Proceedings of the 8th Conference of the Polish Taxonomical Society

Universal Classification of Organisms
- a Challenge for Classic and Molecular Taxonomy

Dedicated to Professor Maciej Mroczkowski
(1927-2007)

Professor Maciej Mroczkowski - Honorary Guest of the VIII Conference of PTTax.
(Wiechlice, 18-20.05.2007)

Professor Maciej Mroczkowski
(1927-2007)

Maciej Mroczkowski was born on the 21st of March 1927 in Lublin. At the age of one he moved with his parents to Podkowa Leśna near Warsaw. There he spent his childhood and the time of German occupation. There, with a gap in 1948-76, did he also live the rest of his life. He died on the 6th of October, 2007 in Podkowa Leśna.

At the age of 16, in March 1943, he joined Armia Krajowa (after the war decorated with the Medal of the Army, the Cross of Armia Krajowa, the Badge of "Akcja Burza").

Married twice, to Anna Mikłaszewska from 1948 to her tragic death in a rail accident in 1986 (two children, seven grandchildren, a grand-grand-daughter) and since 1989 to Maria Niewitecka.

Started biological studies in 1947 on the University of Warsaw, attaining a master's degree in 1951. Attained a Ph.D. degree in 1961 (PAN Institute of Zoology in Warsaw) and a postdoctoral degree in 1968 (University of Warsaw). In 1987 he received the title of professor (PAN Institute of Zoology in Warsaw).

In 1948 he began scientific work as an assistant in the State Zoological Museum (now it's a PAN facility) in Warsaw on Wilcza 64, where he has worked until today (so it's already been 60 years) - during the last 10 years, already on pension, voluntarily. He became senior assistant in 1952, lecturer in 1955, reader in 1973, associate professor in 1987 and full professor in 1992. Decorated with a Medal of 25 Years of PAN (1978) and a Golden Cross of Merit (1984).

In 1952-1974 a registrar of Polish Entomological Society, in 1974-1977 the chairman of the Editorial Board of "Key to determination of insects of Poland". Also the chairman of the Polish Entomological Society for several terms (1965-72). Mainly for this activity he received a golden badge of PTEnt. in 1974 and the title of honorary member of PTEnt. and a medal "For merits to development of PTEnt." in 1998. In 1984-1998 a member of the Scientific Council of the Museum and Institute of Zoology of PAN, in 1987-1998 a member of the Committee of Zoology of PAN.

His scientific activity was bidirectional. The first direction was systematics and zoogeography of world's Dermestidae and Silphidae. He published a number of works on this topic, described about 50 taxons new to sciences, and a catalogue of world's Dermestidae was his postdoctoral degree work.

The second direction, to which he dedicated most of his life, was a monographic faunistic synthesis of beetles of Poland. He solitarily began work on a catalogue of domestic beetles in 1954. When a new editorial series "Catalogue of Polish Fauna" was created in the Zoological Institute of PAN in 1959, he took on the compilation of Coleoptera (he was the main author and leader of the team; he cooperated with dr. Bolesław Burakowski and Janina Stefańska). He presented a timetable with 20 volumes meant to be released in 1.5-year intervals. And so 21 volumes of the catalogue emerged in 1971-1997, with a 22nd, complementary, released in 2000. The last (23rd) one saw light in the beginning of 2007. It completed work on a grand and globally unique opus (in preparation for 56 years). These 23 volumes comprise elaboration of

6811 beetle species, of which 6000 are certain to live in Poland. They constitute about 20% of all domestic animals.

134 entomological works of prof. Mroczkowski were printed by leading zoological journals (among others from the UK, Belgium, Denmark, Germany, Sweden, Hungary, Italy, Russia, Saudi Arabia, Japan, North Korea and Poland). He is also the author of over 350 other naturalistic publications and several hundred non-zoological articles. They involve cynology, various collecting issues and phillumeny (published under the alias of "Feliks KIETOWICZ"), descriptions of scientific expeditions, various recollections, notes on Podkowa Leśna, and other affairs unrelated to nature.

In 1975-1991 a member of the International Board of Zoological Nomenclature (an organ of the International Union of Biological Sciences, a part of UNESCO) - and the only one coming from a socialist country. He was elected for the Board by the finest zoologists from all around the world to replace the recently (1974) deceased professor dr. hab. Tadeusz JACZEWSKI, one of Poland's most outstanding zoologists, of whom he was a student.

24 species and genera of animals new to sciences from various systematic groups were given his name.

In honour of his merits to global and Polish taxonomy and on the occasion of 80th birthday and 60 years of scientific activity, on the 18th of May 2007 the administration of PTTax. awarded him the title of Honorary Member of the Polish Taxonomical Society.

Maciej Mroczkowski urodził się 21 marca 1927 roku w Lublinie. Gdy miał rok, rodzice przeprowadzili się do Podkowy Leśnej koło Warszawy. Tam spędził młodość i lata okupacji niemieckiej. Tam też, z przerwą w latach 1948-1976, mieszkał do śmierci. Zmarł 6 października 2007 roku w Podkowie Leśnej.

Gdy ukończył 16 lat, w marcu 1943 roku wstąpił do Armii Krajowej (odznaczony po wojnie Medalem Wojska, Krzyżem Armii Krajowej, Odznaką „Akcja Burza").

Dwukrotnie żonaty: z Anną Mikłaszewską od 1948 roku do Jej tragicznej śmierci w katastrofie kolejowej w 1986 roku (dwoje dzieci, siedmioro wnuków, prawnuczka) i od 1989 roku z Marią Niewitecką.

W 1947 roku rozpoczął studia biologiczne na Uniwersytecie Warszawskim, uzyskując w 1951 roku tytuł magistra. Doktorat obronił w 1961 roku (Instytut Zoologii PAN w Warszawie), a habilitację w 1968 (Uniwersytet Warszawski). W 1987 roku nadano mu tytuł profesora (Instytut Zoologii PAN w Warszawie).

W 1948 roku rozpoczął pracę naukową na stanowisku asystenta w Państwowym Muzeum Zoologicznym (dziś to placówka PAN) w Warszawie przy ulicy Wilczej 64, gdzie pracuje naukowo do dziś, a więc już 60 lat; przez ostatnie 10 lat - będąc już na emeryturze - jako wolontariusz. Starszym asystentem został w 1952 roku, adiunktem w 1955, docentem w 1973, profesorem nadzwyczajnym w 1987 i profesorem zwyczajnym w 1992. Odznaczony Medalem 25-lecia PAN (1978) i Złotym Krzyżem Zasługi (1984).

W latach 1952-1974 był sekretarzem naukowym Polskiego Towarzystwa Entomologicznego, a od 1974 do 1977 roku przewodniczącym Kolegium Redakcyjnego „Kluczy do oznaczania owadów Polski". W Polskim Towarzystwie Entomologicznym pełnił też przez kilka kadencji funkcję wiceprezesa (1965-1972). Głównie za tę działalność otrzymał w 1974 roku złotą oznakę honorową PTEnt., a w 1998 tytuł Członka Honorowego Polskiego Towarzystwa Entomologicznego i medal „Za zasługi dla rozwoju PTEnt.". W latach 1984-1998 był członkiem Rady Naukowej Muzeum i Instytutu Zoologii PAN, a od 1987 do 1998 roku członkiem Komitetu Zoologii PAN.

Jego działalność naukowa szła w dwu kierunkach. Pierwszym były prace związane z systematyką i zoogeografią światowych Dermestidae i Silphidae. Z tego tematu ogłosił szereg prac, opisał około 50 nowych dla wiedzy taksonów, a katalog Dermestidae świata był jego pracą habilitacyjną.

Drugim kierunkiem, któremu poświęcił większość swojego życia, była monograficzna synteza faunistyczna chrząszczy Polski. Prace nad katalogiem chrząszczy krajowych rozpoczął samotnie w 1954 roku. Gdy w 1959 roku utworzona została w Instytucie Zoologicznym PAN seria wydawnicza „Katalog Fauny Polski", podjął się opracowania rzędu Coleoptera (był głównym autorem i kierownikiem zespołu autorskiego; wciągnął do współpracy dr. Bolesława Burakowskiego i panią Janinę Stefańską). Przedstawił harmonogram, przewidując 20 tomów wydawanych w półtorarocznych odstępach. I tak, w latach 1971-1997 powstało 21 tomów katalogu Coleoptera, a w roku 2000 - tom 22, uzupełniający. Ostatni, 23 tom katalogu chrząszczy Polski został wydrukowany na początku 2007 roku. Zamknął on prace nad wielkim i unikalnym na skalę światową dziełem wykonywanym przez 54 lata. Łącznie omówiono w tych 23 tomach 6811 gatunków chrząszczy, z których 6000 żyje w Polsce z całą pewnością. Stanowi to około 20% wszystkich krajowych zwierząt.

134 prace naukowe z entomologii prof. Mroczkowskiego drukowały czołowe czasopisma zoologiczne, miedzy innymi z Anglii, Belgii, Danii, Niemiec, Szwecji, Węgier, Włoch, Rosji, Arabii Saudyjskiej, Japonii, Północnej Korei i Polski. Poza tym jest autorem ponad 350 innych publikacji przyrodniczych i kilkuset artykułów niezoologicznych. Dotyczą one kynologii, różnych zagadnień kolekcjonerskich i filumenistyki (ogłaszane pod pseudonimem „Feliks KIETOWICZ"), opisów ekspedycji naukowych, różnych wspomnień, notatek o Podkowie Leśnej, i innych spraw niezwiązanych z przyrodą.

W latach 1975-1991 był członkiem Międzynarodowej Komisji Nomenklatury Zoologicznej (organ International Union of Biological Sciences, będącej częścią UNESCO) - i to jedynym z krajów socjalistycznych. Wybrany został do tej Komisji przez najwybitniejszych zoologów z całego świata, na miejsce zmarłego w 1974 roku jednego z najwybitniejszych polskich zoologów profesora dr. hab. Tadeusza Jaczewskiego, którego był uczniem.

Aż 24 gatunki i rodzaje nowo odkrytych dla nauki zwierząt z różnych grup systematycznych nazwanych zostało jego nazwiskiem.

W uznaniu jego zasług dla światowej i polskiej taksonomii oraz z okazji 80. rocznicy urodzin i 60-lecia pracy naukowej w dniu 18 maja 2007 roku zarząd PTTax. nadał Mu tytuł Członka Honorowego Polskiego Towarzystwa Taksonomicznego.

The profile of Prof. Maciej Mroczkowski - a handful of recollections

ANDRZEJ WARCHAŁOWSKI
Department of Biodiversity and Evolutionary Taxonomy, Zoological Institute, University of Wrocław, ul. Przybyszewskiego 63-77, 51-148 Wrocław, Poland
e-mail: awar@biol.uni.wroc.pl

I first met prof. Maciej Mroczkowski in 1936, in the School of Ziemia Mazowiecka, Klonowa street 7, Warsaw. There was no time for a closer acquaintance, as I attended the school for a very short time, so his silhouette was the only thing I remembered from there - he was conspicuous because of his lack of participation in social games, a thoughtful expression and a slightly bent head. He would always keep aloof and was called "curl" by his schoolmates because of his dense, curly, fair hair, always in disorder. During the occupation he was engaged in conspirational activity, he also fought in the Uprising (as a signaller). However, it was not until our contacts were restored (or rather initiated in 1946 by his visit in Wrocław to Janusz Złotorzycki, now deceased, but then a young entomologist) after the war that I learned about it.

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In the next 60 years we would meet frequently during my trips to Warsaw (at first professional, then related to my functions in editorial offices, scientific councils and the PAN Committee of Zoology). He also stayed at my place in Wrocław with his dogs several times, when he came for dog shows. Maciek, as he was called by his mates, hardly changed during all those years. Hidden in his study, buried under heaps of literature, he would welcome his guests with a merry look on his face, always with an amusing anecdote or yarn in store for them, as he was very keen on jokes and pranks. For example: there used to be a little café called "Barataria" by the Wilcza street, opposite the Institute, where its employees (and also Maciek) would come for a second breakfast or a cup of coffee. Another frequent visitor of the place was a famous designer, Szymon Kobyliński with his two dogs, always the same, preposterously ugly mongrels. Every time he went in and took a seat, Maciek, provided he was there, addressed his companions in a very loud and shrill whisper: "Oh, look, Mr. Szymon here has brought new dogs around. The ones you have seen last week he already ate." Kobyliński had a good sense of humour, so he just shook his finger on him.

In his young years, Maciek's exemplar and master was prof. Tadeusz Jaczewski. He didn't even have to imitate him that much, because they were very similar in both appearance and personality. It is however doubtless that the astonishing and specific traits of Maciek's character have consolidated and solidifed under prof. Jaczewski's influence. He was very pedantic, formalistic and headstrong in his work, and yet, at which I have always marvelled, he could abandon his study at a fixed, definite time and forget about it completely until the next day. He had, however, several hobbies. In his spare time he dedicated himself to numismatics, phillumeny, dog breeding and gardening, and he was as passionate about them as he was about his scientific work. In order to cultivate several passions simultaneously and successfully, one needs absolutely extraordinary inner discipline – and that Maciek had.

His dominant traits of character were the aforementioned tenacity and truthfulness. He was very direct with others, which added him enemies, but he could also be an amusing figure at times, being the least elastic of all disputants because of his straightforwardness, and it was a known thing that any proposition he took on to defend was doomed to go down. It even used to be said that in order to a overthrow project on a meeting, it is sufficient to ask Maciek to defend it. Anyway, there is no doubt that he would make the worst diplomat ever. This hardhead was however kind for everyone and always ready to help even those with whom he periodically argued, which, by the way, had never endured long. From the 60s I remember his loud and violent (sometimes even scandalizing) arguments with dr. Burakowski, with whom he had been eventually united in long friendship and cooperation.

He dedicated the most of his life to compilation of a catalogue of Polish beetles. I watched this work of his for over half a century with appreciation and wonder, although, like other zoologists, I doubted that his strength and life would suffice to finish the job. And yet they did. A finished, 23-volume opus has been created, complete, having no equal (or even close to equal) in faunological literature worldwide, an object of admiration and envy of specialists of all the countries where faunistic studies had already reached a level similar to ours. This was demonstrated in 1981 by a project of the

University of Harvard to create a catalogue of beetles of Northern America based on the Polish catalogue and entrust its making to none other but prof. Maciej Mroczkowski, offering him a professor's job in the USA and advantageous financial conditions. To all Polish zoologists' astonishment he refused, as the completion of the mostly-finished work was more important for him than personal benefits. He showed that dedication of whole life's efforts to a purpose doesn't need to be a rhetorical catchword. And not only efforts, but also private ambitions. When placing the names of the three co-authors on the title page in alphabetical order became the condition of proceeding with works on the "Catalogue", prof. Mroczkowski agreed to this as well, however larger his contribution might have been. Although I have always been full of respect and friendly feelings for dr. Bolesław Burakowski, I can't escape a feel of distaste when seeing the commonly used bibliographical citation "Burakowski and others", pushing aside the name of prof. Mroczkowski, the actual author.

Because no one understood better than him that no scope of science is more important than another, as they all form the possession of generations and that the task of scientists is not only to contribute to it, but, as to use the words of a poet, to roll it, like a giant mass of gold, through the centuries. A style of work and life unseen nowadays has passed away together with prof. Mroczkowski, a style much more beautiful than the hectic chase after success dominant presently. A style where the hierarchy of qualities is not determined by money and welfare measured with it, but by the wish to create something useful in one's favourite and beloved field.

Sylwetka prof. Macieja Mroczkowskiego - garść wspomnień

Z prof. Maciejem Mroczkowskim zetknąłem się po raz pierwszy w roku 1936, w Szkole Ziemi Mazowieckiej, przy ul. Klonowej 7, w Warszawie. Nie było wtedy czasu, by bliżej się zaznajomić, bo do tej szkoły chodziłem bardzo krótko, toteż z tej szkoły zapamiętałem tylko Jego sylwetkę, gdyż rzucał się w oczy przez swój słaby udział we wspólnych zabawach, zamyślony wyraz twarzy i lekko pochyloną głowę. Trzymał się zawsze trochę na boku, a koledzy mówili o nim „kindzior", bo miał kędzierzawe, gęste, jasne włosy, zawsze w dużym nieładzie. W czasie okupacji był zaangażowany w działalność konspiracyjną, a w czasie Powstania w walki (był łącznikiem). O tym dowiedziałem się jednakże dopiero po wojnie, gdy nasze kontakty zostały wznowione, a właściwie zainicjowane w 1946 roku Jego wizytą we Wrocławiu, u dzisiaj nieżyjącego już, a młodego podówczas entomologa, Janusza Złotorzyckiego.

Przez następne sześćdziesiąt lat widywaliśmy się wielokrotnie w czasie moich wyjazdów do Warszawy, najpierw służbowych, a później związanych z moimi funkcjami w redakcjach, radach naukowych i Komitecie Zoologii PAN. Parę razy gościł także u mnie we Wrocławiu wraz ze swymi pieskami, gdy przyjeżdżał na wystawy psów rasowych. Maciek, bo tak Go koledzy w rozmowach nazywali, przez te wszystkie lata prawie zupełnie się nie zmieniał. Zaszyty w swoim gabinecie, zatopiony w stosach literatury, witał gości z wesołym wyrazem twarzy, zawsze mając dla nich jakąś zabawną anegdotę lub plotkę, bardzo bowiem lubił żarty i psoty. Na przykład: przy ulicy Wilczej, naprzeciwko Instytutu, przez wiele lat znajdowała się cukierenka czy też barek o nazwie „Barataria". Pracownicy Instytutu, a także i Maciek, zachodzili tam na drugie śniadanie lub na filiżankę kawy. Zachodził tam także znany rysownik i grafik, Szymon Kobyliński ze swymi dwoma psami, zawsze tymi samymi, okropnie brzydkimi kundlami. Za każdym razem gdy wszedł i zajął miesce przy stoliku, to Maciek, jeśli akurat tam był, bardzo głośnym i przenikliwym szeptem odzywał się do swoich towarzyszy: „O, patrzcie, pan Szymon przyprowadził nowe psy. Te, coście widzieli w zeszłym tygodniu, już zjadł". Kobyliński znał się na żartach, więc tylko groził mu palcem.

W młodych latach mistrzem i wzorem dla Maćka był profesor Tadeusz Jaczewski. Maciek nawet nie musiał za bardzo go naśladować, bo byli do siebie, zarówno fizycznie, jak i w usposobieniu bardzo podobni. Nie ulega jednak wątpliwości, że zadziwiające, specyficzne cechy charakteru Maćka utrwaliły się i okrzepły właśnie pod wpływem prof. Jaczewskiego. Maciek był w pracy wielkim pedantem i formalistą, cechował go ogromny upór, a przy tym potrafił, co było dla mnie zawsze rzeczą niepojętą, o określonej, z góry zaplanowanej godzinie, oderwać się od pracy naukowej i całkowicie o niej na resztę dnia zapomnieć. Inna rzecz, że pasji miał kilka. Wróciwszy do domu oddawał się numizmatyce, filumenistyce, hodowli psów i pracy w ogrodzie, a czynił to tak samo zaciekle, jak zaciekle pracował naukowo w Instytucie. By kultywować równocześnie kilka pasji i we wszystkich odnosić sukcesy, trzeba zupełnie niezwykłej dyscypliny wewnętrznej – i Maciek ją miał.

Jego dominującymi cechami były wspomniany już upór i prawdomówność. Mówił wszystkim prawdę w oczy bez ogródek i to mu nieraz przysparzało przeciwników, ale pod niektórymi względami był też czasem postacią zabawną, bo jego prostolinijność czyniła go najmniej elastycznym z dyskutantów i było rzeczą znaną, że gdy się zabrał do obrony jakiejś propozycji, to ta propozycja musiała upaść. Mówiono nawet żartobliwie, że gdy na zebraniu chce się obalić jakiś projekt, to wystarczy poprosić Maćka, by go bronił. W każdym razie nie mam żadnej wątpliwości, że gdyby był został dyplomatą, to byłby to najgorszy dyplomata na świecie. Ten uparciuch i weredyk był jednak życzliwy wszystkim i zawsze gotów do niesienia pomocy nawet tym, z którymi okresowo "darł koty", co zresztą nie miało nigdy charakteru trwałego. Z lat sześćdziesiątych utkwiły mi w pamięci jego głośne i gwałtowne, niekiedy wręcz gorszące kłótnie z doktorem Burakowskim, z którym przecież w końcu połączyła go wieloletnia przyjaźń i współpraca.

Większą część życia poświęcił on opracowaniu katalogu chrząszczy polskich. Przez ponad pół stulecia z uznaniem i podziwem obserwowałem tę Jego pracę, chociaż, podobnie jak inni zoologowie, powątpiewałem, by mogło Mu wystarczyć sił i życia na wykonanie całości zadania. A jednak wystarczyło. Powstało dzieło obejmujące dwadzieścia trzy tomy, doprowadzone do końca, kompletne, nie mające nawet w przybliżeniu precedensu lub przykładu na skalę światowej literatury faunologicznej, od dziesięcioleci będące przedmiotem uznania i zazdrości specjalistów ze wszystkich tych krajów, gdzie badania faunistyczne osiągnęły już podobny poziom jak u nas. Wyrazem tego był, w roku 1981, projekt Uniwersytetu Harwardzkiego stworzenia wzorowanego na "Katalogu fauny Polski" katalogu fauny chrząszczy Ameryki Północnej i powierzenia jego wykonania właśnie profesorowi Maciejowi Mroczkowskiemu, przy czym zaoferowano Mu w USA etat profesora i korzystne warunki finansowe. Ku zdumieniu wszystkich polskich zoologów profesor Mroczkowski odmówił, gdyż zakończenie wykonanego już w znacznej części dzieła było dla Niego ważniejsze od osobistych korzyści. Pokazał, że poświęcenie wysiłku całego życia dla jakiegoś celu nie musi być retorycznym frazesem. Zresztą nie tylko wysiłku, ale i ambicji osobistych. Gdy warunkiem kontynuowania prac nad rozpoczętym "Katalogiem" stało się umieszczenie na stronicy tytułowej nazwisk trojga współautorów w kolejności alfabetycznej, profesor Mroczkowski zgodził się i na to, chociaż Jego udział w tych pracach był o wiele większy niż wkład pozostałych autorów. Chociaż zawsze byłem pełen szacunku i przyjaznych uczuć dla dra Bolesława Burakowskiego, to jednak odczuwam pewien niesmak, gdy widzę powszechnie w odniesieniu do "Katalogu" stosowany cytat bibliograficzny "Burakowski i inni", odsuwający na drugi plan nazwisko profesora Mroczkowskiego, jego rzeczywistego autora.

Bo nikt tak dobrze jak On nie rozumiał, że w nauce nie ma dziedzin ważniejszych i mniej ważnych, gdyż wszystkie składają się na dorobek pokoleń i że zadaniem uczonych jest nie tylko wzbogacanie tego dorobku, ale, by użyć słów poety, przetaczanie go, niby ogromnej bryły złota, poprzez stulecia. Wraz z profesorem Mroczkowskim odszedł w przeszłość pewien niespotykany już dzisiaj styl pracy i życia, o ileż piękniejszy od panującego obecnie gorączkowego pościgu za sukcesem. Styl, w którym hierarchię wartości wyznacza nie pieniądz i nie mierzone nim powodzenie życiowe, lecz pragnienie stworzenia czegoś pożytecznego w wybranej przez siebie samego, umiłowanej dziedzinie.

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Taxonomy and EDIT – Toward of European Distributed Institute of Taxonomy*

JACEK SZWEDO
Department of Systematics and Zoogeography, Museum and Institute of Zoology
Polish Academy of Sciences, Wilcza 64, PL 00-679 Warszawa;
e-mail: szwedo@miiz.waw.pl

ABSTRACT. Taxonomy with its countless contributions genereated much taxonomic knowledge over the past. However, it is now weakened by decades of neglect. Taxonomy is not a service to other biological disciplines, but an integral part of evolutionary biology. Taxonomy is essential for rational assignment in conservation biology. Facing the biodiversity crisis, the need to rebuild expertise and infrastructure is clearly visible. The reasons of 'taxonomic impediment' are recognized by the EU and responsibility to help to resolve the problems is taken. The project EDIT — "Toward the European Distributed Institute of Taxonomy", supported by European Union by 11.9 million € for years 2006–2010 comprises 27 partner institutions in Europe, Russia and USA. It will aim to coordinate the European contribution to the global taxonomic effort with the Global Taxonomy Initiative (GTI), in and outside Europe. Organisation, operational structure, objectives, aims and activities of EDIT are briefly announced.

Key words: European Distributed Institute of Taxonomy, EDIT, taxonomy, biodiversity.

> *The first step in wisdom is to know the things themselves; this notion consists in having the true idea of the objects; objects are distinguished and known by their methodical classification and appropriate naming; therefore Classification and Naming will be the foundation of our Science*
>
> C. LINNAEUS (1735)

> *The laws of biology are written in the language of diversity*
>
> E. O. WILSON (1989)

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Europe is the cradle of scientific taxonomy and has the most comprehensive collections in the world. Although the research effort related to these collections is notoriously insufficient to allow full exploitation of their potential, European taxonomists and institutions are still responsible to help resolve the 'taxonomic impediment' at a global level.

The term "taxonomic impediment" was used by IUBS/Diversitas to describe the lack of taxonomic expertise and information to handle the enormous task of identifying and naming biodiversity (HOAGLAND 1996). Describing biodiversity is lagging far behind **1**) discovery of new biodiversity, and **2**) extinction of biodiversity. In recent years there has been a number of different opinions on what to do about the slow rate of publication of new species descriptions. Numerous papers on the taxonomic impediment and their respective responses appeared recently (WHEELER *et al.* 2004; LYAL & WIETZMANN 2004; MARTIN 2004; GEETA et al. 2004; CAUSEY et al. 2004; YOUNG 2004; CARVALHO et al. 2005, FLOWERS 2007a, b; EVENHUIS 2007). Some see the impediment as a complex interaction of low funding and slow adoption of new molecular techniques and informatics, others see it in the work habits of individual taxonomists (WHEELER et al. 2004; EVENHUIS 2007; FLOWERS 2007b). While even the most recent may argue the details, they clearly all agree that we still lack taxonomic expertise to adequately describe the biodiversity on this planet.

Taxonomy with its countless contributions generated much taxonomic knowledge over the past. However, it is now weakened by decades of neglect, suffers the loss of positions and funding of studies that reconstruct phylogeny but don't improve formal classification, or biodiversity and ecology studies that give no application of scientific names, etc. Biological sciences entered the 21st century with tensions among "phylogenetic biology", "molecular taxonomy", "biodiversity" studies and "classical taxonomy". Although phylogeny studies, particularly capitalised by molecular phylogenetic analyses, are commonly cited as evidence of active taxonomic research, the 'real' taxonomy is hecatombed. Numerous articles and letters claim the relative importance of DNA technology versus morphological traits in modern taxonomy and biodiversity studies. Is advantages and disadvantages (MALLET et WILLMOTT 2003; SEBERG et al. 2003; LIPSCOMB et al. 2003; TAUTZ et al. 2003; FITZHUGH 2006a, b). Numerous "biodiversity" studies add only more question marks and mess to the knowledge, without formal descriptions ("morphospecies 1, 2, …, genus A, species a, genus A species b, etc.), because lack of taxonomic expertise. Taxonomy seen as a time-consuming hindrance is believed to be inconvenient in areas of exceptional biological richness, so the concept of so-called recognizable taxonomic unit (RTU) was developed. The importance of taxonomic background in ecological studies was discussed by WOODCOCK (2003), stating "…even a minimal level of taxonomic training could dramatically increase the accuracy between biological species and RTUs". Descriptive taxonomy, morphologybased taxonomy is believed to be passé (WHEELER 2004). Taxonomy is perceived to face a lack of prestige and resources and not to attract large-scale funds in the same way as other huge programs like Human Genome Project (GODFRAY 2002a).

We live in an era of elevated rates of extinction, yet about 90% of the Earth's species of animals, plants and micro-organisms remain undescribed (WILSON 2004).

Taxonomy, the description and classification of living things, has its origins in ancient Greece and in its modern form dates back 250 years, to when Linnaeus introduced the binomial classification still used today. Linnaeus, of course, hugely underestimated the number of plants and animals on Earth (GODFRAY 2002a). Taxonomy is often considered a purely descriptive science. It has been under siege for much of the last century, accused as 'soft' science, as 'not hypothesis driven' science. The task of inventorying is often mistaken for 'stamp collecting', as taxonomy is collectionbased science. These views are obviously not true: descriptive aspects of taxonomy are scientific in their own right and taxonomy is not 'soft' with rigorous theories and methods. Only few disciplines have witnessed such profound theoretical revolutions as taxonomy (HENNIG 1966; NELSON et PLATNICK 1981; SCHOCH 1986; FOREY et al. 1992; SCHUH 2000). Modern species descriptions are based on syntheses of a broad range of different data, including DNA or other molecular features (WINSTON 1999; ESSELSTYN 2007). The Linnean system, based largely on morphological features, has served biology extremely well for over 250 years. Taxonomy will be advanced by appropriate and prudent dependence on both DNA and morphology (LIPSCOMB et al. 2003; DUNN 2004). Such information is a prerequisite to proper formulation of evolutionary or ecological questions. Taxonomic knowledge and expertise is basic for collection-based informatics systems and for biodiversity analysis (GRAHAM et al. 2004). There are various projects aimed at listing e.g. all the valid described species of animals in Europe, butterflies on Earth, or data on species distribution (GRAHAM et al. 2004). These aims are eminently achievable and worthwhile, but the results are raw, unexciting and of relatively little value by themselves to non-specialists (GODFRAY 2002a). Taxonomy is not a service to other biological disciplines, but is an integral part of evolutionary biology. Taxonomy is essential for rational assignment in conservation biology. Facing the biodiversity crisis, the need to rebuild expertise and infrastructure is clearly visible.

The taxonomic impediment, the lack of sufficient taxonomic skills, information and capacity is well-known and has been well-lamented over the past years (GODFRAY 2002b; WHEELER 2004; ENGHOFF et SEBERG 2006). Evenhuis (2007) argued another aspect of the taxonomic impediment – some of the existing taxonomists are not doing much or even any taxonomy. There are numerous legitimate reasons for this inactivity – most having to do with squeezing their taxonomic research in between other obligations such as administration, bioinformatics, phylogenetic analyses that do not name new taxa, non-taxonomic research, teaching, travel, meetings, etc. Many taxonomists are now "molecular systematists", because they found that funding would be impossible otherwise. The lack of interest shown by these taxonomists (from laziness, career burnout, administrative duties, etc.), which is a serious problem, ultimately contributing to the decline of taxonomy as a science and loss of positions (ZHANG 2007). Not all taxonomists follow these dictates as presented in an interesting survey of European and Australian beetle specialists (LÖBL et LESCHEN 2005). Unfortunately, the situation for taxonomists has seemingly not improved. In contrast to many other fields of science, taxonomy is rather slow to learn. Many reasons for this slowness are closely related with the over 250-year long history of taxonomy.

Taxonomic papers are not just pieces of paper with scientific information, they are also 'legal' documents to some extent. Containing descriptions of new taxa and other acts as ruled by the International Codes of Nomenclature, taxonomic papers last virtually for ever (MINELLI 2003). The old original descriptions, often in rare and inaccessible books, have to be consulted and ancient geographic names have to be traced. For a detailed comparison the original and the type specimens need to be consulted, and so the museum where these types are stored needs to be traced and specimen sent by post to the examiner. On today's academic market, a 'publish or perish' world, the journal where the paper is published is a fundamental (or the only) criterion for assigning resources, the score of taxonomy is clearly very poor. Most of the journals publishing taxonomic papers fail to reach the pages of ISI Journal Citation Report and, in consequence, their impact factor is 0.00. Taxonomic monographs, because of their size, are often published as books, which means they are not mentioned by abstracting and bibliographic services. Products of collections-based taxonomic research, monographs, identification keys, catalogues, faunas, floras, etc. cannot be fairly assessed by standard bibliometrical measurements, which must be taken into account by scoring and decisionmaking bodies.

The impediment in publishing has a huge negative impact on taxonomy. It is increasingly more difficult to publish papers on descriptive taxonomy in a timely and cost-effective manner. It is common for a taxonomist to wait eight to twelve months and sometimes even years to get a paper published. Unless there is access to an institutional monograph series, it is even more difficult to publish a large taxonomic revision or monograph, not only because of costs, but the fact that most journals are of a fixed size and have limits on the length of papers. The delay and difficulty in getting works published discourage taxonomists who had worked for years and unpublished works are a huge waste of talent and resources. Large monographs are particularly important to the study of complex species-rich taxa, as taxonomy is about comparison, and closely related species must be compared together (ZHANG 2006b). To remove these impediments in taxonomy, and to help systematists rapidly document the world's zoological diversity, which includes many undescribed species now threatened by the rapid habitat loss (ZHANG 2006a), a web-based journal "Zootaxa" was established in 2001. Before 2006, sections of "Zootaxa" were taxon-oriented. In 2006, a new section, "Theory and Methodology", was introduced to facilitate the publication of papers discussing general issues in systematic zoology (ZHANG 2007). Another opportunity was given by GBIF (Global Biodiversity Information Facility), as well as by many private enthusiasts, who designed websites for their favourite taxa (ARAGES 2007; GDO 2007; HAAS 2006). A proposal for establishing an autonomous system (ZooBank of names as GenBank of DNA sequences) for registration of nomenclatural acts could put taxonomic papers on the same footing as other scientific papers and significantly increase their average quality and visibility (MINELLI 2003; POLASZEK et al. 2005). The essential problem which still slows down the learning of taxonomy is that it involves learning of shapes and colours, which cannot be done directly from the literature alone. It requires comparing specimens and remembering the characters. Details often matter only after comparison, so one needs to re-examine specimens again. Details may vary, so one needs to see much material to remember and distil the essentials of shape and colour. For many taxa, very few specialists world wide will be able to cover most possibly arising needs. Therefore regions, such as the European Union, and countries should coordinate when vacancies are filled or new jobs created in taxonomy. In total, we are talking about 4.000 to 6.000 professional taxonomists worldwide, which is very little personnel. The same applies to the design and assembling of collections (HAAS 2006). A number of articles have appeared recently, discussing the nature of 'taxonomic crisis' and potential strategies to overcome it (see WHEELER 2004; ENGHOFF et SEBERG 2006; ESSELSTYN 2007).

Taxonomists need to agree on deliverable projects that will receive wide support across the biological and environmental sciences, and attract public interest. Being at a crossroads, having impressive past, having documented and organized knowledge of nearly 2 million species, taxonomy needs revitalization. Taxonomic researches are urgent due to the environmental ravages of the biodiversity crisis. They are absolutely necessary for progress in conservation and in biological research in general. The challenges for taxonomy have been identified (GODFRAY 2002a; WHEELER et VALDECASAS 2005; DAYRAT 2005), argued and discussed (ENGHOFF et SEBERG 2006; ESSELSTYN 2007).

According to the decision VI/8 of the 6th Conference of Parties to the Convention on Biological Diversity, taxonomy could be defined as follows:

"Broadly understood, taxonomy is the classification of life, though it is most often focused on describing species, their genetic variability, and their relationships to one another. For the purposes of the Convention taxonomy is taken in its broadest sense and is inclusive of systematics and biosystematics at the genetic, species and ecosystem levels."

There are several levels or kinds of taxonomic activities (ENGHOFF et SEBERG 2006):

1. Recognition, description and naming of taxa (a nearly equiralent definition of alpha-taxonomy). Alpha-taxonomists describe, name, revise and synonymise taxa.
2. Comparison of taxa, including studies of relationship (phylogeny) (a nearly equiralend definition of a part of beta-taxonomy).
3. Classification of taxa (a nearly equiralent definition of a part of beta-taxonomy). Beta-taxonomists compare and classify taxa, create phylogenies.
4. Study of (genetic) variation within species (a nearly equiralent definition of gamma-taxonomy). Gamma-taxonomists study infraspecific variation.
5. Construction of tools for identification (e.g. keys for identification, DNA barcodes). Tool-makers construct keys and other identification tools.
6. Identification of specimens (using the tools);
7. Inventories of taxa in specific areas or ecosystems (using the tools for identification). Tool-users identify specimens, make inventories, check-lists, catalogues.

Taxonomic research currently suffers from four types of fragmentation and access problems:

1. Its results are fragmented across 250 years of literature and much of the collected 'legacy data' is inaccessible to the vast majority of users, and the taxonomists themselves find that this fragmentation has become a heavy handicap for research preventing taxonomy from achieving its full potential as an enabling science;
2. The most comprehensive resources are restricted to those key institutions (particularly museums and herbariums) with extensive collections and libraries;
3. Even for the few users with easy access to these institutions, the taxonomy of any given group of organisms still remains scattered in many different formats across many publications, and more recently in differently formatted databases of variable quality: at present only one documentary centre on animal taxonomy in Europe can provide more than 85% of the original descriptions of the 3139 European animal species new to science discovered between 1998 and 2003 (FAUNA EUROPAEA 2007), and the position is far worse in medium and small centres;
4. Unlike many disciplines, taxonomy has traditionally been a relatively solitary exercise instead of an integrated enterprise with specialists on particular taxa working together.

Furthermore, many producers of new taxonomic information are not employed as taxonomists. Between 1998 and 2003, over 50% of the 3139 newly discovered European animal species have been described and named by non-professional taxonomists. The major museums and herbariums of the world are the obvious core centres able to promote the integration of taxonomy in a structured way. Most taxonomic information is created and remains accessible only on paper and in dispersed collections of specimens, as it was in Linnaeus's time. Taxonomy is a field in which the state of the art changes fast, both through knowledge of previously unknown species, and through acquisition of new kinds of data such as molecular sequences. The fragmentation of taxonomic resources means that at present even researchers lack access to fundamental information essential for the development of effective strategies and policies for conservation and understanding biodiversity changes. Developing taxonomic research and sharing information with the countries of origin to contribute to their capacity building in taxonomy are key objectives of the Convention on Biological Diversity. These can be achieved only through a strong and coordinated action of those European institutions with the relevant expertise and collections and also the training capabilities.

The project EDIT is a "Network of Excellence", with full name: "Toward the European Distributed Institute of Taxonomy" (EDIT 2007). It is supported by European Union by 11.9 million € for years 2006–2010. EDIT partnership includes holders of large amounts of data, it comprises 27 partner institutions from Belgium, Denmark, France, Germany, Hungary, the Netherlands, Poland, Slovakia, Spain, United Kingdom, Russia and USA + non-governmental organizations: Species2000 and SMEB.

Project EDIT will aim to coordinate the European contribution to the global taxonomic effort with the Global Taxonomy Initiative (GTI), in and outside Europe, through:

1. Production of new knowledge,
2. Search to ensure complementarity of expert capacities through coordination of training and recruitment strategies,
3. The provision of the skills necessary for a taxonomic task force for inventories,
4. Developing a programme of expert training both to enhance skills and to fill gaps,
5. Implementing the integrated information infrastructure to feed the Clearing House Mechanism and the GBIF, which provide the general portals for access to taxonomic and other biodiversity information worldwide,
6. Making the information housed in the collections and the taxonomy based on them better available to the countries of origin.

EDIT will collaborate with the GTI in strengthening the infrastructure for biological collections in the country of origin and the transfer of modern technologies for taxonomic research that are represented within the EDIT consortium. The overall objective of EDIT is to integrate European taxonomic effort within the European Research Area and to build a worldleading capacity. EDIT will create a European virtual centre of excellence, which will increase both the scientific basis and capacity for biodiversity conservation (EDIT DoW 2005).

The operational and structural objectives of EDIT are:

1. To reduce fragmentation and to transform taxonomy into an integrated science;
2. To strengthen the scientific, technological and information capacities needed for Europe to understand how biodiversity is modified through global change;
3. To progress toward a transnational entity by encouraging durable integration of the most important European taxonomic institutions, forming the nucleus of excellence around and from which institutions and taxonomists can integrate their activities;
4. To promote the undertaking of collaborative research developing, improving and utilizing the bio-informatics technologies needed;
5. To create a forum for stakeholders and end-users for taxonomy in biodiversity and ecosystem research;
6. To promote the spreading of excellence to fulfill the needs of biodiversity and cosystem research for taxonomybased information.

EDIT will address significant information and management of knowledge problems in a rapidly changing field. The issues to be addressed are structural: about governance and management; about providing a suitable Information Techniques environment; about the development of new tools; and about getting taxonomists to work as one across European (and other) institutions. EDIT will bring together the leading taxonomic institutions in Europe that for historical reasons have developed independently. The association with leading North American and Russian partners will make it a worldwide leading network. The consortium so constituted unites the premier natural history collections-based institutions to progress toward EDIT's structural and scientific objectives. It is the intention of the current EDIT membership to extend membership progressively. EDIT aims at addressing these significant information and management of knowledge problems in a rapidly changing field. The overall objective of EDIT is to integrate European taxonomic effort within the ERA and to build a world leading capacity. This will provide better access to a more unified and better quality taxonomic research information base, particularly for:

1. those users who assess changes in biodiversity and protect it against decline,
2. those who are dedicated to understanding ecosystem functioning, and
3. other taxonomists.

EDIT aims at playing a key role in the creation of new knowledge and the adoption of new methods and tools in order to optimise the use of the taxonomic resources held by the partner organisations for the substantial benefit of European research capacity on the conservation of biodiversity. EDIT will create a European virtual centre of excellence, which will increase both the scientific basis and capacity for biodiversity conservation across the European Research Area. EDIT intends to make some of the extant resources available for gaining new information on little-known taxa and unexploited gaps in taxonomic knowledge. EDIT will address the needs of four concentric circles of stakeholders:

1. EDIT founding members, which will lead the effort to integrate research;
2. Other members of CETAF, who will provide a European forum for EDIT;
3. Those taxonomists working outside these institutions, yet contributing significantly to the taxonomic effort;
4. The wider user community, including citizens, researchers on biodiversity and ecosystems, industry, and managers of biodiversity at all levels.

