

Biology & Behavioral Ecology of Swarming in Honey Bees



Who\\What\\when\\where\\how\\why

What is swarming?

- What's happening: a natural event; a good event in natural circumstances
 - Part of the reproductive process; propagation (preserving the species)
 - Involves a large group of bees leaving an established colony
 - May result in the establishment two colonies of bees [why]
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- The propensity to swarm resides in genetics
 - Hence there can be race bias for swarming
 - Race = biotypes, subspecies, strains
 - Inclination (urge) to swarm varies among biotypes
 - Varying sensitivity to factors that trigger swarming



Who \\ **What** \\ when \\ where \\ how \\ why

Why do honey bees swarm?

- Two main reasons a colony swarms
 - Space
 - Colony becomes too congested for the space within the hive
 - This scenario results in “reproductive fission”
 - One colony becomes two colonies
 - About 75% of worker bees leave [50% total?]
 - Most food stores remain in original hive
 - Undesirable conditions
 - Bad environment; diseases; pests, lack of food
 - Results in the loss of an established colony
 - All the bees leave
 - Little or no food stores left



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When do honey bees swarm?

- When does space become an issue?
 - Usually in the late spring and early summer
 - Strong colonies can become space-limited earlier and throughout the summer
 - Feeding colonies can extend the time of swarming
- When do undesirable conditions become an issue?
 - When diseases and pests increase
 - Usually later in the summer or early fall
 - [Are current losses an example of swarming?]



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How does swarming start? A Timeline – in a perfect world

- Series of events that initiate **space-induced** swarming
 - Symptoms start 30-40 days prior to swarming
 - Worker bees detect a problem (space, condition)
 - Worker bees are able to out-perform the queen
 - Too many bees for the queen pheromone
 - Too high of a young/old ratio of worker bees
 - > 90% of the brood comb is in use
 - Bees exceed 2.3 workers/ml space (1/5 teaspoon)
 - Worker bees signal its time to swarm (not the queen)
 - Some foraging bees begin to search for a new site
 - Some foraging bees protect an optimal new site



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How does swarming start? A timeline (continued)?

- At 15-30 days before the swarm appears, worker bees start making queen cells
- Usually, at 15 days before swarming the new queen egg is laid
- At 14 days before swarming
 - Worker bees decrease feeding the queen
 - Increased vibrations of the queen
 - Fewer worker bees foraging
- At 10 days before swarming
 - Departing worker bees (young) begin to engorge
 - Piping sound made by queen
 - Piping sound made by worker bees



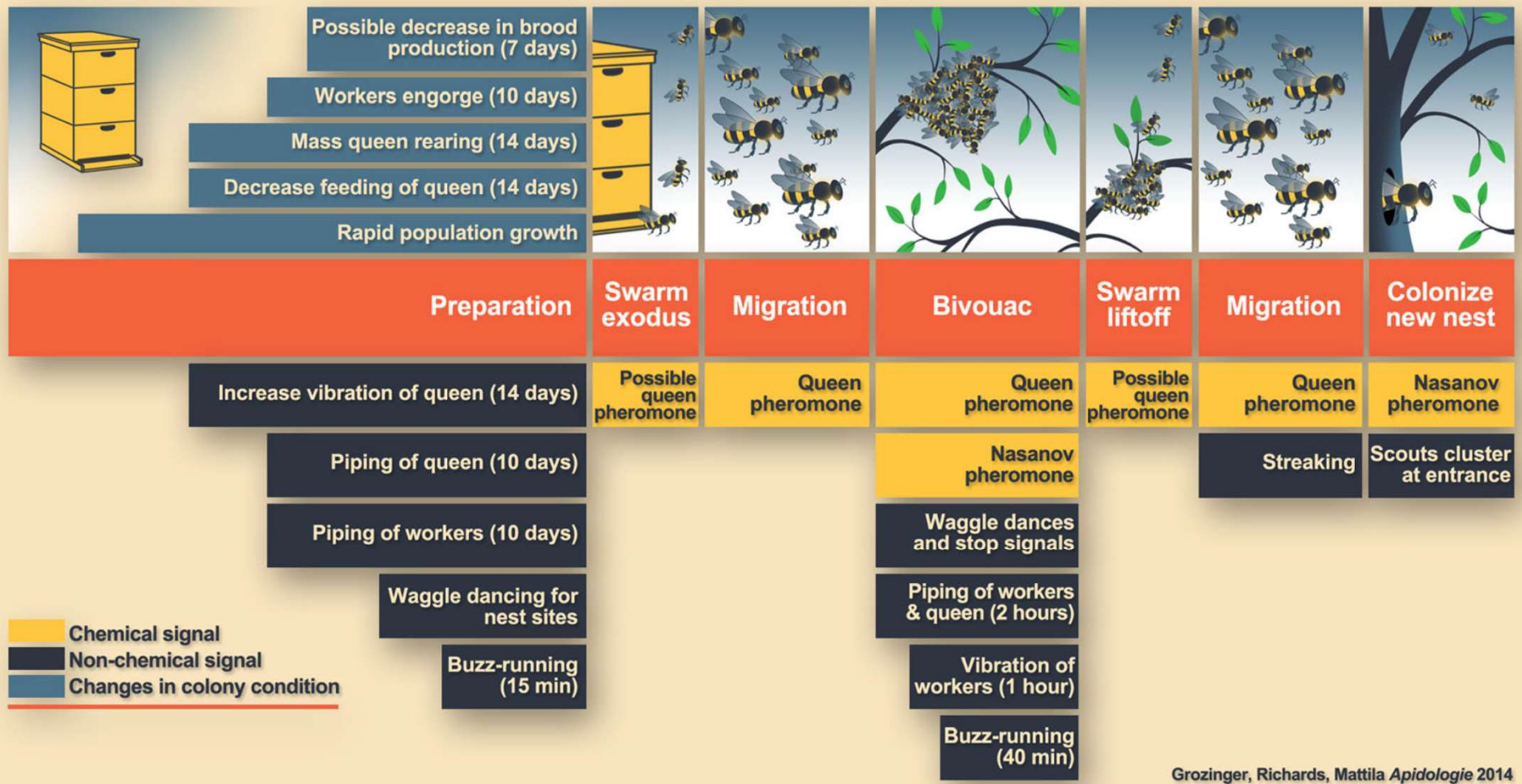
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How does swarming start (continued)?

