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# Abstracts of the Immature Beetles Meeting 2013

## October 3–4, Prague, Czech Republic

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Following the biennial tradition, the fifth Immature Beetles Meeting was held in Prague in October 3–4, 2013. As usual, the meeting took place at the Faculty of Science of Charles University in Prague and was organized in cooperation with the National Museum in Prague and the Crop Research Institute in Prague. In total, 59 participants from Europe, North and South America and Asia attended the meeting, including four students and researchers from Brazil (some of them met for the first time in Prague), leading experts in beetle systematics and morphology (Michael Ivie, Vasily Grebennikov, Petr Švácha), the head of one of the largest collections of beetles (Max Barclay from the Natural History Museum, London) and several newbies, i.e. pregraduate or even pre-university students (Vitor Abrahão Cabral Bexiga, Jordan Rainey and Albert Damaška). Fifteen oral lectures and three posters were presented, concerning the morphology, taxonomy and biology of immature stages of beetle families Carabidae, Helophoridae, Hydrophilidae, Staphylinidae, Silphidae, Elmidae, Buprestidae, Scarabaeidae, Lycidae, Chrysomelidae, Cerambycidae and Curculionidae. Three presentations were more general, focused on the introduction of the beetle larvae collections of the Zoological Museum in São Paulo and the Natural History Museum in London, and especially on the larval collection of Roy Crowson. As a novelty, a workshop focused on methodology of the studies of immature stages of beetles was organized on Friday afternoon, thanks to the willingness of Yusuke Minoshima, Andrea Di Giulio, Petr Šípek and Petr Švácha to show part of their secrets concerning preparing and mounting small and large beetle larvae, preparation of computer-based larval drawings, ways to treat seemingly lost dried-up larval material or so-far overlooked methods of focused ion beam microscopy. Discussions continued during the coffee breaks (covering and explaining in detail, for example, failures which led to a hypothesis concerning Lycidae as sister-group to all other winged insect) and naturally in the evening over glasses of Czech beer.

The next meeting is planned for autumn 2015 and will be held at Charles University in Prague again. Details about the 2013 and earlier meetings are available on the Immature

Beetles Meeting web pages at http://www.immaturebeetles.eu, but the pages will be moved to a new provider next year (please contact the organizer for details). A possibility of creating a web archive of papers published by the attendants of the meeting was also discussed, further suggestions and advice concerning techical aspects of this idea are welcome.

In case you are interested to get more information on the Immature Beetles Meetings, or you wish to be included into the mail-list to which latest information on the next meeting will be sent, please contact any of the organizers.

organizers of the Immature Beetles Meeting

## Acknowledgements

We are greatly indebted to all colleagues and students who supported the organization of the Immature Beetles Meeting 2013 by providing the oral presentation, workshop lecture or presenting a poster, taking care of the hungry and coffee/tea-addicted attendants of the meeting, and taking over our duties during the week around the meeting. The authorities of the Department of Zoology, Charles University in Prague kindly supported our initiative to organize the meeting, and our dear halves kindly tolerated our mental or physical absence from our homes during the evenings and nights. The meeting was organized as a part of the research activities of the organizers under a partial support of the grant of the Ministry of Culture of the Czech Republic (DKRVO 2013/12, National Museum, 00023272) to M. Fikáček, grant of the Ministry of Agriculture of the Czech Republic (CZ0002700604) to J. Skuhrovec and the institutional resources of the Ministry of Education, Youth and Sports of the Czech Republic for the support of science and research to P. Šípek.

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# ORAL PRESENTATIONS

## Egg cocoons, larvae and chromosomes of *Lihelophorus* Zaitzev (Helophoridae)

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*Lihelophorus* Zaitzev, currently a subgenus of *Helophorus* Fabricius, is endemic to the Tibetan Plateau. There are three species, one of which is as yet undescribed. The subgenus is unique within the Helophoridae in that all the elytral interstices, including the outermost one, are completely flat – there is no pseudepipleuron outside the elytral epipleurs. *Lihelophorus* is of particular interest as Fikáček et al. (2012) found evidence from cladistic analysis that it represents the most basal lineage of the Helophoridae, raising the possibility that its larvae may have dorsal abdominal sclerites resembling those of some of the Mesozoic fossils rather than those of other known *Helophorus*.

Here we give an account of a collecting trip to the Tibetan Plateau, in the course of which we obtained living material of all three species and brought them back to the laboratory in Qinghai Normal University.

We obtained egg cocoons of two of the species, *L. lamicola* Zaitzev and almost certainly the undescribed species. Both cocoons are type 4 as described by Angus (1992, 2011) with thin silk masts derived from the entire hollow tube (tube-threads), as in *H. lapponicus* Thomson and *H. laticollis* Thomson.

