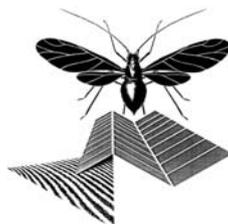


30e
Nederlandse
Entomologendag

14 december 2018
De Reehorst
Ede

P r o g r a m m a
A b s t r a c t s



Sectie Entomologendag (v/h SETE)
van de Nederlandse Entomologische Vereniging

ALGEMENE INFORMATIE

GENERAL INFORMATION

Locatie

De 30e Entomologendag wordt gehouden in congrescentrum De Reehorst, Bennekomseweg 24, 6717 LM Ede. De Reehorst is zeer goed met openbaar vervoer te bereiken. Het ligt op 3 min. loopafstand van het treinstation Ede-Wageningen. Automobilisten kunnen in Ede de routeborden 'De Reehorst' volgen. De Reehorst ligt ten zuiden van het station, aan het begin van de Bennekomseweg. Er is ruime parkeergelegenheid.

The 30th Entomologendag will be held in De Reehorst, Bennekomseweg 24, 6717 LM Ede. De Reehorst is most easily reached by public transport: it is located about 3 min. walking from train station Ede-Wageningen. By car: after reaching Ede, follow the signs 'De Reehorst'. De Reehorst is situated just south of the train station, at the beginning of the Bennekomseweg.

Inschrijf- en informatiebalie / Registration and Information desk

De balie in de Beethovenfoyer is open vanaf 08:30 uur. Hier kunt u terecht voor inschrijven, algemene informatie en het ophalen van uw naambadge. Als u zich wel aangemeld hebt, maar nog niet hebt betaald, dan kunt u dat ook aan de balie doen.

The desk will be open at 08:30 hrs. Here you can register, get information throughout the day, and obtain your badge. If you registered before but have not as yet paid, you can also do this at the desk.

Dagindeling / Timetable

- 08:30 Aanmelden/inschrijven bij de balie en ontvangst met koffie of thee. Posters ophangen. Voorbereiden presentatie. / *Registration, welcome with coffee or tea, mounting of posters. Prepare for presentation.*
- 10:00 Opening en plenaire lezing door Bart Pannebakker (Wageningen UR) / *Plenary lecture*
- 11:00 Koffie, thee, postersessie / *Coffee, tea, posters*
- 11:30 Start parallelle sessies
- 12:30 Lunch
- 13:40 Vervolg parallelle sessies
- 15:00 Koffie, thee, postersessie / *Coffee, tea, posters*
- 15:30 Vervolg parallelle sessies
- 16:15 NEV Dissertatieprijs en lezing / *NEV Dissertation award and lecture*
- 16:45 Borrel, postersessie / *Refreshments, posters*

Organisatie / Organization

NEV, Sectie Entomologendag (v/h SETE / *Netherlands Entomological Society, Section Entomologendag.*

Programmaboekje / *Abstracts:*

Jan Bruin (janbruin@bred.nl)

Gaarne uw badge inleveren bij vertrek

Please, return your badge before leaving

**Next-generation biocontrol:
using genetics to optimize
natural enemy deployment**

BART A. PANNEBAKKER

*Laboratory of Genetics, Wageningen University & Research,
Wageningen, The Netherlands, bart.pannebakker@wur.nl*

Secure and sustainable food production in terms of quantity and quality is a major challenge facing human societies. However, food security is continuously threatened by current and invasive pest species. In addition, regulations for the use of pesticides are getting stricter to ensure food safety and protect ecosystem health. Biocontrol of agricultural pests by using natural enemies has great potential to deal with these two demands. Biocontrol of novel exotic pests, however, often involves importing non-native natural enemies. Such practices are being restricted due to the Nagoya Access and Benefit Sharing regulations. The dependence on imported natural enemies can be reduced by optimizing existing and native biocontrol agents. A powerful way of optimizing biocontrol agents is the use of genetic knowledge. In this talk, I will outline the use of genetic tools and knowledge to improve the efficiency of biocontrol, and highlight the need for integrative (research) efforts to further consolidate the role of biocontrol in the future food production.

