Communication in bee colonies

Christoph Grüter

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Zoology studies at University of Bern, Switzerland


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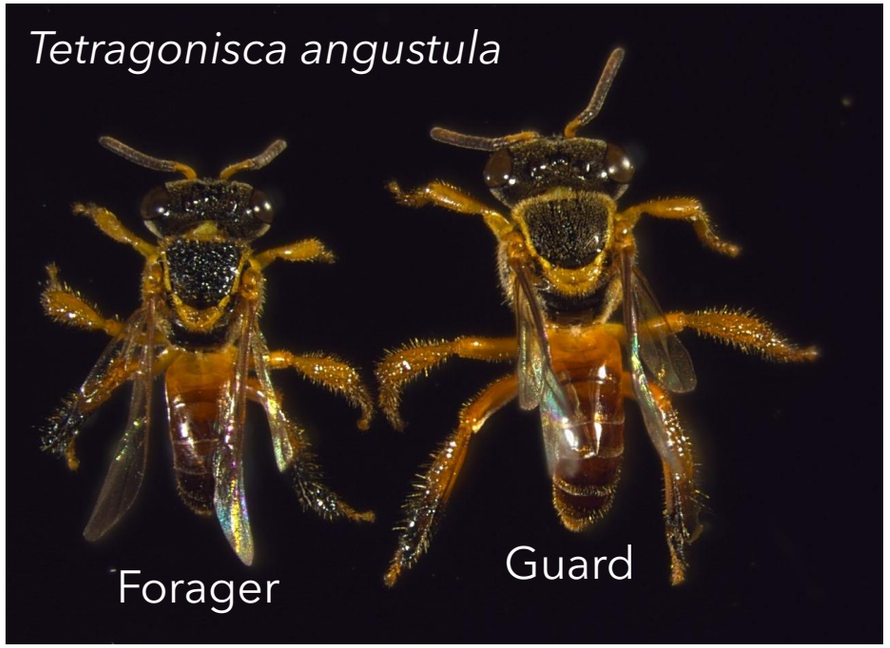
Buenos Aires - Argentina

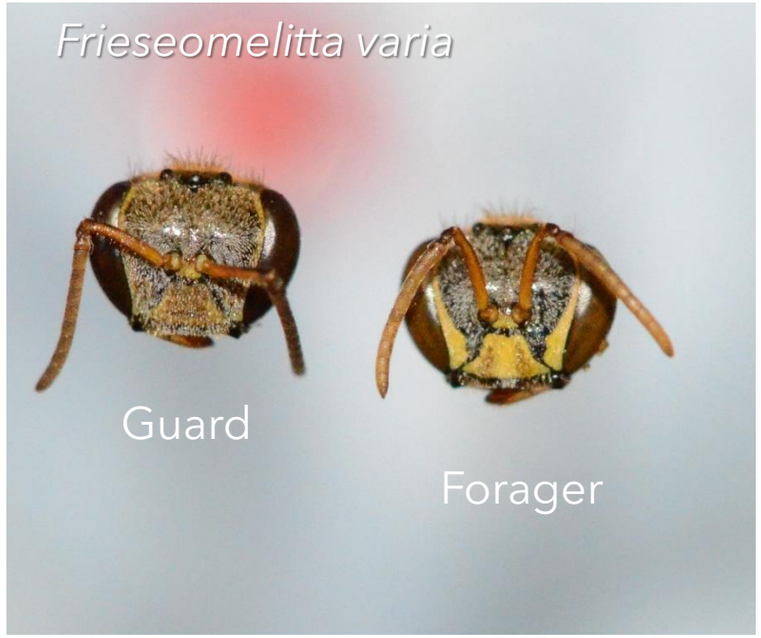

PhD at the University of Buenos Aires (2004-2008)

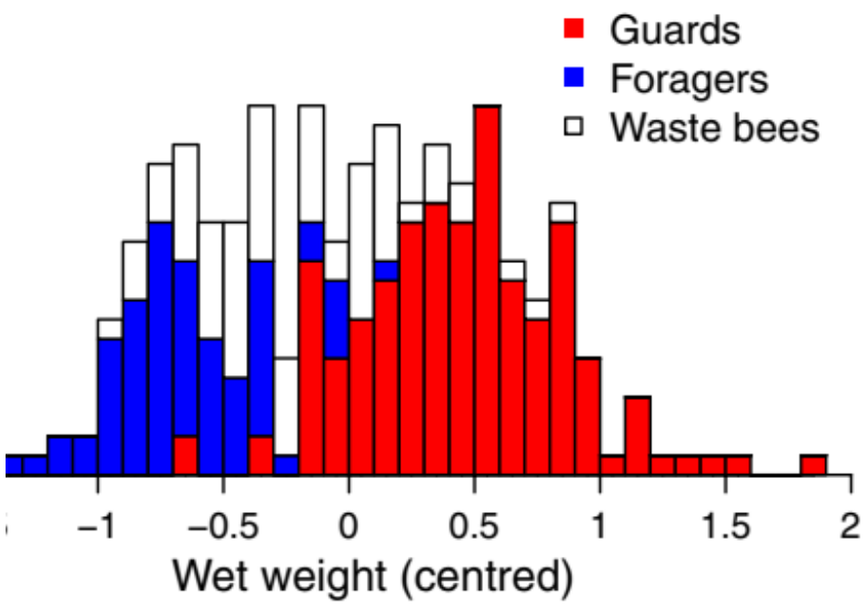

Social learning of flower scents

Postdoc at the University of Sussex (2008-2012)

Prof. Francis Ratnieks



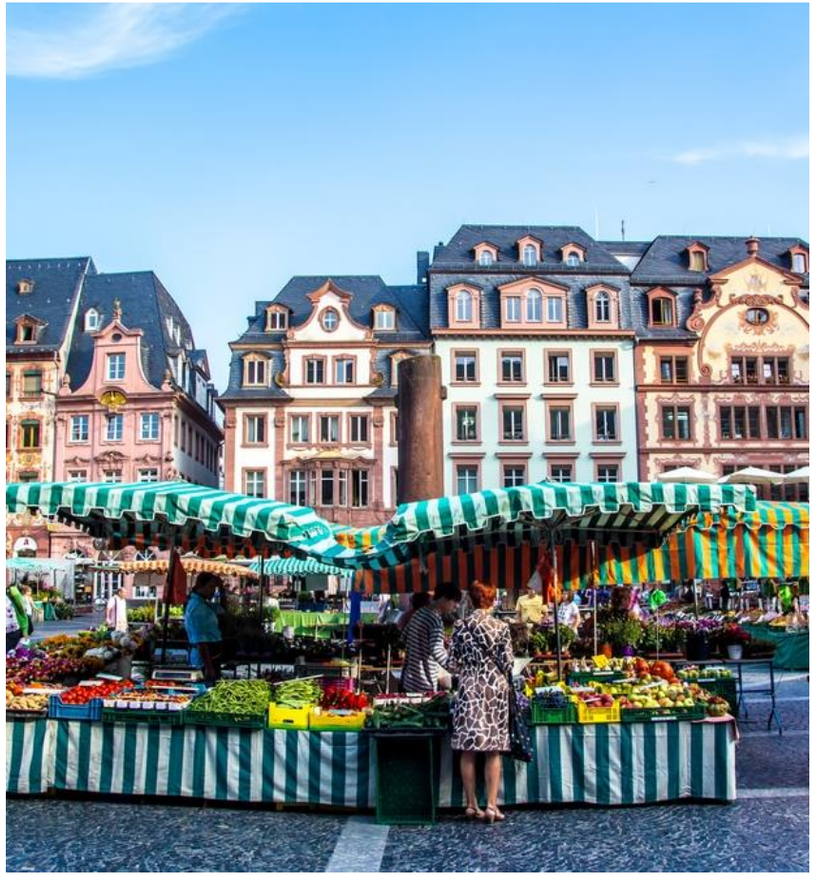




Guards are larger and of different shape
(Grüter et al. 2012 *PNAS*)

First discovery of a "soldier" caste in a bee

Postdoc at the
University of São Paulo
(2012-2013)



Assistant professor at University of Lausanne & Mainz (2013-2020)

Senior Lecturer at University of Bristol
(2020 –)

Outline

I. Dance communication in honeybees

II. Communication in stingless bees

Communication: the basis of society

“Dance language”