The eggs in both cocoons hatched, but we were unable to rear the larvae beyond first instar as we could not get them to eat. One larva of each species was preserved in absolute ethanol for DNA analysis, which has confirmed the identity of *L. lamicola* but which was initially unsuccessful with the second larva. The others were mounted directly into DMHF on slides. The larvae have unusually long legs and urogomphi (about twice the length of those of other similar-sized *Helophorus* larvae). The heads are unique in Helophoridae in having the anterior margin asymmetrical – the right hand side of the median part of the head, between the left hand edge of the nasale and the right setigerous lobe, is produced forwards so the nasale is deflected towards the left. The hair-tuft on the distal tooth of mandibular retinaculum is more than twice the size of that in other similar-sized *Helophorus* larvae. The dorsal abdominal sclerites are of the normal *Helophorus* pattern but the *L. lamicola* larva has all the abdominal segments except the apical one with a long richly tracheated sausage-like projection on each side. These projections, probably tracheal gills, appear to replace the lateral sclerites of the abdomen and are somewhat sclerotised apically but with three terminal setae. The other larva, almost certainly the undescribed species, lacks these projections and has normal helophorid lateral sclerites, the posterior one bearing a single long seta, as is normal in Helophoridae. The spiracles of both species are of similar size and appear fully functional, which makes the apparent tracheal gill of the *L. lamicola* larva all the more surprising.

All three species have the chromosome formula $2n = 20 + Xy_p$ (♂)/XX (♀), with small differences between the karyotypes of the three species. This chromosome formula contrasts with the $2n = 16 + Xy_p$/XX of the other *Helophorus* subgenera with intercalary (scutellary) striae on the elytra and asymmetrical apical segments of the maxillary palpi (*Helophorus* s. str. and *Gephelophorus* Sharp), but is also found in *Hydrochus* Leach (Hydrochidae).

ANGUS R. B. 1992: *Süsswasserfauna von Mitteleuropa 20/10-2. Insecta Coleoptera Hydrophilidae Helophorinae.* Gustav Fischer Verlag, Stuttgart, 144 pp.

ANGUS R. B. 2011: Rearing Helophorus: egg cocoons & larvae. P. 733. In: FIKÁČEK M., SKUHROVEC J. & ŠIPEK P. (eds.): Abstracts of the Immature Beetles Meeting 2011, September 29–30, Prague, Czech Republic. *Acta Entomologica Musei Nationalis Pragae* **51**: 731–756.

FIKÁČEK M., PROKIN A., ANGUS R. B., PONOMARENKO A., YUE Y. L., REN D. & PROKOP J. 2012: Phylogeny and fossil record of Helophoridae reveal Jurassic origin of extant hydrophiloid lineages (Coleoptera: Polyphaga). *Systematic Entomology* **37**: 420–447.

## Towards a guide to the larvae of the British Coleoptera

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The Coleoptera collections of the Natural History Museum in London date back to the early collections of explorers such as Sir Joseph Banks, supplemented by material from famous names such as Darwin and Wallace, and latterly the vast collections of Victorian researchers such as David Sharp and G. C. Champion. In the 20th Century the Museum has continued to develop its collections through staff fieldwork and by a large number of acquisitions of important private collections. One of these was the collection of Coleoptera larvae assembled by Fritz Isidor van Emden (1898–1958); this was deposited in the museum on the understanding that it would form the basis of a *Handbook to the Identi cation of the Larvae of the Families of British Coleoptera*, a work started but unfortunately never finished by van Emden himself. During the past decades, the original manuscripts were extensively redrafted, rewritten and updated by several members of the Coleoptera Section staff, most importantly by P. M. Hammond and J. E. Marshall. Still, it was never brought to a ready-to-publish state. We recently inherited this task, and in the interests of discharging the Museum's responsibility to van Emden, it is our pleasure to announce that the manuscript is now almost ready for publication. It will submitted as a book to the Royal Entomological Society's *Handbooks for the Identi cation of British Insects* and will include general chapters on morphology, some interesting aspects of beetle larval ecology (hypermetamorphosis, parasitism), guidance on collecting beetle larvae and how to build and maintain a collection of larval specimens. A key is provided to the larvae of the families and major subfamilies of beetle present in the British Isles, with a short summary of morphological and ecological characteristics of each taxon discussed. The work is illustrated with hundreds of line drawings and a number of high resolution photographs of beetle larvae.

The talk also discussed recent advances in care of and providing access to the larval collections of the Natural History Museum. The extensive larval collection is retained in a dedicated temperature-controlled storage area, and is available for scientific study.

## The curious bionomy of the curious larva and a good luck in the taxonomy (Buprestidae)

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The mature larva of the Australian buprestid genus *Julodimorpha* Gemminger & Harold, 1869 (*J. saundersii* Thomson, 1878) was recently described, illustrated and compared with the larvae of Julodinae, Polycestinae, Chrysochroinae, and Buprestinae (Bílý et al. 2013). In situ observations confirm the soil inhabiting life-strategy of *Julodimorpha* larva. The comparative morphological study of the *Julodimorpha* larva proves its buprestine-chrysochroine affinities, while the superficial similarity of *Julodimorpha* and Julodinae adults, with their identical life-strategies, due to convergence. The curious circumstances acompanying the discovery of the larva were described. Another case of a "good luck" in taxonomy was described on the case of larvae of *Coomaniella* Bourgoin, 1924.