In the international context where overcoming the "taxonomic impediment" has become a major concern of the Convention on Biological Diversity, EDIT has a major responsibility as constituting by far the largest taxonomic resource in the world. EDIT brings together the leading taxonomic institutions in Europe that for historical reasons have developed independently. It also involves six universities and one public research institute that are primarily not collectionsbased and whose prime expertise is in biodiversity and ecosystem research. The association with leading North American and Russian partners will make it a worldwide leading network. The European Union collection-holding core members of EDIT are also members of the Consortium of European Taxonomic Facilities (CETAF). CETAF was established by the Directors of taxonomic institutions in 1996 to stimulate cooperation and collaboration. Russian and North American institutions are being proposed for inclusion in EDIT due to the magnitude and quality of their collections and expertise. As a structuring effect of European Unionsupported programmes, Dutch, Belgian, Polish and Slovakian members are grouped into national consortia (NL-TAF, BE-TAF, PL-TAF and NATAF), of which the first three have been constituted to manage access to infrastructures within the frame of the EU 3I programme SYNTHESYS. In addition to these institutions, the consortium includes two network organisations devoted to management of species data, at EU and world level, and one non-collectionbased research institute devoted to dissemination of information on scientific knowledge and innovation in the fields of agriculture and environment. Six members of the consortium belong to universities. The consortium so constituted unites the premier natural history collections-based institutions, which have both the management capacity and the will to progress toward EDIT's structural and scientific objectives, and the EU-based network organisations devoted to management of species data. Their collections are global in coverage and are supported by complementary expertise. More than half of the world's natural history specimens, which constitute the large scale infrastructure for taxonomic research, are held in the repositories of EDIT's membership. The EU and Russian participants of EDIT employ about 1100 active professional taxonomists and doctoral students, of whom more than 600 of the EU participants have expressed their interest. The core groups of researchers, aimed at reaching a total ca. 200, will be defined when the network is actually set up. In part A, the actual numbers have been reduced in function of a rough estimate of their availability for integration. It is the intention of the current EDIT membership to extend the consortium to include wider representation from the New Member States and Associated States. It is also the intention of EDIT founding members to extend membership progressively to CETAF members and other institutions.

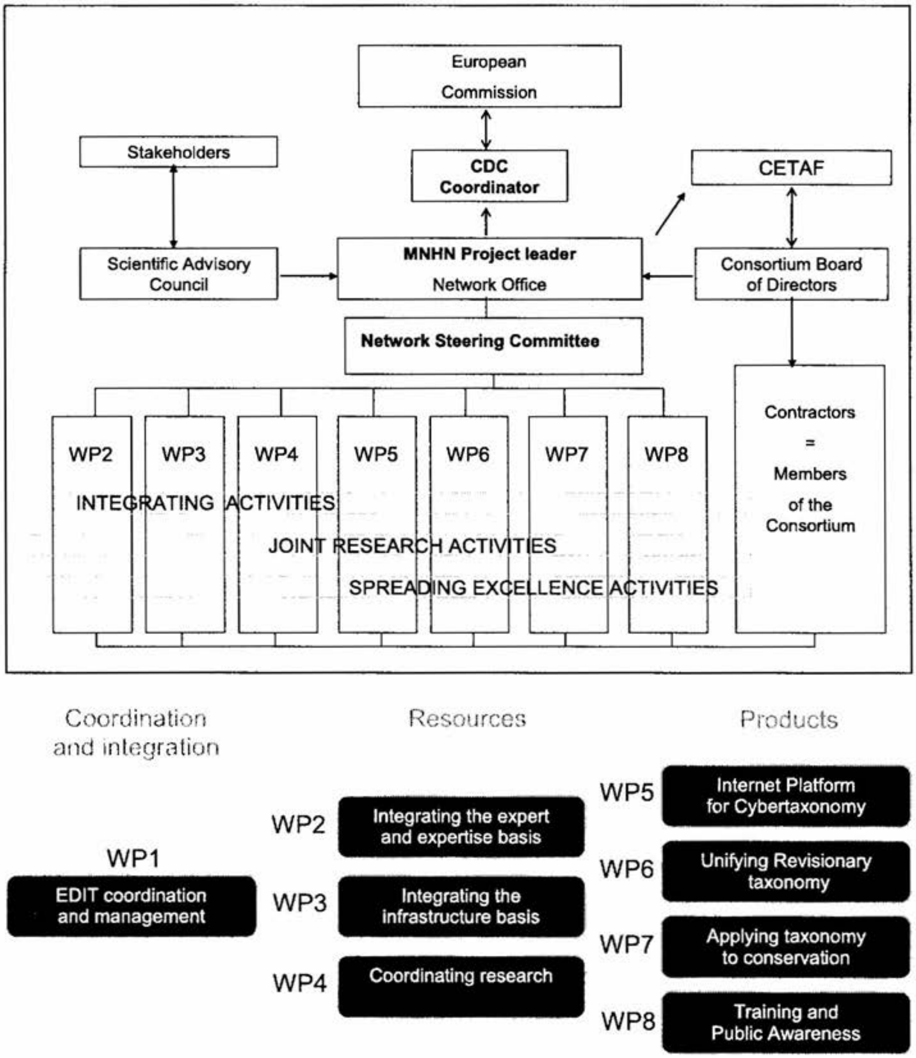
Project EDIT is led by Museum national d'Histoire naturelle in Paris. Administrative and financial issues of EDIT are coordinated by the Caisse des dépôts et consignations (CDC). Decision-making bodies are: Board of Directors (BoD), Network Steering Committee (NSC) and Scientific Advisory Council (SAC).

Short descriptions of objectives, aims and acitivities of Work Packages is given below (EDIT DoW 2005; EDIT 2007).

Work Package 1 — EDIT Coordination and Management

Objectives:

1. Establish and operate the management structure, involving the top executive level of the partners, with the objective of ensuring long-term operational and structural links between partners through open-ended agreements regarding infrastructure, expertise, research and training.
2. Coordinate the activities regarding research, infrastructures and expertise towards common goals integrated at director's level for implementation of further common decisions, aiming at combining all work packages objectives into a single integrated sustainable structure.



EDIT operational structure is organized in eight work packages (WP)

3. Coordinate interactions with stakeholders, including communication with institutional stakeholders.
4. Establish and update the roadmap of EDIT, including plans to enlarge the consortium.
5. Ensure internal and external communication of EDIT, and its visibility in the Web.

Aims:

To progress toward the integration of institutions with different histories, sizes, national legislative frameworks, status, regulations and policies will be demanding. Integration necessarily involves less autonomy. Like other large bodies, taxonomic institutions have to be convinced that the advantage of integration overcomes the possible handicaps, in particular large institutions where the taxonomic capacity achieves the critical mass for maintaining a sustainable structure. The role of WP1 is to synthesise progress made step by step in the work packages and plan further progress through interaction of the advisory bodies with the WP leaders and the top executive level of the partners.

Activities:

1. **Establishment and operation of the administrating structure, including coordination of the WPs:** Network Office, Network Steering Committee, Board of Directors, including coordination of the WPs.
2. **Orientation, sustainability and development of exploitation strategies for EDIT:** operate the Scientific Advisory Board; orient EDIT activities according to the users' needs and the capabilities of the partners; establish mechanisms allowing sustainability of integration, and sustainable development of activities beyond the term of the contract.
3. **Communication (internal/external):** establish and operate the website; make all EDIT partners aware in real time of progress in the activities; provide an internal forum where activities and directions can be discussed internally to all participants; make the taxonomic community external to EDIT aware of EDIT activities and encourage its support and participation; promote EDIT and taxonomy in forums dedicated to biodiversity and beyond.
4. **Liaison programme coordinating the *ad hoc* liaison groups established by WPs:** maintain coherence and impulse common direction among the liaison groups established for various goals in the different work packages.
5. **Gender action plan:** promote gender equality in all activities: gender balance, gender awareness for men and women in EDIT, promotion of women in science, family-friendly policies.

Work Package 2 — Integrating the expert and expertise basis

To remedy fragmentation of the expert and expertise basis, work package 2 aims at obtaining an overview of the European taxonomic expert and expertise basis and its relation to the global expert and expertise basis, and making information on the taxonomists and taxonomy basis easily available for all potential users. By coordinating the recruitments strategies of the EDIT partners, facilitating exchange of staff and supporting networks and taxonomic societies, this work package will allow reduction of fragmentation and contribute to the integration of the experts who together form the European taxonomic workforce. Taken together, European taxonomists constitute a potentially extremely powerful workforce to deal with the abovementioned challenges. However, the European expertise is currently badly fragmented by taxa (e.g. botanists/zoologists, entomologists/other zoologists, etc.), by countries, by institutions, and by status of the experts (professional/amateurs), resulting in a suboptimal use of both human and financial resources: the rate of experts per taxon is extremely uneven, and needs for expertise have overall little effect on recruitment strategies because we have no vision of the existing forces. By integration, efficiency will be increased in three ways:

1. Access to the experts by users of taxonomic information will be greatly facilitated.
2. Formation of targeted taskforces to deal with specific tasks will become much easier.
3. A coordinated recruitment strategy will help optimizing the investment in human resources.

Objectives:

The activities of this WP will serve to reduce fragmentation and contribute to the integration of the experts who together form the European taxonomic workforce. It is EDIT's intention to maintain and strengthen Europe's position as a stronghold of taxonomic scientific expertise, and to make taxonomic information more readily accessible to stakeholders in biodiversity and ecosystem research and management.

1. Evaluating the European workforce.
2. Formation of EDIT Task forces.
3. "Early warning" system.
4. Mobility of researchers.
5. Increasing the participation of amateur taxonomists.
6. Sustaining networks created for other taxonomic EU projects.
7. Integrated recruitment strategy.

Aims:

There is up to now no rational organisation of complementarity of expertise among large taxonomic institutions, who often duplicate competences and do not fill the needs for taxonomic knowledge and expertise in little studied taxa altogether. It is the intention of EDIT to coordinate recruitments and provide information on the current state of the European taxonomic expertise in order to optimize a workforce which most probably will not increase much overall in the next years.

Activities:

1. Information service on taxonomic experts ;
2. Information service on ongoing taxonomic projects;
3. Taxonomic societies and networks;
4. Mobility of researchers;
5. An integrated recruitment strategy for taxonomists.

Work Package 3 — Integrating the infrastructure basis

The main objective of this work package is to come to a unified vision for the preferred infrastructural basis at the European level, and to prepare the design of the new integrated infrastructure for implementation, which, once decided at director's level, will be formalized through Memoranda of Understanding (MoUs). The challenge is to bring together the separate components and to add scientific value for such a next generation infrastructure. **Adaptation and collaboration of the European taxonomic infrastructures are necessary to establish the institutional and digital networks which will be able to answer to the demand for taxonomic information.** The central objective is to come to a unified vision for the preferred infrastructural basis at the European level, and to prepare the design of the new integrated infrastructure for implementation, which, once decided at director's level, will be formalized through MoUs. The challenge is to bring together the separate components and to add scientific value for such a next generation infrastructure. The ambition to achieve such an integrated approach will find quite some barriers on its way, since it requires substantially different work processes, ranging from setting a distributed physical facility (remote microscopy, bar-coding) to agreeing on a common management structure, through agreement on shared standards and processes. However, the commitment of the EDIT partnership will be a driving force to promote institutional and professional changes. The whole EDIT network will contribute to this work package, also in close coordination with WP 2 and WP 6.

Objectives:
The Integration of physical infrastructures.

Aims:
The EDIT network identified two barriers to overcome in relation to the ambition to 'construct' a new infrastructure consortium from the present situation.

- Barriers to institutional change: the ambition to implement a new integrated infrastructure will have consequences for each separate institutional policy, and may even sometimes have legal implications. National legal systems and sentiments have to be overcome in order to create joint operations and decision mechanisms. In addition, it is expected that resistance to transfer of activities or facilities will hamper the anticipated progress. Open procedures, information and leadership are crucial to overcome these barriers.
- Taxonomic paradigms and routines: a basic problem in biodiversity informatics is that although names are critical metadata for biological information, up to now no reliable mechanisms exist to prevent wrong or ambiguous returns (of data objects) of the results from different databases. More strongly, this holds for provisional taxonomic identities, such as un-named molecular taxonomic units. This hampers the development of proper methods for (automated) cross-referencing of taxonomic concepts and attached biodiversity information. Another constraint is that potentially innovative solutions in a digital environment should be preferable complemented with the adaptation of

different codes of taxonomic nomenclature, which now still have their roots in the printed information environment.

Activities:

1. Network of the physical taxonomic infrastructures;
    - Complementarity and Integration,
    - The concept of Biological Resource Centres,
    - Economics of physical infrastructures.
2. The taxonomic information infrastructure network;
    - The taxonomic information backbone,
    - European Taxonomic Information Services,
    - Bioinformatics toolbox facilities.
3. Sustaining the cybertaxonomy process;
4. Prototypes of large-scale networked instrumental facilities;
    - Organisation of the European contribution to the DNA bar-coding efforts,
    - Advanced Remote Microscopy in Europe.
5. Liaisons with international infrastructures.

Work Package 4 — Coordinating

This work package addresses the scientific and cultural impediments which hamper development of new taxonomic knowledge to fulfill the needs of scientific and other stakeholders, including top management levels. Fragmentation reduces the impact of the high quality of current European research in all the fields of taxonomy in a broad sense, as it is understood by the Global Taxonomy Initiative of the Convention on Biological Diversity. Challenges facing taxonomy (to fully discover and describe the species on the Earth and to study the patterns of diversification – to explore and document life on the Earth) are too immense to be solved by the approaches of the past. It is essential that taxonomists approach their work on a scale appropriate to meet the current decline in biodiversity. It is necessary to test and make accessible the existing information and generate new knowledge around prioritised taxa-driven objectives, around biodiversityrich geographical regions and/or ecosystems, or focus on hot spots of biodiversity. This requires a cultural change among taxonomists, who now need to function as a community, and the resolution of many consequent issues, of which the least is not making innovative research accessible to all researchers in taxonomy to induce a new dynamics of the community. This new dynamics can make it possible to meld the theoretical taxonomic advances of the twentieth century with the emerging technologies of the twenty-first century to maintain and enhance the excellence of the experts that has marked taxonomy, while expanding and expediting its work according to the user communities' requirements. By this cultural shift and by promoting the application of the appropriated cutting edge technologies (digital, molecular), the ERA can recover its historical leadership in taxonomic research and promote and strengthen its view in political and economic decisions in sustainable development, global changes and ecosystems research.

Objectives:

1. Maximise the efficiency and scientific excellence of the extant organizational effort by promoting synergies among research teams within EDIT and beyond.
2. Link taxonomic research with societal requirements (end user communities).
3. "Scientific alertness": Explore prospecting areas for future collaborative projects. This will include emerging research topics and new tools and technologies for taxonomic identification.
4. Develop a durable integrated research agenda for the EDIT roadmap.
5. Organize competitive calls for tender and follow up projects.

Aims:

Competition is the basis for evaluation of researchers, and the resulting trend to individualism is still encouraged by fragmentation of the expertise. Most often, the expert of a taxon has more affinities with experts of the same taxon working in other institutions than with his colleagues working on other taxa. Providing the common tools will probably not be sufficient to overcome this major barrier, and EDIT Coordinating Research WP will create incentives towards the necessary common new culture, both intellectual through discussions and meetings aiming at developing innovative approaches, and through support of projects which will be called for with a strong constraint on integration of the research proposed. At institution level, coordinating research agendas with the objective of integrating into the EDIT roadmap will also be demanding, and will be addressed through constant interaction with other WPs, and from the researchers level to the NSC level. On the user side EDIT has to prove its efficacy in communication and in providing the information required by end-user communities quickly and in appropriate forms.

Activities:

1. Integrating research projects within and beyond EDIT;
2. Design and establish mechanism for calls for tender and follow-up of projects;
3. Liaison research/end-users;
4. Scientific alertness;
5. Progress toward an integrated Research agenda.

Work Package 5 — Internet Platform for Cybertaxonomy

One of the major impediments to full usage of the existing taxonomic research potential is the lack of a common and networked platform for taxonomic work processes such as taxonomic revisions, biodiversity inventories, and monitoring. The overall purpose of work package 5 is to harness the advanced biodiversity informatics expertise of the partner institutions into a focused effort for a European joint taxonomic research structure. Progress has been made over the past decade to network taxonomic resources in the areas of specimen and taxon information and specialist knowledge. The networks created by projects like ENBI, EuroCat or BioCASE provide access to individual institutional resources or to the output from such resources. However, they have not significantly changed the institutions' information production process, priorities, or documentation and IT structures. The community thus remains fragmented in its approach to applied biodiversity informatics. **One of the major impediments to full usage of the existing taxonomic research potential is the lack of a common and networked platform for taxonomic work processes such as taxonomic revisions, biodiversity inventories, and monitoring.** Through its work package "Internet platform for cybertaxonomy" (WP5), EDIT aims at:

1. Demonstrating exemplary integration mechanisms in the area of informatics for taxonomy.
2. Raising scientific efficiency by significantly reducing the number and/or duration of steps involved in the taxonomic research and publication/dissemination process.

An EDIT set of software programs and standards, specified, tested and implemented within the project and maintained and enhanced beyond the project's period in the spirit of open source software development, will not only forge an institutionalised European biodiversity informatics community, but also keep the development open for use and contributions through institutions not taking part in the initial network.

Objectives:

The overall purpose of WP5 is to harness the advanced biodiversity informatics expertise of the partner institutions into a focussed effort for a European joint taxonomic research structure.

1. Promote specification, testing and implementation of an EDIT set of software programs and standards, together forming a platform for the taxonomic work process including revisionary taxonomy, and all taxa biodiversity inventories and monitoring.
2. Integrate activities of the partners' IT departments into a collaborative structure.
3. Achieve a "distributed institutionalisation" of responsibilities, i.e. individual institutions taking the lead in a defined area and making that area a longterm priority.

Aims:

An important sociological barrier is the additional workload scientists face when creating re-usable information resources. This will be addressed by an incremental approach to software development, with tangible output at any stage, thus easing the scientist's way from the traditional printed publication approach to the creation of such multi-purpose resources. The initial phase of workflow modelling will play an essential role in identifying major bottlenecks in the process and developing strategies for their removal. An organisational barrier is posed by the different structures and sizes of the IT sections and departments at participating institutions, with most of them lacking biodiversity informatics research capabilities that can support the ongoing taxonomic work. Efforts to obtain additional funding to build IT capacity will be supported by EDIT, so that IT people from these institutions are enabled to participate in the project. A concerted effort will be made, with the aim of identifying successful structural models and suggesting their implementation. Another organisational barrier which has to be overcome throughout the network is to ensuring the longterm maintenance of high-quality taxonomic information and the supporting authority files by appropriate mechanisms of institutional commitments. WP5 will address this barrier in all software development tasks by means of application of professional tools for source code documentation and versioning, thus greatly reducing subsequent maintenance costs. During the last two years of the project, an activity within WP3 will specifically address the sharing of responsibility for longterm maintenance of the software components constituting the Platform.

Activities:

1. Integration of Informatics and IT departments; over-all WP5 coordination;
2. Creating the Internet Platform for Cybertaxonomy;
3. Auxiliary taxonomic data repositories;
4. Geographical platform components.

Work Package 6 — Unifying Revisionary Taxonomy

This workpackage is focused on what is termed revisionary taxonomy, which includes analysis and synthesis of taxonomic concepts to create new knowledge. Revisions typically include:

- introductory information on a group of organisms;
- its taxonomic history;
- descriptions of species and higher taxa;
- keys for, or other means of, identification;
- citation of specimens, including type specimens;
- bibliographic citation, with the broad aim of establishing a scientifically sound classification of the units of biodiversity: species.

Phylogenetic analysis is explicitly a part of many revisions or implicitly provides the framework for the results. This work package is focused on what is termed revisionary taxonomy, which includes analysis and synthesis of taxonomic concepts to create new knowledge. Revisions typically include:

- introductory information on a group of organisms;
- its taxonomic history;
- descriptions of species and higher taxa;
- keys for, or other means of, identification; citation of specimens, including type specimens;
- bibliographic citation, with the broad aim of establishing a scientifically sound classification of the units of biodiversity: species.

Phylogenetic analysis is explicitly a part of many revisions or implicitly provides the framework for the results. The taxonomic information base is currently fragmented, as is the effort of the taxonomists that work on the groups. By the end of the five-year period, it is expected that unified revisions will have been undertaken for subsets of the demonstrator taxa and that the work of constructing the expert taxonomic networks will show the means by which integrated effort of taxonomists can be achieved. A further aim is to encourage, by example and encouragement, the construction of further expert taxonomic networks. The long-term aim of the WP, which extends beyond the project, is to create a mechanism for revisionary taxonomic effort to be better integrated and its multitudinous and distributed results migrated to a common web-environment for each taxon. Better integration of effort by the community of researchers is essential to achieve these ends and this will require backing from the senior management of participating institutions. Technical developments are necessary, but not sufficient to deliver these ends.

Objectives:

1. Define and develop the means to provide access to the currently highly fragmented information sources.
2. Formulate the construction of expert networks in the form of distributed taxon-specific committees to manage taxonomic effort across institutions.
3. Define closely what is needed from the cyber-environment for taxonomic Web content to be delivered.

Aims:

The barriers are cultural, organisational and technical. The greatest challenge is to encourage taxonomists to work together on selected taxa in teams and distributed networks to define focused goals and develop taxonomic knowledge bases with web-based revisions forming a central component. They include issues relating to intellectual property, including crediting authors and their institutions appropriately for input into the rich collaborative outputs we envisage as taxonomy becomes more integrated and Web-based. The sustainability of Web-based taxon sites will require institutional commitment and harmonisation of effort, and we will work towards these ends.

Activities:

1. Content structure and presentation;
2. Define what is needed from the cyber-environment;
3. Community structuring by management committees and expert taxonomic networks;
4. Publication within the web-environment.

Work Package 7 — Applying taxonomy to conservation

The establishment of an ATBI+M (All Taxa Biodiversity Inventory & Monitoring) task force network is expected to support the integration of the taxonomic community throughout Europe, and also to substantially increase the capacities for efficient protected area management on a local, regional, and international scale. For this work package, therefore, it will be important to draw from experiences of and connect to relevant initiatives and programs in Europe (e.g., Fauna Europaea, Euro+Med PlantBase, Species2000, MARBEF), as well as internationally. In close cooperation with all partners of the EDIT consortium, the outcomes of this work package will make a significant contribution towards the implementation of the Global Taxonomy Initiative Programme of Work, particularly at the European level. The increasing need of sound taxonomic information and expertise for the successful implementation of biodiversity policies and management programmes has been expressed widely at European and international fora. With the prevailing political focus on the establishment of an effective global network of protected areas for biodiversity conservation, efforts supporting an efficient inventorying and monitoring of biodiversity in existing and proposed protected areas seem particularly pertinent. The restructuring of the taxonomic community through EDIT should enable European taxonomists to take a leading position in the fields of biodiversity inventories, monitoring and assessments towards the year 2010 and beyond. Through the introduction of demanddriven processes into the taxonomic workflow, it should be possible to influence and stimulate research agendas, such as setting priorities for which taxa revisions or phlyogenetic analyses would be most relevant in terms of user needs.

Objectives:

Within the framework of EDIT, the ultimate objective is to overcome the taxonomic impediment, to which this WP will particularly contribute by:

1. Strengthening the input of taxonomic expertise in Europe for biodiversity conservation programmes and policies, especially for inventories, assessments, and monitoring of biodiversity.
2. Integrating user needs for taxonomic expertise from the conservation management side with research agendas for biosystematics and biogeography from leading European centres of excellence.
3. Further developing and promoting standards, techniques and methodologies for state of the art and costefficient biodiversity assessments including a new approach for an "All Taxa Biodiversity Inventory & Monitoring" (ATBI+M) programme, which will help to establish a European expert task force for undertaking and supporting biodiversity inventories, assessments, and monitoring activities.

Aims:

A major challenge for the success will be to strike a good balance between individual and institutional research interests and the inventory and monitoring needs in protected areas. On the side of the taxonomic community and the individual scientists involved, it will require a change in attitude by accepting user requests for setting priorities in the location and specific goals for their field work. For the conservation community, it will require a better understanding of the need for taxonomic research beyond the actual identification of organisms, and the recognition of scientific research projects being conducted within protected areas supporting the cause of conservation. The proposed mechanism to accomplish the abovementioned WP goals is to establish teams for different groups of organisms integrating the expert base from the EDIT Partners and other institutions in Europe, which together will form a task force ready to be deployed wherever needed.

Activities:

1. Assessing biodiversity inventory and monitoring needs, evaluating relevant taxonomic capacities, and raising stakeholder awareness.
2. Mobilising taxonomic resources and establishing the ATBI+M task force network.
3. Developing standards, protocols, and tools for conducting an ATBI+M programme.

4. Operating the ATBI+M task force and evaluating relevant methods and techniques.

5. Sustaining the European ATBI+M task force and longterm study sites.

Work Package 8 — Training and Public Awareness

The work package 8 will stimulate the provision of more integrated courses and research training opportunities that bring together traditional taxonomy, molecular approaches, informatics, biodiversity and conservation management. In addition, to facilitate access to existing training courses, an essential task of EDIT will be to investigate ways and means to integrate all training resources into a coherent and widely publicised training programme, the "European School of Taxonomy", which will encompass training for experts and curators from southern countries. European science is facing a tremendous loss of taxonomic expertise. Despite the availability of a welldeveloped taxonomic infrastructure, European taxonomic research, including management aspects in its collection, increasingly relies on an aging taxonomic community, with permanent staff often over 50 years old and with a significant input by retired researchers and skilled amateurs who frequently have to self-fund their research. Efforts to find enthusiastic young people with an interest in becoming qualified taxonomists are thwarted by insufficient training opportunities and a lack of long-term professional prospects. To address this problem, education is an essential component of EDIT. The main challenge is to stop the loss of taxonomic expertise, and have this negative trend reversed in 5-10 years from now. EDIT will strive to achieve this by increasing the transfer of knowledge and by establishing an integrated European training programme for taxonomy. In parallel, public education will increase the awareness of the vital contribution that taxonomy can make to biodiversity and ecosystem research and consistent lobbying will contribute to maintain the interest of the various decision-makers and funding agencies.

Objectives:

1. Encourage greater use of existing training courses and initiate new training opportunities;

2. Assess European strengths and weaknesses and create an integrated programme in the form of the European School of Taxonomy (EST);

3. Develop access to the EST for students and professionals and provide opportunities for mobility;

4. Raise the societal profile of taxonomy as one of the 'big sciences' by networking NHM-BG professionals dealing with public awareness.

Aims:

The barriers to the training are both structural and content-based. First, it is needed to overcome the fragmentation of the training offers, by making these better known, reducing redundancies and pooling efforts. Second, gaps must be filled through elaboration of new courses in areas where training is urgently needed. Third, taxonomic education must be made more enjoyable and more relevant to the needs of 'twenty-first century taxonomy'. This addresses the need to better document the world's biodiversity, especially poorly known taxa, but also the adaptation to appropriate technologies to achieve its research. In order to overcome those barriers, established taxonomists must be given the tools and opportunity to transmit their knowledge. Attitude changes in the taxonomic community towards service delivery, especially in terms of education, need to be encouraged. Finally, structural support must be established, not only to provide resources for training, but also to put this training into practice, via the creation of adequate job opportunities. Being also centres of diffusion of taxonomy-based knowledge, NHM and BG are already on the way to reinforce their operational co-operation for co-producing and transferring products and best practices devoted to public awareness in natural sciences. EDIT is the adequate framework to get staff dealing with science and staff dealing with the public within taxonomy institutions closer.

Activities:

1. Assessment of the training resources for taxonomy in Europe.
2. Mobilisation of European training providers into EDIT's School of Taxonomy.
3. Establishment of pilot schemes for integration.
4. Implementation of EDIT's School of Taxonomy.
5. Public Awareness and Public Relations for the promotion of Taxonomy.

Detailed descriptions of all dealings of the project EDIT and its work packages are available via its web-site: www.e-taxonomy.eu. EDIT also publishes Newsletters to announce its activities.

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Morphological analysis of carpel styles of polish members of the *Potentilla collina* group (Rosaceae)*

Jeremi Kołodziejek
Department of Geobotany and Plant Ecology, University of Łódź, Banacha 12/16, 90-237 Łódź, Poland;
e-mail: kolo@biol.uni.lodz.pl

Abstract. Carpel style morphology in taxa from *P. collina* group, i.e. *P. collina* Wibel s.str., *P. thyrsiflora* Hülsen ex Zimmeter., *P. silesiaca* Uechtr., *P. leucopolitana* P.J. Müller, *P. wimanniana* Günther & Schummel and *P. argentea* L. x *P. leucopolitana* P.J. Müller is presented. The examination of these taxa has been performed by SEM for the first time. Morphological analysis of carpel style confirmed that the carpel style in taxa from the *P. collina* group has a conical (*coniformis*) shape. However, plants of this type plants show divergence of style shape details into two forms. Looking from the base upwards, i.e. towards the broad carpel stigma, the style may be: suddenly conically narrowing (typically conical) – *P. collina* and *P. argentea* x *P. leucopolitana* or longitudinally filiform-elongated, i.e. equally thick from the middle up to the stigma (atypically conical) – *P. leucopolitana*, *P. thyrsiflora*, *P. silesiaca* and *P. wimanniana*. All of the 6 studied taxa have a carpel style which is always thicker (swollen) at the base, but in *P. leucopolitana* and *P. argentea* x *P. leucopolitana* the broader base is very conspicuous, while in *P. silesiaca* and *P. collina* it is less visible. The author's research has also shown that the carpel style base in all studied taxa is provided with a few papillae, which in *P. collina* and *P. thyrsiflora* are large and conspicuous, while in *P. silesiaca*, *P. thyrsiflora* and *P. wimanniana* – small and insignificant. The investigated morphological features type of the carpel styles of the *P. collina* group proved significant in taxonomic terms and may be useful in the systematic diagnosis of the *Potentilla* genus.

Key words: Rosaceae, *Potentilla collina* group, carpel style, SEM.

INTRODUCTION

Within the genus *Potentilla*, the form of carpel style is a very important taxonomic character. With regard to its shape, Wolf (1908) has divided the genus *Potentilla* into 6 subsections:

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1) *Rhopalostylae* – with clavate style (*clavaeformis*).
2) *Closterostylae* – with fusiform style (*fusiformis*).
3) *Conostylae* – with conical style (*coniformis*).
4) *Gomphostylae* – with nail-shaped style (*claviculiformis*).
5) *Nematostylae* – with filiform style (*filiformis*).
6) *Leptostylae* – with rod-shaped style (*virguliformis*).

Based on their carpel style shape, WOLF (1908) included taxa from the *P. collina* group in the *Conostylae* subsection.

Identification of most of the taxa from *Potentilla collina* group is based on the calyx to petals length ratio, the shape of carpel style, the number of leaflets on basal leaves, the pattern of pubescence of upper and lower surfaces of leaf blades (WOLF 1901, 1903, 1908; ASCHERSON & GRAEBNER 1904-1905; JUZEPCZUK 1941; BALL et al.1968; BORHIDI & ISÉPY 1965; SOJÁK 1995; GERSTBERGER 2002). Moreover, in recent, years the morphology of achenes (KOŁODZIEJEK & GABARA 2007), in addition to anatomy of leaves (KOŁODZIEJEK & GABARA 2003), has been a useful tool in their identification.

However, apart from descriptions of anatomy of achenes and leaves, no morphological studies of *Potentilla* group have been carried out in Poland. Therefore, the aim of the present paper is to analyse in detail the morphological analysis of carpel style of *P. collina* group to distinguish and characterise individual taxa.

MATERIAL AND METHODS

The present study describes the carpel styles of 6 taxa: *P. collina* WIBEL s.str., *P. thyrsiflora* HÜLSEN ex ZIMMETER, *P. silesiaca* UECHTR., *P. leucopolitana* P. J. MÜLLER, *P. wimanniana* GÜNTHER & SCHUMMEL and *P. argentea* L. x *P. leucopolitana* P. J. MÜLLER. Nomenclature of taxa was used according to WOLF (1908) and KURTTO et al. (2004).

Plants of *Potentilla collina* group originated from the Czech Republic (PR, PRC), Hungary (BP) and Russia, (LE – for abbreviations see HOLMGREN et al. 1990) except for *P. argentea* x *P. leucopolitana*, which came from their natural habitat in Poland. Carpel styles from herbarium material were rehydrated by boiling in water and detergent, then mounted and coated with gold, examined and photographed using a Tesla BS 340 scanning electron microscope. The carpel styles were analyzed on 3 photographs for each taxon.

RESULTS AND DISCUSSION

Morphological analysis of carpel style, performed by the author using a scanning electron microscope, confirmed that the carpel style in taxa from the *P. collina* group has a conical (*coniformis*) shape. However, plants within this type (*coniformis*) show divergence of style shape details into two forms – see Tab. 1 and Plate 1. Looking from the base upwards, i.e. towards the broad carpel stigma, the style may be: suddenly conically narrowing (typically conical) - *P. collina* and *P. argentea* x *P. leucopolitana* or longitudinally filiform-elongated, i.e. equally thick from the middle up to the stigma (atypically conical) - *P. leucopolitana*, *P. thyrsiflora*, *P. silesiaca* and *P. wimanniana*.

All of the 6 studied taxa have a carpel style which is always thicker (swollen) at the base, but in *P. leucopolitana* and *P. argentea* x *P. leucopolitana* the broader base is very conspicuous, while in *P. silesiaca* and *P. collina* it is less visible. The author's research has also shown that the carpel style base in all studied taxa is provided with a few papillae, which in *P. collina* and *P. thyrsiflora* are large and conspicuous, while in *P. silesiaca*, *P. thyrsiflora* and *P. wimanniana* – small and insignificant.

Tab. 1 Shape of the carpel style in 6 taxa of *P. collina* group

Taxa	narrowing towards the stigma	not narrowing towards the stigma	thicker at base	papillae at base
P. collina	present	absent	distinctly	large
P. thyrsiflora	absent	present	weekly	slightly
P. silesiaca	absent	present	weekly	slightly
P. leucopolitana	absent	present	weekly	large
P. wimanniana	absent	present	weekly	slightly
P. argentea x *P. leucopolitana*	absent	present	weekly	large

However, if we intend to determine the shape of carpel style in a specific taxon, it is important to investigate a significant number of carpels within the receptacle and determine the prevalent shape type, since the two forms of the conical (*coniformis*) style shape type frequently co-exist within a single flower. The often-seen biformity of carpel style shape within one flower does not preclude the usefulness (diagnostic value) of carpel style shape as a distinguishing characteristic for discrimination of taxa within the *P. collina* group, since its shape is constant, and, within the *Conostylae* subsection, can serve as a very good distinguishing characteristic between the morphologically similar taxa of *P. collina* s.l. and *P. argentea* s.l. The shape of carpel style in *P. collina* s.str. is very similar to the style of taxa from the *P. argentea* s.l. group, which also show a typically conical style with conspicuous papillae at the strongly thickened base - see Plate 1: F. This is an additional proof that the *P. collina* group formed as a result of hybridisation and taxa from the *P. argentea* s.l. (among others) participated in its emergence.

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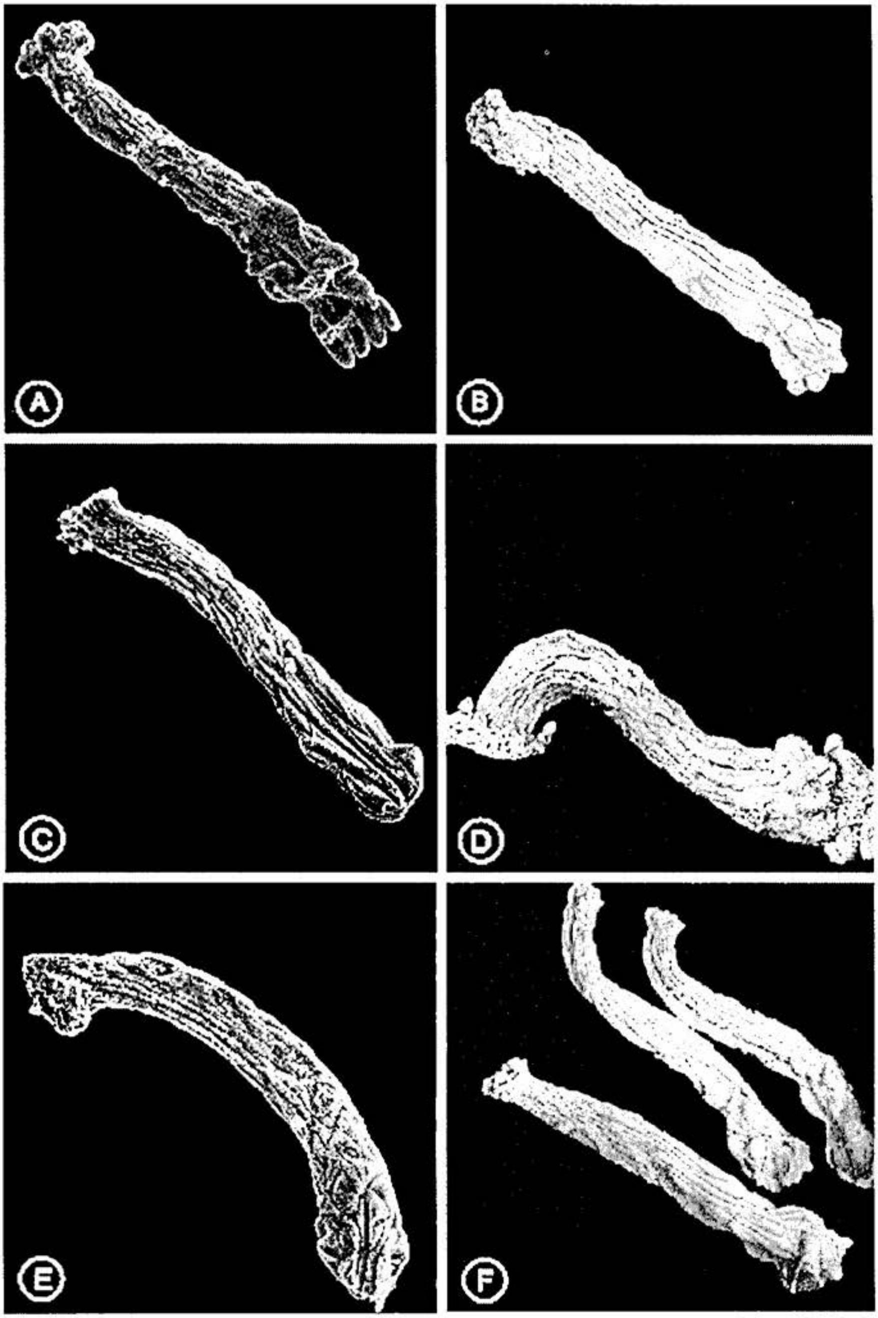

Plate 1. Carpel styles (SEM x 250): A - *P. collina*, B - *P. thyrsiflora*, C - *P. silesiaca*, D - *P. leucopolitana*, E - *P. wimanniana*, F - *P. argentea x P. leucopolitana*

Provenance of analysed samples of *Potentilla collina* group:

P. collina WIBEL – syntype, A. WIBEL, 1801 (LE 2174); *P. thyrsiflora* – Fl. Silesiaca Exs. no 1042, Leszno (Lissa), forest near road, 20.7.1894, A. CALLIER (BP 167321); *P. silesiaca* – syntype, Wrocław (Breslau: Spitzberg zwischen Nimkau und Nippern), 28.6.1863, R. UECHTRITZ (PR); *P. leucopolitana* - F. SCHULTZ herbarium normale Cent. 3 no. 256, Wissenbourg (Bas-Rhin, France), 27.5.1857, F. SCHULTZ; (BP 165401); *P. wimanniana* – isotype, GÜNTHER et SCHUMMEL 1813?, Schedae Cent. Plant. Sil. Exsicc. 5 Wratislaviae, (LE); *P. argentea* x *P. leucopolitana* - Jaroszów near Żarki 50°39'21"N/19°21'32"E, 333 m a.s.l., 21.6.2003, J. KOŁODZIEJEK (LOD).

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Genus	Supplement 14: 41-45	Wrocław, 15 XII 2007

The analysis of morphological differentiation of the epidermis of selected species of the genus *Epipactis* ZINN, 1757 (Orchidaceae: Neottieae)*

ANNA JAKUBSKA
Department of Biodiversity and Plant Cover Protection, Institute of Plant Biology, University of Wrocław,
Kanonia 6/8, 50-328 Wrocław, e-mail: Ajak@biol.uni.wroc.pl

ABSTRACT. Examining the qualities of epidermis can be useful in identification of some plant species. In an attempt to determine whether it can be useful in case of *Epipactis* ZINN, 1757: *E. helleborine* (L.) CRANTZ, *E. albensis* NOVÁKOVÁ et RYDLO, *E. atrorubens* (HOFFM.) BESSER, *E. palustris* (L.) CRANTZ, and *E. purpurata* SM. genera, their species have been studied. The following qualities, essential taxonomically, have been considered: the shape and size of epidermal cells; the presence or absence of subsidiary cells – a type of stomata; the presence, build and types of trichomes. The detailed studies proved that the identification of species of the *Epipactis* ZINN, 1757 genus based solely on the qualities of epidermis is not possible.

Key words: morphology, anatomy, epidermis, *Epipactis* ZINN, orchids

Abundant literature data (e.g. ELLIS 1979; LAWTON 1980; STACE 1993; BARUAH & NATH 1997) indicate that epidermis can constitute a good material for identifying a particular taxon thanks to its non-homogeneous structure. Examining the shape of epidermal, guard and subsidiary cells as well as the different types of trichomes may prove useful for identification of selected plant species. Regrettably, the quality of morphological features can vary depending on a taxonomic group, which makes it difficult to predict its value within the group without thorough examination (STACE 1993).

The object of the research was to verify whether the qualities of epidermis may be used in the process of identification of *Epipactis* ZINN, 1757 species, particularly when the examined material is taxonomically doubtful or incomplete, e.g. as a result of inappropriately secured herbarium sheets. It was also essential to determine possible differences between the species within epidermis qualities, which could be used in construction of determination key.

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MATERIALS AND METHODS

Analyses were conducted on herbarium material as well as that collected from the field in Poland, with the consent of the Polish Minister of Environment No.DOPog.-421-5/2002. The adaxial and abaxial epidermis of leaves was the main object of the examination. Small fragments of leaves of 5 × 5 mm size taken from the middle peripheral region of mature leaves were macerated in sodium hypochlorite for a period of two to four days. Both epidermal layers were stripped off gently from the mesophyll tissue with the help of a pointed needle and forceps (BARUAH & NATH 1997). The slides were examined under optical microscope and sketches were drawn. The following qualities of epidermis, important taxonomically, were taken into consideration: the shape and size of proper epidermal cells, the presence or absence of subsidiary cells – the type of stomata; the number of chloroplasts in stomata guard cells, the presence, the build and the types of trichomes. Optical microscope Nikon Eclipse 600 and scanning microscope LEO 435 VP were used in the examination.

