XV International Symposium on Zygaenidae

11–18 September 2016

Mals/Malles, Südtirol/Alto Adige, Italy

Organised by

Community of Mals/Malles, Vinschgau/Val Venosta,

Südtirol/Alto Adige, Italy

and

BGO Citizen cooperative upper Venosta Valley

in collaboration with

Museum of Nature South Tyrol (Bozen/Bolzano, Italy)

and

Tiroler Landesmuseen (Innsbruck, Austria)

Edited by:
G. M. Tarmann, W. G. Tremewan & A. Spalding

Arranged and printed by:
sabine tappeiner, graphic & design

Published 08 September 2016 by:
Gerhard M. Tarmann and BGO Bürgergenossenschaft Obervinschgau, Mals/Malles, Vinschgau/Val Venosta, Südtirol/Alto Adige, Italy

This symposium is sponsored by:
Apotheke Mals
Kinderärztin Dr. Viertler Elisabeth
Abtei Marienberg
Tierklinik Gasser Peter, Mals
Gemeinde Mals
Bäckerei Zerzer Karl, Mals
Hotel "Greif", Mals
Druckerei A.WEGER, Brixen
Bio-Hotel "Panorama", Mals
Stiftung "Landschaft Südtirol"
Ingenieur-Büro Patscheider & Partner
Hotel „Garberhof", Mals
Umweltschutzgruppe Vinschgau
Naturfreunde Obervinschgau
Hotel „Tyrol", Mals
Schutzhaus Sesvenna, Fam. Pobitzer
Ferienregion Obervinschgau

Front cover: *Zygaena carniolica* (Scopoli, 1763). This species is a characteristic inhabitant of undisturbed dry meadows. It is a key species for clean air (poison free). It was extremely abundant in Vinschgau/Val Venosta until the late 1970s. Now it is extinct in most parts of the valley and restricted to higher elevations and the higher parts of the valley around Mals where there is a poison free atmosphere. (*Photo* Peter Buchner, ex archive TLMF, Innsbruck).

Back cover: Egg of *Pollanisus subdolosa clara* Tarmann, 2004, protected by the poisonous scales of the abdominal hairtuft of the female. Australia, New South Wales, Budawang National Park. (*Photo* Andreas Zwick, CSIRO, Canberra, Australia).

Contents

List of Participants and Authors

Authors = A
Participants = P

Eyjolf AISTLEITNER (A)
Büro OeGDI, Kapfstr. 99B, A–6800 Feldkirch, Austria
eyjaist@yahoo.de

Daniela ATANASOVA (A)
Faculty of Plant Protection and Agroecology, Agricultural University, Blvd. Mendeleev 12, 4000 Plovdiv, Bulgaria
daniat88@abv.bg

Burkhard BEINLICH (A)
Bioplan GbR, Höxter, Untere Mauerstraße 6–8, D–37671 Höxter
B.Beinlich-Bioplan.Hx@t-online.de

Emmanuelle BRIOLAT (A, P)
26, West Street, Penryn, Cornwall, TR10 8ER, U.K.
esb204@exeter.ac.uk

Joseph BURMAN (A, P)
Senior Lecturer in Biology, Ecology Research Group, School of Human and Life Sciences, Canterbury Christ Church University, Canterbury, U.K.
joseph.burman@canterbury.ac.uk

Alain CAMA (P)
24 rue du Parfait, F–37140 La Chapelle sur Loire, France
alain.cama@orange.fr

Feza CAN-CENGIZ (A, P)
University of Mustafa Kemal, Faculty of Agriculture, Department of Plant Protection, 31034 Hatay, Turkey
cezafan_onurcan@hotmail.com

Jean-Marie DESSE (A, P)
52 rue Franklin, F–49100 Angers, France
jean-marie.desse@laposte.net

Helmut DEUTSCH (A)
Bannberg 22, A–9911 Assling, Austria
dlav45@aon.at

Eric DROUET (A, P)
86b route de la Luye, F–05000 Gap, France
edrouet.zyg@wanadoo.fr

Konstantin A. EFETOV (A, P)
Crimean Federal University, Department of Biological Chemistry and Laboratory of Biotechnology, RU–295006 Simferopol, Crimea, Russia
efetov.konst@gmail.com

Stanislav GOMBOC (A, P)
Šiškovo naselje 19, 4000 Kranj, Slovenia
stanislav.gomboc@siol.net

Kathrin GUENIN (P)
Grauholzweg 14, CH-3084 Wabern, Switzerland
raymondguenin@bluewin.ch

Raymond GUENIN (A, P)
Grauholzweg 14, CH–3084 Wabern, Switzerland
raymondguenin@bluewin.ch

Axel HILLE (A, P)
Rosengarten 21, D–33605 Bielefeld
axel.hille@gmx.net.

Axel HOFMANN (P)
Am Hochgestade 5, D–76351 Linkenheim-Hochstetten
hofmann@abl-freiburg.de

Predrag JAKŠIĆ (A)
Čingrijina 14/25, 11000 Beograd, Serbia
jaksicpredrag@gmail.com

Kamuran KAYA (A)
University of Mustafa Kemal, Faculty of Agriculture, Department of Plant Protection, 31034 Hatay, Turkey

Christine KEIL (P)
Wachwitzer Bergstraße 5b, D–01326 Dresden, Germany
thomas-keil@web.de

Thomas KEIL (A, P)
Wachwitzer Bergstraße 5b, D–01326 Dresden, Germany
thomas-keil@web.de

Anna V. KIRSANOVA (A)
Crimean Federal University, Department of Biological Chemistry and Laboratory of Biotechnology, RU–295006 Simferopol, Crimea, Russia

Jiři KLIR (A, P)
Ankertova 6, CZ–412 01 Litoměřice, Czech Republic
klir.jiri@seznam.cz

Nika KOGOVŠEK (A)
Centre for Cartography of Fauna and Flora, Antoličičeva 1, SI–2204 Miklavž na Dravskem polju, Slovenia
kogovsek.nika@gmail.com

Chiharu KOSHIO (A, P)
Naruto University of Education, Takashima, Naruto 772-8502, Japan
koshio@naruto-u.ac.jp

Toni KOREN (A, P)
Croatian Herpetological Society – Hyla, I. Lipovac 7, 10 000 Zagreb
koren.toni1@gmail.com

Elena E. KUCHERENKO (A)
Crimean Federal University, Department of Biological Chemistry and Laboratory of Biotechnology, RU–295006 Simferopol, Crimea, Russia
shysh1981@mail.ru

Bruno LAMBERT (P)
5 Route des Grandes Beausses, F–49630 Mazé, France
eslbl@wanadoo.fr

Mojmir LASAN (A)
Glavarjeva 47, 1000 Ljubljana, Slovenia

Zoya S. LAZAREVA (A)
Crimean Federal University, Department of Biological Chemistry and Laboratory of Biotechnology, RU–295006 Simferopol, Crimea, Russia

Marija MARKOVIĆ (A)
Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš, 18000 Niš, Serbia
marijam@pmf.ni.ac.rs

Bernard MOLLET (A, P)
16 Parc Valtonne, F–91190 Gif sur Yvette, France
molletb@wanadoo.fr

Maryse MOULIN (P)
7 rue des Ecoles, F–37330 Gizeux, France

Ana NAHIRNIĆ (A, P)
National Museum of Natural History, Tsar Osvoboditel Blvd 1, BG-1000 Sofia, Bulgaria
e3009_2012@stud.bio.bg.ac.rs
ananahirnic@nmnhs.com

Marc NICOLLE (A, P)
Résindence Schubert, 2 rue Paul Pousset, F–49100 Angers, France
marc.nicolle@sfr.fr

Zühal OKYAR (A)
University of Mustafa Kemal, Faculty of Agriculture, Department of Plant Protection, 31034 Hatay, Turkey

Hagen M. O'NEILL (A, P)
School of Biological and Biomedical Sciences, Durham University, South Road, Durham, DH1 3LE, UK
h.m.o'neill@durham.ac.at

Ekaterina V. PARSHKOVA (A)
Crimean Federal University, Department of Biological Chemistry and Laboratory of Biotechnology, RU–295006 Simferopol, Crimea, Russia

Slavko POLAK (A)
Notranjska Museum Postojna, Kolodvorska cesta 3, SI–6230 Postojna, Slovenia
slavko.polak@guest.arnes.si

Tom PRESCOTT (A)
Butterfly Conservation Scotland, Balallan House, 24 Allan Park, Stirling, FK8 2QG, Scotland; UK
tprescott@butterfly-conservation.org

Franc REBEUŠEK (A)
Centre for Cartography of Fauna and Flora, Antoličičeva 1, SI–2204 Miklavž na Dravskem polju, Slovenia
franc.rebeusek@amis.net

Jurij REKELJ (A)
Struževo 40 c, SI–4000 Kranj, Slovenia
jurij.rekelj@gmail.com

Maria RYRHOLM (P)
Högskolan i Gävle, 801 76 Gävle, Sweden

Nils RYRHOLM (A, P)
Högskolan i Gävle, 801 76 Gävle, Sweden
Nils.Ryrholm@hig.se

Martina ŠAŠIĆ (A, P)
Hrvatski prirodoslovni muzej, Demetrova 1, HR–10000 Zagreb
martina.sasic@hpm.hr

Michel SAVOUREY (P)
481 Avenue Samuel Pasquier F–73300 Saint Jean de Maurienne
savourey73@gmail.com

Boyan STALEV (A)
Faculty of Plant Protection and Agroecology, Agricultural University, Blvd. Mendeleev 12, 4000 Plovdiv, Bulgaria
stalev26@abv.bg

Radovan ŠTANTA (A)
Miren 163, SI–5291 Miren, Slovenia
radovan.stanta@gmail.com

Martin STEVENS (A)
Centre for Ecology and Conservation, Department of Biosciences, College of Life and Environmental Sciences, University of Exeter (Penryn), Cornwall, TR10 9FE, UK
Martin.Stevens@exeter.ac.uk

Yoshihisa TANAKA (A)
Naruto University of Education, Takashima, Naruto 772-8502, Japan
koshio@naruto-u.ac.jp

Gerhard M. TARMANN (A, P)
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, Feldstrasse 11a, A–6020 Innsbruck, Austria
g.tarmann@tiroler-landesmuseen.at
gerhard@blasiusberg.at

Monika TARMANN (P)
Widum am Blasiusberg, Bauhof 8, A–6176 Völs, Austria
monika@blasiusberg.at

Teodora B. TOSHOVA (A, P)
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Tsar Osvoboditel Blvd 1, BG–1000 Sofia, Bulgaria
teodora_toshova@yahoo.com

Blerina VRENOZI (A, P)
Tirana University, Faculty of Natural Sciences, Tirana, Albania
blerinavrenozi@yahoo.com

Jean-Claude WEISS (A, P)
2, Place G. Hocquard, F–57000 Metz, France
weissjeanclaude5@aol.com

Benjamin WIESMAIR (P)
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, A–6020 Innsbruck, Feldstrasse 11a, Austria
b.wiesmair@tiroler-landesmuseen.at

Mark R. YOUNG (A, P)
Meiklepark, Oldmeldrum, Aberdeenshire, AB510DL, UK
m.young@abdn.ac.uk

Matjaž ZADRGAL (A)
Pod Lazami 53, SI–5290 Vrtojba, Slovenia
matjaz.zadrgal@si.mahle.com

Bojan ZADRAVEC (A)
Vipavska cesta 88, SI–5000 Nova Gorica, Slovenia
bojan.zadravec1@siol.net

Mika ZAGROBELNY (A, P)
Plant Biochemistry Laboratory, Department of Plant Biology and Biotechnology, Faculty of LIFE Science, University of Copenhagen; Denmark
miz@life.ku.dk
miz@plen.ku.dk

Barbara ZAKŠEK (A, P)
Centre for Cartography of Fauna and Flora, Antoličičeva 1, SI–2204 Miklavž na Dravskem polju, Slovenia
barbara.zaksek@ckff.si

Bojan ZLATKOVIĆ (A)
Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš, 18000 Niš, Serbia
bojanzlat@yahoo.com

General Organization

BGO – Bürgergenossenschaft Obervinschgau – Genossenschaft
General-Ignaz-Verdroß-Straße Nr. 17
I–39024 Mals (BZ)
info@bgo.bz.it

Scientific organization of the Symposium

Gerhard M. TARMANN
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, Feldstrasse 11a, A–6020 Innsbruck, Austria
g.tarmann@tiroler-landesmuseen.at

Editors of Abstracts

Gerhard M. TARMANN
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, Feldstrasse 11a, A–6020 Innsbruck, Austria
g.tarmann@tiroler-landesmuseen.at

W. Gerald TREMEWAN
Department of Entomology, Natural History Museum, Cromwell Road, London SW7 5BD, UK
wgt.pentreath@btinternet.com

Adrian SPALDING
Tremayne Farm Cottage, Praze-an-Beeble, Camborne, Cornwall TR14 9PH, UK
a.spalding@spaldingassociates.co.uk

Programme of the XV International Symposium on Zygaenidae 11–18 September 2016

Sunday, 11 September 2016

Arrival of participants, accommodation, registration at Kulturhaus Mals, in the centre of Mals, Bahnhofstraße, with distribution of the symposium map by the symposium hostesses Tabea and Rebecca Gianordoli

19.00 Relaxed informal welcome in Kulturhaus Mals

Monday, 12 September 2016

Location: Kulturhaus Mals, Bahnhofstraße

09.00 Registration at Kulturhaus Mals, in the centre of Mals, Bahnhofstraße, with distribution of the symposium map by the symposium hostesses Tabea and Rebecca Gianordoli

09.30 **Opening session** of the symposium

10.30 **Opening of the Lepidoptera exhibition *by by butterfly*** of the Museum of Nature South Tyrol

11.00 *Coffee break*

11.30 **LECTURES: Zygaenidae as bio-indicators**

Tarmann, Gerhard M. (Innsbruck, Austria)
The decline of Zygaenidae in the valleys of the Alps during the last 100 years

Burman, Joseph (Canterbury, UK)
The distribution and habitat requirements of *Zygaena filipendulae, Zygaena viciae* and *Zygaena osterodensis* in southern Sweden (Zygaenidae, Zygaeninae)

12.30 *Lunch* (buffet)

14.00 **LECTURES: Sexual attraction in Zygaenidae (pheromones, chemical attractants)**

Efetov, Konstantin A. (Simferopol, Russia)
Zygaenidae sex pheromones and attractants: laws and paradoxes

Ryrholm, Nils (Gävle, Sweden)
Zygaena pheromones, a simple system?

