

OSMIA LIGNARIA, THE MASON BEE TWO HOURS

(PIC 1) KEEP CALM.

**(PIC 2) I MAINTAIN A NUMBER OF
RESEARCH SITES ACROSS WASHINGTON
COUNTY. HERE IS A MAP OF THE SITES I'VE
MAINTAINED.**

(PIC 3) BEE STATISTICS MAP.

**I'VE TAUGHT OVER 100 MASON BEE
CLASSES TO AUDIENCES RANGING FROM
PRE-SCHOOLERS TO SENIOR CITIZEN
GROUPS.**

FREQUENTLY I ASK THEM TO NAME THREE BEES. INVARIABLY THEY NAME HONEY BEES, BUMBLE BEES AND YELLOW JACKETS. YELLOW JACKETS ARE ACTUALLY WASPS AND NOT BEES. HONEY BEES AND BUMBLE BEES ARE BOTH PRIME EXAMPLES OF SOCIAL BEES.

SOCIAL BEES HAVE A VERY HIGH DEFENSE INSTINCT AND A VERY LOW TOLERANCE FOR HUMAN ACTIVITY. SOCIAL BEES WILL QUICKLY PROTECT THEIR HIVE, THEIR QUEEN AND THEMSELVES. THEIR ATTACK WEAPON IS THEIR STING.

IT SHOULD BE NOTED THAT ONLY FEMALE BEES AND WASPS CAN STING. MALE BEES AND WASPS DON'T EVEN HAVE STINGERS.

(PIC 4) SOCIAL BEES MAKE UP ONLY 10% OF THE BEE SPECIES IN THE WORLD BUT BECAUSE THEY CAN BE AGGRESSIVE, THEY ARE WELL KNOWN TO MOST PEOPLE. BASED ON THIS LIMITED KNOWLEDGE OF BEES, PEOPLE SEEM TO HAVE AN INSTINCTIVE YET UNFOUNDED FEAR OF ALL BEES.

THE REMAINING 90% OF THE BEE SPECIES IN THE WORLD IS MADE UP OF SOLITARY BEES WHICH HAVE A LOW DEFENSE INSTINCT AND A HIGH SURVIVAL INSTINCT. THEY ARE NOT AGGRESSIVE AND PREFER TO JUST FLY OFF IF THEY FEEL THREATENED.

MANY SOLITARY BEES HAVE A HIGH TOLERANCE FOR HUMAN ACTIVITY YET MOST PEOPLE HAVE LITTLE AWARENESS OF SOLITARY BEES.

MASON BEES ARE SOLITARY BEES WHICH MEANS EACH FEMALE BUILDS AND PROVISIONS HER OWN NESTING CELLS AND LAYS HER OWN EGGS. MASON BEES ARE SOLITARY BEES BUT THEY CAN EASILY LIVE NEAR OTHER MASON BEES. THEY CAN BE GREGARIOUS.

70% OF ALL BEE SPECIES NEST IN THE GROUND. MASON BEES ARE IN THE 30% OF BEE SPECIES THAT NEST ABOVE THE GROUND.

(PIC 5) MASON BEES ARE CAVITY NESTERS AND PREFER A CAVITY DIMENSION OF 5/16" (89%, MY RESEARCH).

WHEN IT COMES TO NESTING, MASON BEES ARE OPPORTUNISTS AND WILL NEST IN ANY CAVITY THAT IS APPROXIMATELY 5/16". THEY DO NOT EXCAVATE THEIR CAVITIES.

IN THE WILD THESE NESTING CAVITIES COULD BE CRACKS IN TREE BARK, BROKEN TWIGS, OR INSECT BURROWS MADE IN DEAD LOGS OR TREE STUMPS. IN A MANAGED ENVIRONMENT THESE CAVITIES WOULD LIKELY BE NESTING STRAWS OR WOODEN NESTING TRAYS. (PICS 6 - 11)

PLASTIC MATERIALS SHOULD BE AVOIDED AS NESTING DEVICES BECAUSE THEY DON'T ABSORB AND DISSIPATE THE MOISTURE FROM THE MUD USED BY MASON BEE FEMALES IN BUILDING THEIR NESTING CELLS.

