Behavioral Syndrome

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Behavioral Syndrome: A suite of correlated behaviors reflecting between individual consistency in behavior across multiple (2 or more) situations.

Ex: More aggressive versus less aggressive behavioral types.

Sih et al. 2004, TREE

Behavioral ecology assumes:

Behavioral plasticity is unlimited (individuals can always exhibit the optimum or immediate change) and infinitely reversible.

Developmental Plasticity is often thought to unfold slowly and be irreversible.

Example: having spine as an antipredator trait, they can be stuck with it (even if the predator reduces the feeding efficiency).

What factors responsible for behavioral syndrome?

1) Environments that individuals experience more frequently.

Example: Aggressive behavior is correlated with Antipredator boldness before any experience with predators- Mechanism is learning and increased skill with the predator.

2) Environments with stronger selection per se (stronger effect of focal phenotype on fitness).

E.g. Bold individuals will learn with experience, how to be effective at being bold, which will favor them continuing to be bold, which gives them more experience at being bold, and so on

3) Higher quality environments (i.e. Sources versus sinks).

Ex: Mating context/ Predator-Prey choice.

Types Ecologically important Behavioral syndromes.

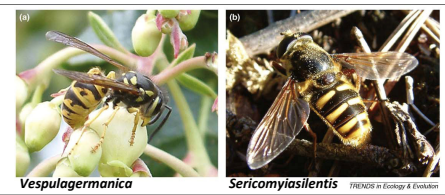
Syndrome

- **Carried across contexts**
- **Exhibited by individuals or groups (spp)**

Behavioral *Types*

- **Trade offs**
- **Aggression Levels**
- **Activity Levels**
- **Shyness / Boldness**
- **Proactive – Reactive**
- **Learning performance**

Trade offs plays a crucial role in explaining many ecological and evolutionary patterns. Speed and Accuracy trade off.



Vespulagermanica ***Sericomyiasilentis*** *TRENDS in Ecology & Evolution*

Time-costly discriminations
Sensory and cognitive ability of predator that are unable to discriminate.

Mimic its predator
They are defense less
More time to escape from predation

Reviewed by Chittka*etal*, TREE 24(7), 2009.

Aggression Syndrome

More aggressive individuals should do well in competitive situations where aggression is favored.

Aggressive individuals might be unsuitably aggressive in CONTEXTS where caution or care are more appropriate.

Example:
Funnel Web Spider, *Agelenopsisaperta*
- **Aggressive Individuals**
  - **– More likely to attack prey**
  - **– Show reduced anti-predator response**
  - **– Excessive, non-adaptive wasteful killing**
- **Aggressive populations**
  - **– Reside in areas with low food availability**

Maupin &Riechert 2001; Riechert& Hedrick 1993

Less aggressive individuals might do well in situations where low aggression is favored, but poorly in competitive situations.

Proactive-Reactive

Proactive Individuals
- **Manipulate environments**
- **More aggressive**
- **Constant environment**
- **Long time to adjust to change**

Reactive Individuals
- **Passive response to environment**
- **Less aggressive**
- **Variable environment**
- **Pay careful attention to external stimuli**

Great tit (*Parus major)*
- **Positive correlations b/n slow and fast explr**
- **Exploratory Behavior**
- **Foraging Behavior**
- **Boldness / Reactions to novel environment**
- **Behavioral / Physiological Reactions to stress**

Reviewed in Sih et al. 2004

Learning Performance

Intercolony variation in learning performance of wild British bumblebees population (*Bombus terrestris* audax)

NIGEL E RAINE, THOMAS C INGS, OSCAR RAMOS-RODRIGUEZ & LARS CHITTKA

EntomolGenr 28(4): 241-256

Results

Colony	Never pro-bed yellow/ n (%)	Probed yellow + 100 choices / n	Total bees tested/ n	workers tested per colony/%
A16		15	15	8.5
A21	2 (12%)	15	17	13.4
A24	9 (43%)	12	21	21.4
A33	3 (17%)	15	18	14.9
A42	1 (6%)	15	16	7.9
A62		15	15	11.2
A65		15	15	13.2
A99		14	14	13.1
A113		15	15	10.8
A126		8	8	11.3
A142		15	15	6.1
A163	2 (12%)	15	17	7.7
A180	1 (6%)	15	16	8.6
A212		15	15	12.3
A228		15	15	11.7
A236	1 (13%)	7	8	10.7
Total	**19**	**221**	**240**	

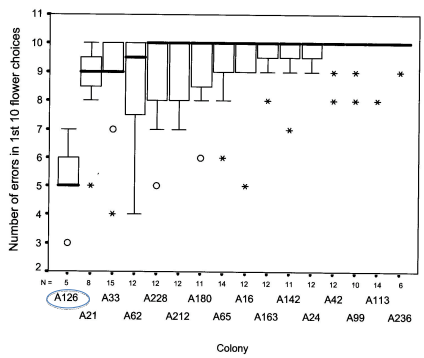


Fig 1: Variation in the number of errors (blue choices) made by bumblebees during first 10 flower choices.

