia) dental remains from the Miocene of Lower Austria and Burgenland. – Annalen des Naturhistorischen Museums in Wien, **103 A**: 251-285.

HUTTUNEN K. 2004. On a *Prodeinotherium bavaricum* (Proboscidea, Mammalia) skeleton from Franzensbad, Czech Republic. – Annalen des Naturhistorischen Museums in Wien, **105 A**: 333-361.

HUTTUNEN K., GÖHLICH U. 2002. A partial skeleton of *Prodeinotherium bavaricum* (Proboscidea, Mammalia) from the Middle Miocene of Unterzolling (Upper Freshwater Molasse, Germany). – Geobios, **35**: 489-514.

KHOMENKO J. 1914. La faune méotique du village Taraklia du district de Bendery. – Trudy Bessarabskago Obshestva Estestvoispytatelei i liubitelei estestvoznania (Trav. Soc. Nat. Bessarabie), **5**: 1-55. (In Russian with French summary).

KOROTKEVICH E. L. 1979. Grandincisivoid mastodonts of the northern Black Sea region in the Ukr. SSR. – Vestnik Zoologii, **4**: 34-40. (In Russian with English summary).

KOROTKEVICH E. L. 1988. History of the formation of the Hipparion fauna of Eastern Europe. – Naukova Dumka, Kiev, 162 p. (In Russian).

KOUFOS G. D. 1980. Paleontological and stratigraphical study on the continental Neogene deposits of Axios Basin. – Scientific Annals of the Faculty of Physics and Mathematics, University of Thessaloniki, **19**: 1-322. (In Greek).

KOVACHEV D. 2006. [Dated 2004]. Cranium of *Stegotetrabelodon* (Proboscideo [sic], Mammalia) from the Neogene in the East Maritsa basin. – Review of the Bulgarian Geological Society, **65** (1-3): 167-173. (In Bulgarian with English summary).

KOVACHEV D., NIKOLOV I. 2008. [Dated 2006]. *Deinotherium thraceiensis* sp. nov. from the Miocene near Ezerovo, Plovdiv District. – Geologica Balcanica, **35** (3-4): 5-40.

KRAHMALNAYA T. V. 1996. Hipparion fauna of the Old Meotian of the Northern Black Sea region. – Naukova Dumka, Kiev, 225 p. (In Russian with English summary).

KUBIAK H. 1972. The Skull of *Mammut praetypicum* (Proboscidea, Mammalia) from the Collection of the Jagiellonian University in Cracow, Poland. – Acta Zoologica Cracoviensia, **17** (13): 305-324.

LASKAREV V. 1948. Sur les restes fossiles de *Dinotherium* en Serbie. – Glasnik Prirodniackog Muzeja Srpske Zemlje (Bull. Mus. Hist. Nat. du Pays Serbe), Série A, **1**: 1-20. (In Serbian with French summary).

LISTER A. M., SHER A. V. 2001. The Origin and Evolution of the Wooly Mammoth. – Science, **294**: 1094-1097.

LISTER A. M., SHER A. V., VAN ESSEN H., WEI G. 2005. The pattern and process of mammoth evolution in Eurasia. – Quaternary International, **126-128**: 49-64.

LUNGU A., OBADA T. 2001. Contributions to study of the Neogene representatives of Ordo Proboscidea (Mammalia) from Eastern Europe. – In: Cavaretta G., P. Gioia, M. Mussi, M.R. Palombo (eds). The World of Elephants. Proceedings of the 1st International Congress, Consiglio Nazionale delle Ricerche - Roma, 119-121.

MARINOS G., SYMEONIDIS N. 1974. Neue Funde aus Pikermi (Attika, Griechenland) und eine allgemeine geologische Übersicht dieses paläontologischen Raumes. – Annales Géologiques des Pays Helléniques, **26**: 1-27.

MARKOV G. N. 2004a. The fossil proboscideans of Bulgaria and the importance of some Bulgarian finds – a brief review. – Historia naturalis bulgarica, **16**: 139-150.