THEATRE AZURE**BACH (1+2)**

11:30

**1.1 Role of genomes in advancing
biocontrol research**KIM B. FERGUSON & BART A. PANNEBAKKER
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While initially confined to the realm of model species, genome sequencing, assembly, and annotation is becoming more accessible and feasible for de novo projects. There are several uses for the genomes of biocontrol agents, including for the purpose of improvement or risk assessment. Featuring work on biocontrol superstars *Trichogramma brassicae*, *Nesidiocoris tenuis*, and *Amblyseius swirskii*.

**2.1 Mosquito behavioral responses to bird
odor stimuli**ALAZNE DÍEZ-FERNÁNDEZ, JOSUÉ
MARTÍNEZ-DE LA PUENTE, LAURA
GANGOSO, PILAR LÓPEZ, JOSÉ MARTÍN,
RAMÓN SORIGUER & JORDI FIGUEROLA
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Host selection behavior by mosquitoes is a key factor affecting the transmission of mosquito borne pathogens. Avian odors have been identified as potential stimuli used by mosquitoes to locate their hosts. Here, we experimentally assess the role of the uropygial gland secretion and headspace extract with bird body odor in the attraction of mosquitoes. In addition, we tested for the potential impact of infection by *Plasmodium* on the attraction of mosquitoes to infected avian hosts

3.1 Arthropod diversity on green rooftops

EVA F. DRUKKER, RENS A. DE BOER & NINA FATOUROS

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Green roofs are an innovative climate stress mitigation strategy in urban areas. The biodiversity aspect of this new type of green areas in cities is currently not well studied. Building height, substrate depth, surrounding green areas, plant species richness, age of the roof and human influence were tested for their influence on arthropod diversity in this study. Design factors were identified that green roof developers can use to optimise green roofs for species diversity.

4.1 The probing mechanism of the braconid parasitic wasp *Diachasmimorpha longicaudata*

SANDER W.S. GUSSEKLOO, UROŠ CERKVENIK, BRAM VAN DE STRAAT, ALEXANDER KOVALEV, STANISLAV N. GORB, YOKO MATSUMURA & JOHAN L. VAN LEEUWEN

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We investigated the mechanisms used by *Diachasmimorpha longicaudata* to propel and steer the ovipositor during host-finding in solid substrates. Alternating sliding of the three ovipositor elements along the longitudinal axis is used for propulsion. Predominant protraction of the ventral valves leads to dorsal curving of the path, while predominant protraction of the dorsal valve results in straight paths. Curvature is probably induced by changes in the ovipositor tip as a result of longitudinal variation in the stiffness of the valves, and changes in their alignment.

11:50

1.2 Polyploidy in biological control

KELLEY LEUNG, LOUIS VAN DE ZANDE & LEO W. BEUKEBOOM
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Polyploidy is having additional chromosome sets. Parasitoid wasps are haplodiploid. Unfertilized eggs develop into 1n males and fertilized eggs develop into 2n females, but polyploidy is common (2n males and 3n females). In complementary sex determination (CSD) species, inbreeding increases sterile 2n male production, which is detrimental to biocontrol. We take a first look at how inbreeding and polyploidy impact non-CSD species by phenotyping inbred and outbred *Nasonia vitripennis* polyploids.

12:10

1.3 Finding the egg elicitor that triggers egg-killing

LOTTE CAARLS, NICCOLÒ BASSETTI, ROLAND MUMM, ERIC SCHRANZ & NINA FATOUROS
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On black mustard plants, eggs of cabbage white butterflies (*Pieris* spp.) trigger a programmed cell death-response that leads to egg desiccation and/or dropping. How the plant detects the presence of the eggs and then activates defence is not known. We show that a wash of *Pieris* eggs can elicit a similar response as the eggs itself, suggesting that a compound in or on the eggs is recognized by the plant. Our aim is to isolate and chemically identify that elicitor from *Pieris* eggs.

2.2 Gone with the wind - Parasitoid downwind foraging

ILKA VOSTEEN, YAVANNA AARTSMA, FELIX BIANCHI & ERIK H. POELMAN
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Herbivore-induced plant volatiles (HIPVs) are important foraging cues for parasitoids, but field experiments revealed that HIPV-guided upwind flights are impeded by moderate wind speeds, thereby forcing parasitoids to 'go with the wind'. Downwind foraging may be more difficult for parasitoids since volatile information only becomes available after the odour source has been passed. *Cotesia glomerata* indeed needed more time to find a host-infested plant when they are forced to fly downwind.