RESULTS

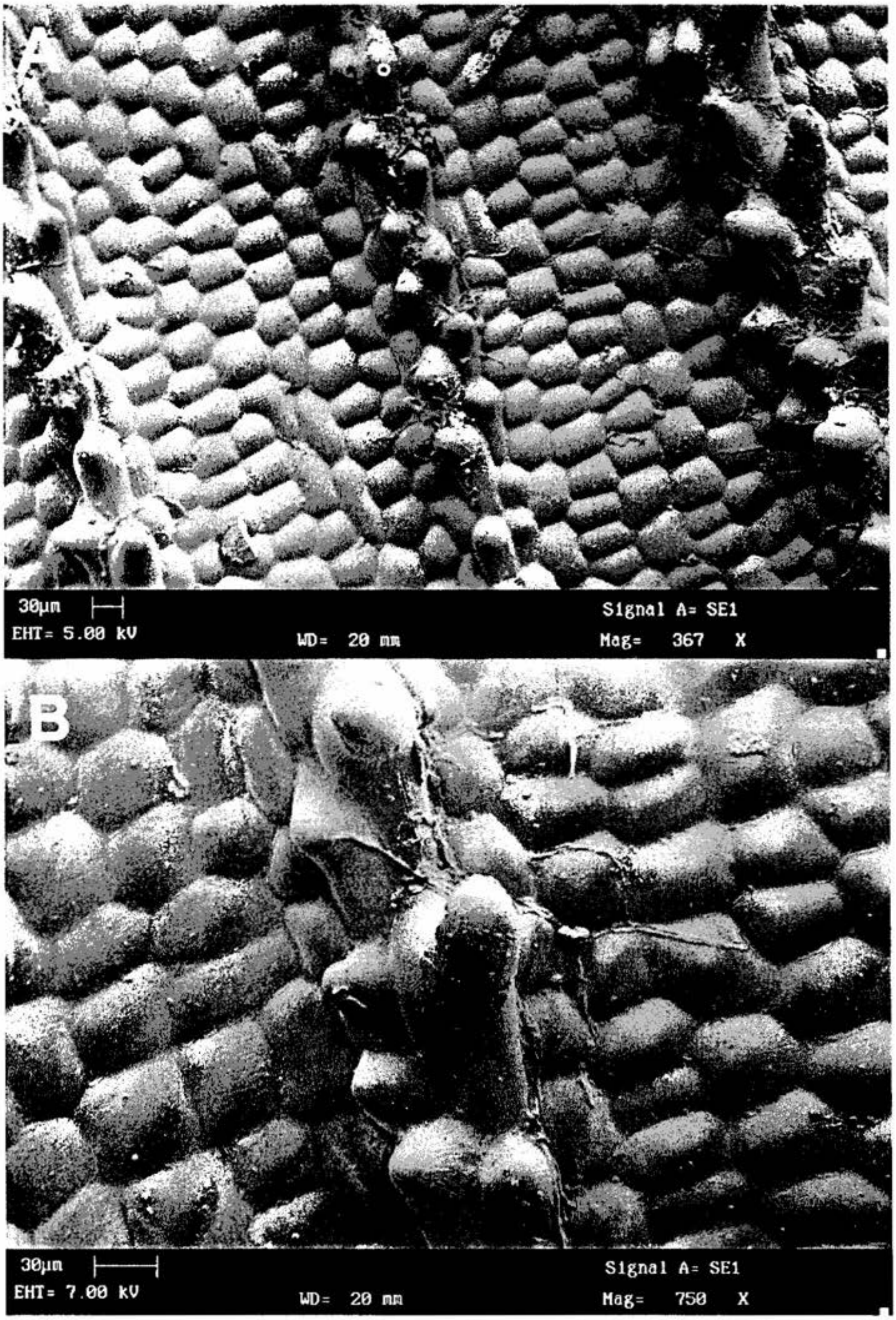
Using available material, i.e. 169 specimens of *Epipactis helleborine* (L.) CRANTZ, 10 specimens of *Epipactis albensis* NOVÁKOVÁ et RYDLO and *Epipactis atrorubens* (HOFFM.) BESSER, 27 specimens of *Epipactis palustris* (L.) CRANTZ and 16 specimens of *Epipactis purpurata* SM., samples of adaxial (upper) and abaxial (lower) epidermis were made.

The number of chloroplasts in stomata guard cells is an indirect method for assessing the degree of ploidality, used successfully in cytotaxonomic examinations.

The numbers of chloroplasts in stomata guard cells were counted. The results are presented below (table 1):

Table 1.
The number of chloroplasts in stomata guard cells in the examined species of *Epipactis* ZINN, 1757 (Orchidaceae, Neottieae)

Species	Number of observations	Number of chloroplasts in stomata guard cells	Most often observed number of chloroplasts in stomata guard cells
Epipactis helleborine (L.) CRANTZ	1032	22,24,25,27,28,29,30,32, 34,35,36,38	25 - 28
Epipactis atrorubens (HOFFM.) BESSER	610	21,22,23,24,25,26,27,28, 29,31,32,33,34,37	24 - 28
Epipactis palustris (L.) CRANTZ	559	13,19,20,21,22,23,24, 25,26,27,28,30,32,33	26 - 28
Epipactis purpurata SM.	562	12,15,19,20,24,25,26,27, 28,29,30,31,32	27 - 29
Epipactis albensis NOVÁKOVÁ et RYDLO	496	20,21,22,23,24,25,26,27, 28,31,32,35	26 - 29



Phot.1. Scanning electron micrograph surface view of the upper epidermis of *Epipactis helleborine* leaf with visible papillae (A, B)

The similar numbers of chloroplasts in a stomata guard cells obtained from representatives of different species do not allow to form long-range conclusions as the number of examined specimens was too small. The amount of examined material depended on its availability as well as the fact that the *Epipactis* genus is legally protected in Poland. Obtaining material from the field without the consent of the Minister of Environment is treated as an offence. Considering the small amount of specimens, it was not possible to make calculations which would confirm the statistic vitality of potential morphological-anatomic differences in the examined species.

The presence of trichomes on the upper and lower side of the leaf blade was found in all examined species within the genus. No fundamental interspecies differences in

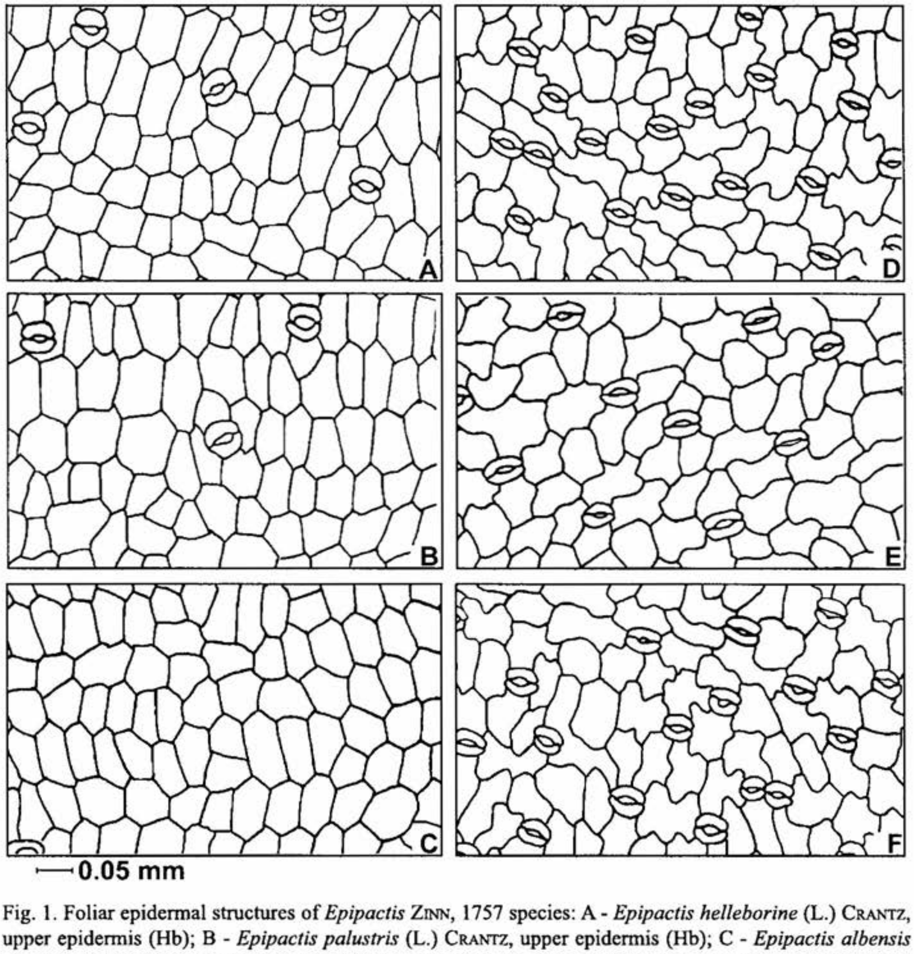


Fig. 1. Foliar epidermal structures of *Epipactis* Zinn, 1757 species: A - *Epipactis helleborine* (L.) Crantz, upper epidermis (Hb); B - *Epipactis palustris* (L.) Crantz, upper epidermis (Hb); C - *Epipactis albensis* Nováková et Rydlo, upper epidermis (F); D - *Epipactis palustris* (L.) Crantz, lower epidermis (Hb); E - *Epipactis purpurata* Sm., lower epidermis (Hb); F - *Epipactis albensis* Nováková et Rydlo, lower epidermis (F); Abbreviations: Hb – slides made from the herbarium material; F – slides made from the freshly collected material

the shape or size of the trichomes, which could help in the process of taxa identification, were discovered (JAKUBSKA 2003).

An interesting cytological feature of all the species within the genus is the occurrence of papillae on the veins of the upper and lower side of the leaf blade (Phot.1. A, B), whose role in the species of *Epipactis* genus has not yet been recognized.

The most vital among all the important anatomic features of the stomata is the way the epidermal cells surrounding the stoma, called subsidiary guard cells (STACE 1993), are arranged. However, the subsidiary guard cells did not occur in the examined species. No substantial differences between the species were found, nor were any regarding to the shape of the epidermal cells. On the basis of the examined material, STACE's (1993) sugggestion that the qualities of stomata are not always an unfailing diagnostic criterion helpful in species identification was confirmed.

The study of the shape and size of the epidermal cells in the examined representatives of *Epipactis* genus does not allow a faultless identification as the shape of the cells in all the examined species is comparable (fig.1).

Taking into consideration the samples prepared in the research, it was stated that, in the case of the species of *Epipactis* genus, herbarium material should not constitute the only source of information, but only complement the examinations carried out on freshly collected material, as the guard and epidermal cells might be deformed in the process of drying.

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Genus	Supplement 14: 47-49	Wrocław, 15 XII 2007

Analysis of the exine micromorphology of *Epipactis helleborine* (L.) CRANTZ and *Epipactis albensis* NOVÁKOVÁ et RYDLO (Orchidaceae: Neottieae) and its application to genus taxonomy*

ANNA JAKUBSKA
Department of Biodiversity and Plant Cover Protection, Institute of Plant Biology, University of Wrocław, Kanonia 6/8, 50-328 Wrocław, e-mail: Ajak@biol.uni.wroc.pl

ABSTRACT. The *Epipactis* ZINN, 1757 genus belongs to the so-called 'critical' and controversial plant taxa. The aim of the research was to determine whether the analysis of micromorphology of the pollen grains (particularly the exine structure) is useful in identification of two species, i.e. *Epipactis helleborine* (L.) CRANTZ and *Epipactis albensis* NOVÁKOVÁ et RYDLO, which are difficult to distinguish between. No substantial differences in the exine ornamentation or the pollen size of the two species, which would allow to identify the species or confirm the diagnosis in doubtful cases have been found in the course of the research.

Key words: pollen, exine micromorphology, *Epipactis helleborine* (L.) CRANTZ, *Epipactis albensis* NOVÁKOVÁ et RYDLO, orchids

Orchidaceae family is well known for wide diversity of its pollen in regard to its micromorphology (i.e. HUYNH 1977, ACKERMAN & WILLIAMS 1980, ZAVADA 1990, Dressler 1993, SCHILL & PFEIFFER 1997). This diversity is noticeable at many levels, e.g. the variability of arrangement of the pollen grains in pollinia or the sculpturing of the exine. These qualities are successfully used in the taxonomy of Orchidaceae (LUMAGA et al. 2006).

The taxonomic value of a feature or a group of features is variable and depends on the taxonomic group, which makes it impossible to predict the value of such a feature beforehand without examining it carefully (STACE 1993).

Comparative morphology of pollen grains gives us knowledge about their taxonomic position and can indicate the separate character of a taxon or its wrong classification.

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The aim of the research was to examine whether studying the microstructure of pollen grains can help identify the species of *Epipactis* Zinn, 1757 genus, particularly the critical taxa.

The presented results are of preliminary character and a part of a project on exine microstructure of the genus *Epipactis* Zinn, 1757.

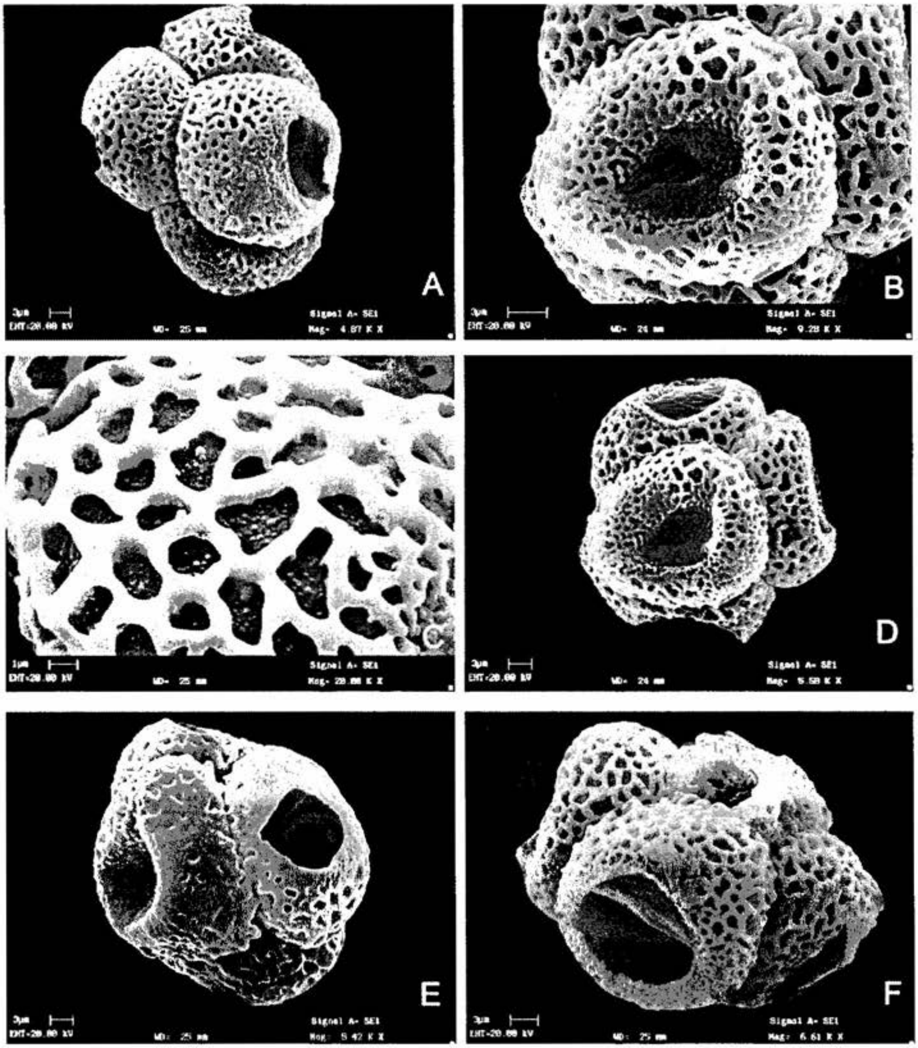

Plate 1. The sculpturing of exine of the pollen grains in taxa of the genus *Epipactis* Zinn, 1757: A – Tetrad pollen with a visible reticular surface (*exinum reticulatum*) in *Epipactis albensis* Nováková et Rydlo, B, C, D – Details of the reticular surface of *E. helleborine* (L.) Crantz pollen grains, E, F – Undeveloped (E) and deformed (F) tetrad pollen of *Epipactis albensis* Nováková et Rydlo

MATERIALS AND METHODS

PLANT MATERIAL

Pollinaria were collected from plants growing in Poland and the Czech Republic and from herbarium materials. To cover intraspecific variation, pollinaria of 25 individuals per species were sampled. The pollen used in the slides was collected from buds as well as from open flowers. Biometric measurements, e.g. the length of the polar axis and the diameters of openings of reticulum, were carried out in order to compare the size of individual pollen grains.

SCANNING ELECTRON MICROSCOPY (SEM)

Scanning microscope LEO 435 VP produced by LEO (Zeiss+Leica) company was used in the research together with an apparatus for freezing slides in liquid nitrogen „Cryo" CT 1500 Oxford ™. The slides were prepared with the use of the freezing technique (Cryofixation). Pollinaria were fixed in FAA (formalin-acetic acid-alcohol 10:5:50), dehydrated in an ethanol series, critical-point dried in liquid CO_2 and sputter-coated with approx. 30 nm of gold.

RESULTS

The pollen of the studied species of *Epipactis* ZINN, 1757 genus is spread in the form of tetrads with characteristic exine sculpturing (Plate 1). No substantial differences between the studied species in the micromorphology of the exine surface or in the size of the pollen grains, which would allow to identify the taxa were found in the course of the examination. It may result from the young age of the species. The exine sculpturing in both species is of the same type, i.e. reticular surface (*exinum reticulatum*). In the case of *Epipactis albensis* pollen, 18 % of the grains were undeveloped, smaller or deformed (Plate 1E, 1F). In the case of E. *helleborine,* the defective pollen accounted for approximately 4 %, although the figure varies depending on the quality of the material under examination. The external diameter of the pollen is 20,25-26 µm in *E. helleborine* and 20,18-25,6 µm in *E. albensis*, yet the average figures are approximate.

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Genus	Supplement 14: 51-52	Wrocław, 15 XII 2007

Sobraliinae SCHLECHT. & Elleanthinae SZLACH. – classificatory differences*

MAGDALENA DUDEK[1], PIOTR TUKAŁŁO
Department of Plant Taxonomy and Nature Conservation, Gdańsk University, Al. Legionów 9, PL-80-441 Gdańsk, e-mail: [1]magdalena_kulak@wp.pl

ABSTRACT. In spite of differences in the structure of the seeds and pollinia, some authors classified *Sobralia* with *Elleanthus*, *Epilyna* and *Sertifera* as a members of a common subtribe Sobraliinae (DRESSLER 1981, 1993; BURNS-BALOGH & FUNK 1986). SZLACHETKO (1995) separated *Elleanthus*, *Epilyna* and *Sertifera* into the subtribe Elleanthinae (Elleantheae, Epidendroideae). Also, he transferred the remaining Sobraliinae with only one genus *Sobralia* into another subfamily Vanilloideae.

Key words: Sobraliinae, Elleanthinae, Orchidaceae, classification.

Members of subtribes Sobraliinae and Elleanthinae exhibit significant morphological diversity in both generative and vegetative structures. Such diversity is likely to be caused by adaptation to different environmental conditions and various groups of pollinators. It is also the main reason of classification problems described below.

Most species of *Elleanthus* and *Sertifera* indicate the hummingbird-pollination syndrome. However, *Epilyna* and *Elleanthus* sect. *Chloidelyna*, characterized by presence of small, white flowers, can be pollinated by hummingbirds and perhaps Lepidoptera (PRIDGEON & al. 2005). Almost all members of *Sobralia* are pollinated by euglossine bees, although other bees can also serre as pollinators. Some species of *Sobralia* may be atractive to male euglossine bees because of secretion of specific fragrance. Only two species, *Sobralia amabilis* and *Sobralia callosa*, appear to be adapted to hummingbird pollination. For example, lip of *S. amabilis* is short, flat and open and pollinaria of *S. callosa* resemble those found in genus *Elleanthus*.

Sobraliinae sensu DRESSLER 1981 comprised the most primitive taxa of the subfamily Epidendroideae. The subtribe included five genera: *Arpophyllum* LLAVE & LEX.,

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Sertifera LINDL. & RCHB. f., *Sobralia* LINDL., *Xeorchis* SCHLECHT. and *Elleanthus* PRESL. DRESSLER, followed by BURNS-BALOGH & FUNK in 1986, classified Sobraliinae with the tribe Arethuseae. In 1993, DRESSLER discarded his previous concept and transferred Sobraliinae to New World Epidendreae. Finally, SZLACHETKO (1995), basing on differences in the structure of the seeds and pollinia, separated *Sobralia* from remaining Sobraliinae sensu DRESSLER 1993 and transferred them into the newly described tribe Elleantheae. Elleantheae, as delimited by SZLACHETKO, consists of three subtribes, Xerorchidinae and Arpophyllinae, both monotypic, and Elleanthinae with, three genera, *Elleanthus*, *Sertifera* and *Epilyna*. All three genera are characterized by similar morphology of the vegetative and floral parts, including gynostemium. The remaining Sobraliinae, with only one genus *Sobralia*, was then transffered into another subfamily Vanilloideae.

In *Sobralia*, the pollen grains are loosely held together by elastoviscin and form a more or less S-curved soft mass, not found in Elleantheae. Almost all species of *Sobralia* have seeds of *Bletia* type. In contrast, members of Elleantheae are characterized by clavate to obovoid, almost equal in size pollinia with sticky caudicles on their apices. The seeds are of *Elleanthus* type, with only one exception in species of *Xerorchis* (*Limodorum* type). Within *Sobralia* only species, *S. callosa* L. O. WILLIAMS have pollinia of *Elleanthus* type. This unusual state probably represent an interesting case of paralellism in plants pollinated by hummingbirds (PRIDGEON & al. 2005). Another diagnostic feature, spongy tilosomes, is found in both *Sobralia* and Elleanthinae. However, this feature can't be used exclusirely in verification of close relationships between these orchids, as this kind of tilosomes has also been noted in many Coelogyninae, and ocasionally in other groups of orchids as well (PRIDGEON & al. 1983).

The results of recent molecular studies concerning representatives of Elleanthinae and Sobraliinae indicate a close relation between *Sobralia* and *Elleanthus* (CAMERON 1999, VAN DEN BERG et al 2000, CHASE 2001, PRIDGEON et al 2005). Unfortunately, in each phylogenetic analysis both subtribes were very poorly sampled, e.g. including some undetermined species of *Elleanthus*, single accesions of *E. caravata* (AULB.) RCHB.f., and very few species of Sobraliinae sensu DRESSLER 1993. Thus, both subtribes alone still require comprehensive phylogenetic studies, mainly based on DNA markers, which will help clarify the relationships within and between them and provide valuable information about orchid evolution.

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Genus	Supplement 14: 53-58	Wrocław, 15 XII 2007

Crab spiders (Araneae, Thomisidae) of Australia and New Guinea. Taxonomy of some species of *Diaea* as described by KULCZYŃSKI (1911)*

PAWEŁ SZYMKOWIAK
Departament of Animal Taxonomy and Ecology, Institute of Environmental Biology, A. Mickiewicz University, Poznań, Poland, e-mail: pawel.szymkowiak@amu.edu.pl

ABSTRACT. Australia and New Guinea have drifted on the same tectonic plate. The collision of indo-australian tectonic plate with the Asia plate brought about the final uplift of New Guinea and the majority of islands making the present Orient. Moreover, in the Pleistocene New Guinea was connected with Australia, together with some other nearby islands, in a land known as Sahul. It was probably at that time that the faunal exchange between the New Guinea and Australia started. Despite similar geological history and close vicinity of both areas, the crab spiders show great distinction between New Guinea and Australia. 36 genera on both areas have been recorded, of which only 13 are common (*Amyciaea, Cymbacha, Diaea, Hedana, Loxoporetes, Mastira, Misumena, Porropis, Runcinia, Stephanopis, Tharrhalea, Tmarus* and *Xysticus*), and 167 species, of which 6 are common (*Amyciaea albomaculata* (O. P. CAMBRIDGE, 1874), *Cymbacha saucia*, L. KOCH, 1874, *Mastira cimicina* (THORELL, 1881), *Porropis callipoda* THORELL, 1881, *Runcinia acuminata* THORELL, 1881, *Tharrhalea albipes* L. KOCH, 1875). Thus, similarity of the spider fauna of the family Thomisidae at genera level is near 37%, while at species level it is 3.7%. 41 species of the genus *Diaea* living on both areas, including 9 species endemic for New Guinea, have been recorded. Five of the latter were described by KULCZYŃSKI in 1911 and assigned to *Diaea*: *Diaea decempunctata, Diaea papuana, Diaea sticta Diaea varians, Diaea limbata*. Preliminary revisional studies on those species revealed that *D. sticta* is a synonym of *Diaea evanida* (L. KOCH, 1867) and *D. limbata, D. decempunctata* and *D. limbata* are closely related species. They belong, together with several others of the "*D. praetexta* group", to an undescribed genus. *Diaea adusta* (L. KOCH, 1867) = *Diaea tumefacta* L. KOCH, 1874 = *Diaea varians*. Three of the latter have been transferred to *Mastira* - now Mastira adusta (L. KOCH, 1867) comb.nov. State of knowledge of the spiders of the family Thomisidae of Australia and New Guinea is still insufficient. Some genera seem to be unclearly defined (*Diaea, Misumena, Thomisus, Xysticus*), and so several Australian and New Guinean crab spider species have been incorrectly assigned to them.

Key words: crab spiders, *Diaea*, revisional studies, Australia, New Guinea.

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INTRODUCTION

The collision of Australia with the Asia plate brought about the final uplift of New Guinea and the majority of islands making the present Orient (RAVEN et AXELROD 1972; AUDLEY-CHARLES 1983; BELL 1985; TROJAN 1997). New Guinea has the same geological history as Australia, as they both drifted on the same tectonic plate. Moreover, in Pleistocene this island was connected with Australia, together with some other nearby islands, in a land known as Sahul (SMITH et al. 1993). Probably at that time the mixing of faunas between the Orient and Australia started. However, there is no agreement as to the possible stepping stones in Indonesia (PRÓSZYŃSKI 1961; KEAST 1981; DIAMOND et GILPIN 1983; AUDLEY-CHARLES et HARRIS 1990).

The family Thomisidae is rich in species and comprises over 2000 species araund the world (JOCQUE et DIPPENAAR-SCHOEMAN 2006). It is divided into seven subfamilies (DIPPENAAR-SCHOEMAN et JOCQUE 1997). Four of them occur in Australia and New Guinea: Bominae, Dietinae, Stephanopinae i Thomisinae. The last one is the most numerous both in the world (75 genera and about 1500 species) (ONO 1988, PLATNICK - Internet database) and in Australia (14 genera and 76 species – on the basis of the catalogues made by SIMON, ROEWER, BRIGNOLI and PLATNICK).

STUDY HISTORY

The first taxonomic papers on crab spiders in Australian region come from the end of the 19th century, and the first described species representing this family were: *Stephanopis malacostracea* (WALCKENAER, 1837) from Australia and *Phrynarachne jobiensis* (THORELL, 1877) from New Guinea. In this period a significant number of species was described and the person most devoted to it was LUDWIG KOCH, who described 71 species of crab spiders from this continent (almost 57% of all known from Australia). Later, the crab spiders have enjoyed less interest, although a considerable contribution to their recognition was brought by: HICKMANN (1944), RAINBOW (1920), SIMON (mainly 1895a, 1895b), STRAND (1901, 1911, 1913, 1915) and recently MAIN (1988), EVANS (1995), SCHIELD et STRUDWICK (2000). Crab spiders of New Gwinea are less studied although KULCZYŃSKI (1911) described 17 species from this island. Recently, LEHTINEN (2003) presented a few interesting taxonomic remarks on the Palearctic and Oriental Misumenini in his worldwide revision of thomisid genera.

SPECIES RICHNESS

High heterogenity of habitats may lead to considerable variability of fauna. Australia and New Guinea are characterized by huge floristic, topographic and climatic diversity. Thaus, these areas may potentially be numerous in species. In spite of many expeditions which took place in the past, Australia is still weakly explored. The number of crab spider species has not yet been estimated precisely. According to HAWKESWOOD's (2003) estimates, there are nearly 125 species, while RAVEN et al. (2002) revealed a number of 143 species, including the crab spiders from New Guinea and Papua New

Guinea. Having analyzed subject literature (papers with descriptions of particular taxa) and explained taxonomic discrepancies, the total number of crab spiders present in both territories (including Lord Howe Island and Aru Island) is 167 species (8.2 % of world fauna of Thomisidae); more specifically, 126 species of crab spiders assigned to 25 genera in the area of Australia and 47 species of crab spiders assigned to 24 genera in the area of New Guinea have been recorded. The biggest arachnological exploration took place on the Eastern coast of Australia and this is why the best-studied territories of Australia are Queensland and New South Wales.

HAWKESWOOD (2003) stated that knowledge of many Australian spider families (including Thomisidae) is still insufficient. The number of undescribed species of this family is probably high and may be even a few times higher than the number of known species, similarly to how it has been noted in the studies of the Salticidae family of Australia (ŻABKA 1991).

SIMILARITY OF AUSTRALIAN AND NEW GUINEAN CRAB SPIDER FAUNA

In spite of a similar geological history and a close vicinity of both areas, the crab spiders show great discrepancy between New Guinea and Australia. 36 genera have been recorded on both areas, of which only 13 are common (*Amyciaea*, *Cymbacha*, *Diaea*, *Hedana*, *Loxoporetes*, *Mastira*, *Misumena*, *Porropis*, *Runcinia*, *Stephanopis*, *Tharrhalea*, *Tmarus* i *Xysticus*), and 167 species, of which 6 are common (*Amyciaea albomaculata* (O. P. CAMBRIDGE, 1874), *Cymbacha saucia* L. KOCH, 1874, *Mastira cimicina* (THORELL, 1881), *Porropis callipoda* THORELL, 1881, *Runcinia acuminata* THORELL, 1881, *Tharrhalea albipes* L. KOCH, 1875). Thus, the similarity of the spider fauna from the family Thomisidae at genera level is near 37%, while at species level it is 3.7%.

DEGREE OF ENDEMISM

According to the theory of continent drift supported by the theory of plate tectonics, it is assumed that India, Australia with Tasmania, New Guinea and New Zealand lie on the same indo-australian lithospheric plate. Although the eldest described spider species comes from the Devonian deposits (SELDEN et al. 1991), the first families of spiders appeared in late Cretaceous, but no representatives of crab spiders were found among them (PLATNICK et GERTSCH 1976; PENNEY 2001). The oldest specimens belonging to the Thomisidae family are found in Baltic amber (about 40 Ma ago) and Dominican amber (about 20 Ma ago) (Wunderlich 1986). As results from the above data, the fauna of Thomisidae developed in the post-Gondwanian period. Given the long time of isolation of Australia (ok. 55 mya), it should be expected that the endemism of the crab spiders on this continent is greater than assumed until now.

Most species living on the area of Australia and New Guinea are endemic. In Australia there are 119 endemic species (94.4%) and in New Guinea + Aru Island - 41 endemic species (87.2%).

At present, of the 25 genera of the family Thomisidae occurring in Australia, 5 are endemic (*Corynethrix*, *Isala*, *Poecilothomisus*, *Saccodomus*, *Synalus*), and of 24 genera occurring in New Guinea, 3 are endemic (*Cetratus*, *Latifrons* i *Rhaebobates*). High degree of endemism may be caused by floristic diversity of both areas and may also be elevated by small dispersal abilities of the crab spiders by ballooning (0.4%-13.6% contribution relative to the other spider species migrating this way) (GREENSTONE et al. 1987; GREENSTONE 1990; BLANDENIER et FÜRST 1998).

The only species which are widespread and recorded in Australia and/or New Gwinea are: *Runcinia acuminata* (THORELL, 1881) – cosmopolitic distribution and *Thomisus spectabilis* DOLESCHAL, 1859 – pantropical distribution.

TAXONOMIC REMARKS ON SOME GENERA OF THOMISIDAE AND *DIAEA* IN PARTICULAR

Some genera occuring in Australia and New Guinea such as: *Diaea*, *Misumena*, *Thomisus*, *Xysticus* are globally widespread. The dubious status of some of them has been recently questioned by LEHTINEN (1993, 2003). Above mentioned author states that such genera as *Misumena*, *Misumenops*, *Diaea* or *Synaema* have not been clearly defined and species not related to the type species are often mistakenly classified as representatives of a particular genera. This thesis has been supported by recent results of SHIELD et STRUDWICK (2000). These authors presented a line of arguments indicating the necessity of defining a new genus *Diasterea* for two synonymic species classified to the widespread genus *Diaea* (now *Zgometis* - LEHTINEN 2004).

Despite scarce faunistic data and unclear taxonomic statuses of several genera, LEHTINEN (1980, 1993) undertook the first attempt at a zoogeographic analysis of the indo-pacific region. He proposed the probable centres of ranges and possible directions of dispersal of selected spider families. According to his studies, crab spiders had arrived to the Australian continent via Melanesia. Taking into account the present stage of research on spiders from the family Thomisidae, it is not possible to conduct a fully-fledged zoogeographic analysis due to the lack of revisions based on analysis of type material. Current revisions of the Australian genus *Diaea* s. lato show presence of numerous synonyms (SZYMKOWIAK in preparation).

Diaea is the most numerous genus of the family Thomisidae in the Australian region, with 32 species occurring in Australia and 9 species occurring in New Guinea.

Due to an unclear genus diagnosis and possibility of convergence connected with their existence in similar habitats, many species most probably not closely related to the type species have been included in Genus *Diaea.* This claim is supported by diverse structure of sexual organs of species present in Australia or New Guinea in comparison to the type species. Also, within the scope of the genus there is a variety of forms, which led LEHTINEN (2004) to create new genera or use the old ones once again and transfer some of the species formerly classified as *Diaea* or *Diasterea* (formerly *Diaea*) there: *Diaea concinna* THORELL, 1877 = *Misumena gamma* CHRYSANTHUS, 1964 (New Guinea) to *Ebrechtella* DAHL, 1907; *Diaea hilaris* (L. KOCH, 1876) = *Synema seranicum* STRAND, 1913 (New Guinea) to *Henriksenia* LEHTINEN, 2004; *Diaea colcloughi* RAINBOW, 1912 (Australia: Northern Territory) to *Loxoporetes* KULCZYŃSKI, 1911;

Diaea cimicina THORELL, 1881 (Indonesia: Aru Island, Australia: York Peninsula) to *Mastira* THORELL, 1891; *Diasterea lactea* SHIELD et STRUDWICK, 2000 (Australia: New South Wales, Victoria, Queensland) to *Zygometis* SIMON, 1901.

Preliminary revisional studies on species of *Diaea* from the area of New Guinea described by KULCZYŃSKI revealed that *Diaea sticta* KULCZYŃSKI, 1911 is a junior synonym of *Diaea evanida* (L. KOCH, 1867). *Diaea decempunctata* KULCZYŃSKI, 1911, *Diaea limbata* KULCZYŃSKI, 1911 and *Diaea papuana* KULCZYŃSKI, 1911 are closely related species and together with *Diaea haematodactyla* L. KOCH, 1875, *Diaea multopunctata* L. KOCH, 1874 and *Diaea prasina* L. KOCH, 1876 are related to *Diaea praetexta* (L. KOCH, 1865). They should be included in a separate, new genus in the future. *Diaea bipunctata* RAINBOW, 1902 seems to belong to the same group of related species and it may be the junior synonym of *D. praetexta*. Taxonomic position of these species will be established after revisional studies on type material (Australian Museum, KS 6478, female?) (SZYMKOWIAK in preparation). The next species described by KULCZYŃSKI (1911) - *Diaea varians* KULCZYŃSKI, 1911 is a junior synonym of *Diaea adusta* (L. KOCH, 1867) = *Diaea tumefacta* L. KOCH, 1874. This species is transferred to *Mastira*: now *Mastira adusta* (L. KOCH, 1867) comb. nov. considering habitus, occurrence and position of two teeth on inner row of chelicera, lack of central hood in the epigynal plate and occurrence of dried sperm deposits in female copulatory openings (see LEHTINEN 2004).

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Cross-species amplification of microsatellite loci in *Orchesella flavescens* (Apterygota: Collembola)*

ROBERT RUTKOWSKI[1*], IZA OLEJNICZAK[2], PAWEŁ BONIECKI[2], ANNA TEREBA[1],
MAGDALENA CYBULSKA[3] & ANNA PARYS[4]

[1]Museum and Institute of Zoology PAS, Wilcza 64, 00-679 Warsaw, Poland
[2]Center for Ecological Research PAS, M. Konopnickiej 1, 05-092 Łomianki, Poland
[3]Warsaw Agricultural Academy, Ciszewskiego 8, 02-786 Warsaw, Poland
[4]Institute of Zoology, Department of Ecology, Warsaw University, Banacha 2, 02-097 Warsaw, Poland
*Corresponding author: E-mail: robertrut@miiz.waw.pl

ABSTRACT. Cross-species amplification of microsatellite loci, described for *Orchesella cincta* and *O. villosa*, was performed in *O. flavescens*. Among 14 tested markers, 11 were amplified successfully and 5 of them were polymorphic, with 2 to 5 alleles, depending on the locus. Generally, success of amplification was higher for loci described for *O. cincta*, which might suggest close genetic relation between this species and *O. flavescens*.

Key words: Collembola, *Orchesella*, microsatellite markers, cross-species amplification.

INTRODUCTION

Microsatellites are defined as tandem repeats of a short (from two to six nucleotides) DNA motif, forming more or less uniform tracts up to 100 nucleotides long (CHAMBERS et MACAVOY 2000). High level of polymorphisms, together with the power that they provide to solve biological problems, as well as the possibility of analysis using fast and effective technique of PCR, makes the microsatellites a useful genetic marker for wide range of genetic investigation, ranging from identification of individuals to studies on population level (e.g. SLOANE et al. 2000; GIRMAN et al. 2001; LEE et al. 2001; ROEDER et al. 2001). One of the factors limiting even broader use of microsatellites is the fact that the initial identification of the marker is expensive and labour-consuming,

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and is also requires cloning and sequencing. To overcome these disadvantages, researchers often adapt information about microsatellite markers originally developed for one (source) species for use in other, usually closely related species (the target). This strategy, based on using PCR primers described for one species to amplify homologous microsatellite in others, was called cross-species microsatellite amplification and was widely applied, frequently with success (MOORE et al. 1991; GEMMELL et al. 1997; PRIMMER et ELLEGREN 1998; GIBBS et al. 2000). However, application of cross-species microsatellite amplification has been shown to have many limitations. Firstly, the strategy works preferably for species belonging to the same genus or to recently separated genera (SCRIBNER et PEARCE 2000). Secondly, in many cases a given microsatellite may fail to amplify or may be less or even non-polymorphic in target species (RUBINSZTEIN et al. 1995; MORIN et al. 1998). Thus, application of cross-species strategy requires a pilot study which would assess the amplification success of particular markers and their level of polymorphisms in target species, as only polymorphic microsatellites can be successfully used in population genetic studies (FRANKHAM et al. 2003).

In thispaper, we describe results of cross-species amplification of microsatellite loci in *Orchesella flavescens* using PCR primers described for two other species of *Orchesella*: *O. villosa* and *O. cincta*.

MATERIAL AND METHODS

We collected 41 individuals of *O. flavescens* from two sampling sites: one local population from Kampinoski Forest (Poland) ($n = 25$) and one local population from Finland ($n = 16$).

Genomic DNA was isolated using DNeasy® Tissue Kit (Qiagen). Microsatellite loci were amplified using PCR with primers and conditions described by Van Der WURFF et. al. (2001) for *O. cincta* and by SPINSANTI et al. (2006) for *O. villosa*. Results of amplification were assessed using capillary electrophoresis in CEQ 8000 automatic sequencer (Beckman Coulter).

For each successfully amplified locus we described the size of PCR products and the number of alleles. Using GenAlEx version 5.04 (PEAKALL et SMOUSE 2001) we estimated observed heterozygosity for each locus.

RESULTS AND DISCUSSION

Among 14 tested markers 11 (79%) were successfully amplified (Table 1), showing characteristic microsatellite's structure of a peak after analysis of PCR product in sequencing machine. One locus (OvMic47), though amplified, was impossible to interpret due to multiple peaks on the chromatograme, despite applying wide range of annealing temperatures. Monomorphic locus F2a4f was amplified exclusively in specimens from Poland. Five loci (45% of all successfully amplified) presented polymorphism with from 2 to 5 alleles. In one locus (Rt11b4) we found two alleles but no heterozygotes — allele 116 bp was found exclusively in population from Poland, whereas allele 118 bp only in sample from Finland.

Generally, success of amplification in *O. flavescens* was higher in the case of primers described for *O. cincta* (100%) and size of alleles in these two species appeared to be very similar. This might suggest close genetic relation between O. *flavescens* and O. *cincta*, as PRIMMER et al. (2005) shawed that the success of amplification of a locus in cross-species strategy was higher when the genetic distance between source and target species was small.

The success of amplification and the ratio of polymorphic loci among those successfully amplified (79% and 45% accordingly) are both similar to values reported by other authors applying the cross-species strategy (e.g., PRIMMER et al. 1996; GALBUSERA et al. 2000).

We have identified 5 polymorphic microsatellites in *Orchesella flavescens*. Whilst it is postulated that at least 10 polymorphic loci are necessary to avoid erroneous inference in genetic population studies (KOSKINEN et al. 2004), studies based on four to six microsatellite markers are not rare (e.g. RICHARD et THORPE 2001). Moreover, as obtaining large samples of Collembola is rather easy, it could be stated that we described a useful molecular tool for "small scale" as well as "wider" population genetic analysis of *O. flavescens*.