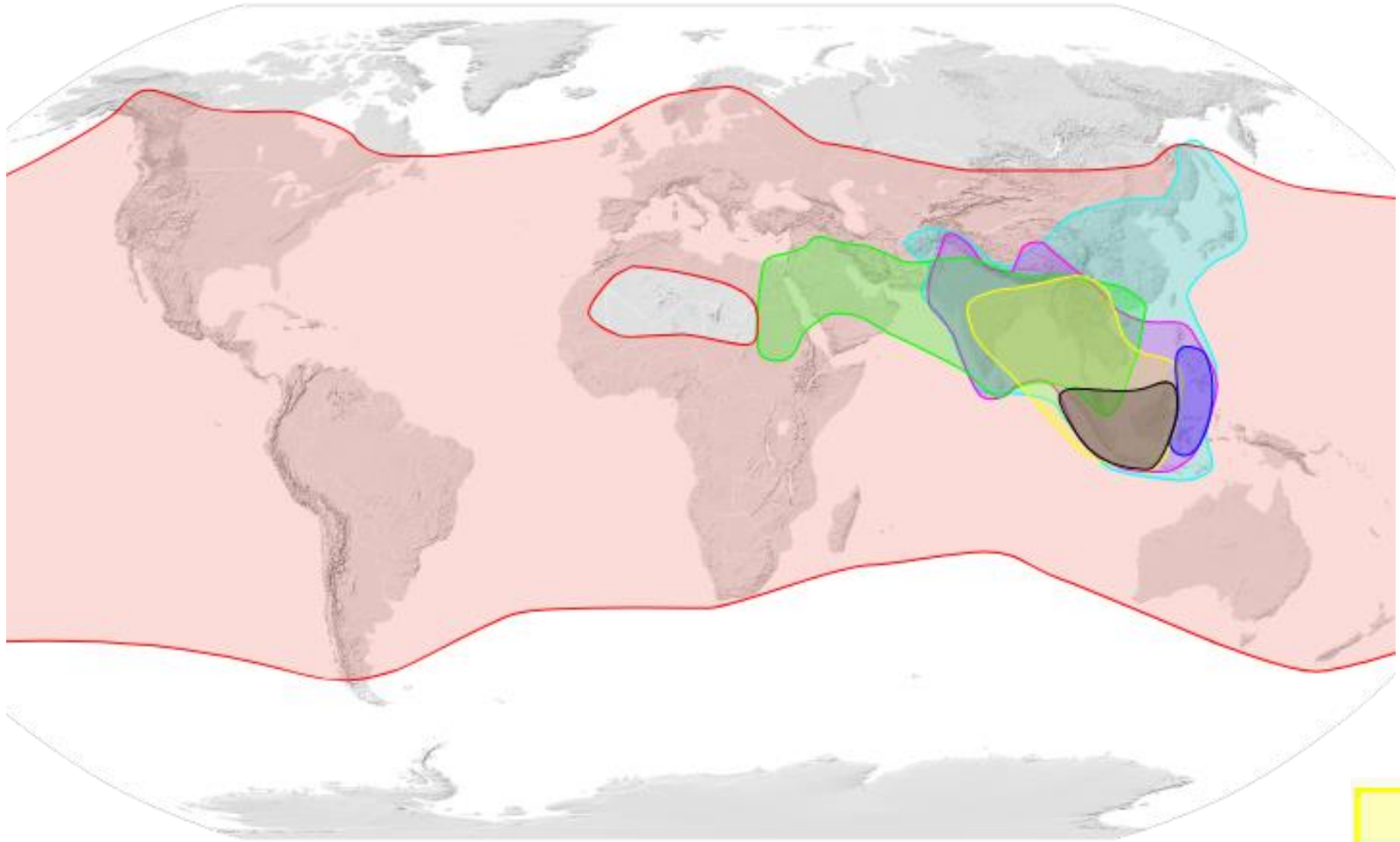
Karl von Frisch

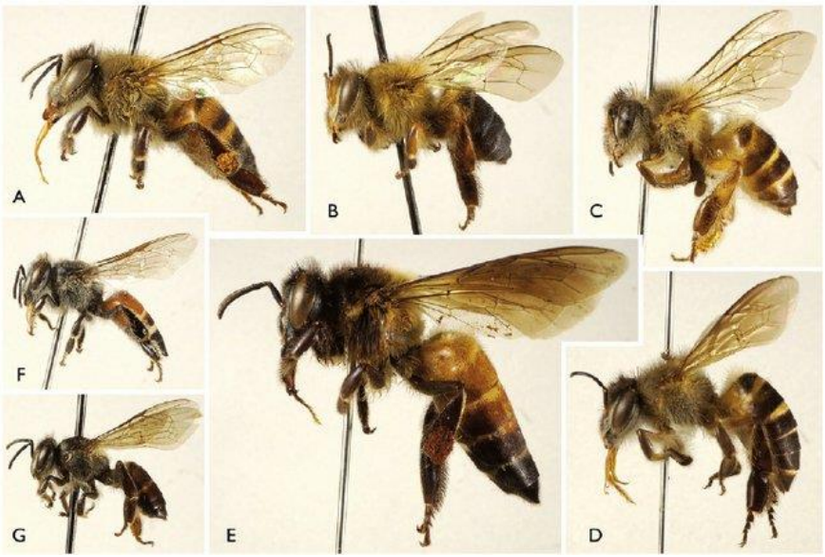
Nobel Prize in 1973

Bees dance for good food sources

Video: Margaret Couvillon

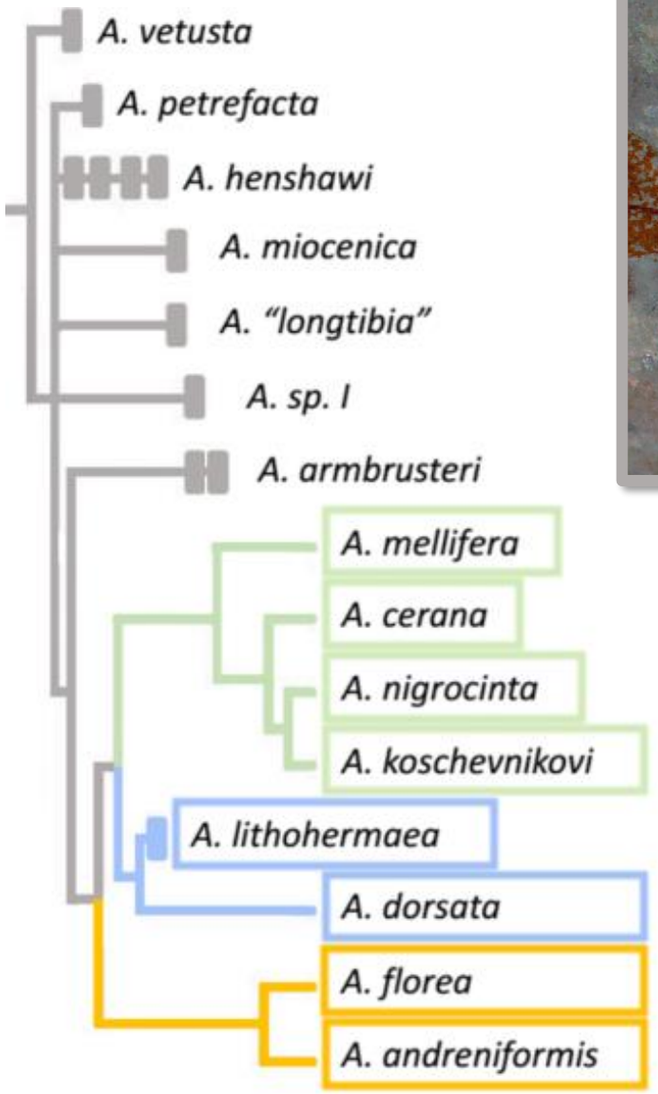
The “dance language” in other honeybees



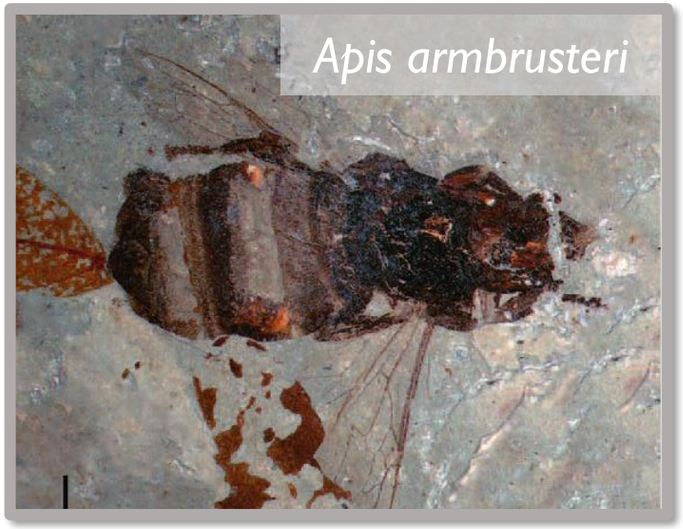


Apis andreniformis
Apis cerana
Apis dorsata
Apis florea
Apis koschevnikovi
Apis nigrocincta
Apis mellifera

The “dance language” in other honeybees

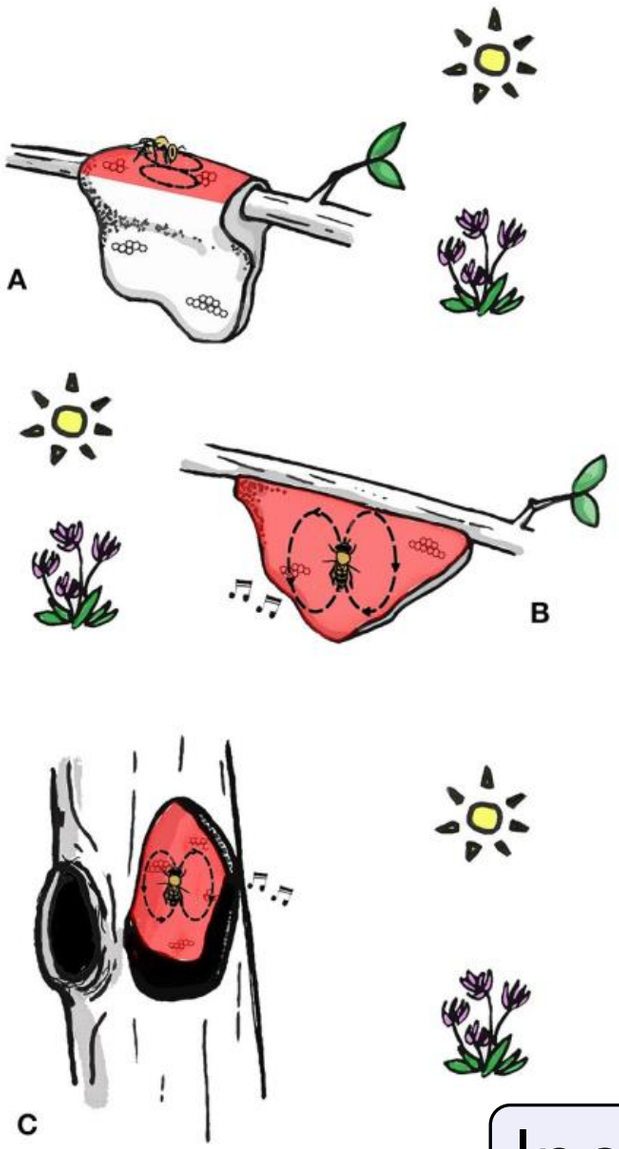


20-30 Mio years



l’Anson Price & Grüter (2015)

The “dance language” in other honeybees



- Dance on **horizontal** surface
- “Silent dances”

- Dance on **vertical** surface
- “**Vibrating** dances”

- **Cavity** nesting
- Dance on **vertical** surface
- “**Vibrating** dances”