2.3 Low humidity impedes odour-guided foraging

LAURA ZUIDEMA, ERIK H. POELMAN & ILKA VOSTEEN
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Foraging parasitoids strongly rely on herbivore-induced plant volatiles to detect host-infested plants. Field data suggests that parasitoids have difficulties to perceive host-infested plants under low humidity conditions. Wind tunnel experiments revealed that low humidity does not hamper volatile perception in *Cotesia glomerata*, but results in reduced systemic volatile emission by host-infested plants due to stomata closure. Our results suggest that HIPV-signalling is disrupted by low humidity.

3.2 A rapid radiation of flightless crickets on Hawaii

THOMAS BLANKERS & KERRY SHAW
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In Hawaii, 38 morphologically and ecologically cryptic species of swordtail crickets (*Laupala*) are endemic to single islands and even single volcanoes within islands. They show high diversity in mating songs and song preferences, which constitute a major reproductive barrier between species. I will discuss phylogeographic and genotype-phenotype data that explain why *Laupala* has among the highest speciation rates in the animal world and what that tells us about insect diversity more generally.

4.2 Unreliable memory affecting foraging efficiency

JESSICA A.C. DE BRUIJN, LOUISE E.M. VET & HANS M. SMID
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Parasitic wasps, such as *Cotesia glomerata*, are known to improve their foraging efficiency after learning of herbivore-induced plant volatiles (HIPVs) upon encountering their hosts on these plants. However, these learned HIPVs can become unreliable by no longer correctly predicting host presence, due to spatial and temporal variation of herbivore communities. Here we present how persistent memory, containing unreliable information, affects the foraging efficiency for hosts in *C. glomerata*.

3.3 Selys watercolour collection of dragonflies

KARIN VERSPUI & MARCEL WASSCHER
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The nineteenth century watercolour collection of Edmond de Selys Longchamps, housed in the Royal Belgian Institute for Natural Sciences, illustrates specimens of his important collection of dragonflies. To make this unpublished material available, we catalogued and digitised the sheets with watercolours, drawings and notes. Interpretation of notes is given and the watercolours are associated with current species names. The scientific value of this dragonfly watercolour collection is advocated.

4.3 Boy or girl? Host size matters to hyperparasitoids

JETSKE DE BOER, SVEN FELLING, JEROEN VAN BUREN & LUCIA SALIS
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Host size can influence parasitoid sex ratio. Here, we investigated the effect of host size and rearing origin on sex ratio of five species of aphid hyperparasitoids. *Dendrocerus carpenteri*, *D. laticeps*, *Asaphes vulgaris*, *A. suspensus*, and *Pachyneuron* aphidid were reared on, and presented with, mummies of pea aphid (large) or green peach aphid (small). We present and discuss our findings on the effects of rearing origin and host size on the proportion of sons and daughters.

13:40

1.4 Current generation biocontrol: find new species

JOOP C. VAN LENTEREN & VANDA H.P. BUENO
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Thousands of natural enemy species await discovery as candidates for biocontrol of pests. If currently used species are insufficiently effective, one can try to improve them, but another approach might be to just look for another species. Prospecting for natural enemies for use in augmentative biocontrol has been a rather random process until now. We will illustrate how this process can be improved, based on a case study with biocontrol agents of the invasive pest species, *Tuta absoluta*.

14:00

1.5 Parasitoid optimization for biocontrol

ASTRID KRUITWAGEN, LEO BEUKEBOOM & BREGJE WERTHEIM
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Development of biocontrol methods for exotic invasive pest species requires more focus on native enemies. We propose a four-step approach to investigate how one can exploit existing variation to optimize native natural enemies. We apply this approach to parasitoids of the new invasive pest *Drosophila suzukii*. Can we select native parasitoids to adequately control this novel, highly resistant pest?

6.1 Genomics of host-race formation in a mite

ERNESTO VILLACIS-PEREZ, SIMON SNOECK, ANDRE KURLOVS, RICHARD CLARK, HANS BREEUWER & THOMAS VAN LEEUWEN
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Genetic differentiation can isolate herbivores from sympatric conspecifics. How do host-specialized genotypes exist in sympatry with conspecifics in *Tetranychus urticae*? Field surveys, genome sequencing and bioassays revealed a host-race in this species. We show that this results from ecological isolation partially due to host-adaptation, that genetic divergence from sympatric conspecifics is genome-wide, and that reproductive isolation in sympatry results from a post-zygotic barrier

6.2 Male morph coexistence in a bulb mite

TOM VAN DEN BEUKEN & ISABEL SMALLEGANGE
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Males of many species are either armed or unarmed. For these morphs to coexist, neither morph always does best. However, contrary to armed males, unarmed males have no clear fitness benefits. For the male-dimorphic mite *Rhizoglyphus robini*, I experimentally showed that unarmed males sired more offspring, and sired higher-fitness daughters than armed males. Armed males killed conspecifics, but avoided killing kin and thus inclusive fitness. These results highlight how the two morphs can coexist.

