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PROGRAMME

32ème colloque de l'Union Internationale pour l'Etude des Insectes Sociaux

Section Francophone

18-20 juin /25

AUDITORIUM 150 > CENTRE DE COLLOQUES CAMPUS CONDORCET

UFR LLSHS
Lettres, Langues, Sciences Humaines et des Sociétés

LEEC | Laboratoire d'Ethologie Expérimentale et Comparée

institut francilien d'éthologie

18 juin /25

13:00 - 13:45 | **Accueil des participant-e-s et café de bienvenue**

13:45 – 14:00 | **Introduction au colloque**

14:00 – 15:00 | **Jean-Christophe SANDOZ**
Evolutionary neuroethology of olfaction in honey bees and social Hymenoptera

15:00 – 15:30 | **Pause café**

15:30 – 15:45 | **Coline MONCHANIN**
Chronic radioactive exposure impairs the learning skills of giant hornets

15:45 – 16:00 | **Mélissa PITZALIS – Julie CARCAUD**
Gustatory perceptual similarity and discrimination abilities in Apis mellifera

16:00 – 16:15 | **Benjamin JAUFFRET**
Learning performance is consistent across time and tasks in ants

16:15 – 16:30 | **Kristine ABENIS**
Automating monitoring of visual learning and memory in bees

16:30 – 16:45 | **Iago BUENO DA SILVA**
Putting the social cockroaches on the map: Recent advances in the structural and functional neuroplasticity of termites

16:45 – 17:00 | **Antoine WYSTRACH**
Ant visual navigation: an intriguing mix of rigidity and flexibility

17:00 – 17:15 | **Christophe LUCAS**
Chemical keys to recognition in ant-aphid mutualism

17:15 – 17:30 | **Mathieu LIHOREAU**
How do bees move across space and why does it matter?

17:30 | **Fin de la première journée**

19 juin /25

9:30 – 10:30 | **Yuko ULRICH**
Behaviour and infection in clonal ant societies

10:30 – 11:00 | **Pause café**

11:00 – 11:15 | **Joël MEUNIER**
Alternative reproductive strategies in two cryptic species of the European earwig complex

11:15 – 11:30 | **Arthur MATTE**
The evolution of cheaper workers facilitated larger societies and accelerated diversification in ants

11:30 – 11:45 | **Thomas PARMENTIER**
Coupled but highly contrasting symbiont networks inside and outside ant nests in heathland

11:45 – 12:00 | **Gabriela LACHAUD**
Premier cas de coléoptère Cleridae (Phyllobaenus obscurus) parasitoïde de fourmis (complexe d'espèces Ectatomma ruidum)

12:00 – 12:15 | **Eddie PÉROCHON**
Global distribution of sociality and its associations with environmental conditions in ants

12:15 – 12:30 | **Jean-Paul LACHAUD**
Quelques cas d'interactions trophobiotiques entre Membracidae (Hemiptera) et la fourmi Ectatomma tuberculatum au Mexique

12:30 – 14:00 | **Pause déjeuner**

14:00 – 15:00 | **Erik FRANK**
Evolution of Wound Care Behaviours in Ants: from amputations to antimicrobials

15:00 – 15:30 | **Pause café**

15:30 – 15:45 | **Sébastien OLLIER**
Studying ant colour using a picture database: from human expertise to IA recognition – application to the hyperdiverse ant genus Pheidole.

15:45 – 16:00 | **Arthur HAIS**
The potential role of microbiota on the variation in ants' cuticular chemical profile and consequences on nestmate recognition

16:00 – 16:15 | **Marie CASTERET**
Food solicitations of Ectatomma tuberculatum larvae and their effects on worker's behavioural responses

16:15 – 16:30 | **Simon DE WEVER**
Immune cost of parental care in the European earwig

16:30 – 16:45 | **Alice ROUX**
Impact of thermal stress on colony foundation in ants

16:45 – 17:00 | **David SILLAM-DUSSÈS**
Behavioral differentiation among workers reducing reproductive conflicts during colony inheritance in termites

17:00 – 17:15 | **Laura PASQUIER**
Does Juvenile Hormone regulate maternal egg care in the European earwig?

17:15 – 17:30 | **Vincent FOURCASSIE**
Effet de la température sur le métabolisme et la déshydratation des ouvrières de différentes tailles de la fourmi granivore Messor barbarus

17:30 | **Session Poster suivie du cocktail dinatoire**

23:00 | **Fin de la deuxième journée**

20 juin /25

9:30 – 9:45 | **Romane BLAYA**
Le commerce de plantes ornementales comme voie d'introduction privilégiée des fourmis exotiques en France

9:45 – 10:00 | **Cleo BERTELSMEIER**
Microclimates predict smaller niche shifts in introduced ants than macroclimates

10:00 – 10:15 | **Baptiste NÉZEL**
Consequences of an emerging infectious disease on the invasion extent of the invasive garden ant over space and time

10:15 – 10:30 | **Olivier BLIGHT**
De la détection à l'éradication : réponse à l'introduction de Wasmannia auropunctata dans le sud de la France

10:30 – 11:00 | **Zoé SHERPA**
Temporal niche dynamics during ant invasions

10:45 – 11:15 | **Pause café**

11:15 – 11:30 | **Rafael CARVALHO DA SILVA**
Uncovering the impact of heat stress on ant's foraging activity

11:30 – 11:45 | **Xim CERDA**
A comparative study of the foraging efficiency of two Cataglyphis Spanish desert ants

11:45 – 12:00 | **Marina CHOPPIN**
Genetic and behavioral effects of social supergene on colony phenotype in Alpine silver ants

12:00 – 12:15 | **Enikő CSATA**
Chronic Fungal Infection Accelerates Age Polyethism in Ants Without Altering Immune Response

12:15 – 12:30 | **Romain LIBBRECHT**
Social control of queen specialization in ants

12:30 – 14:00 | **Pause déjeuner**

14:00 – 15:00 | **Damien GERGONNE**
Are social arthropods better invaders? – A case study of Vespula germanica

15:00 – 15:30 | **Pause café**

15:30 – 15:45 | **Hugo LE LAY**
Reversible transcriptomic changes underlie the social control of queen specialization in the black garden ant

15:45 – 16:00 | **Matthieu DE LAMARRE**
Revealing the fine-scale genomic structure of a wood ant supercolony

16:00 – 16:15 | **Brandon DUQUENOY**
Maintien du polymorphisme social et alaire chez la fourmi Myrmecina graminicola par la transmission égoïste d'un haplotype compensant un déficit de fitness

16:15 – 16:30 | **Tristan KLAFTENBERGER**
Global latitudinal patterns and bioclimatic drivers of colour diversity in ant assemblages

16:30 | **Clôture du colloque**

Conférences plénières

Evolution of Wound Care Behaviours in Ants: from amputations to antimicrobials

Erik Frank*[1]

[1]Department of Animal Ecology and Tropical Biology, Biocenter, University of Würzburg, Würzburg, Germany – Allemagne

Résumé

Open wounds represent a significant risk of infection and mortality, driving diverse ant species to evolve sophisticated social wound care strategies. *Megaponera analis* employs therapeutic treatments on infected wounds with antimicrobial secretions from the metapleural gland, dramatically reducing mortality. Chemical analyses of these secretions identified numerous antimicrobial compounds and proteins. Conversely, *Camponotus floridanus*, lacking this gland, perform prophylactic limb amputations to halt infection spread. *Dinoponera grandis* conduct self-wound care using their front legs, while *Eciton burchellii* army ants exhibit "first aid" wound care behaviours near the raiding sites, followed by antimicrobial care inside the bivouac. These wound care behaviours highlight the evolutionary flexibility of cooperative behaviours under pathogenic pressures and the convergent emergence of functionally analogous solutions in response to a shared threat.

*Intervenant

Are social arthropods better invaders? – A case study of Vespula germanica

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Résumé

Although social arthropods represent a minority among invasive alien species, they are responsible for over half of harmful invasions, suggesting a role of social traits like polygyny, division of labour, or behavioural plasticity. Invasiveness - the capacity to overcome introduction barriers - can also result from hybridisation or repeated propagule introductions, increasing genetic diversity.
Mechanisms such as the bridgehead effect, spatial sorting, or the hydra effect can offset low initial genetic diversity, challenging the centrality of genetic diversity in invasion success. Intraspecific variation suggests the involvement of other factors. For instance, a 2b-RAD analysis of 50 *Vespula germanica* individuals in South Africa revealed a highly structured population, stemming from two separate introductions and maintained by limited male dispersal and assortative mating. These findings suggest that traits related to social complexity may also enhance invasiveness.

To explore this hypothesis, we aimed to measure social complexity objectively. Existing indices are often too simplistic or hard to apply, so we developed an expert-based approach. Three hundred arthropod specialists rated the social complexity of real and fictional species (scale: 0–20) based on eight key traits. Our analysis showed that three main traits consistently guided their evaluations.
We propose a standardised social complexity index, applicable to *V. germanica* and other social species, to compare complexity levels and invasive potential. While social traits and genetic structure can facilitate invasions, each biological and environmental context is unique. A 'social-invasive' framework combining general principles with local specificities may support broader comparative analyses.

*Intervenant

Evolutionary neuroethology of olfaction in honey bees and social Hymenoptera

Jean-Christophe Sandoz*[1]

[1]Évolution, Génomes, Comportement et Écologie – Institut de Recherche pour le Développement, Université Paris-Saclay, Centre National de la Recherche Scientifique, Centre National de la Recherche Scientifique : UMR9191 – France

Résumé

Social insects navigate a remarkably complex olfactory world. Our lab employs an integrative neuroethological approach to understand how the brains of these insects decode their rich olfactory environment. First, I will discuss our long-term research on olfactory perception and learning in the honey bee, our primary model species. This work integrates behavioral analysis, neuroanatomy, and brain calcium imaging, but also recent advances in transgenesis and heterologous expression. In particular, I will show how we attempt to decipher the neural basis of pheromonal communication in bees. I will then present our research on the evolution of the olfactory system in Hymenoptera, the insect order with the most frequent transitions to eusociality. We focus on a specific olfactory subsystem composed of dedicated structures in insects' antennae and brain, which is involved in the detection and processing of cuticular hydrocarbon information and social recognition in ants, wasps, and other Hymenoptera. By combining broad taxonomic sampling with detailed neuroanatomical, functional and molecular characterization of these olfactory structures, we aim to understand the role of the olfactory system in the evolution of social behavior.