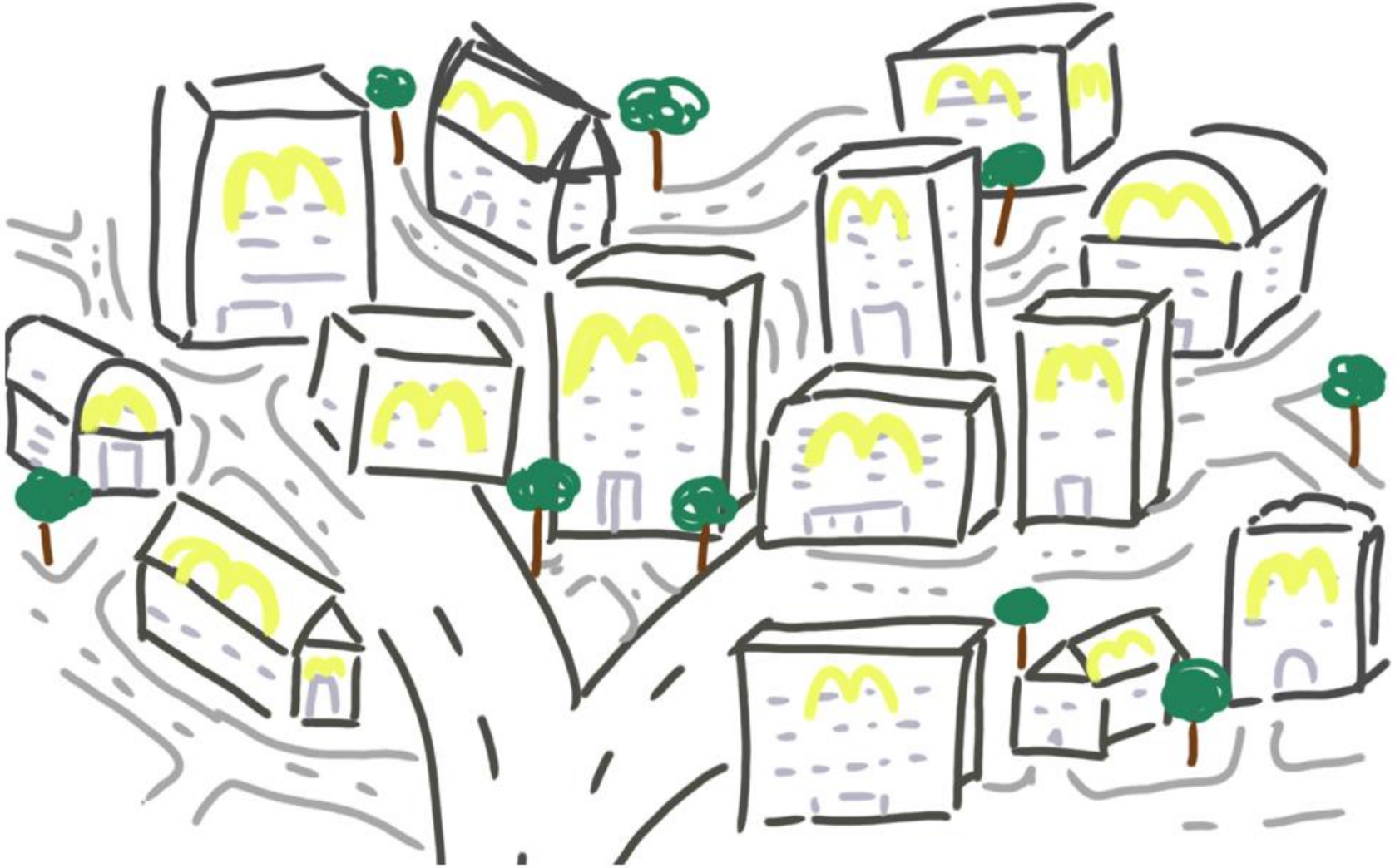
Increasing complexity over time

Many social insects do not communicate food locations

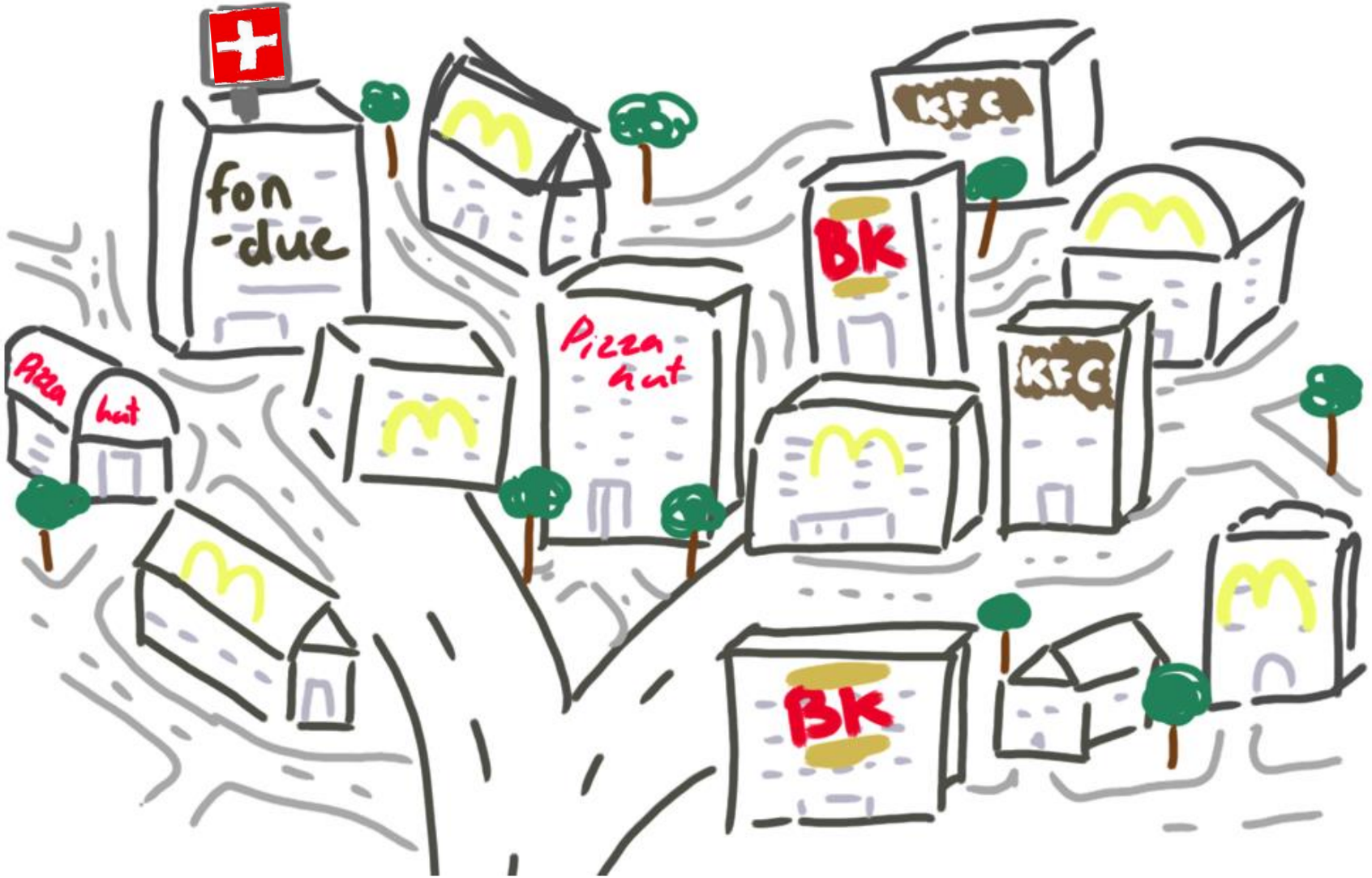
Studies have found that the waggle dance is not beneficial

Is communication in foraging overrated?

When is communication useful?

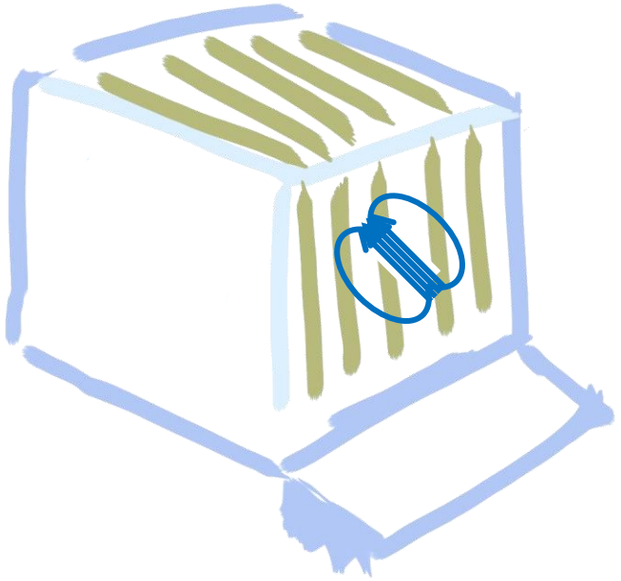


When is communication useful?

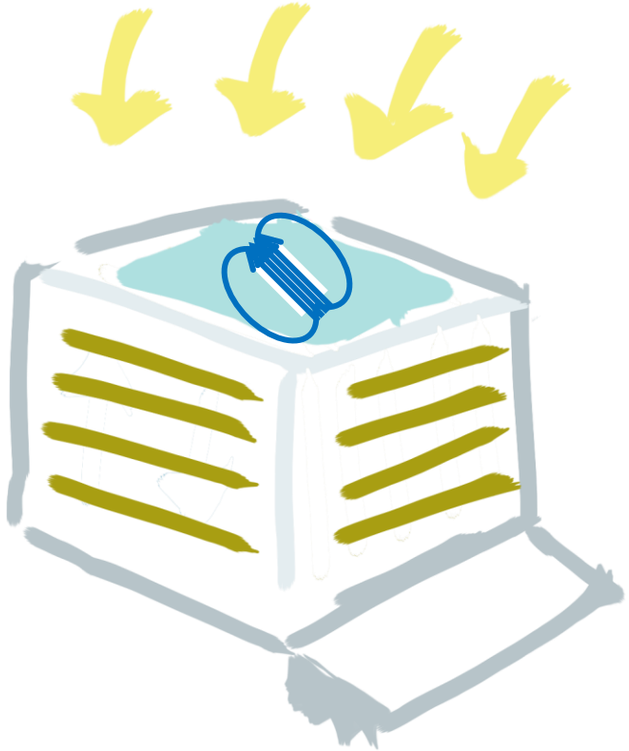


When is communication useful?