BÍLÝ S., VOLKOVITSH M. & PETERSON M. 2013: Larvae of Australian Buprestidae (Coleoptera). Part 4. Genus Julodimorpha. *Zootaxa* **3637**: 341–354.

## Discovery of *Hintonelmis* Spangler (Coleoptera: Elmidae) larvae and preliminary phylogenetic relationships based on COI mDNA sequences

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For many decades, studies on the association among adults and larvae of Elmidae were restricted to rearing trials or even merely by selection of individuals with proportional size and overlapping occurrences. However, despite its importance for the knowledge of the species biology, rearing techniques are not feasible for all Elmidae species. Many elmids may take several months to become imago and most of them require special environmental conditions to complete their development (Brown 1987, Elliot 2008, Jäch & Balke 2008). In the last decade, molecular techniques like RFLP and DNA sequencing became more accessible for zoological studies, being used for several purposes.

In this work we describe the larvae of *Hintonelmis delevei* Hinton. The conspecificity among the adults and larvae was confirmed based on the mitochondrial gene region cytochrome c oxidase subunit I (COI). We also present a first draft on the genus phylogeny based on five more *Hintonelmis* species, *H. atys* Hinton, *H. carus* Hinton, *H. opis* Hinton, *H. perfecta* (Grouvelle) and *H.* sp. and three larval morphotypes. We used Bayesian and Maximum likelihood phylogenetic analyses using MrBayes and MEGA software respectively. Multiple alignement was done using MAFT software and then sequences (about 820bp) were checked manually.

Both methods were congruent for all clades. Despite molecular analysis made clear that larval morphotypes belong to different species, a careful morphological study (including SEM visualizations) did not show any remarkable difference among them (apart slight difference in size and color pattern). As expected, *H. perfecta* and *H. carus* showed to be the closest known Elmidae species analyzed. Sepatation between *H. opis* and *H.* sp. is not corroborated and, despite their remarkable differences in color pattern, they seem to be extremely close or even belonging to the same species. *Hintonelmis atys* and *H. delevei* are well defined and supported by high values of bootstrap (99 %), positioned externally to the remaining species as following (((*H. delevei* + (*H. atys* + (remaing *Hintonelmis*))).

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ELLIOT J. M. 2008: The ecology of riffle beetles (Coleoptera: Elmidae). *Freshwater Reviews* **1**: 189–203.
JÄCH M. A. & BALKE M. 2008: Global Diversity of Water Beetles (Coleoptera) infreshwater. *Hydrobiologia* **595**: 419–442.

## First immature descriptions of *Metapteron xanthomelas* (Lucas, 1857) from the Neotropical Region (Lycidae: Lycinae: Calopterini)

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The Neotropical tribe Calopterini comprises 21 genera (Bocáková 2001). The genus *Metapteron* include 15 species (Kleine 1933). Except by a taxonomic revision of the tribe Calopterini (Bocáková 2001) the literature available to *Metapteron* is composed only by the succinct original descriptions. Larvae of Calopterini are poorly known and just a few immatures from related genera were studied (Costa et al. 1988, Miller 1988, Bocák & Matsuda 2001). The examined material was collected on District "Cidade Santa Júlia, Itanhaém, São Paulo, Brazil" under decaying wood of palm tree and deposited on the Immature Coleoptera Collection of Museu de Zoologia da Universidade de São Paulo, Brazil (CIC-MZUSP). Adults of *Metapteron* can be recognized by almost square elytra cells and by a forked longitudinal carina (areola) medially constricted on pronotum (Bocáková 2001). The larva is dorsoventrally flattened, with integument creamy with dark-brown spots; head more or less hypognathous, small, transverse, integument strongly alveolate, completely sclerotized excepting by the smooth retractable posterior region and without nasal. Antennae 2-segmented; antenommere 1 ring-shaped, conatus to head, wider than longer; antenommere 2 elongated, with sclerotized area carrying two pegs and three microsetae triangularly arranged. Abdominal segments 1–8 conspicuously lobed laterally; segment nine without urogomphi, and segment ten pygopodium-like. *Metapteron* larva differs from known larvae of Calopterini by the head integument strongly alveolate, absence of median longitudinal division on dorsal abdominal segments, abdominal segments 1–8 conspicuously lobed laterally, and absence of urogomphi.

BOCÁK L. & MATSUDA K. 2003: Review of the immature of the family Lycidae (Inseca: Coleoptera). *Journal of Natural History* **37**: 1463–1507.
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MILLER R. S. 1988: Behavior of Calopteron reticulatum (F.) larvae (Coleoptera: Lycidae). *Ohio Journal of Science* **88(3)**: 119–120.