Burman, Joseph (Canterbury, UK)
Olfactory speciation in zygaenids and the use of pheromone lures for species discrimination in the field

15.45 *Coffee break*

16.15 **LECTURES: Sexual attraction in Zygaenidae (pheromones, chemical attractants)**

Efetov, Konstantin A. (Simferopol, Russia), Kucherenko, Elena E. (Simferopol, Russia) & Tarmann, Gerhard M. (Innsbruck, Austria)
New synthetic sex attractants for Zygaenidae

Toshova, Teodora B. (Sofia, Bulgaria), Atanasova, Daniela (Plovdiv, Bulgaria), Stalev, Boyan (Plovdiv, Bulgaria) & Nahirnić, Ana (Sofia, Bulgaria)
New data about the vine bud moth *Theresimima ampellophaga* (Bayle-Barelle, 1808) from Bulgaria – investigations by pheromone-baited traps (Zygaenidae, Procridinae)

Can-Cengiz, Feza (Hatay, Turkey), Efetov, Konstantin A. (Simferopol, Russia), Kaya, Kamuran (Hatay, Turkey), Kucherenko, Elena E. (Simferopol, Russia), Okyar, Zühal (Hatay, Turkey) & Tarmann, Gerhard M. (Innsbruck, Austria)
Monitoring of Procridinae (Zygaenidae) by new sex attractants in Thrace Region (European Turkey)

Efetov, Konstantin A. (Simferopol, Russia), Kucherenko, Elena E. (Simferopol, Russia) & Desse, Jean-Marie (Angers, France)
The study of a new sex attractant for Procridinae (Zygaenidae) in Tajikistan

19.30 **Guided tour through Mals**, followed by a **social dinner** with food from the region in Hotel Garberhof, (Staatsstraße 25/Strada State 25, Mals) (price not included in symposium fee)

Tuesday, 13 September 2016

Location: Kulturhaus Mals, Bahnhofstraße

09.30 **LECTURES: Molecular results, taxonomy and systematics of Zygaenidae**

Efetov, Konstantin A. (Simferopol, Russia), Kirsanova, Anna V. (Simferopol, Russia), Lazareva, Zoya S. (Simferopol, Russia), Parshkova, Ekaterina V. (Simferopol, Russia) & Tarmann, Gerhard M. (Innsbruck, Austria)
A role of the mitochondrial COI gene study in Zygaenidae biosystematics and new species descriptions

Efetov, Konstantin A. (Simferopol, Russia), Lazareva, Zoya S. (Simferopol, Russia) & Parshkova, Ekaterina V. (Simferopol, Russia) & Tarmann, Gerhard M. (Innsbruck, Austria)
The primary structure of the mitochondrial cytochrome oxidase first subunit fragment: amino acids variability in species of the genus *Zygaena* Fabricius, 1775 (Zygaenidae, Zygaeninae)

10.45 *Coffee break*

11.30 **LECTURES: Taxonomy and systematics of Zygaenidae**

Nahirnić, Ana (Sofia, Bulgaria)
Zygaena diaphana Staudinger, 1887, bona species! (Zygaenidae, Zygaeninae)

Guenin, Raymond (Wabern, Switzerland) & Tarmann, Gerhard M. (Innsbruck, Austria)
Hybridisation between *Adscita statices* (Linnaeus, 1758) and *A. alpina* Alberti, 1937 in the Alps – an overview (Zygaenidae, Procridinae)

12.30 *Lunch* (buffet)

14.00 **LECTURES: Biology, ecology and distribution of Zygaenidae**

Koshio, Chiharu (Naruto, Japan) & Tanaka, Yoshihisa (Naruto, Japan)
Emergence patterns in *Illiberis rotundata* (Zygaenidae, Procridinae)

Zagrobelny, Mika (Copenhagen, Denmark)
Colonization of Northern Europe by *Zygaena filipendulae* (Zygaenidae, Zygaeninae)

Briolat, Emmanuelle (Penryn, UK), Zagrobelny, Mika (Copenhagen, Denmark) & Stevens, Martin (Exeter, UK)
Investigating the honesty of warning signals in the Zygaenidae

15.45 *Coffee break*

16.15 **LECTURES: Biology, ecology and distribution of Zygaenidae**

Zagrobelny, Mika (Copenhagen, Denmark)
Interplay of cyanogenic glucosides in burnet moths and their food plants (Zygaenidae, Zygaeninae)

O'Neill, Hagen M. (Durham, UK)
Assessing the vegetative and topographic factors contributing to *Zygaena purpuralis* abundance at different scales (Zygaenidae, Zygaeninae)

O'Neill, Hagen M. (Durham, UK)
The impacts of red deer (*Cervus elaphus*) on the persistence of *Zygaena purpuralis* in the Inner Hebrides (Zygaenidae, Zygaeninae)

Prescott, Tom (Stirling, UK) & Young, Mark R. (Aberdeen, UK)
Progress with the conservation of rare Scottish *Zygaena* species, in relation to fence failure and varying grazing levels (Zygaenidae, Zygaeninae)

18.15 **POSTER session and SHORT REPORTS** (no abstracts)

Free evening

20.00 **Popular public talk** about Lepidoptera by G. M. Tarmann (for non-experts) followed by a public night collecting performance of members of the Entomological Working Group of the Tiroler Landesmuseen, Ferdinandeum, Innsbruck (organised by Benjamin Wiesmair)

Wednesday, 14 September 2016

EXCURSION to view cultural highlights around Mals and important locations for the understanding of the pesticide problem in Alpine valleys, based on the example of Mals

09.00 Departure by bus from Kulturhaus Mals, Bahnhofstraße.
1. Short walk over the historical important site 'Tartscher Bichl' where there is a good view on the development of civilisation and agriculture of the surroundings of Mals, with an explanation of the problem of the use of pesticides and the changes of former and present habitats of Zygaenidae
2. Visit of the 'Matschertal' with some short stops to explain the environment and zygaenid habitats

ca 12.00 *Lunch* in the traditional Gasthof zur Post in the medevial city of Glurns
14.00 3. Visit of the Monastery of Marienberg with a following walk through the vineyard and a wine taste in the vineyard of the monastery
4. Visit of one of the best still preserved undisturbed zygaenid habitats in the whole area at the beginning of the Avignatal in Taufers

Free evening

Thursday, 15 September 2016

EXCURSION to interesting Zygaenidae biotopes and interesting historical sites

08.30 Departure by bus from Kulturhaus Mals, Bahnhofstraße
1. Bus drive over the famous 'Stilfserjochstraße' to the historical Hotel Franzenshöhe, where already in the 19th century entomologists stayed and collected high altitude Alpine Lepidoptera. Dr Hanspeter Gunsch, one of the responsible authorities for the National Park Stilfser Joch, who will provide our group with interesting additional background information, accompanies this trip
2. Visit of the type locality of *Adscita alpina* (2300 m).
12.30 *Lunch* in the traditional restaurant Franzenshöhe on the Stilfserjochstraße (at an elevation of 2000 m)
15.00 3. Visit of the castle 'Churburg' with a personal guided tour by the owner of the castle Count Johannes Trapp
ca 17.00 4. Bus drive to the historical site 'Calvenbrücke' where in 1499 the Swiss army destroyed the Tyrolean army of Kaiser Maximilian I., with a further view on interesting biotopes for Zygaenidae

At 20.00, there will be a **film performance** about Lepidoptera by Christoph Wieser.

Friday, 16 September 2016

Location: Kulturhaus Mals, Bahnhofstraße

09.30 **LECTURES: Biology, ecology and distribution of Zygaenidae**

Nicolle, Marc (Angers, France)
Ups and downs in an ab ovo breeding attempt of a high mountain *Zygaena* sp. in an oceanic environment (Zygaenidae, Zygaeninae)

Keil, Thomas (Dresden, Germany)
Rediscovery of *Zygaenoprocris* (*Keilia*) *albertii* Efetov, 1991, with remarks on biology and distribution (Zygaenidae, Procridinae)

Nahirnić, Ana (Sofia, Bulgaria) & Tarmann, Gerhard M. (Innsbruck, Austria)
On the early stages of species of the *Zygaena purpuralis* – complex on the Balkan Peninsula and adjacent regions (Zygaenidae, Zygaeninae)

10.45 *Coffee break*

11.15 **LECTURES: Biology, ecology and distribution of Zygaenidae**

Desse, Jean-Marie (Anger, France)
Zygaena filipendulae subspecies distribution in France (Zygaenidae, Zygaeninae)

Gomboc, Stanislav (Kranj, Slovenia), Tarmann, Gerhard M. (Innsbruck, Austria), Nahirnić, Ana (Sofia, Bulgaria), Rebeušek, Franc (Miklavž na Dravskem polju, Slovenia), Zakšek, Barbara (Ljubljan Miklavž na Dravskem polju, Slovenia), Zadravec, Bojan (Nova Gorica, Slovenia), Štanta, Radovan (Miren, Slovenia), Zadrgal, Matjaž (Nova Gorica, Slovenia), Kogovšek, Nika (Miklavž na Dravskem polju, Slovenia), Lasan, Mojmir (Ljubljana, Slovenia), Polak, Slavko (Postojna, Slovenia), Deutsch, Helmut (Assling, Austria), Rekelj, Jurij (Kranj, Slovenia) &Jakšić, Predrag (Belgrade, Serbia)
A distributional overview on the Zygaenidae of Slovenia

12.30 *Lunch* (buffet)

14.00 **LECTURES: Biology, ecology and distribution of Zygaenidae**

Šašić, Martina (Zagreb, Croatia), Nahirnić, Ana (Sofia, Bulgaria) & Tarmann, Gerhard M. (Innsbruck, Austria)
Relevance of the collections of the Croatian Natural History Museum for the faunistic of the Zygaenidae of Croatia

Nahirnić, Ana (Sofia, Bulgaria), Jakšić, Predrag (Belgrade, Serbia), Marković, Marija & Zlatković, Bojan (Niš, Serbia)
New data on rare Zygaenidae and their habitats from eastern Serbia

Vrenozi, Blerina (Tirana, Albania), Aistleitner, Eyjolf (Feldkirch, Austria) & Tarmann, Gerhard M. (Innsbruck, Austria)
Contribution to the knowledge of Procridinae (Zygaenidae) of Albania

Koren, Toni (Zagreb, Croatia)
On the biotopes of *Zygaena cynarae* Esper, 1789, in Croatia (Zygaenidae, Zygaeninae)

15.45 *Coffee break*

16.15 **LECTURES: Biology, ecology and distribution of Zygaenidae**

Klir, Jiří (*Litoměřice****, Czech Republic)***
Epiorna abessynica (Koch, 1865) – contribution to the knowledge of the life cycle (Zygaenidae, Zygaeninae)

Drouet, Eric (Gap, France)
GIRAZ-*Zygaena* – 30 years devoted to Zygaenidae

Weiss, Jean-Claude (Metz, France)
'*Zygaena* stories'

ca 18.30 End of lectures

19.30 **Official Symposium Dinner in Biohotel Panorama in Mals**

Saturday, 17 September 2016

EXCURSION to the Natural History Museum Südtirol, Bozen/Bolzano and to the Südtiroler Landesmuseum für Kultur- und Landesgeschichte Schloss Tirol near Meran/Merano

08.00 Departure by bus from Kulturhaus Mals, Bahnhofstraße
10.00 Visit to the Natural History Museum South Tyrol
12.00 *Lunch* in the traditional Tyrolean restaurant Weißes Rössl in the old city of Bozen/Bolzano
15.00 Visit to the Südtiroler Landesmuseum für Kultur- und Landesgeschichte Schloss Tirol (Castle of Tirol) near Meran/Merano
ca 19.00 Return to Mals

Free evening

Sunday, 18 September 2016

Departure of participants

Investigating the honesty of warning signals in the Zygaenidae

Emmanuelle Briolat
Centre for Ecology and Conservation, Department of Biosciences, College of Life and Environmental Sciences, University of Exeter (Penryn), Cornwall, TR10 9FE,UK; esb204@exeter.ac.uk

Mika Zagrobelny
Plant Biochemistry Laboratory, Department of Plant and Environmental Science, University of Copenhagen, Denmark; miz@plen.ku.dk

Martin Stevens
Centre for Ecology and Conservation, Department of Biosciences, College of Life and Environmental Sciences, University of Exeter (Penryn), Cornwall, TR10 9FE, UK; Martin.Stevens@exeter.ac.uk

Warningly-coloured, or aposematic, animals advertise their physical or chemical defences with conspicuous colours and displays, to dissuade potential predators from attacking. Though this concept has been well established since Wallace and Darwin first applied it to the colouration of caterpillars, the question of how the strength of defence should relate to the conspicuousness of the signal, and in particular whether aposematic colouration can function as a quantitatively honest indicator of toxicity, remains controversial. The Zygaenidae present an ideal system in which to address this issue, as their chemical defences are well understood and they present differences in wing colour and pattern, both subtle within and between species, and more dramatic across subfamilies. To test how colour and toxicity are related in the Zygaenidae, this project combines LC-MS analyses of the moths' cyanogenic glucoside content with photography and image analysis, measuring wing colour from the perspective of avian predators. In the six-spot burnet, *Zygaena filipendulae*, sex is a major determinant of colouration, suggesting a dual role as an aposematic and sexual signal. Between sexes, signals appear to some extent to be "dishonest": while females are larger than males, and thus contain more cyanogenic glycosides, males display more highly-saturated red colours on their forewings and hindwings. Yet the red markings of females are also inherently larger, and have greater UV reflectance, a signal which could be relevant for both avian predators and conspecifics. Preliminary results of an ongoing cross-species analysis of toxicity and colouration in the Zygaenidae confirm the importance of sex, and suggest that the relationships between colour and defence may follow different patterns between species.