MOLD CAN RESULT FROM RETAINED MOISTURE AND CAN BE FATAL TO BEE EGGS AND LARVAE.

MASON BEES ARE SOMETIMES MISTAKEN FOR FLIES. THERE ARE TWO EASY WAYS TO DIFFERENTIATE BETWEEN A BEE AND A FLY. FLIES HAVE VERY SMALL ANTENNAE AND THEIR EYES ARE VERY LARGE AND THERE IS VERY LITTLE IF ANY FACIAL SPACE. [\(PICS 13 - 14\)](#)

(PIC 15) BEES HAVE EASILY IDENTIFIABLE ANTENNAE AND THEY HAVE FACIAL SPACE BETWEEN THEIR EYES.

WE'LL GO THROUGH THE MASON BEE LIFE CYCLE STARTING FROM THEIR COCOON STAGE. MASON BEES PRODUCE ONE GENERATION PER YEAR. THEY ARE IN THEIR COCOONS FOR APPROXIMATELY 10 MONTHS.

A MASON BEE COCOON IS THREE LAYERS THICK. THE OUTER LAYER IS A COARSE WEBBING (PIC 16) .

THE INNER TWO LAYERS ARE VERY VERY THIN PAPER-LIKE LAYERS. THE COCOON IS FAIRLY WATER PROOF AND AIR PERMEABLE (PIC 17) .

IN THEIR COCOONS THE BEES LIVE OFF OF THEIR BODY FAT (PIC 18) .

(PICS 19 - 21) MALES EMERGE GENERALLY 5-10 DAYS BEFORE THE FEMALES.

EMERGENCE OCCURS IN THE EARLY SPRING WHEN THE OUTDOOR TEMPERATURE RISES ABOVE 55° FOR 4-5 DAYS.

MALES WILL LIVE 2 TO 3 WEEKS AFTER THEY EMERGE. THEIR ONLY FUNCTION IS TO MATE WITH FEMALES.

(PIC 22) MALES HAVE LONG ANTENNAE AND WHITE FACIAL HAIR.

(PIC 23) MALES ARE SMALLER THAN FEMALES.

FEMALES WILL LIVE 6 TO 8 WEEKS AFTER THEY EMERGE. FEMALES ARE ABOUT AS LONG AS A HONEY BEE, BUT STOUTER.

(PICS 24-25) FEMALES HAVE SHORTER ANTENNAE THAN MALES AND NO WHITE FACIAL HAIR.

MASON BEE MALES EMERGE FROM THEIR COCOONS AND SPEND SOME TIME FLEXING THEIR WINGS. THEY THEN FLY OFF AND DRINK NECTAR WHICH IS THE SUBSTANCE THEY WILL LIVE ON DURING THEIR SHORT TWO TO THREE WEEK LIFE SPAN OUTSIDE OF THEIR COCOONS.

NECTAR IS A CARBOHYDRATE. FLOWER NECTARS CAN RANGE FROM 7% TO 70% SUGAR.

BEEES ARE MOST ATTRACTED TO FLOWERS WITH NECTAR THAT IS 30% TO 70% SUGAR. FOR CONTEXT, A REGULAR COKE IS 10% SUGAR.

FLOWERS ARE CONSTANTLY REPLENISHING THEIR NECTAR DURING THEIR BLOOMING PERIOD.

MASON BEE FEMALES ARE GENERALISTS MEANING THAT THEY WILL FORAGE ON ANY FLOWER THEY CAN ACCESS.

MALES SPEND THEIR SHORT LIVES DRINKING NECTAR, PATROLLING, AND TRYING TO MATE WITH FEMALES.

(PICS 26 - 27) FEMALES ARE MATED WITH SOON AFTER THEY EMERGE. THE SPERM THEY RECEIVE IS STORED IN AN INTERNAL SAC CALLED A SPERMATHECA.