## Suprising morphological diversity of New Zealand hydrophilid larvae: a preliminary report

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We are summarizing preliminary results of an ongoing project focused on a revision of the fauna of the beetle family Hydrophilidae of New Zealand. Based on the material examined so far, 67 species accommodated in 20 genera occurs in New Zealand, of which 13 genera and 62 species are New Zealand endemics. The fauna is moreover taxonomically biased, as 72 % of all species belong to a single subfamily Rygmodinae (following the new classification of the family proposed by Short & Fikáček 2013), which is a group endemic to Southern Hemisphere temperate zone. During the recent field work in New Zealand, quite numerous samples of larvae were collected. Thanks to the DNA sequences generated for all New Zealand genera in another part of the project, we were able to associate the field-collected larvae using the ca. 750 bp fragment of cytochrome oxidase I (*cox1*). So far, larvae of 8 of 13 endemic genera have been identified successfully in this way. The detailed studies of these larvae are now performed by one of us (Y. Minoshima), with the first results published recently (Fikáček et al. 2013). Surprisingly, we found a wide morphological diversity of the larvae of the subfamily Rygmodinae, which strongly differ especially in the morphology of the nasale and in general body form, suggesting that they largely differ in biology and prey preference. This is also congruent with habitat preferences observed: larvae of *Cylomissus* and *Rygmodus* are aquatic, *Cyloma, Adolopus* and *Saphydrus* inhabit forest leaf litter, *Tormissus* was found in tree sap fluid together with adult and larvae of *Nosodendron* (Coleoptera: Nosodendridae) and *Tormissus guanicola* was collected from under stones in penguin colonies in subantarctic islands (Ordish 1974). The diverse larval morphology of the New Zealand Rygmodinae corresponds with the diversity of adults which differ not only in gross external morphology, bus also exhibit large differences in the morphology of the mouthparts. This suggests that the radiation of Rygmodinae in New Zealand affected the morphology of larvae to the same extent as those of adults.

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FIKÁČEK M., MINOSHIMA Y., VONDRÁČEK D., GUNTER N. & LESCHEN R. A. B. 2013: Morphology of adults and larvae and integrative taxonomy of Gondwanan genera Tormus and Afrotormus (Coleoptera: Hydrophilidae). *Acta Entomologica Musei Nationalis Pragae* **53**: 75–126.

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## Description of the last larval instar of *Pelosoma* (Hydrophilidae: Sphaeridiinae) from Brazil

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The water scavenger beetle genus *Pelosoma* Mulsant, 1844 (Hydrophilidae: Sphaeridiinae: Megasternini) comprises 21 described species distributed worldwide (introduced to Paleartic), with most species (15 spp.) occurring in the Neotropical Region (Hansen 1999, Short & Hebauer 2006). Although the knowledge concerning the immature stages of Hydrophiloidea has increased throughout the last 20 years, information about the biology and the ontogeny of *Pelosoma* remained scanty. The general morphology of the egg case, third instar larva and pupa of this taxon was described for the first time by Archangelsky (1997), based on an unidentified species from Venezuela. Archangelsky (1997) highlighted the similarity between the larvae of *Pelosoma* and *Cercyon* Leach, 1817, and the need to analyze different species of *Pelosoma* in order to support the generic diagnosis. Eight larvae and four adults of *Pelosoma* cf. *cercyonoides* Sharp, 1882 were collected on decaying fruits of *Persea americana* Mill. (Lauraceae) on an urban park in São Paulo State, southeastern Brazil. Four larvae were successfully reared to adult stage in laboratory, enabling the identification of the species.

In the present work a description of the third larval instar of Pelosoma cf. cercyonoides are given, representing the first chaetotaxy study for the genus. Due to lack of information about chaetotaxy on last larval instar of Sphaeridiinae, the mapping was done using mainly the primary chaetotaxy of Cercyon convexiusculus Stephens, 1829 presented by Fikáček et al. (2008), for comparison. The additional sensilla described were considered secondary.

The general morphology of the larvae of this species is similar to the one described by Archangelsky (1997), in which the coronal suture is absent; clypeolabrum asymmetrical, without teeth, with shallow pubescent groove on the left side; epistomal lobes reduced; frontal suture lyriform; externoapical sensorial appendage present on pedicel, somewhat shorter than flagellum; mandibles asymmetrical; prementum reduced, present as a pair of sclerites, each bearing one stout long seta; hypopharynx asymmetrical, pubescent, strongly prominent to left side; cervical sclerites present; spiracular atrium present; urogomphi one-segmented. The present species differs from the previously described larva by the frontal suture which reaches the occipital foramen; epistoma membranous and setose; right mandible with five sensilla, left mandible with long ventral sulcus; legs two-segmented; urogomphi with distinct terminal papilliform tubercle bearing large setae, and with a dorsal puncture, a dorsal setae and a distal sensilla. Corroborating with Archangelsky (1997), the genus larvae can be distinguished from *Cercyon* larvae by the dorsal plate of abdominal segment VIII which is subquadrate and without apical projections. If the specific identification of the herein described larvae is confirmed after comparison with the holotype (deposited in the Natural History Museum, London, England), then *P. cercyonoides*, originally described from Guatemala and later recorded from Mexico (Hansen 1999), will be reported for the first time in South America.