7.1 Bat-ectoparasite-*Bartonella* communities

CLIFTON D. McKEE, ALEKSANDRA I. KRAWCZYK, ATTILA D. SÁNDOR, TAMÁS GÖRFÖL, MIHÁLY FÖLDVÁRI, GÁBOR FÖLDVÁRI, DAAN DEKEUKELEIRE, ANNE-JIFKE HAARSMÁ, MICHAEL Y. KOSOY, COLLEEN T. WEBB & HEIN SPRONG
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The ecology of *Bartonella* bacteria in bat species and their arthropod vectors is poorly understood. We examined *Bartonella* sequences and ectoparasites from European bats. Seven communities have been identified that can be explained by bat families and roosting patterns. In addition, we found that sharing of *Bartonella* species was strongly associated with host phylogenetic distance and roost sharing and less strongly with geographic range overlap and ectoparasite sharing.

7.2 Biosystematic analysis of *Rhipicephalus* ticks

MARIA JOÃO COIMBRA-DORES, MARIANA MAIA-SILVA, FERNANDA ROSA & DEODÁLIA DIAS
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Rhipicephalus ticks present considerable medical and veterinary importance due to their role as pathogens' vectors. Since this tick genus present cryptic diversity and phenotypic plasticity, it requires an urgent taxonomic clarification especially because its vectorial capacity seems to be species-related. The phylogenetic clarification of this tangled genus can significantly improve ticks' identification methods which will have epidemiologic implications on public health.

8.1 *Doublesex* and sexual dimorphism in a *Nasonia* brain

AIDAN WILLIAMS
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The sex-determination gene *Doublesex* regulates development of sexual-dimorphic morphology and behaviour, such as the response to sex pheromones. In the antennal lobe in the brain, such sex-specific responses are reflected in the number of sex-specific glomerular units called 'olfactory glomeruli'. We characterised these glomeruli in male wasps in which *Doublesex* expression had been silenced and compared these to wild-type male and female *Nasonia vitripennis* wasps.

8.2 Mating in *Nasonia* is regulated by *doublesex*

WEIZHAO SUN
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Doublesex (*dsx*) is an essential and conserved gene controlling sexual dimorphism in insects, but its effect on mating behaviour has only been studied in the fruitfly. In the parasitoid wasp *Nasonia vitripennis* we now show that a reduction of *dsx* expression in *N. vitripennis* males interferes with mating behaviour and thereby reduces female receptivity. Moreover, using a Y-tube olfactometer we observed that the olfactory behaviour of females is changed in response to the odour of these males.

14:20

1.6 Maintenance of variation in life-history traits

WOUTER PLOUVIER

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Several studies have noticed high intra-specific variation in different life-history traits of natural enemies. Looking more closely at this intra-specific variation and how it can be maintained can offer valuable insights for biocontrol practitioners to optimize the efficacy of natural enemies. To this end, we constructed a mathematical model that is able to identify the environmental conditions that allow for the maintenance of variation in natural populations of parasitoids.

14:40

1.7 Fighting flies with context

J.T. ALKEMA, H. DOORNBOSCH, A. ALESHO, F. LUCASSEN, S. DE JONG, B. WERTHEIM & M. DICKE

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The invasive pest species *Drosophila suzukii* plagues European and North-American fruticulture. Conventional protection strategies are inefficient and often harmful. Integrated pest management (IPM) provides a sustainable alternative. We investigated the push-pull system as part of an IPM. This system uses aversive compounds to push pests away from crops while simultaneously pulling them with attractive traps. We investigated how motivational states influence responses to relevant push-pull cues.