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Table 1. Results of cross-species amplification of microsatellite loci described for *Orchesella cincta* (WURFF et. al. 2001) and *O. villosa* (SPINSANTI et al. 2006) in *O. flavescens*. * — :cited data ** — range of observed heterozygosities found in different sampling localities, size/range — size of PCR products in base pairs and (in the case of polymorphic loci) size range of alleles; A — number of alleles in locus ; H_o — observed heterozygosity; *n* — sample size

	*O. cincta** (*n* = 30)			*O. flavescens* (*n* = 41)		
Locus	Size/range	A	H_o^{**}	Size/range	A	H_o
Ft29b3	208–214	4	0.0–0.2	256–268	5	0.6
Rt17f2	204–206	2	0.1–0.5	202	1	0.0
Rt23d11	307–310	2	0.2	301–307	3	0.4
Rt11b4	114–116	2	0.1–0.5	116–118	2	0.0
Rt10d9	183–193	5	0.6–0.9	176	1	0.0
Rt18d7	230–234	3	0.4–0.8	236	1	0.0
F2a4f	190–196	2	0.0–0.2	216	1	0.0
	*O. villosa** (*n* = 75)					
OvMic3	109–125	11	0.33–0.66	143–145	2	0.2
OvMic7	132–146	10	0.46–0.73	132	1	0.0
OvMic11	105–109	3	0.13–0.53	–	–	–
OvMic16	115–147	18	0.13–0.40	–	–	–
OvMic32	131–149	9	0.40–0.80	73	1	0.0
OvMic38	107–131	12	0.26–0.73	131–137	4	0.3
OvMic47	153–167	10	0.80–0.86	–	–	–

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Genus	Supplement 14: 63-65	Wrocław, 15 XII 2007

Classification of the drepanosiphine aphids (Hemiptera, Aphidoidea: Phyllaphidinae, Calaphidinae) in the light of anatomical research*

Karina Wieczorek[1] & Piotr Świątek[2]
Faculty of Biology and Environmental Protection, University of Silesia, Bankowa 9, 40-007 Katowice, Poland, [1] Department of Zoology, karina.wieczorek@us.edu.pl , [2] Department of Histology and Embryology of Animals, piotr.swiatek@us.edu.pl

Abstract. The structure of the male reproductive system of 3 drepanosiphine aphid species, *Myzocallis carpini* (Koch, 1855), *Myzocallis coryli* (Goeze, 1778), and *Phyllaphis fagi* (Linne, 1767), is discussed. The histological analysis of the structure of the male reproductive system (paraffin method, semi-thin sections and total preparation) have been used to supplement morphological data in order to explain the taxonomy of these aphids.

Key words: classification, the male reproductive system of aphids, Phyllaphidinae, Calaphidinae.

INTRODUCTION

Classification of the drepanosiphine aphids, one of the largest and most diverse aphid groups, is still far from settled. The status of particular taxa, especially at the subfamily and tribe level, is flexible, various aphid genera are included or omitted from this group of aphids (e.g. Borner 1952; Bodenheimer & Swirski 1957; Shaposhnikov 1964; Stroyan 1977) and, more often than not, the authors do not provide any criteria for this division.

Among more recent approaches, based on phylogenetic characters, Heie (1987) divides the family Drepanosiphidae (1980, 1982) into 3 subfamilies: Drepanosiphinae, Phyllaphidinae and Chaitophorinae. In contrast, Quednau (1999, 2003), referring to the classification of aphids proposed by Remaudiere & Remaudiere (1997), divides drepanosiphine aphids into 12 subfamilies (Mindarinae, Neophyllaphidinae, Lizeriinae,

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Israelaphidinae, Taiwanaphidinae, Pterastheniinae, Spicaphidinae, Macropodaphidinae, Saltusaphidinae, Phyllaphidinae, Drepanosiphinae, Calaphidinae). In comparison with HEIE's classification, the subfamily Chaitophorinae is excluded from, and the subfamily Mindarinae included in, the drepanosiphine aphids; moreover, the range of the subfamily Phyllaphidinae is different.

Anatomical analysis based chiefly on the changes in the structure of the male reproductive system has been successfully employed to verify views on the classification of aphids. Earlier researches into the structure of this systems of the drepanosiphine aphids have shown distinct developmental trends among particular subfamilies (GŁOWACKA et al., 1974; WIECZOREK & WOJCIECHOWSKI 2001), suggested a close relationship between Drepanosiphinae and Chaitophorinae (WIECZOREK & WOJCIECHOWSKI 2004), and identified a number of shared characters in the structure of the male reproductive system of Calaphidinae (WIECZOREK 2006).

The present research – histological structure and ultrastructure (in preparation) of selected species of drepanosiphine aphids, as a supplement to morphological data traditionally used in taxonomy – aims at better understanding of evolutionary relationships among these aphids.

MATERIAL AND METHODS

Adult males of *Myzocallis carpini* (KOCH, 1855), *Myzocallis coryli* (GOEZE, 1778) and *Phyllaphis fagi* (LINNE, 1767) were collected in the vicinity of Katowice in October 2006. For a plane reconstruction and histological analysis of the male reproductive system of the studied species, the paraffin method (sections of 5-6 μm) and Epon – 812 - immersed material in semi-thin sections (0,7 μm) were used. A series of microtome slides was prepared, as well as total preparations of the male reproductive system. Material was analysed under the light microscope Olympus BX 60, the research was documented by photographs and drawings.

RESULTS AND DISCUSSION

The structure of the male reproductive system of *M. carpini* and *M. coryli* is similar: each of the paired testes *(testes)* consists of 3 follicles which are strongly elongated, 375-625μ long and 70-175μ wide, and overlapping. Vasa deferentia (*vasa deferentia*) run separately along their length (1014μ), their walls cling together only in the proximal part. The ejaculatory duct is reduced, the outlets of accessory glands and vasa deferentia open to it separately. The main difference is in the size and the position of accessory glands *(glandulae accessoriae)* - in *M. coryli* they are much longer (1014μ) than in *M. carpini*, and asymmetric. This kind of structure resembles the male reproductive system of another representative of the same genus, *Myzocallis (Lineomyzocallis) walshii* (MONELL, 1879), which is a Nearctic species lately introduced to Europe. Moreover, it is similar to the structure of this system in other described species of the subfamily Calaphidinae (Phyllaphidinae sensu HEIE 1982) (WIECZOREK 2006).

The male reproductive system of *P. fagi* is marked by 3 short, lobate follicles in a testis (475-741μ long and 140-234μ wide), arranged in a rosette. Vasa deferentia run separately, their walls cling together only in the proximal part, they are expanded in 2/3 of their length. Accessory glands are club-shaped and elongated (585-624μ); the ejaculatory duct is reduced. HEIE (1982) has placed this species in the tribe Phyllaphidini and subfamily Phyllaphidinae. Although REMAUDIERE & REMAUDIERE (1997) and QUEDNAU (1999, 2003) have also classified it in the subfamily Phyllaphidinae, the range of this subfamily in their view is different from that in Heie's classification. Thus, it seems an urgent task to verify views on the taxonomic position of these species and on the range of the subfamily Phyllaphidinae. It is hoped that, on the basis of morphological characters and anatomical data (in particular histological structure and ultrastructure - WIECZOREK & ŚWIĄTEK in preparation), it will be possible to identify the actual phylogenetic relationships as well as the universal classification of this large group of aphids.

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Genus	Supplement 14: 67-69	Wrocław, 15 XII 2007

Classification of the true bugs of the subfamily Peiratinae (Heteroptera: Reduviidae)*

DOMINIK CHŁOND
Department of Zoology, Faculty of Biology and Environmental Protection, University of Silesia,
Bankowa 9, 40-007 Katowice, Poland, e-mail: dominik.chlond@us.edu.pl

ABSTRACT. Subfamily Peiratinae of the assassin bugs (Reduviidae) is numerous and distributed worldwide. Still, there are few papers revising genera of this subfamily. Very little attention has been given so far to *Sirthenea* SPINOLA, one of the largest and most numerous genera in this subfamily. The revision of this and other genera will be the basis for the taxonomic study and for the study of relationships within subfamily Peiratinae.

Key words: Heteroptera, Reduviidae, Peiratinae, classification, revision.

Subfamily Peiratinae of the assassin bugs (Reduviidae) is numerous and distributed worldwide. 32 genera and over 300 species have been described so far (MALDONADO-CAPRILES 1990; COSCARÓN et MORRONE 1995; COSCARÓN 1995, 1996, 1997a; GIL-SANTANA et COSTA 2003; CAI et TOMOKUNI 2004, CAI et TAYLOR 2006); however, only a few taxa have been studied in detail.

The subfamily name Peiratinae was first used by Amyot i Serville (1843), who coined it from the genus *Peirates* described by Serville (1831). Since that time, the taxonomy of this subfamily has changed several times because new species were discovered and described, while those already known were synonimised.

Genus *Peirates* SERVILLE is one of the best analysed genera in this subfamily. As a result of a revision, two other genera, *Cleptocoris* STÅL and *Spilodermus* STÅL, have been synonimised with *Peirates* SERVILLE (COSCARÓN et MORRONE 1995; COSCARÓN, 1996); moreover, cladistic and biogeographical analyses have been conducted. Cladistic analysis based on 51 morphological characters showed three distinct groups in this genus: *Peirates quadrinotatus* group, *P. singularis* group and *P. lepturoides* group.

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The most important morphological characters in this analysis concerned *pronotum* and *scutellum* (COSCARÓN 1997b).

A similar research has been conducted on genus *Rasahus* AMYOT et SERVILLE (COSCARÓN 1983a, 1990, 1994a), species of *Sirthenea* SPINOLA from North and South America (WILLEMSE 1985), and China (CAI et LU 1990), species of *Ectomocoris* MAYR distributed in China (CAI et LU 1991), as well as less numerous genera, such as *Eidemannia* TAEUBER (COSCARÓN 1986, 1989), *Melanolestes* STÅL (MCPHERSON et al. 1991; COSCARÓN et CARPINTERO 1994; COSCARÓN et MORRONE 1994), *Phorastes* KIRKALDY (LENT et JURBERG 1966; VAN DOESBURG 1981), *Tydides* STÅL (LENT 1955; LENT et JURBERG 1967), and *Tymbreus* STÅL (COSCARÓN 1994b).

One of the most interesting genera, distributed world-wide but not fully studied, is *Sirthenea* SPINOLA, which contains 35 species and many subspecies (MALDONADO-CAPRILES 1990, CAI et TOMOKUNI 2004). A taxonomic revision of 12 species from the New World and 3 species from China has been attempted so far by WILLEMS (1985) and CAI et LU (1990). Their works contain descriptions of morphological characters and keys to 15 species and 8 subspecies as well as information on the distribution. Many species, mostly from Africa, still need detailed study.

Results of continually updated research into various genera of subfamily Peiratinae, their revision and cladistic analysis help construct more consistent phylogenetic trees, as in the case of *Peirates* SERVILLE (COSCARÓN 1983b). Analyses of the distribution of the genera and species of this subfamily in the world supplement such studies, making it possible to account for chorological elements, which make the analysis of cladograms based on morphological characters much easier.

Classification of Peiratinae is subject to constant changes; thorough research into other genera of this subfamily will help determine phylogenetic relations within this group of insects. It is worth noting that more and more often such studies propose a detailed description of morphological characters which may serve as a basis to confirm the taxonomic position of a particular genus. A thorough examination of a large number of characters will help construct cladograms which are closer to the natural system. This, in turn, will make it possible to trace phylogenetic relations within subfamily Peiratinae and its phylogenetic links with other subfamilies of Reduviidae.

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Genus	Supplement 14: 71-75	Wrocław, 15 XII 2007

A new species of the genus *Peritropis* from Brunei (Heteroptera: Miridae: Cylapinae)*

ANDRZEJ WOLSKI[1] & JACEK GORCZYCA[2]
[1]Plant Protection Institute, Sośnicowice, Gliwicka 29, 44-153 Sośnicowice, Poland, e-mail: a.wolski@ior.gliwice.pl
[2]Department of Zoology, University of Silesia, Bankowa 9, 40-007 Katowice, Poland, e-mail: gorczyca@us.edu.pl

ABSTRACT. A new species of *Peritropis bruneica* is described on the basis of specimens collected in Brunei. The key to the species of *Peritropis-thailandica* group from the Oriental Region is presented. Dorsal habitus of the new species and the pictures of male genitalia are given.

Key words: Cylapinae, Heteroptera, Miridae, new species, *Peritropis*.

INTRODUCTION

The genera *Peritropis* UHLER and *Fulvius* STÅL are the most numerous of the subfamily Cylapinae. Genus *Peritropis* contains more than 70 species known all over the World (SCHUH 1995; GORCZYCA 2006a; MOULDS and CASSIS 2006). This genus is the most speciose in the Old World, where about 50 species have been reported so far (GORCZYCA 2006ab). In a recent revision of this genus from the Oriental region, five groups of species were established: *lewisi*, *nigripenis*, *poppiana*, *suturella* and *thailandica*, on the basis of coloration and external morphology (GORCZYCA 2006b). The *thailandica*-group contains three species in the Oriental Region: *P. electilis* BERGROTH, *P. sulawesica* GORCZYCA and *P. thailandica* GORCZYCA.

Within the material borrowed from the Natural History Museum in London, the senior author found two representatives of the genus *Peritropis* belonging to the *thailandica*-group. They represent a new species, whose description is given below.

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TAXONOMY

Key to species of *thailandica*-group of Oriental Region

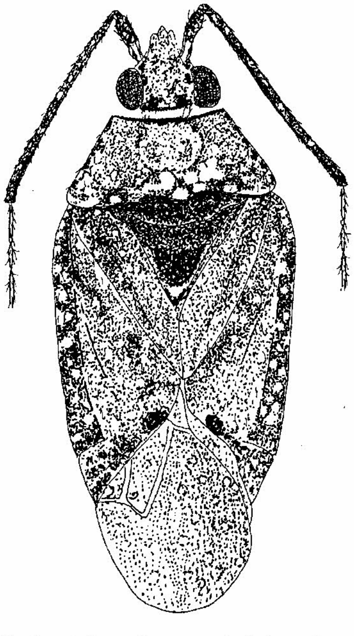
1. Length of the body about 3 mm .... 2.
- . Length of the body about 3,5 mm or more. .... 3.
2. Head dark, covered with small, pale patches, pale patches on scutellum well visible .... *electis* BERGROTH
- . Head pale, with red pattern, pale patches on scutellum slightly visible, it seems unicoloured dark brown (except pale patch near apex) .... *bruneica* n. sp.
3. First and second antennal segment pale, almost unicoloured, mesoscutum and scutellum dark brown, almost unicoloured (except white apex) .... *sulawesica* GORCZYCA
- . First and second antennal segment not pale, mesoscutum and scutellum mottled, not unicoloured (except white apex) .... *thailandica* GORCZYCA

***Peritropis bruneica* n. sp.**

(Figs. 1-6)

DIAGNOSIS

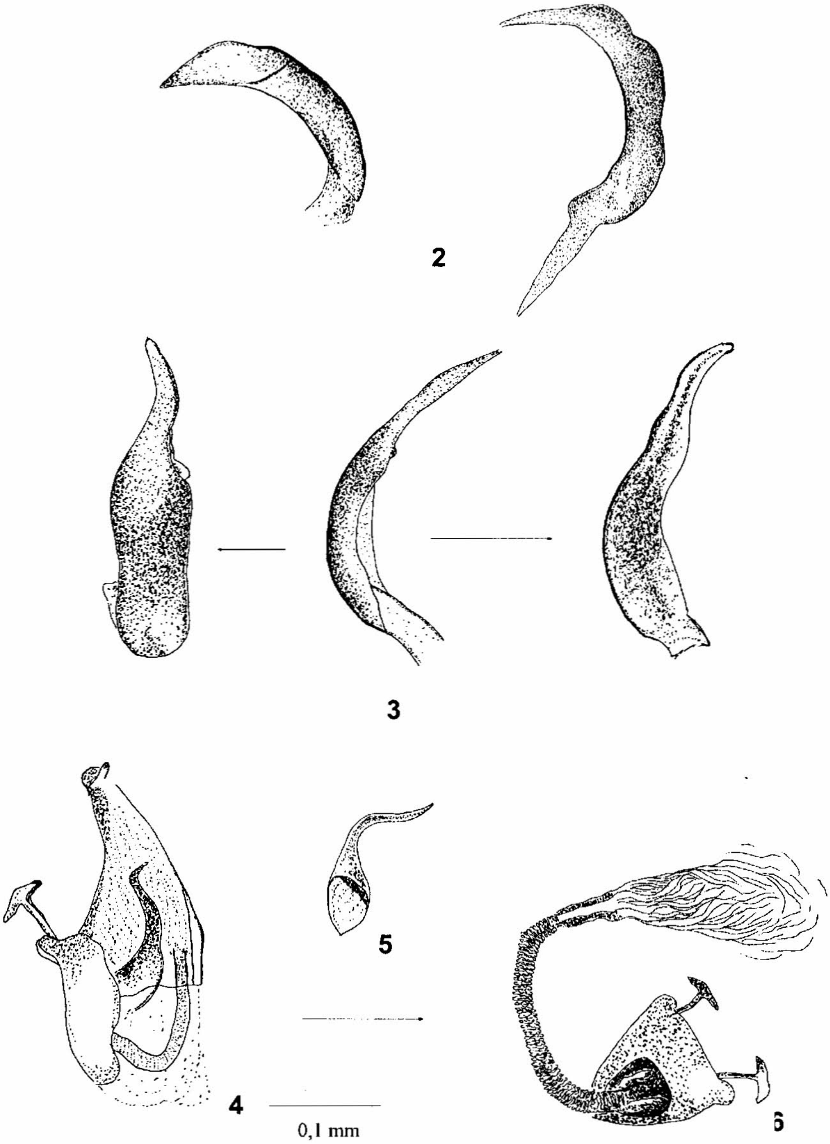
This species is distinguished from *Peritropis annulicornis* Poppius and *Peritropis punctatus* CARVALHO et LORENZATO from Papua New Guinea by the coloration of second antennal segment and male genitalia (figs 1-6).



1. *Peritropis bruneica* sp. n., holotype, dorsal habitus

DESCRIPTION

Male (female unknown): Body small, pale brown reddish, covered with pale, short, scale like setae and small, pale patches, length of the body 2.55-2.65 mm, width 1.15-1.30 mm. Head pale, covered with pale, short, scale like setae, mottled with red pattern, two brown patches on occipitale carina, two pair of patches on frons, besides



2-6. *Peritropis bruneica* sp. n., holotype. male genitalia, 2 – left paramere, 3 – right paramere, 4 – aedeagus, 5 – vesical spiculum, 6 – aedeagus without theca eyes, vertex with thin, longitudinal sulcus at middle, eyes dark grey reddish, length of head 0.50-0.53 width 0.60-0.64 mm, diameter of eye 0.16-0.19 mm. First antennal segment covered with pale, scale like setae, basal part pale, with a reddish brown spot laterally, then reddish brown. Second antennal segment pale brown, mottled with pale patches, covered with pale, lying dense, scale like setae. Third and fourth segments brown, covered with pale, stick, erect and semi-erect setae. Fourth segment divided, slightly thickened toward apex. Length of antennal segments in mm: 0.27-0.34; 1.0-1.09. 0.29-0.31; 0.39. Rostrum pale, reaching the middle of abdomen.

Pronotum pale, with brown and red spots and patches, pronotal collar invisible. Anterior lobe of pronotum raised, tinged with red, with a short, longitudinal sulcus at middle, lateral margins with distinct dark spots, posterior margin paler, slightly sinuate, with two distinct, broad stripes in the middle. Length of pronotum 0.44 mm, the anterior margin of pronotum 0.53-0.60; lateral margins 0.44-0.50 mm, posterior margin 1.04. Mesoscutum dark brown with indistinct pale patches. Scutellum dark brown with a hardly visible pale patches in the middle and laterally and with distinct pale path near apex, apex dark brown.

Hemelytra pale brown, covered with short setae and pale patches. Corium tinged with red in the middle and with large, brown patch contiguous with membrane. Embolium and cuneus with brown and red patches, cuneus slightly darker than embolium. Membrane grey, with paler pattern, venation distinct, grey, with pale spots.

Body brown ventrally, covered with pale, lying setae, coxae pale, remaining parts of legs are broken in the specimen examined.

TYPE MATERIAL

Holotype (male): BRUNEI: Bukit Sulang, nr Lamunin, N.E. Stork, 20.viii-10.ix.82, fogging, B.M. 1982-388. Tree 16: Shorea johorensis Fox. Dipterocarp; paratype (male): Bukit Sulang, nr Lamunin, N.E. Stork, fogging , 20.viii-10.ix.82, B.M. 1982-388. Tree 17: Shorea johorensis Fox. Dipterocarp. Both housed in the Natural History Museum in London.

DISTRIBUTION

Brunei: Bukit Sulang.

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Genus	Supplement 14: 77-81	Wrocław, 15 XII 2007

Anatomical and molecular studies of *Stenodema* LAPORTE genus (Heteroptera: Miridae)*

EWA MRÓZ
Department of Zoology, University of Silesia, Bankowa 9, 40-007 Katowice, Poland,
e-mail: ewmroz@op.pl

ABSTRACT. In this paper, the results of anatomical and molecular studies on some species of *Stenodema* genus have been presented. The results confirm separation of two subgenera: *Brachystira* and *Stenodema*.

Key words: entomology, taxonomy, Stenodemini, Miridae, Heteroptera, male reproductive system, 16S rRNA, COI.

INTRODUCTION

Stenodema LAPORTE is the most numerous genus within Stenodemini CHINA tribe (SCHUH 1995). 49 species occuring all over the world have been described so far, 6 of them occur in Poland (KERZHNER et JOSIFOV 1999). All the species belonging to this genus are phytophagae, feeding on different kinds of grass (*Poaceae*) (WACHMANN et al 2004).

There are two subgenera within this genus: *Brachystira* FIEBER and a nominative subgenus. Initially, *Brachystira* has been determined as an individual genus with a typical species *Miris calcaratus* (FALLEN 1807). Later, it has been considered as a subgenus within *Stenodema* (KERHNER et JOSIFOV 1999).

Three species are included into *Brachistyra* subgenus: *Stenodema calcarata* (FALLEN 1807), *S. pilosa* (JAKOVLEV 1889), *S. trispinosa* REUTER,1904 (KERZHNER et JOSIFOV 1999).

The above-mentioned subgenera have been determined basing on morphological features. All the representatives of *Brachystira* have distinctive spines on their metafemora, while the representatives of *Stenodema* lack that feature.

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The objective of this research is to determine whether there are any anatomical and molecular differences between these both subgenera.

MATERIALS AND METHODS

Males of 3 species belonging to the *Stenodema* genus have been analysed: *S. (B.) calcarata* (FALLEN, 1807), *S. (S.) holsata* (FABRICIUS, 1787), *S. (S.) laevigata* (LINNAEUS, 1759). The individuals of *S.calcarata* species came from 5 countries: Spain, Japan, Kazakhstan, Korea and Poland. The *S. laevigata* individuals came from Spain and Poland.

In order to make anatomical analyses, gathered material and data were consolidated in Carnoy liquid. The paraffin method, together with standard histological methods, was used to make specimens.

These specimens were coloured by sour Erlich hematoxilin, oxygenated under running water and differentiated by 0,5% xylidine ponceau (in 1% acetic acid) (BAGIŃSKI1969).

Two species were used to make molecular analyses: of *S. (B.) calcarata* and *S. (S.) laevigata.*

The analysed species were consolidated in 96% of ethynol. Next, each individual was homogenized to isolate the whole DNA.

Samples of isolated DNA were treated with PCR (SAIKI et al 1988; SIMON et al 1991) to multiply and isolate the fragments of genes that were of interest to us , namely COI and 16S rRNA.

Primers used normally in such analyses among similar groups of insects were used to amplify both genes. The primers used for 16S rRNA gene were as follows: LR-K-13417, LR-J-12961 (SIMON et al 1994; HEBSGAARD et al 2004), while for COI we used the primers: C1J2183 and TL2-N-3014 (SIMON et al 1994; DAMGARD et al 2001).

The sequences were obtained in the form of chromatograms, which were then analysed with the usage of Chromas 1.45 programme (MCCARTHY 1988), as well as Clustral X (THOMPSON et al 1997).

After adjusting the sequences, genetic distances between sequences of some species were calculated using BioEdit program DNADist (HALL 1999).

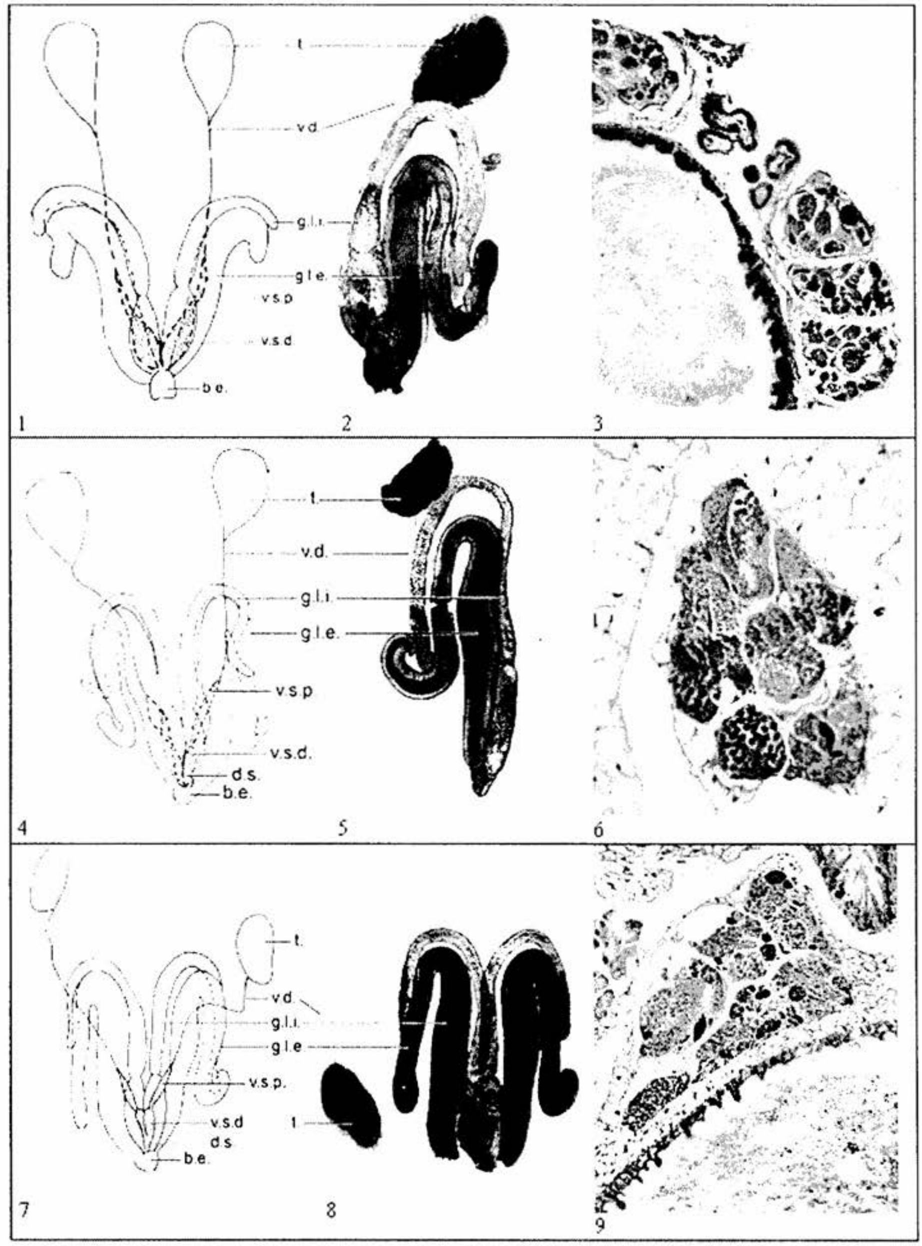
RESULTS

ANATOMICAL RESEARCHES

In the course of the research it has been proved that the species of the *Stenodema* genus are characterised by similar features of structure of the male reproductive system (Figs 1,2,4,5,7,8), but essential differences were found in the amount of testis follicles within individual subgenera. *S. (B.) calcarata* has 3 testis follicles (Fig 3), while species of *S. (S.) laevigata* (Fig 6) and *S. (S.) holsata* (Fig 9) have 6 testis follicles each.

MOLECULAR RESEARCHES

The alcali sequences obtained in the case of 16S rRNA were of the following lengths: *S. (B.) calcarata* 442p, while *S. (S.) laevigata* - 440pz . In the case of COI, the length of the sequences for both species was 839pz.



1- 9. Male reprodactive system: 1-3 *Stenodema (B.) calcar*ata, 4-6 *Stenodema (S.) laevigata*, 7-9 *Stenodema (S.) holsata*: t.- testes, v.d. – vas deferens, g.l.i - internal lateral gland, g.l.e. - external lateral glands, v.s.p.- proximal seminal vesicles, v.s.d.- distal seminal vesicles ,d.s.- ductus seminis, b.e. - bulbus ejaculatorius. 3, 6, 9. Testicular follicle of adult male in cross-section (x100)

Both markers had the majority of rules characteristic of insects, namely A+T 74,21-74,32 16S rRNA, 70,08-68,89 COI. The genetic distances calculated between these two species in the case of 16S rRNA were 0.0574, while in the case of COI they were 0.1231-0,1254.

The anasyses proved that the sequences of COI gene are far less conservative that those of 16S rRNA. Little differences in the sequence of this gene between two individuals belonging to one species were observed. Such differences were not noticed at the 16S rRNA marker, where the analysis was based on 3 individuals of 1 species. The value of the distances in these sequences was always 0,0000.

DISCUSSION

The amount of testis is one of the most frequently analysed features when taking a closer look at the build of a reproductive system. The basic amount of testis follicles in a nucleus of insects is in agreement with the amount of pregenital sequences and equals 7 (Sharov 1966). It can be reduced in the process of oligomerization, which happens independently in individual families (Pendegrast 1957, Grozeva et Kuznetzova 1992).

The older taxons usually have more testis. The analysis of 72 species of the Mirinae subfamily proved that 83,33% of the analysed species have 7 testis follicles (Akingbohungbe 1983). We can, therefore, conclude that the amount of 7 testis follicles in the Mirinae subfamily is a phlesiomorphic feature.

Basing on the obtained results, we can say that the build of the reproductive system of males of *Stenodema* genus is characterised by homogeneity and similarity of build between individual species. The changes are mainly comprised of reduction of the amount of testis follicles, the so-called oligomerization process at *Brachystira* subgenus. The differences are, nevertheless, essential, as such a big difference in the amount of testis follicles has never been observed at species belonging to one genus, before so far in no group of analysed Heteroptera (Akinboughe 1983).

In all the individuals belonging to *Stenodema calcarata* species the build of the system has always been identical (Figs 1, 2), and the amount of testis follicles was 3 (Fig 3), while in species belonging to *Stenodema* subgenus the amount of testis was 6 (Figs 6, 9).

The molecular analyses based on two mitochondrial markers of COI and 16S rRNA show a bigger difference in nucleotide sequences between species belonging to these two subgenera than between different genera within this tribe. The values of genetic distances between these two species obtained in the case of a 16S rRNA marker are ex. three times bigger than the obtained value of distances between species belonging to *Notostira* genus,while in the case of a COI marker-two times bigger.

The are therefore faced with the question: the *Brachystira* subgenus be promoted to a genus?

In order to answer this question, similar researches on a bigger amount of species from both subgenera need to be conducted.

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Genus	Supplement 14: 83-88	Wrocław, 15 XII 2007

Balticoleria michaeli, gen. et spec. nov. from Eocene Baltic amber (Diptera: Heleomyzidae)*

ANDRZEJ J. WOŹNICA
Department of Zoology & Ecology, Wrocław University of Environmental & Life Sciences, 51-631 Wrocław, Kożuchowska 5b, Poland, e-mail: woznica@ozi.ar.wroc.pl

ABSTRACT. The new genus and new species *Balticoleria michaeli* from Baltic amber is described and illustrated. Its systematic position is discussed. A key for identification of heleomyzine genera from Baltic amber is provided.

Key words: Diptera, Heleomyzidae, *Balticoleria*, new genus, new species, phylogeny, Eocene, Baltic amber.

INTRODUCTION

The family Heleomyzidae is a remarkable group of acalyptrate flies, having probably appeared in the late Cretaceous or Early Palaeogene. Fossil representatives of the family are known from amber, compression and copal. Thus far, seven species representing seven genera have been described from Baltic amber only (WOŹNICA 2006). Five of these genera are extinct and only three of them belong to the subfamily Heleomyzinae in the sense of GORODKOV (1972) (WOŹNICA 2005, 2006) and are keyed below. During examination of a personal collection of amber heleomyzid flies of MICHAEL VON TSCHIRNHAUS (Bielefeld, Germany) an undescribed species representing an unknown heleomyzid genus has been found and is described herein. Similarily to other representatives of the subfamily Heleomyzinae, the frontal plate is parallel to eye margin, central cheek bristle is absent, proepimeral bristle well developed, more than one ventral bristle on mid tibia is present, and anal vein distinctly reaches the wing margins. The fossil genus *Electroleria* HENNIG 1965, which lacks the proepimeral bristle, is not included in the key presented herein (WOŹNICA et PALACZYK 2005), because it belongs to another subfamily (WOŹNICA in prep.).

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MATERIAL AND METHODS

The holotype specimen is housed in a private collection of MICHAEL VON TSCHIRNHAUS (Bielefeld, Germany). The figures are based on original drawings of the specimen and photographs taken using a Canon EOS 350D digital camera to a Nikon SMZ800 microscope in conjunction with the computer program Designer 4.1 and Corel Photopaint X3. In order to protect against damage, the amber piece is embedded in an artificial resin. The size of the cuboid is as follows: 15,33x11,00x8,33 (all in mm).

Specimen was measured (with accuracy of to 0.01mm), and the results were used to calculate the various indices defined below. The morphological terminology and abbreviations follow those proposed by WOŹNICA (2003).

ACKNOWLEDGEMENTS

I am very grateful to Dr. MICHAEL VON TSCHIRNHAUS (Bielefeld, Germany), for making the specimen available for the present study. Also, I wish to express my appreciation to Prof. RYSZARD SZADZIEWSKI for all his comments and insights during the preparation of the manuscript.

SYSTEMATIC PALAEONTOLOGY

Order Diptera LINNAEUS, 1758
Family Heleomyzidae BEZZI, 1911
Subfamily: Heleomyzinae BEZZI, 1911

DESCRIPTION

Balticoleria WOŹNICA gen. nov.

Type-species: *Balticoleria michaeli* spec. nov. Present designation.

ETYMOLOGY

Gender: feminine. The name derived from the name of the locus typicus (Baltic sea region) and the generic name *Leria* (=*Heleomyza*).

DIAGNOSIS

Balticoleria is a unique genus, which differs distinctly from other fossil and recent genera in the following combination of character states: one proepimeral and one distinct stigmatal bristles present, no prescapullars, only 3 postsutural dorsocentrals (0+3), one well developed katepisternal, one pair of prescutellars, 2 pairs of variable-length scutellar bristles, and mid tibia with one preapical bristle and few ventral setulae. The characters of the mesonotal chaetotaxy and the distinct stigmatal bristle constitute the autapomorphies of *Balticoleria*. The chaetotaxy is similar in number of dorsocentrals to those in *Tephrochlamys* LOEW (Heteromyzini), but the lack of the central cheek bristle and the absence of prescapulars, distinguish from it as well.

***Balticoleria michaeli* spec. nov.**

(Figs 1-2)

ETYMOLOGY

The name of the species is dedicated to Dr. MICHAEL von TSCHIRNHAUS, for his passion in collecting inclusions of the acalyptrate flies in amber.

DIAGNOSIS

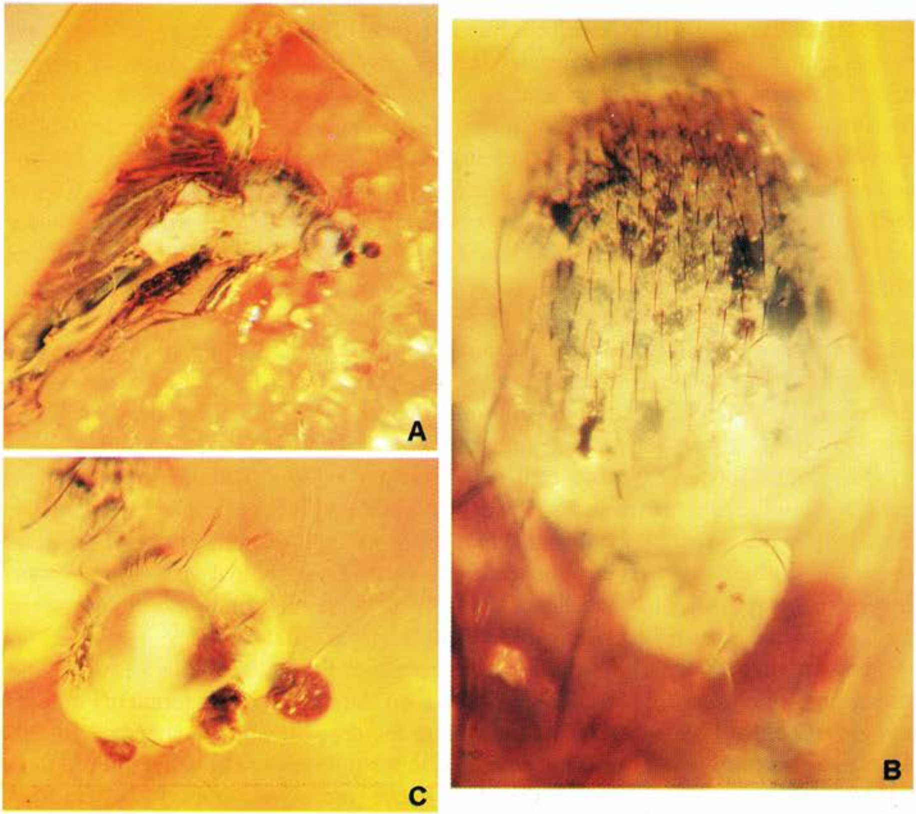
As for the genus.

DESCRIPTION

Body colour greyish-brown and a great part of mesonotum silver greyish dusted (Fig. 1A). Body length: ca. 3.4 mm (without antennae).

Head:

Head ratio: ca. 1.1. Face slightly depressed under antennae. One big vibrissa present, genal setulae well developed, situated in one or two irregular rows (Fig. 2B).



1. *Balticoleria michaeli* WOŹNICA sp. n:. A - total habitus, B - mesonotum, C - head

Central cheek bristle absent. Eyes round and big. Cheeks broad and greyish (cheek-eye ratio ca. 0.45).

Face similar in colour to the cheeks area. Hypostom orange-brownish, palpus dark brown, corpulent, regularly broad and rounded apically. The distance from anterior to posterior orbital bristle equal to the distance from anterior frons margin to anterior orbital and equal to the distance from posterior orbital to first vertical bristle. Frons slightly brownish.

Antenna between scape and pedicel not deflexed. Scape and pedicel and first flagellomere brown. Pedicel with big apical seta in the anterodorsal part. First flagellomere large, round and brown (first-flagellomere to cheek ratio ca. 1.0). Arista slightly shorter than height of head and minutely pubescent, brownish in colour, with typically swollen basal part. Frons covered by some black setulae. Frontal plate elongated, parallel to eye margins. Two orbital bristles present, the anterior one ca. 0.9 of the posterior one and both not reclinated. A pair of strong ocellar bristles present. Vertical bristles welldeveloped, both similar in length. Postocellar bristles mediumsized and cruciate. Between outer postocellar and inner vertical a small additional seta present (smaller in size than the postocellar bristle).

Thorax:

Mesonotum (Fig. 1B, 2C) with chaetotaxy typical of Heleomyzini sensu GORODKOV, except for the number of dorsocentrals (0+3). One well developed postpronotal bristle, two notopleural bristles, one presutural, one supra-alar and two post-alar bristles present. Mesonotum is sparsely setulose with a few irregular rows (5-6) of acrostichal setulae. Three pairs of dorsocentral bristles present, all of them not arising from spots. Dorsocentral bristles variable in length, first ca. 0.35 of the second and the second ca. 0.56 of the third one (1,0:2,8:5,0). The distance between first and second dorsocentrals shorter than the distance between second and third one. A pair of well developed prescutellar bristles present (Fig. 1B). Scutellum slightly elongated and bare, except for two pairs of scutellars (the anterior pair slightly longer than the posterior bristles). Proepimeron setulose with one well developed proepimeral bristle. One distinct stigmatal bristle with no additional setae in anterior corner of anepisternum. Anepisternum and meron entirely bare. Katepisternum bare, with one distinct katepisternal bristle, and with a few additional but hair-like setulae anteriorly.

Wing much longer than body length, ca. 4.3 mm, width ca. 1.0 mm. Wing membrane transparent with pale brown veins. Costa with short and weak costal spines dorsally, especially in the anterior part. Costal spines slightly longer than the costal width. Subcostal cell ending at the level of anterior crossvein. Longitudinal veins pale-brown. Anterior crossvein not darkened. Apical part of both veins enclosing posterior crossvein plucked off and destroyed. Halter whitish with triangular-like knob.

Legs normal, short setulose and brown in colour. Fore femur with a row of nine strong and long bristles anterodorsally (less than the width of the femur) (Fig. 2A) and greyish externally (Fig. 1A). Mid and hind femora sparsely and shortly setulose. All tibiae short setulose, each with small and thin single preapical bristles. Fore tibia and fore tarsomere paler in colour than fore femur (more yellowish-grey). Mid tibia with a row of small anterodorsal setae and few ventral apical setulae. Mid and hind leg (including tarsomeres) more greyish. First tarsomere of all tarsi much longer than the second segment.

Abdomen:

The abdomen is barely visible, almost totally moulded, rather short and sparsely setulose with weak lateral marginal bristles. Cerci well separated and haired.

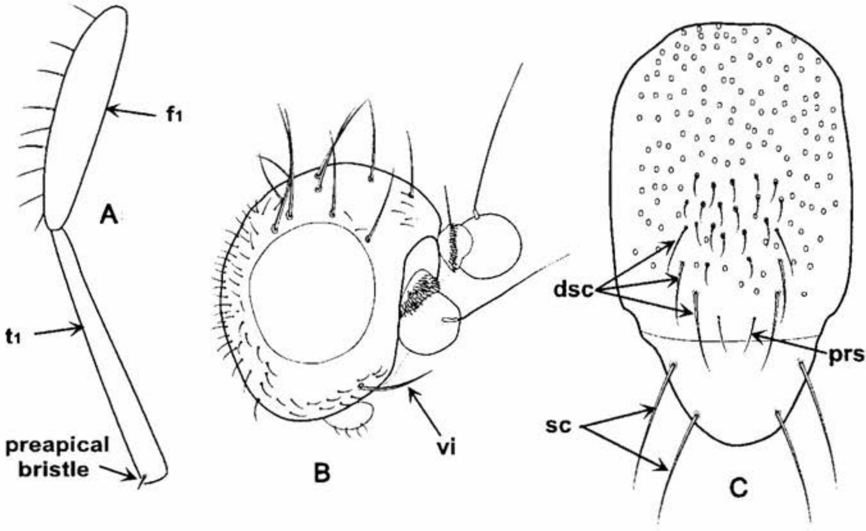
TYPE MATERIAL

Holotype, female, deposited in the collection of Dr. MICHAEL von TSCHIRNHAUS (Bielefeld, Germany). Labelled: *Balticoleria michaeli* WOŹNICA gen. et sp. n. [♀] (red framed).