*Intervenant

Behaviour and infection in clonal ant societies

Yuko Ulrich*[1]

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Résumé

Group living is a widespread evolutionary strategy that confers both benefits and costs. For example, it allows for cooperation and division of labour, which can enhance group efficiency. However, close social interactions also increase the risk of disease transmission. In this talk, I will present recent and ongoing work exploring how social organisation influences infection dynamics and how chemical communication underpins collective behaviour, using the clonal raider ant *Ooceraea biroi* as a model system.
We investigate the interplay between division of labour and parasitic infection through experiments with nematodes that naturally infect the heads of ants. Our findings show that behavioural roles strongly influence infection risk, with parasite distribution among individuals mirroring the spatial structure of task allocation within the colony. Moreover, infections alter host behaviour, in ways that unexpectedly appear to favour the parasite's interests.
In parallel, we are collaborating with chemists to uncover some of the chemical foundations of social behaviour in the clonal raider ant. I will highlight recent progress in identifying pheromones, characterising their behavioural effects, and elucidating their biosynthetic pathways, to shed light on the molecular mechanisms that regulate ant sociality.

*Intervenant

Communications orales

Automating monitoring of visual learning and memory in bees

Kristine Abenis*[1,2], Loïc Goulefert[1], Gabriel Madirolas[1,3], Blandine Mahot-Castaing[1], Ella Spaargaren[4], Mathilde Lacombrade[1], Coline Monchanin[1], and Mathieu Lihoreau[1]

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Résumé

Technological advances, such as the Internet of Things and embedded artificial intelligence, now allow for the automated monitoring of cognitive abilities in different animal species. Despite the increasing number of studies that use such automated devices, these are largely restricted to rodents and primates, which serve as good models in understanding human neurodegenerative diseases, and some farmed animals, for welfare assessment, and only rare studies have been performed in invertebrates. Here we introduce a unique device for the automated measurement of learning and memory in nectar feeding insects, which can be used both in the laboratory and the field. As a proof of concept, we compared differential visual learning abilities of bumblebees, tested by the automated device and by human experimenters. We also explored the generalizability of this automated approach to other species by comparing these visual cognitive capacities in domestic honey bees, domestic bumblebees, and wild yellow-legged Asian hornets. We believe that automated cognitive testing opens new opportunities for fundamental research in animal behaviour, for instance in comparative cognition, by including non-model species, or in ecotoxicology, by enabling the measurement of the cognitive health of insect populations in various environments characterized by different stressors.

*Intervenant

Microclimates predict smaller niche shifts in introduced ants than macroclimates

Olivia Bates[1], Sébastien Ollier[1], and Cleo Bertelsmeier*[2]

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[2]Université de Lausanne (UNIL) – Départment d'Ecologie et Evolution Biophore UNIL-SORGE Université de Lausanne 1015 Lausanne, Suisse

Résumé

Introduced species can establish in climates outside of their native niche and undergo 'niche shifts'. However, studies of niche shifts generally rely on above-ground climate data, neglecting the potential buffering effect of ground-level or soil climates. We compared niche shifts in 95 introduced ant species using air temperature and soil temperature. Overall, between 65.2% and 82% of species (depending on the metric) exhibited smaller niche shifts when considering soil temperature, with varying levels of correlation between air-and soil-temperature niche shifts across species. Furthermore, air and soil climate conditions were generally more uncoupled than expected at random. This suggests that species use microrefugia and that this may explain the lower levels of niche shifts observed when using microclimatic conditions. Ecological traits, nesting type, forest cover and spatial spread did not consistently impact the differences across metrics in soil temperature buffering of niche shifts among species. This highlights the need for experimental microclimatic research to explore species differences in air-versus ground-climatic niche shifts. We overall highlight the importance of incorporating ecologically relevant microclimatic data, particularly for small, ground-dwelling organisms like ants. This study emphasises the ongoing need for a nuanced understanding of the intricate interplay between air and soil temperatures in the context of niche dynamics. Ultimately, soil-level datasets may improve habitat suitability models, leading to more accurate predictions of establishment success for introduced species.

*Intervenant

Le commerce de plantes ornementales comme voie d'introduction privilégiée des fourmis exotiques en France

Romane Blaya*[1], Eline Hiron[2,3], Jérémy Migliore[4], and Olivier Blight[2]

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Résumé

Les espèces exotiques envahissantes constituent une menace majeure pour l'équilibre des écosystèmes. Plus de 500 espèces de fourmis ont été introduites en dehors de leurs aires de répartition naturelles, certaines ayant des effets majeurs sur la biodiversité et l'économie des zones envahies. La dispersion de ces espèces à différentes échelles spatiales est principalement causée par les activités humaines. Une des voies d'introduction privilégiée de ces espèces exotiques semble être le commerce de plantes ornementales. Malgré l'augmentation des introductions et l'arrivée récente en Europe d'espèces particulièrement préoccupantes, telles que *Solenopsis invicta* et *Wasmannia auropunctata*, toujours peu d'informations sont disponibles sur cette voie d'introduction sur le continent. En étudiant la myrmécofaune des pépinières du Var, l'objectif est d'identifier le rôle du commerce de plantes dans l'introduction d'espèces exotiques envahissantes dans la région, et notamment dans celle de *Wasmannia auropunctata*. En 2024, des premiers résultats concernant 20 pépinières du Var ont montré que cette voie d'introduction est particulièrement active, avec une dizaine de nouvelles espèces identifiées pour la métropole. La diversité des provenances des espèces identifiées témoigne également d'un processus de dispersion assistée opérant à différentes échelles spatiales. Le commerce de plantes joue ainsi un rôle au niveau mondial, par la présence d'espèces provenant d'autres continents, au niveau européen, en favorisant la dispersion d'espèces natives de pays limitrophes, mais également à l'échelle de la métropole, en assistant la généralisation d'espèces déjà très dominantes, notamment du genre *Tapinoma*. Afin de compléter les résultats de cette étude de nouvelles pépinières seront prospectées au printemps 2025.

*Intervenant

De la détection à l'éradication : réponse à l'introduction de Wasmannia auropunctata dans le sud de la France

Olivier Blight*[1], Hervé Jourdan[2], Laurent Colindre , Christophe Galkowski , and Luc Gomel[3]

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Résumé

La petite fourmi de feu ou fourmi électrique (*Wasmannia auropunctata*) est l'une des espèces de fourmis exotiques envahissantes les plus largement répandues à l'échelle mondiale, avec des conséquences environnementales, économiques et sanitaires majeures. Alors qu'une première population établie en France a été détectée en 2022 dans le département du Var, un second foyer a été identifié en 2024, à environ 60 km de distance. Nous présentons ici les circonstances de ces détections, l'ampleur de l'invasion dans les deux foyers, les premiers impacts écologiques observés, ainsi que la méthodologie retenue pour l'éradication. Les premiers signalements de piqûres, datant de 2019, suggèrent une introduction de l'espèce remontant à au moins six ans pour la population de Toulon qui s'étend sur 1ha. Celle de La Croix-Valmer couvre déjà une surface d'environ 4 hectares, indiquant vraisemblablement une introduction antérieure. Malgré ces introductions relativement récentes, une diminution de l'abondance et de la richesse des fourmis indigènes est déjà observable. Aucun impact sur les autres arthropodes n'a toutefois encore été constaté. Un programme d'éradication est actuellement en cours sur la commune de Toulon, parallèlement à l'identification des voies d'introduction. Cette situation souligne l'urgence de renforcer la surveillance biosécuritaire face à la progression des espèces de fourmis envahissantes en Europe.

*Intervenant

Putting the social cockroaches on the map: Recent advances in the structural and functional neuroplasticity of termites

Iago Bueno Da Silva*[1], Lohan Valadares[1], Arthur Roque Justino[2], Jaqueline Eterna Batista[3], Ana Maria Costa-Leonardo[4], Klaus Hartfelder[2,5], David Sillam-Dussès[6], Fabio Santos Do Nascimento[3], and Jean-Christophe Sandoz[1]

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Résumé

Social insects represent an informative system to evaluate the relationship between brain functioning and ontogeny since the division of labor observed in their societies may be aligned with task-specific cognitive demands. Such a relationship has been widely studied in the social Hymenoptera, but in termites, social cockroaches with independent eusociality evolution, the link between neuroplasticity and division of labor remains overlooked. It is especially relevant considering the mixed-sex societies and the caste differentiation of termites, which includes workers, responsible for a wide range of tasks, molting into soldiers specialized in defense. Here, we present our recent advances aiming to fill this knowledge gap. First, we provide evidence that the irreversible task shift following worker-to-soldier differentiation in *Procornitermes araujoi* relates to a reduction of the mushroom bodies, centers related to sensory integration, learning, and memory. Such changes are possibly due to the restriction of their behavioral repertoire associated with defense. Second, we show that in the sex-based division of labor of *Syntermes dirus*, male workers, who constitute the foraging workforce, have an enlarged central complex, a center related to navigation and orientation, as well as higher expression of the gene *foraging* in their brains, which regulates foraging behavior. Third, we present our current goals in elucidating the effects of ontogeny and experience on the defensive performance of *Hodotermopsis sjostedti* soldiers. Similarly, we aim to understand how these factors relate to the structural (subesophageal zone enlargement) and functional (serotonin levels) plasticity in the soldier brain.