Key words: aposematism, colouration, cyanogenic glucosides, predation, Zygaenidae, *Zygaena filipendulae*.

The distribution and habitat requirements of *Zygaena filipendulae, Zygaena viciae* and *Zygaena osterodensis* in southern Sweden (Zygaenidae, Zygaeninae).

Joseph Burman
Canterbury Christ Church University, North Holmes Road Campus, Canterbury, Kent, CT11QU, UK; joseph.burman@canterbury.ac.uk

Three zygaenid moth species, *Zygaena viciae*, *Zygaena osterodensis*, and *Zygaena filipendulae* were monitored using pheromone lures across the Swedish counties of Skåne, Blekinge, Kalmar, and Östergötland in one of the most comprehensive and systematic species monitoring efforts for moth species to date. The monitoring uncovered numerous occupied sites previously unknown to conservationists at 250 localities in 2012.

Using the distribution data generated by pheromone monitoring, habitat analyses were carried out using the Swedish habitat mapping data (Marcktäckedata) in order to establish the true habitat requirements of these increasingly threatened species, and to produce models to predict potential distribution elsewhere. This study highlights the importance of multiple spatial scales at predicting occupancy, and draws on the habitat difference between these related species. We use partial least square models and binomial linear regression to establish the importance of habitat types such as coniferous forest, grassland, and agricultural land in predicting presence and absence of species, in order to draw up guidelines for the species' longer term conservation.

Key words: Sweden, pheromone, habitat, *Zygaena viciae, Zygaena osterodensis, Zygaena filipendulae*.

Olfactory speciation in zygaenids and the use of pheromone lures for species discrimination in the field

Joseph Burman
Canterbury Christ Church University, North Holmes Road Campus, Canterbury, Kent, CT11QU, UK; joseph.burman@canterbury.ac.uk

Moth species often share chemically similar pheromone compounds in order to attract mates, one of the most common groups being the long chained acetates derived from fatty acids. The concentrations and blend ratios of multiple acetate components are often important for species specific attraction in moths, and especially important in the production of synthetic lures. This study describes this occurrence in *Zygaena* and *Adscita* species in western Europe, and discusses how blends can be characterised and modified for field testing.

In some cases, the exact blend ratio seems to be highly conserved within a species across broad geographical ranges. This level of conserved species specificity can be used as a tool for discriminating cryptic or highly similar species in the field, where morphology is identical, but pheromone composition is different between species. The concept is discussed in the context of the British zygaenid moths, *Zygaena lonicerae*, and *Zygaena trifolii*, as a way of eliminating ambiguity in the British species records. In other zygaenid moths, subspecies variation in pheromone composition appears to occur at a narrower regional or sub-species level, a phenomenon which is currently poorly understood. The talk also discusses the possible causes for this, and the research approach that could be applied to understand the process better.

Key words: Zygaenidae, pheromone, speciation, lure, cryptic species.

Monitoring of Procridinae (Zygaenidae) by new sex attractants in Thrace Region (European Turkey)

Feza Can Cengiz
University of Mustafa Kemal, Faculty of Agriculture, Department of Plant Protection, 31034 Hatay, Turkey; cezafan_onurcan@hotmail.com

Konstantin A. Efetov
Crimean Federal University, Department of Biological Chemistry and Laboratory of Biotechnology, RU–295006 Simferopol, Crimea, Russia; efetov.konst@gmail.com

Kamuran Kaya
University of Mustafa Kemal, Agricultural Research and Application Center, 31034 Hatay, Turkey; kayakamuran@gmail.com

Elena E. Kucherenko
Crimean Federal University, Department of Biological Chemistry and Laboratory of Biotechnology, RU–295006 Simferopol, Crimea, Russia; shysh1981@mail.ru

Zühal Okyar
University of Trakya, Faculty of Science, Department of Biology, 22030 Edirne, Turkey; zuhalo@trakya.edu.tr

Gerhard M. Tarmann
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, Feldstrasse 11a, A–6020 Innsbruck, Austria; g.tarmann@tiroler-landesmuseen.at

In this study, Procridinae species were collected by sticky traps with the sex attractants (esters of 2-dodecenoic acid and isomers of 2-butanol): EFETOV-2 (racemic mixture of *R*- and *S*-enantiomers) and EFETOV-S-2 (*R*-enantiomer) in the Thrace Region of Turkey in May–July 2016. These attractants have been created in the Crimean Federal University, Simferopol (Efetov et al., 2014). The traps were placed in 10 localities with three traps in each locality: EFETOV-2, EFETOV-S-2 and control (without attractant).

The following species were attracted:

Theresimima ampellophaga (Bayle-Barelle, 1808) – 37 males to EFETOV-S-2 (Tekirdağ);

Rhagades (*Rhagades*) *pruni* ([Denis & Schiffermüller], 1775) – 2 males to EFETOV-S-2 (Tekirdağ);

Adscita (*Adscita*) *statices drenowskii* (Alberti, 1939) – 87 males to EFETOV-2 (Edirne, Kırklareli, Tekirdağ) and 31 males to EFETOV-S-2 (Edirne, Kırklareli, Tekirdağ);

Jordanita (*Jordanita*) *globulariae* (Hübner, 1793) – 2 males to EFETOV-2 (Kırklareli);

Jordanita (*Solaniterna*) *subsolana* (Staudinger, 1862) – 1 male to EFETOV-2 (Tekirdağ) and 3 males to EFETOV-S-2 (Edirne, Tekirdağ).

Control traps were empty in all localities.

Rhagades pruni is found for the first time in Turkey. Moreover, *Jordanita globulariae* is possibly also new for Turkey as the only literature data known so far originates from southern Turkey (Mollet, 1995) and is doubtful as the mentioned locality is far away from the distributional range of this species. Old Rebel's (1936) record of '*Procris globulariae*' for Ankara must be attributed to another species, viz. *Jordanita notata* (Zeller, 1847).

This study was supported by BAP with Project No. 15445, financed by Mustafa Kemal University of Turkey.

Key words: Zygaenidae, sex attractants, Thrace Region, Turkey.

References

Efetov, K. A., Parshkova, E. V., Baevsky, M. Y. & Poddubov, A. I. 2014. Sec-butyl ester of dodecenoate: synthesis and attractive properties. *The Ukrainian Biochemical Journal* **86** (6): 175–182.

Mollet, B. 1995. Contribution à la connaissance des Procridinae du Turquie et des isles grecques de l'est de la mer Egée (Lepidoptera: Zygaenidae). *Linneana Belgica* **15**: 127–136, 1 pl., 15 maps.

Rebel, H. 1936. Lepidopteren aus der Umgebung Ankaras. 2.Teil. *Annalen des Naturhistorischen Museums in Wien* **47**: 43–58.

Zygaena filipendulae (Linnaeus, 1758) – its different populations and their distribution in France (Zygaenidae, Zygaeninae)

Jean-Marie Desse
52 rue Franklin, F–49100 Angers, France; jean-marie.desse@laposte.net

The purpose of this lecture is to show with comments the distribution of the different subspecies of *Zygaena filipendulae* on the French territory. In this country roughly the larvae are living in the northern part on *Lotus corniculatus* and in southern part on *Dorycnium pentaphyllum*.

In the North of France the **ssp. *polygalae*** is widely distributed, except on the West Coast (Atlantic Ocean) and in the South (around the Mediterranean sea).

The mapping of all the localities demonstrates this situation and it is illustrated by a large diversity of taxa specifically in the area in contact with the Alps and Pyrenean mountains.

Today, the precise limits between the different sspp/taxa are not yet fully known. Their study is under way and hopefully will bring more precise explanations about the invasion of France by *Z. filipendulae* and its various population groups.

Key words: France, *Zygaena filipendulae*, geographic variation, distribution.

GIRAZ-*Zygaena* – 30 years devoted to Zygaenidae

Eric Drouet
86b route de la Luye, F–05000 Gap, France; edrouet.zyg@wanadoo.fr

The GIRAZ-*Zygaena* association is 30 years old. An account is given related to the aim of this little group of amateurs and its activities devoted to a better knowledge of the French Zygaenidae fauna. Meetings, symposia, publications, field work, work in public and in private collections, promotion of Zygaenidae in survey activities of many other associations, help by determinations and also support of student's studies are some facets of the GIRAZ "life".

Key words: France, GIRAZ, Zygaenidae.

Zygaenidae sex pheromones and attractants: laws and paradoxes

Konstantin A. Efetov
Crimean Federal University, Department of Biological Chemistry and Laboratory of Biotechnology, RU–295006 Simferopol, Crimea, Russia; efetov.konst@gmail.com

Sex pheromones are important factors in the recognition of conspecific males and females in Lepidoptera and some other groups of animals. One can suppose that every species has its unique molecule of sex pheromone. However, experiments with pheromones and attractants of different zygaenid species show that situation is not so simple (Efetov et al., 2010, 2011, 2015; Subchev et al., 2010, 2012, 2013, 2016).

Sex attractants in the family Zygaenidae are known for two subfamilies. In Zygaeninae they are esters of higher fatty unsaturated alcohols and acetic acid, while in Procridinae sex attractants and pheromones are esters of 2-butanol and fatty unsaturated acids (Efetov et al., 2010; Subchev, 2014).

There are two features in the function of sex attractants that seem to be paradoxes. First: the structure of female pheromones has no absolute specificity for every species. For example, the males of *Illiberis* (*Primilliberis*) *rotundata* Jordan, 1907, and *I.* (*P.*) *pruni* Dyar, 1905, were attracted by the same substances, viz. (2*R*)-butyl (7*Z*)-dodecenoate and (2*R*)-butyl (9*Z*)-tetradecenoate, but in different ratios (Subchev et al., 2012, 2013, 2016). Second: the males can be attracted not only by the natural female pheromone, but also by similar substance. Our investigations in the Crimea have shown that the males of *Theresimima ampellophaga* (Bayle-Barelle, 1808) were attracted to the traps not only with 2-butyl 7-tetradecenoate (natural female pheromone) but also with 2-butyl 2-dodecenoate (Efetov et al., 2014).

It is also interesting that different species have different reactions to the mixture of attractant enantiomers. For example, the presence of (2*S*)-butyl (7*Z*)-dodecenoate does not inhibit the attractiveness of (2*R*)-butyl (7*Z*)-dodecenoate for the males of *Jordanita* (*Tremewania*) *notata* (Zeller, 1847). The opposite result was obtained in our experiments in Armenia (Efetov et al., 2011) with *Zygaenoprocris* (*Molletia*) *taftana* (Alberti, 1939), which was attracted to (2*R*)-butyl (7*Z*)-dodecenoate, while the presence of (2*S*)-butyl (7*Z*)-dodecenoate completely cancelled the attractiveness of (2*R*)-butyl (7*Z*)-dodecenoate. This means that (2*S*)-butyl (7*Z*)-dodecenoate is an inhibitor of (2*R*)-butyl (7*Z*)-dodecenoate for *Z.* (*M.*) *taftana*. The importance of that situation is understandable because *J.* (*T.*) *notata* and *Z.* (*M.*) *taftana* are sympatric and syntopic in Armenia.

The present author found that if closely related species are syntopic they can have different pheromone systems. The examples are Crimean populations of *Jordanita* (*Jordanita*) *graeca* (Jordan, 1907) and *J.* (*J.*) *chloros* (Hübner, 1813). On the other hand, phylogenetically far species, like *Rhagades* (*Rhagades*) *pruni* ([Denis & Schiffermüller], 1775) and *J.* (*T.*) *notata*, may have the same structure of attractants (Subchev et al., 2010).

Well known interspecific copulations and hybrids in the family Zygaenidae are confirmation that the chemical isolation of different species is not absolute.

Key words: Zygaenidae, Zygaeninae, Procridinae, sex pheromones, sex attractants, esters.

References

Efetov, K. A., Can, F., Toshova, T. B. & Subchev, M. 2010. New sex attractant for *Jordanita anatolica* (Naufock) (Lepidoptera: Zygaenidae: Procridinae). *Acta Zoologica Bulgarica* **62**: 315–319.

Efetov, K. A., Parshkova, E. V., Baevsky, M. Y. & Poddubov, A. I. 2014. Sec-butyl ester of dodecenoate: synthesis and attractive properties. *The Ukrainian Biochemical Journal* **86** (6): 175–182.

Efetov, K. A., Subchev, M. A., Toshova, T. B. & Kiselev, V. M. 2011. Attraction of *Zygaenoprocris taftana* (Alberti, 1939) and *Jordanita horni* (Alberti, 1937) (Lepidoptera: Zygaenidae, Procridinae) by synthetic sex pheromones in Armenia. *Entomologist's Gazette* **62**: 113–121.

Efetov, K. A., Tarmann, G. M., Toshova, T. B. & Subchev, M. A. 2015. Enantiomers of 2-butyl 7*Z*-dodecenoate are sex attractants for males of *Adscita mannii* (Lederer, 1853), *A. geryon* (Hübner, 1813), and *Jordanita notata* (Zeller, 1847) (Lepidoptera: Zygaenidae, Procridinae) in Italy. *Nota Lepidopterologica* **38**: 161–169.

Subchev, M. 2014. Sex pheromone communication in the family Zygaenidae (Insecta: Lepidoptera): a review. *Acta Zoologica Bulgarica* **66**: 147–158.