MARKOV G. N. 2004b. The Fossil Proboscideans of Bulgaria. – Unpublished PhD Thesis, Sofia, 225 + 81 p. (In Bulgarian with English summary).

MARKOV G. N. 2008. Fossil proboscideans (Mammalia) from the vicinities of Varna: a rare indication of middle Miocene vertebrate fauna in Bulgaria. – Historia naturalis bulgarica, **19**: 137-152.

MAZO A. V. 1996. Gomphotheres and mammutids from the Iberian Peninsula. – In: Shoshani J., Tassy P. (eds). The Proboscidea. Evolution and Palaeoecology of Elephants and their Relatives, Oxford University Press, Oxford, New York, Tokyo, 136-142.

MAZO A. V., MONTOYA P. 2003. Proboscidea (Mammalia) from the Upper Miocene of Crevillente (Alicante, Spain). – Scripta Geologica, **126**: 79-109.

MELENTIS J. K. 1967. Studien über fossile Vertebraten Griechenlands. 19. Die Pikermi-Fauna von Halmyropotamos (Euboä, Griechenland), 1. Teil: Odontologie und Kraniologie. – Annales Géologiques des Pays Helléniques, **19**: 283-411.

METZ-MULLER F. 2000. La population d'*Anancus arvernensis* (Proboscidea, Mammalia) du Pliocène de Dorkovo (Bulgarie); étude des modalités évolutives d'*Anancus arvernensis* et phylogénie du genre *Anancus*. – Unpublished doctoral thesis, Muséum National d'Histoire Naturelle, Paris.

MUCHA B. B. 1980. A new species of yoke-toothed mastodont from the Pliocene of Southwest USSR. – In: Quaternary and Neogene faunas and floras of Moldavskaya SSR, Shtiintsa, Kishinev, 19-26. (In Russian).

NIKOLOV I, KOVAČEV D. 1966. Pliozäne Säugetierfauna aus Assenovgrad. – Travaux sur la géologie de Bulgarie – série paléontologie, **8**: 131-142. (In Bulgarian with German summary).

OSBORN H. F. 1936. Proboscidea. Vol. I. – American Museum Press, New York, xi + 802 p.

PAVLOW M. 1894. Les mastodontes de la Russie et leurs rapports avec les mastodontes des autres pays. – Mémoires de l'Académie Impériale des sciences de St.-Pétersbourg, **1** (3): 1-43.

PAVLOW M. 1907. *Dinotherium gigantheum* Kaup des environs de Tiraspol. – Annuaire géologique et mineralogique de la Russie, **9** (1-2): 1-7.

PIDOPLICHKO I. G. 1956. Materials on the study of past faunas of the Ukr. SSR, Second Edition. – Academy of Sciences of the Ukr. SSR, Kiev, 236 p. (In Ukrainian).

RĂDULESCU C., ŞOVA C. 1987. A preliminary note on a Late Miocene mammalian fauna from Moldavia (Romania). – Travaux de l'Institut de Spéologie "Émile Racovitza", **28**: 67-71.

RIABININ A. N. 1929. Faune de mammifères de Taraklia. I. Carnivora vera, Rodentia, Subungulata. – Travaux de Musée Géologique près l'Académie des Sciences de l'URSS, **5**: 75-134. (In Russian with French summary).

ROOK L. 1992. Italian Messinian localities with vertebrate faunas. – Paleontologia i Evolució, **24-25**: 141-147.

SAEGUSA H. 1996. Sister group relationships within Elephantoidea as suggested by the occlusal direction of their teeth. – In: Ratanasthien B., Rieb S. L. (eds.). Proceedings International Symposium on Geology and Environment 31 January – 2 February 1996, 133-145.

SAEGUSA H., THASOD Y., RATANASTHIEN B. 2005. Notes on Asian stegodontids. – Quaternary International, **126-128**: 31-48.

SANDERS W. J. 2003. Proboscidea. – In: Fortelius M., Kappelman J., Sen S., Bernor R. L. (eds.). Geology and Paleontology of the Miocene Sinap Formation, Turkey, Columbia University Press, New York, 202-219.