*Intervenant

Uncovering the impact of heat stress on ant's foraging activity

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Résumé

Global warming negatively impairs various traits in organisms, from molecules to behaviors. Ectotherms, such as ants, are particularly vulnerable because their body temperature largely depends on external conditions. As such, rising environmental temperatures can directly impact ant foraging dynamics. To test this, we studied incipient colonies of *Lasius niger* shortly after their first winter quiescence. We used a heat stress assays in the laboratory as this offers a valuable proxy for investigating the effects of global warming on workers behavior. Colonies were subjected to either short-term (10 min or 1 h) or long-term (2 weeks) exposure to different temperature treatments: 25∘C (control), 30∘C, and 35∘C for the short-term assays (where colonies are reared at 25∘C/20∘C day/night), and 25∘C/20∘C (control) and 35∘C/30∘C for the long-term assays. We aimed to determine whether the latency to start foraging and the number of foraging trips (visits) varied with temperature and exposure duration. We predicted that short-term heat stress would have a lower impact on foraging activity, regardless of temperature exposure, while longer heat exposure would more clearly impair foraging, particularly under suboptimal conditions. Alternatively, we considered that short-term exposure might delay foraging if colonies can afford waiting for more favorable conditions, whereas long-term exposure might lead to faster foraging responses due to acclimation to unfavorable conditions. Our findings are expected to provide insights into how thermal stress influences early foraging dynamics in ants, shedding light on the behavioral plasticity of ectotherms under climate change scenarios.

*Intervenant

Food solicitations of Ectatomma tuberculatum larvae and their effects on worker's behavioural responses

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Résumé

In many species, juveniles must communicate their needs to the adults they depend on for survival. To beg for food, juveniles produce food solicitations to indicate their nutritional state. In social insects, several studies have characterised the existence of larval signals that play a role in the foraging activity of workers. Moreover, the overlapping generations of young cause asymmetry in needs and, therefore, in larval signals according to age. In this study, we used Ectatomma tuberculatum ant species as a model to answer some questions : are there differences in larval feeding demands as a function of age for the same development stage? Is the behavioural response of workers influenced by food solicitations ? Finally, does the development time of the larvae modify the emission of signals? To answer these questions, we observed three groups from different larval stages (stages 2, 3, and 4) from six different colonies at the beginning and the end of larval stage 4. Several behaviours produced by larvae and workers were quantified (larval solicitation movements, larval feeding, searching, food provisioning and brood care). We predict that larvae at the end of stage 4 will produce more food solicitation than those at the beginning of the stage. We also expect to find positive relationships between the number of food solicitations and workers behaviour. By using the 15 929 quantified behaviours, we aim to provide a better understanding of the communication between larvae and workers. Keywords
Communication ; Social Insect ; Larval stage ; Begging ; Larval development

*Intervenant

A comparative study of the foraging efficiency of two Cataglyphis Spanish desert ants

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Résumé

The high thermophily of Cataglyphis species confers them a great ecological advantage by not having competitors during most of their daily activity period. In addition, the speed of food collection increases with increasing soil temperature. This study compares, in terms of energetic efficiency, the advantages of thermophily in two Spanish species of different sizes of the genus Cataglyphis: C. velox and C. rosenhaueri. Artificial prey of known weight were offered to workers of both species, and once collected, the workers' individual paths to transport them to the nest were studied. For each path, the soil temperature, distance traveled, time to reach the nest, and worker weight were recorded. In each case, the following parameters were calculated: 1) worker speed (cm/s); 2) the prey delivery rate (PDR), i.e., the load that a worker is able to carry at a speed of 1 cm/s; and 3) the net profit (NP), i.e. the number of times a worker transports its own weight at a speed of 1 cm/s. Both species are highly efficient at high temperatures, with PDR and NP values that increase with soil temperature and reach their maximum around 55 ∘C. PDR is higher in C. velox – the largest species –, but the small C. rosenhaueri are more competitive, with a NP around 140 compared to the maximum values of 100 reached by C. velox. These values are significantly higher than those of Aphaenogaster senilis, their main competitor. The role of thermophily on competition between these three species is discussed.

*Intervenant

Genetic and behavioral effects of social supergene on colony phenotype in Alpine silver ants

Marina Choppin*[1] and Michel Chapuisat[1]

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Résumé

Social organization in ants varies within and across species, from monogynous colonies with a single reproductive queen to polygynous colonies with many queens. The formation of polygynous colonies can result from different processes, including the stable association of multiple queens during colony founding or the adoption of queens into existing colonies. In *Formica selysi*, social form variation is determined by an intraspecific genetic polymorphism at a supergene, so that individuals from monogynous colonies exclusively carry the *M* haplotype, whereas individuals from polygynous colonies carry at least one copy of the *P* haplotype. The proximate mechanisms resulting in polygyny remain poorly understood. Crosses between social forms occur, but we never found a mature monogynous colony headed by an *MM* queen mated to a *P* male. To investigate whether paternal inheritance of *P* could promote polygyny, we mated *MM* queens with *M* or *P* males, monitored colony growth, and tested if the resulting one-year-old colonies accepted additional queens. Colonies founded by *P*-mated queens were significantly larger after one year, potentially paving the road to polygyny. We introduced freshly mated queens into these small incipient colonies. *MM* and *MP* workers exhibited similar, strong discrimination against all non-nestmate queens, suggesting that young colonies do not adopt foreign queens. We are investigating the cuticular hydrocarbon profiles of *MM* and *MP* workers. In parallel, we documented that queens from polygynous colonies were more likely to co-found new colonies peacefully. These findings provide novel insights into the genetic and behavioral mechanisms underlying polygynous colony formation in ants.

*Intervenant

Chronic Fungal Infection Accelerates Age Polyethism in Ants Without Altering Immune Response

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Résumé

Foraging is a critical activity for many animals, particularly in eusocial organisms like ants, where only a subset of colony members undertake this task as a part of a structured division of labour. Colonies of *Myrmica scabrinodis* (common elbowed red ant) face a variety of parasites that could compromise colony homeostasis, potentially disrupting this division of labour. One such parasite is the ectoparasitic fungus *Rickia wasmannii*, which infects the majority of workers in the colony and is linked to reduced lifespan, enhanced immune responses, and altered behaviour. Given that task allocation in *M. scabrinodis* is age-dependent, we tested whether *R. wasmannii* infection accelerates the transition to foraging due to the ants' shortened life expectancy. Our results confirmed that colonies with high infection intensity exhibited an earlier onset of foraging behaviour. Additionally, immune response, measured through phenoloxidase activity, was more strongly influenced by worker age than task performance or infection status. This suggests that while infection accelerates task-switching, it does not directly impact immune function. Our findings highlight how chronic fungal infection can disrupt the division of labour in social insect colonies.

*Intervenant

Revealing the fine-scale genomic structure of a wood ant supercolony

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Résumé

Supercoloniality is an extreme form of social organization characterized by high polygyny, large networks of connected nests, and low relatedness between cooperating individuals. The evolution of supercolonies, and their maintenance as coherent units of cooperation, remain poorly understood. In supercolonial native wood ants, growth by nest budding and limited dispersal of alates may lead to cryptic genetic structuring within supercolonies, with higher than zero relatedness among nestmates. Here, we study fine-scale patterns of genomic differentiation within a large supercolony of the wood ant Formica paralugubris. Based on few genetic markers, early genetic studies indicated high queen philopatry and restricted gene flow between distant nests. Patterns of genetic differentiation suggested that most queens reproduce in their native nest or a neighboring nest, with a low level of male-mediated long-distance gene flow. In this new study, we mapped all 961 nests of the supercolony and sequenced the whole genome of 192 individuals. Fine-scale population genomic analyses revealed clusters of related nests, geographic patterns of isolation by distance, and a positive influence of population density on inbreeding. We are further exploring how the reproductive dynamics of queens and males affect spatial patterns of relatedness, which in turn drive both competitive and cooperative interactions within supercolonies. This study will help to understand how gene flow and inbreeding shape the kin structure and affect patterns of cooperation in supercolonial ants.

*Intervenant

Immune cost of parental care in the European earwig

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Résumé

The evolutionary costs of reproduction, particularly those associated with parental care, represent a fundamental area of ecological research. While extensive studies have documented the immunological burdens of offspring production and parental investment in vertebrates like mammals and birds, the corresponding costs in insects exhibiting maternal care remain comparatively underexplored.

Our research focus on the European earwig (*Forficula auricularia*), a subsocial insect species characterized by prolonged maternal care on eggs and juveniles. We aimed to quantify the impact of reproductive state and maternal investment on the immunological and metabolic levels of female earwigs, investigating the physiological trade-offs in this behaviour. Specifically, we examined how different reproductive stages (pre-oviposition, immediate post-oviposition, 35 days post-oviposition, and post-juvenile care) and varying levels of maternal investment (we placed 0, 55, or 110 eggs with mothers tested 35 days post-oviposition, and 0, 40, or 80 juveniles with mothers tested post-juvenile care) influence maternal physiology. We employed a suite of physiological and immune measurements: respirometry to assess metabolic rate, lytic activity, phenol oxidase activity, and encapsulation rate as immune measures. These measures were conducted on individuals at both a basal level of immunity and with enhanced immunity induced by heat-killed bacteria 24 hours prior to measurement. We also performed survival assays following exposure to the pathogenic bacterium Serratia marcescens.

We hypothesize that both the reproductive stage and the magnitude of maternal investment will significantly shape maternal immune and metabolic responses, highlighting the significant physiological costs associated with maternal care in this insect.

*Intervenant

Behavioral differentiation among workers reducing reproductive conflicts during colony inheritance in termites

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Résumé

In the process of inheriting reproduction among social insects, conflicts over reproduction widely exist among potential reproductive individuals. These conflicts are expressed by the suppression of reproductive success or the competition for reproduction. However, such suppression and competition are often accompanied by high cost for individuals. Whether there may or may not be a harmonious behavioral strategy that has evolved to reduce these conflicts has received negligible attention in termites so far. In the termite *Reticulitermes labralis*, we studied specific behaviors of workers before they differentiate into reproductives. Our behavioral observations show that when the queen was present, the workers which were going to replace successfully reproductives in the future had three different behavioral profiles compared to workers which were not going to develop into reproductives. That is, in queenright colony, the workers which were going to differentiate into reproductives moved less, performed more proctodeal trophallaxis (anal feeding), and were groomed more than others. These three specific behaviors may indicate which workers have priority during the process of differentiation when queens are absent. We suggest that the weak mobility was intended to save energy, the higher number of proctodeal trophallaxis occurrences could serve as an honest signal to indicate their status, and the higher number of grooming behavior received could be a sign of dominance. Therefore, the termite *R. labralis* may reduce reproductive conflicts with these specific behaviors which indicate the priority of certain workers to differentiate into replacement reproductives.