- At ≥ 7 days before swarming
 - Often a decrease in brood production
 - Waggle dancing by workers for nest site selection
 - Buzz-running by workers
- At 6 days before swarming
 - Queen cell is capped
 - Colony is now **committed** to swarming
- The colony swarms – day zero
- Usually, at 1-3 days **after** swarming (in the perfect world)
 - The new queen emerges in the original hive



Who\\What\\when\\where**how**\\why



Who\\What\\when**where**\\how\\why

How does swarming start (continued)?

- Series of events that initiate **undesirable condition-induced** swarming
 - Less researched topic than space-induced swarming
 - Assumed a similar timeline
 - Assume similar series of events, except –
 - Plenty of brood comb available
 - No crowding issues
 - Likely to be more older bees than young bees
 - Absence of building a queen cell
 - All bees engorge and participate in leaving
 - Unknown if piping occurs
 - Time-line of events is not well articulated



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The Order of Events During Swarming

- Swarm of bees leave the hive *en masse*
- Form a cloud of bees just outside the parental hive
- After ~ 20 minutes they coalesce into a cluster
- Cluster forms at an interim site, usually nearby
 - From there they choose their future nest site
- “Piping” starts ~ 1 hour prior to swarm taking flight
- Followed by “buzz running & piping” to warm up
- Swarm takes flight again and goes to the new site



Selecting the Future Nest Site

- Several hundred scout bees are involved
- They search for potential dwelling sites
- Suitable locations are reported via waggle dances
- Other scouts decode the dance messages
- Other scout bees visit the sites
- Recruitment and selection ensues on the cluster
 - More details on the next slide
- The swarm moves to the new site



Nest site selection

Seeley and Visscher research:
Behav Ecol Sociobiol (2003) 54:511-520

Democratic

Majority agreement

Affected by an observation at the cluster

Despotic

Single individual

Affected by either the cluster or the nest site

Quorum

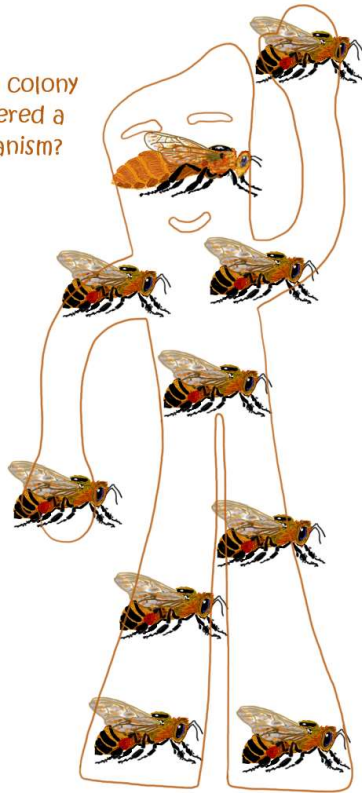
Small minority of the whole body

Affected by an observation at the nest site



The Superorganism has collective intelligence – the group acts as a single decision maker

Can a bee colony be considered a superOrganism?



[Nurse & forage bees do not display nepotism in performing their functions, even though their biology would allow for it.]

Table 1. Comparison of bees and their traits.