Subchev, M. A., Efetov, K. A., Toshova, T. B. & Koshio, C. 2016. Sex pheromones as isolating mechanisms in two closely related *Illiberis* species – *I.* (*Primilliberis*) *rotundata* Jordan, 1907, and *I.* (*P.*) *pruni* Dyar, 1905 (Lepidoptera: Zygaenidae, Procridinae). *Entomologist's Gazette* **67**: 51–57.

Subchev, M., Efetov, K. A., Toshova, T., Parshkova, E. V., Toth, M. & Francke, W. 2010. New sex attractants for species of the zygaenid subfamily Procridinae (Lepidoptera: Zygaenidae). *Entomologia Generalis* **32**: 243–250.

Subchev, M. A., Koshio, C., Toshova, T. B. & Efetov, K. A. 2012. *Illiberis* (*Primilliberis*) *rotundata* Jordan (Lepidoptera: Zygaenidae: Procridinae) male sex attractant: Optimization and use for seasonal monitoring. *Entomological Science* **15**: 137–139.

Subchev, M., Koshio, C., Toshova, T., Efetov, K. A. & Francke, W. 2013. (2*R*)-butyl (7*Z*)-dodecenoate, a main sex pheromone component of *Illiberis* (*Primilliberis*) *pruni* Dyar (Lepidoptera: Zygaenidae: Procridinae)? *Acta Zoologica Bulgarica* **65**: 391–396.

A role of the mitochondrial COI gene study in Zygaenidae biosystematics and new species descriptions

Konstantin A. Efetov, Anna V. Kirsanova, Zoya S. Lazareva & Ekaterina V. Parshkova
Crimean Federal University, Department of Biological Chemistry and Laboratory of Biotechnology, RU–295006 Simferopol, Crimea, Russia; efetov.konst@gmail.com

Gerhard M. Tarmann
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, Feldstrasse 11a, A–6020 Innsbruck, Austria; g.tarmann@tiroler-landesmuseen.at

Many new species of the Zygaenidae were described recently only on the base of imago morphology (for example: Efetov, 1997a, 1997b, 2006). Some other characters, i.e. morphology of the first instar larvae, karyology etc., are also very useful for Zygaenidae study (Efetov et al., 2006; Efetov, Parshkova & Koshio, 2004). However, in the most recent years nearly all new species descriptions could not have managed without DNA sequences data.

1030 COI gene sequences of more than 240 species of the family Zygaenidae have been obtained during the last seven years as the result of joint «ZYGMO» (BOLD) project (with the Biodiversity Institute of Ontario, University of Guelph, Canada) on the extraction, amplification and sequencing of 658 bp fragment of the gene of mitochondrial cytochrome oxidase first subunit (COI) (www.boldsystems.org; Efetov et al., 2016).

DNA barcodes demonstrate high level specificity (94.2%) in the traditionally recognized Zygaenidae species. It has been found that the mitochondrial DNA study plays an important role in the solution of the problems of Zygaenidae biosystematics and taxonomy. For example, hitherto unknown males of *Zygaenoprocris* (*Zygaenoprocris*) *eberti* (Alberti, 1968) collected by A. Hofmann had been described in 2014 after comparison of their barcodes with the COI sequence of this species holotype (female collected in 1966) (Efetov, Hofmann & Tarmann, 2014). The application of this molecular technique in combination with traditional morphological methods was also helpful for descriptions of several new Procridinae species from the genera *Adscita* Retzius, 1783, and *Illiberis* Walker, 1854: *Adscita* (*Procriterna*) *pligori* Efetov, 2012, *Adscita* (*Adscita*) *dujardini* Efetov & Tarmann, 2014, *Illiberis* (*Alterasvenia*) *cernyi* Efetov & Tarmann, 2013, *Illiberis* (*Alterasvenia*) *banmauka* Efetov & Tarmann, 2014, and *Illiberis* (*Alterasvenia*) *kislovskyi* Efetov & Tarmann, 2016 (Efetov, 2012; Efetov & Tarmann, 2013, 2014a, 2014b, 2016). The COI genetic distances have been also taken in account in recent descriptions of French Guiana new species from the genera *Pampa* Walker, 1854, *Monalita* Tremewan, 1973, and *Seryda* Walker, 1856: *Pampa hermieri* Tarmann & Drouet, 2015, *Monalita faurei* Tarmann & Drouet, 2015, *Monalita laguerrei* Tarmann & Drouet, 2015, and *Seryda gallardi* Tarmann & Drouet, 2015 (Tarmann & Drouet, 2015).

COI gene investigation is not only an effective tool for Zygaenidae species identification or the study of biodiversity, but also provides additional data for scientific solutions in biosystematics and evolution research.

Key words: Zygaenidae, COI gene, biosystematics, taxonomy, new species.

References

Efetov, K. A. 1997a. Two new species of the genus *Artona* Walker, 1854 (Lepidoptera: Zygaenidae, Procridinae). *Entomologist's Gazette* **48**: 165–177.

———— 1997b. Three new species of the genus *Illiberis* Walker, 1854, from Taiwan and Vietnam (Lepidoptera: Zygaenidae, Procridinae). *Entomologist's Gazette* **48**: 231–244.

———— 2006. Nine new species of the genus *Chrysartona* Swinhoe, 1892 (Lepidoptera: Zygaenidae, Procridinae). *Entomologist's Gazette* **57**: 23–50.

———— 2012. *Adscita* (*Procriterna*) *pligori* sp. nov. (Lepidoptera: Zygaenidae, Procridinae) from Afghanistan. *Entomologist's Gazette* **63**: 99–105.

Efetov, K. A., Hofmann, A. & Tarmann, G. M. 2014. Application of two molecular approaches (use of sex attractants and DNA barcoding) allowed to rediscover *Zygaenoprocris eberti* (Alberti, 1968) (Lepidoptera, Zygaenidae, Procridinae), hitherto known only from the female holotype. *Nota Lepidopterologica* **37**: 151–160.

Efetov, K. A., Kirsanova, A. V., Lazareva, Z. S., Parshkova, E. V. & Tarmann, G. M. 2016. A study of nucleotide sequences of the mitochondrial COI gene and solution of some problems of Zygaenidae (Lepidoptera) biosystematics. *Tavricheskiy Mediko-biologicheskiy Vestnik* **19** (1): 28–33.

Efetov, K. A., Parshkova, E. V. & Koshio, C. 2004. The karyotype of *Illiberis* (*Primilliberis*) *rotundata* Jordan, [1907] (Lepidoptera: Zygaenidae, Procridinae). *Entomologist's Gazette* **55**: 167–170.

Efetov, K. A. & Tarmann, G. M. 2013. *Illiberis* (*Alterasvenia*) *cernyi* sp. nov. (Lepidoptera: Zygaenidae, Procridinae) from northern Thailand. *Entomologist's Gazette* **64**: 33–39.

———— 2014a. *Illiberis* (*Alterasvenia*) *banmauka* sp. nov. (Lepidoptera: Zygaenidae, Procridinae) from China and Myanmar. *Entomologist's Gazette* **65**: 62–70.

———— 2014b. A new European species, *Adscita dujardini* sp. nov. (Lepidoptera: Zygaenidae, Procridinae) confirmed by DNA analysis. *Entomologist's Gazette* **65**: 179–200.

———— 2016. A new *Illiberis* species: *I.* (*Alterasvenia*) *kislovskyi* (Lepidoptera: Zygaenidae, Procridinae) from Myanmar. *Entomologist's Gazette* **67**: 137–142.

Efetov, K. A., Tarmann, G. M., Hayashi, E. & Parshkova, E. V. 2006. New data on the chaetotaxy of the first instar larvae of Procridini and Artonini (Lepidoptera: Zygaenidae, Procridinae). *Entomologist's Gazette* **57**: 229–233.

Tarmann, G. M. & Drouet, E. 2015. Zygaenidae from French Guiana, with a key to the narrow-winged Zygaenidae genera of the New World. *Journal of the Lepidopterists' Society* **69**: 209–235.

The study of a new sex attractant for Procridinae (Zygaenidae) in Tajikistan

Konstantin A. Efetov & Elena E. Kucherenko
Crimean Federal University, Department of Biological Chemistry and Laboratory of Biotechnology, RU–295006 Simferopol, Crimea, Russia; efetov.konst@gmail.com

Jean-Marie Desse
Groupe d'Information de Recherche et d'Animation sur les Zygaenidae, F-49100 Angers, France; jean-marie.desse@laposte.net

A study of Zygaenidae sex attractants is an important direction of contemporary biochemistry because it can open up wide possibilities in ecology and evolutionary biology (Efetov et al., 2010, 2011, 2015; Subchev et al., 2010, 2012, 2013, 2016).

The attractant EFETOV-2 was created by the first author in 2013 (Efetov et al., 2014). The attractiveness of this substance for Procridinae species was tested in Tajikistan in 2015 by the third author. Lures with the attractant were hung on bushes or trees at a height of approximately 1.0 m above the ground. The attracted males were collected near the baits (Efetov, Kucherenko & Desse, 2016).

Field observations were made in four localities: Turkestan range, Shahristan, 2330 m, E 68º33.651′ / N 39º27.562′; Hissar range, Shurmash, 2072 m, E 68º26.934′ / N 39º13.584′; Hissar range, Kondara, 1628 m, E 68º48.488′ / N 38º48.978′; Darvaz range, Kalai-Husein, 2212 m, E 70º43.476′ / N 38º43.477′.

In the first and second biotopes the males of *Adscita* (*Procriterna*) *subtristis* (Staudinger, 1887) were flying around the lure. In the other two biotopes the males of *Jordanita* (*Tremewania*) *splendens* (Staudinger, 1887) were attracted to EFETOV-2.

Thus, the sex attractant for the males of *A.* (*P.*) *subtristis* and *J.* (*T.*) *splendens* was synthesized for the first time.

Key words: Procridinae, sex attractant, EFETOV-2, *Adscita subtristis*, *Jordanita splendens*, Tajikistan.

References

Efetov, K. A., Can, F., Toshova, T. B. & Subchev, M. 2010. New sex attractant for *Jordanita anatolica* (Naufock) (Lepidoptera: Zygaenidae: Procridinae). *Acta Zoologica Bulgarica* **62**: 315–319.

Efetov, K. A., Kucherenko, E. E. & Desse, J.-M. 2016. Sex attractant for *Adscita* (*Procriterna*) *subtristis* and *Jordanita* (*Tremewania*) *splendens* (Lepidoptera: Zygaenidae, Procridinae). *Crimean Journal of Experimental and Clinical Medicine* **7** (2): 33–36.

Efetov, K. A., Parshkova, E. V., Baevsky, M. Y. & Poddubov, A. I. 2014. Sec-butyl ester of dodecenoate: synthesis and attractive properties. *The Ukrainian Biochemical Journal* **86** (6): 175–182.

Efetov, K. A., Subchev, M. A., Toshova, T. B. & Kiselev, V. M. 2011. Attraction of *Zygaenoprocris taftana* (Alberti, 1939) and *Jordanita horni* (Alberti, 1937) (Lepidoptera: Zygaenidae, Procridinae) by synthetic sex pheromones in Armenia. *Entomologist's Gazette* **62**: 113–121.

Efetov, K. A., Tarmann, G. M., Toshova, T. B. & Subchev, M. A. 2015. Enantiomers of 2-butyl 7*Z*-dodecenoate are sex attractants for males of *Adscita mannii* (Lederer, 1853), *A. geryon* (Hübner, 1813), and *Jordanita notata* (Zeller, 1847) (Lepidoptera: Zygaenidae, Procridinae) in Italy. *Nota Lepidopterologica* **38**: 161–169.

Subchev, M. A., Efetov, K. A., Toshova, T. B. & Koshio, C. 2016. Sex pheromones as isolating mechanisms in two closely related *Illiberis* species – *I.* (*Primilliberis*) *rotundata* Jordan, 1907, and *I.* (*P.*) *pruni* Dyar, 1905 (Lepidoptera: Zygaenidae, Procridinae). *Entomologist's Gazette* **67**: 51–57.

Subchev, M., Efetov, K. A., Toshova, T., Parshkova, E. V., Toth, M. & Francke, W. 2010. New sex attractants for species of the zygaenid subfamily Procridinae (Lepidoptera: Zygaenidae). *Entomologia Generalis* **32**: 243–250.

Subchev, M. A., Koshio, C., Toshova, T. B. & Efetov, K. A. 2012. *Illiberis* (*Primilliberis*) *rotundata* Jordan (Lepidoptera: Zygaenidae: Procridinae) male sex attractant: Optimization and use for seasonal monitoring. *Entomological Science* **15**: 137–139.

Subchev, M., Koshio, C., Toshova, T., Efetov, K. A. & Francke, W. 2013. (2*R*)-butyl (7*Z*)-dodecenoate, a main sex pheromone component of *Illiberis* (*Primilliberis*) *pruni* Dyar (Lepidoptera: Zygaenidae: Procridinae)? *Acta Zoologica Bulgarica* **65**: 391–396.

New synthetic sex attractants for Zygaenidae

Konstantin A. Efetov & Elena E. Kucherenko
Crimean Federal University, Department of Biological Chemistry and Laboratory of Biotechnology, RU–295006 Simferopol, Crimea, Russia; efetov.konst@gmail.com

Gerhard M. Tarmann
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, Feldstrasse 11a, A–6020 Innsbruck, Austria; g.tarmann@tiroler-landesmuseen.at

Sex attractants are widely used for faunistic investigations of Lepidoptera, for monitoring moths in various biotopes (both rare and pest species), and for the elaboration of biological methods of pest control (Efetov et al., 2010, 2011, 2015; Subchev et al., 2010, 2012, 2013, 2016).