*Intervenant

Maintien du polymorphisme social et alaire chez la fourmi Myrmecina graminicola par la transmission égoïste d'un haplotype compensant un déficit de fitness

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Résumé

Chez un nombre croissant d'espèces de fourmis, des études génomiques montrent la détermination génétique d'un polymorphisme social (la présence d'une ou de plusieurs reines) par un supergène. Chez les deux espèces où le supergène social a été bien étudié (*Solenopsis invicta* et *Formica selysi*), la transmission mendélienne est biaisée en faveur de l'haplotype dérivé déterminant la polygynie. Ce biais joue un rôle important dans le maintien du polymorphisme. Nous avons testé l'existence de distorsions des fréquences haplotypiques chez *Myrmecina graminicola*, espèce où les polymorphismes sociaux et alaires sont génétiquement déterminés par un supergène à trois haplotypes : Mo (ancestral), Ma et Pa (dérivés). Les reines MoMo sont ailées et monogynes ; les reines MaMa et MaMo sont aptères et monogynes ; les reines MaPa et MoPa sont également aptères mais polygynes. Dans les colonies polygynes, quel que soit le père, le taux d'hétérozygote au supergene social devrait être de 50% puisque les reines polygynes sont toutes hétérozygotes. Les premiers résultats sur les ouvrières (N= 375) indiquent une proportion plus élevée (66%) d'hétérozygotes. Nous déterminons actuellement cette proportion sur les larves tout en vérifiant avec des marqueurs microsatellites le niveau de ploïdie des larves. Nos premiers résultats suggèrent une augmentation de la fréquence des hétérozygotes sur le stade adulte. Des expériences en cours visent à comprendre les mécanismes responsables de ce biais.

*Intervenant

Effet de la température sur le métabolisme et la déshydratation des ouvrières de différentes tailles de la fourmi granivore Messor barbarus

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Résumé

Les fourmis granivores de l'espèce *Messor barbarus* se caractérisent par un fort polymorphisme de la caste ouvrière, la masse des individus pouvant varier d'un facteur de 1 à 20. Ce polymorphisme est associé à une division du travail, les ouvrières de taille intermédiaire (media) étant plus représentées sur les pistes de fourragement par rapport à leur effectif dans les colonies que les ouvrières les plus grosses (major) et les plus petites (media). Notre hypothèse est que ces différences pourraient s'expliquer par des différences dans la thermotolérance des ouvrières de différentes tailles, liées à leur physiologie. Pour tester cette hypothèse nous avons mesuré l'effet de températures croissantes sur le métabolisme et la résistance à la déshydratation des ouvrières de différentes tailles d'une colonie de *M. barbarus*. Nos résultats montrent que les ouvrières minor se déshydratent plus rapidement et ont également un taux métabolique spécifique (taux métabolique rapporté à la masse des individus) qui augmente plus rapidement pour des températures croissantes que les ouvrières major et media. De plus, le calcul de la valeur du Q10, qui mesure la sensibilité des individus aux changements de température, montre que plus la température ambiante est élevée, moins le taux métabolique spécifique varie avec des changements de température. La résistance à la déshydratation est quant à elle très peu sensible aux changements de température. Ces résultats montrent que dans les colonies de *M. barbarus* les fourmis de différentes tailles possèdent des capacités physiologiques différentes pour faire face aux changements de température du milieu.

*Intervenant

The potential role of microbiota on the variation in ants' cuticular chemical profile and consequences on nestmate recognition

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Résumé

Cuticular hydrocarbons (CHCs) are important for insects because they prevent desiccation and are involved in colony communication. CHCs form chemical profiles composed of different compounds like alkanes, alkenes, and methylated alkanes or alkenes, whose variability is used by eusocial insects, such as ants, to discriminate between nestmates and foes. An underrated factor that could influence CHC profiles is the microbiota.
To assess whether modifications in ant chemical profiles can be related to changes in their internal microbial community, we collected *Lasius paralienus* colonies at three locations in the Piedmont region (Italy). CHCs were then extracted from five ants after the initial sampling (T0) and after three weeks of feeding with tetracycline, a wide-spectrum antibiotic (T1Ab), or by administering a standard diet as control (T1C). CHC extracts were analysed by GC-MS. Significant differences, primarily explained by marked reductions of some methylated compounds, were found between T0 and T1Ab as well as between T1Ab and T1C, while we did not observe any changes by comparing T0 vs T1C.

To corroborate these findings, new colonies were fed the same treatments for three weeks. At this time, a first round of assays was performed. Then, during two additional weeks, T1C subsets were fed the standard diet while T1Ab were fed either the standard diet or a diet enriched with their colony microbiota.
Reducing the ant microbiota appears to affect the ant CHC profile, but ultimately, behavioural assays did not corroborate these findings.

*Intervenant

Learning performance is consistent across time and tasks in ants

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Résumé

The study of inter-individual behavioural and cognitive variability, once neglected, has gained momentum over the last decades. However, studies focused mostly on vertebrates, revealing for instance that individual cognitive performance can be stable across time and tasks, and may be linked to some personality traits, although findings are mixed and species-dependent. Invertebrates, including social insects, have received far less research attention despite evidence of clear inter-individual behavioural variability. Here, we studied the widespread ant species *Formica fusca* to measure the repeatability of exploratory activity (open-field) and learning performance (olfactory discriminative conditioning) over time at the individual level (Experiment 1), and to investigate consistency in learning across two tasks and its relationship with exploratory behaviour (Experiment 2). We found that learning performance is stable over time, and that ants can reverse odorant-reward contingencies, providing the first evidence of individual-level reversal learning in ants. Furthermore, individual performance in discriminative learning was positively correlated with performance in reversal learning. However, contrary to previous observations in a different ant species, exploratory activity did not clearly predict learning performance, prompting a more systematic study of this link in ants. Our results expand the limited body of evidence for stable cognitive traits and cross-task consistency in invertebrate learning.

*Intervenant

Global latitudinal patterns and bioclimatic drivers of colour diversity in ant assemblages

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Résumé

Naturalists have described tropical species as more colourful than temperate species. Whether this is true or is an extrapolation based on some colourful species remains unknown. To clarify it, scientists had to wait until sufficient data were available. Recent studies on latitudinal gradients in Passerine birds show that they are more colourful in the tropics. However, a similar analysis is still lacking for insects. To address this gap, ants provide a suitable system, representing a diverse clade distributed globally. Using images from AntWeb, an online database of ant images and specimen records, we digitalised over 40,000 images from more than 10,000 ant species and extracted the dominant colours of each specimen. Our results challenge the idea of a universal geographical rule according to which colour diversity is greater at the equator. Indeed, we found that the peak of colour diversity is observed in the southern hemisphere with a decrease towards the north pole. This pattern is linked to species richness and disappears when controlled for. Furthermore, colour diversity variations across ecoregions are partly explained by exposure to UVB radiation and temperature. Specifically, we found that ant assemblage brightness aligns with two key hypotheses in ectotherm colouration: the thermal melanism hypothesis, suggesting darker colours absorb heat in cold environments, and the UVB protection hypothesis, which proposes that darker colours protect from UV radiation in high-exposure areas.

*Intervenant

Premier cas de coléoptère Cleridae (Phyllobaenus obscurus) parasitoïde de fourmis (complexe d'espèces Ectatomma ruidum)

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Résumé

Les coléoptères Cleridae sont généralement prédateurs d'insectes, tant au stade larvaire qu'adulte. Ils comptent parmi les principaux prédateurs ou parasitoïdes des coléoptères xylophages, mais plusieurs espèces sont facultativement spécialisés dans l'attaque d'abeilles ou de guêpes solitaires, très rarement dans la prédation d'insectes sociaux. Entre 2015-2017, 146 colonies ou fragments de colonies de quatre des six espèces de fourmis appartenant au complexe d'espèces *E. ruidum* ont été récoltées sur plusieurs sites de la région côtière pacifique de Oaxaca, au Mexique ; 98 contenaient des cocons et/ou des larves. Les cocons, conservés quelques semaines dans des boîtes de Pétri pour attendre l'émergence de parasitoïdes, ont ensuite été disséqués. Les larves et les adultes, conservés dans de l'alcool à 96○, ont été examinés ultérieurement pour détecter une attaque éventuelle d'ecto- ou endoparasites ou parasitoïdes. Sur un total de 11057 adultes, 5795 cocons et 2185 larves examinés, aucune larve n'a été trouvée parasitée, 36 ouvrières adultes étaient parasitées par des nématodes, huit cocons contenaient des guêpes Eucharitidae (une espèce non-identifiée de *Kapala*), et cinq cocons (un d'*Ectatomma* sp. 3, quatre d'*Ectatomma* sp. 6) étaient attaqués par des larves de Phyllobaenus obscurus. Tous les stades larvaires de ce coléoptère ont été obtenus et se trouvaient à l'intérieur de cocons intacts, confirmant son statut de parasitoïde. L'absence d'œufs suggère que l'introduction dans le nid hôte se fait vraisemblablement par phorésie de la larve de premier stade (*planidium*). Ces observations constituent le premier cas documenté de parasitoidisme primaire d'un insecte social par un Cleridae.