DISCUSSION

The newly described genus (Plate 1-2) is a typical representative of the subfamily Heleomyzinae in having distinct preapical bristles present on all tibiae, wings with well developed costal spines and sereral ventral setulae on mid tibia. *Balticoleria* is a unique genus within the tribe Heleomyzini. Like other extant genera, *Balticoleria* has two orbitals, but almost equal in length (and not extending from the frontal plate and not as long as in *Paleoheleomyza* WOŹNICA et PALACZYK). Its thoracic chaetotaxy is unique in the scope of all known genera of Heleomyzinae.

The presence of one katepisternal, distinct stigmatal seta, three postsutural dorsocentrals and a bare prosternum distinguishes *Balticoleria* well from other Heleomyzinae as well. However, the taxonomic position of *Balticoleria* within the subfamily is rather unclear. The chaetotaxy is similar in number of dorsocentrals to those of extinct *Chaetohelomyza* HENNIG, but the lack of the prosternal setae, one katepisternal bristle



2. *Balticoleria michaeli* WOŹNICA sp. n. A - fore femur and fore tibia; B - head; C - mesonotum and scutellum

(three in *Chaetohelomyza*) and the absence of posterodorsal setulae on mid tibia distinguish from it as well.

Unfortunately, the important abdominal and postabdominal characters are invisible, so further implications are not allowed. However, it is probably impossible to demonstrate the most expected relationship between various taxa of Heleomyzid flies using only standard cladistic methods (MCALPINE 1985).

KEY TO THE IDENTIFICATION OF FOSSIL GENERA OF THE SUBFAMILY HELEOMYZINAE BEZZI, 1911

1. Presutural dorsocentral bristles present .... 2.
-. Presutural dorsocentral bristles absent .... 3.
2. More than four pairs of dorsocentral bristles and a pair of welldeveloped prescapular setae present .... *Paleoheleomyza* WOŹNICA & PALACZYK 2005
-. Four pairs of dorsocentral bristles present and prescapular setae absent .... *Protoorbellia* WOŹNICA 2006
3. Three katepisternal and two dorsocentral bristles present; mid tibia setulose posterodorsally .... *Chaetohelomyza* HENNIG 1965
-. One katepisternal and three dorsocentral bristles present; mid tibia without posterodorsal setulae .... *Balticoleria* WOŹNICA gen. nov.

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Genus	Supplement 14: 89-172	Wrocław, 15 XII 2007

The species of the genus *Mulsanteus* Gozis, 1875 of Southeast Asia (Insecta: Coleoptera: Elateridae)*

Rainer Schimmel[1] & Dariusz Tarnawski[2]
[1]Wiesenstraße 6, D-66957 Vinningen, Germany, e-mail: rainer.schimmel@web.de
[2]Department of Biodiversity and Evolutionary Taxonomy, Zoological Institute, University of Wrocław, Przybyszewskiego 63-77, 51-148 Wrocław, Poland, e-mail: elater@biol.uni.wroc.pl

Abstract. The known species of the genus *Mulsanteus* Gozis, 1975 of Southeast Asia are revised, new species of this group are described and illustrated, and keys to species and overviews of their geographical distribution in the Oriental region, and in the territories of the Himalaya, as well as in the Wallacea, and in the Papuan sub-region are given. The following species are introduced as new to science: *Mulsanteus brignolii* n. sp., *M. cambodiensis* n. sp., *M. godawariensis* n. sp., *M. hartmanni* n. sp., *M. holzschuhi* n. sp., *M. hubeiensis* n. sp., *M. ingridae* n. sp., *M. irianjayensis* n. sp., *M. kubani* n. sp., *M. langtangensis* n. sp., *M. murenus* n. sp., *M. nepalensis* n. sp., *M. pedongensis* n. sp., *M. pejchai* n. sp., *M. platiai* n. sp., *M. portulinensis* n. sp., *M. pokharanus* n. sp., *M. riesei* n. sp., *M. sausai* n. sp., *M. shaanxiensis* n. sp., *M. sikkimensis* n. sp., *M. weigeli* n. sp., and *M. wudangshanensis* n. sp. For the following species new name combinations are proposed: *Mulsanteus aemulus* (Candèze, 1891) n. comb., *M. anchastinus* (Candèze, 1881) n. comb., *M. antennatus* (Candèze, 1896) n. comb., *M. bonifacyi* (Fleutiaux, 1918) n. comb., *M. borneoensis* (Ôhira, 1973) n. comb., *M. clavus* (Candèze, 1891) n. comb., *M. germanus* (Candèze, 1894) n. comb., *M. hirsutus* (Candèze, 1875) n. comb., *M. hirticornis* (Candèze, 1893) n. comb., *M. illotipes* (Candèze, 1863) n. comb., *M. longicornis* (Fleutiaux, 1936) n. comb., *M. lucidus* (Candèze, 1865) n. comb., *M. maceratus* (Candèze, 1893) n. comb., *M. phillipsi* (Van Zwaluwenburg, 1936) n. comb., *M. rugosus* (Fleutiaux, 1918) n. comb., *M. touffus* (Vats & Chauhan, 1992) n. comb., and *M. tumidicollis* (Schwarz, 1901) n. comb. A analysis of the plesiomorph characteristics shows the genus *Elater* to be the sister-group of the *Mulsanteus godawariensis* basic-group. The following species are removed from the *Mulsanteus*-group, and transferred to the genera *Elater* Linnaeus, 1758, and *Gamepenthes* Fleutiaux, 1928: *Elater vitalisi* (Fleutiaux, 1918) n. comb., *E. hoabinhus* (Fleutiaux, 1936) n. comb., and *Gamepenthes malaisei* (Fleutiaux, 1942) n. comb. *Elater phongsalyensis* n. sp. is described as new to sciences. *Ludius suturalis* Candèze, 1889 is treated as species incertae sedis. The records of *Mulsanteus sausai* n. sp. are the first of species of the genus *Mulsanteus* for the Chinese province Guangxi, those of *M. hubeiensis* n. sp. and *M. wudangshanensis* n. sp. are the first for the province Hubei, and the records of *M. shaanxiensis* n. sp. are the first for the province Shaanxi in China. The records of *M. weigeli* n. sp. from the Maluku islands Ternate and Bacan are the first of species of the

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genus *Mulsanteus* for the zoogeographic sub-region named Wallacea, and the records of *M. irianjayensis* n. sp. from the islands of Biak and Yapen, and from Nabire in Irian Jaya, are the first of species of this genus from the Papuan sub-region.

Key words: entomology, taxonomy, Coleoptera, Elateridae, *Mulsanteus*, new species, new records, revision, Southeast Asia.

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1. INTRODUCTION

This study represents the results of a revision of the *Mulsanteus*-species of the Oriental region including the Wallacea and the Papuan sub-region, as well as the territories of the Himalaya and Tibet. In this paper the Oriental region is divided into the Indo-Chinese sub-region, the Malayan sub-region, the Indian sub-region, the Ceylonese sub-region, and the Wallacea. The Chinese provinces Guangxi, Hubei and Shaanxi, as well as the territory of Hong Kong, are associated here to be parts of the Indo-Chinese sub-region, as their wet-warm, and summer-hot climate classifies them as to belong to the sub-tropical zone. The territory of the Himalaya, which includes Bhutan, and Nepal, as well as the North-Indian provinces Assam, Bengal, Darjeeling, and Sikkim, and the highland of Tibet, is a part of the Palaearctic region. The western part of New Guinea, Irian Jaya, is included into the Papuan sub-region.

The genus *Mulsanteus* has been established by GOZIS (1875) based on the type species *Trichophorus guillebelli* MULSANT & GODART, 1853. As the name *Trichophorus* was published by MULSANT & GODART (1853) in homonymy, pre-occupied for a group of the family Cerambycidae by SERVILLE (1838), and the work of GOZIS (1875) was little known, CANDÈZE (1863, 1865, 1875, 1881, 1889, 1891, 1893, 1894, 1896), FLEUTIAUX (1918), and SCHWARZ (1901) in the following period described new Southeast Asian species of the group under the genus *Ludius* BERTHOLD (1827). However, a part of these species has been later transferred by SCHWARZ (1906) into the genus *Trichophorus* MULSANT & GODART (1853), and FLEUTIAUX (1936) placed it into the genus *Neotrichophorus* YAKOBSON (1913). *Neotrichophorus* was established by YAKOBSON (1913) as the name *Trichophorus* was a nomen praeoccupâtum, but not considering the fact, that an older name, *Mulsanteus*, had already been available at that time. SCHENKLING (1925-27), some years later, overtook the name combinations given by CANDÈZE (1863-1896) and FLEUTIAUX (1936), not considering those of SCHWARZ (1906), and placed the species under *Ludius* BERTHOLD (1827) and *Neotrichophorus* YAKOBSON (1913). KISHII (1983), MIWA (1934), NAKANE & KISHII (1957), and ÔHIRA (1966, 1973) published new species of the group from Japan, Borneo and Taiwan under the genus *Neotrichophorus* YAKOBSON (1913) as well. IABLOKOFF-KHNZORIAN (1974) described the genus *Nairus* based on the species *N. dux* from Armenia, but MARDJANIAN (1987) synonymised *Nairus* with *Neotrichophorus*. As the name *Trichophorus* had been published by MULSANT & GODART (1853) as a homonym, SÁNCHEZ-RUIZ (1996) re-established the next younger name, *Mulsanteus*, that was forgotten for a long time, and treated it as nomen oblitum.

Since that time, there was a need to re-name the known species of the group with new name combinations in accordance with the ICZN. Furthermore, as newly collected material of the genus *Mulsanteus* from Oriental region and from Himalaya became available in addition, a revision on the whole group of these species occurring in Southeast Asia became necessary.

As result of this revision, we propose new name combinations for 17 known Southeast Asian species of the genus *Mulsanteus*, for two of the genus *Elater*, and for one of the genus *Gamepenthes*. 22 further species of the genus *Mulsanteus* from Oriental region, and from Himalaya, as well as from the Wallacea and from the Papuan sub-region are describd as new to sciences. One species is treated in this paper as incertae sedis, because its systematic status could not be cleared.

Together 45 species of the genus *Mulsanteus* are known now from the Oriental region, from Papuan sub-region, from the Wallacea, and from Himalaya. These species are described, illustrated, and keyed below.

2. ABBREVIATIONS AND METHODS

ABBREVIATIONS

The following abbreviations have been used in this study:

CMH	Coll. MERTLIK, Hradec Králové, Czech Republic
CPG	Coll. PLATIA, Gatteo, Italy
CRG	Coll. RIESE, Genova, Italy
CSV	Coll. SCHIMMEL, Vinningen, Germany
CTW	Coll. TARNAWSKI, Wrocław, Poland
HNHM	Hungarian Natural History Museum, Budapest, Hungary
ICZN	International Code for zoological nomenclature
MTD	Museum for Natural History, Dresden, Germany
NMB	Hatural History Museum, Basel, Switzerland
NME	Natural History Museum, Erfurt, Germany
NMW	Natur Historical Museum, Vienna, Austria
SMNS	Staatliches Museum für Naturkunde, Stuttgart, Germany
TICB	TAMMIN, Ins. Coll., Brno, Czech Republic

METHODS

The examination of the collected material has been executed by using a binocular ZEISS, Stemi 2000-C with a micron insert. Photographs were taken with a NIKON E4500 camera with an addaption TV2/3"C 0.63x to the binocular.

Body length of the specimens has been measured from apical margin of frons up to apex of elytra, and body width along basis angles of pronotum, by using the micron insert of the binocular.

The examined specimen are fixed on white pastboard. The genitalia of the males have been pulled out of the abdomen, cleaned and fixed beside the body of the specimen by using water-soluble transparent glue.

Types of new species have been marked with red labels indicating the type status (Holotype or Paratype), and the names of the species and of the author.

Keys to species are given for those occurring in the Indo-Chinese sub-region, in the Malayan sub-region, in the Indian and Ceylonese sub-regions, as well as in the territories of the Himalaya. The given keys are built basing on the characteristics of males. Females of the genus *Mulsanteus* are very rare, and just known for the minority of the species. Their exact determination will only be possible, with studying the appertaining males at the same time (except for *M. pedongensis* which is easy to determine by its body measures and colour). The Sectioning of the zoogeographic regions and sub-regions is in accordance with the work of DE LATIN (1967).

For the construction of the sister-group of the genus *Mulsanteus*, body parts and characteristics of three closely relaterd genera (*Aphanobius*, *Elater* and *Mulsanteus*) have been compared. The constitution of monophyletic basic-groups within the genus *Mulsanteus* is basing on hypothetical plesiomorphies, and by using the principle of parsimony.

3. SYSTEMATIC POSITION, DIAGNOSIS AND TAXONOMICAL REMARKS OF THE GENUS *MULSANTEUS*

Genus *Mulsantheus* Gozis, 1875

Trichophorus (Cerambycidae) Serville, 1838.
Trichophorus (nomen praeoccupátum) Mulsant & Godart, 1853: 181 (nec Serville, 1838).
Mulsanteus Gozis, 1875: 50.
Neotrichophorus Yakobson, 1913: 741.
Nairus Iablokoff-Khnzorian, 1974: 52.

Systematic position and diagnosis

The genus *Mulsanteus* belongs to the tribe Elaterini, Leach, 1815, and is delineated within this group by the following characteristics: Head inclined from centre to apex, frons convex, slightly raised above the base of antennae, and completely edged. Antennae are serrate from fourth antennomere on (fig. 92), second antennomere globular, as long or slightly shorter than the following, third antennomere sub-globular, truncate at apex, both together combined clearly shorter than each of the following antennomeres (fig. 93); antennae covered with long, and conspicuously protruding hairs (fig. 95) in most of the species (except the species of the *M. schaumi*-group, known from Turkey possessing semi-erected hairs on antennae). Metacoxal plates strongly narrowed outwards. Basal angles of pronotum truncate at apex, and bent downward (best visible from lateral view), apices with a tuft of long, spreading, and bristly hairs (fig. 94).

Differential diagnosis

From other genera of the tribe Elaterini, the genus *Mulsanteus* may be easily distinguished by the mentioned characteristics of the basal angles of pronotum, and by the form and pubescence of the antennae.

Taxonomical Remarks

Dolin & Atamuradov (1994) published *Neotrichophorus* (*Mulsanteus*) *turanicus* (Reitter, 1887) for the fauna of Turkmenistan, and provided drawings of the characteristics of the abdominal segment of the larva of this species. These characteristics show conspicuous conformities to those of the species of the *Elater*-group, and therefore it can be established that the systematic position of the genus *Mulsanteus*, based on the characteristics of the adults as well as those of the larva, is well founded.

4. THE SPECIES OF THE GENUS *MULSANTEUS* OF THE INDO-CHINESE SUB-REGION

The material of the genus *Mulsanteus* from the Indo-Chinese sub-region used in this study has been collected in the environments of Cambodia, Laos, Myanmar, Thailand, Vietnam, in the Chinese provinces Guanxi, Shaanxi, Hubei, and Hong Kong, in Tibet and Taiwan.

4.1. KEY TO SPECIES

(*M. wudangshanensis* is not to be determinated by the following key. For determination, see note in the differential diagnosis of the description)

1\. Antennomeres 4-10 truncate at apex .... 2.
–. Antennomeres 4-10 convex to lamellate at apex .... 6.
2\. Body black .... 3.
–. Body brown .... 4.
3\. Punctures of pronotum with simple intersices .... *M. riesei* n. sp.
–. Punctures of pronotum with wrinkled interstices .... *M. shirozui* (ÔHIRA, 1966)
4\. Punctures of pronotum regularly rounded, interstices flat .... *M. anchastinus* (CANDÈZE, 1881)
–. Punctures of pronotum oval to drop-shaped, interstices wrinkled at posterior third ... 5.
5\. Antennae exceeding posterior angles of pronotum by the length of the last antennomere .... *M. sausai* n. sp.
–. Antennae exceeding basis posterior of pronotum by the length of the last two antennomeres .... *M. foldvarii* PLATIA & SCHIMMEL, 2007
6\. Elytra bicoloured .... 7.
–. Elytra unicoloured .... 9.
7\. Elytra black, base reddish-brown .... *M. longicornis* (FLEUTIAUX, 1936)
–. Elytra brown, apical half, or suture and apex black .... 8.
8\. Elytra brown, apical half black .... *M. pejchai* n. sp.
–. Elytra brown, along suture and apex black .... *M. brignolii* n. sp.
9\. Body black, antennae exceeding posterior angles of pronotum by the length of the last four antennomeres .... *M. bonifacyi* (FLEUTIAUX, 1918)
–. Body brown, antennae shorter .... 10.
10\. Antennae exceeding basis angles of pronotum by the length of the last three antennomeres .... 11.
–. Antennae exceeding basis angles of pronotum by the length of the last two antennomeres .... 14.
11\. Antennomeres 4-10 sub-lamellate at apex .... 12.
–. Antennomeres 4-10 convex at apex .... 13.
12\. Interstices of punctures of pronotum wrinkled ...... *M. clavus* (CANDÈZE, 1891)
–. Interstices of punctures of pronotum simple, only at basis wrinkled .... *M. cambodiensis* n. sp.
13\. Dark brown, antennae, and legs lighter brown .... *M. peregovitsi* PLATIA & SCHIMMEL, 2007

–. Black, elytra, legs and antennae chestnut-brown ..... *M. rugosus* (FLEUTIAUX, 1918)
14. Antennomeres 4-10 concave at apex .... 15.
–. Antennomeres 4-10 sub-lamellate at apex .... 16.
15. Body reddish-brown .... *M. rubuginosus* (ÔHIRA, 1966)
–. Body blackish-brown, elytra chestnut-brown ..... *M. shaanxiensis* n. sp.
16. Interstices of punctures of pronotum wrinkled .... *M. hubeiensis* n. sp.
–. Interstices of punctures of pronotum simple .... *M. kubani* n. sp.

4.2. REVIEW OF SPECIES

Mulsanteus anchastinus (CANDÈZE, 1881) n. comb.

(Fig. 1)

Ludius anchastinus CANDÈZE, 1881: 104.
Trichophorus anchastinus (CANDÈZE, 1881): SCHWARZ, 1906: 259.
Neotrichophorus anchastinus (CANDÈZE, 1881): SCHENKLING, 1927: 432; LIU, 1932: 234; WU, 1937: 462; JIANG, 1993: 155.

LOCUS TYPICUS

China: Moupin.

NEW MATERIAL

China: Hong Kong, Tai Po, 1996, 1 spm., leg. G. de Rougemont.

DISTRIBUTION

China: Moupin; Hong Kong.

Mulsanteus bonifacyi (FLEUTIAUX, 1918) n. comb.

(Figs. 2-3)

Ludius bonifacyi FLEUTIAUX, 1918: 228; Schenkling, 1927: 428.
Neotrichophorus bonifacyi (FLEUTIAUX, 1918): FLEUTIAUX, 1936: 295-296.

LOCUS TYPICUS

Vietnam: Tonkin, Hagianh.

NEW MATERIAL

Laos: Huaphanh province, Phou Pan Mts., 12.-17.V.2004, 1 spm., leg. Petr Kresel; Laos: Xamneva, Phu Pan, 1350-2700 m, IV.-V.2001, 1 spm., leg. T. Porion.

DISTRIBUTION

Vietnam: Tonkin.
Laos: Huaphanh; Xamneva.

Mulsanteus brignolii n. sp.

(Figs. 4-5)

LOCUS TYPICUS

Myanmar: Shan State.

TYPE MATERIAL

Holotypus ♂ (CPG): Myanmar: Shan State, Pindaya e Angua Da, 22.V.1983, 1300 m, leg. M. Brignoli.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and moderately shiny species. Length: 9.4 mm, width: 2.4 mm. Black, pronotum reddish-brown with apices of posterior angles black; legs brown; elytra lighter brown, along suture and lateral margin, as well as apex black. Pubescence light-yellowish, long, semi-erect, bristly and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae with conspicuously long and protruding hairs.

DESCRIPTION

Head with dense and simple puncturation, interstices of points half to once their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching the posterior angles of pronotum for the length of the last three antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length, but semi-globular, truncate at apex, and both combined are conspicuously shorter than fourth and each of the following antennomeres; those are extended and convex at apex; last antennomere oval, sub-apical bevelled.

Pronotum campaniform, along median line slightly longer than wide at the posterior angles (length/width ratio 1.02:1.00), prominently and regularly raised at centre, arcuate laterally, and with a relatively prominent dropping at basis. Posterior angles of pronotum slightly divergent, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum without any trace of furrow or mould. Puncturation of pronotum dense, coarse, simple, and rounded to drop-forming, interstices of points at the whole surface flat and shiny.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, and edged at basis, puncturation dense, fine and umbilicate; pubescence dense, fine, and just visible, inclined from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, without an inner tooth. Base of elytra slightly smaller than that of pronotum and slightly depressed at scutellum, margins raised shoulders prominent (winged species). Striae of elytra covered with fine and dense, simple puncturation, interstices of striae finely punctured, shiny, and flat, not raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe noticeably extending parameres, sub-parallel, in middle conspicuously thick, apically slightly narrowed and bevelled. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females unknown.

DIFFERENTIAL DIAGNOSIS

M. brignolii is closely allied to *M. germanus*, but may be easily distinguished from this species by the reddish-brown pronotum, the regularly rounded apex of elytra, and by the form of aedeagus.

ETYMOLOGY

Named after the discoverer of the new species, Mr. M. BRIGNOLI.

DISTRIBUTION

Myanmar: Shan State.

Mulsanteus cambodiensis n. sp.

(Figs. 6-7)

LOCUS TYPICUS

Cambodia: Mondolkiri.

TYPE MATERIAL

Holotypus ♂ (HNHM): Cambodia: Mondolkiri province, Seima biodiv. cons. area, road between Seima and O'Rang, 360 m, at light, 27.I.2006, leg. G. Csorba, L. Duval & G. Ronkay. **Paratypus** ♂ (CSV): Laos: Bolikhamsay province, Phou Khao Kouay NBCA, Tad Leuk waterfall, 280 m, at light, 11.-12.IV.1998, 1 spm., leg. O. Merkl & G. Csorba.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and moderately shiny species. Length: 12.8 mm, width: 3.1 mm. Black, elytra and legs chestnut-brown. Pubescence yellowish brown, long, semi-erect, bristly and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae with conspicuous long and protruding hairs.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum for the length of the last three antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined are conspicuously shorter than the fourth and each of the following antennomeres; those are extended and convex at apex; last antennomere oval, sub-apical bevelled.

Pronotum trapezoid, along median line slightly longer than wide at the posterior angles (length/width ratio 1.08:1.00), prominently and regularly raised at centre, arcuate laterally, and with a relatively prominent dropping at basis. Posterior angles of pronotum straight, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum without any trace of furrow or mould. Puncturation of pronotum dense, coarse, umbilicate, and drop-forming, interstices of points at basis reduced to very small and shiny wrinkles.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, fine and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved and with an inner tooth. Base of elytra slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with rugosities and dense, simple puncturation, interstices of striae finely punctured, shiny, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe noticeably extending parameres, sub-parallel, in middle conspicuously thin, apically slightly narrowed. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females unknown.

DIFFERENTIAL DIAGNOSIS

M. cambodiensis is closely allied to *M. clavus*, but may be easily distinguished from this species by the shorter antennae, the darker colour, by the less dense puncturation of pronotum, and by the form of aedeagus.

ETYMOLOGY

Named after the locus typicus.

DISTRIBUTION

Cambodia: Mondolkiri.

Mulsanteus clavus (CANDÈZE, 1891) n. comb.

(Figs. 8-9)

Ludius clavus CANDÈZE, 1891: 786-787; SCHENKLING, 1927: 428.
Trichophorus clavus (CANDÈZE, 1906): SCHWARZ, 1906: 259.

LOCUS TYPICUS

Myanmar: Carin-Cheba.

NEW MATERIAL

Myanmar: Downa Hills, 29.IV.1994, 1 spm., leg. S. Steinke; Thailand: Mae Hong Son district, Soppong, 10.-13.V.1993, 2 spm., leg. V. Kubáň; same location but 7.-12.V.1996, 2 spm., leg. J. Horák; same location but 23.-27.V.1990, 3 spm., leg. D. Hauck; Thailand: Loei province, Phu Pra Dung, 16.-17.V.1999, 1 spm., leg. M. Rina.

DISTRIBUTION

Myanmar: Carin-Cheba; Downa Hills.
Thailand: Mae Hong Son; Loei.

Mulsanteus foldvarii PLATIA & SCHIMMEL, 2007

(Figs. 10-11)

Mulsanteus foldvarii PLATIA & SCHIMMEL, 2007 (in press).

LOCUS TYPICUS

Taiwan: Shanping, Kaoshiung Hsien.

Mulsanteus hubeiensis n. sp.

(Figs. 12-13)

LOCUS TYPICUS

China: Hubei.

TYPE MATERIAL

Holotypus ♂ (CSV): China: Hubei province, Mulinzi, 30 km north-east of Hefeng, 23.-24.V.2004, leg. J. Turna.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and moderately shiny species. Length: 12.7 mm, width: 3.3 mm. Chestnut-brown, legs and antennae reddish-brown. Pubescence yellowish brown, semi-erect, short, bristly and dense, on pronotum inclined

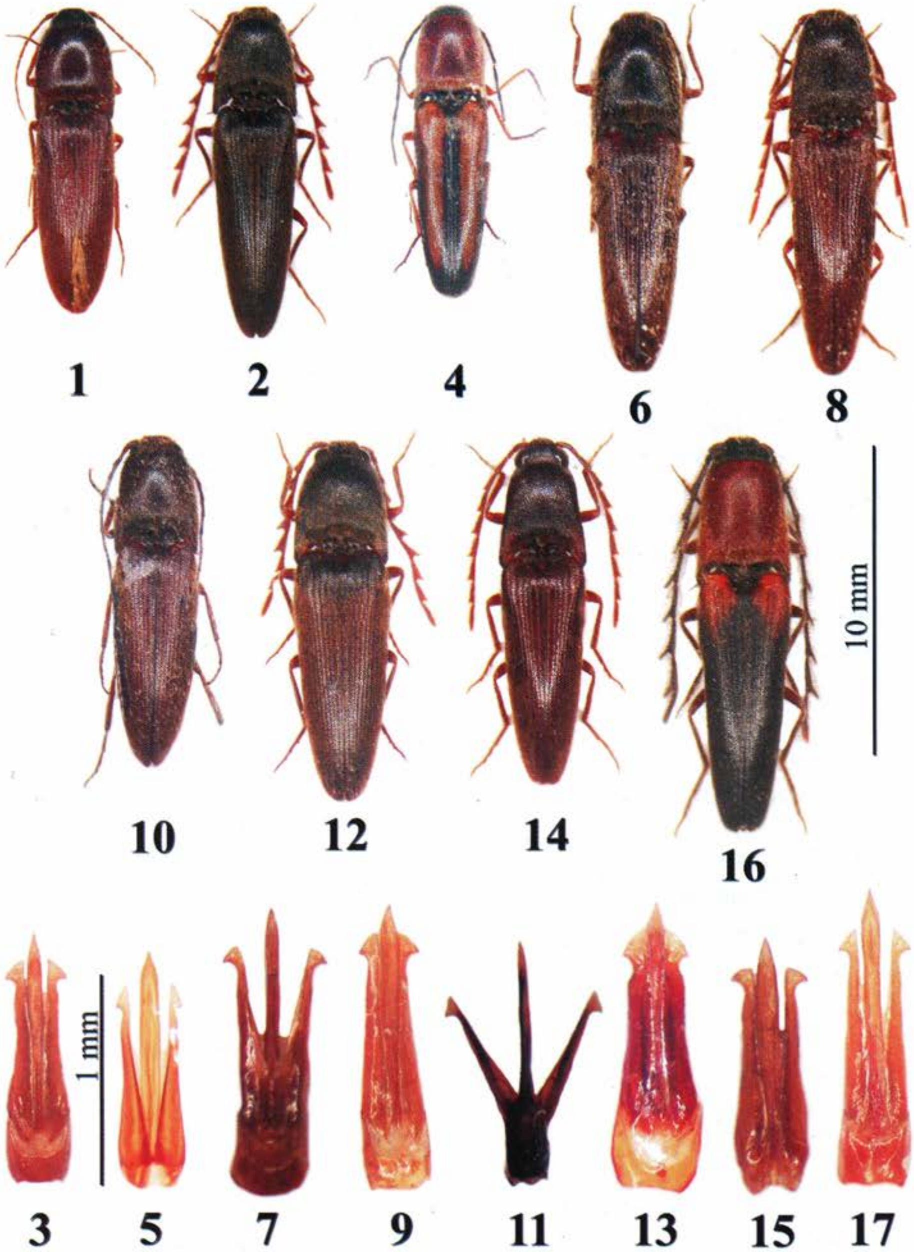


Plate 1 (figs. 1-17). 1. Habitus of *Mulsanteus anchastinus* (Candèze, 1881) n. comb.; 2, 3. *M. bonifacyi* (Fleutiaux, 1918) n. comb.: 2 – habitus, 3 – aedoeagus; 4, 5. *M. brignolii* n. sp.: 4 – habitus, 5 – aedoeagus; 6, 7. *M. cambodiensis* n. sp.: 6 – habitus, 7 – aedoeagus; 8, 9. *M. clavus* (Candèze, 1891) n. comb.: 8 – habitus, 9 – aedoeagus; 10, 11. *M. foldvarii* Platia & Schimmel, 2007: 10 – habitus, 11 – aedoeagus; 12, 13. *M. hubeiensis* n. sp.: 4 – habitus, 5 – aedoeagus; 14, 15. *M. kubani* n. sp.: 14 – habitus, 15 – aedoeagus; 16, 17. *M. longicornis* (Fleutiaux, 1936) n. comb.: 16 – habitus, 17 – aedoeagus to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae with moderate long and protruding hairs.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points less than half their diameter, and forming small wrinkles, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long and serrate from fourth antennomere on, outreaching posterior angles of pronotum for the length of the last two antennomeres; second antennomere short, globular, as long as wide; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined slightly shorter than fourth and each of the following antennomeres; those are extended and lamellate at apex; last antennomere oval, sub-apical bevelled.

Pronotum trapezoid, along median line slightly longer than wide at the posterior angles (length/width ratio 1.05:1.00), prominently and regularly raised at centre, arcuate laterally, and with a prominent dropping at basis. Posterior angles of pronotum convex, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum without any trace of furrow or mould. Puncturation of pronotum very dense, coarse, umbilicate, and sub-oval to drop-forming, interstices of points at the whole pronotum reduced to small and shiny wrinkles.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, fine and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, with a very small apical tooth. Base of elytra slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with rugosities and dense, simple puncturation, interstices of striae roughly punctured, shiny, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with little longer and more protruding bristles.

Aedeagus with median lobe just extending parameres, sub-parallel, in middle slightly thickened, apically narrowed and triangular. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females unknown.

DIFFERENTIAL DIAGNOSIS

M. hubeiensis is closely allied to *M. sausai*, but may be easily distinguished from this species by the smaller body, the darker colour of legs and antennae, by the much denser puncturation of pronotum, and by the form of aedeagus. From the similar *M. bonifacyi*, the new species may be easily distinguished by the lighter colour, and by the form of aedoeagus.

ETYMOLOGY

Named after one of the locus typicus.

DISTRIBUTION

China: Hubei.

***Mulsanteus kubani* n. sp.**

(Figs. 14-15)

LOCUS TYPICUS

Thailand: Chom Thong.

TYPE MATERIAL

Holotypus ♂ (CSV): Thailand: Mae Hong Son province, Ban Huai Po, 30.IV.-4.V.1991, 1 spm., leg. J. Horák. Cambodia: **Paratypes** 2 ♂♂ (CKB, NMB): Mondolkiri province, Seima biodiv. Cons. area, road between Seima and O'Rang, 300 m, at light, 30.I.2006, 1 spm., leg. G. Csorba, L. Duval & G. Ronkay; Huaphanh province, Phou Pan Mts., 30 km south of Xam Neua, 1500 m, 6.-17.V.2004, 1 spm., leg. Petr Kresel.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and moderately shiny species. Length: 11.5 mm, width: 3.0 mm. Black, elytra, legs and antennae chestnut-brown. Pubescence yellowish brown, semi-erect, short, bristly and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum for the length of the last three antennomeres; second antennomere globular, short, only as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and convex at apex; last antennomere oval, sub-apical bevelled.

Pronotum trapezoid, along median line slightly longer than wide at the posterior angles (length/width ratio 1.05:1.00), prominently and regularly raised at centre, arcuate laterally, and with a relatively prominent dropping at basis. Posterior angles of pronotum convex, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum without any trace of furrow or mould. Puncturation of pronotum dense, coarse, umbilicate, and drop-forming, interstices of points at the whole surface reduced to very small and shiny wrinkles.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, fine and umbilicate; pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved and with a very small inner tooth. Base of elytra slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with rugosities and dense, simple puncturation, interstices of striae finely punctured, shiny, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe just extending parameres, sub-parallel, in middle slightly thickened, apically narrowed and sharped. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females unknown.

DIFFERENTIAL DIAGNOSIS

M. kubani is closely allied to *M. sausai*, but may be easily distinguished from this species by the shorter body, the darker colour, by the longer antennae, by the denser puncturation of pronotum, and by the form of aedeagus.

ETYMOLOGY

Named after one of the discoverers of the new species, Mr. V. KUBÁŇ, Brno, Czech Republic.

DISTRIBUTION

Laos: Ban-Honai-Sai; Louang Namtha; Phongsaly; Louang Phrabang.

Thailand: Chom Thong.

***Mulsanteus longicornis* (FLEUTIAUX, 1936) n. comb.**

(Figs. 16-17)

Neotrichophorus longicornis FLEUTIAUX, 1936: 295-296.

LOCUS TYPICUS

Vietnam: Tonkin.

NEW MATERIAL

Vietnam: Vinh Phu province, Tam Dao, 6.-23.V.1990, 1 spm., B. Makovský; same location, but 16.-23.V.1991, 1 spm., leg. J. Strnad; same location, but 12.-24.V.1989, 1 spm., leg. J. Strnad; same location, but 17.-21.V.1990, 3 spm., leg. V. Kubán.

DISTRIBUTION

Vietnam: Tonkin; Vinh Phu.

Mulsanteus pejchai n. sp.

(Figs. 18-19)

LOCUS TYPICUS

Laos: Hua Phan.

TYPE MATERIAL

Holotypus ♂ (CSV): Laos: Vientiane Municip., Phou Khao Khouay NBCA, Ban Van Hua, 800-1000 m, 5.-20.V.2005, leg. M. Pejcha. **Paratypus** ♂ (CRG): Laos: Hua Phan province, from Ban Saluei to Phu Pan, 1500-2000 m, 20.IV.-11.V.2001, leg. D. Hauck.

DIAGNOSIS

Holotyus ♂: Elongate, wedge-shaped, raised, and moderately shiny species. Length: 10.6 mm, width: 2.8 mm. Black, elytra brown at posterior half. Pubescence reddish-brown, semi-erect, long, bristly and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae with conspicuous long and protruding hairs.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last antennomere; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and convex at apex; last antennomere oval, sub-apical bevelled.

Pronotum trapezoid, along median line slightly longer than wide at the posterior angles (length/width ratio 1.08:1.00), prominently and regularly raised at centre, especially at the posterior third, arcuate laterally, and with a prominent, abrupt dropping at basis. Posterior angles of pronotum straight, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum with a deep, but short mould in the posterior third. Puncturation of pronotum very dense, coarse, umbilicate, and regularly rounded, interstices of points at the whole surface reduced to very small and dull wrinkles, forming raised rugosities at posterior third.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved and with an inner tooth. Base of elytra slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe noticeably extending parameres, sub-parallel, in middle slightly thickened, apically narrowed and sharped. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females unknown.

Photo 1: Laos, primary Forest at Phue Pane Mts. Photo V. Kubàn, 2007

DIFFERENTIAL DIAGNOSIS

M. pejchai is closely allied to *M. longicornis*, but may be easily distinguished from this species by the conspicuously raised basis of pronotum, shorter antennae, the lighter colour, by the denser puncturation of pronotum, and by the form of aedeagus.

ETYMOLOGY

Named after the discoverer of the new species, Mr. M. PEJCHA, Brno, Czech Republic.

DISTRIBUTION

Laos: Hua Phan.

Mulsanteus peregovitsi PLATIA & SCHIMMEL, 2007

(Figs. 20-21)

Mulsanteus peregovitsi PLATIA & SCHIMMEL, 2007 (in press).

LOCUS TYPICUS

Taiwan: Ilan County.

Mulsanteus riesei n. sp.

(Figs. 22-23)

LOCUS TYPICUS

Thailand: Loei.

TYPE MATERIAL

Holotypus ♂ (CRG): Thailand: Loei province, Phu Ruan, 1100 m, 6.-9.V.1999, leg. D. Hauck. **Paratypes** 4 ♂♂, 1 ♀ (CRG, CSV, CTW): Same data as Holotypus.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, conspicuously raised, and moderately shiny species. Length: 13.7 mm, width: 3.6 mm. Black, elytra and legs blackish-brown, antennae reddish-brown, apices of antennomeres reddish. Pubescence yellowish brown, semi-erect, short, bristly and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last two antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined slightly shorter than fourth and each of the following antennomeres; those are extended and obtuse at apex; last antennomere oval, sub-apical bevelled.

Pronotum campaniform, raised, along median line slightly longer than wide at the posterior angles (length/width ratio 1.03:1.00), prominently and regularly raised at centre, arcuate laterally, and with a relatively prominent dropping at basis. Posterior angles of pronotum convex, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum without any trace of furrow or mould. Puncturation of pronotum fine and dense, coarse, umbilicate, and oval to drop-forming, interstices of points at the whole surface less then half their diameter, and simple.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, fine and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved and with a very small inner tooth. Base of elytra slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with rugosities and dense, simple puncturation, interstices of striae finely punctured, shiny, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe just extending parameres, sub-parallel, in middle slightly thickened, apically narrowed and sharped. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females slightly larger than males, their antennae are shorter, not reaching posterior angles of pronotum, for the length of the ultimate antennomere.

DIFFERENTIAL DIAGNOSIS

M. riesei is closely allied to *M. sausai*, but may be easily distinguished from this species by the finer puncturation of pronotum, the conspicuously raised body, and by the form of aedoeagus.

ETYMOLOGY

Named after our dear friend Mr. S. RIESE, Genova.

DISTRIBUTION

Thailand: Loei.

Mulsanteus rubuginosus (ÔHIRA, 1966)

(Figs. 24-25)

Neotrichophorus rubuginosus ÔHIRA, 1966: 272.
Neotrichophorus rubiginosus ÔHIRA, 1966: ÔHIRA, 1970: 214.
Neotrichophorus rubuginosus ÔHIRA, 1966: 1972: 9; JIANG, 1993: 155.
Mulsanteus rubuginosus (ÔHIRA, 1966): SUZUKI, 1999: 197.

LOCUS TYPICUS

Taiwan: Nanshanchi.

NEW MATERIAL

Taiwan: Sichiao, Chiayi Hsien, 9.-10.VI.1988, 1 spm., leg. K. Masumoto; Wushe, 10.VI.-9.VII.1997, 1 spm., leg. T. Spevár.

DISTRIBUTION

Taiwan: Nanshanchi; Chiayi; Wushe.

Mulsanteus rugosus (FLEUTIAUX, 1918) n. comb.

(Figs. 26-27)

Ludius rugosus FLEUTIAUX, 1918: 257; SCHENKLING, 1927: 428.
Neotrichophorus rugosus (FLEUTIAUX, 1918): FLEUTIAUX, 1936: 195-196.

LOCUS TYPICUS

Cambodia: Pnom-Phen.

NEW MATERIAL

Thailand: Chom Thong, 24.-27.IV.1991, leg. J Horák; same location as Holotype but 25.IV.1991, 1 spm., S. Bily; Thailand: Bangkok, 11.I.1989, 1 spm., without further data; Laos: Ban-Honai-Sai, III.1984, 1 spm., without further data; Laos: Louang Namtha province, from Namtha to Muang Sing, 900-1200 m, 5.-31.V.1997, 1 spm., leg. V. Kubáň; Laos: Phongsaly province, Phongsaly environment, 1500 m, 28.V.-20.VI.2003, 1 spm., leg. V. Kubáň; Laos: Louang Phrabang province, 25 km east of Muang Ngoy, 1000 m, 23.IV.1999, 1 spm., leg. V. Kubáň; same location but 6.-17.V.2004, 2 spm., leg. M. Brancucci.

DISTRIBUTION

Cambodia: Pnom Phen; Mondolkiri; Bolikhamsay; Huaphanh.
Thailand: Mae Hong Son.

Mulsanteus sausai n. sp.

(Figs. 28-29)

LOCUS TYPICUS

Laos: Bolikhamsai.

TYPE MATERIAL

Holotypus ♂ (CSB): Laos: Bolikhamsai province, Ban Nape – Kaew Nua pass, 18.IV.-1.V.1998, 600 m, leg. E. Jendek & O. Sauša. **Paratypes** 3 ♂♂, 2 ♀♀ (CRG, CSV): Thailand: Doi Saket, Chiang Mai, 12.X.1989, 1 spm., leg. Y. Maint; Thailand: Saraburi, III.1989, 1 spm., leg. S. Steinke; Myanmar: Shan Highland, Monghkok, 15.-20.VII.2006, 1 spm., leg. Li Jingke; China: Guangxi, Bai He-Na He County, 1.-11.VII.2006, 1 spm., leg. L. Jingke; Tibet: Cha Yu province, Xia-Cha-Yu, 1.-28.VII.2004, 1 spm., leg. L. Jingke (in the "Check-list of the geographical distribution of the *Mulsanteus*-species in Southeast Asia", the later record is included into the part of Himalaya and Tibet, which is part of the Palaearctic region).

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and moderately shiny species. Length: 13.5 mm, width: 3.7 mm. Chestnut-brown, legs and antennae light-brown. Pubescence yellowish brown, semi-erect, short, bristly and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last antennomere; second antennomere short, globular, slightly longer than wide; third antennomere slightly shorter than second antennomere, but semi-globular, truncate at apex, and both combined slightly shorter than fourth and each of the following antennomeres; those are extended and obtuse at apex; last antennomere oval, sub-apical bevelled.