New sex attractants (esters of 2-dodecenoic acid and isomers of 2-butanol): EFETOV-2 (racemic mixture of *R*- and *S*-enantiomers), EFETOV-S-2 (*R*-enantiomer) and EFETOV-S-S-2 (*S*-enantiomer) were synthesized in the Crimean Federal University (Efetov et al., 2014). The attractiveness of these substances for different species of the Procridinae was tested during the field observations in Russia, Austria and Italy in 2013–2016.

For preparing baits, EFETOV-2, EFETOV-S-2 and EFETOV-S-S-2 were applied onto grey rubber vial caps. These lures were fixed in Delta traps with removable sticky layers. Sometimes only rubber caps were used without traps with netting of coming specimens.

It was shown that EFETOV-2 was attractive for the males of more than 10 Procridinae species: *Theresimima ampellophaga* (Bayle-Barelle, 1808), *Adscita* (*Adscita*) *statices* (Linnaeus, 1758), *A.* (*A.*) *geryon* (Hübner, 1813), *Jordanita* (*Tremewania*) *notata* (Zeller, 1847), *J.* (*Jordanita*) *graeca* (Jordan, 1907), and some other species. The males of *J.* (*J.*) *globulariae* (Hübner, 1793) and *J.* (*Solaniterna*) *subsolana* (Staudinger, 1862) were mainly attracted by *R*-enantiomer, while the males of *Rhagades* (*Rhagades*) *pruni* ([Denis & Schiffermüller], 1775) were mainly found in traps with *S*-enantiomer.

J. (*T.*) *notata* came in large amounts to the racemic mixture as well as to *R*-enantiomer. The presence of *S*-enantiomer does not inhibit the attractiveness of *R*-enantiomer for this species. The opposite result was obtained for *J.* (*J.*) *globulariae*, *J.* (*S.*) *subsolana* and *Rh.* (*Rh.*) *pruni*. *S*-enantiomer is the inhibitor of the attractiveness of *R*-enantiomer for *J.* (*J.*) *globulariae* and *J.* (*S.*) *subsolana*, while *R*-enantiomer is the inhibitor of the attractiveness of *S*-enantiomer for *Rh.* (*Rh.*) *pruni*. It was also shown that the racemic mixture was more attractive for *Th. ampellophaga* than *R*-enantiomer.

Key words: Procridinae, sex attractants, EFETOV-2, EFETOV-S-2, EFETOV-S-S-2, 2-dodecenoic acid, 2-butanol.

References

Efetov, K. A., Can, F., Toshova, T. B. & Subchev, M. 2010. New sex attractant for *Jordanita anatolica* (Naufock) (Lepidoptera: Zygaenidae: Procridinae). *Acta Zoologica Bulgarica* **62**: 315–319.

Efetov, K. A., Parshkova, E. V., Baevsky, M. Y. & Poddubov, A. I. 2014. Sec-butyl ester of dodecenoate: synthesis and attractive properties. *The Ukrainian Biochemical Journal* **86** (6): 175–182.

Efetov, K. A., Subchev, M. A., Toshova, T. B. & Kiselev, V. M. 2011. Attraction of *Zygaenoprocris taftana* (Alberti, 1939) and *Jordanita horni* (Alberti, 1937) (Lepidoptera: Zygaenidae, Procridinae) by synthetic sex pheromones in Armenia. *Entomologist's Gazette* **62**: 113–121.

Efetov, K. A., Tarmann, G. M., Toshova, T. B. & Subchev, M. A. 2015. Enantiomers of 2-butyl 7*Z*-dodecenoate are sex attractants for males of *Adscita mannii* (Lederer, 1853), *A. geryon* (Hübner, 1813), and *Jordanita notata* (Zeller, 1847) (Lepidoptera: Zygaenidae, Procridinae) in Italy. *Nota Lepidopterologica* **38**: 161–169.

Subchev, M. A., Efetov, K. A., Toshova, T. B. & Koshio, C. 2016. Sex pheromones as isolating mechanisms in two closely related *Illiberis* species – *I.* (*Primilliberis*) *rotundata* Jordan, 1907, and *I.* (*P.*) *pruni* Dyar, 1905 (Lepidoptera: Zygaenidae, Procridinae). *Entomologist's Gazette* **67**: 51–57.

Subchev, M., Efetov, K. A., Toshova, T., Parshkova, E. V., Toth, M. & Francke, W. 2010. New sex attractants for species of the zygaenid subfamily Procridinae (Lepidoptera: Zygaenidae). *Entomologia Generalis* **32**: 243–250.

Subchev, M. A., Koshio, C., Toshova, T. B. & Efetov, K. A. 2012. *Illiberis* (*Primilliberis*) *rotundata* Jordan (Lepidoptera: Zygaenidae: Procridinae) male sex attractant: Optimization and use for seasonal monitoring. *Entomological Science* **15**: 137–139.

Subchev, M., Koshio, C., Toshova, T., Efetov, K. A. & Francke, W. 2013. (2*R*)-butyl (7*Z*)-dodecenoate, a main sex pheromone component of *Illiberis* (*Primilliberis*) *pruni* Dyar (Lepidoptera: Zygaenidae: Procridinae)? *Acta Zoologica Bulgarica* **65**: 391–396.

The primary structure of the mitochondrial cytochrome oxidase first subunit fragment: amino acids variability in species of the genus *Zygaena* Fabricius, 1775 (Zygaenidae, Zygaeninae)

Konstantin A. Efetov, Zoya S. Lazareva & Ekaterina V. Parshkova
Crimean Federal University, Department of Biological Chemistry and Laboratory of Biotechnology, RU–295006 Simferopol, Crimea, Russia; efetov.konst@gmail.com

Gerhard M. Tarmann
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, Feldstrasse 11a, A–6020 Innsbruck, Austria; g.tarmann@tiroler-landesmuseen.at

Nowadays the investigations of 658 bp fragment of the mitochondrial COI gene are widely used for the study of biodiversity and biogeography, for species identification and for the improvement of systematics and taxonomy in many groups of organisms (Hebert, deWaard & Landry, 2010). This DNA segment codes the part of primary structure (219 amino acid residues) of the first subunit of cytochrome oxidase, the protein that is the respiratory chain enzyme.

On the base of nucleotide sequences obtained within BOLD «ZYGMO» project (Efetov et al., 2010a, 2010b, 2011, 2012, 2013, 2016; www.boldsystems.org) we analyzed the amino acids variation in specimens of studied species of the genus *Zygaena* Fabricius, 1775 (Lepidoptera, Zygaenidae). Only the changes of the protein primary structure were in the focus of this work.

Preliminary results allowed us to identify three AAPs in the genus *Zygaena* (AAP – amino acid position in the studied fragment of the enzyme at which replacements were observed): in AAP_{10} and AAP_{117} alanine or serine presents, in AAP_{123} glycine, serine or (rarer) alanine can be found. In the mentioned cases the replacement is represented by amino acids with different properties (hydrophobic and hydrophilic). It is interesting that in AAP_5 only leucine is present in species of the subgenus *Mesembrynus* Hübner, 1819, and only methionine is present in the subgenus *Agrumenia* Hübner, 1819. In comparison, in the subgenus *Zygaena* Fabricius, 1775, two different hydrophobic amino acids (methionine or isoleucine) can be found in this position. Furthermore, in AAP_{104} of *Mesembrynus* spp. and in AAP_{161} of *Agrumenia* spp. two different hydrophilic amino acids can be found, viz. serine or asparagine (in *Zygaena* spp. only serine presents).

Except AAP_5, AAP_{10}, AAP_{117}, and AAP_{123} six other amino acid replacement positions were found in the subgenus *Zygaena*: AAP_8 (isoleucine or valine), AAP_{13} and AAP_{97} (valine or leucine), AAP_{95} (leucine or methionine), AAP_{106} (alanine or asparagine), AAP_{125} (serine or glycine), and AAP_{187} (alanine or threonine). This means that the subgenus *Zygaena* has the most heterogenic primary structure of the studied protein fragment compared with other two subgenera.

Key words: Zygaenidae, COI gene, amino acids, protein primary structure, *Agrumenia, Mesembrynus, Zygaena*.

References

Efetov, K. A., Kirsanova, A. V., Lazareva, Z. S., Parshkova, E. V., Tarmann, G. M. & Rougerie, R. 2010a. Early results in DNA barcoding of Zygaenidae (Lepidoptera), pp. 7–8. *In* Can, F. (Ed.), *Abstracts of XII International Symposium on Zygaenidae, 5–9 May 2010*: 26 pp. Hatay.

Efetov, K. A., Kirsanova, A. V., Lazareva, Z. S. & Parshkova, E. V. 2010b. Filogeneticheskiy signal v gene mitokhondrial'noy tsitokhromoksidazy u predstaviteley semeystva Zygaenidae [Phylogenetic signal in the gene of mitochondrial cytochrome oxidase in representations of the family Zygaenidae]. *The Ukrainian Biochemical Journal* **82** (4): 25–26.

Efetov, K. A., Kirsanova, A. V., Lazareva, Z. S., Parshkova, E. V., Tarmann, G. M., Rougerie, R. & Hebert, P. D. N. 2011. Zygaenidae taxonomy and a DNA study: status quo, p. 50. *Abstracts of XVII European Congress of Lepidopterology, 9–13 May 2011*: 84 pp. Luxembourg.

———— 2012. Variations in sequences of the 658-bp region of the COI mitochondrial gene and their importance for the investigation of the Zygaenidae (Lepidoptera), pp. 11–12. *In* Tarmann, G. M., Tremewan, W. G. & Young, M. R. (Eds), *Abstracts of XIII International Symposium on Zygaenidae, 16–23 September 2012*: 40 pp. Innsbruck.

———— 2013. DNA barcoding as an efficient tool for the Zygaenidae study, p. 34. *Abstracts of XVIII European Congress of Lepidopterology 29 July – 4 August 2013*: 100 pp. Sofia.

Efetov, K. A., Kirsanova, A. V., Lazareva, Z. S., Parshkova, E. V. & Tarmann, G. M. 2016. A study of nucleotide sequences of the mitochondrial COI gene and solution of some problems of Zygaenidae (Lepidoptera) biosystematics. *Tavricheskiy Mediko-biologicheskiy Vestnik* **19** (1): 28–33l.

Hebert, P. D. N., deWaard, J. R. & Landry, J.-F. 2010. DNA barcodes for 1/1000 of the animal kingdom. *Biology Letters* **6**: 359–362.

A distributional overview on the Zygaenidae of Slovenia

Stanislav Gomboc
Šiškovo naselje 19, SI–4000 Kranj, Slovenia; stanislav.gomboc@siol.net

Gerhard M. Tarmann
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, Feldstrasse 11a, A–6020 Innsbruck, Austria; g.tarmann@tiroler-landesmuseen.at

Ana Nahirnić
National Museum of Natural History, Blvd. Tzar Osvoboditel 1, 1000 Sofia, Bulgaria; ananahirnic@nmnhs.com; e3009_2012@stud.bio.bg.ac.rs

Franc Rebeušek
Centre for Cartography of Fauna and Flora, Antoličičeva 1, SI-2204 Miklavž na Dravskem polju, Slovenia; franc.rebeusek@amis.net

Barbara Zakšek
Centre for Cartography of Fauna and Flora, Antoličičeva 1, SI-2204 Miklavž na Dravskem polju, Slovenia; barbara.zaksek@gmail.com

Bojan Zadravec
Vipavska cesta 88, SI–5000 Nova Gorica, Slovenia; bojan.zadravec1@siol.net

Radovan Štanta
Miren 163, SI–5291 Miren, Slovenia; radovan.stanta@gmail.com

Matjaž Zadrgal
Pod Lazami 53, SI–5290 Vrtojba, Slovenia; matjaz.zadrgal@si.mahle.com

Nika Kogovšek
Centre for Cartography of Fauna and Flora, Antoličičeva 1, SI–2204 Miklavž na Dravskem polju, Slovenia; kogovsek.nika@gmail.com

Mojmir Lasan
Glavarjeva 47, SI–1000 Ljubljana, Slovenia

Slavko Polak
Notranjska Museum Postojna, Kolodvorska cesta 3, SI–6230 Postojna, Slovenia; slavko.polak@guest.arnes.si

Helmut Deutsch
Bannberg 22, A–9911 Assling, Austria; hdlav45@aon.at

Jurij Rekelj
Struževo 40 c, SI–4000 Kranj, Slovenia; jurij.rekelj@gmail.com

Predrag Jakšić
Čingrijina 14/25, 11000 Beograd, Serbia; jaksicpredrag@gmail.com

The zygaenid fauna of Slovenia is relatively well studied, although a detailed review of the group was never published. Many collectors worked intensively on the Lepidoptera in this country between the Alps and the Balkans. However, specialists have never carefully examined most of the collected Zygaenidae material. The project *Zygaenidae of the Balkan Peninsula* (editors Jakšić, Nahirnić & Tarmann) provided the initiative to bring together data from Slovenian collectors, museum collections, three different databases, literature data and additional field observations made during 2016 to present them in a distributional atlas of the Zygaenidae of Slovenia. A workshop was organised by the Slovenian Lepidopterists in spring 2016 in Postojna to check the identifications of the collected specimens and to combine the data of the collected material. Moreover, Ana Nahirnić and Gerhard Tarmann have revised a large part of the collections of the Slovenian Natural History Museum in Ljubljana and incorporated the data into the Austrian BioOffice system that will be used for the analysis of the Zygaenidae of the Balkans project. All together more than 4.000 data were gathered for the Slovenian zygaenid fauna and analysis and distribution maps made for all 24 zygaenid species present in Slovenia. Two additional species are still expected to occur in Slovenia - *Jordanita graeca* (Jordan, 1907) and *Zygaena minos* ([Denis & Schiffermüller], 1775) - as they have been found not far from the border. Detailed examination of numerous specimens has not yet confirmed this. In the Slovenian faunistic list the recently described species *Adscita dujardini* Efetov & Tarmann, 2014, has replaced the previously known *Adscita albanica* (Naufock, 1926), which was mentioned in the two checklists of Slovenian Lepidoptera.