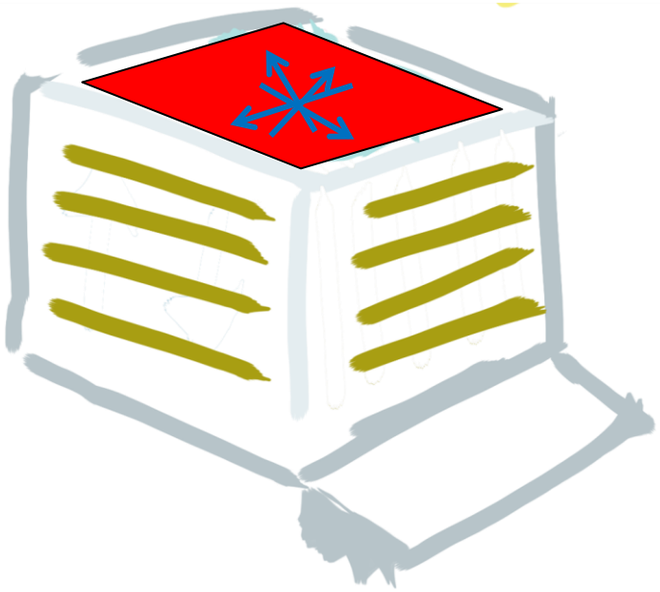
Is dance information useful in modern landscapes?



Oriented dances



Oriented dances



Disoriented dances

Is dance information useful in modern landscapes?

12 colonies: 18 days oriented + 18 days disoriented

Colony success: daily weight change

From June to September in 2014

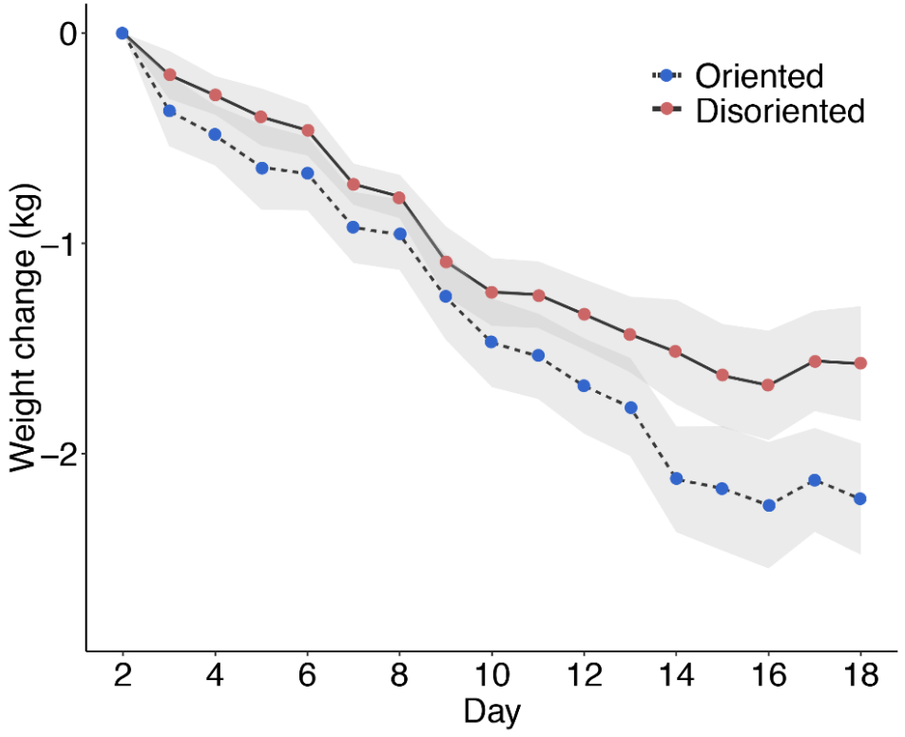

Dr. Robbie I'Anson Price


Automated balances

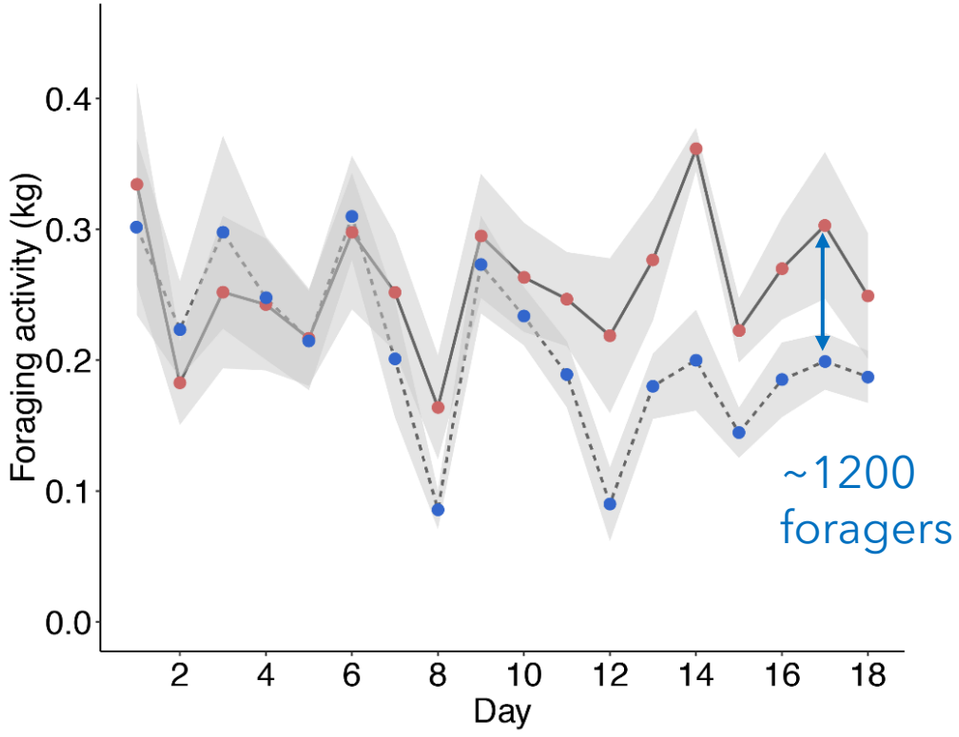

Lausanne, Switzerland

Colony weight change

Colony weight



Foraging effort



Less dance following in disoriented treatment

Bees switched to a more individual foraging strategy

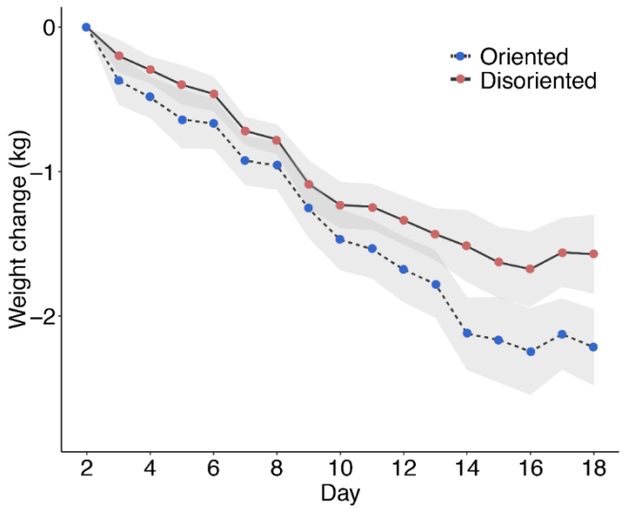
l'Anson Price et al. (2019) *Sci Adv*

Poor foraging conditions

Nectar crop loads were small

Nectar sugar content was low

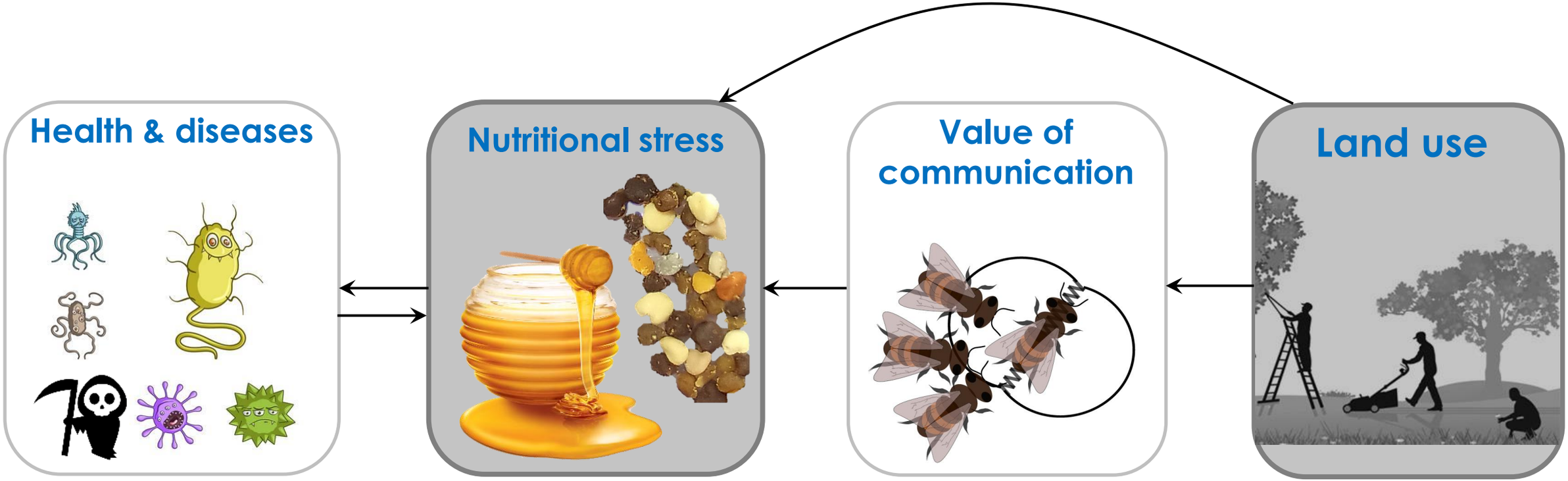
During summer, colonies often lose weight Couvillon et al. (2014), Nürnberger et al. (2017), Timberlake et al. (2019)



Is the dance communication poorly adapted to modern landscapes?

How does *land use* affect bee health & behaviour?