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## Cerambycid larvae intercepted from wood packaging material and wooden handicrafts imported from China

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Canada and the Netherlands have adopted the International Standard for Phytosanitary Measures (ISPM) No. 15 for Wood Packing Materials (WPM). This measure reflects the necessity of a heat- or a chemical (Methyl Bromide) treatment of wood thicker than 6 mm and is approved by the International Plant Protection Convention (IPPC). Prior to use WPM should be properly treated and debarked to prevent the spread of live plant pests and diseases, especially Quarantine species. WPM treated according to ISPM 15 is marked, but these measures are not always properly implemented. Interceptions by the plant protection services of Canada and the Netherlands of living insects, such as larvae of Cerambycidae, occurs regularly in WPM during import inspections at airports, at harbours or at stone-importing companies. Living larvae of Cerambycidae have been intercepted in wood from numerous tree species, both coniferous and deciduous trees, in particular those used for the transport of stone and tiles from China. In addition to wood packaging, handicrafts manufactured from wood are also a pathway for live Cerambycid larvae.

In this presentation we discuss our identifications of the various cerambycid larvae (Cerambycinae, Lamiinae, Prioninae, Spondylinae). Often it is not possible to complete the identification of larvae of Cerambycidae, because little diagnostic information is published or available online. Molecular information (PCR, CO1-sequences) is becoming more available and offers an additional possibility to support identifications.

## The larval collections of Roy Albert Crowson (1914–1999)

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Roy A. Crowson is well known among Coleoptera systematists for the huge volume of published papers and his several books, much of which formed the foundation of the current higher-level classification of the order Coleoptera. Less known and largely overlooked by current researchers are the unpublished components of Crowson's legacy, most of which are now deposited in the Natural History Museum (BMNH) in London (slide mounted specimens, spirit collection of adults and larvae, spirit bulk samples, diaries, incomming correspondence, field books and unpublished manuscripts) and at Glasgow University (collection of British adult beetles, pinned material, carded morphological mounts, parts of correspondence, biographical materials and illustrations). Smaller parts are dispersed in various other museums, e.g. fossil specimens (many in the collections of the Paleontological Institute of the Russian Academy of Sciences in Moscow), outgoing correspondence and type specimens of modern taxa.

The spirit larval collection of R. Crowson, today deposited in the BMNH, includes a huge amount of material: 29 tubs of 6 jars each, with up to 40 vials per jar of sorted and identified larvae, 1 tub of pupae, 10 tubs of mixed and unsorted adults and larvae with associations documented in field books, and 12 tubs of mixed identified material. The core slide collection, also in the BMNH, includes over 5,000 slides housed in 8 cabinets, each with 55 trays each with up to 18 slides. Three of these cabinets contain exclusively the larval slides. In many cases, it is even possible to trace the specimens/slides on which Crowson based his illustrations and descriptions. In addition, up to another 5,000 slides are uncataloged.

Larval material deposited both in the spirit and slide collections of R. Crowson is clearly a valuable source for current and future larval workers who should not hesitate to come, see and study it. An ongoing databasing of all this material currently performed by the Coleoptera section of BMNH and associated researchers (including the author of this contribution) will largely facilitate these studies in the near future.

## Morphology of the larva of *Nicrophorus nepalensis* (Coleoptera: Silphidae)

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The genus *Nicrophorus* Fabricius, 1775 is the most species-rich genus of the family Silphidae, with 68 extant species (Sikes & Venables 2013). Morphology of its larva is known only for 20 species, mostly for western Palaearctic (Pukowski 1934, Růžička 1992, Parkhomenko 2000a,b), Japanese (Hayashi 1986) and Nearctic taxa (Anderson 1982, Palestrini et al. 1996).

Recent molecular phylogeny confirmed classification of *Nicrophorus* with two subgenera and several species groups in the nominotypical subgenus (Sikes & Venables 2013); most of them contain species with known larvae. Exceptions are the subgenus *Necroxenus* Semenov-Tian-Shanskiy, 1933 and *N. didymus*, *N. pustulatus* and *N. nepalensis* groups. The latter group contains 16 species, distributed from Pakistan to Japan and Solomon Islands, with many local endemics (Sikes et al. 2006, Sikes & Mousseau 2013).

We present description of all three instars of *Nicrophorus nepalensis* Hope, 1831, distributed from Pakistan to Ryukyu Islands and Philippines (Sikes et al. 2006). Larvae were reared from several breeding pairs collected from Tanah Rata (Cameron Highlands, Malaysia). Several morphological characters of *N. nepalensis* third instar larva (labium with sclerotization medially widely interrupted, maxillary palpomere 1 with complete sclerotization, ventrite 9 entire, ventrite 10 entire, without posterior Y-shaped structure) resembles the same semaphoront in *N. humator* (Gleditsch, 1767). This is congruent with position of *N. nepalensis* and *N. humator* species groups as a single clade in molecular phylogeny of the genus (Sikes & Venables 2013). Differences are e.g. in posterior margin of ventrite 10 – entire in *N. nepalensis* and deeply and widely emarginate in *N. humator*.