*Intervenant

Quelques cas d'interactions trophobiotiques entre Membracidae (Hemiptera) et la fourmi Ectatomma tuberculatum au Mexique

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Résumé

Certains hémiptères sont prédateurs d'insectes et quelques espèces se nourrissent du sang d'autres animaux. Toutes les autres espèces sont phytophages et utilisent leurs pièces buccales suceuses et perforantes pour se nourrir de la sève des plantes. C'est le cas de la famille des Membracidae dont de très nombreuses espèces ont des interactions trophobiotiques avec des fourmis, et notamment avec le genre *Ectatomma*. Compte tenu de l'aspect esthétique attractif des organismes impliqués, ces interactions suscitent souvent l'intérêt des photographes amateurs ou professionnels mais sont rarement rapportées de façon officielle. Nous présentons ici plusieurs cas de trophobioses qui ont été observés de façon fortuite au Mexique dans les états du Chiapas et du Quintana Roo entre la fourmi *Ectatomma tuberculatum* et plusieurs genres de Membracidae. Sept espèces sont rapportées ici appartenant aux sous-familles Membracinae (*Guayaquila gracilicornis*, *Bolbonota pectipennis*, *Enchenopa binotata*, *E. latipes*, *E. squamigera*, *Membracis mexicana*) et Smiliinae (*Vanduzea segmentata*). *Ectatomma tuberculatum* est une fourmi essentiellement carnivore qui s'attaque à une grande diversité d'arthropodes (dont environ 50% sont constitués d'autres fourmis), mais comme la plupart des autres espèces d'*Ectatomma* son régime est généraliste et elle se nourrit également de proies mortes et exploite les sources de sucre. Cette attraction pour les liquides sucrés est sûrement responsable de la grande diversité d'interactions trophobiotiques avec les Membracidae rapportées récemment en Guyane Française et, maintenant au Mexique, et il est vraisemblable que des observations plus systématiques et des études plus approfondies, notamment dans les banques photographiques, devraient révéler de très nombreux autres cas.

*Intervenant

Reversible transcriptomic changes underlie the social control of queen specialization in the black garden ant

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Résumé

Insect societies are characterized by a reproductive division of labor between the queen and worker castes. Queens specialize in egg production and this specialization is generally accepted to be constitutive and unaffected by environmental modifications. This notion was recently challenged by evidence that the presence of workers both initiates and maintains queen specialization in egg production in the black garden ant (*Lasius niger*). However, the transcriptomic changes that translate the presence of workers into queen behavioral specialization remain unknown. To address this question, we generated 96 single-brain RNAseq samples from specialized and unspecialized *L. niger* queens under various, experimentally manipulated environmental conditions. Our transcriptomic analyses identified 123 genes that were differentially expressed in response to the presence of workers. Several of these genes were linked to the juvenile hormone pathway, such as *Krüppel homolog-1*, a transcription factor regulating behavioral variation in other ant species. Further differential expression analyses indicated that the identified transcriptomic signal likely regulated the queen specialization, as the gene expression changes (i) mirrored the variation in queen behavior, including its reversibility upon worker removal, (ii) were associated with queen behavioral changes rather than modifications of the social environment, and (iii) were the cause rather than the consequence of the queen behavior. In addition to providing a better understanding of the molecular basis of reproductive division of labor, our results represent the first steps towards building an integrated mechanistic model of the queen behavioral specialization in ants.

*Intervenant

Social control of queen specialization in ants

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Résumé

Insect societies show a division of labor between queens that monopolize egg production and workers that perform all the other tasks necessary to maintain the colony. Such reproductive division of labor between the queen and worker castes is central to the functioning, ecological success and evolution of social insects. It is generally accepted that queens are intrinsically specialized in egg production once they reach the adult stage, and that this constitutive specialization is independent of environmental conditions. We recently reported that this is not the case in two ant species, where the presence of workers both initiates and maintains the queen specialization. To investigate whether such social control of queen specialization is common across the ant phylogeny, we quantified the effect of the presence of workers on the brood care behavior of > 400 queens from > 35 ant species. While our behavioral analyses indicated that the social control of queen specialization could be found in multiple ant species, they also revealed interspecific variation in the flexibility of queen specialization, from queens that never express brood care (even in absence of workers) to queens that always do (even in presence of workers). We are in the process of mapping the behavioral data on the ant phylogeny to identify the factors and species-specific life-history traits that underlie variation among species in the flexibility of queen specialization. In addition to shedding light on reproductive division of labor in ants, our findings overturn the longstanding notion of social insect queens as intrinsically specialized egg-laying machines.

*Intervenant

How do bees move across space and why does it matter?

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Résumé

Predicting pollination is a key challenge for the conservation of natural ecosystems and sustainable food production. While ecology models typically assume pollen disperses randomly around flowers, recent behavioural studies show how individual pollinators do not forage randomly. Bees, for instance, heavily rely on sensory cues, learning and memory, and communication to move across space and collect floral resources in an efficient manner. These complex - yet predictable – collective movement patterns may significantly shape pollen dispersal and, ultimately, plant reproduction patterns. Here, we discuss the importance of better considering pollinator behaviour and cognition when studying pollination. We explore this idea with a series of field experiments on bee navigation and simulations an agent-based model of pollen dispersal mediated through bee movements, leading to new hypotheses about plant mating patterns and fitness. Such crosstalk between pollination ecology and animal behaviour holds the potential to provide powerful mechanistic tools for predicting and acting on pollination, in the alarming context of a looming crisis.

*Intervenant

Chemical keys to recognition in ant-aphid mutualism

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Résumé

The mutualistic relationship between ants and aphids is a complex phenomenon that relies on a combination of tactile and chemical cues. Recent research has shown that ants can modify the chemical profiles of aphids, but the specific mechanisms and compounds involved in this process are not well understood. This presentation will delve into the chemical mechanisms that govern the mutualistic relationship between *Tapinoma ibericum* ants and *Aphis gossypii* aphids, identifying key compounds involved in communication between these two species.

Using gas chromatography-mass spectrometry, we analyzed the chemical profiles of 14 colonies of aphids and ants, over 3 days of interactions. Results show that contacts with *T. ibericum* lead to a swift alteration of the aphids' cuticular chemical profiles, highlighting the dynamic nature of this mutualistic relationship. Moreover, a key finding is the identification of a specific compound (3,15-di-MeC27) which is highly abundant in attended aphids and is a major component of the ant's cuticle. This compound may serve as a recognition marker, facilitating communication between ants and aphids, but other identified compounds may also play a crucial role in this mutualistic interaction.

These discoveries have important implications for the development of novel pest control strategies. By manipulating specific chemical cues, it may be possible to disrupt the mutualistic relationship between ants and aphids, ultimately reducing aphid populations and mitigating their impact on crops. Further research is needed to fully explore the potential of this approach, but the findings of this study provide a promising starting point.

*Intervenant

The evolution of cheaper workers facilitated larger societies and accelerated diversification in ants

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Résumé

Trade-offs between quantity and quality are common in the organization and evolution of biological, technological, and economic systems. In social insects, shifts from solitary organisms to complex societies bring this dilemma at the scale of the entire colony: producing fewer robust units or many cheaper ones. Here, we investigate how cuticle investment-a major nutritional cost-shaped the evolution of ant societies and their diversification. Using a computer vision approach applied to 3D X-ray microtomography scans of 880 specimens from 507 species, we show that the evolution of larger colonies was facilitated by reducing exoskeleton investment rather than worker miniaturization. Furthermore, reduced cuticle investment is associated with accelerated diversification rates in ants, whereas other candidates-colony size and worker size-didn't show such an effect. Diet and climate had measurable but secondary effects on cuticle investment. Our results support a hypothesis whereby the evolution of cheaper but more numerous units through reduced investment in structural tissues was a strategic trend in the evolution and diversification of more complex insect societies.

*Intervenant

Alternative reproductive strategies in two cryptic species of the European earwig complex

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Résumé

Reproductive strategies often reflect species-specific adaptations to ecological pressures. However, identifying such strategies within cryptic species complexes remains challenging. We address this gap in two cryptic species of the European earwig complex (*Forficula dentata* and *Forficula auricularia*) known for their agricultural importance, invasive potential, and maternal care. Using a common garden experiment with adults from seven populations, including sympatric ones, we measured 24 life-history traits across the female life cycle and identified species via COI analyses. Nine traits were species-specific, revealing distinct reproductive strategies. Both species produce the same number of eggs. However, *F. dentata* females prioritize pre-oviposition investment by laying late, a strategy that enhances egg provisioning and offspring quality, but shortens post-oviposition egg development and reduces hatching success. Conversely, *F. auricularia* females prioritize post-oviposition investment through early oviposition, which limits egg provisioning before oviposition, resulting in lower-quality juveniles, but prolongs egg development, thereby increasing hatching success. These strategies did not alter three forms of maternal egg care, although *F. dentata* mothers showed greater egg defence. Overall, these strategies may confer species-specific advantages in colonising and competing for new environments, potentially contributing to the global invasive success of the European earwig complex.

*Intervenant

Chronic radioactive exposure impairs the learning skills of giant hornets

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Résumé

In March 2011, a 15-meter tsunami struck the Fukushima Daiichi nuclear power plant, causing a nuclear accident. Massive releases of cesium, a radionuclide with a half-life of 30 years, permanently contaminated the soil, and several areas are still designated "exclusion zone." Our research, in collaboration with the University of Fukushima, aims to explore the behavior and morphology of the giant hornet, *Vespa mandarinia*, along a cesium contamination gradient. We assessed the environmental contamination by attaching dosimeters to individuals that were then released, and confirmed that the three selected sites exhibited a contrasted level of radiation exposure. We trained the hornets from these three sites to associate a sugar solution with a colored stimulus in a Y-maze. After 20 trials, 93% of the hornets at the control site antennated on the rewarded side, compared to 60% for the most exposed hornets. The latency to find the reward was also higher for the individuals closer to the power plant. We measured several morphological parameters, and found differences for eye length, thorax and abdomen widths. Surprisingly, we found a higher eye asymmetry at the control site compared to the most exposed site. Altogether, our results suggest that the legacy cesium contamination can impact the behavior and morphology of the giant hornet, with potential deleterious effect on the fauna more generally. Our work emphasizes the importance of understanding the ecological consequences of radiation exposure, particularly in areas around nuclear power plants, with broader implications regarding the environmental monitoring, conservation efforts, and public health.

*Intervenant

Consequences of an emerging infectious disease on the invasion extent of the invasive garden ant over space and time.

