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VECTOR ENTOMOLOGY

Moderation: Alexander Mathis

Hauptvortrag / Conference principale

Mauro Tonolla, Eleonora Flacio, Luca Engeler, Begoña Ponzellini, Francesco Pace, Giovanni Licheri, Silvia Antognoli , Nicola Patocchi, Peter Lüthy, Valeria Guidi, Damiana Ravasi, Pie Müller & Tobias Suter (Mosquito working group, Canton Tessin and Laboratory of applied microbiology, University of Applied Sciences and Arts of Southern Switzerland, SUPSI, Bellinzona & Swiss Tropical and Public Health Institute, UNI Basel). Ten years of *Aedes albopictus* surveillance and control in Southern Switzerland.

Over the last 30 years, the Asian tiger mosquito, *Aedes albopictus*, has rapidly spread around the world and is now considered one of the most important invasive species world-wide. It has been introduced to the USA, Europe, Africa, and the Indo-Pacific region mainly through international trade of used tyres and the import of lucky bamboo (*Dracaena sanderiana*). From the original points of entry *Ae. albopictus* has usually been spread passively by road traffic. As an efficient vector of at least 26 arboviruses, including Dengue and Chikungunya viruses, *Ae. albopictus* is considered a major risk to public health in Europe. In Switzerland, *Ae. albopictus* was recorded for the first time in summer 2003, in the Canton of Ticino within a monitoring program started in 2000 by our local Mosquito Working Group (Gruppo Lavoro Zanzare, Canton of Ticino, GLZ). Efforts to control and eliminate *Ae. albopictus* from the Swiss territory were unsuccessful. In 2007 it became firmly established in urban areas bordering Italy and started to expand northwards. At the end of 2013, a total of 61 municipalities were involved in the survey (50 in 2012) covering about 76 % of the total population of the Canton. The monitoring and control program relies on a GIS-based grid system of 250x250 m squares with about 1300 ovitraps controlled with the collaboration of the municipalities. The whole system relies on a tight collaboration and a fluent exchange of information among the different parties: GLZ, municipalities, civil protection agency, cantonal health department, federal offices of environment and health. Prevention, by a capillary information to the citizens and the elimination of the breeding sites, is of primary importance. Moreover, the control measures undertaken with the help of the municipalities and civil protection are mainly against larvae on public ground (catch basins) using diflubenzuron or *Bacillus thuringiensis* var. *israelensis*-based larvicides. Adulticides are applied only exceptionally in case of high nuisance and in sensitive areas (nurseries, kindergarten, schools...). Predictions based on climatic change scenarios indicate that in the near future the area suitable for the Asian tiger mosquito will expand considerably, enabling the mosquito to invade northern regions of the country from Geneva toward Constance. Thanks to the help of the federal office of environment a Swissmonitoring program has been initiated in 2013 allowing to detect eggs of imported *Ae. albopictus* in three highway parking places (Gotthard, UR, Heidiland, SG and Grauholz, BE); this project will continue for the next 3 years. Canton Ticino, whose procedures represent the base of the national strategy has initiated in 2013 discussions related to the risk of transmission for Dengue, Chikungunya and West Nile viruses in collaboration with the federal office of health.

Tobias Suter, Eleonora Flacio, Luca Engeler, Valeria Guidi, Begoña Ponzellini, Seraina Vonzun, Valentin Pflüger, Mauro Tonolla & Pie Müller (Swiss Tropical and Public Health Institute, University of Basel, Gruppo Cantonale di Lavoro Zanzare, University of Applied Sciences and Arts of Southern Switzerland & Mabritec AG). Surveillance and control of *Aedes albopictus* in Switzerland.

The Asian tiger mosquito, *Aedes albopictus* is an invasive species originating from the tropical and subtropical regions of Southeast Asia and has been spread across the globe primarily through the used tyre trade to the USA, Latin America, Africa, Europe and several Pacific and Oceanic islands. *A. albopictus* is a competent vector for over 20 viruses, including chikungunya and dengue and where present may pose a threat to human health. Since 2003, *A. albopictus* is also present in Southern Switzer-

land in the Canton of Ticino and has since then been continuously surveyed and controlled, mainly by larviciding and larval source reduction. The Italian communities just across the border, however, lack such a surveillance and intervention programme. We examined the seasonal and spatial abundance of *A. albopictus* in forested and urban areas across the Swiss-Italian border during the mosquito's active season in 2012 and 2013, and measured the susceptibility of the local mosquito population against larvicides in use. We found that mosquito densities peaked between August and September and that they were significantly higher in Italy and in the urban areas. Laboratory bioassays showed that the local mosquito population is still susceptible to the applied larvicide, *Bacillus thuringiensis* var. *israelensis* (Bti). Further bioassays will be performed for testing other larvicides and adulticides.

Together the results support the hypothesis that the intervention programme in Ticino successfully lowers the local *A. albopictus* population.

Within the frame of the Swiss national tiger mosquito surveillance programme, *A. albopictus* has been found for the first time in the Northern part of Switzerland (highway service areas: Grauholz/Berne, Gotthard Nord/Uri, Heidiland/GR).

Andrea Schönenberger, Holly Tuten, Samuel Furrer & Alexander Mathis (Institute of Parasitology, Zürich & Zoo Zürich). Host preferences of Swiss mosquitoes.