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## Geographical variation in thermal constants for development of carabid beetles

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Thermal constants are important descriptors of thermal requirements of species and their adaptations to local conditions. Geographical variation in the thermal constants of egg development was studied in 11 populations of 10 species of carabid beetles originating from the Czech Republic and Russian Federation. The data were obtained based on development times at 4–6 temperatures ranging from 9 to 29 °C, depending on species. Thermal constants – lower development threshold (LDT) and sum of effective temperatures (SET) – were calculated using three different linear equations (Lopatina et al. 2012, Honěk 1996, Ikemoto & Takai 2000) in the range of ecologically relevant temperatures. The obtained data were also compared with the literature data. In most cases the three methods provided similar estimates, but the method of Ikemoto & Takai (2000) seemed to be the most precise. In case of *Amara eurynota*, we found that the population from Russian Federation had higher SET with identical LDT, and thus developed longer, compared to the Czech population. In other cases there was no variation in thermal constants among populations or ecological significance of the observed variation in thermal constants cannot be distinguished from the natural autocorrelation of LDT and SET estimates.

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## Immatures of Palaearctic species of the weevil genus *Tychius* (Curculionidae): descriptions and bionomic data with an evaluation of their potential in a phylogenetic reconstruction of the genus

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The genus *Tychius* Germar, 1817 belongs to the subtribe Tychiina of the tribe Tychiini (Coleoptera: Curculionidae: Curculioninae). Presently about 300 taxa of this genus are considered as valid species and recently all the adults of these were taxonomically revised: 240 live in the Palaearctic region, whereas the remaining are distributed in the Afrotropical (about 45 species mainly from South Africa) and Nearctic (10 species) regions, and in the Indian subcontinent (3 species). Species of *Tychius* have a relatively homogeneous biology, since all of their known hosts belong to the subfamily Papilionoideae of the worldwide distributed family Leguminosae. Most species are seed predators, whereas a few species form galls on leaves, flowers or pods. When mature, larvae feeding on the seeds typically leave the pod and enter the soil to pupate.

Larvae of 14 species and pupae of 12 species of Palaearctic *Tychius* are described for the first time. Larvae and pupae of *T. meliloti* Stephens, 1831, *T. squamulatus* Gyllenhal, 1835 and *T. quinquepunctatus* (Linnaeus, 1758), previously incompletely described, are redescribed with more details. They belong to 10 of 22 groups of species assembled through adult morphological characters in this region and live on Leguminosae Papilionoideae, belonging to the tribes Genisteae, Loteae, Galegeae, Trifolieae and Vicieae at least with regard to treated species. Generally larvae, but not pupae, show a few characters useful to support some groupings previously postulated on adult morphology, and possibly some phylogenetic relationships although these are partly weak because of several clear parallelisms or convergences. One of the most numerous and better known group of species, the *T. stephensi* group living on Trifolieae, is supported by two distinctive larval character states, whereas all the other groups seem to be distinguishable from each other at least by a unique larval character state. New bionomic data concerning larval and pupal development and adult emergence are reported for all the described species. These data confirm that this genus is highly homogeneous in habits and times of development, with unique adaptive differences in adult emergence and overwintering due to the single or double seasonal flowering of the host plant. It seems that there is only partial concordance between the evolution of *Tychius* and that of their host plants.

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# Contribution to the biology and immature stages of some weevils of subfamily Lixinae (Coleoptera: Curculionidae)

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Weevil subfamily Lixinae Schoenherr, 1823 (Coleoptera: Curculionidae) contains about 1,200 species, distributed mainly in the Palaearctic Region (about 700 species) (Ter-Minasian 1967). In Europe, the highest species number is known from the Mediterranean area. The subfamily is currently divided in three tribes: Cleonini, Lixini and Rhinocyllini (Alonso-Zarazaga & Lyal 1999).

Most species of Lixinae are oligophagous or even monophagous. Larvae of Cleonini live on plant roots and are usually endophagous, less often ektophagous. Larvae of Lixini are typical stem borers (*Lixus* Fabricius, 1801) or feed on herb flowers (*Larinus* Germar, 1824 and *Lachnaeus* Schönherr, 1826), similarly as species of the tribe Rhinocyllini.

Recently, great attention has been paid to the taxonomy of Lixinae (e.g. Gültekin 2006, 2011), whereas their bionomy has been much less studied. For many species, data on their host plants, life cycles and immature stages are very scarce or completely missing.

