

BIOCONTRACT



Explaining the evolution of cooperation
between different species

Mutualisms



Mutualisms pose problems for evolutionary theory

Highly diverse in origins, scale, specificity,
and obligacy of associations

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Mutualisms pose problems for evolutionary theory

Subject to invasion by cheaters and parasites,
but common and abundant in nature



Puccinia monoica rust fungus mimics mustard-family flowers

Roy, B.A. (1993) Floral mimicry by a plant pathogen. *Nature*, 362, 56-58.



Mutualisms pose problems for evolutionary theory

Diverse in origins, scale, specificity, and obligacy of association

Subject to invasion by cheaters and parasites



Mutualisms pose problems for evolutionary theory

Can there be a coherent theory of mutualism?

How do we explain the origin and maintenance of mutualisms?



The state of mutualism theory

By-products

Investing in pseudo-reciprocity

Spatial games/Cooperator association

Partner fidelity feedback

Partner choice



The biological research programme: A menu of **solutions**

By-products

Investing in pseudo-reciprocity

Spatial games/Cooperator association

Partner fidelity feedback

Partner choice



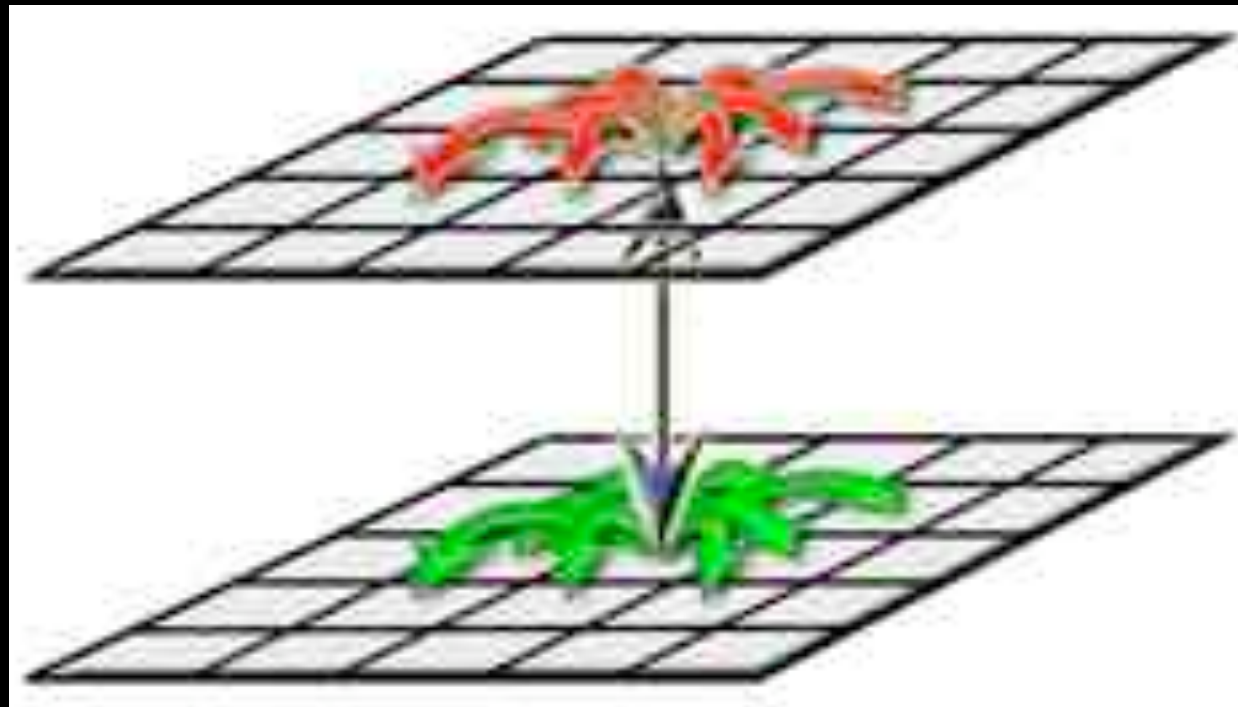
We will concentrate on

Spatial games

Contract theory



Spatial games





Ulf Dieckmann

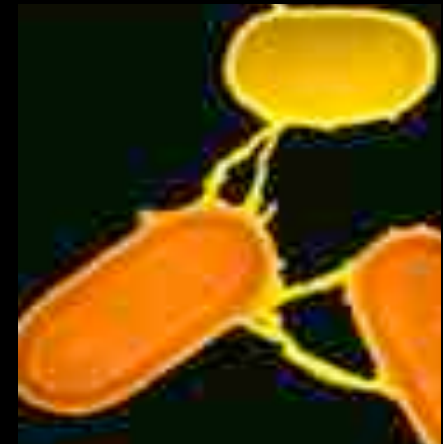
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Collaborative structure



Empiricists

Theoreticians

Post-doc

Phylogenetic analyses
Cross-dating theory



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Spatial games

Contract theory





Economic contract theory





Economic contract theory

Used to model transactions in which either the buyer or the seller has more information than the other