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Résumé

Anthropogenic activities are known to significantly alter environments, with the intentional or unintentional transportation of species potentially leading to biological invasion and emerging infectious diseases. Given the increasing number of both, there is a pressing need to understand how they interact, influence and impact each other and the native biodiversity. Recently, an ectoparasitic fungus, *Laboubenia formicarum*, started to infect European populations of an invasive alien garden ant species, *Lasius neglectus*. The consequences of this emerging infectious disease for the invasive garden ant and European native ant species are currently unclear. Within the project EMINENT I aim to clarify this, using a combination of field monitoring, laboratory experiments and molecular analyses. Here, I will present first preliminary data on the invasion extend of multiple infected and non-infected *L. neglectus* supercolonies over time, capitalizing on previous collection data from 2014 and my own collections during 2024 and 2025 springsthis spring. This long-term field monitoring allowed me to assess if an infection with *L. formicarum* leads to colony contraction, expansion, or no change and thus to assess fitness impacts of the parasite on the invasive ant under natural conditions.

*Intervenant

Studying ant colour using a picture database: from human expertise to IA recognition – application to the hyperdiverse ant genus Pheidole.

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Résumé

Body colour is an important trait that may have a central adaptive role in the relationships of organisms with the environment. While image analysis has become mainstream in consumer applications, it is still used only on a rudimentary basis in the biological analysis of digital collection of pictures, especially in ant studies. Although a growing number of images are now accessible from different databases like Antweb (more than 780 000 specimens, around 47 000 of which have associated images), most studies continue to use subjective qualitative description of colours where a human observer assigns a colour category to a set of references (wheel of colour).
To address this gap, we explore computer vision technics using classical image analysis tools and IA recognition process. IA may replace subjective assignation by humans but is still limited to one colour per specimen and we miss the diversity of patterns. Combining computer vision technics with quantitative colour profiling appears as a more interesting alternative. Using diversity metrics on these profiles provides a quantitative estimation of colour diversity. This framework is quite simple and computationally efficient.
We illustrate its performance compared to approaches previously used in the field, revisiting the exploration of colour diversity of the ant genus Pheidole. These methodological recommendations are quite generalist and could be applied to different taxa of insects given the increasing number of picture database sources (GBIF, iNaturalist).

*Intervenant

Coupled but highly contrasting symbiont networks inside and outside ant nests in heathland

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Résumé

Ants are key partners in diverse host-symbiont networks. Although ant symbiont networks typically involve multiple types of interactions, such as mutualists and parasites, most studies typically focus on only one, making it unclear whether evolutionary (e.g., host relatedness) and ecological (e.g., colony size) factors shape the composition and structure of the subnetworks of different interaction types in similar ways. We reconstructed a multilayered ant-symbiont network in heathland. Specifically, the network comprised three interconnected bipartite subnetworks: (1) an aboveground plant–aphid subnetwork, (2) a mutualistic aphid–ant subnetwork, and (3) an underground ant–myrmecophile subnetwork, consisting primarily of parasitic and agonistic arthropods living strictly inside ant nests. The number of underground myrmecophilous symbionts differed substantially among ant taxa, with mound-building ants supporting the highest species richness. The number of aphid symbionts outside the nest was less variable among ant species and was highest in species that forage across both canopy and herbaceous layers. The subnetworks varied markedly in their degree of specialization. The plant–aphid subnetwork was highly specialized, whereas the aphid–ant mutualistic subsnetwork was strongly generalized, with ants showing little preference for specific aphid species. The underground ant–myrmecophile subnetwork exhibited an intermediate specialization level. Evolutionary factors had little effect on either aboveground or belowground subnetworks, while the ecological factors colony size and presence of organic material in the nest clearly shaped the structure and diversity of the belowground myrmecophile subnetwork.Overall, our findings show that aboveground and belowground interaction patterns of ants with symbionts markedly differ.

*Intervenant

Does Juvenile Hormone regulate maternal egg care in the European earwig?

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Résumé

Parental care is a crucial behaviour in the animal kingdom, enhancing the survival and development of eggs and juveniles. However, the hormonal mechanisms underlying this behaviour remain poorly understood, especially in insects. Juvenile Hormone (JH), primarily known for its roles in development and reproduction, also regulates parental care, although its effects vary widely across species. In this study, we investigated the role of JH in regulating maternal care in the European earwig *Forficula auricularia*, a species in which egg care is essential. We experimentally treated 496 females with three JH agonists (JHIII, methoprene, and pyriproxyfen) or a JH synthesis inhibitor (Precocene I). We measured four forms of maternal care, two non-parental behaviours, four physiological parameters, and the expression of key genes in the JH signalling pathway. Our results show that inhibiting JH synthesis with Precocene significantly reduced maternal care behaviours, while JH agonists had no effect compared to control treatments. Molecular analyses confirmed a downregulation of JH pathway genes following Precocene treatment. No effects were observed on other behaviours or physiological parameters, ruling out toxic side effects of the treatments. These findings indicate that JH positively regulates maternal care in *F. auricularia*, in contrast to other insect species, and highlight the importance of species-specific hormonal regulation in understanding the evolution of parental strategies.

*Intervenant

Global distribution of sociality and its associations with environmental conditions in ants

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Résumé

Sociality represents a key strategy for facing environmental challenges. Variations in social traits can provide adaptative advantages in response to various abiotic and biotic factors. Ants are an ideal system to study such variation and their drivers due to their exceptional species richness and diversity of social traits. However, to date, the links between sociality and environment have only been studied for a fraction of species and for reduced sets of environmental factors. Consequently, much remains to be discovered about these interactions. To address this knowledge gap, we compiled an unprecedented dataset on three social traits (nest size, reproductive structure, and worker polymorphism), reflecting different aspects of sociality, for more than 1,500 ant species. We combined this dataset with global-scale climatic and ecological variables to test for associations between social traits and environmental conditions. We show certain social trait combinations are more common than others at the species-assemblage level. The different combinations are intimately associated with different geographical contexts at the global scale, suggesting an important role of environmental conditions in shaping sociality. Finally, our results show that temperature and climate variability are the main factors influencing sociality. Altogether, this study provides novel insights regarding the environmental drivers of the evolution of sociality in the richest and most widespread social taxa in the history of life on Earth.

*Intervenant

Gustatory perceptual similarity and discrimination abilities in Apis mellifera

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Résumé

Apis mellifera is well-known for associating sensory cues like colour or odour with a sugar reward, a feature that enabled extensive study of discrimination abilities for vision and olfaction. Yet, similar success has not been achieved with gustation, although its crucial role in ensuring proper food selection for colony survival. Surprisingly, *A. mellifera*'s genome encodes very few gustatory receptors (GRs), despite the wide range of tastants encountered in its environment. Bees could compensate for this scarcity of GRs by generalizing gustatory stimuli based on their hedonic value rather than on their chemical identity. To test this hypothesis, we applied associative conditioning to gustatory stimuli in an appetitive context. First, we developed a multi-capillary feeder to determine *A. mellifera's* gustatory preferences over sixteen tastants (salts, bitters, amino acids), each at six concentrations. Then, choosing tastants from different qualities (equally well detected and with the same hedonic value), we performed appetitive conditioning experiments in a free-walking arena. Using absolute conditioning, bees learnt to associate each tastant (conditioned stimulus, CS) to a sucrose reward (unconditioned stimulus, US), and chose the rewarded tastant over a "novel" stimulus in a test session. This suggests low generalization levels between molecules bearing the same hedonic value. Bees also differentiated between tastants in a differential conditioning task, in which one gustatory stimulus was rewarded while the other explicitly "punished". Our findings will help explain how *A. mellifera* compensates for its limited number of gustatory receptors, and will provide insights into the mechanisms underlying discrimination of gustatory stimuli.

*Intervenant

Impact of thermal stress on colony foundation in ants

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Résumé

Climate change not only leads to increased average temperatures but also to episodes of extreme heat that impact the reproduction and survival of organisms. These effects have broader ecological consequences when thermal disturbances affect ecosystem engineers such as ants. The impacts of thermal stress on ant populations have primarily been studied in mature colonies, which are relatively protected against thermal disturbances by the nest architecture and/or various behavioral responses. However, little is known about the effects of thermal stress on founding queens, which are commonly exposed to heat stress during and after the nuptial flight. To study the impact of thermal stress on ant colony foundation, we exposed founding queens of the black garden ant (*Lasius niger*) to a brief, acute heat stress just after the nuptial flight, before returning them to optimal conditions. We monitored queen survival and the number of eggs, larvae, pupae and workers produced. We found that the exposure of founding queens to the thermal stress impacted the success of colony foundation via increased queen mortality and reduced likelihood of producing workers, which stemmed from alterations of brood production and/or development. Our findings demonstrate impacts of climate change-associated thermal disturbances on colony foundation in ants.

*Intervenant

Temporal niche dynamics during ant invasions

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Résumé

Accurately predicting areas at risk of invasion is crucial to managing both current and future biological invasions. Most forecasting models assume that species conserve their climatic niche over time but growing evidence of niche expansion during invasions strongly challenge this assumption. Yet, the timescales over which we expect niches to change remain poorly understood. To our knowledge, no analyses of detailed temporal niche dynamics exist for non-native terrestrial invertebrates despite ranking among some of the world's worst invaders. Ants in particular are highly successful invaders; over 290 ant species have established outside of their native range, where most have shifted their niche. Their ecological success has been associated to the diversity of social traits they can exhibit. In this study, we compiled the year of first observation in a country to retrace the invasion history of twenty-six ant species. To track niche dynamics over time, we recorded measures of niche expansion between the native and invaded range. Our findings reveal various temporal niche dynamics in ants: some species expanded immediately, others gradually, while some showed no expansion at all. Finally, we grouped species with similar patterns in niche dynamics and investigated whether specific social traits differed between groups of interest. Overall, this research aims to develop a deeper understanding of niche dynamics over invasion-timescales and therefore improve forecasts of establishment and spread of non-native species.