An overview on our current knowledge of the Slovenian Zygaenidae will be presented and interesting taxonomic and distributional problems will be discussed.

Key words: Slovenia, Zygaenidae, fauna, distribution, atlas.

Hybridisation between *Adscita statices* (Linnaeus, 1758) and *A. alpina* Alberti, 1937 in the Alps – an overview (Zygaenidae, Procridinae)

Raymond Guenin
Grauholzweg 14, CH–3084 Wabern, Switzerland; raymondguenin@bluewin.ch

Gerhard M. Tarmann
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, Feldstrasse 11a, A–6020 Innsbruck, Austria; g.tarmann@tiroler-landesmuseen.at

In the Alps the closely related species *Adscita statices* (Linnaeus, 1758) and *Adscita alpina* (Alberti, 1937) show a vicariant distribution. However, although the genitalic differences are very significant several hybrid areas are known. In the eastern Alps hybrids have been found in the upper Inn valley of Tirol (Austria), south of the Brenner pass in Südtirol (Italy) and in the Ahrntal in Südtirol (Italy). In the south-eastern Alps single hybrids are known from Friuli (Italy). In the western Alps there is a significant hybrid zone known in Wallis/Valais that extends as far as the Canton of Uri (Switzerland). Recently, also in the Ligurian Alps (Italy) hybrids could be found.

The situation in the eastern Alps was discussed in detail by Tarmann (1979). But at that time the hybrid zone in Switzerland was not completely understood and there were no records known from a potential hybrid zone in the Ligurian Alps.

Extended field work in the Swiss Alps by Guenin (2004–2015) could significantly contribute to our knowledge of the western hybrid zone (Guenin, 2013, 2016). As a result of numerous excursions made in the years 2004 to 2015 in the Canton of Valais the two already known contact zones between *A. alpina* and *A. statices* could be confirmed (Guenin, 2013). Besides, a series of hitherto unknown locations could be found in the area ranging from the upper part of the Rhone Valley to the region of the Val d'Anniviers and Val de Nendaz. Most of the newly detected sites are located south of the Rhone Valley ranging between 1300 and 1900 m a. s. l. where the populations differ strongly by the extent of individuals with intermediate genital structures. Populations from the upper part of the Rhone Valley (Obergoms) are characterized by a relatively high proportion, while this seems to be much smaller in populations from the central Valais and the southern valleys. Unexpectedly, hybrids between *A. alpina* and *A. statices* could be observed on the south-facing slope of the Simplon pass. This fact is remarkable because until today *A. statices* has never been observed in this area. Moreover, *A. statices* seems to be absent in the region between the Swiss border and the entrance to the Centovalli valley located in the western part of the Canton of Ticino. These findings suggest a similarity to the situation in the area on the Brenner pass at the border between Austria and South Tirol (Italy) where *A. statices* could only be found on the north-facing slope of the pass although hybrids also exist on the south-facing slope (Tarmann, 1979). Therefore, the Simplon pass region might be a second place within the Alps where *A. statices* has been reached the south-facing slope arriving from the north. Finally, from the Val d'Anniviers and Val de Nendaz and the north-facing Gredetsch-, Baltschieder- and Lötschental only a few individuals with intermediate genital structures are known so that these sites have to be investigated further (Guenin, 2016).

Recently, in summer 2016, another hybrid zone could be found in the western Ligurian Alps in Italy around Drego (West of Passo di Teglia, Province Imperia) by G. M. Tarmann (unpublished).

Key words: Alps, *Adscita statices*, *Adscita alpina*, distribution, hybridisation, intermediate genitalia structures.

References

Guenin, R. 2013. Zur Verbreitung von *Adscita alpina* (Alberti, 1937) im Oberwallis (Lepidoptera: Zygaenidae, Procridinae). – *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* **86**: 49–61, tab. 1, figs 1–30.

Guenin, R. 2016. Kontaktstellen zwischen *Adscita alpina* (Alberti, 1937) und *Adscita statices* (Linnaeus, 1758) im Wallis (Lepidoptera: Zygaenidae, Procridinae) - eine Zwischenbilanz. – *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* **89**: 15–35.

Tarmann, G. 1979. Die *statices*-Gruppe des Genus *Procris* F. (Lepidoptera, Zygaenidae). – *Mitteilungen der Münchner Entomologischen Gesellschaft* **68**: 45–108, 2 tbls, 6 maps, figs 1–15.

POSTER

Surveying *Zygaena purpuralis* (Brünnich, 1763) as one of the priority species on natural Chalk Grasslands of Eastern Westphalia (Germany) with regard to the EU Habitats Directive – population connectivity and regionally informed abundance (Zygaenidae, Zygaeninae)

Axel Hille
Rosengarten 21, D–33605 Bielefeld, Germany;
axel.hille@gmx.net.

Burkhard Beinlich
Bioplan GbR, Höxter, Untere Mauerstraße 6–8, D–37671 Höxter, Germany;
B.Beinlich-Bioplan.Hx@t-online.de

The authors compiled simple occurrence and quantified abundance data of *Zygaena purpuralis* from natural dry grassland biotopes to survey the metapopulation dynamics in a landscape mosaic in Eastern Westphalia. Available occurrence data were used to simulate habitat patch dynamics in terms of dispersal coherence. Furthermore, information about local and regional abundance broadly spanning a time span over 30 years clearly shows decreasing trends. Possible causes for the decline are discussed.

Key words: *Zygaena purpuralis*, natural dry grassland, Eastern Westphalia, metapopulations dynamics.

Rediscovery of *Zygaenoprocris* (*Keilia*) *albertii* Efetov, 1991, with remarks on biology and distribution (Zygaenidae, Procridinae)

Thomas Keil
Weißenberger Str. 32, D–01324 Dresden, Germany; Thomas-Keil@web.de

Zygaenoprocris albertii Efetov, 1991 was described only based on two specimens (male holotype and female paratype) from Turkmenistan. No more specimens were known from this species, maybe due to the lack of enough information about the type locality on the label of the type specimens. Food-plants as well as larval stages and geographic distribution of the species were unknown. In 2015 during an entomological excursion in north-eastern Iran, *Zygaenoprocris albertii* could be rediscovered in Kuh-e Sorkh (near Kopet-Dagh Mountain on the border of Turkmenistan) and recorded as new for the fauna of Iran. An *Atraphaxis* species was recognized as hostplant of the species in Kuh-e Sorkh, a plant that is widely distributed also in adjacent mountains (e.g. Kopet Dagh and Binaloud). The copulation behaviour together with the biology of *Zygaenoprocris albertii* and the morphology of the eggs, larvae, cocoon and adults were studied and photographed for the first time. The results of this study are presented in this talk.

Key words: Iran, Khorassan, Kuh-e Sorkh, larva, Procridinae.

POSTER

DNA barcoding with Logic (BLOG) of taxonomically problematic *Mesembrynus* taxa of the *Zygaena manlia* – group from Iran (Zygaenidae, Zygaeninae)

Thomas Keil
Weißenberger Str. 32, D–01324 Dresden, Germany;
Thomas-Keil@web.de

Axel Hille
Rosengarten 21, D–33605 Bielefeld, Germany;
axel.hille@gmx.net.

In an attempt to genetically assign problematic specimens belonging to Iranian taxa of the *Zygaena manlia*- group we used so-called Barcoding with Logic (BLOG) to address specific taxonomic problems posed by formally established taxa, mainly testing for challenging hypotheses about subspecific allocation and syntopic occurrence.

Key words: Iran, *Zygaena manlia*, Barcoding, Logic (BLOC).

Additional notes about the life cycle of *Epiorna abessynica* (Koch, 1865) (Zygaenidae, Zygaeninae)

Jiři Klír
Ankertova 6, CZ–412 01 Litoměřice, Czech Republic; klir.jiri@seznam.cz

Additional notes about the life cycle of *Epiorna abessynica* (Koch, 1865) from the Guge Mountains in southern Ethiopia are provided. New information on the behaviour, copulation and ovipositing of the adults, and the larvae and cocoon (both in the field and in captivity) are presented.

Key words: *Epiorna abessynica*, Ethiopia, Guge Mountains, behavior, copulation, oviposition, biology.

On the biotopes of *Zygaena cynarae* Esper, 1789, in Croatia (Zygaenidae, Zygaeninae).

Toni Koren
Croatian Herpetological Society – Hyla, I. Lipovac 7, HR–10 000 Zagreb;
koren.toni1@gmail.com

Zygaena cynarae Esper, 1789, occurs in two different subspecies in Croatia: *Z. cynarae cynarae* Esper, 1789 (distributed only east of the Sava river) and *Z. cynarae adriatica* Burgeff, 1926 (distributed in the Adriatic coastal areas of Croatia and the adjacent mountains). A third subspecies, *Z. cynarae jadovnica* Rauch, 1977, described from an area very close to the Croatian border in northern Bosnia and Herzegovina could not be found so far on Croatian territory but could theoretically also occur in this country.

There are many data from the coastal subspecies known from Croatia but only single data from the nominotypical continental subspecies. The author has collected one male of this population in the vicinity of Zagreb, in the surroundings of Vugrovec village 20.6.2009, at an altitude of approximately 300 m a.s.l. The biotope consisted of a typical continental dry grassland (Festuco-Brometalia), on a very shallow, marly, dry soil, rich with orchids like *Anacamptis pyramidalis* and *Gymnadenia conopsea*. Because the meadows are not mowed, plants from thermophilic forest edges, such as *Geranium sanguineum* are present in great numbers. In some places with deeper soil, *Pteridium aquilinum* is also abundant. In 2016 additional surveys were carried out on this, as well on additional sites, but the record of *Z. cynarae cynarae* was not confirmed. Additional surveys are planned for the following years, in order to gain additional information on the occurrence and habitat preference of this rare subspecies in Croatia.

Key words: Croatia, *Zygaena cynarae*, biotopes.

Emergence patterns in *Illiberis rotundata* (Zygaenidae, Procridinae)

Chiharu Koshio
Naruto University of Education, 748 Nakajima, Takashima, Naruto, 772-8502 Japan;
koshio@naruto-u.ac.jp

Yoshihisa Tanaka
Naruto University of Education, 748 Nakajima, Takashima, Naruto, 772-8502 Japan;
koshio@naruto-u.ac.jp

Insect protandry, the emergence of males before females during the mating season, is generally assumed to be an adaptive male reproductive strategy. Protandry is, however, negatively correlated with polyandry, mainly due to the trade-off between size and emergence in males: small males emerged early in the adult season are not advantageous in the severe sperm competition predicted from polyandry. The plum moth, *Illiberis rotundata* is univoltine and polyandrous, but has a week tendency of protandry. We examined emergence patterns and some life history traits of both males and females. Both male and female body sizes decreased with emergence date against the prediction. In some butterfly species, males of generations without pupal diapause can achieve large body size without paying the cost of longer development time. *Illiberis rotundata* males may also have a similar developmental mechanism. We will discuss their life history strategies in comparison with that of a monandrous zygaenid moth, *Elcysma westwoodii*.

Key words: Japan, *Illiberis rotundata*, protandry, reproductive strategy, monandry, polyandry.

Zygaena diaphana Staudinger, 1887, bona species! (Zygaenidae, Zygaeninae)

Ana Nahirnić
National Museum of Natural History, Blvd. Tzar Osvoboditel 1, 1000 Sofia, Bulgaria; ananahirnic@nmnhs.com; e3009_2012@stud.bio.bg.ac.rs

In *Zygaena minos* ([Denis & Schiffermüller], 1775) two species-groups are recognized: '*minos*-group' and '*diaphana*-group', with differences in male genitalia, larvae and host-plants. The distribution of the '*minos*-group' includes Sweden, parts of western, central and eastern Europe, the western Balkan Peninsula to Russia and Transcaucasia, while the '*diaphana*- group' occurs from the southern, central and eastern Balkan Peninsula to Turkey and Transcaucasia. Since they have never been found sympatrically they were considered to be conspecific by many authors. Much hope was placed in DNA barcoding but results failed to distinguish *Z. purpuralis* (Brünnich, 1763) and both groups of *Z. minos,* except *Z. minos persica* Burgeff, 1926. Finally, efforts to obtain the pheromone of *Z. minos* have not been successful so far.

During a visit to the Museum Witt in Munich the author was able to recognize *Z. minos* ssp. nov. from Albania and Macedonia. Discoveries of *Z. minos* in the central Balkan Peninsula show that *Z. minos* is geographically closely distributed to *Z. diaphana* Staudinger, 1887 **stat. rev.** and, furthermore, they are sympatric. In the Witt collection there are *Z. purpuralis, Z. minos* and *Z. diaphana* with same label data from Pelister National Park (Mt. Baba) in southwestern Macedonia. Moreover there are clear differences in male genitalia and habitus between the males of *Z. minos* and *Z. diaphana* from that series. As these two species were found to be sympatric on one mountain range and based on their constant genitalic differences *Z. diaphana* must be raised to species rank. Preliminary field studies could not confirm the presence of *Z. minos* or *Z. diaphana* on Mt. Baba. The reason for this may be that the habitats favourable for *E. amethystinum* L., which is the larval host-plant of *Z. diaphana* on the nearby Mt. Galičica, are subject to succession and the historical localities have changed.

Key words: *Zygaena purpuralis*, *Z. minos*, *Z. diaphana* **stat. rev.**, sympatry, Balkan Peninsula, Macedonia.