West Nile virus (WNv) circulates locally in Southern and Eastern Europe, and has spread to new areas (e.g. north-eastern Italy) over the last decade. Mosquitoes are the main biological vectors of WNv, which primarily affects birds but can also cause zoonotic neuroinvasive diseases in horses and humans. Within the framework of a larger project (risk assessment of Swiss mosquito populations, funded by the Federal Food Safety and Veterinary Office), host preferences of mosquitoes are being investigated using three approaches: 1) Animal-baited traps (horse, dogs, chicken, mice) at two sites (rural, natural zone) over 12 hours (to collect diurnal, crepuscular and nocturnal mosquitoes). A preliminary experiment has been performed in 2013. 2) Laboratory tests using a Y-shaped wind tunnel (olfactometer), which enables to observe mosquitoes in a closed system choosing between two different olfactory stimuli. This system is established. 3) Analysis of mosquito blood meals from blood-fed mosquitoes collected at the Zoo Zürich (with traps and by hand aspiration from resting sites) from June to October in 2013. All collected mosquitoes were identified either morphologically or by MALDI-TOF mass spectrometry, and blood meals were analyzed with PCR/sequencing. In the year 2013, 158 blood-fed mosquitoes of six different mosquito species (*Aedes geniculatus*, *Ae. japonicus*, *Ae. vexans*, *Anopheles maculipennis*, *Culex pipiens/torrentium*, *Cx. territans*) were collected, mainly by hand aspiration. The majority (69%) of the blood-fed mosquitoes was *Culex pipiens/torrentium*, mostly collected next to the penguin enclosure. The second most common species, *Ae. japonicus*, was mainly collected in September and October on a site close to the nearby forest. Among the 108 blood meals analyzed to date, 14 host species were identified (78 avian and 29 mammalian hosts), including zoo animals (guanaco, elephant, blackbuck, Humboldt's penguin, Darwin's rhea, horse) and indigenous animals (e.g. house sparrow, blackbirds, roe deer, common wall lizard).

Stefanie Wagner, Francis Schaffner, Holly Tuten, Christian Kaufmann & Alexander Mathis, (Institute of Parasitology, Zürich). Vector capacity traits of Swiss mosquitoes for West Nile virus.

With this project, we determined mosquito population densities, host preferences and vector competences for West Nile virus (WNv) to inform a risk assessment for WNv transmission in Switzerland. We estimated species richness and seasonal abundances of mosquitoes in two natural zones adjacent to extended wetlands and two suburban sites, on both sides of the Alpine crest over two consecutive years (2012 – 2013). Mosquitoes (eggs, larvae, pupae and adults) were collected from ovitraps, juvenile breeding sites and CDC traps baited with CO_2 (2012) and additionally with the lure iGu® (2013). Further, we assessed the vector competence of abundant Swiss mosquito populations for WNv under realistic simulated Swiss environmental conditions (early/late and midsummer fluctuating temperature regime). Trapping efficiency in 2013, when the lure iGu® was added to the traps, was much higher for most species (e.g., up to 12 times higher, i.e. for *Coquillettidia richiardii*). The earliest species flying in summer was *Aedes annulipes* (i.e. Mai/June). While adults of *Culex pipiens* were only abundant in midsummer (i.e. July/August), the flying season of *Ae. japonicus* or *Ae. albopictus* was much longer (i.e. July – October). The seven most abundant species, *Ae. vexans*, *Ae. sticticus*, *Cq. richiardii*, *Ae. annulipes*, *Ae. japonicus*, *Cx. pipiens*, *Ae. geniculatus*, plus a laboratory strain of *Cx. quinquefasciatus* (as positive control) were included for preliminary experiments using oral inoculation with different strains of WNv. Various parameters needed to be evaluated for the different species

(e.g. suitable membrane type for blood-feeding, phagostimulants). So far, no WNv RNA could be detected in saliva or body parts of inoculated mosquitoes after incubation on a Swiss August day (24 °C +/- 7 °C) or after incubation of *Cx. quinquefasciatus* at 28 °C for 1-2 weeks. Further experiments will be performed with new viral strains and with higher numbers of blood-feeding mosquitoes.

Jessica Delhaye, Letizia Moroni, Philippe Christe & Olivier Glaizot (Department of ecology and evolution, University of Lausanne & Museum of zoology, Lausanne). Exposure of the mosquito vector *Culex pipiens* to *Plasmodium* parasite and potential cost of resistance.

Parasites may affect a vector's life history traits through direct energy diversion and/or immune system activation. Both are energetically costly for the vector, which has to differentially reallocate its resources to ensure its reproduction and/or survival. Until now, studies have focused on the effect of infections on vectors' life history traits. However, when vectors are exposed to a parasite, resistant individuals also experience immune activation to clear the infection. Consequently, they are expected to pay a cost of immune response if resistance is costly.

We investigated the effect of exposure to a parasite on the vector's life history traits using the natural *Plasmodium relictum – Culex pipiens* association. We allowed female mosquitoes reared in the lab to feed on healthy or *Plasmodium*-infected canaries. We recorded mosquitoes' blood meal size, reproductive effort (measured as time until oviposition and clutch size) and survival. Because we were interested to evaluate the potential costs of resistance, infected females were discarded from our analyses. We found that *Plasmodium*-exposed mosquitoes experienced delayed oviposition compared to females that had fed on uninfected birds. There was also a significant interaction between blood meal size and exposure on fecundity. When ingesting a small blood meal, exposed females produced more eggs than unexposed ones, and the opposite pattern was found for large blood meal size. In contrast, we found no effect of exposure on survival. These results suggest that resistant, uninfected individuals may pay a cost when encountering a pathogen.

Moderation: Olivier Glaizot

Francis Schaffner & Alexander Mathis (Institute of Parasitology, Zürich). Dengue fever in the WHO European Region: past and current situation, future scenarios.