SARWAR M. 1977. Taxonomy and distribution of the Siwalik Proboscidea. – Bulletin of the Department of Zoology, University of the Punjab (New Series), Article **10**: 1-172.

SAUNDERS J. J., TASSY P. 1989. Le mastodonte américain. – La Recherche, **209**: 452-461.

SCHLESINGER G. 1917. Die Mastodonten des K. K. Naturhistorischen Hofmuseums. – Denkschriften des K. K. Naturhistorischen Hofmuseums, Geologisch-Paläontologische Reihe, **1**: 1-230.

SCHLESINGER G. 1919. Die stratigraphische Bedeutung der europäischen Mastodonten. – Mitteilungen der Geologischen Gesellschaft in Wien, **11** (1918): 129-166.

SCHLESINGER G. 1922. Die Mastodonten der Budapester Sammlungen. – Geologica Hungarica, **2** (2), 284 p.

SCHMIDT Z. 1963. *Tetralophodon grandincisivus* Schlesinger, 1917 z pliocénu (pontu) v Kuzmiciach pri Topoľčanoch. – Geologické práce, Zprávy **27**: 169-174.

SIMIONESCU I., BARBU V. 1939. Mamiferele pliocene dela Cimişlia (România). III. Proboscidieni. – Academia Română Publicaţiunile Fondului V. Adamachi, **9** (52): 1-20.

ŞTIUCA E. 2003. Note préliminaire sur les mammifères du Miocène de Reghiu (Dept. Vrancea, Roumanie). – In: Petculescu A., Ştiucă E. (eds.). Advances in Vertebrate Paleontology "Hen to Panta", Bucharest, 113-116.

TARABUKIN B. A. 1974. New data on the systematics, phylogeny and ecology of Suborder Deinotherioidea Osborn (1921). – In: Mammals of the late Cenozoic from Southwestern USSR, Kishinev, 77-90. (In Russian).

TASSY P. 1983. Les Elephantoidea miocènes du plateau du Potwar, groupe de Siwalik, Pakistan. – Annales de Paléontologie (Vert.- Invert.), **69** (2): 99-136; (3): 235-297; (4): 317-354.

TASSY P. 1985. La place des mastodontes miocènes de l'ancien monde dans la phylogénie des Proboscidea (Mammalia): hypothèses et conjectures. – Unpublished Thèse Doctorat ès Sciences, UPMC, Paris, 85-34, Volumes I-III.

TASSY P. 1986. Nouveaux Elephantoidea (Mammalia) dans le miocène du Kenya: essai de réévaluation systématique. – Cahiers de Paléontologie. Éditions du Centre National de la Recherche Scientifique (CNRS), Paris, 135 p.

TASSY P. 1994. Les gisements de mammifères de Miocène supérieur de Kemiklitepe, Turquie: 7. Proboscidea (Mammalia). – Bulletin du Muséum d'Histoire Naturelle, Paris, série 4, section C, **16** (1): 143-157.

TASSY P. 1996. Who is who among the Proboscidea? – In: Shoshani J., Tassy P. (eds.). The Proboscidea. Evolution and Palaeoecology of Elephants and their Relatives, Oxford University Press, Oxford, New York, Tokyo, 39-48.

TASSY P. 1999. Miocene Elephantids (Mammalia) from the Emirate of Abu Dhabi, United Arab Emirates: Palaeobiogeographic Implications. – In: Whybrow P. J., Hill A. (eds.). Fossil Vertebrates of Arabia. Yale University Press, New Haven, 209-233.

TASSY P. 2005. Proboscideans (Mammalia) from the late Miocene of Akkaşdagı, Turkey. – In: Sen S. (ed.). Geology, mammals and environments at Akkaşdagı, late Miocene of Central Anatolia. Geodiversitas, **27** (4): 707-714.

TASSY P., SEN S., JAEGER J.-J., MAZIN J.-M., DALFES N. 1989. Une sous-espèce nouvelle de *Choerolophodon pentelici* (Proboscidea, Mammalia) à Esme Akçaköy, Miocène supérieur d'Anatolie occidentale. – Comptes rendus de l'Académie des sciences, Paris, Série II, **309**: 2143-2146.