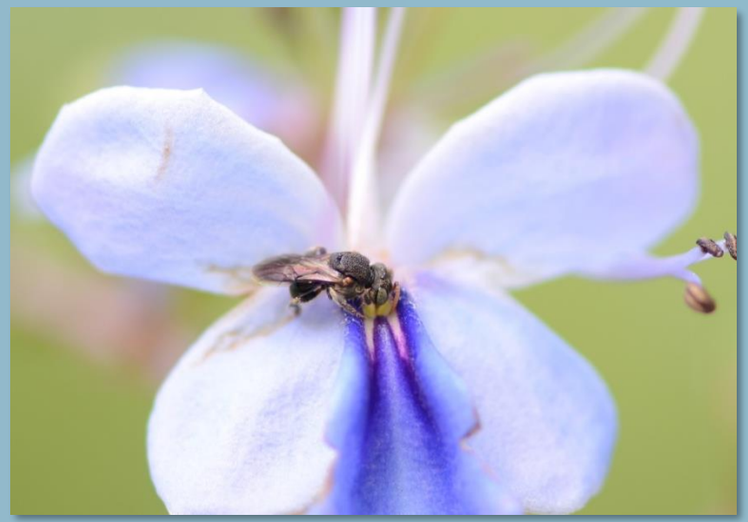
~18 sites that differ in the landscape composition: agricultural, urban and semi-natural land



Stingless bees – a very brief introduction

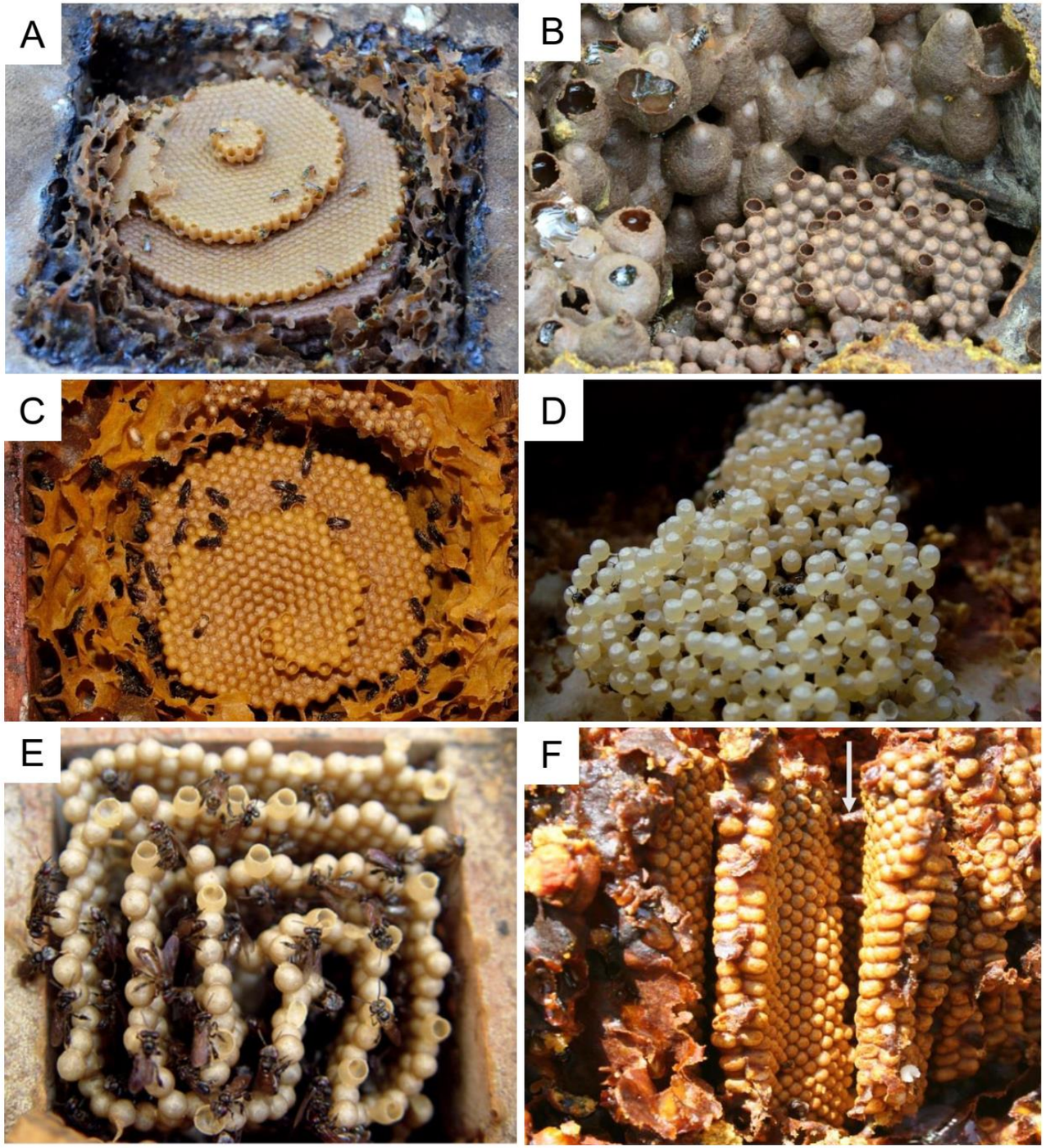


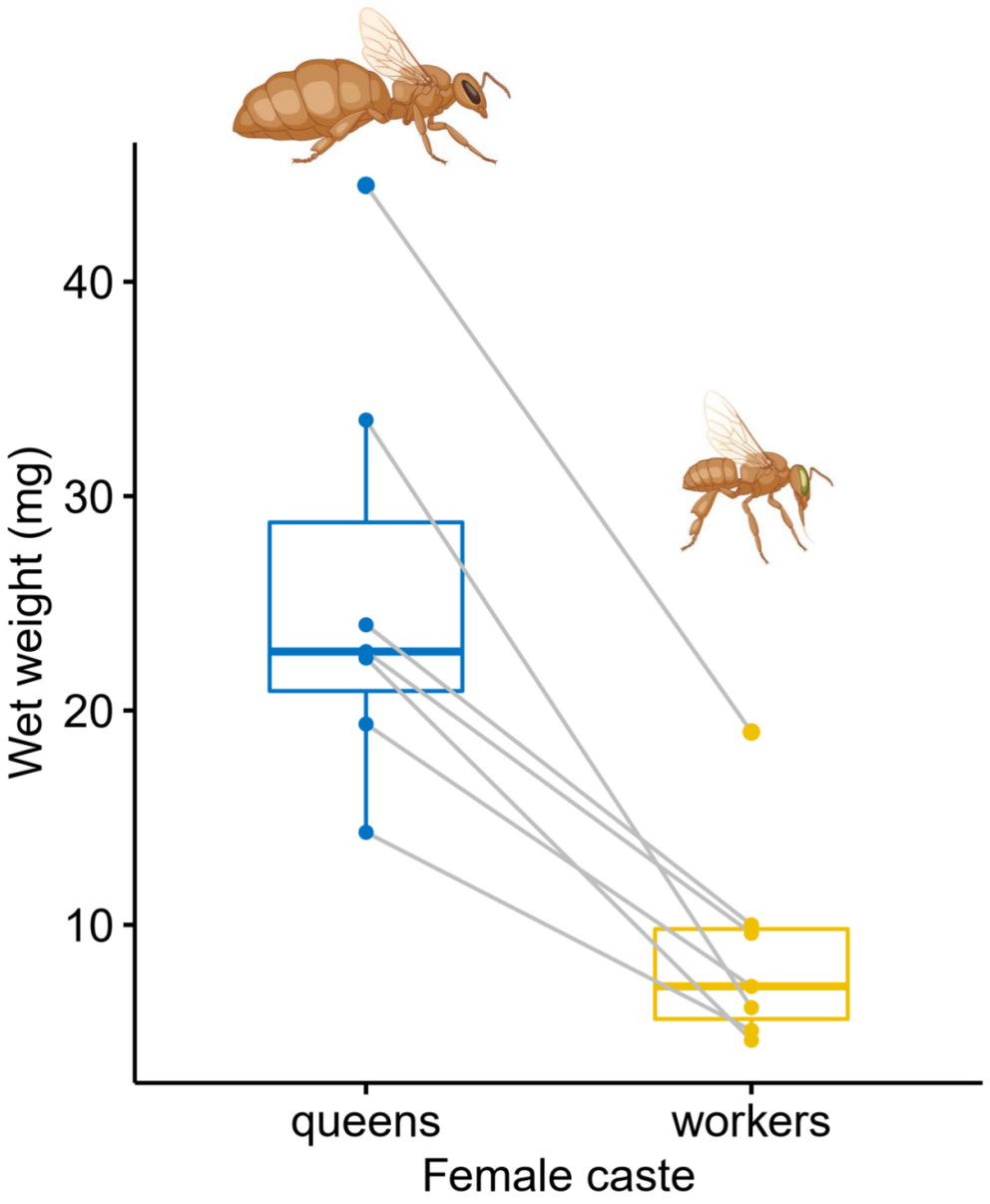


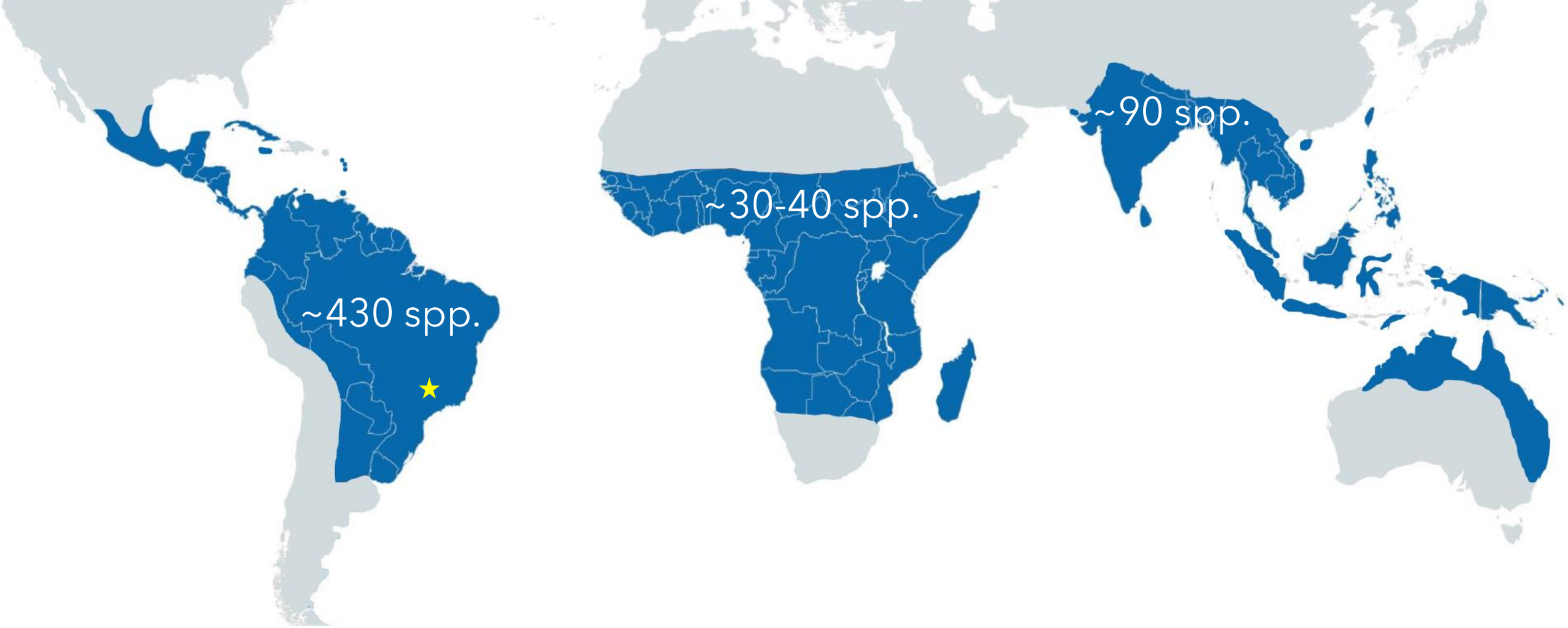


~550 described social, tropical species





Grüter (2020) *Stingless Bees*



Brazil has ~250 species + many undescribed forms

Pedro 2014

Communication in stingless bees: the pioneers

Zeitschrift für vergleichende Physiologie, Bd. 41, S. 405—434 (1958)