*Intervenant

Ant visual navigation: an intriguing mix of rigidity and flexibility.

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Résumé

In 2006, Collett et al. described insect navigation as "an intriguing mix of rigidity and flexibility"-a view strongly supported by research since. Ants, for example, encode visual memories in a surprisingly rigid way: those trained with only one eye cannot recognize the same route when using both eyes, despite having more visual information. They also require the same body orientation during learning and recall, suggesting an egocentric, binocular encoding of scenes. This aligns with how visual input is processed in the mushroom bodies and helps explain the stereotyped movements insects use to learn and recognize views. Yet, this rigidity is balanced by striking flexibility. When one eye is covered, ants can no longer follow familiar routes, but they adapt-within hours, they relearn their environment using the remaining eye. While current models explain the immediate disorientation, they don't capture this spontaneous recovery. It seems ants can re-initiate learning as if revisiting earlier developmental stages. This reveals a key distinction between organisms and artificial systems: animals are not passively built, but actively reconstruct themselves when needed. Understanding this resilience could reshape how we think about behaviour, learning, and the evolution of cognitive systems.

*Intervenant

Communications affichées

Stress toxique et apprentissage : le cas du cadmium chez Formica fusca

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Résumé

La pollution chimique représente une menace croissante pour les êtres vivants, notamment en raison des activités humaines, qui entraînent une augmentation des concentrations environnementales de pesticides et de métaux lourds. Si les effets de ces polluants sur la survie, le développement ou la croissance des organismes commencent à être bien documentés, les conséquences comportementales et cognitives d'une exposition à de faibles doses environnementales restent encore peu explorées, en particulier chez les insectes sociaux. Ainsi, de premières études réalisées sur les abeilles ont permit de mettre en évidence une baisse des capacités d'apprentissage suite à l'exposition à des métaux lourds. Dans cette étude, nous avons évalué les effets d'une exposition chronique à des doses sublétales de cadmium – un métal lourd toxique fréquemment retrouvé dans les sols – sur l'apprentissage chez la fourmi Formica fusca, Des ouvrières provenant de 24 groupes expérimentaux ont été exposées à trois concentrations – retrouvées dans l'environnement – de cadmium différentes (0, 50 et 100 mg/kg) via leur alimentation. Après un mois d'exposition, leurs capacités d'apprentissage sensorimoteur ont été évaluées dans un labyrinthe à deux choix séquentiels (en moyenne 22 individus testés par condition). Le cadmium étant connu pour ses effets neurotoxiques et pour son influence sur de nombreux traits physiologiques, nous nous attendons à observer une diminution des performances d'apprentissage et de mémorisation avec l'augmentation de la concentration en cadmium. Si ces hypothèses sont confirmées, nos résultats permettront de mieux comprendre l'impact de faibles doses de polluants chimiques environnementaux sur les comportements d'organismes sociaux.

*Intervenant

Olfactory sensitivity and division if labor in the honey bee Apis mellifera

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Résumé

Division of labor is found in many animal societies, with individuals specializing in specific tasks, and thereby enhancing the efficiency of the group. Task specialization is especially present in honey bees (Apis mellifera), in which it depends on the animal's age, but remains also flexible as it is influenced by the social context and the particular needs of the colony. Various models have attempted to explain division of labor, with the widely accepted response threshold model, which postulates that individuals differ in their response threshold to task-associated stimuli.
Division of labor in honey bees relies on an efficient communication system among colony members, with the use of many pheromones involved in almost all aspects of their life, making olfaction a crucial sensory modality for these species. Even if the response threshold model has been extensively studied in the honey bees, especially on the gustatory modality, the role of olfactory sensitivity has remained greatly overlooked.

We are thus testing the hypothesis that differences in olfactory perception lead to task specialization in the honey bee colony. Behavioral assessments using olfactometer will allow to determine olfactory response thresholds to a diversity of olfactory stimuli, including social pheromone compounds, in different worker task groups.

We expect to identify a variation of olfactory detection specific to each worker task groups, in particular to social pheromones, and use these patterns to predict which task a worker will perform in the colony.

*Intervenant

Biogeography of the stingless bee Tetragonisca angustula in northwestern South America and the impact of meliponiculture practices

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Résumé

Stingless bees (Meliponini) are unique to tropical and subtropical areas but more diverse in the Neotropics. Some species thrive in both natural and urban environments and are of great socio-cultural and economic importance. Of all the species in the group, *Tetragonisca angustula* is commonly reared by beekeepers as they are primordial for pollination of native and imported crops and provide honey and wax, known for their medicinal properties.
In Colombia, the rising interest for the beekeeping of these species raises questions about management practices on the maintenance of this species' populations.

In order to analyze the biogeography of *Tetragonisca angustula* in northwestern South America, managed and wild colonies were collected from 20 sites in Colombia and three sites in Ecuador. Available sequence databases from Peru, Brazil and Venezuela were added to the dataset. At the scale of Colombia, this study aimed to investigate the local and regional influence of management practices on the genetic differentiation between wild and managed colonies, and to determine whether the populations are structured by regions/landscapes.
To this end, variations at Cytochrome Oxydase I (COI) and Cytochrome b (Cyt b) fragments of mitochondrial DNA were analyzed for the colonies studied. Preliminary results show that populations appear to be geographically structured. Local differentiation in the south between wild and managed colonies suggests the possible translocation of colonies from Peruvian and Ecuadorian sites.

*Intervenant

Interplay between individual and collective cognition in ants

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Résumé

Group cognition has been extensively studied in humans, particularly to understand group dynamics and societal functioning. It has been shown that group performance on cognitive tasks is correlated with the cognitive abilities of its individual members. Similar to humans, social insects, such as ants, show complex social organization, which may depend on the cognitive capacities of their members. This study aims to explore and understand the relationship between individual cognitive abilities and collective performance in the ant Formica fusca. Ants were characterized individually for their exploratory activity in an open-field to explore the potential link between exploration and cognition. The same ants were then tested in a spatial navigation task, using a T-maze, to assess their cognitive abilities at the individual level. Following this task, individual ants were ranked according to a learning score and assigned to two different groups: either "high cognitive performance" or "low cognitive performance." These groups had to solve three collective tasks: finding food in a maze, detecting and acting upon the presence of an intruder near their nest, and relocating to a new nest. We predict that "high cognitive performance" groups will perform better in collective tasks than "low cognitive performance" groups. Studies in humans suggest that the cognitive profile of individuals forming a group influences its performance, with effects depending on the type of task. Investigating these dynamics in ants may give further insight into collective intelligence in highly social species.
Key words

Individual cognition ; group performances ; personality ; social insects

*Intervenant

Species delimitation for a male-only clonal lineage of ants

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Résumé

Messor ibericus exhibits a unique reproductive strategy in which queens must clone males of another species, *Messor structor*, to produce the worker caste. Thus, in addition to mating with males of their own species, *M. ibericus* queens also reproduce with *M. structor* males, which they subsequently clone. Consequently, *M. structor* males exist in two forms: "wild" males found in *M. structor* colonies and "clonal" males residing within *M. ibericus* nests. These two types of males are genetically and morphologically distinct. To determine whether clonal males should be considered a lineage of *M. structor* or a distinct species, we conducted several analyses (calculation of the Fst fixation index, species delimitation, population structure analyses etc)
While empirical data indicate that clonal males rarely mate with wild-type *M. structor* females, species delimitation and structure analyses show no significant separation between the two groups. Their intertwined origin, low Fst, low genetic divergence, and high historical gene flow all support the conclusion that clonal males belong to *M. structor*, despite their morphological differentiation. Their low current hybridization rate with wild-type females may be explained by reduced mating opportunities due to their recent "domesticated" condition within *M. ibericus* nests. Low genetic differentiation but high morphological difference compared to wild counterparts echoes typical cases of domesticated species, which suggests that clonal males may be considered as a domesticated lineage of *M. structor*.

*Intervenant

Nids-pièges artificiels : une méthode simple et efficace pour étudier la diversité des organismes associés aux fourmis arboricoles

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Résumé

Les colonies et les nids de fourmis représentent une ressource importante pour de nombreux autres arthropodes qui ont développé des stratégies particulières pour infiltrer leurs sociétés. Cependant, les organismes associés aux fourmis arboricoles restent peu étudiés à cause de la difficulté d'accès aux colonies hôtes. Nous avons testé des nids-pièges artificiels en bambou comme outils permettant d'accéder à cette diversité méconnue. En 2023, pendant la saison des pluies, 128 nids-pièges présentant deux tailles de cavité intérieure (petite ou grande) ont été placés sur des arbres, à 0.4 ou à 2 m de hauteur, dans deux sites peu perturbés représentatifs de la forêt tropicale semi-décidue de la péninsule du Yucatan, au Mexique. Après 12 semaines, 26,8 % des nids artificiels étaient occupés par dix espèces de fourmis (principalement *Camponotus* et *Crematogaster*). La plupart des nids-pièges occupés par les fourmis (75,8 %) abritaient des organismes associés (Acari, Collembola, Araneae, Hymenoptera, Coleoptera, Blattodea et Diptera), avec une prédominance d'acariens (dans 69,7 % des colonies). Une colonie de *Crematogaster curvispinosa* hébergeait des larves de coléoptère (Monotomidae), et des immatures de *Camponotus cressoni* et de *Neoponera crenata* étaient parasités par des guêpes Eucharitidae. Les fourmis ont rapidement colonisé les nids artificiels avec leur faune associée, révélant une espèce de fourmi non observée avec d'autres méthodes d'échantillonnage. Les nids-pièges semblent bien constituer une méthode complémentaire simple, peu coûteuse et utile pour évaluer à la fois la richesse des fourmis et la diversité des organismes qui leur sont associés dans différentes strates de la canopée.

*Intervenant

Can bumblebees learn to differentiate neutral and negative foraging options?