New data on rare Zygaenidae and their habitats from eastern Serbia

Ana Nahirnić
National Museum of Natural History, Blvd. Tzar Osvoboditel 1, 1000 Sofia, Bulgaria; ananahirnic@nmnhs.com; e3009_2012@stud.bio.bg.ac.rs

Predrag Jakšić
Čingrijina 14/25, 11000 Beograd, Serbia; jaksicpredrag@gmail.com

Marija Marković & Bojan Zlatković
Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš, 18000 Niš, Serbia; marijam@pmf.ni.ac.rs; bojanzlat@yahoo.com

In the last two years fieldwork was conducted in eastern Serbia targeting sun-exposed calcareous rocky slopes. The explored area comprises mountains around Nišava River Valley in the municipalities of Knjaževac, Svrljig, Niš, Bela Palanka, Pirot and Dimitrovgrad. Nišava River Basin is influenced by Pontic and Mediterranean region through Struma River Valley and Sofia Basin. Additional information on habitat, larval host-plants and nectar plants of rare Zygaenidae species was collected in the field. Here we provide habitat types identified according to the Eunis Habitat Classification. All mentioned habitats are common in eastern Serbia and therefore the following species are expected to be more distributed in explored area.

Rhagades pruni ([Denis & Schiffermüller], 1775) is a rare species in Serbia. It is found on Mt. Vidlič in habitat typical for it F3.24 Subcontinental and continental deciduous thickets.

Jordanita graeca (Jordan, 1907) is reported from less than ten localities in Serbia. We observed it on Mt. Vidlič in habitat E1.22 Arid subcontinental steppic grassland (*Festucion valesiacae*).

Adscita albanica (Naufock, 1926) is one of the rarest and least investigated Zygaenidae species on the Balkan Peninsula. Here we report it for the first time in Serbia. On Suva Planina Mts it inhabits grasslands on the main ridge while on Mt. Vidlič its habitat is dry clearings with *Geranium sanguineum* L. in open deciduous forests. The localities in Serbia represent the northernmost records on the Balkan Peninsula.

Zygaena punctum Ochsenheimer, 1808 has been known in Serbia only from a few localities in northern and eastern part. It was found in seven localities in the investigated area (Jelašnička Klisura Gorge, Svrljiški Timok River Gorge, Svrljiške Planine Mts, Mt. Šljivovički Vis, Mt. Vidlič and Stara planina Mts) and inhabits following habitat types: E1.21 Helleno-Balkanic *Satureja montana* steppes and E1.22 Arid subcontinental steppic grassland (*Festucion valesiacae*). On each site we observed eggs or larvae on *Eryngium campestre* L.

Zygaena brizae (Esper, 1800) occurs in Jelašnička Klisura Gorge and Mt. Vidlič in E1.21 Helleno-Balkanic *Satureja montana* steppes, E1.22 Arid subcontinental steppic grassland (*Festucion valesiacae*) and E1.72 *Agrostis - Festuca* grassland.

Zygaena diaphana Staudinger, 1887 is a new species for Serbia. On Stara Planina Mts. adults as well as young and last instar larvae were observed in habitat E1.22 Arid subcontinental steppic grassland (*Festucion valesiacae*). On Mt. Tresibaba it reaches the northern limit of its general distribution. Two additional localities are Jelašnička Klisura Gorge and Svrljiški Timok River Gorge.

Key words: Zygaeninae, Procridinae, *Rhagades pruni*, *Jordanita graeca*, *Adscita albanica*, *Zygaena punctum*, *Zygaena brizae*, *Zygaena diaphana,* eastern Serbia, habitats.

On the early stages of species of the *Zygaena purpuralis*–complex on the Balkan Peninsula and adjacent regions (Zygaenidae, Zygaeninae)

Ana Nahirnić
National Museum of Natural History, Blvd. Tzar Osvoboditel 1, 1000 Sofia, Bulgaria; ananahirnic@nmnhs.com, e3009_2012@stud.bio.bg.ac.rs

Gerhard M. Tarmann
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, Feldstrasse 11a, A–6020 Innsbruck, Austria; g.tarmann@tiroler-landesmuseen.at

Here we present results of ongoing breeding experiments of *Z. purpuralis* (Brünnich, 1763), *Z. minos* ([Denis & Schiffermüller], 1775) and *Z. diaphana* Staudinger, 1887, from the Balkan Peninsula and northern Italy.

The colour of *Zygaena purpuralis* last instar larvae is much more variable than published in literature where most authors mention 'yellow' as the colour of the adult larva. The colour of larvae from Montenegro and Bulgaria varies from light to dark yellow. Larvae from northern Greece are dark grey, those from Friuli (Italy) are slightly brownish yellow and larvae from northern Italy (Südtirol) are yellow ventrally and brown dorsally. The eggs of all populations of *Z. purpuralis* that we could rear so far are yellow. Various populations from Albania, Greece and Italy accept the following species of *Thymus* in captivity: *Thymus striatus* Vahl., *Th. pannonicus* All., *Th. glabrescens* Willd., *Th. pulegioides* L. and *Th. vulgaris* L.

The last instar larvae of *Zygaena minos* from Montenegro are light to dark greyish or very light mint blue. Its host-plant is *Pimpinella nigra* Mill. The larvae refused to feed on *Eryngium* species in captivity. *Zygaena minos* larvae from northern Italy (Südtirol) are dark grey until hibernation and light grey in the later instars after hibernation. The eggs are light yellow. This population also refused to accept *Eryngium* in captivity as larval host-plant.

Z. diaphana from eastern Serbia and western Bulgaria has been found to feed on *E. campestre* L. in nature. The eggs are yellow and the last instar larvae are greenish bright yellow. *Z. diaphana* from Mt. Chelmos is found on *E. amethystinum* var. *tenuifoloum* Boiss. & Heldr. Last instar larvae are greyish dark olive-green. Eggs of populations from Peloponnese and Macedonia are pale yellow. Different populations from the Balkan Peninsula in captivity accept *Eryngium amethystinum* var. *amethystinum* L., *E. amethystinum* var. *tenuifolium* Boiss. & Heldr., *E. campestre* L., *E. giganteum* M. Bieb, *E. creticum* Lam., *E. palmatum* Pančić & Vis., *E. wiegandii* Adamović, and *Falcaria vulgaris* Bernh., but refuse *Pimpinella tragium* Vill., *P. nigra* Mill. and *P. saxifraga* L.

Key words: *Zygaena purpuralis*, *Z. minos*, *Z. diaphana*, early stages, host-plants, Balkan Peninsula, Italy.

Ups and downs in an ab ovo breeding attempt of a high mountain *Zygaena* sp. in an oceanic environment (Zygaenidae, Zygaeninae)

Marc Nicolle
Residence Schubert, 2 rue Paul Pousset, F–49100 Angers, France; marc.nicolle@sfr.fr

On receiving eggs of *Zygaena* (*Agrumenia*) *cocandica* Erschoff, 1874, from Tajikistan sent by Jean-Marie Desse in July 2013, the author was presented with the challenge to succeed in the breeding of this montane species in Angers, a city located along the Loire valley, approximately 120 km east of the Atlantic ocean at an altitude of 50 m.

The first problem concerned the host-plant of the larvae which was quickly resolved, the literature proposing different Fabaceae species, some of them readily available in the vicinity. Three of them were offered (*Lotus corniculatus* L., *Onobrychis viciifolia* Scop., *Securigera varia* (L.) Lassen) and these were more or less readily accepted, the second one appearing to be the favourite.

The second question was related to the conditions of diapause, taking into account the major differences of altitude, temperature, average humidity and snow coverage between the natural habitat and the location of breeding. During the first two winter seasons (2013–2014 and 2014–2015), the larvae were kept in a garden shed fully open to ambient conditions before being brought into room conditions in March in order to terminate diapause. Relatively high losses (one-third) were observed at the time of diapause termination, with problems of moulting. All of the surviving caterpillars appeared to eat normally and achieved three moults before entering diapause again in June. A new strategy was adopted for the third winter (2015–2016), the larvae being placed for approximately six months in a fridge. Diapause also terminated later (April) and three years after hatching, five larvae spun cocoons, the adults emerging in June 2016. All of the remaining larvae entered a fourth diapause.

Additionally, it has to be noted that all of the five examples emanating from the eggs laid by a female with a yellow phenotype also exhibited the same yellow phenotype.

Key words: *Z. cocandica*, breeding, winter diapause.

Assessing the vegetative and topographic factors contributing to the abundance of *Zygaena purpuralis* at different scales (Zygaenidae, Zygaeninae)

Hagen M. O'Neill
School of Biological and Biomedical Sciences, Durham University, South Road, Durham, DH1 3LE, UK;
h.m.o'neill@durham.ac.at

The transparent burnet moth (*Zygaena purpuralis*) inhabits steep, south/south-west facing coastal grasslands. However, the importance of specific habitat characteristics such as plant composition, diversity and structure in determining *Z. purpuralis* densities is unknown. The application of pheromone-baited traps as an ecological monitoring tool has generally been limited to quantifying the presence of pest populations, but can be used in conjunction with traditional ecological fieldwork methods to make inferences about species ecology. In this study, the catch-rate of funnel-traps baited with female transparent *Z. purpuralis* pheromone was related to a variety of local vegetative metrics. Moreover, the effects of spatial heterogeneity in habitat quality on *Z. purpuralis* abundance were tested at varying scales. Factors found to be important in driving *Z. purpuralis* abundances and the scales at which they operate are discussed. Finally, the applicability of pheromone-baited funnel traps as ecological monitoring tools is reviewed.

Key words: *Zygaena purpuralis*, habitat quality, ecological monitoring, pheromones, funnel-trapping.

The impacts of red deer (*Cervus elaphus*) on the persistence of *Zygaena purpuralis* in the Inner Hebrides (Zygaenidae, Zygaeninae).

Hagen M. O'Neill
School of Biological and Biomedical Sciences, Durham University, South Road, Durham, DH1 3LE, UK;
h.m.o'neill@durham.ac.at

A new management scheme is planned for an island estate in the Inner Hebrides, aiming to promote biodiversity on the island whilst moving significantly away from the 'traditional' land use in the region. The island features short sward habitats which are breeding grounds for rare Lepidoptera, namely the transparent burnet moth (*Zygaena purpuralis*) and slender scotch burnet moth (*Z. loti*), and one of the main aims of this new management scheme is to promote these habitats through controlled grazing pressures and distribution of red deer (*Cervus elaphus*), whilst avoiding the negative impacts of *C. elaphus* overabundance. Behavioural observations and habitat plots were conducted to quantify the foraging patterns and habitat use of *C. elaphus* in areas of known *Z. purpuralis* activity. Recorded *Z. purpuralis* abundances in these areas were related to a series of *C. elaphus* habitat use metrics. The impacts of deer habitat use and foraging behaviours on *Z. purpuralis* abundances are discussed.

Key words: *Zygaena purpuralis*, habitat management, red deer, *Cervus elaphus*.

Progress with the conservation of rare Scottish *Zygaena* species, in relation to fence failure and varying grazing levels (Zygaenidae, Zygaeninae)

Tom Prescott
Butterfly Conservation Scotland, Balallan House, 24 Allan Park, Stirling, FK8 2QG, Scotland; UK;
tprescott@butterfly-conservation.org

Mark R. Young
School of Biological Sciences, University of Aberdeen, Oceanlab, Newburgh, Aberdeenshire AB41 6AA, Aberdeenshire, Scotland, UK;
m.young@abdn.ac.uk

Two species of *Zygaena*, namely *Z. loti scotica* (Rowland-Brown, 1919) and *Z. viciae ytenensis* Briggs, 1888, have been the main subjects for recent conservation work in Scotland, although there has also been much work carried out on the ecology of *Adscita statices* (Linnaeus, 1758). Of these, *Z. viciae* has only one location and by 1990 had been reduced to a population of less than twenty adults. Urgent fence placement, to remove grazing from its site, had allowed a dramatic increase, so that thousands of adults were found until three years ago. The focus of work on *Z. loti* has been on survey, to assess the extent of its distribution, as well as on the reduction of bracken fern, *Pteridium aquilinum* Linnaeus and *Cotoneaster* sp., which act to smother the open grassland favoured by the moth. In the winter season of 2014/2015, probably during November 2014, the fence surrounding the site where *Z. viciae* occurs was breached by land-slip and falling boulders and so sheep were allowed access to its site and the heavy grazing had an immediate impact on the vegetation. In 2015, probably as a result of this deleterious change, the numbers of adult moths recorded had fallen to a maximum transect count of 14, approximately a 90% reduction on the count made in 2013, representing a serious risk to the continuation of the species in Scotland. A complicating factor was that the weather was very poor during the flight season in 2015, which may have also acted to depress the population. The fence was repaired in July and August 2015 and sheep excluded, so that by 2016 the vegetation had changed again. It is hoped that this will allow a recovery in moth population numbers and monitoring is planned for July 2016. The results of this monitoring will be reported, as will the state of the vegetation, and discussion will be included on prospects for the species. Survey work has continued to discover some new small populations of *Z. loti* but all are in the same general area of north-west Mull, which is the known range of the moth in Scotland. Meanwhile parties of volunteers, as well as staff from Butterfly Conservation Scotland and from National Trust for Scotland have continued to control the *P. aquilinum* that has been invading moth locations on the peninsular of Ardmeanach and the island of Ulva, and the *Cotoneaster* sp. that smothers some of the slopes at Kilninian, where the moth also occurs. Recorded moth numbers were low in 2015 at Ardmeanach and NTS note that further bracken clearance is needed. No moths were seen at Kilninian in 2015 but *Cotoneaster* clearance is restoring herb-rich vegetation effectively. A change of ownership at Langamull has allowed some grazing to be restored on an overgrown site and it is hoped that this will be beneficial. The paper will use results from 2016 to illustrate these various changes.

Key words: *Zygaena loti scotica*, *Z. viciae ytenensis*, Scotland, conservation, monitoring, biotope management.

Zygaena pheromones, a simple system?

Nils Ryrholm
University of Gävle, 801 76 Gävle, Sweden; Nils.Ryrholm@hig.se

At first glance the pheromone system used by the European species of *Zygaena* appears to be a rather straightforward system. They use carbon chains in different sizes from 10 to 16 carbon atoms in length. In the carbon chain a double bond of the *Z*-type always is included, so far the racemic (mirrored) *E*-type has never been found among any of the *Zygaena* species. On top of that the only added subgroup used by *Zygaena* is an acetate group placed in the end of the chain, despite the fact that other types of subgroups are used by other Lepidoptera species using the same type of compounds.