The incidence of dengue has strongly increased in tropical and subtropical countries in the past decades, and the disease has re-emerged in the WHO European Region. This mosquito-borne viral disease is the second most frequent febrile illness accounting for hospitalisation in Europe after return from abroad, and autochthonous cases have recently been reported from Croatia, France, and Madeira. In order to better understand dengue in the European context, a systematic literature review was performed on historical and current occurrences of dengue and its mosquito vectors, as well as on model projections for the future. Dengue outbreaks occurred until the 1930s mainly in the eastern part of the Mediterranean basin. The major vector *Aedes aegypti* was present in southern Europe for decades until the 1950s, then seemingly disappeared, but is currently established in the Portuguese Autonomous Region Madeira and on the north-eastern Black Sea coast. Current climate suitability for *Ae. aegypti* in Geographical Europe is highest in coastal regions of the Mediterranean, the Black and the Caspian Seas as well as along large lowland rivers. There are no predictive models with regard to a potential future distribution of *Ae. aegypti*. The secondary vector *Ae. albopictus* is reported as widely established and spreading in the western Mediterranean basin. Incursions have been reported from northern countries and around the Black sea coast, but no establishment is yet confirmed. Models predict a further spread of the species, particularly under climate change conditions. Currently, no models of dengue virus transmission mediated by *Ae. albopictus* have been developed, and big gaps of information exist with regard to the Caucasus and the Central Asian countries. As long as no dengue-specific prophylaxis or therapeutics is available, integrated vector management is the most sustainable control option. Very few European countries have developed integrated plans on surveillance and control measures for mosquitoes and on disease prevention and management. Rapid elimination of *Ae. aegypti* populations should be aimed for, at least in southern Europe, while *Ae. albopictus*, once established, cannot be eliminated anymore.

Holly Tuten, Philipp Moosmann, Alexander Mathis & Francis Schaffner (Institute of Parasitology, Zürich). Mosquito growth regulator (MGR) transfer among larval habitats via oviposing *Aedes japonicus* females: laboratory assays.

Pyriproxyfen, a juvenile hormone mimic, is a potent insect growth regulator with a long history of use in mosquito control. We performed three assays to determine the efficacy of pyriproxyfen against a previously unexamined invasive mosquito in Switzerland, *Aedes japonicus*. We asked: 1) At what concentrations does pyriproxyfen have an effect on emergence of adults? 2) Can it affect larvae after only a brief exposure, and can it persist in water? 3) Can females deliver it under seminatural conditions to larval habitats at high enough concentrations to affect development? For the bioassay in our first question, we saw that pyriproxyfen caused adult emergence inhibition (EI) at all concentrations tested: 0.01 ppb (74 % EI), 0.50 (83 % EI), 2.50 (86 % EI), and 5.00 (92 % EI). For our second question, pyriproxyfen caused adult emergence inhibition both when larvae were removed (upon appearance of first pupae in treatment cohorts) from treated water (5 ppb pyriproxyfen) to clean water (e.g., 92/100 larvae emerged as adults in control, 11/100 emerged in treatment), and when reared in water treated (5 ppb pyriproxyfen) 10 days previously (71/100 larvae emerged as adults in control, 12/100 emerged in treatment). For our third question, we saw that females forced to walk through a paper tube liberally dusted with pyriproxyfen (thus acquiring it on their bodies) could deliver a high enough dose to cause adult emergence inhibition from cups with larvae (20 larvae per cup, 5 cups per treatment or control, in an enclosed tent) (17.1 ± 1.1 SE adults emerged per cup in control vs. 12.7 ± 1.1 SE in treatment, $p < 0.01$ Wilcoxon rank test); the data indicate a lower dose might cause an increase in duration of pupal stadium rather than pupal mortality. In summary, pyriproxyfen causes emergence inhibition of adult *Ae. japonicus*, even at scant quantities, and after brief exposure or being present in water for 10 days. Additionally, flying adult female mosquitoes can deliver pyriproxyfen to habitats with larvae in sufficient quantities to inhibit adult emergence. In all cases, inhibition of adult emergence was due to mortality either in the pupal stadium or at eclosion.

Jonas Durand & Maarten Voordouw (Institute of Biology, University of Neuchâtel). Evolution of the diversity of *Borrelia burgorferi* sensu lato, agent of Lyme disease: survey of a tick population during 11 years.

Borrelia burgdorferi sensu lato is a complex of tick-borne spirochete bacteria that cause Lyme disease in humans. *Borrelia* strains are often classified using a highly polymorphic gene that codes for outer surface protein C (OspC). The OspC protein is critical for infection and induces a strong antibody response in the vertebrate host. Previous genetic studies on the ospC gene found a pattern of negative frequency-dependent selection. One explanation is that the host immune system targets common ospC groups, thereby reducing their frequency over time.

We examined the diversity of ospC groups in a local population of *Ixodes ricinus* ticks over 11 years (2000-2010). We compared the ospC communities between *B. afzelii* and *B. garinii*, the two main *Borrelia* species in Europe. We used PCR and RLB to identify nymphs infected with *B. garinii* (n=193) or *B. afzelii* (n=196). We used 454-sequencing to determine the ospC community in each tick.

The two *Borrelia* species had different community compositions. The community of ospC groups was very even in *B. garinii* whereas one particular ospC group dominated the community in *B. afzelii*. Thus in *B. afzelii*, we found no evidence that being common for a period of 11 years decreased the fitness of the dominant ospC strain.

Coralie Herrmann, Lise Gern, & Maarten J. Voordouw (Institute of Biology, University of Neuchâtel). Species co-occurrence patterns among Lyme borreliosis pathogens in the tick vector *Ixodes ricinus*.