6.3 Bulb mites develop weapons if they can afford them

FLOR T. RHEBERGEN & ISABEL M. SMALLEGANGE

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Male traits are often phenotypically plastic, and expression of these traits often depends on somatic condition. Such plasticity can evolve when males differ in mating opportunities, but also when the energetic cost of trait development differs among males. Male bulb mites *Rhizoglyphus robini* do or do not develop weapons, depending on body size. We show that these weapons are costly traits, and that the cost is higher for poor-condition males, which consequently cannot afford to produce them.

6.4 Brassicaceae killing butterfly eggs with necrosis

EDDIE GRIESE, SETAREH MOHAMMADIN, ERIC M. SCHRANZ, ERIK POELMAN, RIETA GOLS & NINA E. FATOUROS

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Plants evolved several defence mechanisms against herbivorous insects' eggs, defending plants against future larvae. Those defences have been getting much attention recently. However, missing so far is an evolutionary approach, tracing the expression and elicitation of egg defence reactions through a phylogenetic tree. We used the Brassicaceae, specialist butterflies and an egg killing necrosis to research the phylogenetic context of the expression and elicitation of this egg defence reaction.

7.3 Challenges in the control of livestock pests

WILLEM TAKKEN
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A large number of arthropod species are associated with livestock, affecting the animals' health through damage and infectious disease. Changes in animal production as well as environmental and climate change cause increased risks for livestock production and disease outbreaks. Traditional control relies on hygiene and the use of pesticides, but high levels of resistance render pest control ineffective. Novel strategies are being presented that promise to overcome current problems.

7.4 eDNA based trapping of mosquitoes in the tropics

MAARTEN SCHRAMA, LOUIE KROL, SAM P. BOERLIJST, KRIJN TRIMBOS, BERRY VAN DER HOORN, PETER M. VAN BODEGOM & ERIN E. GORSICH
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The aim of this study was to develop an eDNA approach and to assess whether we could accurately detect mosquito communities in stagnant water bodies using a novel family-specific primer targeted on COI, and how these eDNA results compare to traditional trapping methods. Results from field studies in South Africa and the Caribbean provide evidence that an eDNA based detection of larvae present a method that is as reliable, and for some species even more reliable than the currently used methods.

8.3 A novel insect sex determination gene

YUAN ZOU, ELZEMIEK GEUVERINK, EVELINE C. VERHULST, LEO W. BEUKEBOOM & LOUIS VAN DE ZANDE
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Insect sex determination involves a cascade of genes that show a large diversity of primary signals. To identify the primary signal of the haplodiploid parasitic wasp *Nasonia* we compared transcriptomes of early male and female embryos. We identified a p53-like gene, termed womanizer, that is expressed in diploid female embryos only and silenced on the maternal genome. Knockdown of this gene caused diploid female embryos to switch to male development

8.4 The male determining gene of the housefly

XUAN LI, LEO W. BEUKEBOOM & LOUIS VAN DE ZANDE
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Houseflies have a male determining locus (M) that can be located on the Y chromosome or any of the autosomes. PacBio sequencing revealed that the M locus contains about 100 copies of the male determiner gene (*Mdmd*), most of which are likely non-functional. Fluorescence in situ hybridization showed that M is located close to the centromere both on the Y chromosome and on autosome III.

15:30

5.1 Medical appointment for crickets

GABRIELA MACIEL-VERGARA, VERA ROS, ANNETTE BRUUN JENSEN, MONIQUE VAN OERS, JORGEN EILENBERG & JOOP VAN LOON.

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Several species of crickets are mass-reared as a source of protein. However, they are susceptible to various insect pathogens which cause diseases that lead to big losses in the production systems. Therefore, tools are needed to diagnose cricket diseases as well as broader understanding of the interaction between the environmental rearing conditions, the pathogens and the cricket. This knowledge will be useful to draft prevention and control measures in cricket mass-rearing systems.

15:50

5.2 Optimising nutrition of the black soldier fly

JOOP VAN LOON, KAROL BARRAGAN-FONSECA, GERRIT GORT & MARCEL DICKE

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We investigated the influence of protein (P)- and carbohydrate (C)-contents on both larval and adult performance of black soldier fly (BSF), and on larval body nutrient content. Twenty-five artificial diets varying in their P- and C-content and ratio were formulated. BSF performance was affected by P+C-content rather than by P:C ratios. P-content is limiting for most of the performance variables. C-content affected egg production more strongly than P-content.