THEODOROU G., ATHANASSIOU A., ROUSSIAKIS S., ILIOPOULOS G. 2003. Preliminary remarks on the Late Miocene herbivores of Kerassiá (Northern Euboea, Greece). – In: Reumer, J. W. F., Wessels, W. (eds.). Distribution and Migration of Tertiary Mammals in Eurasia. A volume in Honour of Hans de Bruijn. DeinseA, **10**: 519-530.

THOMAS H., SEN S., LIGABUE G. 1980. La faune Miocène de la Formation Agha Jari du Jebel Hamrin (Irak). – Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen, Series B, **83** (3): 269-287.

TITOV V. V., TESAKOV A. S., DANILOV I. G., DANUKALOVA G. A., MASHCHENKO E. N., PANTELEEV A. V., SOTNIKOVA M. V., SYCHEVSKAYA E. K. 2006. The First Representative Vertebrate Fauna from the Late Miocene of Southern European Russia. – Doklady Biological Sciences, **411**: 508-509. [Original Russian text published in Doklady Akademii Nauk, 2006, **411** (5): 715-717].

TOBIEN H. 1976. Zur paläontologischen Geschichte der Mastodonten (Proboscidea, Mammalia). – Mainzer geowissenschaftliche Mitteilungen, **5**: 143-225.

TOBIEN H. 1978. On the Evolution of Mastodonts (Proboscidea, Mammalia). Part 2: The bunodont tetralophodont Groups. – Geologisches Jahrbuch Hessen, **106**: 159-208.

TOBIEN H. 1986. Die paläontologische Geschichte der Proboscidier (Mammalia) im Mainzer Becken (BRD). – Mainzer Naturwissenschaftliches Archiv, **24**: 155-261.

TOBIEN H. 1988. Contributions a l'etude du gisement miocene superieur de Montredon (Herault). Les grands mammiferes. 7 – les proboscidiens Deinotheriidae. – Palaeovertebrata, Montpellier, Mémoire extraordinaire 1988: 135-175.

TOBIEN H., CHEN G., LI Y. 1986. Mastodonts (Proboscidea, Mammalia) from the Late Neogene and Early Pleistocene of the People's Republic of China. Part 1: Historical Account; the Genera *Gomphotherium*, *Choerolophodon*, *Synconolophus*, *Amebelodon*, *Platybelodon*, *Sinomastodon*. – Mainzer geowissenschaftliche Mitteilungen, **15**: 119-181.

TOBIEN H., CHEN G., LI Y. 1988. Mastodonts (Proboscidea, Mammalia) from the Late Neogene and Early Pleistocene of the People's Republic of China. Part 2: The Genera *Tetralophodon*, *Anancus*, *Stegotetrabelodon*, *Zygolophodon*, *Mammut*, *Stegolophodon*. Some generalities on the Chinese Mastodonts. – Mainzer geowissenschaftliche Mitteilungen, **17**: 95-220.

TSOUKALA E. 2000. Remains of a Pliocene *Mammut borsoni* (Hays, 1834) (Proboscidea, Mammalia), from Milia (Grevena, W. Macedonia, Greece). – Annales de Paléontologie, **86** (3): 165-191.

VACEK M. 1877. Über Österreichische Mastodonten und ihre Beziehungen zu den Mastodonarten Europas. Abhandlungen der k. k. Geologischen Reichsanstalt, **7** (4): 1-45.

VISLOBOKOVA I., DAXNER-HÖCK G. 2004. The importance of Late Miocene faunal exchanges between Eastern Mediterranean Areas and Central Europe. – In: Chatzipetros A. A., Pavlides S. B. (eds.). Proceedings of the 5th International Symposium on Eastern Mediterranean Geology, vol. 1, 363-364.

VISLOBOKOVA I. A., SOTNIKOVA M. V. 2001. Pliocene faunas with Proboscideans of the Former Soviet Union. – In: Cavaretta G., P. Gioia, M. Mussi, M.R. Palombo (eds.). The World of Elephants. Proceedings of the 1st International Congress, Consiglio Nazionale delle Ricerche - Roma, 157-160.