Multiple infections structure the ecology and evolution of host-pathogen interactions. In vector-borne diseases, multiple infections occur in both the arthropod vector and the vertebrate host. *Borrelia burgdorferi* sensu lato is a species complex of tick-borne spirochete bacteria that cause Lyme borreliosis in humans. In Europe there is a high diversity of *Borrelia* species that are adapted to either rodent or avian hosts. The main tick vector, *Ixodes ricinus*, is often infected with multiple *Borrelia* pathogens. In the current study, we examined the pairwise interactions between five species of *B. burgdorferi* s.l. in a large data set of *I. ricinus* ticks collected from one field site in Neuchâtel, Switzerland. We quantified two types of pairwise interactions: (1) positive or negative co-occurrence is whether double infections were more or less common than the random expectation, and (2) facilitation or inhibition

with respect to spirochete load is whether the joint spirochete load in double infections was greater or less than the sum of the loads from the single infections. Mixed infections of species adapted to the same class of vertebrate reservoir hosts showed positive co-occurrence and had joint spirochete loads consistent with facilitation or neutral interactions. By contrast, mixed infections of *Borrelia* species adapted to different classes of vertebrate reservoir hosts showed negative co-occurrence and had joint spirochete loads consistent with inhibition. The observed community patterns confirm our understanding of how the innate immune system of vertebrate reservoir hosts interacts with *Borrelia* pathogens inside the tick vector.

Moderation: Francis Schaffner

Maxime Jacquet & Maarten Voordouw (Institute of Biology, University of Neuchâtel). Effects of acquired immunity on systemic and cofeeding transmissions of the Lyme disease agent, *Borrelia afzelii*.

Tick-borne pathogens have multiple modes of transmission including systemic and cofeeding transmission. Cofeeding transmission can occur when infected and uninfected ticks exchange pathogens by feeding at the same time on the same host. We wanted to test whether *Borrelia afzelii*, a spirochete bacterium responsible for Lyme disease in Europe, can use cofeeding transmission to escape the host acquired immune response, as has been shown for other tick-borne pathogens.

To induce a strong antibody response against *B. afzelii*, mice were immunized with recombinant outer surface protein C (rOspC). The OspC protein is highly polymorphic and to test the specificity of the IgG against this antigen, we immunized mice with two *B. afzelii*-derived rOspC antigens: A3 and YU. Immunized mice were subsequently challenged with *Ixodes ricinus* ticks infected with either *B. afzelii* ospC strains A3 or YU. To measure cofeeding and systemic transmission, pathogen-free *I. ricinus* larvae were fed on mice during the challenge infestation. Larvae were allowed to molt and the resultant nymphs were tested for *B. afzelii* infection using qPCR.

Acquired immunity against the rOspC antigens blocked both cofeeding and systemic transmission of *B. afzelii*. In the control mice, the proportion of larvae infected via co-feeding (52.8 %) was 15 times higher than the larvae fed on the immunized mice (3.6 %). Protection of the anti-OspC IgG was highly specific; mice were only protected if the rOspC antigen matched the *B. afzelii* ospC strain. This is the first demonstration that the acquired immune system blocks cofeeding transmission in a Lyme disease pathogen.

ANGEWANDTE ENTOMOLOGIE

Isabelle Fleury, Dominique Fleury & François Lefort (University of Applied Sciences: hepia (GE) & Changins (VD)). Assessment of the biocontrol potential of entomopathogenic fungi on *Lygus rugulipennis* and *Myzus persiae*.

Aphids (*M. persicae*) and true bugs (*L. rugulipennis*) are some of the most important pest insects of several crops. They can decrease growth and reduce yield as well as transmit plant viruses. In order to reduce economic losses, producers must control those pests with pesticides application to decrease the damages. The use of insecticides unfortunately reduces the effect of beneficial insects in agro-ecosystems and Integrated Pest Management (IPM). The use of selective Biological Control Agents (BCAs) should therefore be incorporated in IPM strategies.

In order to provide producers with a biological control tool against aphids, the pathogenicity of 14 strains of entomopathogenic fungi was evaluated on *M. persicae* and *L. rugulipennis*. Strains of *Beauveria bassiana*, *Paecilomyces* spp., *Metarhizium anisopliae* and *Lecanicillium lecanii* were tested under laboratory conditions. Disks of Chinese cabbage (for *M. persicae*) or common bean pods (for *L. rugulipennis*) were inoculated with 10^7 conidia / ml in suspension. After inoculation, *M. persicae* or *L. rugulipennis* were added inside a Petri dish. The laboratory conditions were the following: photoperiod (16 light: 8 dark), 70 ± 2 % RH and temperature 23 ± 2 °C. The mortality of *M. persicae* and *L. rugulipennis* were recorded at 3, 5 and 7 days after the treatment.

Seven days after treatment, fungal hyphae were observed on dead bodies. Out of the 14 strains, two strains of *B. bassiana* were highly virulent to both pests with mortality rates reaching 91.7 to 98 %. These promising results should be confirmed in open field experiments by exposing *M. persicae* to these two strains of *B. bassiana* in combination.

Dominique Fleury, Isabelle Fleury & Marc Kenis (University of Applied Sciences: Changins (VD) & Centre for Agriculture and Biosciences International, Delémont (JU)). Evaluating the population dynamic of multicolored Asian lady beetle in Swiss vineyards.