Aus dem Zoologischen Institut der Universität München und der Escola Superior de Agricultura „Luiz de Queiroz“ Universidade de São Paulo, Piracicaba

DIE GEGENSEITIGE VERSTÄNDIGUNG BEI DEN STACHELLOSEN BIENEN*

Von

MARTIN LINDAUER und WARWICK E. KERR

Mit 17 Textabbildungen

(Eingegangen am 26. Juni 1958)

Martin Lindauer

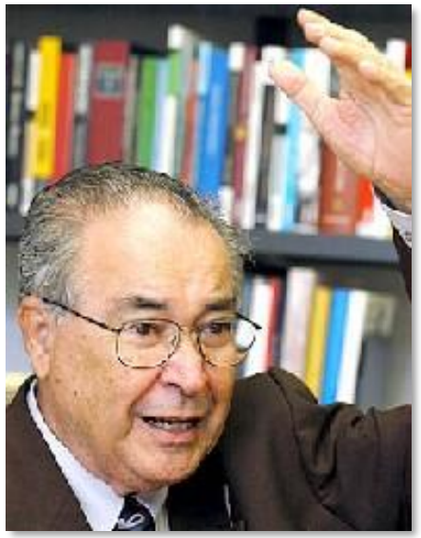
BEE WORLD

Vol. 41 No. 2 FEBRUARY 1960

COMMUNICATION BETWEEN THE WORKERS OF STINGLESS BEES

M. LINDAUER & W. E. KERR

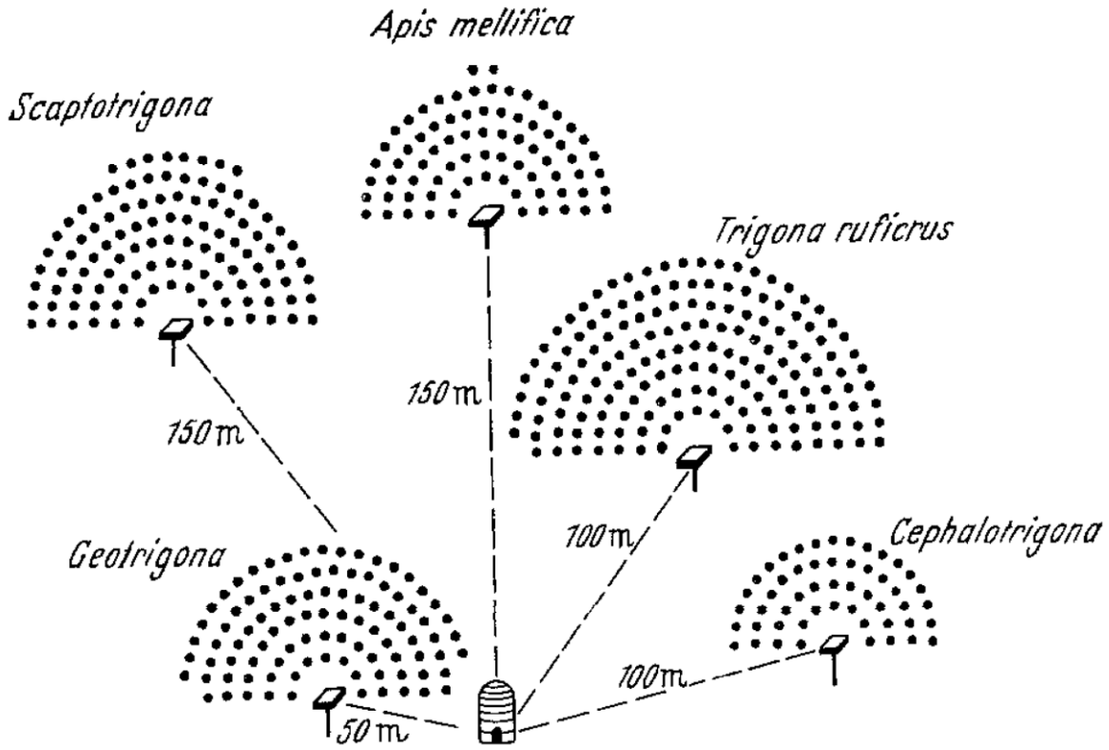
Zoologisches Institut München, Germany (D.B.R.) & Faculdade de Filosofia, Ciências e Letras, Rio Claro, Brazil