Pronotum campaniform, along median line slightly longer than wide at the posterior angles (length/width ratio 1.05:1.00), prominently and regularly raised at centre, arcuate laterally, and with a relatively prominent dropping at basis. Posterior angles of pronotum convex, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum without any trace of furrow or mould. Puncturation of pronotum dense, coarse, umbilicate, and drop-forming, interstices of points at posterior third reduced to small and shiny wrinkles.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, fine and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, without any apical tooth. Base of elytra slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with rugosities and dense, simple puncturation, interstices of striae finely punctured, shiny, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe just extending parameres, sub-parallel, in middle slightly thickened, apically narrowed and triangular. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females slightly larger than males, their antennae are shorter, not reaching basis angles of pronotum, for the length of the ultimate two antennomeres.

DIFFERENTIAL DIAGNOSIS

M. sausai is closely allied to *M. kubani*, but may be easily distinguished from this species by the larger body, the chestnut-brown colour, by the shorter antennae, the less dense puncturation of pronotum, and by the form of aedeagus.

ETYMOLOGY

Named after one of the discoverers of the new species, our dear friend, Dr. O. SAUŠA, Bratislava, Slovacia.

DISTRIBUTION

Laos: Ban Nape; Bolikhamsai.
Myanmar: Shan Highland.
Thailand: Chiang Mai; Saraburi.
Tibet: Cha Yu.
China: Guangxi.

***Mulsanteus shaanxiensis* n. sp.**

(Figs. 30-31)

LOCUS TYPICUS

China: Shaanxi.

TYPE MATERIAL

Holotypus ♂ (CSV): China: Shaanxi province, Lueyang, 23.-26.VI.2004, leg. E. Kučera. **Paratypus** ♂ (CMH): Same location as Holopypus but 26.V.1997, leg E. Kučera.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and moderately shiny species. Length: 12.6 mm, width: 3.2 mm. Blackish-brown, elytra, legs and antennae chestnut-brown. Pubescence reddish-brown, semi-erect, long, bristly and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

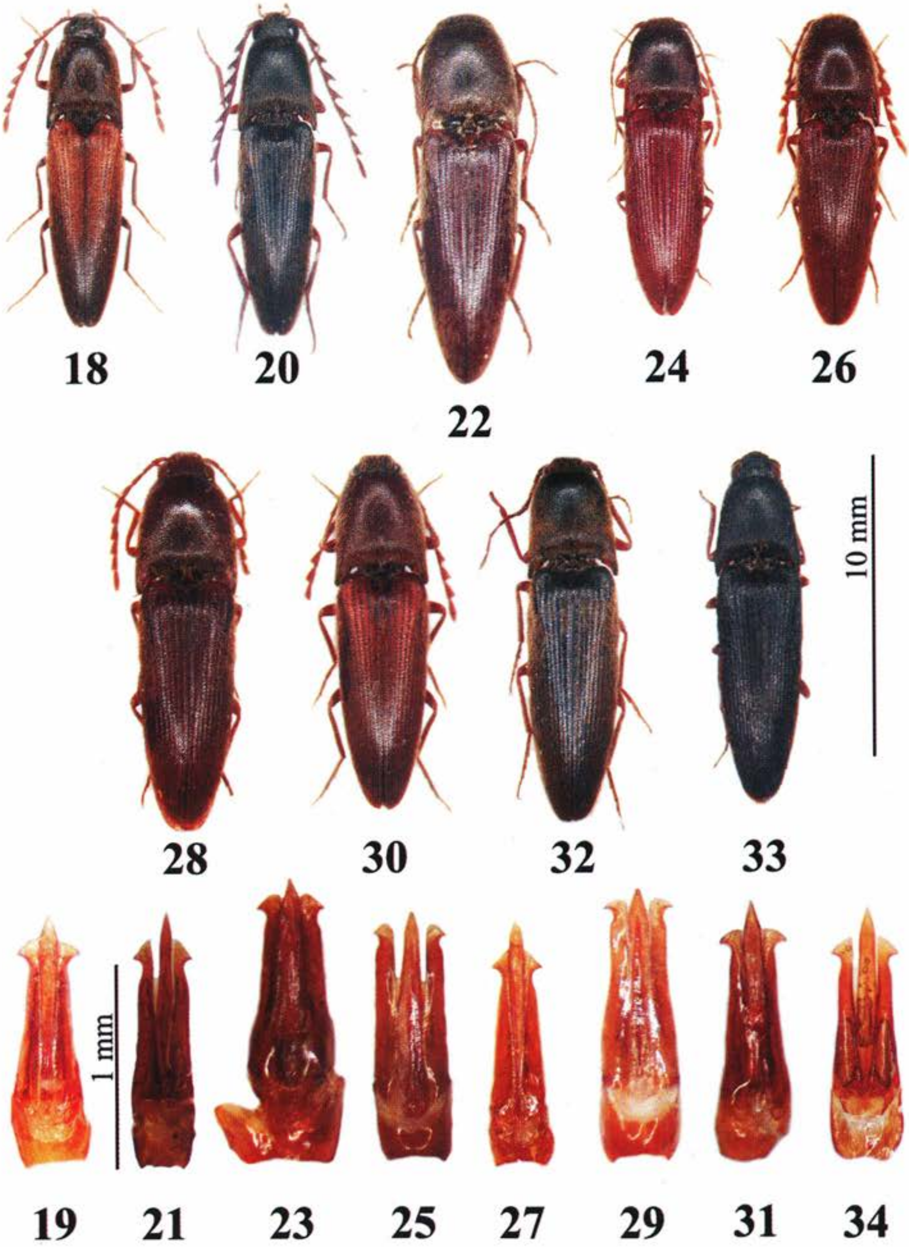


Plate 2 (figs. 18-34). 18, 19. *Mulsanteus pejchai* n. sp.: 18 – habitus, 19 – aedeagus; 20, 21. *M. peregovitsi* Platia & Schimmel, 2007: 20 – habitus, 21 – aedeagus; 22, 23. *M. riesei* n. sp.: 22 – habitus, 23 – aedeagus; 24, 25. *M. rubuginosus* (Ôhira, 1966) n. comb.: 24 – habitus, 25 – aedeagus; 26, 27. *M. rugosus* (Fleutiaux, 1918) n. comb.: 26 – habitus, 27 – aedeagus; 28, 29. *M. sausai* n. sp.: 28 – habitus, 29 – aedeagus; 30, 31. *M. shaanxiensis* n. sp.: 30 – habitus, 31 – aedeagus; 32. Habitus of *M. shirozui* (Ôhira, 1966) n. comb.: 33, 34. *M. wudangshanensis* n. sp.: 33 – habitus, 34 – aedeagus

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last two antennomeres, second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and convex at apex; last antennomere oval, sub-apical bevelled.

Pronotum campaniform, along median line slightly longer than wide at the posterior angles (length/width ratio 1.02:1.00), prominently and regularly raised at centre, especially at the posterior third, arcuate laterally, and with a prominent, abrupt dropping at basis. Posterior angles of pronotum slightly convex, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum without any mould or furrow. Puncturation of pronotum very dense, coarse, umbilicate, and regularly rounded, interstices of points at the whole surface reduced to very small and dull wrinkles, forming raised rugosities at posterior third.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved and with an inner tooth. Base of elytra slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe noticeably extending paramere, sub-parallel, in middle thickened, apical slightly narrowed and sharp. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females unknown.

DIFFERENTIAL DIAGNOSIS

M. shaanxiensis is closely allied to *M. langtangensis*, but may be easily distinguished from this species by the darker colour, by the longer antennae, and by the form of aedeagus.

ETYMOLOGY

Named after the locus typicus.

Distribution
China: Shaanxi.

Mulsanteus shirozui (Ôhira, 1966)

(Fig. 32)

Neotrichophorus shirozui Ôhira, 1966: 272-274; 1972: 9; Jiang, 1993: 155.
Mulsanteus shirozui (Ôhira, 1966): Suzuki, 1999: 198.

Locus typicus
Taiwan: Sungkang.

New material
Taiwan: Hsinchu, Netwan, Litung-Shan, 17.-21.III.2004, 3 spm., leg. J. D. Baštová.

Distribution
Taiwan: Sungkang; Hsinchu.

Mulsanteus wudangshanensis n. sp.

(Figs. 33-34)

Locus typicus
China: Hubei.

Type material
Holotypus ♂ (CPG): China: Hubei province, Wudang shan, 20.-25.V.2005, without further data.

Diagnosis
Holotypus ♂: Elongate, wedge-shaped, raised, and moderately shiny species. Length: 12.1 mm, width: 3.0 mm. Black, antennae, legs, and scutellum chestnut-brown. Pubescence yellowish brown, semi-erect, short, bristly and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles.

Description
Head with very dense and umbilicate puncturation, interstices of points less than half their diameter, and forming small wrinkles, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Second antennomere short, globular, as long as wide. The following antennomeres are lost.

Pronotum trapezoid, along median line slightly longer than wide at the posterior angles (length/width ratio 1.03:1.00), prominently and regularly raised at centre, arcuate laterally, and with a prominent dropping at basis. Posterior angles of pronotum convex, and with a prominently raised carina, apical edge of posterior angles truncate, and bent downwards (best visible from lateral view). Pronotum with a flat mould at basis. Puncturation of pronotum very dense, coarse, umbilicate, and sub-oval to drop-forming, interstices of points at the whole pronotum reduced to small and shiny, conspicuously raised wrinkles.

Scutellum triangular, wedge-shaped, slightly convex and raised at base, laterally straight, and sharp at apex. Surface moderately flat, puncturation dense, fine and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, with a very small apical tooth. Base of elytra slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with rugosities and dense, simple puncturation, interstices of striae roughly punctured, shiny, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe conspicuously extending parameres, sub-parallel, in middle thickened, apical narrowed and triangular. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females unknown.

DIFFERENTIAL DIAGNOSIS

M. wudangshanensis is closely allied to *M. hubeiensis*, but may be easily distinguished from this species by the darker colour, by the denser puncturation of pronotum, and by the form of aedeagus.

ETYMOLOGY

Named after the locus typicus.

DISTRIBUTION

China: Hubei.

5. THE SPECIES OF THE GENUS *MULSANTEUS* FROM HIMALAYA

Himalayan material of the genus *Mulsanteus* has been collected in Nepal and Bhutan, and in the North-Indian provinces Assam, Bengal, Darjeeling and Sikkim.

5.1. KEY TO SPECIES

1. Pronotum and elytra black or blackish-brown .... 2.
–. Pronotum and elytra chestnut-brown to reddish-brown or of different colour .... 5.

2. Body larger (15.4 mm) .... *M. pedongensis* n. sp.
–. Body shorter (11.0-12.5 mm) .... 3.
3. Basis of pronotum step-resembling (visible in lateral view) .... *M. hartmanni* n. sp.
–. Basis of pronotum sloping (visible in lateral view) .... 4.
4. Pronotum regularly raised, its punctures very dense, interstices of points less than half their diameter and wrinkled .... *M. godawariensis* n. sp.
–. Pronotum conspicuously raised, its punctures less dense, interstices of points once their diameter and flat .... *M. pokharanus* n. sp.
5. Pronotum and elytra chestnut-brown or reddish-brown .... 6.
–. Pronotum and elytra of different colour .... 8.
6. Pronotum reddish-brown, elytra brownish-yellow .... *M. langtangensis* n. sp.
–. Pronotum and elytra chestnut-brown .... 7.
7. Pronotum conspicuously raised, its punctures dense, points oval, their interstices wrinkled .... *M. nepalensis* n. sp.
–. Pronotum less raised, disk flat, its punctures dense, points rounded, their interstices wrinkled .... *M. hirtellus* CANDÈZE (1863)
8. Pronotum black, elytra chestnut-brown .... *M. ingridae* n. sp.
–. Pronotum black or reddish-brown, elytra chestnut-brown, its apex black .... 9.
9. Pronotum reddish-brown .... *M. holzschuhi* n. sp.
–. Pronotum black .... 10.
10. Pronotum conspicuously raised, with a flat mould at posterior third, basis angles straight .... *M. sikkimensis* n. sp.
–. Pronotum regularly raised, with a flat, just visible, and short mould at basis, basis angles conspicuously divergent .... *M. murenus* n. sp.

5.2. REVIEW OF SPECIES

***Mulsanteus godawariensis* n. sp.**

(Figs. 35-36)

LOCUS TYPICUS

Nepal: Lalitpur.

TYPE MATERIAL

Holotypus ♂ (CPG): Nepal: Kathmandu Vall., Lalitpur distr., Godawari, 2200-2700 m, 1.-7.VI.1996, leg. P. Čechovsky. **Paratypes** 5 ♂♂, 1 ♀ (CPG, CSV, MTD, NMB): Rasuwa distr., Langtang nat. park, Dhunche, Bharkhu-Syabru, 2000-2800 m, 6.-13.V.1996, 1 spm., leg. P. Čechovsky; Janakpur, Jiri, 1850 m, 20.-24.V.1980, 1 spm., leg. G. Sabatinelli; Annapurna Mts., Kali Gandaki Valley, Sirkung, 2550 m, 1.VI.2001, 1 spm., leg. J. Schmidt; Bhutan: Thimphu, 1972, 1 spm., without further data; Arun Valley, from Arunthan to Chichila, 1300-1950 m, 29.V.1983, 1 spm., leg. M. Brancucci; India: Darjeeling, Pudung, 900 m, 3.V.1985, 1 spm., leg. B. Bhakta.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and shiny species. Length: 11.0 mm, width: 2.6 mm. Black, antennae, legs and elytra blackish-brown, the basis of the later chestnut-brown. Pubescence reddish-brown, semi-erect, long, fine and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

DESCRIPTION

Head with very dense and umbilicate puncturation, interstices of points less than half their diameter, and reduced to small wrinkles, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last two and a half antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and truncate at apex, last antennomere oval, sub-apical bevelled.

Pronotum trapezoid, along median line slightly longer than wide at the posterior angles (length/width ratio 1.05:1.00), regularly raised, disk flat, straight laterally, and with a relative prominent dropping at basis. Posterior angles of pronotum slightly convex, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum with a very flat, and short median mould at posterior fifth. Puncturation of pronotum very dense, coarse, umbilicate, and regularly rounded, interstices of points less than half their diameter, and at the whole surface reduced to small, and shiny wrinkles, forming raised rugosities.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with an inner tooth. Base of elytra slightly smaller than that of pronotum, depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe just extending parameres, sub-parallel, thin, apically slightly narrowed and sharp. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females are slightly larger, their antennae are shorter than those of the males.

DIFFERENTIAL DIAGNOSIS

M. godawariensis is closely allied to *M. ingridae*, but may be easily distinguished from this species by the darker colour of elytra, longer antennae, and by the form of aedeagus.

ETYMOLOGY

Named after the locus typicus.

DISTRIBUTION

Bhutan: Thimphu.
Nepal: Lalitpur; Rasuwa; Janakpur.
India : Darjeeling.

Mulsanteus hartmanni n. sp.

(Figs. 37-38)

LOCUS TYPICUS

Nepal: Karnali-Humla.

TYPE MATERIAL

Holotypus ♂ (NME): Nepal: Karnali province, Humla distr., 6 km north-west of Simikot, Dandaphara, 2300 m, 18.VI.2001, leg. A. Weigel. **Paratypes** 5 ♂♂ (CSV, NMB, NME, SMNS): same location but 19.VI.2001, 2 spm., leg. M. Hartmann; same location but 19.VI.2001, 1 spm., leg. A. Kopetz; India: Darjeeling, Ralle, 16.IV.1987, 1 spm., leg. B. Bhakta. Sindhulpalchok distr., south-west of Dolangsa, 2300 m, 16.VI.2000, 1 spm., leg. W. Schawaller; Bhutan: Thimphu, VIII.1975, 1 spm., without further data; Thimphu, Phuntsholing, 1680 m, 22.V.1972, 2 spm., Nat. Hist. Mus. Basel, Bhutan expedition.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and shiny species. Length: 12.5 mm, width: 3.0 mm. Blackish-brown, antennae and legs chestnut-brown. Pubescence reddish-brown, semi-erect, long, fine and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points less than half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last two antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and truncate at apex; last antennomere oval, sub-apical bevelled.

Pronotum trapezoid, along median line clearly longer than wide at the posterior angles (length/width ratio 1.05:1.00), regularly raised, disk flat, straight laterally, and with a conspicuous step-resembling dropping at basis. Posterior angles of pronotum slightly divergent, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum with a very flat, just visible median mould at posterior fifth. Puncturation of pronotum very dense, coarse, umbilicate, and regularly rounded, interstices of points at the whole surface, but especially at basis, reduced to small, and shiny wrinkles, forming raised rugosities at posterior third.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with an inner tooth. Base slightly smaller than that of pronotum, depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe just extending parameres, sub-parallel, thin, apically slightly narrowed and sharp. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females are slightly larger than the males, their pronotum is more subparallel than trapezoid.

DIFFERENTIAL DIAGNOSIS

M. hartmanni is closely allied to *M. murenus*, but may be easily distinguished from this species by the ligther colour of body, the shorter antennae, the longer pronotum, and its step-resembling dropping at basis, and by the form of aedoeagus.

ETYMOLOGY

Named after one of the discoverers of the new species, Mr. M. HARTMANN, Naturkundemuseum, Erfurt.

DISTRIBUTION

Bhutan: Thimphu.

Nepal: Karnali; Sindhulpalchok.
India: Darjeeling.

Mulsanteus hirtellus **(CANDÈZE, 1863) n. comb.**

(Figs. 39-40)

Ludius hirtellus CANDÈZE, 1863: 303; FLEUTIAUX, 1918: 256; 1924: 146.
Trichophorus hirtellus (CANDÈZE, 1863): SCHWARZ, 1906: 259.
Neotrichophorus hirtellus (CANDÈZE, 1863): SCHENKLING, 1927: 433; FLEUTIAUX, 1936: 295; ÔHIRA, 1973: 37; 1978: 95.

LOCUS TYPICUS
Sri Lanka.

NEW MATERIAL

Nepal: Sagarmatha, Khumbu, Ratnanga Danda, Ringmo, 18.-20.V.2000, 2 spm., leg. J. Dalinod; Dana, 15.V.1984, 1 spm., leg. A. Hamet; Chitre ghar Kho, 26.-31.V.1984, 3 spm., leg. C. Holzschuh; Kopchepani, 20.V.1984, 3 spm., leg. C. Holzschuh; Ganesh Himal, Salankhu Khola Valley, Bhalche, 2000 m, 9.VI.2000, 1 spm., leg. Santa & Santé; Kali-Gandaki, Kopchepani, 1600 m, 18.VI.1986, 1 spm., leg. C. Holzschuh; same location but 1600-2000 m, 20.VI.1986, 8 spm., leg. C. Holzschuh; same location but 2500-2800 m, 21.-25.VI.1986, 9 spm., leg. C. Holzschuh; same location but 1500-1600 m, 21.V.1984, 3 spm., leg. B. Bhakta; Khumbu, Namche Bazar, 3200 m, 1979, 1 spm.,

Photo 2: Nepal, valley of Myagdi Khola, south of Dobang, 2000-2400 m. Photo W. Schawaller, 1995

leg. B. Bhakta; Piang-lake, Rara, 30.V.1977, 1 spm., leg. W. Wittmer; Parbat distr., from Kosma to Karkineta, 900-1600 m, 2.VII.1986, 1 spm., leg. C. Holzschuh; Basantapur, 2300 m, 30.V.-2.VI.1985, 1 spm., leg. M. Brancucci; Ghar Khola, Ghorepani, 2800-2000 m, 12.VI.1986, 1 spm., leg. C. Holzschuh; Darjeeling: Monshong Kaman, 20.-21.IV.1987, 1 spm., leg. B. Bhakta; Kalimpong, 1500 m, 14.VII.1984, 1 spm., leg. C. J. Rai; Tatopani, 1100-1400 m, 27.-28.VI.1986, 2 spm., leg. C. Holzschuh; Lolay, 980 m, 23.IV.1986, 3 spm., leg. B. Bhakta; Bhutan: Thimphu, Phuntsholing, 1680 m, 22.V.1972, 3 spm., Bhutan exped. Nat. Hist. Mus. Basel; Myagdi distr., Myagdi Khola, south of Dobang, 2000-2400 m, 21.V.1995, 8 spm., leg. J. Martens & W. Schawaller; Sankhua Sabha distr., between Pahakhola and Karnarang, 1800-1500 m, 4.VI.1988, 1 spm., leg. J. Martens & W. Schawaller; Solukhumbu distr., east above Kharikhola, 2100 m, 14.V.1997, 3 spm., leg. W. Schawaller; same distr., but above Gudel, 2000-2500 m, 22.V.1997, 1 spm., leg. W. Schawaller; same distr., but Jubing, 1700-2000 m, 14.V.1997, 1 spm., leg. W. Schawaller.

DISTRIBUTION

Sri Lanka.
India: Darjeeling.
Nepal: Sagarmatha; Burhanilkantha; Dana; Chitre; Kopchepani; Sankhua Sabha.
Bhutan: Thimphu.

DISCUSSION

SCHENKLING (1927) recorded this species as to be distributed in Sri Lanka, Bengal, Singapore, Java, Tonkin, Cambodia, and Cochin chine. All specimens of *M. hirtellus* we have studied so far have been collected from Sri Lanka and from the Himalaya exclusively. The presence of this species outside Sri Lanka, North-India, and Himalaya is doubtful.

***Mulsanteus holzschuhi* n. sp.**

(Figs. 41-42)

LOCUS TYPICUS:

Nepal: Modi Pothana.

TYPE MATERIAL

Holotypus ♂ (CSV): Nepal: Modi Pothana, 7.-9.VI.1984, leg. C. Holzschuh. **Paratypes** 4 ♂♂ (CSV, NMB): Nepal: Kali Gandhaki Khola, Tatopani, 1100-1400 m, 1 spm., leg. B. Bhakta; Dhawalagiri, Myagdi district, from Hille to Ghorepani, 1600-2600 m, 10.VI.1986, 1 spm., leg. C. Holzschuh; Hong Goan, Hatya, 1500-2300 m, 1.VI.1980, 1 spm., leg. W. Wittmer; India: Darjeeling, Trista, 18.IV.1987, 1 spm., leg. B.Bhakta.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and shiny species. Length: 11.0 mm, width: 2.6 mm. Black, pronotum and antennae reddish-brown, elytra light-brown, its apex blackish, legs chestnut-brown. Pubescence reddish-brown, semi-erect, long, fine

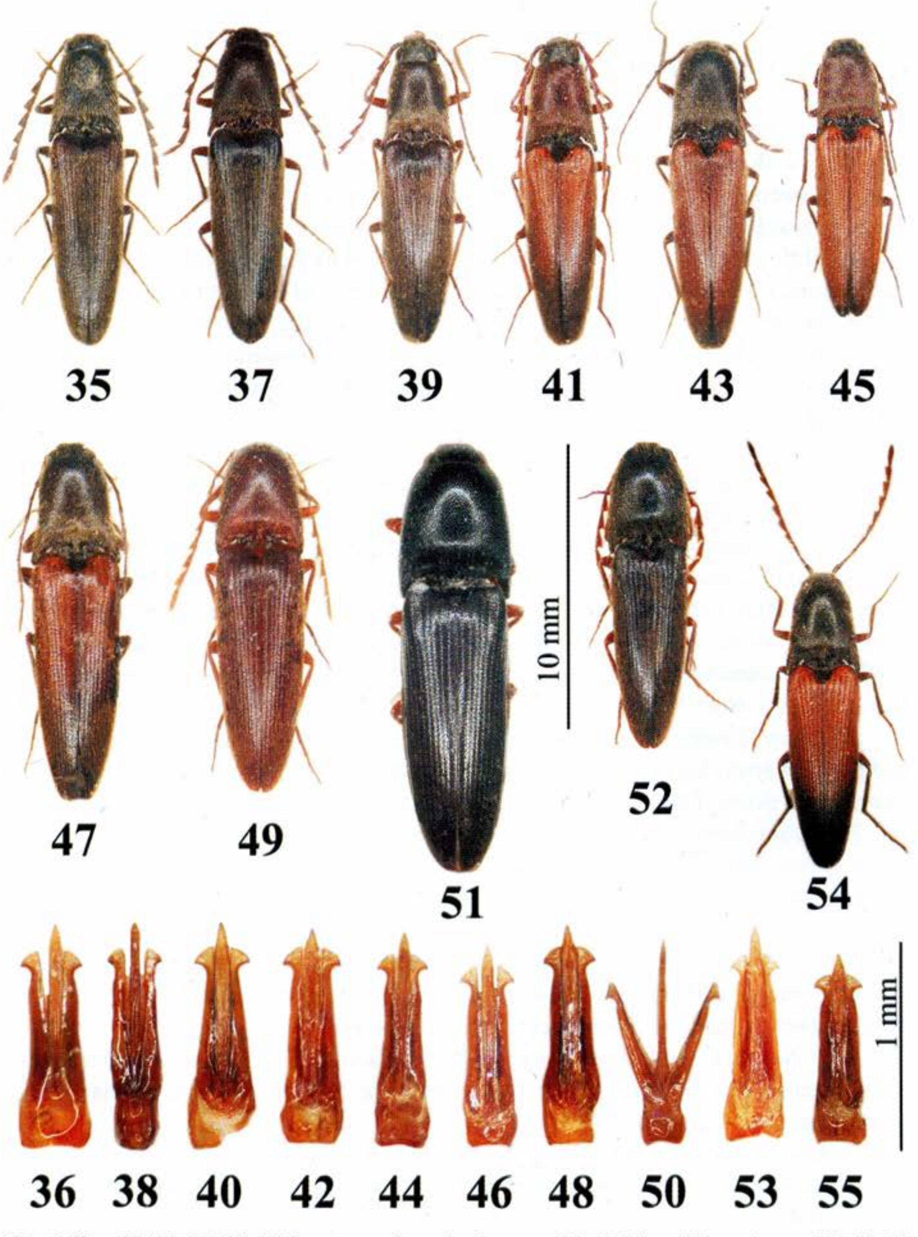


Plate 3 (figs. 35-55). 35, 36. *Mulsanteus godawariensis* n. sp.: 35 – habitus, 36 – aedeagus; 37, 38. *M. hartmanni* n. sp.: 37 – habitus, 38 – aedeagus; 39, 40. *M. hirtellus* (CANDÈZE, 1863) n. comb.: 39 – habitus, 40 – aedeagus; 41, 42. *M. holzschuhi* n. sp.: 41 – habitus, 42 – aedeagus; 43, 44. *M. ingridae* n. sp.: 43 – habitus, 44 – aedeagus; 45, 46. *M. langtangensis* n. sp.: 45 – habitus, 46 – aedeagus; 47, 48. *M. murenus* n. sp.: 47 – habitus, 48 – aedeagus; 49, 50. *M. nepalensis* n. sp.: 49 – habitus, 50 – aedeagus; 51. Habitus of *M. pedongensis* n. sp.; 52, 53. *M. pokharanus* n. sp.: 52 – habitus, 53 – aedeagus; 54, 55. *M. sikkimensis* n. sp.: 54 – habitus, 55 – aedeagus and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last two antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and truncate at apex; last antennomere oval, sub-apical bevelled.

Pronotum trapezoid, along median line slightly longer than wide at the posterior angles (length/width ratio 1.05:1.00), regularly raised, disk flat, straight laterally, and with a flat dropping at basis. Posterior angles of pronotum straight, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum with a flat median mould at posterior third. Puncturation of pronotum very dense, coarse, umbilicate, and regularly rounded, interstices of points at the whole surface, but especially at basis, reduced to small, and shiny wrinkles, forming raised rugosities at posterior third.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with an inner tooth. Base slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe just extending parameres, sub-parallel, in middle thickened, apically slightly narrowed and sharp. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females unknown.

DIFFERENTIAL DIAGNOSIS

M. holzschuhi is closely allied to *M. langtangensis*, but may be easily distinguished from this species by the blackish apex of elytra, by the shorter antennae, and by the form of aedeagus. From the similar *M. murenus*, the new species may be easily distinguished by the shorter body, the shorter antennae, the straight posterior angles of pronotum, by the lighter colour, and the form of aedeagus.

ETYMOLOGY

Named after the discoverer of the new species, Mr. C. HOLZSCHUH, Vienna, Austria.

DISTRIBUTION

Nepal: Modi Pothana; Kali Gandhaki Khola; Dhawalagiri; Hong Goan.
India: Darjeeling.

***Mulsanteus ingridae* n. sp.**

(Figs. 43-44)

LOCUS TYPICUS

Nepal: Kathmandu Valley.

TYPE MATERIAL

Holotypus ♂ (CSV): Nepal: Kathmandu Vall., Jamajok, 18.-19.V.1993, leg. R. & I. Schimmel; **Paratypes** 7 ♂♂ (CPG, CSV, CTW, SMNS): Same data as Holotypes, leg. R. & I. Schimmel; Sindhulpalchok distr., south-west of Dolangsa, 2300 m, 16.VI.2000, 1 spm., leg. W. Schawaller; same district but Jubing, 1700-2000 m, 14.V.1997, 1 spm., leg. W. Schawaller; Solukhumbu distr., 2000-2500 m, 22.V.1997, 1 spm., leg. W. Schawaller.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and shiny species. Length: 11.0 mm, width: 2.8 mm. Black, elytra chestnut-brown, legs and antennae blackish-brown. Pubescence reddish-brown, semi-erect, long, fine and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last two antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and truncate at apex; last antennomere oval, sub-apical bevelled.

Pronotum trapezoid, along median line slightly longer than wide at the posterior angles (length/width ratio 1.05:1.00), regularly raised, disk flat, straight laterally, and with a flat dropping at basis. Posterior angles of pronotum slightly convex, divergent, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum with a flat median mould at posterior third. Puncturation of pronotum very dense, coarse, umbilicate, and regularly rounded, interstices of points at the whole surface reduced to small, and shiny wrinkles, forming raised rugosities at posterior third.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with an inner tooth. Base slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe just extending parameres, sub-parallel, in middle thickened, apically slightly narrowed and sharp. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females unknown.

DIFFERENTIAL DIAGNOSIS

M. ingridae is closely allied to *M. sikkimensis*, but may be easily distinguished from this species by the darker colour of elytra, legs and antennae, by the much denser puncturation of pronotum, and by the form of aedeagus.

ETYMOLOGY

Named after the dear wife of the first author. She has collected the majority of the specimens of the new species during the Nepal-expedition of R. & I. SCHIMMEL, in spring 1993.

DISTRIBUTION

Nepal: Kathmandu Valley.

***Mulsanteus langtangensis* n. sp.**

(Figs. 45-46)

LOCUS TYPICUS

Nepal: Rasuwa.

TYPE MATERIAL

Holotypus ♂ (CSV): Nepal: Bagmati, Rasuwa distr., Langtang nat. park, Dhunche, 1960-2200 m, 14.V.2001, leg. M. Pejcha. **Paratypes** 13 ♂♂ (CSV, CPG, CRG, CTW, NMB, SMNS): Same data as Holopypus, 4 spm., leg. M. Pejcha; same location as Holotypus but 22.V.-24.V.1999, 1 spm., leg. M. Pejcha; same location but 22.-24.V.1999, 1 spm., leg. J. Dalihod; Langtang nat. park, 2200-2600 m, 25.V.1999, 2 spm., leg. M. Pejcha; Kathmandu Vall., Burhanilkantha, 1440-1650 m, 16.VI.1983, 1 spm., leg. M. Brancucci; Balaju, 1400 m, 3.VI.1986, 1 spm., leg. C. Holzschuh; same location, 1300-1370 m, 23.V.1977, 1 spm., leg. M. Brancucci & W. Wittmer; Trisuli, 570-1200 m, 20.VI.1997, 1 spm., leg. R. & S. Groli; Chandam Bari, 3350 m, 22.VI.1978, 1 spm., leg. B. Bhakta; Solukhumbu distr., 2000-2500 m, 22.V.1997, 1 spm., leg. W. Schawaller.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and shiny species. Length: 10.0 mm, width: 2.4 mm. Black, pronotum, antennae, and legs reddish-brown, elytra brownish-yellow, its apex black. Pubescence yellowish, semi-erect, long, bristly and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

DESCRIPTION

Head with very dense and umbilicate puncturation, interstices of points less than half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last three antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and truncate at apex; last antennomere oval, sub-apical bevelled.

Pronotum trapezoid, along median line slightly longer than wide at the posterior angles (length/width ratio 1.05:1.00), prominently and regularly raised, disk flat, straight laterally, and with a prominent, abrupt dropping at basis. Posterior angles of pronotum slightly convex, little divergent, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum without any median mould or furrow. Puncturation of pronotum dense, coarse, umbilicate, and regularly rounded, interstices of points at the whole surface shiny, and reduced to small wrinkles, forming raised rugosities at posterior third.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with an inner tooth. Base slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe just extending parameres, sub-parallel, in middle thickened, apically slightly narrowed and sharp. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females unknown.

DIFFERENTIAL DIAGNOSIS

M. langtangensis is closely allied to *M. sikkimensis*, but may be easily distinguished from this species by the shorter body, and the shorter antennae, by the lighter colour of elytra, legs and antennae, and by the form of aedeagus.

TAXONOMICAL REMARKS

Among the paratype-material there are two specimens that are different from all others by the dark-brown colour of elytra. Furthermore, all of the paratypes possess a black coloured pronotum, while that of the Holotype is reddish-brown. Concerning the questioned characteristics, the new species, *M. langtangensis*, seems to have a great spectrum of variability in colour, while its body stature and sizes are absolutely constant.

ETYMOLOGY

Named after the locus typicus.

DISTRIBUTION

Nepal: Rasuwa; Kathmandu Valley.

Mulsanteus murenus n. sp.

(Figs. 47-48)

LOCUS TYPICUS

Nepal: Chichila-Mure.

TYPE MATERIAL

Holotypus ♂ (CSV): Nepal: From Chichila to Mure, 1900 m, 24.V.1980, leg. W. Wittmer. **Paratypes** 24 ♂♂, 3 ♀♀ (CPG, CTW, CRG, CSV, NMB): same location as holotypus but 1950 m, 31.V.1983, 4 spm., leg. M. Brancucci; same location, 1900 m, 24.V.1980, 1 spm., leg. W. Wittmer; Nepal: Sagarmatha, Khumbu, Ratnanga Danda, Ringmo, 18.-20.V.2000, 4 spm., leg. J. Dalinod; Basantapur, 2300 m, 30.V.-2.VI.1985, 3 spm., leg. M. Brancucci; Kaski district, Potana, 2100 m, 25.V.1990, 1 spm, leg. G. Sabatinelli; Mure, 2000 m, 2.-8.VI.1983, 1 spm., leg. M. Brancucci; Burhanilkhanth, 1440-1650 m, 16.VI.1983, 1 spm., leg. M. Brancucci; Darjeeling: Kurseong, 1620 m, 20.-29.VIII.1984, 2 spm., leg. B. Bhakta; Kalimpong, 1180 m, VII.-VIII.1983, 2 spm., leg. B. Bhakta; Rang, 26.IV.1987, 2 spm, leg. B. Bhakta; Monshong Maman, 20.-21.IV.1987, 1 spm., leg. B. Bhakta; Alghera, 18.IV.1984, 1 spm., leg. C. J. Rai; Arun Valley, from Chichila to Mure, 2000 m, 1.VI.1983, 1 spm., leg. M. Brancucci; Basantapur, 2000 m, 30.V.-2.VI.1985, 1 spm., leg. M. Brancucci; Bhutan: Nobding, 41 km oest of Wangdi, 2800 m, 1 spm., 1972, Bhutan exped. of the Natural Hist. Mus. Basel.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and shiny species. Length: 12.7 mm, width: 3.2 mm. Black, antennae and legs reddish-brown, elytra chestnut-brown, its apex blackish. Pubescence reddish-brown, semi-erect, long, fine and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last three antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and truncate at apex; last antennomere oval, sub-apical bevelled.

Pronotum trapezoid, along median line slightly longer than wide at the posterior angles (length/width ratio 1.05:1.00), regularly raised, disk flat, straight laterally, and with a flat dropping at basis. Posterior angles of pronotum conspicuously divergent, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum with a very flat, just visible median mould at posterior fifth. Puncturation of pronotum dense, coarse, umbilicate, and regularly rounded, interstices of points at the whole surface, but especially at basis, reduced to small, and shiny wrinkles, forming raised rugosities at posterior third.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with an inner tooth. Base slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe jus extending parameres, sub-parallel, in middle thickened, apically slightly narrowed and sharp. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females have a more raised pronotum, slightly longer elytra and shorter antennae than males.

DIFFERENTIAL DIAGNOSIS

M. murenus is closely allied to *M. holzschuhi*, but may be easily distinguished from this species by the longer body and antennae, by the conspicuously divergent basis angles of pronotum, by the darker colour, and by the form of aedoeagus.

ETYMOLOGY

Named after the locus typicus.

DISTRIBUTION

Nepal: Chichila-Mure; Sagarmatha, Khumbu; Kathmandu valley.
India: Darjeeling.
Bhutan: Nobding.

TAXONOMICAL REMARKS

The four Paratypes have blackish elytra, their elytra bases are just slightly lighter.

***Mulsanteus nepalensis* n. sp.**

(Figs. 49-50)

LOCUS TYPICUS

Nepal: Ganesh Himal.

TYPE MATERIAL

Holotypus ♂ (HNHM): Nepal: Ganesh Himal, Valley of Mailung Khola, 1150 m, 22.V.1995, leg. G. FÁBIÁN & L. RONKAY. **Paratypes** 22 ♂♂, 6 ♀♀ (HNHM, CSV, CPG, CMH, NME): Same data as Holotype, 3 spm., (HNHM, NMB, CMH, CPG, CSV, SMNS); same location as Holotype but Somathang, 3270 m, 15.VI.1993, 1 spm., leg.

M. Hreblay & G. Csorba; Nepal: Kathmandu, 8.-25.V.1993, 1 spm., leg. R. & I. Schimmel; same location but 20.-24.VI.1993, 2 spm., leg. M. Hreblay & G. Csorba; same location but Lazimpat (at light), 7.VI.1980, 2 spm., leg. Sabatilelli & Migliaccio; same location, 1300 m, 22.V.1977, 1 spm., leg. M. Brancucci & W. Wittmer; same location, 24.V.-21.VI.1976, 1 spm., leg. Wittmer, Baroni & Urbani; Lamobagar Gola, 1400 m, 8.-14.VI.1983, 1 spm., leg. M. Brancucci; Nepal: Koshi, Chauki, 3000 m, 22.-24.VI.2001, NMB exped. 2001 to Nepal; same location but Dharan, 18.VI.1985, 1 spm., leg. M. Brancucci; Janakpur, from Kabra to Tamba, Koshi Khola, 1900 -900 m, 1 spm., leg. C. J. Rai; Dhawlagiri, Kali Gandhaki Khola, from Tatopani to Kopchepani, 1100-1500 m, 17.VI.1986, 1 spm., leg. C. Holzschuh; Nepal: Godavari, 16.-17.V.1992, 2 spm., leg I. Jenis; Nepal: Annapurna Region, Pokhara, Phewa Lake, 900 m, 25.IV.2000, 2 spm., leg. A. Skale; Arun Valley, Arunthan, 29.V.1983, 3 spm., leg. M. Brancucci; Trisuli, 570 m, 21.IV.1973, 1 spm., leg. J. Martens; same district, Lamobagar Gola, 1400 m, 9.-14.VI.1983, 1 spm., leg. M. Brancucci; Ilam distr., Sanishara, 5 km north of Siwalik mts., 270-300 m, 3.-5.IV.1988, 1 spm., leg. J. Martens & W. Schawaller; India: Darjeeling, Monsong, 1100-1300 m, 6.-7.V.1983, 1 spm, leg. B. Bhakta; Bhutan: Wangdi Phodrang, 1300 m, 6.-9.VI.1972, 1 spm., Bhutan exped., Natural Hist. Mus., Basel.

Diagnosis

Holotypus ♂: Elongate, wedge-shaped, raised, and shiny species. Length: 10.3 mm, width: 2.6 mm. Reddish-brown. Pubescence yellowish, semi-erect, long, fine and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

Description

Head with dense and umbilicate puncturation, interstices of points less than half their diameter, and wrinkled, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last two antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and truncate at apex; last antennomere oval, sub-apical bevelled.

Pronotum campaniform, along median line slightly longer than wide at the posterior angles (length/width ratio 1.02:1.00), regularly raised, straight laterally, and with a flat dropping at basis. Posterior angles of pronotum little bent, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum without any median mould or furrow. Puncturation of pronotum dense, coarse, umbilicate, and regularly rounded, interstices of points at the whole surface, but especially at basis, reduced to small, and shiny wrinkles, forming raised rugosities at posterior third.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with an inner tooth. Base slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe just extending parameres, sub-parallel, in middle thin, apically slightly narrowed and sharp. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females unknown.

DIFFERENTIAL DIAGNOSIS

M. nepalensis is closely allied to *M. hirtellus*, but may be easily distinguished from this species by the ligther colour of body, by the raised centre of pronotum, by its oval puncturation, and by the form of aedoeagus.

ETYMOLOGY

Named after the locus typicus.

DISTRIBUTION

Nepal: Ganesh Himal; Kathmandu Valley; Dhawlagiri; Arun Valley.
Bhutan: Wangdi Phodrang.
India: Darjeeling.

***Mulsanteus pedongensis* n. sp.**

(Fig. 51)

LOCUS TYPICUS

India: Darjeeling.

TYPE MATERIAL

Holotypus ♀ (CSV): India : Darjeeling distr., Pedong, 800-1500 m, 15.VIII.1978.

DIAGNOSIS

Holotypus ♀: Elongate, wedge-shaped, raised, and shiny species. Length: 15.4 mm, width: 4.0 mm. Black, legs and a very small line at lateral sides of elytra reddish-brown.

Pubescence reddish-brown, semi-erect, short, fine and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex.

DESCRIPTION

Head with very dense and umbilicate puncturation, interstices of points half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae lost.

Pronotum campaniform, along median line slightly longer than wide at the posterior angles (length/width ratio 1.00:1.00), regularly, and conspicuously raised, arcuate laterally, and with a relative prominent dropping at basis. Posterior angles of pronotum slightly convex, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum without any median mould or furrow. Puncturation of pronotum dense, coarse, umbilicate, and regularly rounded, interstices of points at the whole surface shiny, and covered with simple, and smaller points.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with an inner tooth. Base slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Males unknown.

DIFFERENTIAL DIAGNOSIS

M. pedongensis is not comparable with any other *Mulsanteus*-species known so far. The new species may be easily recognized by its large size, the black colour of body, and by the conspicuously raised pronotum.

ETYMOLOGY

Named after the locus typicus.

DISTRIBUTION

India: Darjeeling.