The multicolored Asian lady beetle (*Harmonia axyridis*) is very efficient against aphids and easy to rear in the laboratory. So, *H. axyridis* were used and released to control aphid damages on several crops in organic farming. In Europe, a few years after these releases, several studies showed that *H. axyridis* is the species most represented in agricultural and urban areas. Indigenous lady beetles (i.e.: *Adalia bipunctata*) are seriously declining and *H. axyridis* populations explode literally.

On the economic side, *H. axyridis* causes problems to winegrowers. Since 2000, in Canada and the USA, H. axyridis is a great concern in the wine industry. In late season, before the harvest, *H. axyridis* move onto the grape berries to feed on. With mechanic harvesting, *H. axyridis* could be squeezed and, when stressed, it releases a liquid with volatile compounds (alkylmethoxypyrazines) which give a bad taste to the wine at low concentration.

The aim of this study was to follow the population dynamics of *H. axyridis* in relation to the phenological stages of grapevine. The principal objective was to evaluate the risk of invasion by *H. axyridis* and the contamination of wine in Integrated Pest Management (IPM) and organic vineyards.

In 2012, in La Côte vineyards, the number of *H. axyridis* was too low to cause problems during harvesting. In Switzerland, our agricultural politics allow the cultivation of small fields with several diversified agro-ecosystems. In these kinds of landscapes, *H. axyridis* is able to feed on aphids all year round without invading vineyards and tainting the wine.

SAMSTAG, 8. MARZ 2014

MODUL COLEOPTERA

Moderation: Jean-Luc Gattolliat

Hauptvortrag 1 Conference principale

Eva Sprecher-Uebersax (Naturhistorisches Museum Basel). Diversität der Chrysomelidae (Coleoptera) in Nepal – Faunistische und taxonomische Aspekte

In den letzten Jahrzehnten führten zahlreiche entomologische Reisen nach Nepal, dementsprechend hoch ist die Zahl neu beschriebener Arten von Chrysomelidae aus Nepal und dem Himalaja.

Nepal ist ein Land mit extremen Höhenunterschieden auf kurzer Distanz. Die Vielfalt der Biotope reicht von tropischen Savannen über subtropische und gemässigte Laub- und Nadelwälder und montanen Gras- und Buschlandschaften bis zu Fels und Eis an den höchsten Lagen. Der Gandaki River teilt das Land in eine Ost- und eine Westzone. Die Region im Osten ist niederschlags- und artenreicher als diejenige im Westen. Der Himalaja ist tief zertalt, da Flüsse zu tiefen Durchbruchsschluchten führten. An dessen Südabdachung herrscht Monsunklima. Die landschaftliche Vielfalt und die tiefe Zertalung begünstigen Artenvielfalt und Endemismus.

Ein erster Katalog der Chrysomelidae in Nepal (Medvedev & Sprecher, 1999) umfasst 797 Arten und 230 Gattungen. Die Artenzahl stieg aber weiter auf über 1000. Darunter befinden sich Arten, die neu sind für Nepal, z.B. *Basilepta beccarii*, bekannt aus Thailand, Laos und Vietnam oder *Letzuella viridis*, bekannt aus Yunnan (China). Neu für die Wissenschaft sind z.B. *Colaspoides nepalensis* Kimoto 2001 (Godawari, 1600 m) oder *Nodina obliquocostata* Medvedev 2011 (Gandaki-Kholabenesi, 1650 m). Eine Neuauflage des Katalogs (Sprecher-Uebersax, 2011) enthält 1037 Arten. Das entspricht einer Zunahme der Artenzahl von 23 % seit 1999. Eine Revision der himalajischen *Phaedon*-Arten (Daccordi & Sprecher, 2012) brachte 3 weitere neue Arten, die alle nur von Nepal bekannt sind und auf über 2600 m Höhe leben.

Mit 335 Arten nehmen die Alticinae 33 % der Chrysomelidae in Nepal ein. Mehrere endemische Gattungen und zahlreiche Gebirgsarten zählen zu ihnen, z.B. *Lipraria* oder *Chabriella* und *Neocrepidodera schenklingi* oder *Lipromorpha aptera*. Die Galerucinae sind in Nepal mit 274 Arten (27 %) vertreten. Ihre grösste Verbreitung findet sich zwischen 1000 und 3000 m. Auf über 4000 m leben endemische Arten unter Steinen und fressen Moose, z.B. die 5 Arten von *Nepalogaleruca*. Die andern Unterfamilien kommen in deutlich geringeren Artenzahlen vor, die Eumolpinae mit 94, die Chrysomelinae mit 50, die Cryptocephalinae mit 70 oder die Clytrinae mit 42 nepalesischen Arten. Die Cassidinae mit 35 und die Hispinae (auch als Tribus Hispini den Cassidinae zugeordnet) mit 62 nepalesischen Arten sind vorwiegend orientalisch und teils tropisch.

Fast ein Drittel aller Arten ist endemisch oder bisher nur aus Nepal bekannt (314 Arten), z.B. *Smaragdina fulvitarsis*, *Basilepta laeta*, *Monolepta martensi* oder *Trachytetra aptera*. 318 Arten kommen auch in der orientalischen Region vor, 230 in China und 564 in Indien. Etwa 20 Arten sind in weiten Teilen Asiens und 4 sogar in Europa weit verbreitet, z.B. *Aulacophora foveicollis* oder *Longitarsus weisei*. In der ganzen Paläarktis weit verbreitet sind z.B. *Chrysomela populi* und *Longitarsus succineus*.

