Nest Notes – Pollination Wunder Station

Viewing Notes: Please be gentle with this cabinet. Open side doors and back door to view, being mindful not to expose the inhabitants to too much sun. Press 'start' to listen. Right and left nesting planks each contain an upper and lower microphone. The "**select**" switch chooses between the upper and lower microphones within each plank. Adjust **volume** control for comfortable listening, starting with the volume control at the minimum setting. Volume may vary greatly depending on insect activity. Power will shut off automatically in 10 minutes. PLEASE make sure you re-place the headphones, lens and booklet within the cabinet and CLOSE ALL OF THE DOORS when finished!

Biological classification: Life – Domain – Kingdon – Phylum – Class – Order – Family – Genus – Species

Fig. 1 *Megachile* [leafcutter bees] and mandibles
All our species [of leafcutting bees] use cuttings from leaves or floral petals to line their brood cells which are usually in pre-existing holes in wood (they commonly accept trap-nests), although some species nest in the ground. The almost perfectly semicircular holes cut in the edges of rose leaves are examples of the work of these bees. *Megachile* are common throughout eastern Canada as far north as the sub-arctic zone. The 18 species can be identified using Mitchell (1962), although the key uses characteristics of the mandibles [appendages near the mouth], primarily the teeth and cutting edge shape, and identification of specimens with closed mandibles or badly worn teeth, may be difficult. [Scopa are located on the ventral surface of the abdomen of the female; male bees do not collect pollen].

Fig. 2 *Hylaeus* [masked bee, noted here as cellophane bee]
Unlike most comparatively glabrous (hairless) species, *Hylaeus* are not cleptoparasites – cuckoo bees (see fig. 4); rather, they carry pollen and nectar internally and therefore do not possess a scopa [see fig. 9, below]. *Hylaeus* are shiny black bees with white/yellow markings on the face (although females of one species, H. basalis (Smith), are completely black) and with pale banded legs. *Hylaeus* are small bees common in the summer, and most nest in stems (and trap-nests) but a few species nest in the ground and, like Colletes, they line their nest with cellophane-like material.

Fig. 3 *Andrena* [miner bee]
These are common solitary ground-nesting bees ranging in size from 5mm to over 15mm, which construct nests in a wide variety of soil types and degrees of vegetation cover. They are particularly common visiting willows (Salix, Salicaceae) in spring, but the genus as a whole can be found throughout the spring, summer and autumn. Late summer species are common on goldenrod (Solidago, Asteraceae). These bees can be found throughout eastern Canada, even in the warmer parts of the southern Arctic. There are approximately 74 species recorded from our area and they can be identified, albeit not easily, using Mitchell (1960), the Discover Life internet site, or using the keys of LaBerge.

Fig. 4 *Nomada* [nomad bee] and cleptoparasite
Nomada are wasp-like bees with narrow bodies marked with yellow, orange or red (or combinations of these colours), lacking discrete hair patches and without a strongly curved basal vein. These are mostly cleptoparasites of Andrena and can be easily found flying low above the ground looking for host nests. Cleptoparasitic bees do not collect pollen themselves, but instead lay their eggs on or near the food provisions in the nests of other bees. [*Nomada*] are found throughout our area to the arctic circle with different species active at different times of year, although they are most dominant in the early spring.

Fig. 5 *Osmia conjuncta* [shell-nesting mason bee]
Abandoned snail shells, or other naturally occurring cavities (even locks) are used by a few species of *Osmia.*

Fig 6. *Megachile companularum* [resin nesting leafcutter bee]
Some bees use resin collected from trees, pebbles or mud to line their brood cells and/or to plug nest entrances.
[These are the only species of the genus *M.* known to use resin in Ontario.]

***Fig 7. Trypoxylon lactitarse* [mud dauber wasp]**
This solitary wasp provisions its nest with large spiders which it stuns with venom and buries alive as food for its offspring. Two wasps work together in creating a nest: the female hunts for prey while the male stays and guards the nest from intruders such as cuckoo wasps (cleptoparasites), which may sneak in and lay their own eggs within the nest. *Trypoxylon* can be observed creating cell partitions of mud accompanied by loud sonicating, sometimes while simultaneously mating. This genus is amply distributed throughout the Americas.

Fig 8. *Osmia* species [mason bee]
This is the only *megachilid* genus to overwinter as an adult, and they are thus common in spring and early summer throughout our area, north to the arctic circle. Some individuals in short summer climates skip a year entirely and fly almost two years after their mother laid the egg. They mostly nest in pre-formed cavities; holes in walls, door locks, and have even been found in stethoscopes in field hospitals! These species commonly accept trap nests.