WAGNER A. 1857. Neue Beiträge zur Kenntniss der fossilen Säugthier-Ueberreste von Pikermi. – Abhandlungen der königlichen bayerischen Akademie der Wissenschaften, München, II. Cl., **8** (1): 109-158.

ZAPFE H. 1957. Ein bedeutender Mastodon-Fund aus dem Unterpliozän von Niederösterreich. Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen, **104** (3): 382-406.

ZHAI R. 1963. A New Species of *Gomphotherium* from Changzhi, SE. Shansi. – Vertebrata PalAsiatica, **7** (1): 59-61. (In Chinese with English summary).

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Туролските хоботни (Mammalia) на Европа: предварителни бележки

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(Р е з ю м е)

Статията разглежда шест вида хоботни от турола на Европа. Дискутирани са проблеми на тяхната таксономия, филогения, географско разпространение и хронология; накратко са очертани най-важните находища и материал за всеки от шестте таксона. С изключение на *Anancus*, по-късен имигрант, останалите пет хоботни изглежда са част от мащабните миграции на бозайници от западна Азия към Европа около границата на валезия и турола.

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Western conifer seed bug *Leptoglossus occidentalis* Heidemann, 1910 (Heteroptera: Coreidae) already in Bulgaria

Nikolay SIMOV

Leptoglossus occidentalis Heidemann, 1910 is an invasive alien species of North American origin. The species was first recorded in Europe in 1999 in Vicenza, Italy (BERNARDINELLI & ZANDIGIACOMO, 2001). Within just a decade, the species spread to a large part of Europe, including Italy, Switzerland, Slovenia, Spain, Croatia, Hungary, Austria, Czech Republic, France, Germany, Serbia, Belgium, Poland, Slovakia and the United Kingdom (RABITSCH, 2008). It was expected to reach Bulgaria.

On 9 October 2008 *Leptoglossus occidentalis* was found in Bulgaria for the first time.

Material: 1 female (Fig. 1), Bulgaria, Sofia downtown, 550 m a.s.l., National Radio building, 9 October 2008, leg. N. Simov.

This is the most southeastern record of the species in Europe. *Leptoglossus occidentalis* feeds on the young seeds and strobiles of conifers: *Pinus* sp., *Pseudotsuga menziesii* also on *Picea*, *Cedrus*, *Abies* and *Juniperus* (VILLA et al., 2001), causing reduction in seed fertility. It is classified as pest in its native range (MITCHELL, 2000). Austrian and Scots pine are the most cultivated trees in the intensive forestry in Bulgaria. On the other hand, some of the coniferous trees in Bulgaria are endemics or relicts with restricted range (*Abies borisii-regis*, *Pinus peuce*, *Pinus heldreichii*, *Juniperus excelsa*). Although no economic impact is known so far in Europe, future stable establishment and mass development of *Leptoglossus occidentalis* in Bulgaria most probably will be a problem in protected areas and forestry seed zones. Future monitoring of this invasive alien species in Bulgaria is needed.

Fig. 1. *Leptoglossus occidentalis* Heidemann, 1910 – female

References

BERNARDINELLI I., ZANDIGIACOMO P. 2001. *Leptoglossus occidentalis* Heidemann (Heteroptera, Coreidae): a conifer seed bug recently found in northern Italy. – Journal of Forestry Science, **47**: 56-58.

MITCHELL P. L. 2000. Leaf-Footed Bugs (Coreidae). – In: Schaefer C. W., Panizzi A. R. (eds.). Heteroptera of Economic Importance. CRC Press, Boca Raton, FL, 337-403.

RABITSCH W. 2008. Alien True Bugs of Europe (Insecta: Hemiptera: Heteroptera) – Zootaxa, **1827**: 1-44.

VILLA M., TESCARI G., TAYLOR S. J. 2001. Nuovi dati sulla presenza in Italia di *Leptoglossus occidentalis* (Heteroptera, Coreidae). – Bollettino della Societa Entomologica Italiana, **133**: 101-112.