***Mulsanteus pokharanus* n. sp.**

(Figs. 52-53)

LOCUS TYPICUS

Nepal: Pokhara.

TYPE MATERIAL

Holotypus ♂ (CSV): Nepal: Pokhara, Chhoti Patan, 2.VI.1992, leg. J. Morawec. **Paratypes** 12 ♂♂, 10 ♀ (CPG, CRG, CSV, MTD): Syangia distr., 2-10 km east of Syangia, 1200-1600 m, 22.-26.VII.1995, 1 spm., leg. G. Csorba; Gorkha Distr., Gorkha Vill., 10.-11.V.1999, 1 spm., leg. Ahrens, Kulbe & Rulik; Janakpur, Dolakha, Tama Koshi Valley, Biganthi, 900 m, 13.V.2000, 1 spm., leg. J. Schmidt; India: Godavari, 1500 m, 21.-27.VI.1989, 1 spm., leg. M. Brancucci; Monigow, 1200-1900 m, 10.VI.1978, 1 spm., leg. B. Bhakta; Bagmati, Nuwakot, Gul Bhanjyang, 2300 m, 15.VI.1989, 1 spm., leg. M. Brancucci; Darjeeling, Sangsay, 5.-7.V.1990, 3 spm., leg. B. Bhakta; Payung Busti, 850 m, 25.-27.V.1986, 1 spm., leg. B. Bhakta; Jalpalguri distr., Doors, 11.-15.IV.1990, 1 spm., leg. B. Bhakta; Kalimpong, 5.VI.1989, 1 spm., leg. B. Bhakta; Reenok, 9.-13.V.1990, 1 spm., leg. B. Bhakta; Zambok, 1080 m, 20.III.1986, 1 spm., leg. B. Bhakta; India: Assam, Kaziranga wild life, Pan Bari Reserve forest, 12.-21.XI.1997, 2 spm., leg. V. Siniaey & V., S. & M. Murzin; India: Sikkim, from Diukchu to Gangtok, 11.IX.1997, 2 spm., leg. B. Bhakta; Drongri, 3000 m, 15.X.1977, 1 spm., leg. B. Bhakta; Diukchu, Gantok, 11.IX.1977, 1 spm., leg. B. Bhakta; Chongay, 1700 m, 20.IV.1985, 1 spm., leg. B. Bhakta; India: Utha Pradesh, Gangani, 1250 m, 15.-20.VI.1981, 1 spm., leg. M. Brancucci.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and shiny species. Length: 11.8 mm, width: 3.1 mm. Blackish-brown, legs and antennae chestnut-brown. Pubescence reddish-brown, semi-erect, long, fine and dense, on pronotum inclined to lateral sides, in the posterior third inclined to basis, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last two antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex. Third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and truncate at apex; last antennomere oval, sub-apical bevelled.

Pronotum campaniform, along median line slightly longer than wide at the posterior angles (length/width ratio 1.03:1.00), regularly, and conspicuously raised, arcuate laterally, and with a prominent dropping at basis. Posterior angles of pronotum convex, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum without any median mould or furrow. Puncturation of pronotum less dense, coarse, umbilicate, and regularly rounded, interstices of points once their diameter, shiny, and covered with fine, smaller, and simple points.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with an inner tooth. Base slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe just extending parameres, sub-parallel, in middle thin, apically slightly narrowed and sharp. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females are slightly larger and wider than males, their antennae is slimmer and shorter, just reaching the basis angles of pronotum.

DIFFERENTIAL DIAGNOSIS

M. pokharanus is closely allied to *M. nepalensis*, but may be easily distinguished from this species by the darker colour, the conspicuously raised pronotum, its double punctured surface, and by the form of aedeagus.

ETYMOLOGY

Named after the locus typicus.

DISTRIBUTION

India: (Assam): Kaziranga.
India (Darjeeling): Sangsay.
India: (Sikkim): Diukchu.
India: Utha Pradesh.
Nepal: Pokhara, Syangia.

***Mulsanteus sikkimensis* n. sp.**

(Figs. 54-55)

LOCUS TYPICUS

North-India: Sikkim.

TYPE MATERIAL

Holotypus ♂ (CSV): North-India: Sikkim, Gezing, 1670 m, 31.V.-3.VI.1999, leg. E. Kučera. **Paratypes** 4 ♂♂ (CSV): Same data as Holopypus, 2 spm., leg. E. Kučera; Sikkim, Khecheopari, lake, 1800 m, 15.-22.VI.2006, 1 spm., leg. E. Kučera; North-India: Bengal, Shingalila national park, Tonglu, 3070 m, 14.-19.VI.1999, 1 spm., leg. E. Kučera (in the "Check-list of the geographical distribution of the *Mulsanteus*-species in Southeast Asia", the later record is included into the part of the Indian and Ceylonese sub-region, which is part of the Oriental region).

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and shiny species. Length: 11.0 mm, width: 2.8 mm. Black, elytra reddish-brown, its apex blackish-brown, legs chestnut-brown, antennae light-brown, and first antennomere black. Pubescence reddish-brown, semi-erect, long, bristly and dense, on pronotum inclined to basis and to lateral sides (singular hairs on centre protruding), on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last two antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and truncate at apex; last antennomere oval, sub-apical bevelled.

Pronotum trapezoid, along median line slightly longer than wide at the posterior angles (length/width ratio 1.05:1.00), prominently and regularly raised, straight laterally, and with a prominent, abrupt dropping at basis. Posterior angles of pronotum straight, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum with a flat median mould at posterior third. Puncturation of pronotum dense, coarse, umbilicate, and regularly rounded, interstices of points at the whole surface shiny, and reduced to small wrinkles, forming raised rugosities at posterior third.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with an inner tooth. Base slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe just extending parameres, sub-parallel, in middle thick, apically slightly narrowed and sharp. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females unknown.

Differential diagnosis

M. sikkimensis is closely allied to *M. shaanxiensis*, but may be easily distinguished from this species by the shorter body, by the lighter colour of elytra and antennae, and by the form of aedeagus.

Etymology

Named after the locus typicus.

Distribution

North-India: Sikkim, Gezing, Khecheopari.
North-India: Bengal, Shingalila.

6. THE SPECIES OF THE GENUS *MULSANTEUS* FROM THE MALAYAN SUB-REGION

The material of *Mulsanteus* from the Malayan sub-region includes species from Java, and Sumatra, from the Malayan peninsula (Perak, Pahang, and Kelantan), from Borneo, and from the Philippines.

6.1 KEY TO SPECIES

1\. Elytra black or blackish-brown .... 2.
–. Elytra chestnut-brown or of different colour .... 5.
2\. Antennae black, tenth and eleventh antennomere yellow .... *M. antennatus* (Candèze, 1896)
–. Antennae totally black .... 3.
3\. Elytra with longitudinal bands of fulvous, and coarser hairs .... *M. phillipsi* (Van Zwaluwenburg, 1936)
–. Elytra without longitudinal bands of coarser hairs .... 4.
4\. Legs yellow, tarsus black, disk of pronotum prominently raised .... *M. illotipes* (Candèze, 1863)
–. Legs totally yellow, disk of pronotum flat .... *M. lucidus* (Candèze, 1865)
5\. Elytra totally chestnut-brown to reddish .... 6.
–. Elytra of different colour .... 9.

6. Antennae extending basis angles of pronotum by the length of the ultimate five antennomeres .... *M. hirticornis* (CANDÈZE, 1893)
–. Antennae extending basis angles of pronotum by the length of the ultimate two to four antennomeres ....7.
7. Pronotum and elytra reddish .... 8.
–. Pronotum black, elytra chestnut-brown .... *M. platiai* n. sp.
8. Antennae exceeding basis angles of pronotum by the length of the ultimate four antennomeres .... *M. aemulus* (CANDÈZE, 1891)
–. Antennae exceeding basis angles of pronotum by the length of the ultimate two antennomeres .... *M. hirsutus* (CANDÈZE, 1875)
9. Pronotum bi-coloured, reddish, a triangular spot at its centre black .... *M. borneoensis* (ÔHIRA, 1973)
–. Pronotum unicoloured .... 10.
10. Pronotum reddish-brown; apical third of the reddish-brown elytra black .... *M. potulinensis* n. sp.
–. Pronotum black; suture of the reddish-brown elytra black .... *M. germanus* (CANDÈZE, 1894)

6.2. REVIEW OF SPECIES

***Mulsanteus aemulus* (CANDÈZE, 1891) n. comb.**

(Figs. 56-57)

Ludius aemulus CANDÈZE, 1891: 246; SCHENKLING, 1927: 432.
Trichophorus aemulus (CANDÈZE, 1891): SCHWARZ, 1906: 259.
Neotrichophorus aemulus (CANDÈZE, 1891): VAN ZWALUWENBURG, 1959: 405.

LOCUS TYPICUS
Indonesia: Java.

NEW MATERIAL
Indonesia: Java, Blawan, Idjen-plateau, 900-1500 m, 11.XII.1940, 3 spm., leg. H. Lucht; Sumba, Pogobina, 17.IX.1949, 1 spm., leg. Bühler & Sutter; Rua, 31.VIII.1949, 1 spm. Leg. Bühler & Sutter.

DISTRIBUTION
Indonesia: Java; Sumba.

***Mulsanteus antennatus* (CANDÈZE, 1896) n. comb.**

(Figs. 58-59)

Ludius antennatus CANDÈZE, 1896: 70; SCHENKLING, 1927: 428.
Neotrichophorus antennatus (CANDÈZE, 1896): ÔHIRA, 1973: 117.

LOCUS TYPICUS
Malaysia: Borneo.

NEW MATERIAL

Malaysia: Sabah, Poring Spring, 650 m, 1998, 1 spm., without further data.

DISTRIBUTION

Malaysia: Borneo.

***Mulsanteus borneoensis* (ÔHIRA, 1973) n. comb.**

(Figs. 60-61)

Neotrichophorus borneoensis ÔHIRA, 1973: 117-118.

LOCUS TYPICUS

Malaysia, Borneo.

NEW MATERIAL

Malaysia: Borneo, Sabah, Crocker range, west of Apin Apin, II.2000, 1 spm., leg. M. Snizek; same location but V.1999, 1 spm., leg. M. Snizek.

DISTRIBUTION

Malaysia: Borneo.

Photo 3: Borneo, Crocker range, Gunung Emas, 1600 m. Photo W. Schawaller, 2007

***Mulsanteus germanus* (CANDÈZE, 1894) n. comb.**

(Figs. 62-63)

Ludius germanus CANDÈZE, 1894: 498; SCHENKLING, 1927: 432.
Neotrichophorus germanus (CANDÈZE, 1894): VAN ZWALUWENBURG, 1959: 405.

LOCUS TYPICUS

Indonesia: Sumatra.

NEW MATERIAL

Indonesia: Sumatra, Brastagi, Sikulikap, 1000 m, 5.IX.1992, 1 spm., without further data; Malaysia: Pahang, Cameron highlands, Tanah rata, 1600 m, 1.-10.II.2000, 1 spm, leg. P. Pacholatko; same location but Kampung Kuala, 26.III.-3.IV.2001, 1 spm, leg. M. Štrba.

DISTRIBUTION

Indonesia: Sumatra.
Malaysia: Pahang.

REMARKS

A variety form of *M. germanus*, recorded by FLEUTIAUX (1916), and also by SCHENKLING (1925) from Mindanao, Philippines, has not been studied. The occurrence of this species in the Philippines is questionable.

***Mulsanteus hirsutus* (CANDÈZE, 1875) n. comb.**

(Figs. 64-65)

Ludius hirsutus CANDÈZE, 1875: 126.
Trichophorus hirsutus (CAND ÈZE, 1875): SCHWARZ, 1906: 259.
Neotrichophorus hirsutus (CANDÈZE, 1875): SCHENKLING, 1927: 433; VAN ZWALUWENBURG, 1936: 426; 1959: 405; ÔHIRA, 1974: 52.

LOCUS TYPICUS

Philippines: Luzon.

NEW MATERIAL

Philippines: Luzon, Mt. Banahao, 1 spm., without further data.

DISTRIBUTION

Philippines.

***Mulsanteus hirticornis* (CANDÈZE, 1893) n. comb.**

(Figs. 66-67)

Ludius hirticornis CANDÈZE, 1893: 57.
Trichophorus hirticornis (CANDÈZE, 1893): SCHWARZ, 1906: 259.
Neotrichophorus hirticornis (CANDÈZE, 1893): SCHENKLING, 1927: 433; VAN ZWALUWENBURG, 1959: 405.

LOCUS TYPICUS

Indonesia: Java.

NEW MATERIAL

Indonesia: Sumatra, VIII.1991, 1 spm., without further data; Malaysia: Perak, 25 km northeast of Ipoh, Banjaran, Titi Wangsa Mts., 1200 m, 1.-15.IV.2000, 1 spm., leg. P. Cechovski; same location, 29.III.-15.IV.2004, 2 spm., leg. P. Cechovski; same location, but 1.-15.IV2002, 1 spm., leg. P. Cechovsky; Kelantan, Road between Kampong Raja and Gua Musang, 1400-1700 m, 1.-28.IV.2006, 4 spm., leg. P. Cechovsky.

DISTRIBUTION

Indonesia: Java, Sumatra.

Malaysia: Perak.

Mulsanteus illotipes (CANDÈZE, 1863) n. comb.

(Figs. 68-69)

Ludius illotipes CANDÈZE, 1863: 302.
Trichophorus illotipes (CANDÈZE, 1863): SCHWARZ, 1906: 259.
Neotrichophorus illotipes (CANDÈZE, 1863): SCHENKLING, 1927: 433; VAN ZWALUWENBURG, 1959: 405.

LOCUS TYPICUS

Java: Indonesia.

NEW MATERIAL

Indonesia: Sumatra, Ketambe, Leuser nat. Park, 450 m., 26.II.-1.III.1991, 2 spm., leg. Bocák & Bocáková; Sumatra, Pajakumbuk, 10.V.1991, 1 spm., leg. R. Cermak; Sumatra south-west coast, Ranau lake, 1.-4.VI.2001, 10 spm., leg. Bolm.

DISTRIBUTION

Indonesia: Java, Sumatra.

REMARKS

The new records of this species are the first for Sumatra.

Mulsanteus lucidus (CANDÈZE, 1865) n. comb.

(Figs. 70-71)

Ludius lucidus CANDÈZE, 1865: 55.
Trichophorus lucidus (CANDÈZE, 1865): SCHWARZ, 1906: 259.
Neotrichophorus lucidus (CANDÈZE, 1865): SCHENKLING, 1927: 433.

LOCUS TYPICUS

Indonesia: Java.

NEW MATERIAL

Java: K. O. Biwan, Idjen Plateau, 900-1500 m, 2.XII.1940, 4 spm., leg. H. Lucht; Java: Bebe, 22.VI.1989, 2 spm., leg. L. Chua.

DISTRIBUTION

Indonesia: Java.

REMARKS

Ludius lucidus has been described by CANDÈZE, 1865, and transferred by SCHWARZ (1906) to the genus *Trichophorus*, and by SCHENKLING (1927) to the genus *Neotrichophorus*. However, VAN ZWALUWENBURG (1959) placed this species again under the genus *Elater* LINNAEUS, 1758 (the former group of *Ludius*), but without any remarks on the reason why he did. The characteristics of this species, especially the form of the posterior angles of pronotum, and the pubescence of antennae, classifies it to be a member of the genus *Mulsanteus*, and as to be systematically very near the *M. illotipes*. For this reason, we transfer *Ludius lucidus* to the genus *Mulsanteus*.

***Mulsanteus phillipsi* (VAN ZWALUWENBURG, 1936) n. comb.**

Neotrichophorus phillipsi VAN ZWALUWENBURG, 1936: 426-427; 1959: 406; ÔHIRA, 1973: 8; 1974: 51.

LOCUS TYPICUS

Philippines: Mindanao.

REMARKS

There are no new records of this species.

***Mulsanteus platiai* n. sp.**

(Figs. 72-73)

LOCUS TYPICUS

Malaysia: Peninsula.

TYPE MATERIAL

Holotypus ♂ (CSV): Malaysia: Pahang, Cameron Highlands, Tanah Rata, 1600 m, 26.I.-10.II.2000, leg. J. Horák. **Paratypes** 7 ♂♂ (CPG, CRG, CSV, NMB, TICB): same data as holotype but 1500-1700 m, 1.-13.II.2003, 1 spm., leg. P. Pacholátko; same location but 1500-1800 m, 2.-26.III.2004, 1 spm., leg. P. Pacholátko; Pahang, Cameron highlands, 2.-9.IV.1997, 1 spm., leg. D. Hauck; Perak, Tanah Rata, 13.-16.III.1997, 2 spm., leg. O. Ďulik & I. Jeniš; Kelantan, Road between Karnpong Raja and Gua Musang, 1400-1700 m, 1.-28.IV.2006, 2 spm., leg. P. Cechovsky.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and shiny species. Length: 9.5 mm, width: 2.3 mm. Black, pronotum reddish-brown, elytra, legs and antennae light-brown.

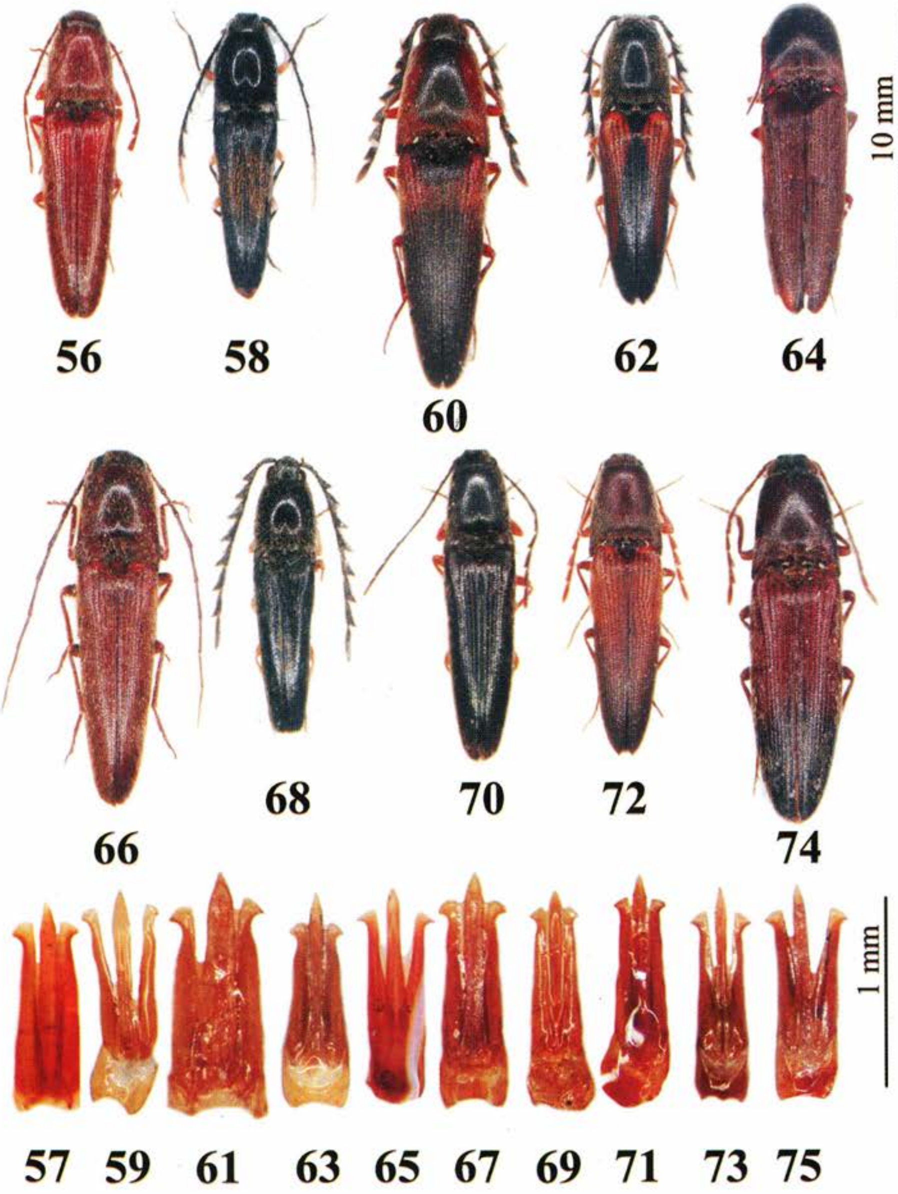


Plate 4 (figs. 56-73). 56, 57. *Mulsanteus aemulus* (CANDÈZE, 1891) n. comb.: 56 – habitus, 57 – aedeagus; 58, 59. *M. antennatus* (CANDÈZE, 1896) n. comb.: 58 – habitus, 59 – aedeagus; 60, 61. *M. borneoensis* (ÔHIRA, 1973) n. comb.: 60 – habitus, 61 – aedeagus; 62, 63. *M. germanus* (CANDÈZE, 1894) n. comb.: 62 – habitus, 63 – aedeagus; 64, 65. *M. hirsutus* (CANDÈZE, 1875) n. comb.: 64 – habitus, 65 – aedeagus; 66, 67. *M. hirticornis* (CANDÈZE, 1893) n. comb.: 66 – habitus, 67 – aedeagus; 68, 69. *M. illotipes* (CANDÈZE, 1863) n. comb.: 68 – habitus, 69 – aedeagus; 70, 71. *M. lucidus* (CANDÈZE, 1865) n. comb.: 70 – habitus, 71 – aedeagus; 72, 73. *M. platiai* n. sp.: 72 – habitus, 73 – aedeagus; 74-75. *M. portulinensis* n. sp.: 74 – habitus, 75 - aedeagus

Pubescence reddish-brown, semi-erect, long, bristly and dense, on pronotum inclined to basis and to lateral sides (singular hairs on centre protruding), on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

DESCRIPTION

Head with very dense and umbilicate puncturation, interstices of points less than half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last three antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and truncate at apex; last antennomere oval, sub-apical bevelled.

Pronotum trapezoid, along median line slightly longer than wide at the posterior angles (length/width ratio 1.02:1.00), prominently and regularly raised, straight laterally, and with a prominent, abrupt dropping at basis. Posterior angles of pronotum straight, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum with a flat median mould at posterior third. Puncturation of pronotum very dense, coarse, umbilicate, and regularly rounded, interstices of points at the whole surface shiny, and reduced to small wrinkles, forming raised rugosities at posterior third, and at centre.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with a very prominent inner tooth, forming an extended thorn. Base slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe noticeably extending median lobe, sub-parallel, in middle thin, apically slightly narrowed and sharp. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Female unknown.

DIFFERENTIAL DIAGNOSIS

M. platiai is closely allied to *M. aemulus*, but may be easily distinguished from this species by the darker colour of body, by the thorn-like apex of elytra, and by the form of aedeagus.

ETYMOLOGY

Named after our dear friend and colleague, Prof. Dr. G. PLATIA, Gatteo, Italy, in honour of his excellent scientific works on the Elateridae.

DISTRIBUTION

Malaysia: Pahang; Perak; Kelantan.

Mulsanteus portulinensis n. sp.

(Figs. 74-75)

LOCUS TYPICUS

Philippines: Mindanao.

TYPE MATERIAL

Holotypus ♂ (CSV): Philippines : Mindanao, Maramag province, Portulin, 3.I.1991, leg. Bolm.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and slightly shiny species. Length: 13.2 mm, width: 3.2 mm. Reddish-brown, head, and apical third of elytra, as well as mesothorax black. Pubescence yellowish-brown, semi-erect, short, bristly and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

DESCRIPTION

Head with very dense and umbilicate puncturation, interstices of points less than half their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last two antennomeres; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and truncate at apex; last antennomere oval, sub-apical bevelled.

Pronotum trapezoid, along median line slightly longer than wide at the posterior angles (length/width ratio 1.08:1.00), prominently and regularly raised, straight laterally, and with a prominent, abrupt dropping at basis. Posterior angles of pronotum straight, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum with a flat median mould at posterior fifth. Puncturation of pronotum dense, coarse, umbilicate, and regularly rounded, interstices of points once their diameter, and little shiny.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with a very small, just visible inner tooth. Base slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae rugged punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe noticeably extending parameres, sub-parallel, in middle thin, apically narrowed and sharp. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females unknown.

DIFFERENTIAL DIAGNOSIS

M. portulinensis is closely allied to *M. murenus*, but may be easily distinguished from this species by the longer body, its darker colour, by the less dense puncturation of pronotum, and by the form of aedeagus.

ETYMOLOGY

Named after the locus typicus.

DISTRIBUTION

Philippines: Mindanao.

7. THE SPECIES OF THE GENUS *MULSANTEUS* OF THE INDIAN AND CEYLONESE SUB-REGION

The material from the Indian and the Ceylonese sub-regions has been collected at India and Sri Lanka. Although, India (excluding Westghats) and Sri Lanka belong to two different zoological sub-regions, we publish the *Mulsanteus*-species occurring there together, for the reason that there is just a little material (three species) known so far from both sub-regions.

7.1. KEY TO SPECIES

1. Interstices of pronotum puncturation once their diameter; larger species (12.5 mm) .... *M. touffus* (VATS & CHAUHAN, 1992)
–. Interstices of pronotum puncturation half their diameter; smaller species (10.5 to 11.5 mm) .... 2.
2. Body surface dull; species of 11.5 mm in length .... *M. tumidicollis* (SCHWARZ, 1901)
–. Body surface shiny; species of 10.5 mm in length .... *M. maceratus* (CANDÈZE, 1893)

7.2. REVIEW OF SPECIES

***Mulsanteus maceratus* (CANDÈZE, 1893) n. comb.**

(Figs. 76-77)

Ludius maceratus CANDÈZE, 1893: 57.
Trichophorus maceratus (CANDÈZE, 1892): SCHWARZ, 1906: 259.
Neotrichophorus maceratus (CANDÈZE, 1893): SCHENKLING, 1927: 433.

LOCUS TYPICUS
India.

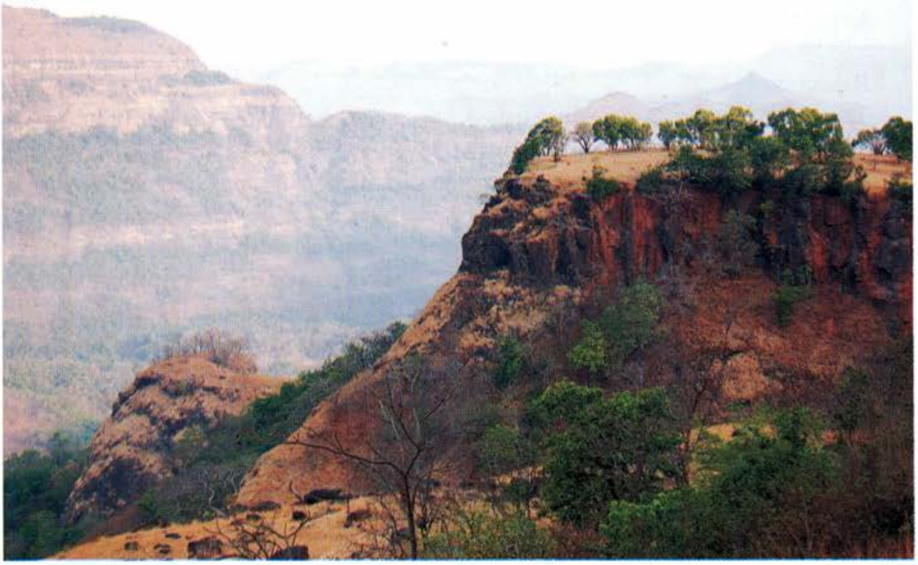


Photo 4: India, western Ghat, north of Mumbai. Photo A. Patwaradhan, 2006

NEW MATERIAL

India: Kerala, Triyandrum, Poonmudi, V.1992, 2 spm., T.R.S. Nathan; Sri Lanka: Dodanduwa, 20.-30.IV.1998, 1 spm., leg. B. Makovsky; Kerala, Peryiar, IV.1993, 1 spm., leg. Senft; Pondicherry, IX.1992, 1 spm., leg. Nathan; same location but VI.1992, 1 spm., leg. Nathan; same location but X.1995, 2 spm., leg. Nathan; same location but XI.2002, 1 spm., leg. L. Surender.

DISTRIBUTION

India: Kerala; Bengale.
Sri Lanka: Dodanduwa.

Mulsanteus touffus (VATS & CHAUHAN, 1992) n. comb.

(Figs. 78-79)

Aphanobius touffus VATS & CHAUHAN, 1992: 189-190.

LOCUS TYPICUS

India: Uttar Pradesh.

NEW MATERIAL

India: Uttar Pradesh, Rishikesh, VII.1991, 1 spm., leg. K. Werner; Kerala, Trivandrum, Poonmudi Range, V.1989, 1 spm., leg. T.R.S. Nathan.

DISTRIBUTION

India: Uttar Pradesh; Kerala.

REMARKS

The authors of the species published it as a member of the genus *Aphanobius*. However, from the description of the thorax, given by the authors, it is discernible that the species belongs to *Mulsanteus*. The mentioned tufts on the apex of posterior angles of pronotum are typical for *Mulsanteus*-species, but not for *Aphanobius*-species.

Unfortunately, the authors of the species *A. touffus* (VATS & CHAUHAN, 1992) placed pictures (1 – male genitalia and 3 – habitus) as part of the description that they also used in another paper (J. ent. Res., **16** (1): 20-23) for the species *Megapenthes variabilis*. In view of this, clarifications should be made, on which pictures belong to which species.

Mulsanteus tumidicollis (SCHWARZ, 1901) n. comb.

(Figs. 80-81)

Ludius tumidicollis SCHWARZ, 1901: 330-331.
Trichophorus tumidicollis (SCHWARZ, 1901): SCHWARZ, 1906: 259.
Neotrichophorus tumidicollis (SCHWARZ, 1901): SCHENKLING, 1927: 433.

LOCUS TYPICUS

India: Madras.

New material

India: Pondicherry, Karaikal, VIII.1979, 1 spm., leg. T.R.S. Nathan; India: Nedungadu, 1936, 1 spm., leg. P.S. Nathan.

Distribution

India: Madras; Pondicherry; Nedungadu.

8. THE SPECIES OF THE GENUS *MULSANTEUS* OF THE WALLACEA

No material of the genus *Mulsanteus* has been recorded from the Wallacea so far. The species described next is the first of this genus known from islands of Ternate, and Bacan, and from the zoogeographic sub-region named Wallacea.

8.1. REVIEW OF SPECIES

***Mulsanteus weigeli* n. sp.**

(Figs. 82-83)

Locus typicus

Indonesia: Maluku.

Type material

Holotypus ♂ (NME): Indonesia: Maluku, Ternate, Tolire lake, 100 m, 29.I.2005, leg. A. Weigel. **Paratypes** 3 ♀♀ (NME, CPG, CSV): Indonesia: Maluku, Bacan, 10

Photo 5: Ternate, northern part, primary forest at the Tolire lake. Photo A. Weigel, 2006

km east of Labuah, 120 m, 14.I.2006, 1 spm., leg. A. Weigel; Bacan, 3 km south of Labuah, 40 m, 13.I.2006, 1 spm., leg. A. Weigel; Maluku, Ternate, 27.I.1979, 1 spm., leg. Brignoli.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and shiny species. Length: 11.9 mm, width: 3.1 mm. Black, legs, antennae, and the centre of scutellum reddish-brown. Pubescence reddish-brown, semi-erect, long, bristly and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half to once their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last antennomere; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and truncate at apex; last antennomere oval, sub-apical bevelled.

Pronotum campaniform, along median line slightly longer than wide at the posterior angles (length/width ratio 1.02:1.00), prominently and regularly raised, arcuate laterally, and with a prominent, abrupt dropping at basis. Posterior angles of pronotum convex, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum without any median mould or furrow. Puncturation of pronotum dense, coarse, umbilicate, and regularly rounded, interstices of points once their diameter, shiny, and covered with fine and simple points.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with an inner tooth. Base slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species).

Plate 5 (figs. 74-91). 76, 77. *M. maceratus* (CANDÈZE, 1893) n. comb.: 76 – habitus, 77 – aedoeagus; 78, 79. *M. touffus* (VATS & CHAUHAN, 1992) n. comb: 78 – habitus, 79 – aedeagus; 80, 81. *M. tumidicollis* (SCHWARZ, 1901) n. comb.: 80 – habitus, 81 – aedeagus; 82, 83. *M. weigeli* n. sp.: 82 – habitus, 83 – aedeagus; 84, 85. *M. irianjayensis* n. sp.: 84 – habitus, 85 – aedeagus; 86. Habitus of *Elater hoabinhus* (FLEUTIAUX, 1936) n. comb; 87, 88. *E. phongsalyensis* n. sp.: 87 – habitus, 88 – aedeagus; 89. Habitus of *Elater vitalisi* (FLEUTIAUX, 1918) n. comb.; 90, 91. *Gamepenthes malaisei* (FLEUTIAUX, 1942) n. comb.: 90 – habitus, 91 – aedeagus; 92, ,93, 94, 95. Characteristics of *Mulsanteus*-species: 92 - antennae; 93 - antennomeres 2-3; 94 – right basis angle of pronotum (lateral view); 95 – antennomeres 5-7 with pubescence


76


78


80


82


84


77


79


81


83


86


87

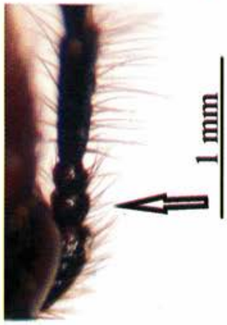

89


90


85


88


91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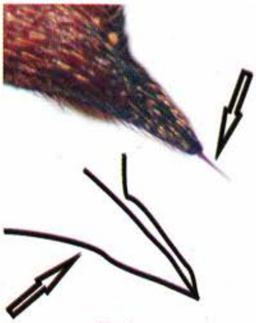
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Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with median lobe noticeably extending parameres, sub-parallel, in middle thick, apically slightly narrowed and sharp. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females are not much different from the males, only their antennae are slightly slimmer, and of nearly the same length.

DIFFERENTIAL DIAGNOSIS

M. weigeli is closely allied to *M. riesei*, but may be easily distinguished from this species by the shorter body and the shorter antennae, and by the form of aedeagus.

ETYMOLOGY

Named after the discoverer of the new species, Mr. A. WEIGEL, Wernburg, Germany.

DISTRIBUTION

Indonesia: Maluku.

9. THE SPECIES OF THE GENUS *MULSANTEUS* OF THE PAPUAN SUB-REGION

No material of the genus *Mulsanteus* has been recorded from the Papuan sub-region so far. *Mulsanteus irianjayensis* is the first of this genus known from Irian Jaya.

9.1. REVIEW OF SPECIES

***Mulsanteus irianjayensis* n. sp.**

(Figs. 84-85)

LOCUS TYPICUS

Indonesia: Irian Jaya.

TYPE MATERIAL

Holotypus ♂ (NME): Indonesia: Irian Jaya, Biak, 10 km north of Bosnik, 13.II.1998, leg. A. Weigel. **Paratypes** 4 ♂♂, 1 ♀ (CSV, NME): Indonesia: Same date as Holotypus, 1 spm., leg. A. Weigel; same location but 14.II.1998, 1 spm., leg. A. Weigel; Nabire, Kwatisore, 3.III.1998, 1 spm., leg. A. Weigel; 170 km south of Nabire, Epomani, 6.I.1996, 1 spm., leg. A. Weigel; Yapen, 20 km south of Serui, 5.I.1999, 1 spm., leg. A. Weigel.

DIAGNOSIS

Holotypus ♂: Elongate, wedge-shaped, raised, and shiny species. Length: 11.7 mm, width: 3.3 mm. Chestnut-brown, elytra, legs and antennae reddish-brown. Pubescence reddish-brown, semi-erect, long, bristly and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex; apices of posterior angles of pronotum with a tuft of longer and protruding bristles; pubescence of antennae covered with conspicuously long and protruding hairs.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half to once their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, frons slightly raised above the base of antennae, and completely edged. Eyes small, spherical, and little prominent. Antennae long, thin and serrate from fourth antennomere on, outreaching posterior angles of pronotum by the length of the last antennomere; second antennomere globular, very short, as long as wide, and slightly extended at apex; third antennomere of the same length as second antennomere, but semi-globular, truncate at apex, and both combined conspicuously shorter than fourth and each of the following antennomeres; those are extended and truncate at apex; last antennomere oval, sub-apical bevelled.

Pronotum campaniform, along median line slightly longer than wide at the posterior angles (length/width ratio 1.02:1.00), prominently and regularly raised, arcuate laterally, and with a prominent, abrupt dropping at basis. Posterior angles of pronotum convex, and with a prominently raised carina, apices truncate, and bent downwards (best visible from lateral view). Pronotum without any median mould or furrow. Puncturation of pronotum less dense, coarse, umbilicate, and regularly rounded, interstices of points two times their diameter, shiny, and covered with fine and simple points.

Scutellum triangular, wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex. Apex curved, and with an inner tooth. Base slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with dense, simple puncturation, interstices of striae finely punctured, dull, and strip-like raised. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with a sub-parallel, in middle thick, apical slightly narrowed and sharp, the paramere noticeably extending median lobe. Apical lobe of parameres crescent-shaped, with prominent, hook-like lateral edge, and long apical hairs.

Females are not much different from the males, just their antennae are slightly slimmer, and of the same length.

DIFFERENTIAL DIAGNOSIS

M. irianjayensis is closely allied to *M. weigeli*, but may be easily distinguished from this species by the ligther colour of body, the less dense puncturation of pronotum, and by the form of aedeagus.

ETYMOLOGY

Named after the locus typicus.

DISTRIBUTION

Indonesia: Irian Jaya.

10. CHECK-LIST OF THE ZOOGEOGRAPHICAL DISTRIBUTION OF *MUSANTEUS*-SPECIES IN SOUTHEAST ASIA

(Sectionings after DE LATIN, 1967: 271)

Species from the Indo-Chinese subregion

Cambodia: *Mulsanteus cambodiensis*, *M. rugosus*.
Laos: *Mulsanteus bonifacyi*, *M. kubani*, *M. longicornis*, *M. pejchai*, *M. rugosus*, *M. sausai*.
Myanmar: *Mulsanteus brignolii*, *M. clavus*, *M. sausai*.
Thailand: *Mulsanteus clavus*, *M. kubani*, *M. riesei*, *M. rugosus*, *M. sausai*.
Vietnam: *Mulsanteus bonifacyi*, *M. longicornis*.
China (Guangxi): *Mulsanteus sausai*.
China (Hong Kong): *Mulsanteus anchastinus*.
China (Hubei): *Mulsanteus hubeiensis*, *M. wudangshanensis*.
China (Shaanxi): *Mulsanteus shaanxiensis*.
Taiwan: *Mulsanteus foldvarii*, *M. peregovitsi*, *M. rubuginosus*, *M. shirozui*.

Species from the territories of the Himalaya and from Tibet

Nepal: *Mulsanteus godawariensis*, *M. hirtellus*, *M. holzschuhi*, *M. ingridae*, *M. langtangensis*, *M. murenus*, *M. nepalensis*, *M. pokharanus*.
Bhutan: *Mulsanteus godawariensis*, *M. nepalensis*.
India (Sikkim): *Mulsanteus murenus*, *M. pokharanus*, *M. sikkimensis*.
India (Darjeeling): *Mulsanteus hartmanni*, *M. holzschuhi*, *M. murenus*, *M. nepalensis*, *M. pedongensis*, *M. pokharanus*.
India (Assam): *Mulsanteus pokharanus*.
India (Uttar Pradesh; Himachal Pradesh): *Mulsanteus touffus*, *M. pokharanus*.
Tibet: *Mulsanteus sausai*.

Species from the Indian and the Ceylonese sub-regions

India: *Mulsanteus maceratus*, *M. tumidicollis*, *M. sikkimensis*, *M. touffus*.
Sri Lanka: *Mulsanteus maceratus*, *M. hirtellus*.

Species from the Malayan sub-region

Borneo: *Mulsanteus antennatus*, *M. borneoensis*, *M. spissus*.
Java: *Mulsanteus aemulus*, *M. hirticornis*, *M. illotipes*, *M. lucidus*.
Malay (Kelantan): *Mulsanteus spissus*.
Malay (Pahang): *Mulsanteus germanus*, *M. spissus*.
Malay (Perak): *Mulsanteus hirticornis*, *M. spissus*
Sumatra: *Mulsanteus germanus*, *M. hirticornis*, *M. illotipes*.
Philippines: *Mulsanteus hirsutus*, *M. phillipsi*, *M. portulinensis*.

Species from the Wallacea

Indonesia (Maluku): *Mulsanteus weigeli.*

Species from the Papuan sub-region

Indonesia (Irian Jaya): *Mulsanteus irianjayensis.*

11. CONSTITUTION OF THE SISTER-GROUP OF THE GENUS *MULSANTEUS*

Analysis

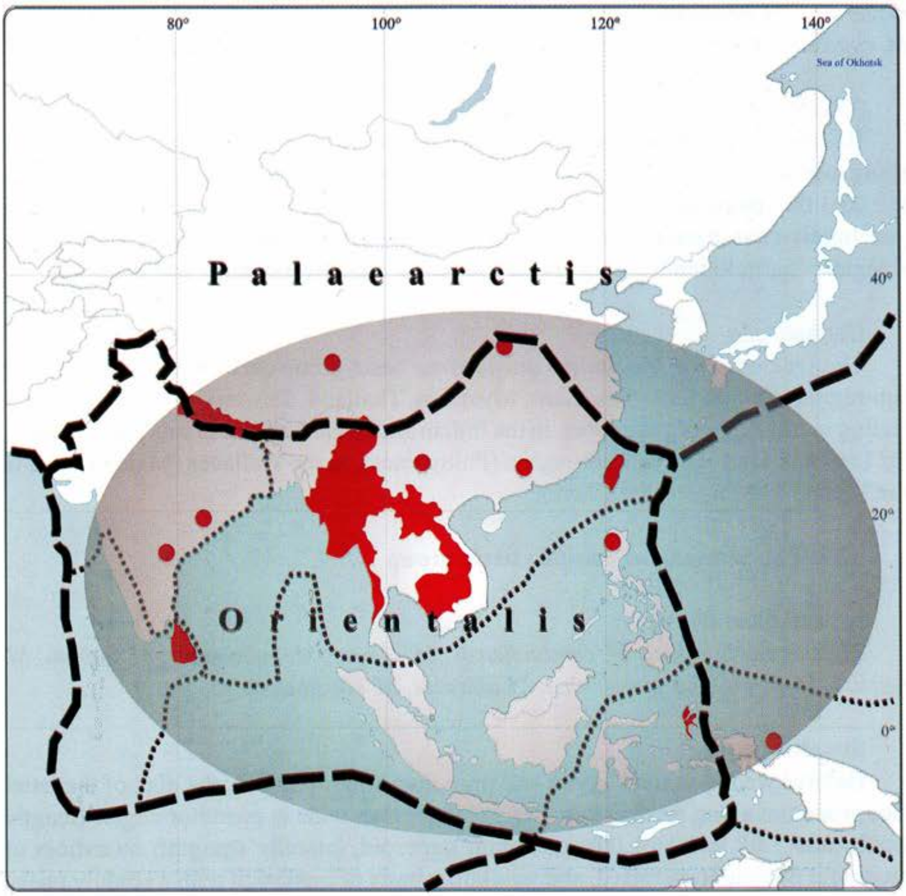
The species of the genera *Aphanobius*, *Elater* and *Mulsanteus* possess common characteristics in various body parts (form and pubescence of antennae, structure of pronotum, scutellum, and male genitalia). These characteristics will be compared within the following analysis.