The first papers published on *Zygaena* pheromones included reference to two or three substances, but our studies reveals that a number of (presumably most) species use much more complex blends. I will give some examples mainly from *Z. filipendulae* and *Z. viciae* which co-occur in many Nordic habitats and at first glance use very similar pheromone blends.

Key words: *Zygaena, Zygaena filipendulae, Zygaena viciae,* pheromones.

Relevance of the collections of the Croatian Natural History Museum for the faunistic study of the Zygaenidae of Croatia.

Martina Šašić
Hrvatski prirodoslovni muzej, Demetrova 1, HR–10000 Zagreb; martina.sasic@hpm.hr

Ana Nahirnić
National Museum of Natural History, Blvd. Tzar Osvoboditel 1, 1000 Sofia, Bulgaria; ananahirnic@nmnhs.com; e3009_2012@stud.bio.bg.ac.rs

Gerhard M. Tarmann
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, Feldstrasse 11a, A–6020 Innsbruck, Austria; g.tarmann@tiroler-landesmuseen.at

The Croatian Natural History Museum was founded in 1846 and from that time on it collects, purchases, cares for and studies natural treasures from Croatia and neighbouring countries. The Lepidoptera collection hosts about 90 000 specimens organized in ten collections. Only a part of this collection has been published so far. The authors have therefore revised this collection together and a publication is in preparation.

The analysed collections of Zygaenidae comprise 24 species (with 552 specimens). The examined species originate from the following six countries: Bosnia and Hercegovina (15 specimens), Croatia 22 (431), Macedonia 2 (3), Montenegro 5 (29), Serbia 2 (3) and Slovenia 8 (71).

Key words: Croatia, Zygaenidae, collection data.

The decline of Zygaenidae in the valleys of the Alps during the last 100 years.

Gerhard M. Tarmann
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, Feldstrasse 11a, A–6020 Innsbruck, Austria; g.tarmann@tiroler-landesmuseen.at

The Alps are the biodiversity centre in Europe. About 6000 different species of Lepidoptera occur there; amongst them, far more than a hundred are endemic. The Zygaenidae are not amongst the most diverse Lepidoptera families in the Alps but 41 species is a large number compared with other areas in the rest of Europe.

Zygaenidae have always fascinated collectors. Therefore, the number of specimens in the museums of the world and in private collections originating from the Alps is breathtaking. However, based on the enormous material we can observe today many interesting changes in the fauna of the Alps that have taken place within the last 100 years and never would have been possible to observe without this important documentation work. Many diverse biotopes have disappeared, landscapes have changed, and agricultural methods are very different from the earlier days. These changes and contamination with chemicals in the soil, in plants and in the air have had substantial influence on the occurrence of zygaenid species and their population densities. Some species have disappeared from their former habitats forever. Only in the higher mountainous areas does the world seem sometimes more or less still 'in order'.

In the Tiroler Landesmuseen, Ferdinandeum, in Innsbruck, intensive documentation work with special emphasis on observing these changes has been undertaken for more than half a century. The observed changes are striking.

This lecture gives an overview on some of the most important changes and the reasons for the decline of zygaenid populations in the Alps in the last 100 years.

Key words: Alps, Zygaenidae, biodiversity decline, environmental changes, contamination with chemicals, extinction of populations.

New data about the vine bud moth *Theresimima ampellophaga* (Bayle-Barelle, 1808) (Zygaenidae, Procridinae) from Bulgaria - investigations by pheromone-baited traps

Teodora B. Toshova
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Tsar Osvoboditel Blvd 1, BG–1000 Sofia, Bulgaria;
teodora_toshova@yahoo.com

Daniela Atanasova & Boyan Stalev
Faculty of Plant Protection and Agroecology, Agricultural University, Blvd. Mendeleev 12, BG–4000 Plovdiv, Bulgaria;
daniat88@abv.bg; stalev26@abv.bg

Ana Nahirnić
National Museum of Natural History, Tsar Osvoboditel Blvd 1, BG–1000 Sofia, Bulgaria
e3009_2012@stud.bio.bg.ac.rs; ananahirnic@nmnhs.com

The vine bud moth, *Theresimima ampellophaga* (Bayle-Barelle, 1808), is among the economically important insect species of grapevine *Vitis vinifera* L. in Bulgaria. Delta sticky traps baited with the synthetic sex pheromone of *Th. ampellophaga* were used for detection and seasonal monitoring of this species in vineyards at three sites in Bulgaria – Lozitsa village (municipality Nikopol) (Northern Bulgaria), village Gornoslav (municipality Asenovgrad) and Plovdiv (Southern Bulgaria) in 2015. Catches of *Th. ampellophaga* males were recorded in the pheromone traps in Lozitsa and Gornoslav and these sites are new localities for this species. In the two sites, only one generation of *Th. ampellophaga* was established in 2015. The flight period of the pest was from the middle of June (Gornoslav) - third decade of June (Lozitsa) to the second decade of July. Monitoring of the seasonal flight of the vine bud moth was organized in Lozitsa and Gornoslav in 2016 as well and the data of two-year monitoring will be presented at the symposium.

Key words: *Theresimima ampellophaga*, pheromone traps, Bulgaria, new localities, seasonal flight.

Contribution to the knowledge of Procridinae (Zygaenidae) of Albania.

Blerina Vrenozi
Tirana University, Faculty of Natural Sciences, Tirana, Albania;
blerinavrenozi@yahoo.com

Eyjolf Aistleitner
Büro OeGDI, Kapfstr. 99B, A–6800 Feldkirch, Austria; *eyjaist@yahoo.de*

Gerhard M. Tarmann
Tiroler Landesmuseen, Ferdinandeum, Naturwissenschaftliche Abteilung, Feldstrasse 11a, A–6020 Innsbruck, Austria; g.tarmann@tiroler-landesmuseen.at

Albania has a huge biodiversity including high mountains with many meadows, which are good spots for the occurrence of moths. There are few studies on this poorly known fauna of Albania, up to now. The project on the zygaenid moths of the Balkans, initiated five years ago, was the first which started to explore different areas of Albania with the intention of having a real understanding of the distribution of these moths in Albania.

The results of our study as part of this project are based on several excursions in the territory of Albania with the aim to collect and observe Zygaenidae.

As a first preliminary result, the Procridinae are presented here. The technique of determination of the specimens was done in two different ways, either by brushing the abdomen or by genitalia dissection. Six species (seven taxa) belonging to the genera *Adscita* and *Jordanita* have been identified: *Adscita* (*Adscita*) *statices statices* (Linnaeus, 1758), *Adscita* (*Adscita*) *statices drenowskii* (Alberti, 1939), *Adscita* (*Adscita*) *geryon orientalis* (Alberti, 1938), *Adscita* (*Tarmannita*) *mannii* (Lederer, 1853), *Jordanita* (*Tremewania*) *notata* (Zeller, 1847), *Jordanita* (*Jordanita*) *globulariae* (Hübner, 1793) and *Jordanita* (*Solaniterna*) *subsolana* (Staudinger, 1862).

Previous studies showed that in northern Albania only *Adscita statices statices* is present, and in central and southern Albania only *Adscita statices drenowskii* is present. These data could be confirmed in our study. Both subspecies show good genitalic differences in the males. However, so far, no hybrids have been found in the territory of Albania although the known hybrid belt of these two taxa is broad and there are hybrid populations known from most of the adjacent countries.

More fieldwork will be done in the following years. Moreover, the large collected material of Zygaeninae has still to be analysed.

Key words: Albania, Procridinae, distribution, faunistics.

'*Zygaena* stories'

Jean-Claude Weiss
2, Place G. Hocquard, F–57000 Metz, France; weissjeanclaude5@aol.com

'Collectors are happy people'. This citation, attributed to the great German poet Johann Wolfgang von Goethe, includes a lot of wisdom about 'us'. We are enthusiastic collectors of Lepidoptera. It is a powerful enthusiasm having its origin in the fact that a collector has always an idea, always a hypothesis and with his inborn hunting sense tries either to fill a gap in his knowledge or is on the search for new 'adventures'. The collector is always in a positive stress situation.

It is only logical that the fanatic search for our insects brings us into many extreme situations, gives us the chance to meet extraordinary people and later gives us the opportunity to tell our 'stories' to those who listen amazed to us as the great 'heroes' of the scenery. The author has lived a life as collector and therefore can tell some of these stories. Life would be much more boring without them.

The author was inspired for his research by personal contact to the leading Zygaenidae-specialists of the twentieth century, particularly to F. Dujardin.

Key words: Collectors, collecting stories, *Zygaena*.

Interplay of cyanogenic glucosides in burnet moths and their food plants (Zygaenidae, Zygaeninae)

Mika Zagrobelny
Plant Biochemistry Laboratory, Department of Plant and Environmental Sciences, University of Copenhagen, Thorvaldsensvej 40, DK–1871 Frederiksberg C, Denmark;
miz@plen.ku.dk

Cyanogenic glucosides are prevalent defense compounds in plants, and also present in some butterfly and moth species, especially in burnet moths. The compounds are toxic due to the release of hydrogen cyanide during enzymatic degradation. Consequently cyanogenic glucosides and their degrading enzymes are kept apart in plants and insects until predation occurs. Six-spotted burnet moths *(Zygaena filipendulae)* are well-known for their high content of cyanogenic glucosides which they may take up from their food plant Birds-foot trefoil (*Lotus corniculatus*) as well as produce themselves from amino acids. *Zygaena* larvae prefer to feed on highly cyanogenic *Lotus* plants over lowly cyanogenic or acyanogenic *Lotus* plants, to optimize the amount of cyanogenic glucosides available for uptake. We have shown that cyanogenic glucosides are taken up intact by *Z. filipendulae* larvae which have evolved several adaptations to avoid degradation of the compounds, namely a high pH in the gut, fast feeding and the use of a leaf-snipping feeding mode. When under attack, *Z. filipendulae* larvae secrete viscous and cyanogenic glucoside-containing droplets. The droplets glue mouthparts, legs and antennae of predators together and immobilize them. Furthermore droplets quickly harden and form sharp crystalline-like precipitates that may act as mandible abrasives to chewing predators. Droplets contain an aqueous solution of proteins and glucose as well as the neurotoxin and detoxification product of hydrogen cyanide, β-cyanoalanine. Despite the presence of cyanogenic glucosides, no specific enzymes able to degrade them are present in the droplets. Accordingly, droplets do not release hydrogen cyanide, unless they are mixed with specific enzymes present in the *Zygaena* haemolymph. In addition to serving as defense compounds, cyanogenic glucosides have been shown to play intimate roles in the mating process of the moth, since it is used for mate attraction and also transferred to the female during mating.

Key words: *Zygaena*, cyanogenic glucosides, viscous cyanogenic glucosides defense compounds, mate attraction.

Colonization of Northern Europe by *Zygaena filipendulae* (Linnaeus, 1758) (Zygaenidae, Zygaeninae)

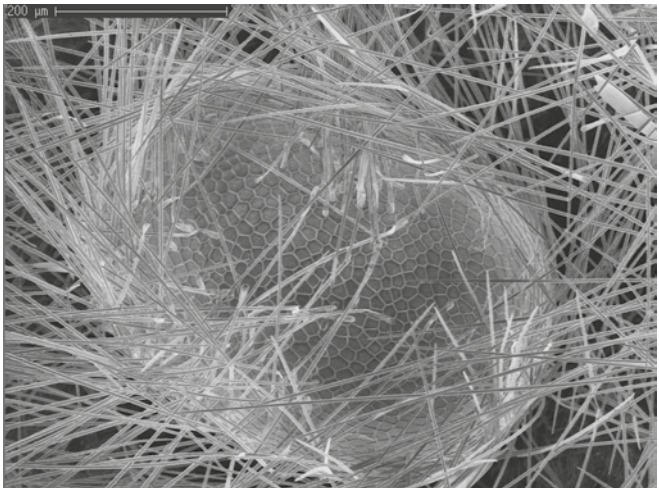
Mika Zagrobelny
Plant Biochemistry Laboratory, Department of Plant and Environmental Sciences, University of Copenhagen, Thorvaldsensvej 40, DK–1871 Frederiksberg C, Denmark;
miz@plen.ku.dk

During the last ice age (110.000-12.000 years ago) temperate species were confined to so-called refugia wherefrom they re-colonized warming northern habitats. In Europe many temperate species have been shown to have inhabited the Iberian, Italian and Balkan peninsulas during the ice age. Consequently, Denmark, the rest of Scandinavia and most of Great Britain were covered in ice until at least 15.000 years ago, resulting in most present day species having arrived in these areas after this time. I have sequenced a gene from specimens of *Z. filipendulae* from different populations across Europe. The resulting phylogenetic tree suggests that there are two major groupings of *Z. filipendulae* populations which could reflect two different refugial populations. Interestingly, it seems that these two types of Z. *filipendulae* are only co-occurring in Denmark, Sweden and Scotland which could indicate that Northern Europe comprises the "hybridization zone" where individuals from the two different refugia met after the last ice age.

Key words: *Zygaena filipendulae*, ice age, refugia, re-colonisation, Denmark, Scandinavia.

The upper Venosta Valley with Mals/Malles in South Tyrol (Italy)
photo by Joachim Winkler

View at the village of Mals/Malles in South Tyrol (Italy)
photo by Joachim Winkler >



978 M
1.738

Marktgemeinde **Mals**
Comune di **Malles Venosta**

NATURMUSEUM SÜDTIROL
MUSEO SCIENZE NATURALI ALTO ADIGE
MUSEUM NATÖRA SÜDTIROL
BIODIVERSITY CENTER

BGO - Bürgergenossenschaft
Obervinschgau

tiroler
landes
museen