Fig 9. *Augochlora pura* and scopa
These are bright green bees with an acute epistomal lobe. There is only one species of this genus in Canada, *A. pura,* a bright bluish-green bee that nests solitarily in rotting wood. It can be found through much of the summer and is common in southern Ontario, less so in the Atlantic provinces. *A. pura* scopa are located on the hind leg. Scopa, pollen-carrying structures, may include branched hairs (wasps have unbranched hairs), a corbicula (leg structures found on some bees such as bumble bees and honey bees) and other types of modified hairs which transport pollen.

Fig 10. ***Xylocopa virginica*** **[Virginia (or large) carpenter bee]**
These large carpenter bees nest in wood and can be pests of outdoor wooden structures. Nest sharing by females is known and they are comparatively long-lived as adults. These bees are becoming increasingly common in southern Ontario and seem to be spreading north. The three species of small carpenter bees [*Ceratina*] found in eastern Canada are all dark metallic blue with ivory markings on the face and/or legs. They nest in dead, pithy stems and, as they overwinter as adults, are among the few Canadian bees that can be collected in midwinter.

Eastern Canada nest locations and distribution
Ground: nests made by burrowing into the soil. **Mason:** nests made on a substrate from resin or mud. **Cavities:** nests made in naturally occurring cavities such as beetle borings in wood, snail shells, etc. **Wood:** nests excavated in woody substrates. **Stems:** nests excavated in pithy stems. **Under rocks:** (one species) brood cells made under rocks. **Hive:** the honey bee is the only species that nests in hives, although feral colonies can be found in other hollows and cavities. **Rodent burrows:** on the ground and in hollow trees; bumble bees nest in these diverse locations. **Parasites:** make no nests

Biology notes
Bees are digger wasps (Hymenoptera: Apoidea-apoid wasps) that took to a diet of pollen and nectar rather than provisioning animal prey to their offspring. Not surprisingly, bees are known to be almost as old as the flowering plants. Most species are mass provisioners, collecting all of the pollen and nectar required for the complete development of an offspring into a single pollen ball before the egg is laid. In such species, there is usually no contact between mother and offspring after oviposition. Bumble bees are the only indigenous bees in Canada in which progressive feeding occurs, the larvae being provided with food by the adults throughout their growth. The only Canadian bee genus to use floral oils as a food source is *Macropis* which collects oil from *Lysimachia (Myrsinaceae).* Bees are one of the most economically important groups of insects as a result of their pollination of agricultural crops. Although the number of species currently managed for pollination in North America is comparatively small, native wild bees are thought to be responsible for quite a large proportion of the economic benefits attributed to honey bees. Sometimes, it is not only the number of visits to a flower, but also the diversity of bee species visiting [controlled for total number of insect visits) that determines crop yield. Wild bees are also crucial for the pollination of most non-crop flowering plants, and thus play an even greater role in most terrestrial ecosystems.

Credits: Bee identifications and biology notes excerpted from ***The Bee Genera of Eastern Canada***, Canadian Journal of Arthropod Identification, except for Fig. 7 notes by Peebles. (CJAI 03 September 25, 2007). By Laurence Packer, Julio A. Genaro and Cory S. Sheffield; York University, Department of Biology. See full article for acknowledgements and all references. Wood- and stem-nesting bee and wasp table (nest provisions, construction materials, etc.) excerpted from ***NB Nest Keys*** (observation notes, December 21, 2006) by Peter Hallett, University of Toronto and Department of Natural History, Royal Ontario Museum.

Expanded Introduction—*Pollination Wunder Station*

Because of fluctuating conditions, it is probably not optimal for a plant to evolve too tight a relationship with any one pollinator. They must hedge their bets and maintain an hierarchy of pollinators. Some apparent inefficiency in the system at any one time may thus be necessary to long-term optimality.

—"Bumblebee Economics" (Bernd Heinrich, Harvard University Press)

Of the variety of earth's pollinators, bees are responsible for the majority of "pollination services" to flowering plants; solitary wasps (from whom bees evolved) pollinate less, but provide essential insect control. There are likely more than 200 species of bees native to these fields and woods. The close synergistic relationship between plants and pollinators suggests that bee biodiversity—and by extension, plant and ecosystem biodiversity—is central to food security and to the health of the biosphere as a whole.