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Résumé

As pollinators, bumblebees (*Bombus terrestris*) face daily challenges when foraging. Learning and choosing among an array of options of varying attributes in a complex environment is a difficult task. It has been shown that the choices performed by bees depend on a number of factors, such as innate preferences, the learned value of each option, or the context. However, it is still unclear how targets associated to different values are treated behaviourally, in particular when bees receive non-rewarding feedbacks that could be perceived as neutral or negative. To investigate this issue, we subjected bumblebees to a context in which they could choose between positive, neutral, and negative feedbacks associated to coloured targets. We show that bumblebees walking in a complex closed-loop virtual environment can be differentially conditioned to multiple targets. Bees successfully associated each colour with either a reward (sugar solution), a punishment (quinine), or a neutral feedback (water). They learned to choose rewarded targets more often than the others, and neutral targets more often than punished ones, at least for some combinations of colours and values. We conclude that bees can discriminate neutral and negative values, but that perception or decision-making processes might be impacted by the context or by which specific colours are associated with the different values. We propose potential mechanisms and discuss the ecological relevance of distinguishing non-rewarding feedbacks.

*Intervenant

Hornet workers are attracted by venom gland volatiles whatever their colonial origine

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Résumé

The invasive Yellow-legged hornet (*Vespa velutina nigrithorax*) poses significant ecological threats, particularly to honeybee populations and biodiversity in Europe. This study explores the chemical communication of *V. velutina*, focusing on the alarm pheromone molecules contained in the venom gland and their potential attraction for workers. Using Y-tube olfactometer assays, we evaluated worker hornets' preferences for the content of the venom gland from intra-colonial versus inter-colonial sources and compared these signals to an appetitive stimuli like honey. Results demonstrated a significant attraction to venom gland signals, but no significant preference for intra-colonial over inter-colonial signals. Interestingly, venom gland cues elicited stronger responses than honey, underscoring their potency in triggering behavioral reactions. These findings highlight the importance of venom-derived signals in *V. velutina*'s communication and suggest potential applications in pest management through the development of targeted attractants.

*Intervenant

Stratégies individuelles de fourragement et efficacité au niveau de la colonie : résultats préliminaires

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Résumé

Dans de nombreuses espèces d'insectes sociaux les colonies récoltent la nourriture par le biais d'ouvrières qui fourragent solitairement, c.-à-d. utilisent exclusivement leur connaissance individuelle de l'environnement et ne communiquent pas avec les autres fourrageuses. Comment les colonies exploitent-elles leur habitat de manière optimale dans ce contexte ? Comment ajustent-elles l'effort de fourragement à la richesse en ressources des diverses régions de leur aire de fourragement ? Comment minimisent-elles la concurrence entre ouvrières ? Un modèle multi-agents explore ces questions en mesurant le succès de stratégies de fourragement qui diffèrent par la capacité des fourrageuses à mémoriser l'emplacement de patchs riches en ressources. Selon les stratégies, chaque fourrageuse mémorise (1) les emplacements exacts des n derniers patchs où elle a récolté de la nourriture, (2) l'emplacement moyen des n derniers patchs où elle a récolté de la nourriture, (3) n patchs aléatoirement, ou (4) un patch aléatoirement. Les résultats préliminaires suggèrent que mémoriser l'emplacement d'au moins un patch est nécessaire à la bonne exploitation de l'habitat. Mémoriser plus d'un patch augmente la performance pour la stratégie mémorisant l'emplacements exacts des patchs, jusqu'à atteindre un plateau, mais diminue la performance pour la stratégie mémorisant l'emplacement moyen des patchs. La répartition spatiale des patchs semble avoir peu d'effet. Ces résultats préliminaires suggèrent qu'une capacité de mémorisation simple des fourrageuses est nécessaire et suffisante pour que le fourragement solitaire soit efficace au niveau de la colonie.

*Intervenant

Dynamiques globale d'invasions des insectes sociaux dans le contexte de la globalisation

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Résumé

L'intensification de la mondialisation depuis deux siècles a entraîné une augmentation rapide des introductions d'espèces exotiques, notamment chez les insectes. Les insectes sociaux, en particulier, représentent un enjeu majeur en raison de leur impact écologique, agricole et sanitaire. Pourtant, les dynamiques historiques d'invasion de ces groupes restent mal documentées à l'échelle mondiale. Nous avons compilé une base de données des premiers cas recensés d'insectes exotiques à l'échelle des pays du monde et depuis l'an 1700. Pour ce faire, nous avons rassemblé et unifié plusieurs bases de données déjà publiés et avons complété ces informations avec une recherche de littérature exhaustive ainsi que les données disponibles sur GBIF. Nous analysons les dynamiques historiques d'invasion à l'échelle mondiale selon les grands groupes d'insectes sociaux (fourmis, abeilles, guêpes, termites). Nous mettons en évidence des disparités géographiques dans le volume d'observations des différents types d'insectes, suggérant un intérêt variable selon les régions. Ces résultats soulignent l'importance de prendre en compte les biais taxonomiques et géographiques pour mieux comprendre et anticiper les futures invasions d'insectes sociaux.

*Intervenant

Des dérivés de nicotine dans le venin des fourmis ?

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Résumé

Les fourmis produisent diverses molécules chimiques, ayant différentes fonctions telles que la reconnaissance coloniale, le suivi de piste, ou encore la défense face à des compétiteurs ou des prédateurs. Dans ce contexte, certaines fourmis de la sous-famille des Myrmicinae ont développé un venin à base d'alcaloïdes, molécules particulièrement décrites dans le règne végétal et utilisées à des fins thérapeutiques, mais largement inexplorées chez les fourmis. Les objectifs de ces travaux de thèse sont de caractériser la diversité alcaloïdique dans les venins de fourmis, particulièrement ceux de la tribu des Stenammini, par une étude métabolomique des glandes à venin en LC-MS/MS, et de déchiffrer leur origine biosynthétique. Les Stenammini ont la particularité de produire des alcaloïdes de la famille de la nicotine dans leur glande à venin, tels que l'anabasine ou l'anabaseine. Ces alcaloïdes nicotiniques connus des plants de tabac ne résultant pas d'une séquestration de composés de l'environnement, leur biosynthèse pourrait être propre à la fourmi, résulter d'un transfert horizontal de gène passé, ou être liée au microbiote intestinal des fourmis. Des fourmis collectées grâce à un projet de sciences participatives ont été disséquées afin d'identifier par LC-MS/MS ces alcaloïdes. De plus, des données transcriptomiques d'*Aphaenogaster senilis,* avec des approches moléculaires d'étude de fonction de gène, permettent d'identifier les enzymes et les gènes clés impliqués dans la biosynthèse de ces composés. Une meilleure compréhension de ces voies métaboliques pourrait permettre d'en apprendre plus sur l'écologie de ces fourmis, leur évolution et ouvrir la voie à de nouvelles molécules médicaments.

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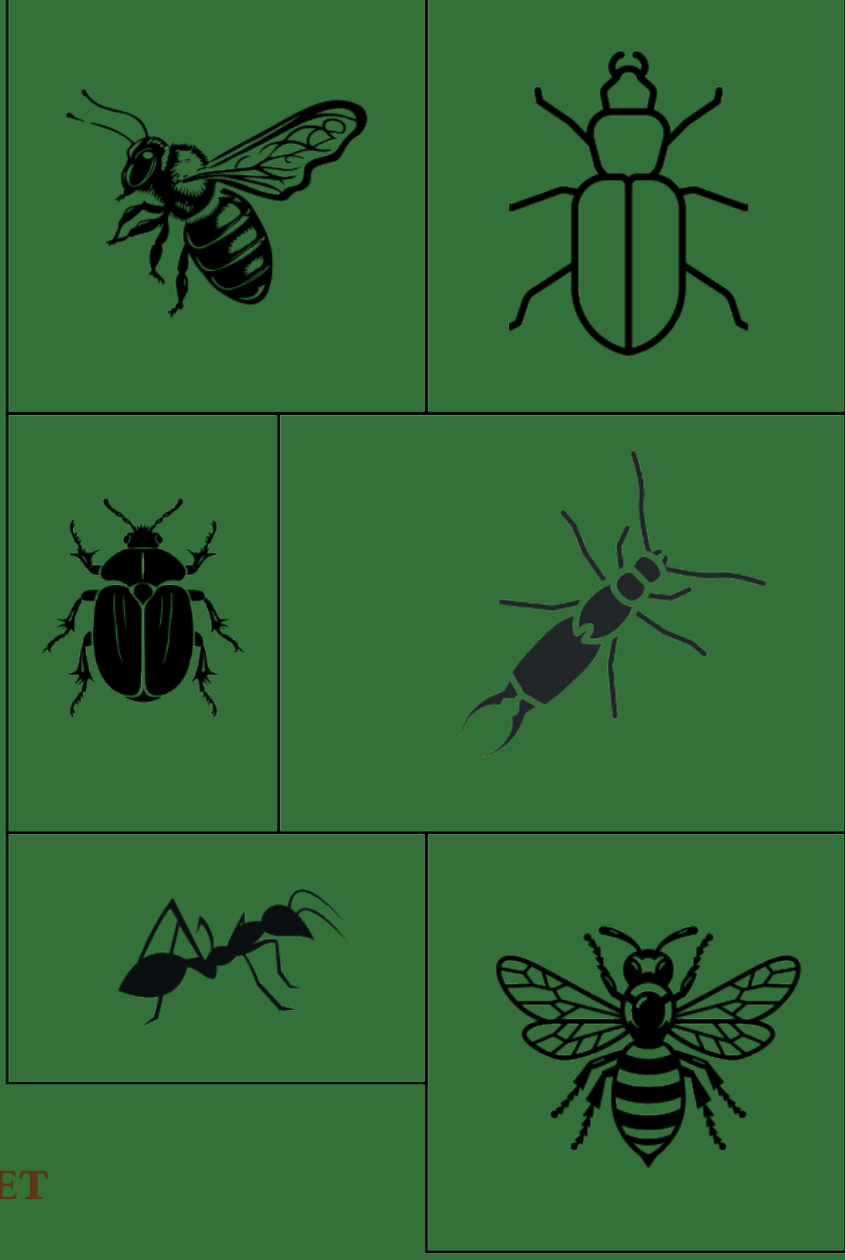

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