Since 2010, we have been summarizing faunistic and bionomical data on Lixinae in the Czech Republic on the basis of study of museum and private collections, compiling literature data and especially field observations. This has been accompanied by photographic documentation of habitats, host plants and larval development of each species. As many Lixinae species are regarded as vanishing or even critically endangered in central Europe, we also focused on critical evaluation of species endangerment. Our results regarding the tribe Cleonini and the genus Lixus were partially published (Stejskal & Trnka 2013), for the first time for Czech fauna. Apart from supplements of missing information for common species, here we present new host plants and details of life cycles of the species cited below.

*Coniocleonus nigrosuturatus* (Goeze, 1777) is a weevil with previously completely unknown bionomy. In spite of its rather common occurrence in some countries of eastern and southern Europe, Thyme (*Thymus* sp.) has been the only reported host plant of adult beetles (e.g. Kleine 1910, Ter-Minasian 1988). Based on our observations, the host plant of this most probably monophagous weevil is Common Stork's-bill (*Erodium cicutarium*). Immature stages of this beetle are being described now.

*Leucophyes pedestris* (Poda, 1761) is a wingless beetle, occurring very commonly in some European countries (e.g. Hungary and Romania). So far only Common Carrot (*Daucus carota*) has been reported as its host plant (Dieckmann 1983). We observed both adults and a larva on Common Bird's-foot-trefoil (*Lotus corniculatus*) which is probably its host plant.

*Lixus bituberculatus* Smreczynski, 1968 has belonged to the rarest beetles of the genus with an unknown bionomy. We observed its development on Common Chicory (*Cichorium intybus*).

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## Weird hairs, less clarity: the immature stages of Taenioderini (Scarabaeidae: Cetoniinae)

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The Cetoniinae tribe Taenioderini (Scarabaeidae: Cetoniinae: Taenioderini) represents a less known, however specious group of flower beetles. With a single exception, the group is distributed only in eastern Palaearctic and Oriental biogeographic regions. Although Taenioderini receive much attention of taxonomists and several species are described each year, no observations on the biology and ecology are available yet. We had the opportunity to collect and rear several species of Taenioderini and thus we provide the first observations on the immature stages and ecology of the group as well. The larvae of *Chalcotea neglecta* Ritsema, 1892, *Coilodera diardi* (Gory & Percheron, 1833), *C. penicillata* Hope, 1831, *Euselastes cineracea* Gory & Percheron, 1833, *E. laotica* Mikšić, 1974, *Meroloba suturalis*

Snellen van Vollenhoven, 1858, *Plectrone tristis* Westwood, 1842 and *Taeniodera* sp. were examined and their morphology is compared with the immature stages of the other Cetoniinae groups. In comparison with other Cetoniinae tribes, the examined larvae show an extraordinary variation in the body setaion (e.g. oblanceolate body setae in *E. cineracea*) and in development of several epipharyngeal structures. However no clear synapomorphies delimiting the group were identified. We tested the phylogenetic relationship of six representatives of the tribe Taenioderini and other Cetoniinae groups using our previously published morphological data matrix (Šípek et al. 2012). However based on our dataset we were not able to establish a reliable phylogenetic hypothesis, nor were we able to support or reject the monophyly of Taenioderini.

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## Growth and ontogeny of sexual size dimorphism in ower beetle *Pachnoda marginata* (Scarabaeidae: Cetoniinae)

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Although beetles from subfamily Cetoniinae have recently enjoyed the attention of amateur breeders, their larval ontogeny is still unknown in most species. We monitored entire larval development of *Pachnoda marginata* (Drury, 1773), middle-sized flower beetle belonging to tribe Cetoniini. Larvae were weighed at two-day intervals in first and second instar and at three-day intervals in third instar. Our results bring insights into juvenile biology and growth characteristics of this beetle. Remarkably, development time and weight increments of consecutive instars were correlated. This did not hold for pupal phase, as time spent in pupal chamber was unaffected by previous growth. Final weights of instars were independent on growth trajectories. Likewise, growth trajectories were unaffected by growth trajectories in previous instar so single instar appears as independent unit. We also found out that this species is sexually dimorphic in size (males are slightly larger) and development of this dimorphism was examined. The males became larger by means of higher growth rate in second instar, as the sexes did not differ neither in development time nor in growth trajectory; in first and third instar relative growth increments (i.e. growth ratios) were similar in both sexes. Finally, our results indicate that the heavily sclerotised head capsule increases in size during intermolt period, as it is significantly larger in late-instar larvae in comparison with larvae soon after ecdysis. However, the measured difference is only marginal in comparison with cranium size difference between the instars.