Zu den Arten mit einem breiten Höhenspektrum zählen z.B. *Lilioceris impressa* und *Cryptocephalus exsulans*. Typische Vertreter der kollinen Stufe (bis 1000 m) sind z.B. *Aspidolopha lesagei* und *Agonita maculigera*. Viele Arten leben im Kronenbereich der Bäume und nur wenige in der spärlichen Bodenvegetation. Auf der unteren montanen Stufe (1000 – 2000 m) kommen verschiedene Schädlinge vor, darunter *Basilepta subcostata* an Bananen, *Aulacophora indica* an Kürbisgewächsen und *Monolepta signata* an Zuckerrohr, Reis, Mais und Getreide. An verschiedenen Kräutern wie Wermut leben verbreitete Arten wie *Platycorynus undatus*, *Chrysolina vishnu* oder *Paridea octomaculata*. Auf der oberen montanen Stufe (2000 - 4000 m), wo die Nebelwaldstufe beginnt, finden sich z. B. *Ambrostoma mahesa*, *Cryptocephalus subnepalensis* und *Arthrotidea nepalensis*. Unbewaldete Gebiete sind oft sehr stark beweidet und folglich artenarm. Auf über 3000 m nimmt die Artenzahl rapide ab und beträgt noch gerade 160. Galerucinae und Alticinae dominieren, sie leben an Kräutern, an spärlicher Vegetation und unter Steinen. Es ist der Lebensraum der apteren und oft endemischen Arten z.B. *Paraminota lamprosomoides* an Wegrändern, *Ivalia minima* auf und unter Steinen oder *Neocrepidodera schenklingi* in Laubstreu. Auf der alpinen Stufe (bis 5500 m) herrschen Graslandschaft und Polsterpflanzen-Gemeinschaften vor. Weniger als 30 Arten sind bis jetzt auf über 4000 m gefunden worden, unter ihnen *Paraminotella nepalensis* und *Sclerophaedon brendelli*.

Moderation: Christoph Germann

Werner Marggi (Naturhistorisches Museum der Burgergemeinde Bern). «Aktenzeichen xy ungelöst» bei drei Laufkäfergruppen (Carabidae, Bembidiina).

Die Subtribus Bembidiina umfasst in der Schweiz die Gattungen *Asaphidion*, *Bembidion*, *Ocys* und *Sinechostictus*. Diese Gruppe ist – zusammen mit den Tachyina – durch die Bildung des letzten Kiefertastergliedes in Form eines kleinen Stiftes gekennzeichnet. Bembidiina sind zwischen 2,5 und 7 mm lang und leben hauptsächlich an Ufern von Bächen und Flüssen und in Feuchtgebieten. Im Folgenden werden drei ungelöste Fälle vorgestellt, ein Fall mit zoogegraphischer Fragestellung, zwei weitere rein taxonomischer Art.

Zuerst wird der Frage nachgegangen, ob *Bembidion* (*Peryphanes*) *brunnicorne* Dejean, 1831, überhaupt in der Schweiz vorkommt. Als das sehr ähnliche *Bembidion* (*Peryphanes*) *italicum* De Monte, 1943 im Jahre 2001 für die Schweiz erstmals gemeldet wurde, ging man davon aus, dass letztere Art nur im Kanton Tessin vorkommt. Drei verschiedene Nachweise von *B. italicum* nördlich der Alpen werfen nun die Frage auf, ob allenfalls *B. brunnicorne* aus dem Inventar der Schweiz gestrichen werden muss, sollten sich auch die andern *B. brunnicorne*-Funde nördlich der Alpen als *B. italicum* erweisen.

Im Jahre 2004 wurde *Bembidion* (*Bembidionetolitzkya*) *pseudascendens* Manderbach & Müller-Motzfeld beschrieben. Die Art steht taxonomisch zwischen *B. fasciolatum* und *B. ascendens* und unterscheidet sich durch eine etwas andere Halsschildform und durch die abweichende Ausbildung des Aedoeagus von den als Vergleich beigezogenen Arten. Der Holotypus der neuen Art stammt von der Oberen Isar in Bayern, Deutschland. Die neue Art besiedelt aber einen weit grösseren geographischen Raum und wurde auch in der Schweiz und in Italien nachgewiesen. Italienische Koleopterologen sind in einer Publikation von 2005 zur Ansicht gelangt, *B. pseudascendens* sei bloss ein Synonym von *B.* (*Bembidionetolitzkya*) *concoeruleum* Netolitzky, 1943. Bloss eine DNA-Analyse der beiden Arten könnte Klarheit schaffen.

Die beiden *Bembidion*-Arten der Untergattung *Peryphus* – *B. bualei* Jacquelin du Val, 1852 und *B. baenningeri* Netolitzky, 1926 – haben eine umfangreiche taxonomische Vergangenheit, beide waren früher bloss Unterarten von zuerst *B. andreae* (Fabricius, 1787) und dann von *B. cruciatum* Dejean, 1831. Da sich sowohl *B. andreae* wie auch *B. cruciatum* als eigenständige Arten erwiesen, wurde *B. bualei* Artstatus zuerkannt. Beim Namen *baenningeri* sind bearbeitende Autoren unterschiedlicher Meinung. Die einen sehen *B. baenningeri* als selbständige Art, andere stufen diesen Namen als Synonym von *B. bualei* ein. Im Habitus sind die beiden Taxa signifikant verschieden. Während *B. bualei* eine kontrastreiche Flügeldeckenzeichnung aufweist ist dieses Merkmal bei *B. baenningeri* durch eine diffuse Färbung gekennzeichnet. Ausgeprägtere Schultern bei *B. bualei* deuten auf Flugfähigkeit hin, während abgerundete Schultern bei *B. baenningeri* letztere wohl einschränken. Der Frage nach dem Status einer Unterart ist in neuerer Zeit niemand mehr nachgegangen. Immerhin

könnte von geographischen Isolaten bedingt durch eine Lebensweise in verschiedenen Höhenstufen gesprochen werden. Auch in diesem ungelösten Fall könnte eine DNA-Analyse womöglich Klarheit schaffen.