Body part	***Aphanobius***	***Elater***	***Mulsanteus***
Antennae	Not reaching posterior angles of pronotum for the length of the last one to two segments; second and third antennomere clearly longer than wide; apexes of fourth to tenth antennomere truncate; hairs short and inclined.	Reaching posterior angles of pronotum or outreaching it for the length of the last antennomere; second and third antennomere globular to semi-globular; apexes of fourth to tenth antennomere serrate (in the majority of the known species) to lamellate (in three species); hairs very short and protruding.	Outreaching posterior angles of pronotum for the length of the last one to four segments; second and third antennomere globular to semi-globular; apexes of fourth to tenth antennomere truncate, serrate or lamellate; hairs long and protruding.
Pronotum	Sub-parallel, at median line clearly longer than wide along posterior angles (length/with ratio as 1.25 to 1.30:1.00); disk of pronotum slightly raised; puncture fine and simple to umbilicate, interstices of points half to once their diameter, reduced to small wrinkles at basis.	Campaniform, at median line as long as wide, or slightly longer than wide along posterior angles (length/with ratio as 1.00 to 1.02:1.00); disk of pronotum conspicuously raised; puncture fine and simple to umbilicate, interstices of points half to manifold their diameter.	Campaniform to trapezoid, at median line slightly to conspiuously longer than wide along posterior angles (length/with ratio as 1.02 to 1.10:1.00); disk of pronotum flat to slightly raised; puncture fine and simple to umbilicate, interstices of points half to once their diameter, flat or reduced to small wrinkles.
Scutellum	Wedge-shaped, arcuate at apex, laterally constricted.	Wedge-shaped, arcuate at apex, laterally straight.	Wedge-shaped, sharp at apex, laterally straight.

RESULTS

The antennae of the species of the genera *Elater* and the *Mulsanteus* are of almost identical structure, while those of the species of the genus *Aphanobius* are different in the form of the second and third antennomere. The campaniform pronotum of the *Elater* and the *Mulsanteus*-species are also similar to almost identical. Only the down-bent apexes of posterior angles of pronotum are unique in the species of *Mulsanteus*. The pronotum of *Aphanobius* is sub-parallel, along median line conspicuously longer than wide at the posterior angles, and just slightly raised. The sharp apex of scutellum is evolved only in the species of *Mulsanteus*, while those of *Elater* and *Aphanobius* are arcuate. The male genitalia are different in all the three compared groups, and especially the lateral edge of paramere is especially significant for the various groups.

As an overall result of the above analysis, the genera of *Elater* and *Mulsanteus* have many more similar to identical characteristics with each other than each of them with the genus *Aphanobius*.



Map 1: Dispersions of the *Mulsanteus anchastinus* basic-group.

12. CONSTITUTION OF MONOPHYLETIC BASIC-GROUPS AND THEIR ZOOGEOGRAPHICAL DISTRIBUTION

The reviewed species of the genus *Mulsanteus* possess characteristics that are developed in some of them as identical structures. Therefore, these characteristics can be treated as hypothetical apomorphies which have been evolved by a common ancestor and overtaken by the descendants (in accordance with the principle of parsimony). Separate and manifold convergent evolution of those characteristics in the various species would be the alternative to synapomorphy. Based on hypothetical apomorphies, the species of the genus *Mulsanteus* are articulated into phylogenetic basic-groups.

12.1. **The *Mulsanteus anchastinus* basic-group**

APPERTAINING SPECIES

Mulsanteus anchastinus, *M. brignolii*, *M. foldvarii*, *M. hirsutus*, *M. irianjayensis*, *M. maceratus*, *M. nepalensis*, *M. pedongensis*, *M. pokharanus*, *M. riesei*, *M. rubuginosus*, *M. rugosus*, *M. sausai*, *M. shaanxiensis*, *M. touffus*, *M. tumidicollis*, *M. weigeli.*

SYNAPOMORPHIES

Habitus wedge-shaped, elytra and disk of pronotum conspicuously raised; pronotum along median line slightly longer than wide at posterior angles (length/width ratio 1.00 to 1.05:1.00); pronotum campaniform, laterally slightly arcuate; interstices of pronotum puncturation flat; basis of pronotum with a prominent, but regular dropping; antennae elongate, fourth to tenth antennomere triangular, apically extended and truncate.

DISTRIBUTION

The species of the *Mulsanteus anchastinus* basic-group occur in the Indo-Chinese sub-region (Cambodia, China, Laos, Myanmar, Thailand, Taiwan), in Himalaya (Darjeeling in India, Nepal) and Tibet, in the Indian and in the Ceylonese sub-region (India, Sri Lanka), in the Malayan sub-region (Philippines), in the Wallacea (Maluku), and in the Papuan sub-region (Irian Jaya).

12.2. **The *Mulsanteus bonifaci* basic-group**

APPERTAINING SPECIES

Mulsanteus bonifaci, *M. cambodiensis*, *M. clavus*, *M. hubeiensis*, *M. kubani*, *M. pejchai*, *M. platiai*, *M. peregovitsi*, *M. shirozui*, *M. sikkimensis*.

SYNAPOMORPHIES

Habitus wedge-shaped, elytra and pronotum sligthly raised, the disk of the latter flat; pronotum along median line clearly longer than wide at posterior angles (length/width ratio 1.05 to 1.10:1.00); pronotum trapezoid, laterally straigtht; interstices of pronotum puncturation raised, and wrinkling; basis of pronotum with a slightly raised dropping; antennae elongate, serrate from fourth antennomere on, apexa of antennomere extended to lamellate.

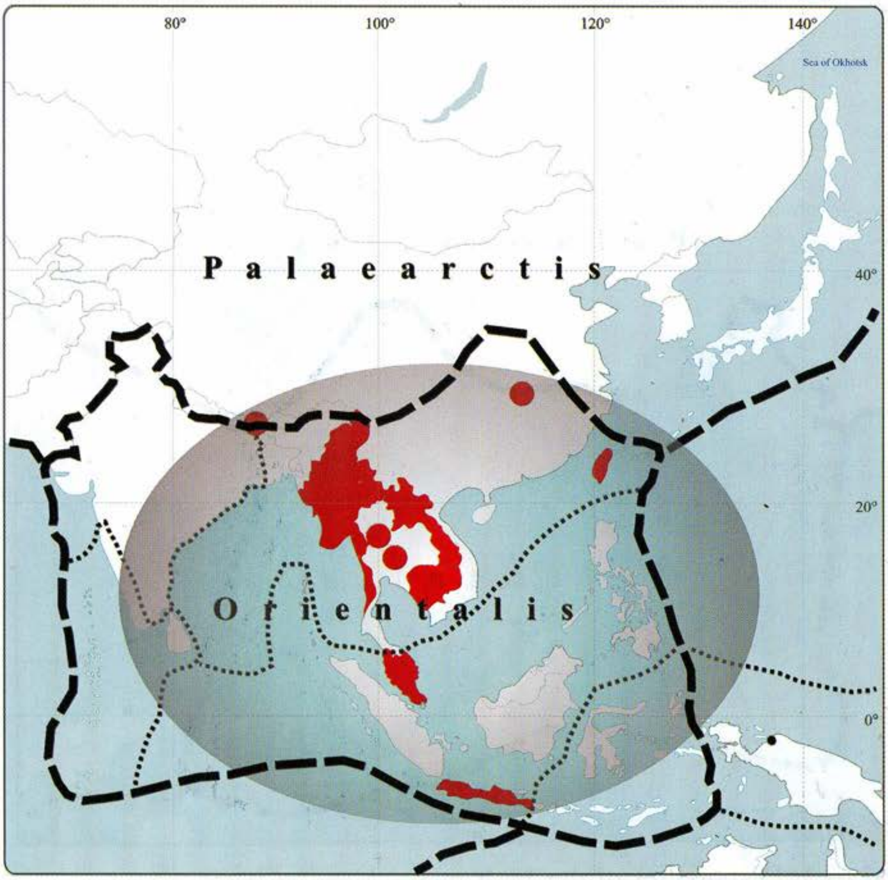
DISTRIBUTION

The species of the *Mulsanteus bonifaci* basic-group occur in the Indo-Chinese subregion (Cambodia, China, Laos, Thailand, Vietnam), in Himalaya (Sikkim in India) and in the Malayan sub-region (Java, Malayan Peninsula).

12.3. The *Mulsanteus godawariensis* basic-group

APPERTAINING SPECIES

Mulsanteus godawariensis, *M. hartmanni*, *M. hirtellus*, *M. holzschuhi*, *M. ingridae*, *M. langtangensis*, *M. murenus*.



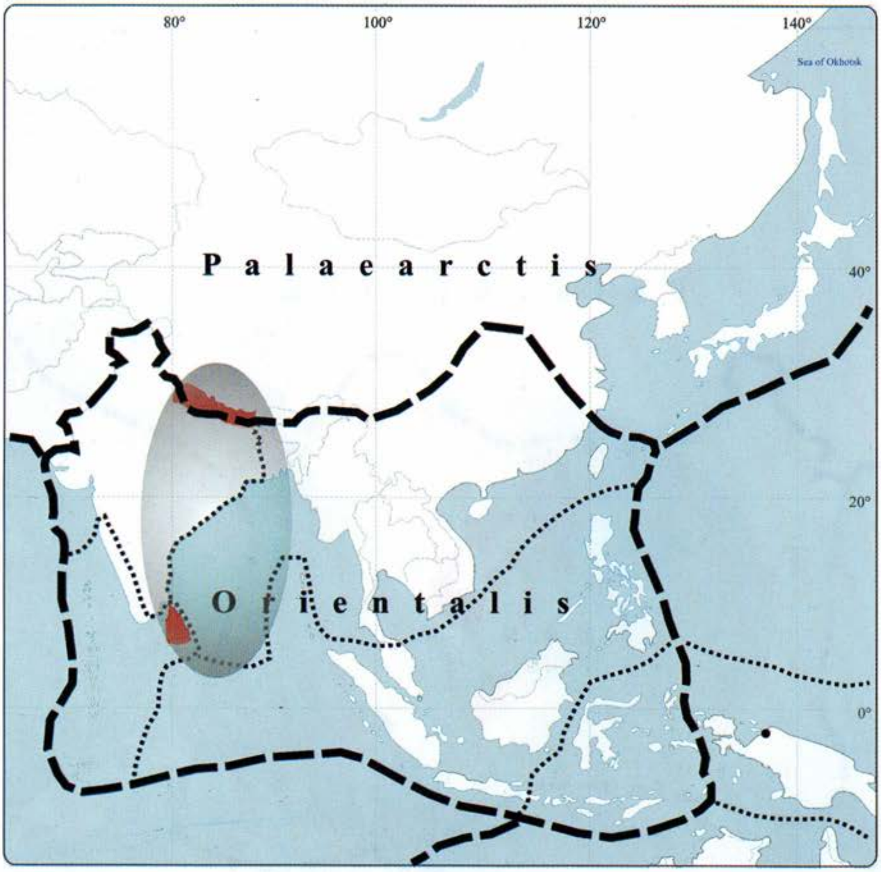
Map 2: Dispersions of the *Mulsanteus bonifaci* basic-group.

SYNAPOMORPHIES

Habitus wedge-shaped, elytra and pronotum sligthly raised, the disk of the latter flat; pronotum along median line clearly longer than wide at posterior angles (length/ width ratio 1.05 to 1.10:1.00); pronotum trapezoid, laterally straigtht; pronotum puncturation dense and umbilicate, interstices of points flat, forming raised rugosities at posterior third; basis of pronotum step-resembling; antennae elongate, fourth to tenth antennomere apically serrate.

DISTRIBUTION

The species of the *Mulsanteus godawariensis* basic-group occur in Himalaya (Nepal) and one species is known from Ceylonese sub-region.



Map 3: Dispersions of the *Mulsanteus hirtellus* basic-group.

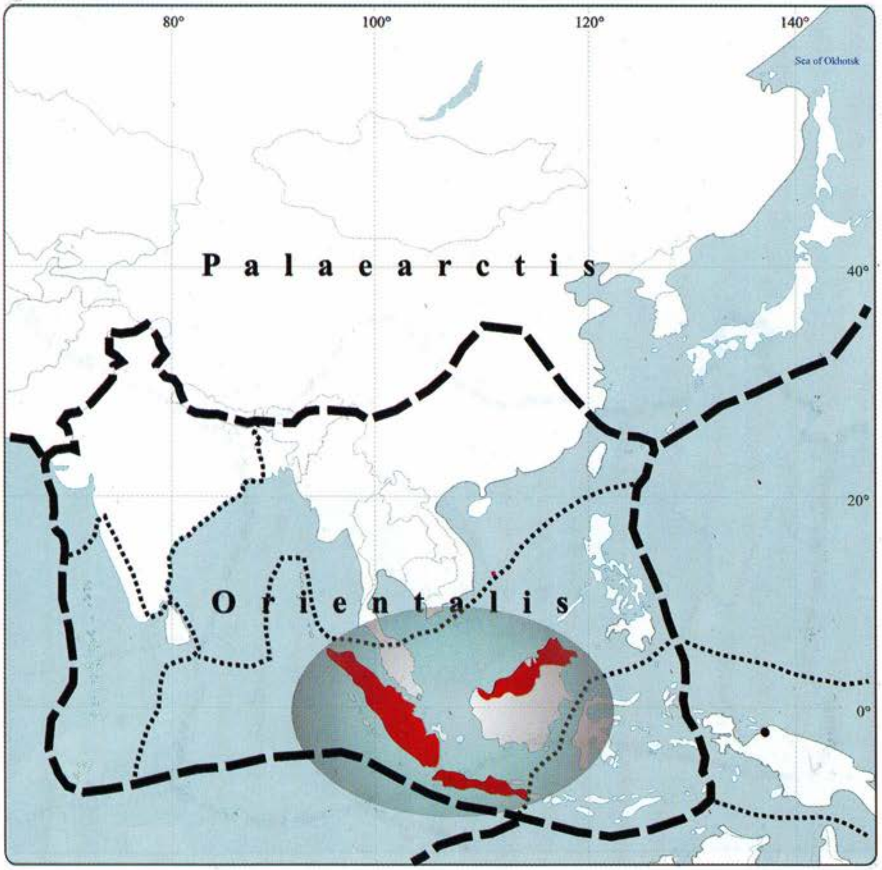
12.4. **The *Mulsanteus aemulus* basic-group**

APPERTAINING SPECIES

Mulsanteus aemulus, *M. antennatus*, *M. hirticornis*, *M. illotipes*, *M. longicornis*, *M. lucidus*, *M. philippsi.*

SYNAPOMORPHIES

Habitus wedge-shaped, elytra and pronotum sligthly raised, the disk of the latter conspicuously raised; pronotum along median line clearly longer than wide at posterior angles (length/width ratio 1.10 to 1.15:1.00); pronotum companiform, laterally arcuate; pronotum puncturation less dense and simple, interstices of points flat and once their diameter; basis of pronotum with a conspicuous dropping; antennae elongate, fourth to tenth antennomere serrate to lamellate, outreaching apical third of elytra, and covered with long protruding, bristly hairs.



Map 4: Dispersions of the *Mulsanteus illotipes* basic-group.

DISTRIBUTION

The species of the *Mulsanteus aemulus* basic-group occur in the Malayan sub-region (Borneo, Java, Malayan Peninsula, Philippines, Sumatra) and in the Indo-Chinese sub-region (Laos, Vietnam).

12.5. The *Mulsanteus borneoensis* basic-group

APPERTAINING SPECIES

Mulsanteus borneoensis, M. germanus, M. portulinensis.

SYNAPOMORPHIES

Habitus wedge-shaped, elytra and pronotum conspicuously raised, the basis of the latter with a short median mould or furrow; pronotum along median line clearly longer than wide at posterior angles (length/width ratio 1.05 to 1.10:1.00); pronotum trapezoid,

Map 5: Dispersions of the *Mulsanteus borneoensis* basic-group.

straight laterally; pronotum puncturation less dense and simple, interstices of points flat and half to once their diameter; basis of pronotum with a conspicuous dropping; antennae elongate, fourth to tenth antennomere serrate, antennomere extended apically, and covered with long protruding, bristly hairs.

DISTRIBUTION

The species of the *Mulsanteus aemulus* basic-group occur in the Malayan sub-region (Borneo, Malayan Peninsula, Phillipines).

12.6. **Results, discussions and interpretations**

SYNAPOMORPHIES

The antennae of the species of the genera *Elater* and the *Mulsanteus* seem to be of almost identical structure, and the serrate form of the antennomere represent the original condition, as it is developed in species of both genera. However, the antennae of the species of *Mulsanteus* are covered with long, protruding hairs, while those of the species of *Elater* are covered with fine and short hairs. From this prospective, the serrate to lamellate apexes of antennomere in the *Mulsanteus bonifacyi*, and the *M. godawariensis* basic-groups show the pristine characteristics, and should be taken as plesiomorphies. As a consequence, the extended or lamellate apex of antennomere in the *M. aemulus* and *M. borneoensis* basic-group should be treated as an extension and therefore as a later modification of the primary condition. Accordingly, the truncated apex of antennomeres in the species of the *M. anchastinus* basic-group represent a reduction of the original condition.

The pronotum outlines and surface punctures in the species of the genus *Elater* and those of the *M. godawariensis* basic-groups are almost identical. The wrinkled interstices of points in the species of the *M. bonifacyi* basic-group also represent a modification of the primary condition.

The apex of scutellum in the species of *Elater* and in all basic-groups of *Mulsanteus* is different. While it is rounded in *Elater*, it appears to be sharp in *Mulsanteus*.

The male genitalia are also different in the *Elater* and in the *Mulsanteus* species. In species of *Elater* the paramere of aedoeagus has no lateral edge, while species of *Mulsanteus* possess a paramere with a conspicuous hook-like lateral edge.

As a result of the above analysis, the genera *Elater* and *Mulsanteus* seem to be more closely related than any of them with the genus *Aphanobius*, and the species of the *M. godawariensis* basic-groups have much closer relations to the species of the genus *Elater*, than those of the *M. bonifacyi*, the *M. anchastinus*, the *M. aemulus*, and the *M. borneoensis* basic-group. For this reason, we treat the genus *Elater* to be the sister-group of the *Musanteus godawariensis* basic-group.

DISTRIBUTION

The species of the *Mulsanteus anchastinus* basic-group have a wide-spread distribution, from Himalaya, the Indian and Ceylonese sub-region to the Indo-Chinese sub-region, including some of the south and south-eastern Chinese provinces, and Taiwan, as well as parts of the Malayan sub-region (Philippines), the Wallacea (Maluku), and a part of the Papuan sub-region (Irian Jaya). This group covers an area from 80-140 degrees of eastern longitude, and 5 degrees of south latitude to 30 degrees north latitude (Greenwich). Beside a west-east orientated dispersion, from Himalaya to the island of Taiwan, there is also a north-south dispersion to be recognised, from southeastern Chinese provinces to the Papuan sub-region.

The *Mulsanteus bonifacyi* basic-group is distributed from northern India across the Indo-Chinese sub-region, including parts of southeastern China and Taiwan, the Malayan Peninsula, and Java. The distribution reaches from 85-125 degrees of eastern longitude and 10 degrees of south latitude to 30 degree north latitude (Greenwich). The dispersions seem to be similar to those of the *Mulsanteus anchastinus* basic-group.

The *Mulsanteus godawariensis* basic-group has a confined distribution in the Himalaya (seven species), and in Sri Lanca (one species). The dispersions of the group seem to be limited to the mentioned regions.

The species of the *Mulsanteus aemulus* basic-group occure in the Malayan subregion, and one species of that group in the Indo-Chinese sub-region. However, the majority of the species have distributions in the Malayan sub-region, and it seems that the distribution centre of the group should be found within this sub-region.

The species of the *Mulsanteus borneoensis* basic-group occupies in the Malayan sub-region exclusively. There is a clear west-eastern distribution from Sumatra, across Borneo, up to the Philippines.

DISPERSIONS

The distribution of the *Mulsanteus*-species in south-eastern Asia shows a situation similar to the one we know from the species of the tribe Megapenthini (ref. to SCHIMMEL, 2005) and the species of the genus *Elater*, the hypothetical sister-group of the *Mulsanteus godawariensis* basic-group. These species have a Palaearctic and an oriental distribution, and there is some reason to assume that they were founded on a population from the old Laurasia continent. Their dispersion to the Indo-Chinese and to the Malayan sub-region, and especially to the islands of the Sunda Archipelago, needs to be analyzed in accordance with the climate situations during the glacial period in the Pleistocene epoch, and the therefrom resulting down-sinking of the sea-level, and the dry-out of the shelf, which created spreading-corridors for the animals.

The dispersion of two species of the *M. godawariensis* basic-group to the islands of the Wallacea (Maluku) and to the Papuan sub-region (Irian Jaya) is impossible to explain with the mentioned mechanisms during the glacial period. Passive drifting, perhaps of rotten wood, in which the beetles may have lived, is the most probable reason for the current occupancies of these species.

The distribution and dispersion of one species, *M. hirtellus*, in Sri Lanka is most enigmatic. As there are currently no species of the genus *Mulsanteus* known from Africa or from the island of Madagascar, the possibility of the occupancies of such species in Sri Lanka being based on passive geological drifting is very slight.

NEARCTIC SPECIES

The specimens of the species *Crigmus texanus*, *Neotrichophorus carolinensis* and *N. arizonensis* from the Nearctic sub-region, which are preserved in the collection of the first author and placed by SCHENKLING (1925) under the genus *Neotrichophorus*, have been treated parallel to the material published in this study. As a result of this comparison, we believe that the mentioned species, and probably all of the Nearctic species of the genus "*Neotrichophorus*", have closer relations to the genus *Elater* than to the genus *Mulsanteus* (*Neotrichophorus*). We think that a revision on the Nearctic material mentioned will be necessary, and that there is very probably a need to be place these species near or into the genus *Elater*. Consequently, we have good reason to believe that there is a need to confine the distribution of the *Mulsanteus*-group to the Palaearctic sub-region, the Oriental region, the Wallacea, and to the Australian region (Papuan sub-region).

13. SPECIES INCERTAE SEDIS

For one of the species treated by SCHENKLING (1927) as a member of the *Neotrichophorus*-group, *Ludius suturalis*, their systematic position could not be defined. Based on the description of the species, given by CANDÈZE (1889), and the characteristics of the species given by VAN ZWALUWENBURG (1959) in a key to species, *L. suturalis* is surely not a species of the genus *Mulsanteus*. However, the type of *L. suturalis* could not be found and studied. For this reason, and in order for this problem not to be forgotten, we treat this species with status incertae sedis.

Ludius suturalis **CANDÈZE, 1889 sp. incertae sedis**

Ludius suturalis CANDÈZE, 1889: 53.
Trichophorus suturalis (CANDÈZE, 1889): SCHWARZ, 1906: 259.
Neotrichophorus suturalis (CANDÈZE, 1889): SCHENKLING, 1927: 433.

LOCUS TYPICUS
Malaysia: Borneo, Sintang.

14. SPECIES REMOVED FROM THE GROUP, AND A NEW SPECIES OF THE GENUS *ELATER*

Three species formerly included into the genus *Neotrichophorus* have had to be excluded from the group, and placed with new name combinations into the genera *Elater* and *Gamepenthes*. *Elater vitalisi* (FLEUTIAUX, 1918) n. comb., and *Elater hoabinhus* (FLEUTIAUX, 1936) n. comb., possess characteristics typical of the genus *Elater*, such as the shape of antennae, the form of head, that of pronotum, and of male genitalia. For this reason, both species are transferred in this paper to the genus *Elater*. *Neotrichophorus malaisei* FLEUTIAUX, 1942 is transferred to the genus *Gamepenthes*, and treated as a member of the tribe Megapenthini. A new species of the genus *Elater*, *E. phongsalyensis* n. sp., which has been collected in Laos, is described.

Elater hoabinhus (FLEUTIAUX, 1936) n. comb.

(Figs. 86)

Neotrichophorus hoabinhus FLEUTIAUX, 1936: 295-297

LOCUS TYPICUS
Vietnam: Tonkin, Hoa-Binh.

NEW MATERIAL
Indo-Chine: Song-Chay, 1908, 1 spm., without further data.

Distribution
Vietnam: Tonkin.
Indo-Chine.

Elater phongsalyensis n. sp.

(Figs. 87-88)

LOCUS TYPICUS
Laos: Phongsaly.

TYPE MATERIAL

Holotypus ♂ (NMB): Laos: Phongsaly province, Phongsaly environments, 1500 m, 6.-17.V.2004, leg. M. Brancucci. **Paratypes** 3 ♂♂, 1 ♀ (CSV, NMB): same data as holotype, 3 spm., leg. P. Pacholátko; same province but Ban Sano Mai, 1150 m, 19.-26.V.2004, 1 spm., leg. P. Pacholátko.

DIAGNOSIS

Holotypus ♂: Elongate, sub-parallel, slightly raised, and shiny species. Length: 15.4 mm, width: 3.8 mm. Blackish-brown, legs and antennae reddish-brown. Pubescence reddish-brown, semi-erect, long, bristly and dense, on pronotum inclined to basis and to lateral sides, on elytra inclined to apex.

DESCRIPTION

Head with dense and umbilicate puncturation, interstices of points half to once their diameter, pubescence short and inclined to apex. Head inclined from centre to apex, disk with a transverse impression, frons slightly raised above the base of antennae. Eyes small, spherical, and little prominent. Antennae long, lamellate from fourth antennomere on, consisting of twelve antennomeres, and outreaching posterior angles of pronotum by the length of the last two antennomere; second antennomere short, triangular, as long as wide; third antennomere slightly longer than second antennomere, and truncate at apex, both combined slightly shorter than fourth and each of the following antennomeres; those having an extended lamelle at apex; last antennomere oval, apically constricted.

Pronotum campaniform, along median line slightly longer than wide at the posterior angles (length/width ratio 1.02:1.00), sligthly and regularly raised, arcuate laterally, and with a prominent, abrupt dropping at basis. Posterior angles of pronotum slightly divergent, and with a prominently raised carina, apices sharp. Pronotum without any median mould or furrow. Puncturation of pronotum dense, coarse, umbilicate, and regularly rounded, interstices of points half their diameter, at basis reduced to small wrinkles.

Scutellum wedge-shaped, slightly convex at base, laterally straight, and sharp at apex. Surface slightly raised, puncturation dense, coarse, and umbilicate, pubescence dense, fine, and just visible, pointed from basis to apex.

Elytra sub-parallel, elongate and wedge-shaped, after middle narrowed to apex, the latter curved, base slightly smaller than that of pronotum, slightly depressed at scutellum, margins raised, shoulders prominent (winged species). Striae of elytra covered with less dense, simple puncturation, interstices of striae finely punctured, little shiny, and flat. Pubescence short, bristly, and inclined to apex.

Pro-, meso- and metathorax with dense and rugose puncturation, interstices of points raised and shiny. Pubescence short and adjacent.

Legs elongate, moderately long and thin, tarsomeres up to claws of decreasing length, ventrally with hardly visible, fine pubescence, and fine upholstery, tibia covered with longer and protruding bristles.

Aedeagus with a sub-parallel, in middle thickned, and excavated, apical slightly narrowed and sharp, the paramere noticeably extending median lobe. Parameres crescent-shaped, with long apical hairs.

Female is little larger (length: 19.6 mm, width: 4.5 mm) and more raised than males, its antennomeres are serrate, not lamellate.

DIFFERENTIAL DIAGNOSIS

E. phongsalyensis is closely allied to *E. vitalisi*, but may be easily distinguished from this species by the darker colour, the denser puncturation at basis of pronotum, by its campaniform lateral outline, and by the form of aedoeagus.

ETYMOLOGY

Named after the locus typicus.

DISTRIBUTION

Laos: Phongsaly province.

Elater vitalisi **(FLEUTIAUX, 1918) n. comb.**

(Fig. 89)

Agonischius vitalisi FLEUTIAUX, 1918: 264.
Neotrichophorus vitalisi (FLEUTIAUX, 1918): FLEUTIAUX, 1939: 148.
Neotrichophorus chapensis FLEUTIAUX, 1936: 295-296; 1939: 148.

LOCUS TYPICUS
Vietnam: Tonkin, Chapa.

NEW MATERIAL
Vietnam: Hoan Lien Son province, Sa Pa, 11.-15.V.1990, 3 spm., leg. V. Kubán; Myanmar: Shan highlands, Monghkok, 15.-20.VII.2006, 1 spm., L. Jingke.

DISTRIBUTION
Vietnam: Tonkin; Hoan Lien Son.
Myanmar: Shan highlands.

Gamepenthes malaisei (FLEUTIAUX, 1942) n. comb.

(Figs. 90-91)

Neotrichophorus malaisei FLEUTIAX, 1942: 18.

LOCUS TYPICUS
Myanmar: Kambaiti.

REMARKS
The revision of the Holotype which is preserved in the Naturhistoriska Riksmuseet (Stockholm), result in the need to tranfere this species to the genus *Gamepenthes*. The species is closely allied to the *G. antennatus* (MIWA, 1934) from Taiwan, and to *G. sausai* SCHIMMEL, 2003, but may be easily distinguished from these species by the flat pronotum, and the form of aedoeagus. There are no new records or material of this species known. Since the description of the Holotype by FLEUTIAUX (1942) this species has never been collected again.

DISTRIBUTION
Myanmar.

15. SUMMARY

As results of this study, we now know 45 species of the genus *Mulsanteus* occurring in the Oriental region, in the Papuan sub-region, in the Wallacea, and in the Himalaya.

The following 22 species are introduced as new to science: *Mulsanteus brignolii* n. sp., *M. cambodiensis* n. sp., *M. godawariensis* n. sp., *M. hartmanni* n. sp., *M. holzschuhi* n. sp., *M. hubeiensis* n. sp., *M. ingridae* n. sp., *M. irianjayensis* n. sp., *M. kubani* n. sp., *M. langtangensis* n. sp., *M. murenus* n. sp., *M. nepalensis* n. sp., *M. pedongensis* n. sp., *M. pejchai* n. sp., *M. platiai* n. sp., *M. portulinensis* n. sp., *M. pokharanus* n. sp., *M. riesei* n. sp., *M. sausai* n. sp., *M. shaanxiensis* n. sp., *M. sikkimensis* n. sp., *M. weigeli* n. sp., and *M. wudangshanensis* n. sp.

For the following species new name combinations are proposed: *Mulsanteus aemulus* (CANDÈZE, 1891) n. comb., *M. anchastinus* (CANDÈZE, 1881) n. comb., *M. antennatus* (CANDÈZE, 1896) n. comb., *M. bonifacyi* (FLEUTIAUX, 1918) n. comb., *M. borneoensis* (ÔHIRA, 1973) n. comb., *M. clavus* (CANDÈZE, 1891) n. comb., *M. germanus* (CANDÈZE, 1894) n. comb., *M. hirsutus* (CANDÈZE, 1875) n. comb., *M. hirticornis* (CANDÈZE, 1893) n. comb., *M. illotipes* (CANDÈZE, 1863) n. comb., *M. longicornis* (FLEUTIAUX, 1936) n. comb., *M. lucidus* (CANDÈZE, 1865) n. comb., *M. maceratus* (CANDÈZE, 1893) n. comb., *M. phillipsi* (VAN Zwaluwenburg, 1936) n. comb., *M. rugosus* (FLEUTIAUX, 1918) n. comb., *M. touffus* (VATS & CHAUHAN, 1992) n. comb., and *M. tumidicollis* (SCHWARZ, 1901) n. comb.

The following species are removed from the *Mulsanteus*-group, and transferred to the genera *Elater* LINNAEUS, 1758, and *Gamepenthes* FLEUTIAUX, 1928: *Elater vitalisi* (FLEUTIAUX, 1918) n. comb., *E. hoabinhus* (FLEUTIAUX, 1936) n. comb., and *Gamepenthes malaisei* (FLEUTIAUX, 1942) n. comb.

Elater phongsalyensis n. sp. is described as new to sciences, and *Ludius suturalis* CANDÈZE, 1889 is treated as species incertae sedis.

Species of the genus *Mulsanteus* have been published in this paper for the first time from China, from the Wallacea, and from the Papuan sub-region.

An analysis on the characteristics of closely related groups of the tribe Elaterini has shown that the genus *Elater* for some reason appears to be the sister-group of the genus *Mulsanteus*.

Basing on some symplesiomorphy we found in the various species of the genus *Mulsanteus* we articulate them into fife phylogenetic basic-groups:

1. The *Mulsanteus anchastinus* basic-group (*Mulsanteus anchastinus, M. brignolii, M. foldvarii, M. hirsutus, M. irianjayensis, M. maceratus, M. nepalensis, M. pedongensis, M. pokharanus, M. riesei, M. rubuginosus, M. rugosus, M. sausai, M. shaanxiensis, M. touffus, M. tumidicollis, M. weigeli*).
2. The *Mulsanteus bonifaci* basic-group (*Mulsanteus bonifaci, M. cambodiensis, M. clavus, M. hubeiensis, M. kubani, M. pejchai, M. platiai, M. peregovitsi, M. shirozui, M. sikkimensis*).
3. The *Mulsanteus godawariensis* basic-group (*Mulsanteus godawariensis, M. hartmanni, M. hirtellus, M. holzschuhi, M. ingridae, M. langtangensis, M. murenus*).
4. The *Mulsanteus aemulus* basic-group (*Mulsanteus aemulus, M. antennatus, M. hirticornis, M. illotipes, M. longicornis, M. lucidus, M. philippsi*).
5. The *Mulsanteus borneoensis* basic-group (*Mulsanteus borneoensis, M. germanus, M. portulinensis*).

Finally, we have good reason to believe, that the species of the genus *Mulsanteus* are distributed in the Palaearctic sub-region, the Oriental region, the Wallacea, and to the Australian region (Papuan sub-region) exclusively.

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A mitochondrial DNA control region phylogeny of the European woodpeckers Picidae*

ROBERT RUTKOWSKI*, PATRYCJA JAGOŁKOWSKA, TOMASZ D. MAZGAJSKI & ŁUKASZ REJT

Museum and Institute of Zoology PAS, Wilcza 64, 00-679 Warsaw, Poland
*Corresponding author: E-mail: robertrut@miiz.waw.pl

ABSTRACT. Hypervariable domain of mtDNA control region was analyzed in nine species of Picidae from Europe. In the majority of species, substantial polymorphism in the investigated sequence was found. Phylogenetic analysis remained in concordance with other studies of woodpeckers, applying mitochondrial as well as nuclear genes. However, using the hypervariable domain of control region to resolve the phylogeny of woodpeckers family showed that the Three-toed woodpecker (genus *Picoides*) has been grouped within a single monophyletic clade with members of genus Dendrocopos.

Key words: woodpeckers, Picidae, control region, mitochondrial DNA, phylogeny.

INTRODUCTION

Mitochondrial DNA has been frequently used in studies of woodpeckres Picidae in order to resolve phylogeny of the family, particularly evolutionary relationship between Old and New World species (WEIBLE et MOORE 2002a, b; WEBB et MOORE 2005; WINKLER et al. 2005). The genes analysed were mainly mitochondrial: COI, cyt b and 12S rRNA, thus sequences presenting only a little variation on a species level. These studies did not clearly define evolutionary relation between woodpeckers from genus *Dendrocopos* and The three-toed woodpecker (*Picoides tridactylus*). Moreover, according to our knowledge, none of the studies performed until now analysed the complete set of European species. Therefore, for example, systematic position of the Middle-spotted woodpecker *Dendrocopos medius* is still unclear.

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The aim of the study was to apply a new molecular marker — a sequence of hypervariable domain of mtDNA and extended sample set of European species to reconstruct phylogeny of Picidae.

MATERIAL AND METHODS

Feathers, tissues and blood samples were collected from 108 individuals, representing 9 *Picidae* species from Europe (Table 1). Extraction of DNA, amplification of hypervariable domain of mitochondrial control region and sequencing of PCR product was performed according to methodology described elsewhere (Rutkowski et al. Submitted).

For each species where more than one sample was collected and more than one haplotype was detected we estimated the number of haplotypes, nucleotide diversity π (NEI 1987) and haplotype diversity *h* (NEI 1987) using DNAsp (v. 3.51, ROZAS et al. 2003). For the total data set, we also estimated the mean number of differences among haplotypes (*k*).

For obtained sequences of all analysed species, as well as for homological fragments of control region of three other woodpeckers: *Drycopus pileatus*, *Sphyrapicus varius* and *Colaptes auratus* (accesion numbers accordingly: NC008546; AF082045; AF082044) deposited in GenBank, we constructed a phylogenetic tree using the Neigbour-joining (NJ) method, as implemented in Mega software (Kumar et al. 2004). Bootstrap values for each node were estimated with 1000 replications. As an out-group, sequence of mtDNA control region of *Pteroglossus azara* (Ramphastidae, Piciformes) (GenBank accesion number: NC008549) was used.

Table 1. Number of samples (*n*), number of haplotypes (H), haplotype diversity (*h*), nucleotide diversity (π), number of identified base pairs (bp) number of parsimony informative sites (p.i.s.) in studied woodpecker's species.

Species	*n*	*H*	*h*	π	bp	p.i.s
Dendrocopos major	94	17	0.757	0.00390	379	9
D. medius	11	7	0.873	0.00794	379	2
D. minor	4	4	1.0	0.01350	380	2
D. syriacus	1	1	–	–	378	–
D. leucotos	2	1	–	–	379	–
Picoides tridactylus	4	1	–	–	378	–
Picus viridis	3	3	1.0	0.01980	381	0
P. canus	1	1	–	–	378	–
Dryocopus martius	6	6	1.0	0.00872	377	1

RESULTS AND DISCUSSION

The analysis of PCR products in an automatic sequencer showed that species amplified fragments in the investigated had 380 base pairs. Among them, from 305 to 321 base pairs were unambiguously identified, depending on species. Thus, comparisons between species were performed on a shareable fragment of 305 base pairs. Set we found 119 polimorphic sites and 29 haplotypes in the total data; nucleotide diversity among haplotypes $\pi = 0{,}09603$; and mean number of nucleotide differences among $k = 28{,}809$. Results for each species are presented in Table 1. The neigbour-joining tree based on obtained sequences is presented in Fig. 1. Because haplotypes for each species were grouped together in a phylogenetic tree, we presented only results for single haplotype within the species.

Nearly all investigated species of which more than one sample was analysed presented a high level of haplotype diversity. We have not confirmed variability of the marker only in the case of *Picoides tridactylus* and *Dendrocopos leucotos*. However, samples of each of these two species were collected at one location, which could be considered as isolated population. Moreover, both of the species are thought to be declining in numbers and even endangered, at least in Poland (TOMIAŁOJĆ et STAWARCZYK 2003). Thus, low genetic variability could be a possible explanation for these results.

The topology of the phylogenetic tree remains in concordance with results from other authors, analysing mitochondrial (WEIBLE et MOORE 2002a; WEBB et MOORE 2005) as well as nuclear genes (WEIBLE et MOORE 2002b). The majority of discrepancies seems

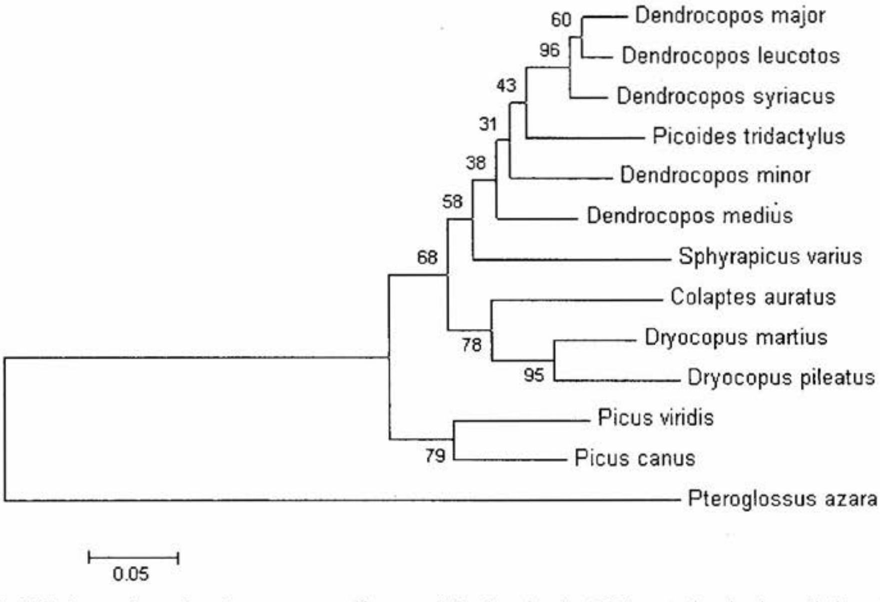

Fig 1. Phylogenetic tree based on sequence of hypervariable domain of mtDNA control region in studied woodpeckers, constructed with Neighbour-joining method. Bootstrap percentages are indicated above nodes

to be connected with interpretation of topology within the *Dendrocopos-Picoides* clade. WEIBLE et MOORE (2002a) separated *Picoides tridactylus* from the *Dendrocopos* clade, while WINKLER et al. (2005) grouped *P. tridactylus* together with other *Dendrocopos* species.

Interpretation of evolutionary relationship between genus *Dendrocopos* i *Picoides* has been frequently changed. PETERS (1948) described two genera: *Dendrocopos* with 31 species and *Picoides* with *P. tridactylus* and *P. arcticus*. Then, both genera were combined in one genus *Picoides* (SHORT 1982; WINKLER et al. 1995). However, recently „spotted" woodpeckers (*Dendrocopos*) were again separated from genus *Picoides* (Del HOYO et al. 2003). Our study suggests that the *Picoides tridactylus* is closely related to other *Dendrocpos* species, which supports the results of WINKLER et al. (2005).

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