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## POSTER ABSTRACTS

### Checklist of the Immature Coleoptera Collection of the Museu de Zoologia da Universidade de São Paulo (CIC-MZUSP)

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Entomological collections are of great importance for the maintenance, knowledge and study of taxonomic and history. Few entomological collections have specimens of immature stages and this number is smaller when you discuss about material reared on laboratory. Coleoptera is one of the biggest insect orders with about 176 families, 29.500 genera and 386.500 species (Ślipiński et al. 2011). The Neotropical Region comprises 127 families, 6.703 genera and 72.476 species. In Brazil are known 104 families, 4.351 genera and 26.755 species (Costa 2000). The Immature Coleoptera Collection of the "Museu de Zoologia, Universidade de São Paulo (CIC-MZUSP)" is one of the largest collections around its congeners and very representative of the Neotropical fauna. This important collection provided material for many studies involvig Coleoptera larvae including the book "Larvas de Coleoptera do Brasil" (Costa et al. 1988). Details about the history, collection methods, sampling sites, rearing method and organization of database of "CIC-MZUSP" can be found in Costa (2010). The present study aims to review the database of "CIC-MZUSP", with material verification, and subsequently set up a checklist of groups of immatures and adults contemplated in this collection. The database of that collection and the specimens itself are analyzed and revised. The preliminary analysis shows that "CIC-MZUSP" contemplates 50.617 specimens fixed in 70% ethylic alcohol and of these 20.364 are larvae, 9.607 are larval exuviae, 3.320 are pupae, 5 are pupal exuviae and 17.317 are adults. The collection includes 103 families, 471 genera and 662 species. We intend to make available to public the list of genera and species from "CIC-MZUSP" and provide means for an effective speed-up on Coleoptera Immature descriptions, conservation and understanding.

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# Identi cation of larval instars of two forensically useful beetle species: *Necrodes littoralis* (Coleoptera: Silphidae) and *Creophilus maxillosus* (Coleoptera: Staphylinidae)

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Insects are used in forensic investigations primarily to develop an estimate of postmortem interval. These estimates can be based on the duration of the immature stages of the insects found on a corpse or on the community composition of insects on the corpse. Morphological measurements of larval specimens collected from the carcass are primarily used for their age determination (Amendt et al. 2007, Higley & Haskell 2010, Villet et al. 2010). Furthermore, these measurements were found to be useful for instar identification of some forensically important beetles (Watson & Carlton 2005, Velasquez & Viloria 2010). In the case of forensically useful flies, 3$^{rd}$ instar is easily distinguishable from others by morphology of spiracles (Szpila 2010). When it comes to the beetles from family Staphylinidae and Silphidae, there are no clear morphological features, which would point to a specific larval instar (Villet et al. 2010). Consequently, the only way to distinguish larval instars of beetles is to measure some of their morphological features.

The wide range of prevalence, intensive reproduction on the remains and PAI (preappearance interval, i.e. period of time between decease and the appearance of insects on the body) being dependent on the temperature, make both, *Necrodes littoralis* and *Creophilus maxillosus*, extremely important species in assessing the time of death in the Palaearctic Region (Matuszewski 2011, 2012). The main aim of the research was to find the characteristics essential for instar identification and to create easy to use classifier of larval stages.

Six features were measured during the research: the distance between dorsal stemmata, the width of the pronotum, the length of the body, the width of the mesonotum, the width of the 8$^{th}$ abdominal tergit, and the length of the 1$^{st}$ segment of urogomphus. To create a classifier, a linear discriminant analysis (LDA) was used. Using the measurements of two morphological features with the best discriminant power and the greatest differences between means, simple classifier was created. The validation of the classifiers were performed by test larvae.

All features were incorporated into discriminant functions in the case of *Necrodes littoralis* and *Creophilus maxillosus.* The width of the mesonotum and the distance between dorsal stemmata turned out to be the best features for separation between instars. Classification functions were solved for training larvae and perfect results (no misclassifications) were achieved. Satisfactory results were also attained for test larvae. In the case of *Necrodes littoralis* only one 3$^{rd}$ instar larva was misclassified as a 2$^{nd}$ instar. In the case of *Creophilus maxillosus* no mistakes were noticed. The width of the mesonotum and the distance between dorsal stemmata were used to create the simple classifier. Correctness of the classification was identical as in the case of classifier with all features, as well for the training and the test larvae.

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## Larval defensive mechanisms of tortoise beetles

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The subfamily Cassidinae, commonly named tortoise beetles, is a part of the large family Chrysomelidae (leaf or plant beetles). Their typical life cycle consists of the eggs, larvae, pupae, and adults occurring mostly on their host plant. Immature folivorous insects are especially vulnerable to predators attacks. Strong enemy selection forces tortoise beetles to develops their defensive strategies.

Defensive mechanisms used by insects often complements each other, so in general, it is difficult to set a clear boundary between them. What is more it is also hard to indicate, which of these factors is most relevant in defense arsenal. But it is possible to distinguish several basic categories of defensive strategies. Different morphological structures, peculiar behaviours, chemical compounds and useless substances like exuviae and excrements may be useful in defense.

Cassidinae larvae use various forms of defense, but it seems that the most intriguing is the use of waste substances. Among Chrysomelidae the waste substances are not only used by immature stages of species of the subfamily Cassidinae, but also the subfamily Criocerinae and subfamilies of Camptosomata Group (i.e. Clytrinae, Cryptocephalinae, Lamprosomatinae and Chlamysinae) make use of this mechanism. Waste substances are retained in various forms by the different species and their effectiveness as a defensive mechanism is also different.