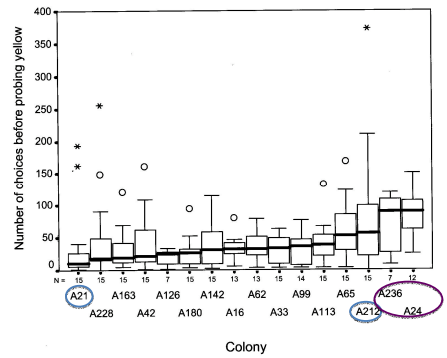


Fig 2: Variation in the number of flower choices made before probing their first yellow flower

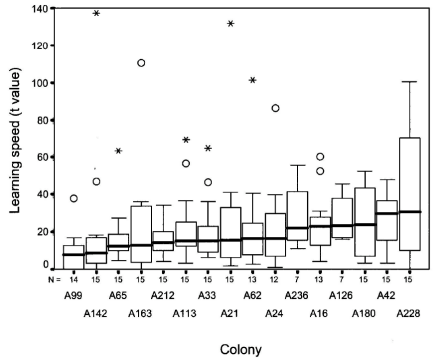


Fig 3: Variation in learning speed.

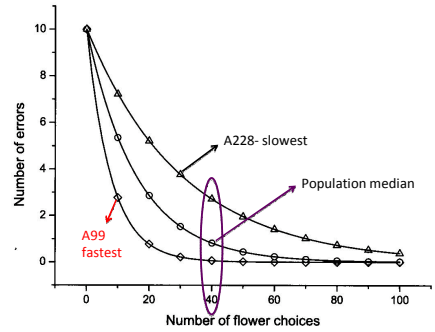


Fig 4: Shape of learning curve relating to learning speed.

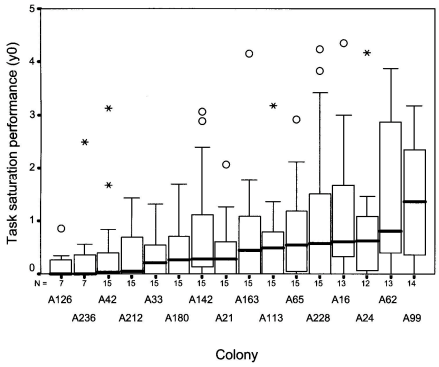


Fig 5: Variation in the number of errors made by bees at saturation performance (y0)

a) bee age	Learning speed/ *t* value		Number of flower choices before probing yellow		
Colony	**r_s**	**p**	**r_s**	**p**	**n**
A16	0.004	0.991	0.250	0.433	12
A21	0.339	0.217	0.500	0.058 ·	15
A24	0.439	0.153	-0.178	0.580	12
A33	-0.586	0.058 ·	0.030	0.931	11
A42	-0.176	0.529	0.038	0.894	15
A62	-0.688	0.009 **†	-0.234	0.441	13
A65	0.586	0.045 *	0.123	0.703	12
A99	-0.290	0.315	-0.242	0.404	14
A113	-0.142	0.614	-0.135	0.632	15
A126	-0.714	0.071	-0.214	0.645	7
A142	-0.179	0.523	-0.177	0.527	15
A163	-0.041	0.884	-0.538	0.039 *	15
A180	0.309	0.262	-0.409	0.130	15
A212	0.115	0.696	-0.341	0.233	14
A228	-0.271	0.370	-0.083	0.787	13
A236	-0.900	0.037 *	<0.001	1.000	5

b) bee size	Learning speed/ *t* value		Number of flower choices before probing yellow		
Colony	**r_s**	**p**	**r_s**	**p**	**n**
A16	-0.484	0.094	0.187	0.540	13
A21	0.273	0.324	0.206	0.462	15
A24	-0.118	0.729	-0.200	0.555	11
A33	0.381	0.179	0.363	0.201	14
A42	0.321	0.243	-0.018	0.950	15
A62	-0.313	0.297	-0.358	0.230	13
A65	-0.555	0.032 *	-0.144	0.608	15
A99	-0.499	0.069 ·	0.064	0.828	14
A113	-0.222	0.427	0.248	0.372	15
A126	0.750	0.052 ·	0.071	0.879	7
A142	0.131	0.642	0.504	0.055 ·	15
A163	0.048	0.864	0.154	0.584	15
A180	-0.325	0.237	0.408	0.131	15
A212	0.039	0.889	0.175	0.532	15
A228	-0.061	0.830	-0.121	0.668	15
A236	0.536	0.215	0.143	0.760	7

Summary

- **Significant variation in average performance at colony level and range of flower choices made.**
- **There was difference in average learning speed.**
- **There was considerable intercolony differences in the saturation performance level of bees with in the same colony.**

In most of the situation we ignore individual variation in behavior in response to environmental variation.

The Behavioral syndrome framework quantifies individual variation in behavior and attempts to explain the maintenance of this variation.

Behavioral syndromes are rarely studied
- Little known about proximate mechanisms of individuality
  – Genes
  – Experience
  – Hormones
  – Interactions of each others

"Behavioral syndromes might often have important ecological impacts because:

(i)Limiting environmental factor have impact on ability of species to cope with behavioral correlation and limited plasticity which can generate trade offs.

(ii) Behavioral correlations across contexts can couple birth, death, and dispersal processes in ways that are not usually included in ecological analyses.

(e.g. between reproductive, predator-prey and dispersal behaviors)

Discussion

- Why behavioral syndrome is ecologically important?
- In what environment would certain behavioral types be better suited? (e.g. aggression, boldness, etc.)
- How is genetic and individual variation in behavioral types maintained within or among populations?
- When would individual variation be maladaptive?
- What role does experience plays in plasticity?

Explicitly evolutionary theory has not yet been developed for behavioral syndromes; however some insights can be drawn from parallels with existing, related evolutionary theory.

Two key interrelated aspects of behavioral syndrome are;

- Limited behavioral plasticity- Animals should show optimal plasticity.
- Behavioral correlation across situations- Selection should decouple correlation that cause conflicts.