Alexander Szallies (Zürcher Hochschule für Angewandte Wissenschaften, Wädenswil). Neue Erkenntnisse zu alpinen Käfern ... und Holzkäfern.

Die alpine Käferfauna wurde in den Jahren 2010-2013 vor allem nördlich der Rhein-Rhone-Furche untersucht, über 100 Zielgebiete, typischerweise über 2000 m NN, konnten bisher untersucht werden. Die Schweizer Endemitenfauna ist relativ arm an Arten, die ausschließlich auf dem Gebiet der Schweiz auftreten. In der Nord- und Südschweiz treten jeweils um ein halbes Dutzend rein endemischer Arten auf (neben einer größeren Menge endemischer subspezifischer Taxa).

Thectusa besucheti (Focarile) ist vermutlich keine rein endemische Art und in den Südalpen weit verbreitet. Neue vermutlich endemische Arten der Gattungen *Leptusa* und *Oreonebria* konnten gefunden werden, deren Beschreibung ansteht. Auch aus den Bergamasker Alpen Italiens wird ein neues Taxon von *Oreonebria* beschrieben. *Nebria heeri* Dan. konnte als eigenständige Art neben *Nebria cordicollis* Chaud. gesetzt werden (sympatrisches Auftreten in der Ostschweiz) und es wurde von mutmaßlichen Vorkommen von *Nebria cordicollis gracilis* Dan. im Berner Oberland berichtet. Zuletzt wurde noch auf die verschiedenen Formen der *Timarcha goettingensis* (L.) hingewiesen, die in der Nordschweiz und dann in den Alpen und im Jura auftreten, deren taxonomischer Status noch unklar ist.

Am Lopper (NW) konnten zahlreiche bemerkenswerte Holzkäfer gefunden werden, von denen ein kleines Portrait gegeben wurde: *Prostomis mandibularis* (F.), *Echinomorphus ravouxi* (Jaq.), *Pediacus dermestoides* (F.), *Euryusa pipitzi* (Epph.) und *Leptoplectus spinolae* (Aubé).

Laura Farina (Casatenovo, Italia). Chrysomelidae (Coleoptera) of the Natural Regional Park of Montevecchia and Curone Valley (Province of Lecco, Lombardy, ITALY).

This report is the result of a research, still in progress, about the Chrysomelidae fauna of the Natural Regional Park of Montevecchia and Curone valley. The Park was established in 1983, it covers an area of about 2741 hectares and is situated at the southern end of the Lecco province. So far 83 species of Chrysomelidae have been recorded, two of which are new for the Lombardy fauna: *Aphthona sicelidis* and *Dibolia femoralis*, found on dry grassland habitat.

Morphologically, Curone Park's *A. sicelidis* has an unusual colour pattern when compared to conspecific Sicilian specimens. Specimens from the Park are green, while Sicilian ones are more bluish. However, more data are needed to ascertain whether these differences are consistent. The closest relative, *A. venustula*, has a darker colour and a less marked elytral punctation.

ALLGEMEINE ENTOMOLOGIE

Moderation: Matthias Borer

Marc Neumann (Walterswil). Indirect effects between aphid parasitoids and the influence of a shared secondary parasitoid.

The importance of indirect effects like apparent competition in shaping certain natural communities has long been recognized. However, the exact mechanisms behind these processes, like asymmetry in effects among prey species, are still not fully understood. In systems with hymenopteran parasitoids a potential influence could be differential sex allocation by females. I performed a laboratory experiment including the secondary parasitoid *Dendrocerus carpenteri* and its hosts *Lysiphlebus fabarum* and *Aphidius megourae* and compared their numbers in treatments with and without potential apparent competition. I could not find any evidence for apparent competition or biased sex ratios of the secondary parasitoid which was presumably caused by a flawed experimental design. Future studies need to ascertain similar densities of hosts and reduce potential intraspecific competition among hosts.

Henryk Luka (FiBL, Frick & NLU-Biogeographie, Universität Basel). Echt «kein Kabis» – Biodiversität fördern und nutzen – Mit Stacheln und Kiefern gegen Kohlschädlinge.

Kohl wird von einer Reihe von Herbivoren befallen, wozu auch Lepidopterenarten gehören. Diese Schädlinge haben in naturnahen Lebensräumen eine breite Palette von Gegenspielern, zum Beispiel räuberische Käfer, Spinnen oder parasitoide Wespen (Pfiffner *et al.* 2005).

Durch gezielte Nützlingsförderung ist es möglich, die Leistungen der räuberisch und parasitisch lebenden Nützlinge zu erhöhen, indem deren Lebensgrundlagen verbessert werden. Zum Beispiel: Als Nahrung dient den adulten Parasitoiden der florale und extraflorale Nektar von Pflanzen. Durch die Anlage von gezielt zusammengestellten Blumenstreifen am Feldrand oder von Beipflanzen (einzelne Pflanzen), direkt im Feld, werden die natürlich vorkommenden Nützlinge gefördert (Géneau *et al*. 2012; Belz 2013).

In mehreren Feldversuchen wurde der Einfluss von Nützlingsblühstreifen am Feldrand und von Beipflanzen direkt im Kohlfeld auf die Parasitierung und Prädation der Schadlepidopteren (Eier und Larven), insbesondere der Kohleule (*Mamestra brassicae*), sowie die Auswirkungen auf die Artenvielfalt der Laufkäfer und Spinnen, untersucht.