	<i>Italian</i>	<i>German</i>	<i>Carniolan</i>	<i>Buckfast</i>	<i>Caucasian</i>	<i>Russian</i>
Color	Light	Dark	Black	Medium	Dark	Gray
Disease resistance						
<i>Varroa</i>	-	-	-	-	-	+
<i>Tracheal</i>	-	-	-	+	0	+
<i>AFB*</i>	0	-	+	0	0	0
<i>EFB**</i>	0	0	0	0	0	0
<i>Other</i>	0	0	+	+	-	0
Gentleness	Moderate	Low	High	Low-Mod	High	Low-Mod
Spring buildup	Good	Low	Very good	Low	Very low	OK
Over-wintering ability	Good	Very good	Good	Good	OK	Very good
Excess swarming	OK	OK	High	Low	Low	OK
Honey processing	Very good	OK	Good	Good	Low	OK
Propolis	Low	OK	Low	Low	High	OK
Other traits	Heavy robbing	Short tongue, nice white cappings	Low robbing, good comb builders	Supersedure queens produce defensive colonies	Long tongue	Brood rearing affected by flow, queen cells always present
* AFB = America foulbrood						
** EFB = European foulbrood						

When to catch a swarm:

When should a beekeeper first think about swarms?

Does it matter when the swarm catcher intervenes during the swarming process?

Is it better to catch a cluster before the scout bees have selected a new site?



Where do honey bees swarm?

Everywhere there are bees.



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Timeline for Multiple reproductive fission events

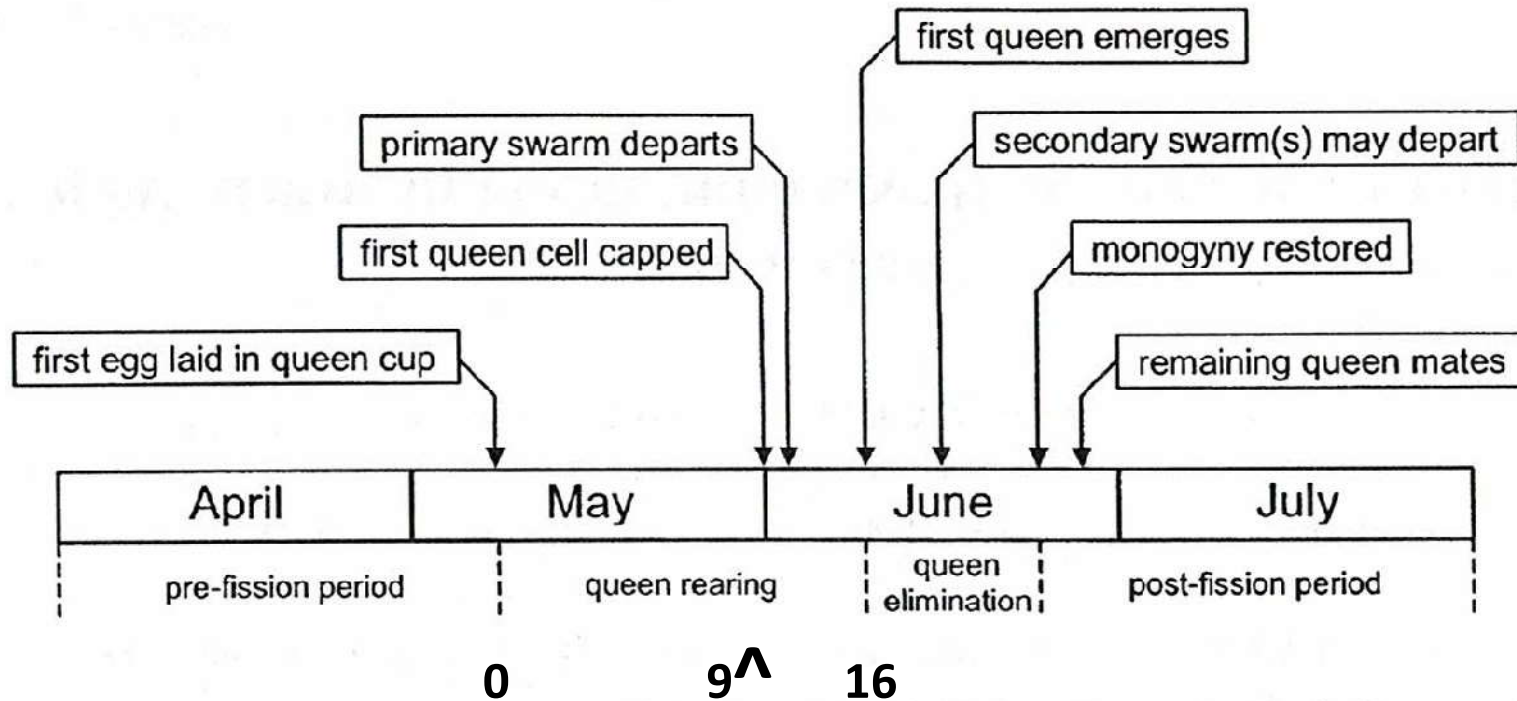


Figure 1. Timeline of the important events during reproductive fission (“swarming”) of a European honey bee colony. The dates of events are typical for a colony in Ithaca, New York (42°26’ N, 76°30’ W), a temperate climate.

^ capping is a trigger point; colony will swarm

**If everything were perfect in the life of a honey bee
this would not happen.**