6.5 Subterranean ant-trophobiont-microbiome mutualism

ANIEK IVENS, ALICE GADAU, TOBY KIERS & DANIEL KRONAUER

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Subterranean ant-trophobiont interactions are classic examples of mutualism: ants protect their aphids and mealybugs from parasites and predators and the trophobionts provide the ants with honeydew. We mapped a North American, multilevel species interaction network of ants, their trophobionts and the insects' microbiomes. We show that the obligate ant-trophobiont interactions vary widely in their specificity, while the insect-microbiome associations are all highly specific.

6.6 *Drosophila suzukii* biology in The Netherlands

AURORE D.C. PANEL, LAURA ZEEMAN, BART J. VAN DER SLUIS, PETER VAN ELK, BART A.

PANNEBAKKER, BREGJE WERTHEIM & HERMAN H.M. HELSEN

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The mechanisms allowing the widespread invasive pest *Drosophila suzukii* to survive from early spring until the availability of the first fruit crops are still unclear. Seasonal biology and population dynamics of *D. suzukii* were investigated in the central Netherlands in order to better understand the contribution of the early spring hosts to the infestation of the first fruit crops of the season.

NEV Dissertatieprijs en lezing / NEV Dissertation award and lecture

Invited Plenary Lecture

16:15

THEATRE AZURE

7.5 Adding CO₂ to improve trapping of *Culicoides*

ANTON BEKENDAM, ARJAN STROO, FRANS JACOBS & SANDER KOENRAADT
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This study examined whether the addition of CO₂ to the Onderstepoort black light trap improves trapping efficiency of biting midges in three habitat types (horse farm, wetland, edge of forest) in The Netherlands. Livestock-associated species were significantly caught more in traps with CO₂, ornithophilic species more in traps without CO₂. The use of CO₂ as bait is advised when the topic of research is focused on potential vector species, since these species are livestock-associated.

8.5 How an endosymbiont influences sex determination

FANGYING CHEN, ELZEMIEK GEUVERINK, MARLOES VAN LEUSSEN, LOUIS VAN DE ZANDE & LEO W. BEUKEBOOM
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In the haplodiploid wasp *Asobara japonica*, *Wolbachia* infected asexual females provide female specific transformer (*tra*) mRNA to their eggs, while uninfected sexual females do not. Upon parental RNAi of *tra* in asexual *A. japonica*, diploid males instead of females were produced. Hence, *Wolbachia* induces this maternal *tra* mRNA provision to ensure female offspring.

7.6 Comparing two different aspirators to catch midges

ARMIN ELBERS, EWA PACHOLEWICZ & JOSE GONZALES
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A mouth and mechanical vacuum aspirator were tested on horses to investigate differences in *Culicoides* counts, proportion of blood-feds and species distribution. There was no significant difference between the aspirators in total midge counts, but the proportion of blood-feds was higher with the mouth aspirator. With the mouth aspirator you visually aspirate midges, while the mechanical aspirator 'wastes' time at places where no midges are present when vacuuming systematically.

8.6 How a wasp becomes a perfect puppet for *Wolbachia*?

YIDONG WANG
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Muscidifurax uniraptor is a solitary wasp species that can parasitize the filthy flies. Because of the endosymbiont *Wolbachia*, the sex determination system of *M. uniraptor* is distorted resulting in reproduction of only females. To explain how *Wolbachia* manipulate the sex, we first need to understand how the sex is determined in this species. We hypothesize that *Wolbachia* may hijack the crucial genes from the sex determination cascade to achieve the final sex distortion.

NEV Dissertatieprijs en lezing / NEV Dissertation award and lecture

Invited Plenary Lecture

16:15

THEATRE AZURE

Aphids out of control?

MARISKA BEEKMAN
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Greenhouse aphids are often biologically controlled with parasitoid wasps. Unfortunately this method is sometimes failing due to unknown reasons. This PhD project aims to understand the role of protective facultative symbionts in the biocontrol success of greenhouse aphids. We are studying: (1) Which symbionts are present in greenhouse aphids? (2) How do these affect their aphid hosts? (3) What mechanisms cause the protective effects? And (4) can we improve the success of biological aphid control?

Creating specific genetic markers for *Trichogramma*

SUSANNE BORGMAN, KIM FERGUSON & BART PANNEBAKKER
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What happens when a biocontrol agent is released into a field of the same species, and is it possible to track different populations with molecular markers? Using genomic sequences from *Trichogramma brassicae*, micro-satellite markers were developed to determine the population genetics of various German field populations of *T. evanescens* as compared to biocontrol populations, in hopes of finding population-specific markers.