AFTER MATING THEY FLY OFF FOR 2-3 DAYS WHILE THEIR OVARIES MATURE.

THEN THEY RETURN CLOSE TO WHERE THEY EMERGED AND BEGIN LOOKING FOR A NESTING SITE.

EACH FEMALE MARKS HER NESTING CAVITY WITH HER UNIQUE PHERMONE TO IDENTIFY IT AS HERS.

ONCE SHE HAS SELECTED AND MARKED A NESTING CAVITY SHE FLYS BACK AND FORTH IN FRONT OF HER NESTING SITE TO MEMORIZE ITS LOCATION.

SHE USUALLY (92% OF THE TIME, MY RESEARCH) FLIES OFF TO COLLECT MUD TO BUILD A BACK WALL IN HER CAVITY. SHE THEN BEGINS TO FORAGE FOR POLLEN AND NECTAR.

SHE WILL LIVE ON NECTAR AND A LITTLE POLLEN. SHE WILL COLLECT POLLEN AND NECTAR FOR HER OFFSPRING. WHILE SHE IS ON A FLOWER SHE DRINKS THE NECTAR AND PACKS DRY POLLEN ONTO THE STIFF HAIRS (CALLED SCOPAE) ON THE UNDERSIDE OF HER ABDOMEN. (PIC 28)

SHE THEN FLIES BACK TO HER NESTING CAVITY AND SPITS UP THE NECTAR.

(PIC 29)

(PICS 30 - 31) SHE TURNS AND SCRAPS OFF THE POLLEN USING HER HIND LEGS AND MIXES THE POLLEN AND NECTAR INTO A PASTY PILE. THIS POLLEN PILE IS SOMETIMES CALLED BEE BREAD. FEMALES FORAGE UP TO 300 FEET FROM THEIR NESTING SITE.

THIS IS THE MOST SIGNIFICANT DIFFERENCE BETWEEN MASON BEES AND HONEY BEES AS POLLINATORS.

(PIC 32 - 33) WHILE ON THE FLOWER THE HONEY BEE MIXES THE NECTAR AND POLLEN INTO A PASTE AND STICKS THIS PASTE ONTO HER HIND LEGS.

HONEY BEES ARE EXCELLENT POLLEN AND NECTAR COLLECTORS BUT POOR POLLEN DISTRIBUTORS.

MASON BEES ALSO COLLECT BOTH POLLEN AND NECTAR BUT DON'T MIX THEM TOGETHER UNTIL THEY ARE IN THEIR NESTING CELLS.

(PIC 34) BECAUSE THE FEMALE MASON BEE CARRIES DRY POLLEN ON HER SCOPAE SHE DISTRIBUTES A GREAT DEAL OF POLLEN FROM FLOWER TO FLOWER.

MASON BEES ARE EXCELLENT POLLEN DISTRIBUTORS AND POOR POLLEN COLLECTORS.

A HONEY BEE IS 5% EFFICIENT AS A POLLINATOR AND A MASON BEE IS 95% EFFICIENT AS A POLLINATOR.

ACCORDING TO THE U.S. DEPARTMENT OF AGRICULTURE IT TAKES 50,000 TO 60,000 HONEY BEES TO POLLINATE AN ACRE OF APPLE TREES (75 TREES). IT TAKES 250 FEMALE MASON BEES TO POLLINATE AN ACRE OF APPLE TREES.

ON EACH FORAGING TRIP THE FEMALE MAY VISIT UP TO 75 FLOWERS AND IT MAY TAKE AROUND 25 FORAGING TRIPS TO COLLECT ENOUGH POLLEN AND NECTAR TO PROVISION ONE NESTING CELL.

SO EACH POLLEN PILE IN EACH NESTING CELL REPRESENTS APPROXIMATELY 1,875 FLOWER VISITS. POLLEN IS A PROTEIN

AND FLOWER POLLENS CAN RANGE FROM 2.5% PROTEIN TO 61% PROTEIN. FOR CONTEXT, A SERLOIN STEAK IS 26% PROTEIN.