This is a *wunderkammer* ('cabinet of curiosities'), full of curious living things. This is not a beehive. It has no honey bees, no honey, no colonies, no beeswax or honeycombs. Like a condo, it has individual apartments for the many varieties of solitary bees and wasps native to Ontario. Use headphones (or earbuds) and a magnifying lens, get up close. You might see how the inhabitants vary greatly in size, form, colour and habits; the variety of materials they construct their brood cells from; which kinds of pollen (bees) or insects (wasps) they provision their eggs with; how their young develop. Don't worry, they won't sting unless accidentally trapped in clothing. They don't care about you or me (or our food), though they might be shy. The enemies of solitaries are other insects, birds, and fungi. They lead simpler lives than their social cousins the bumblebees (who nest in underground cavities), European honeybees (mostly managed in hives) or paperwasps and yellowjackets. They do not defend their nest sites, like the social insects, whose colonies get raided by mammals such as raccoons, bears, or humans. These single mothers live on their own and make series of individual brood cells, usually in old beetle bores in wood, or pithy stems such as raspberry bramble. The cabinet is passive in that – like a dead or dying tree – it naturally attracts local bees and wasps already foraging for food, mating and hunting for homes in the field and surrounding woods. The station allows us to spy on their nesting activities, their fights with fabulously beautiful cleptoparasites (cuckoo bees and wasps) and sometimes with each other—activity normally inaccessible yet omnipresent in most rural and urban environments. All of which normally takes place in the dark.

— Sarah Peebles

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abbreviation	*Linnaean binomial*	*wasps* / *bees*	possible confusions	nest notes (Peter Hallett, 2006)
4thletter: p=pin/photo, " "=supported, f=attribution "forced"				
	Auplopus genus		nil	mud barrel with a spider
	Ancistrocerus-like species group		eAA	almost entirely aaA, with very few aaB aaC & eAA
	Ancistrocerus genus			
	Ancistrocerus antilope (Panzer)		aaB,aaC, auA	mud+"inch worms", large white prepupa, BCD bores
	A. adiabatus			
	A. albophaleratus		aaA	
	A. unifasciatus		aaA	
	Anthidium manicatum		nil	felt + gravel
	Euodynerus genus		aAB	mud + "inch worms", large white prepupa, rare
	Hylaeus spp.		nil	mother makes bee "cellophane" bubbles, not a true silk; white...
	Heriades carinata Cresson		nil,mcA	dry neat resin, 3.2 mm bores // ...larvae usually without cocoon silk
	Hoplitis cylindrica (Cresson)		mpA	unknown
	Hylaeus ellipticus		hAA	bee "cellophane"
	H. modestus		hAA	
	H. verticalis		hAA	
	Isodontia mexicana (Saussure)		nil	long grasses+copiphorine grasshoppers
	Megachile genus		nil	broad genus, leafcutters and resin users
	Megachile leafcutter group.			Megachile leaf cutters, e.g., mcB, mrA and mrB mixture.
	Megachile campanulae (Robertson)		nil	flowing resin, liquid when fresh
	M. centuncularis (L.)		leafcutters	leafcuttings
	M. inermis		leafcutters	leafcuttings
	M. pugnata pugnata Say		otB	green mastic + mud bilayer + blunt white C-shaped prepupae
	Megachile relativa		leafcutters	leafcuttings
	Megachile rotundata		leafcutters	leafcuttings
	Osmia genus.		nil.	notably adults in cocoons, except otB which is biennial
	Osmia coerulescens (L.)		otA	dark green to reddish harder mastic with trace resin AB bores...
	O. lignaria		nil	mud walls + large chocolate cocoons BCD bores// ...males orange hair.
	O. tersula Cockerell		ocA	yellowish Green friable mastic, almost entirely A bores
	O. texana Cresson		mpA	yellowish Green mastic, dark cocoon, trace resin, CD bores; bigger bluer than ocA
	Passaloecus genus		nil	resin + aphids, bright yellow prepupa, usually little or no silk.
	Passaloecus cuspidatus Smith		pAA	
	Passaloecus gracilis Dahlbohm?		pAA	
	Passaloecus monilicornis Smith		pAA	
	Symmorphus genus.			
	Symmorphus two species group			Either scA or scB, when indistinguishable, see Potter sheet
	Symmorphus canadensis		scB	see Potter sheet
	Symorphus cristatus (Saussure)		scA	see Potter sheet
	T. collinum (Smith)		nil	mud + spiders + characteristic cocoons
	Trypoxylon frigidum		nil	mud + spiders + characteristic cocoons
	T. latitarse		nil	mud + spiders + characteristic cocoons
	(various) mastic bee group		ocA, mpA, otB	partitions and plugs of paste of masticated leaves