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Нови находища на три реликтни вида птици в Родопите

Жеко СПИРИДОНОВ, Николай СПАСОВ, Васил ИВАНОВ

Врабчовата кукумявка *Glaucidium passerinum* (L., 1758), пернатоногата кукумявка *Aegolius funereus* (L., 1758) и планинският трипръст кълвач *Picoides tridactylus alpinus* Brehm, 1831 бяха установени от авторите в южните склонове на източната част на родопския дял Перелик в периода 16-19.09 и 16-20.10.2008 г. Проучената територия покрива над 1000 ха естествени иглолистни гори, от тях 80% – от смърч, част от които са вековни. Совите бяха установени по време на 5 нощни прослушвания, най-често между 20,30-21 и 0,00 часа. На 20.10 двойка врабчови кукумявки бяха слушани от 18,30 до 19,15 часа (началото на най-активния период за ловуване на този вид) в района на дивечовата хранилка в горната част на долината на р. Еленска (UTM-кв. LG 00) с 1600-1700 м надм. в. Мъжката птица започна с характерното, подсвиркващо "иу", маркиращо постоянната през цялата година семейна територия. Женската отговори 10-ина минути по-късно, отдалече. Последва дует от "иу-пи-пип" (женската птица с по-висок и пискливи глас). Двойката се бе приближила на 50-ина метра, когато имитирахме нейното териториално обаждане. Последва есенната "лъжлива брачна песен" на мъжкия "иу-иу-иу...", а след повторна имитация, женската отговори със завършващо "киу-киу-кю-кю...". До сега са публикувани само 3 находища на вида в Родопите.

Пернатонога кукумявка беше чута на 16.09 и 19.10 (еднократно тихо обаждане "дзюк") и на 17.09 (звучно излаяно "уак"). И в трите случая обажданията бяха предизвикани с имитиране на брачните викове на вида (уп-уп-уп...) или на горската улулица. Районът й е в съседство и северно на този на врабчовата кукумявка, като преминава и оттатък шосето за с. Стойките. До момента видът не е установяван за Переликския дял (НИКОЛОВ и др., 2007).

Трипръстият кълвач беше наблюдаван 2 пъти, а обажданията му и почукванията по стъблата и клоните на смърчови дървета бяха често слушани през дните 16-19.09 и 17, 19-20.10 в смърчовите гори по целия южен склон между 1600 и 2000 м надм. в. (UTM-кв.кв. KG 90 и LG 00). Обажданията са по-тихи от тези на големия пъстър кълвач, а при безпокойство в края на вика му се чува звънко "ю". Наблюденията сочат за най-високата известна плътност на вида в България.

И трите вида имат Сибирско-канадски тип на разпространение – тайгата на Евразия и С. Америка. В Централна Европа и на Балканския п-ов двете сови са следледникови реликти, а планинският трипръст кълвач е реликтен подвид от ледниково време. Предпочитаният им хабитат са старите естествени иглолистни гори. И трите вида са застрашени от възобновителните и санитарните сечи в старите иглолистни гори и

фрагментирането на горските масиви от изграждането на хотелски комплекси, пътища, съоръжения за алпийски ски, както и от безпокойството за дивите животни, следствие на урбанизацията, навлизането на автомобила в планините и струпванията на посетители (СПИРИДОНОВ и др., под печат а; СПИРИДОНОВ и др., под печат б). Биологически най-уязвим е трипръстият кълвач, тъй като 95% от храната му се състои от насекоми-ксилофаги и ларвите им (ФЕДЮШИН и ДОЛБИК, 1967). Мекият му клюн още повече стеснява хранителната му база. По тази причина той обитава най-вече горите от смърч, тъй като този вид има по-мека дървесина от останалите местни иглолистни. Трипръстият кълвач и врабчовата кукумявка в България са между 100 и 150 гнездови двойки и новите находища са важни за тяхното опазване.

Литература

НИКОЛОВ С., СПИРИДОНОВ Ж., ХРИСТОВ Й., ВЕЛЕВ К. 2007. Пернатонога кукумявка (*Aegolius funereus*). – В: Янков П. (Отговорен редактор). Атлас на гнездящите птици в България. БДЗП, Природозащитна поредица, кн.10. София, 338-339.