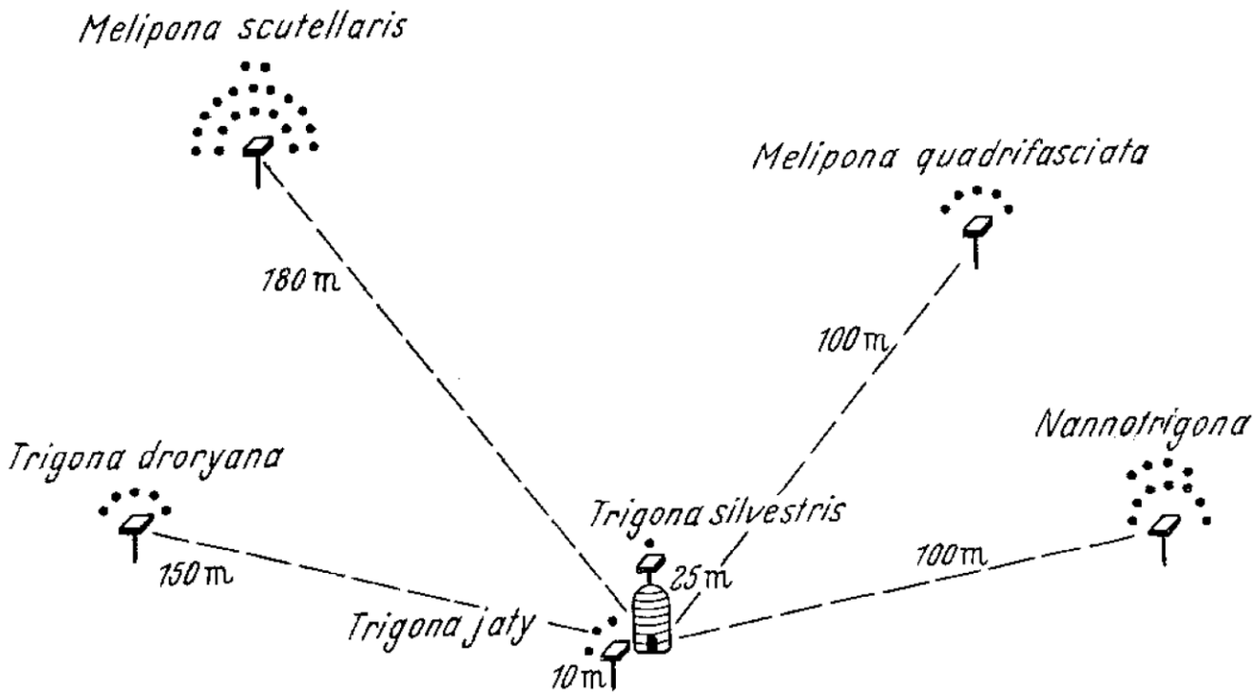
Warwick Kerr

Communication in stingless bees: very diverse

Strongly recruiting species



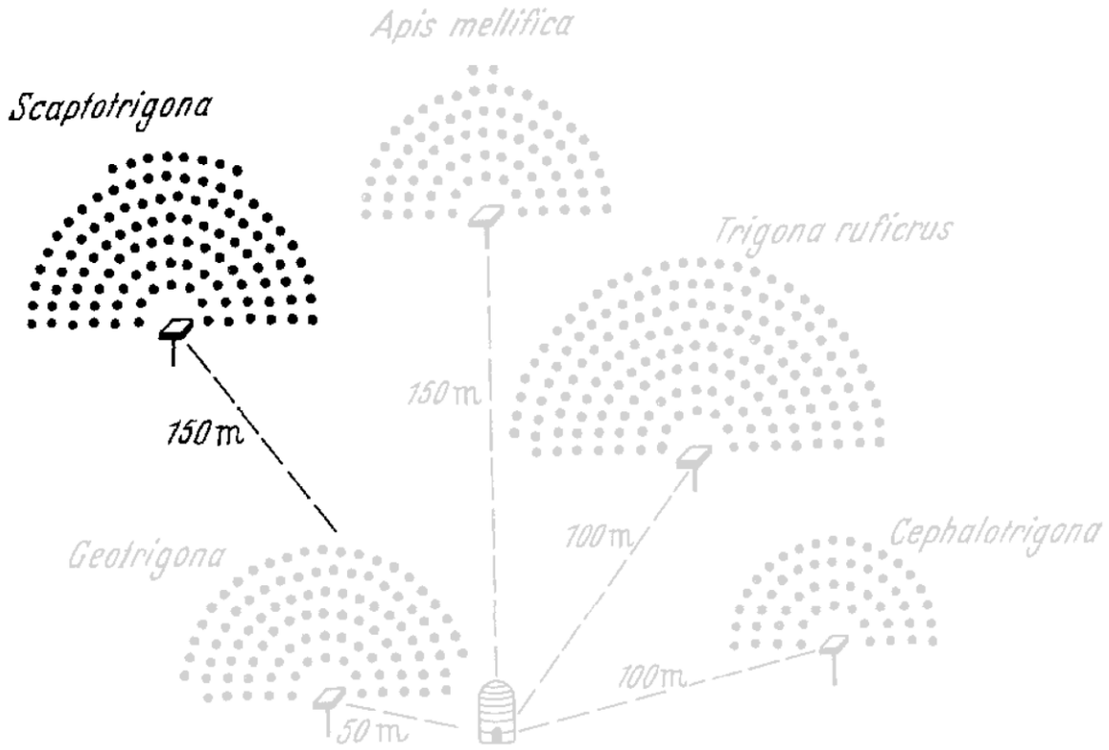
Weakly or non-recruiting species

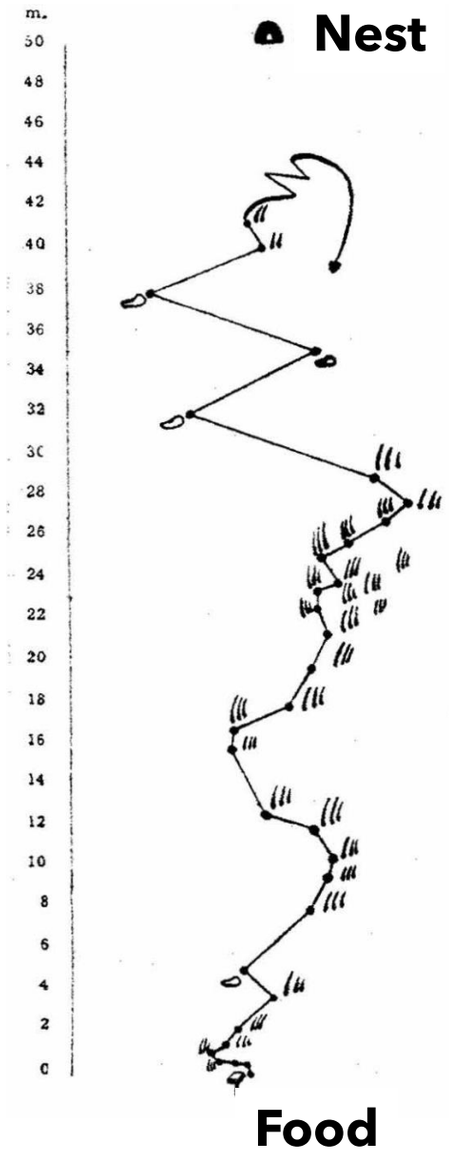


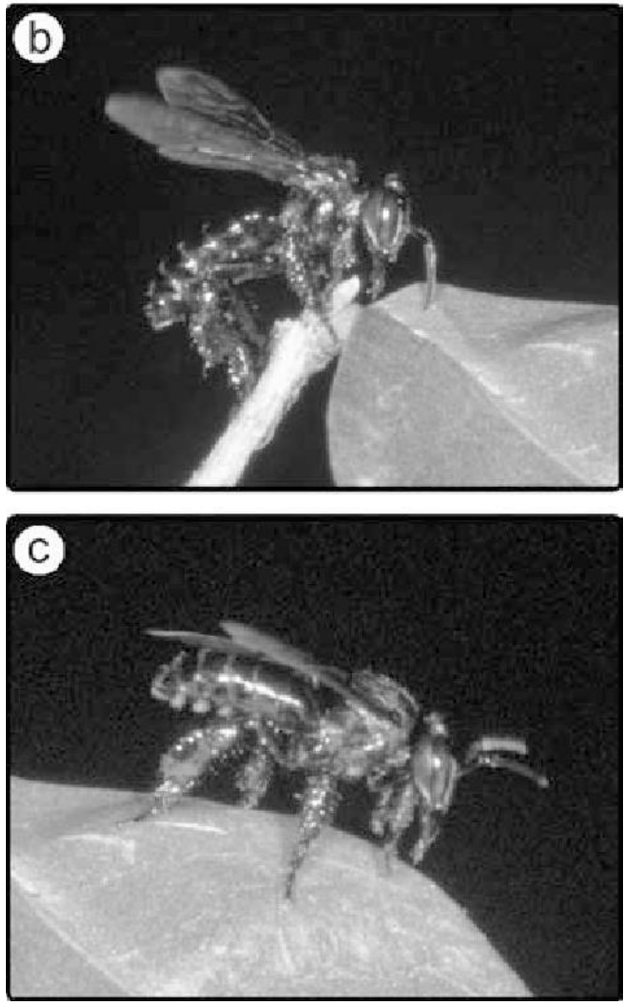
Big **differences** between species

Pheromone trails

Strongly recruiting species

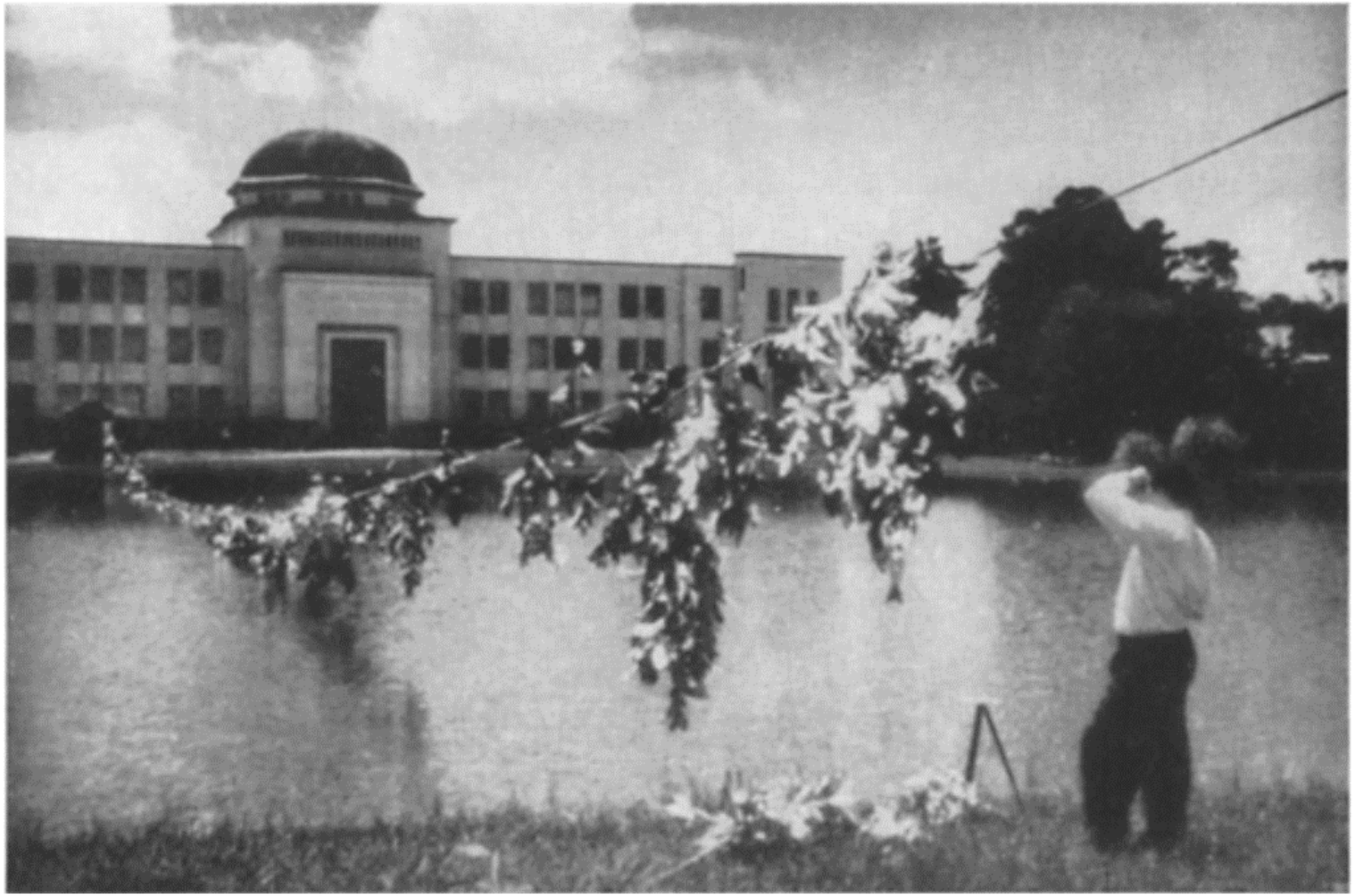




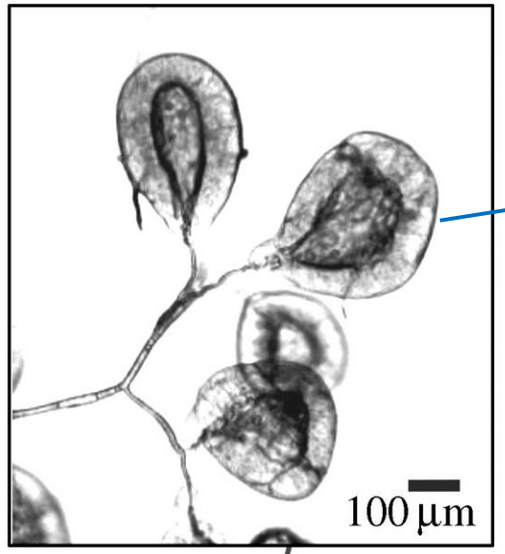


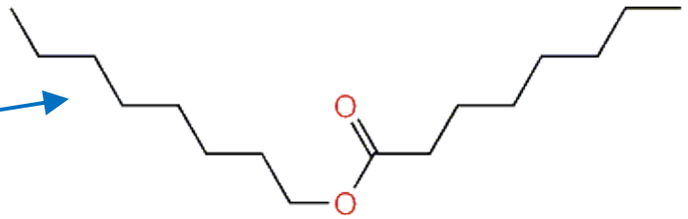
Trigona recursa

The lake experiment



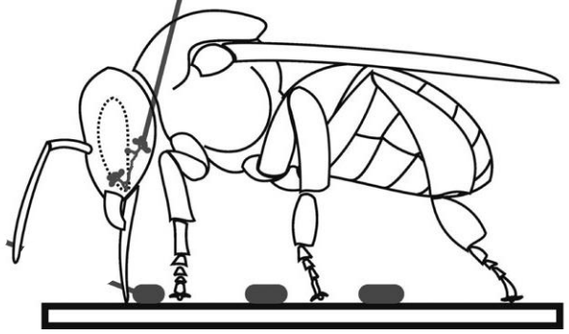
Trail pheromones are produced in labial glands