Die Beipflanzen wirkten sich signifikant positiv auf Prädation der Kohleule-Eier aus. Die Parasitierung der Kohleule-Larven war in Bereichen mit Beipflanzen signifikant höher als ohne Beipflanzen. Die molekularen Darminhaltsanalysen von Lauf- und Kurzflügelkäfern sowie Spinnen ergaben Beutenachweise von drei Schad-Lepidopterenarten. Die Anlage von Nützlingsstreifen und Beipflanzen verursachte eine Erhöhung der Larvenparastierung der Kohleule und folglich eine teilweise Verbesserung der Ernte (Balmer *et al*. 2013; Luka *et al*. 2009)..

Die Resultate zeigen, dass die Anlage von Nützlingsblühstreifen und Beipflanzen zu einer signifikanten Erhöhung der Artendiversität der Laufkäfer und Spinnen beitragen kann. Sie bieten Lebensraum für viele anspruchsvolle und seltene Laufkäfer- und Spinnen-Arten (Ditner *et al*. 2013).

Daniel Burckhardt & Dalva L. Queiroz (Naturhistorisches Museum Basel & Embrapa, Colombo, PR, Brasilien). Australische Eukalyptus-Blattflöhe in Europa.

Zu *Eucalyptus* s. l. (Myrtaceae) werden 600–800 Arten gezählt, deren natürliches Vorkommen auf Australien, Neuguinea, Sulawesi, Mindanao und angrenzende Inseln beschränkt ist. Heute werden weltweit etwa 50 Arten grossflächig angepflanzt, die zur Herstellung von Papier, als Brennholz oder als Zier- und Schnittpflanzen verwendet werden. In Australien besitzen die Eukalypten eine reiche Insektenfauna, zu denen auch die Blattflöhe (Hemiptera, Psylloidea) gehören, von denen viele sehr wirtsspezifisch sind. Von den etwa 350 australischen Blattfloh-Arten entwickeln sich 79 % auf Myrtaceae (71 % auf *Eucalypus*), die grösstenteils zur den Spondyliaspidinae (Aphalaridae) gehören, welche ähnlich wie Eukalyptus fast ausschliesslich in Australien vorkommen. Bei einigen Spondyliaspidinae entwickeln sich die Jungendstadien auf den jungen Pflanzentrieben, bei anderen bilden diese auf den Blättern zuckerhaltige Deckel (Lerps), unter denen sie sich entwickeln, während eine dritte Gruppe die verlassenen Lerps anderer Arten bewohnt. Einige Arten von australischen Spondyliaspidinae wurden auch in andere Kontinente eingeschleppt, wo sie teilweise für grosse Schäden in Pflanzungen verantwortlich sind.

Aus Europa ist *Ctenarytaina eucalypti* seit fast 100 Jahren bekannt. Sie kommt heute in West-, Süd- und Mitteleuropa vor. Weitere drei Arten (*Blastopsylla occidentalis*, *Ctenarytaina spatulata* und *Glycaspis brimblecombei*) wurden in den letzten 12 Jahren in Südeuropa eingeschleppt, wo sich auch die grössten Eukalyptus-Pflanzungen befinden. *Ctenarytaina peregrina* wurde 2006 in Irland entdeckt, später aber auch in Grossbritannien, Deutschland, Frankreich und Portugal gefunden. Die Art stammt wahrscheinlich auch aus Australien, sie ist bis jetzt aber nur aus Europa bekannt. Ähnliches trifft auch für *Platyobria biemani* zu, die bis jetzt nur von der Insel Lesbos in Griechenland bekannt ist. Es ist dies das erste Mal, dass *Platyobria* ausserhalb von Australien festgestellt wird. Weitere Untersuchungen sollten durchgeführt werden, um die aktuelle Verbreitung der Art in Griechenland zu dokumentieren und eventuelle Massnahmen zur Vernichtung dieser Populationen einzuleiten.

Edia Oi Edia (University Nangui Abrogoua, Abidjan, Côte d'Ivoire & Laboratoire d'Ecologie et de Biologie Aquatique, Université de Genève). Distribution of aquatic insects among four costal river habitats (Côte d'Ivoire, West-Africa).

We analysed aquatic insect distribution among four coastal river habitats of southeast Côte d'Ivoire. In each river, two sites were sampled: one upstream and one downstream. In the eight sites, aquatic insects were randomly sampled eight times (i.e. four during the rainy season and four during the dry season) between July 2003 and March 2005. The basic criteria for classifying sampling sites by both the Principal Component Analysis and the hierarchical cluster analysis are mainly the nature of the waterbed substrate and the mineralization of the water. Overall, 115 taxa belonging to 51 families and ten orders were recorded. The richest taxon diversity was observed for Diptera and Ephemeroptera. The Indval method revealed that the most mineralized sites were characterised mostly by dipterans. However, the indicator taxa of weakly mineralized sites are mainly ephemeropterans. Taxa such as *Laccophilus* sp., *Ablabesmyia* sp., *Ceratopogon* sp., *Cryptochironomus* sp., *Labiobaetis gambiae*, *Pro-*

cloeon sylvicola and *Nanocladius* sp. were generalist in respect to the substrate nature. *Riolus* sp., *Perla* sp., *Choroterpes* sp., *Cloeon* sp. and *Ephoron* sp. were specialists of sandy substrate. *Compsoneuria njalensis* was characteristic in habitats whose bottom is muddy.