СПИРИДОНОВ Ж., НИКОЛОВ Б., ШУРУЛИНКОВ П. (под печат а). Врабчова кукумявка *Glaucidium passerinum* (L., 1758). – В: Червена книга на България, том 2. Животни, БАН – МОСВ.

СПИРИДОНОВ Ж., ШУРУЛИНКОВ П., ЗЛАТАНОВ Ц. (под печат б). Планински трипръст кълвач *Picoides tridactylus alpinus* Brehm, 1831). – В: Червена книга на България, том 2. Животни, БАН – МОСВ.

ФЕДЮШИН А., ДОЛБИК М. 1967. Птицы Белоруссии. Наука и техника, Минск, 520 с.

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New record of steppe polecat (*Mustela eversmanni* Lesson, 1827) in Northwestern Bulgaria

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The steppe polecat (*Mustela eversmanni* Lesson, 1827) occurs from Central and Eastern Europe in the west through southern Russia and Central Asia to South Siberia in the east. There is a severe lack of knowledge about the steppe polecat distribution in the Southeastern part of its area (SCHREIBER et al., 1989). In Bulgaria it inhabits only the northeastern part, where it is very rare. The steppe polecat is a strictly protected species in the country, with conservation status Vulnerable (SPASSOV & SPIRIDONOV, in press). Until now the westernmost record for the steppe polecat in Bulgaria was Chomakovtzi village (SPASSOV, 2007).

During a behaviour study of a European ground squirrel (*Spermophilus citellus*) colony in the region of town Knezha (43°29.92`N; 24°05.89`E; 147m.a.s.l.), we observed also a steppe polecat. This was a new record of this species in Northwestern Bulgaria, and confirms the westernmost known border in the steppe polecat's distribution after more than 30 years of absence of observations. It was observed on sixteen days during the period from 3 May to 19 September 2007. On 19.09.2007, two individuals playing together were seen. The steppe polecat was observed again in the spring of 2008. These frequent observations suggest that the site is part of a stable steppe polecat population area. The habitat is a large, heavily grazed pasture with a population of free-living European ground squirrels (KOSHEV & KOCHEVA, in press). The steppe polecat appeared in the midday hours, when it hunted ground squirrels. We made a photos and video films from a distance of 5 m. The species was determined on the base of exterior marks by photographs, using discriminating external keys.

The European ground squirrel is the main prey of the steppe polecat. In Bulgaria the European ground squirrel inhabits about 18 % of UTM quadrants in 332 localities (KOSHEV & KOCHEVA, 2007). For this reason we suggest that there is a great possibility to find the steppe polecat in other localities in Northwestern Bulgaria.

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References

KOSHEV Y., KOCHEVA M. 2007. Environmental factors and distribution of European ground squirrel (*Spermophilus citellus*) in Bulgaria. – Journal "Ecology & Safety. International Scientific Publications", **1**: 276-287.

KOSHEV Y., KOCHEVA M. (in press). Daily activity pattern in free-living European ground squirrels *Spermophilus citellus* (Mammalia, Rodentia) from Northwestern Bulgaria. – Acta Zoologica Bulgarica, **60**, supplement 2.

SCHREIBER A., WIRTH R., RIFFEL M., VAN ROMPAEY H. 1989. Weasels, Civets, Mongooses, and their relatives. An Action Plan for the Conservation of Mustelids and Viverrids. IUCN/SCC Viverrid and Mustelid Specialist Group, IUCN, Gland, 100 p.

SPASSOV N. 2007. Steppe polecat – *Mustela eversmanni* Lesson, 1827. – In: Popov V., Spassov N., Ivanova T., Mihova B., Georgiev K. (eds.). Mammals – important for conservation in Bulgaria. Dutch Mammal Society VZZ, Arnhem, The Netherlands, 265-269 (In Bulgarian)

SPASSOV N., SPIRIDONOV G. (in press). Steppe polecat – *Mustela eversmanni* Lesson, 1827. – In: Red Book of Bulgaria. Vol. 2. Animals. BAS and MEW, Sofia.

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