Economic contract theory: 3 Families of Models

Moral hazard

Adverse selection

Signaling



Economic contract theory: A menu of **problems**

Moral hazard

Adverse selection

Signaling



Economic contract theory: A menu of **problems**

Moral hazard

Adverse selection

Signaling



Ant-plant mutualisms





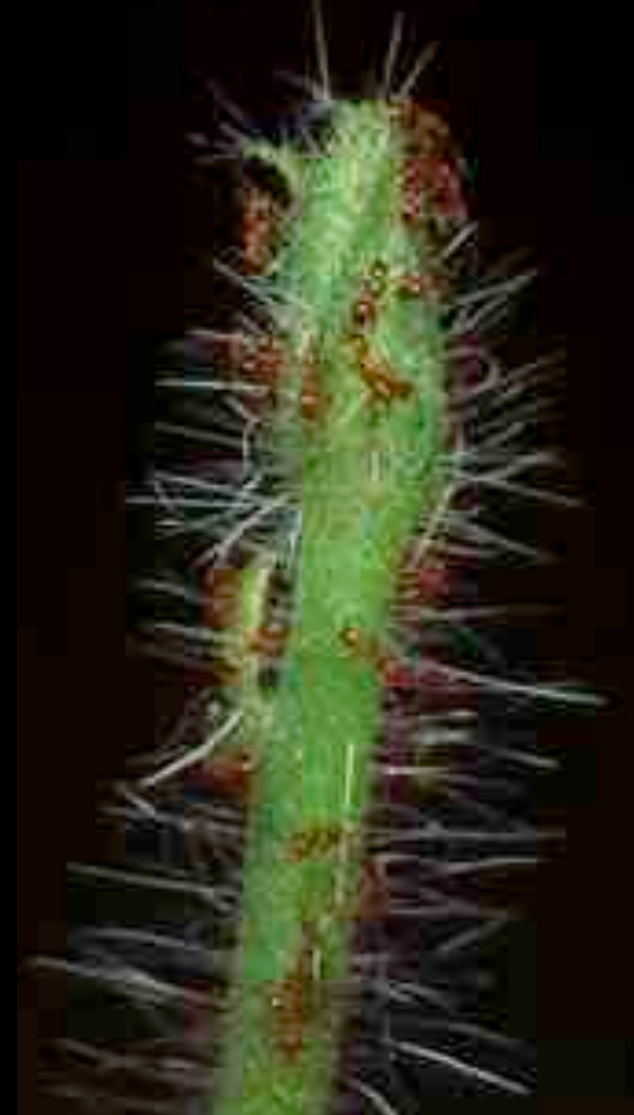
Ants are housed in domatia





The exchange

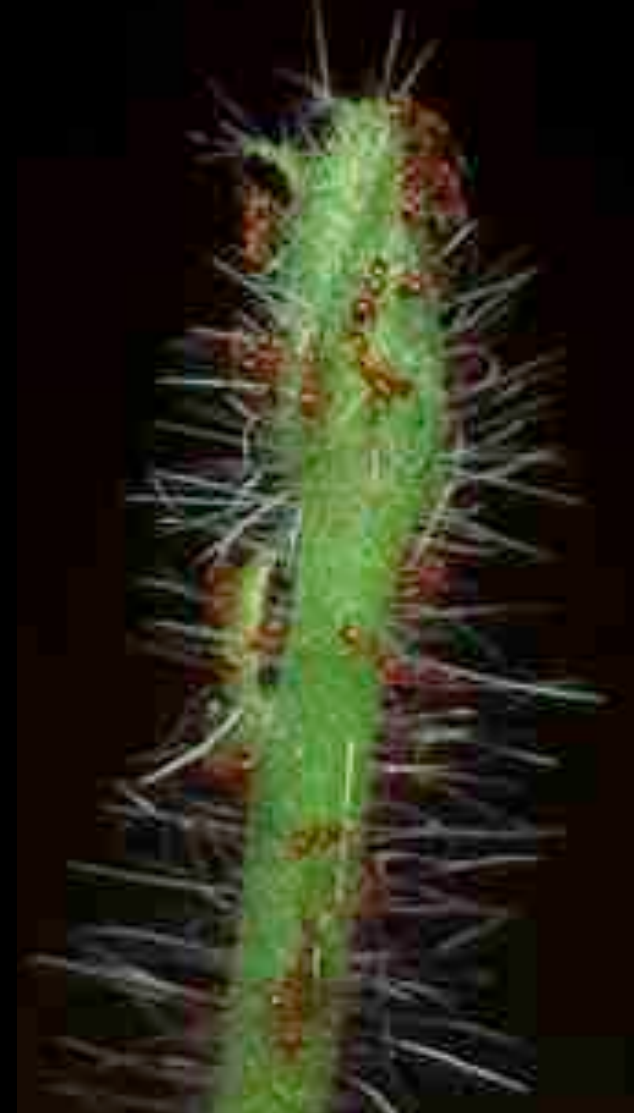
- The plant **employer** pays housing (and food).
- The ant **employees** protect new leaves and shoots.