Host dependent gene expression in *Spodoptera*

THIJMEN BRESCHOTEN, M. ERIC SCHRANZ, VERA I.D. ROS & SABRINA SIMON
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We studied the host-dependent gene expression of *Spodoptera exigua* (Lepidoptera: Noctuidae) larvae feeding on hosts from different plant families, employing various defence mechanisms. We linked larval performance, as quantified in comparative feeding assays, with the newly generated gene expression data. We found differential, diet treatment-linked, gene expression patterns across various gene families including major detoxification families.

***Trichogramma* life history traits – a meta-analysis**

SOPHIE CHATTINGTON, RENATE KIENZLE & ANDRA THIEL
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Members of the genus *Trichogramma* are among the most used biocontrol agents. Keying 'Trichogramma' into 'Web of Science' returns over 2000 publications, making these egg-parasitoids one of the most well-studied natural enemies. This extensive meta-analysis compares life-history traits among *Trichogramma* species. 126 papers were included in the data analysis, with data for 41 species from 36 countries of origin. Traits examined include sex ratio, longevity, and development time.

Performance of black soldier fly on brewery waste

SHAPHAN CHIA, CHRYSANTUS TANGA, SUNDAY EKESI, JOOP VAN LOON & MARCEL DICKE
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Beer and sugar production result in various by-products. We tested 12 diets composed of spent grains, brewers' yeast and molasses as substrates for black soldier fly (BSF) rearing. Diets were offered to newly hatched BSF larvae. Larval development varied significantly among diets. Survival rates varied significantly among diets. Fecundity ranged from 324–787 eggs per female. These findings provide insights for commercial production of BSF larvae as a protein ingredient in animal feed.

The effects of aphid endosymbionts on biocontrol

HELENA DONNER
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Aphids are serious pests in pepper greenhouses. Insecticides are no longer sustainable, and biocontrol using natural enemies such as parasitoid wasps is rising in popularity. Unfortunately, biocontrol sometimes fails for unclear reasons. The problems with parasitoid biocontrol might in part be explained by endosymbiont-conferred resistance. This project will look at the effects of aphid endosymbionts on the success of parasitoid biocontrol in pepper greenhouses.

Effect of rearing complex on parasitoid behavior

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Substrate (artificial diet, host and host plant) on which parasitoids are reared can affect their host-searching behaviour. Rearing on artificial diets can deteriorate foraging success of parasitoids whereas rearing on a host-plant complex can increase their foraging efficacy. Here, we studied whether rearing of mealybug parasitoid *Anagyrus pseudococci* on host-plant complex improves their behavioural response to this host-plant complex compare to mass-reared parasitoids in y-tube olfactometer.

Polyandry and immunity in a *Drosophila* fly

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Females of several species mate with more than one male. Physical contacts during mating can involve potential risk of sexually transmitted infections; i.e., the more females mate, the higher risk of potential infections they may get. If costs of multiple mating outweigh the benefits, females will not mate polyandrously. High-polyandrous females may evolve less-costly immune defences. Here, we present effects of bacterial infections on survival of females showing different levels of polyandry.

Making new sex chromosomes in houseflies

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New sex chromosomes arise from regular chromosomes and are predicted to become differentiated after recombination has stopped. However, the early steps in their evolution remain uncertain. Artificially created sex chromosomes can be used to study their early evolutionary development, as we can track the genomic changes occurring on them from the start. We present how the polymorphic sex determination system of the housefly *Musca domestica* can be exploited to generate new sex chromosomes.

Early and late adult learning by *Anagyrus pseudococci*

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Parasitoid learning can take place during or immediately after emergence (early adult learning) and during the adult stage (late adult learning). The effects of early and late adult learning are rarely studied together but generally it has been shown that early adult experiences have weaker effect on adult host-searching behaviour compare to adult experience. Here, we present the effects of early and late adult learning on host-searching behaviour of the mealybug parasitoid *Anagyrus pseudococci*.

Catching plant aspects of insect-plant interaction

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In the EPG system an insect with piercing mouthparts (stylets) is made part of an electrical circuit. Upon stylet insertion EPG signals are shown. Distinct EPG waveforms reflect insect activities during plant penetration as well as plant electrophysiological phenomena: stylets as a micro-electrode. A new EPG device with a remote controlled switch measures these plant aspects more accurately. Moreover, this model allows EPG recording in the field and from multiple insects (8 max) on the same plant.