octyl octanoate

labial glands of the salivary system



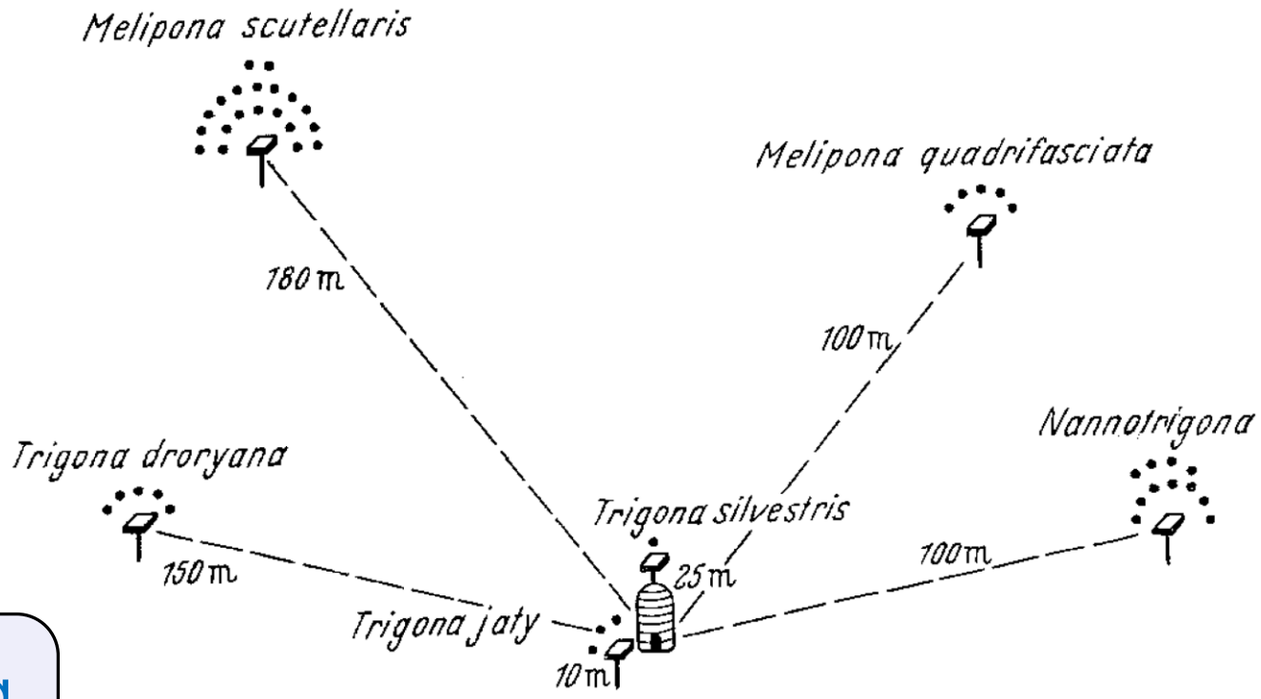
Bees "**spit out**" pheromones

Schorkopf et al. (2007) *Proc B*

Communication in stingless bees: very diverse

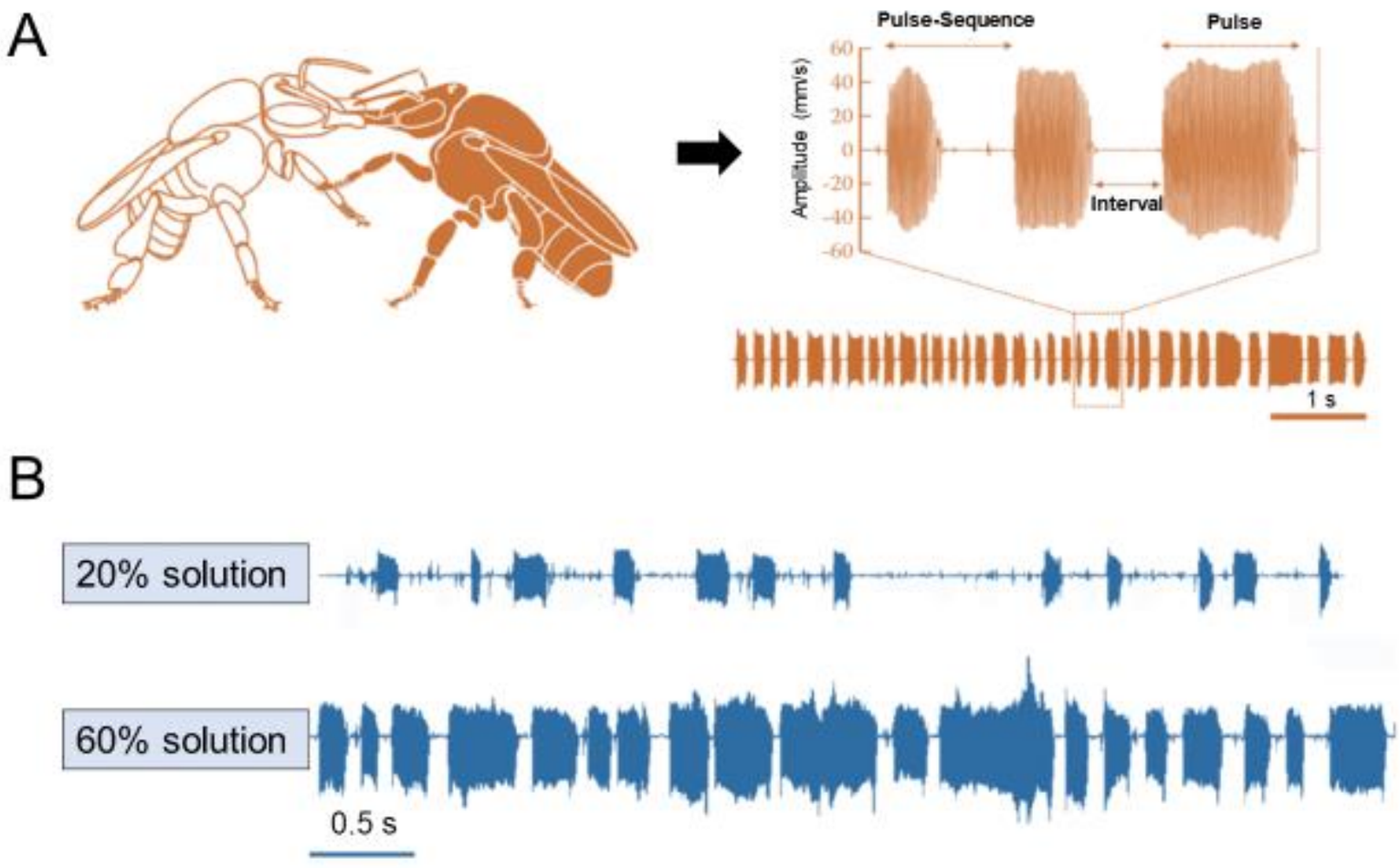
Melipona scutellaris

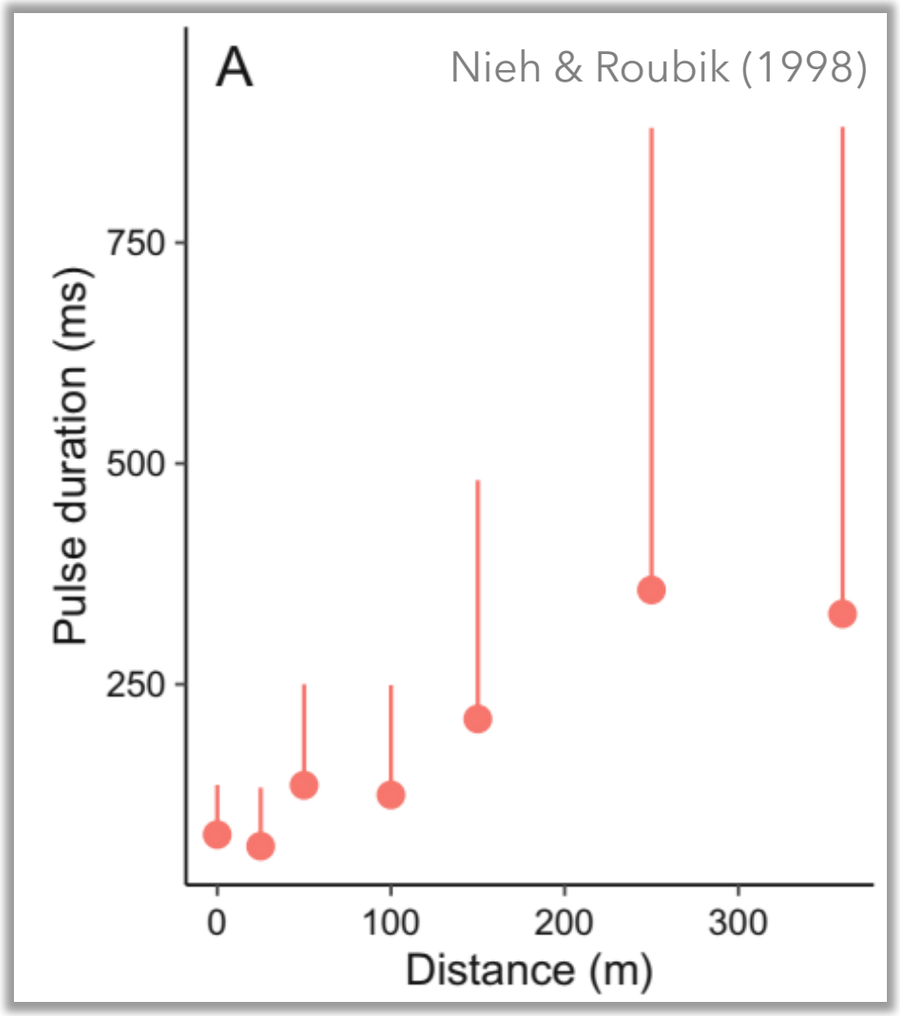
Weakly or non-recruiting species



Melipona bees produce buzzing sounds inside their nest

Communication in stingless bees: very diverse





Pulses could be the "raw material" for the evolution of complex signalling

Take-Home messages

- Bees communicate in different ways
- Honeybees and stingless bees have found different solutions to the same problem
- Communication is not always helpful

Thank you!

University of BRISTOL

- Robbie I'Anson Price (University of Lausanne, Switzerland)
- Francis Ratnieks (University of Sussex)
- Rajbir Kaur (University of Bristol)
- Tianfei Peng (University of Mainz, Germany)
- Anissa Kennedy (University of Mainz, Germany)
- Susanne Foitzik (University of Mainz, Germany)
- Francisca Segers (University of Bristol)

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