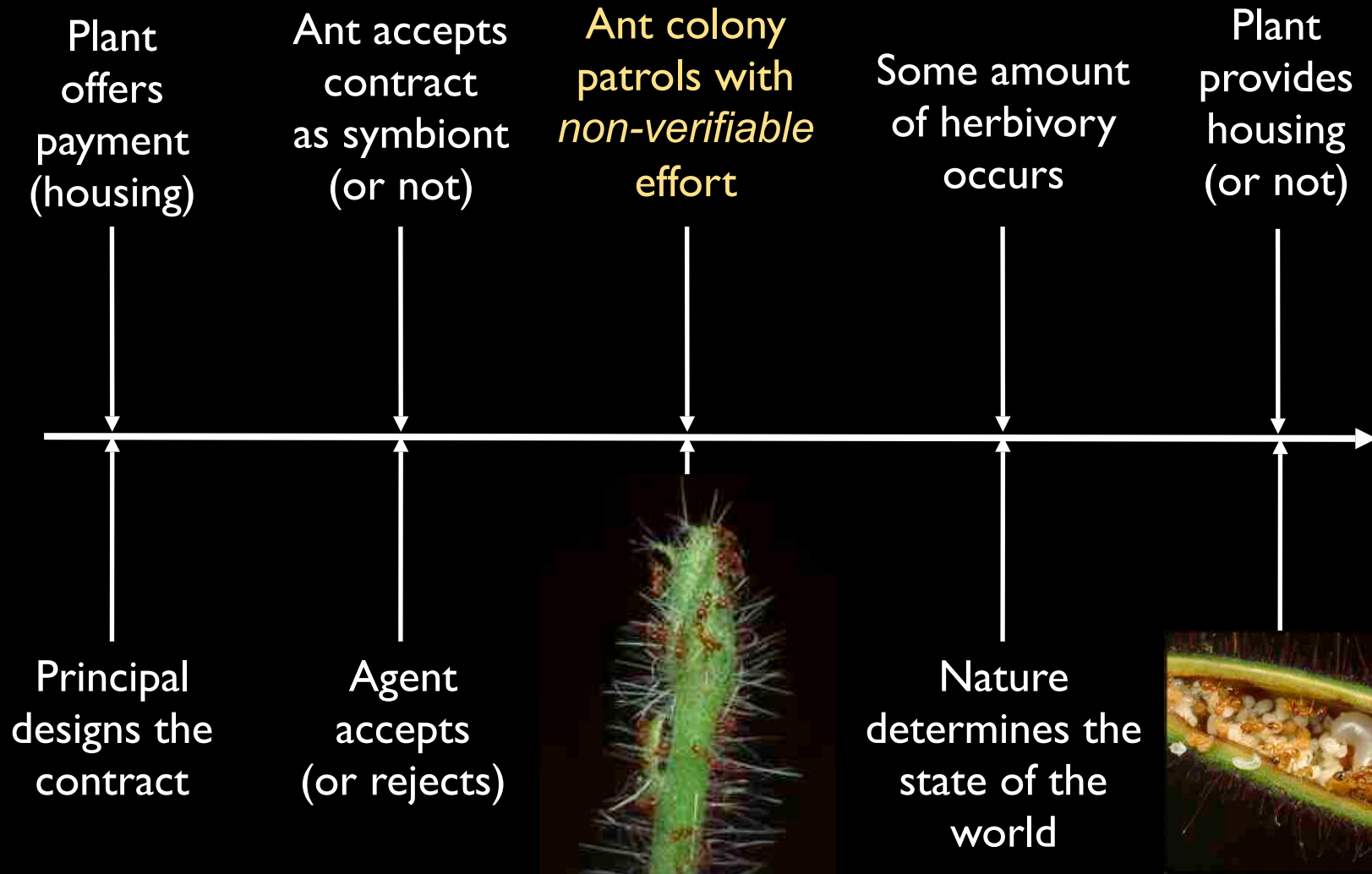


The informational asymmetry

- The ant “knows” whether it is patrolling (or not).
- The plant does not, and so cannot limit rewards only to patrollers.
- The ant’s **actions** are hidden.



Ant-plant mutualisms map onto the **moral hazard** game





80% of “cheated” domatia die within a year





Moral hazard problem solved by paying on a 'verifiable variable' correlated with agent effort.





Economic contract theory

Moral hazard

Hidden actions

Adverse selection

Hidden characteristics

Signaling



The informational asymmetry

- The ant “knows” whether it is an efficient or inefficient defender.
- The plant does not, and so cannot house and feed only patrollers.
- The ant’s **characteristics** are hidden.





Market segmentation





Market segmentation

Excludes the home

Includes the home

Charge less

Charge more