Does *Osmia cornuta* shift diet upon competition?

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When pollinators use the same resource, competition is possible. We will monitor the diet of *Osmia cornuta* that forage with or without abundant foraging honeybees. The aim of the research is to determine whether a shift occurs and to which alternative plant species the *Osmia*'s may turn. The project is long-term and will start in February 2019.

Comparison of sexual and asexual parasitoids

FU-YU YE, YUE-MEI YANG, LI-TING PAN, JIAN-YANG GUO, LI-YAN YANG & WAN-XUE LIU

yefuyu@hotmail.com

Neochrysocharis formosa is an important endoparasitoid of agromyzid leafminers, having typically three types of host-killing behaviours (parasitization, host-feeding and host-stinging), and sexual and asexual (*Rickettsia*-induced) strains in China. Life-history traits and biocontrol potential of the two strains were compared in the laboratory. It is considered that the thelytokous strain could be the better biocontrol agent.

Programma 30e Nederlandse Entomologendag 14 dec 2018	
08:30	Registratie en koffie in ontvangstruimte
10:00	Theatre Azure: Opening door voorzitter Sectie ENTOMOLOGENDAG, Plenaire lezing Dr. Bart Pannebakker. <i>Next-generation biocontrol: using genetics to optimize natural enemy deployment</i>
11:00	KOFFIEPAUZE / POSTERSSESSIE IN ONTVANGSTRUIMTE
ZAAL	Theatre Azure
	1. Advances in biocontrol research and application
11:30	1.1 Ferguson Genomes in advancing biocontrol research
11:50	1.2 Leung Polyploidy in biological control
12:10	1.3 Caarls Finding the egg elicitor that triggers egg-killing
12:30	LUNCHPAUZE
	2. Behaviour
	2.1 Diez-Fernandez Mosquito responses to bird odor stimuli
	2.2 Vosteen Parasitoid downwind foraging
	2.3 Zuidema Low humidity impedes odour-guided foraging
	3. Biodiversity
	3.1 Drukker Arthropod diversity on green rooftops
	3.2 Blankers A rapid radiation of flightless crickets on Hawaii
	3.3 Yerspui Selys watercolour collection of dragonflies
	4. Physiology and morphology
	4.1 Gussekloo The probing mechanism of a braconid parasitic wasp
	4.2 de Bruijn Unreliable memory affecting foraging efficiency
	4.3 de Boer Boy or girl? Host size matters to hyperparasitoids
	5. Mass rearing of insects
13:30	5.1 Maciel-Vegara Medical appointment for crickets
14:00	5.2 v. Loon Optimising nutrition of the black soldier fly
14:20	5.3 Mateschke and M. G. de Meillon The biology of the black soldier fly
14:40	5.4 Mateschke and M. G. de Meillon The biology of the black soldier fly
15:00	KOFFIEPAUZE / POSTERSSESSIE IN ONTVANGSTRUIMTE
	6. Ecology and evolution
	6.1 Villacis-Perez Genomics of host-race formation in a mite
	6.2 v.d. Beuken Male morph coexistence in a bulb mite
	6.3 Rhebergen Bulb mites develop weapons if affordable
	6.4 Griese Brassicaceae killing butterfly eggs with necrosis
	7. Medical entomology
	7.1 Krawczyk Bat-ectoparasite- <i>Bartonella</i> communities
	7.2 Coimbra-Dores Biosystematic analysis of <i>Rhipicephalus</i> ticks
	7.3 Takken Challenges in the control of livestock pests
	7.4 Schrama eDNA based trapping of mosquitoes in the tropics
	8. Sexual dimorphisms and sex determination
	8.1 Williams <i>Doublesex</i> and sexual dimorphism in a <i>Nasonia</i> brain
	8.2 Sun Mating in <i>Nasonia</i> is regulated by <i>doublesex</i>
	8.3 Zou A novel insect sex determination gene
	8.4 Li The male determining gene of the housefly
	9. Ecological genetics
	9.1 M. G. de Meillon and M. Mateschke The biology of the black soldier fly
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16:15	Theatre Azure: Uitreiking NEV Dissertatieprijs + plenaire lezing door winnaar
16:45	BORREL / POSTERSSESSIE IN ONTVANGSTRUIMTE