(PIC 35) WHEN THE POLLEN PILE IS COMPLETE SHE WILL THEN SPIT UP SOME NECTAR, TURN, AND LAY ONE EGG ON THE POLLEN PILE.

(PICS 36-37) SHE WILL THEN BUILD A MUD WALL TO SEAL OFF THE NESTING CELL. ONCE THE CELL IS SEALED OFF THE FEMALE HAS NO FURTHER CONTACT WITH HER OFFSPRING .

FROM MY EXPERIENCE, A FEMALE CAN LAY UP TO FIVE EGGS A DAY ALTHOUGH 2-3 EGGS PER DAY IS THE NORM GIVEN OUR COOLER WET SPRING WEATHER.

SHE CAN LAY UP TO AROUND 30 EGGS IN HER LIFETIME.

A SIX INCH CAVITY WILL LIKELY CONTAIN 6 TO 8 NESTING CELLS. A TWELVE INCH CAVITY WILL CONTAIN 12 TO 20 NESTING CELLS USUALLY.

REGARDLESS OF THE CAVITY DEPTH, THE LAST FOUR TO FIVE NESTING CELLS IN A CHANNEL WILL GENERALLY CONTAIN MALES. FEMALE EGGS ARE LAID DEEPER INTO THE CHANNELS OR STRAWS. ONE HYPOTHESIS IS MALE NESTING CELLS ARE STARTED WHERE LIGHT EXTENDS INTO THE NESTING CHANNEL.

IN A SIX INCH STRAW OR A SIX INCH CHANNEL THERE WILL LIKELY BE 1.5 TO 2 MALE EGGS FOR EVERY FEMALE EGG LAID.

**IN A TWELVE INCH CHANNEL THERE WILL
LIKELY BE A 1.5 TO 2 FEMALE EGGS LAID
FOR EVERY MALE EGG LAID. THE FEMALE
TO MALE SEX RATIO GROWS WITH
LONGER NESTING CHANNELS.**

**THE MORE FEMALES YOU HAVE, THE
LARGER YOUR MASON BEE POPULATION
WILL GROW.**

**MASON BEE MALES CAN MATE WITH
SEVERAL FEMALES AND MASON BEE
FEMALES CAN BE MATED WITH BY
SEVERAL MALES.**

**LIKE MOST FEMALE BEES, THE FEMALE
MASON BEE CAN DETERMINE WHETHER
OR NOT TO FERTILIZE THE EGG AS SHE IS
LAYING IT. IF SHE FERTILIZES IT, THE EGG
WILL HATCH INTO A FEMALE.**

IF IT IS UNFERTILIZED THE EGG WILL HATCH INTO A MALE. SHE LAYS FEMALE EGGS DEEPER IN THE CAVITY AND MALES EGGS IN THE 4-5 NESTING CELLS TOWARD THE OPENING OF THE CAVITY.

A FEMALE CAN LAY UP TO AROUND 30 EGGS IN HER LIFE TIME.

(PICS 38 - 39) WHEN THE FEMALE IS DONE BUILDING NESTING CELLS IN THE CAVITY SHE WILL FREQUENTLY CONSTRUCT A VESTIBULE CELL WHICH WILL BE AN EMPTY NESTING CELL .

I BELIEVE THIS TO BE A DEFENSE STRATEGY. SHE THEN SEALS OFF THE CAVITY WITH A LARGE MUD PLUG.

(PICS 40 - 42) OBSERVING 15,521 MASON BEE EGGS FROM 2019 TO 2023 THE EGGS HATCHED IN AN AVERAGE OF 12.62 DAYS.

(PICS 43 - 44) THE RESULTING LARVA BEGINS TO FEED ON THE POLLEN AND NECTAR PROVISIONS. ON AVERAGE IT TOOK A LARVA 32.35 DAYS TO EAT ITS POLLEN AND NECTAR PROVISIONS IN THE SAME TIME PERIOD.

(PICS 45 - 48) THE LARVA'S GUT MATURES AT THE END OF THIS TIME AND IT BEGINS EVACUATING ITS BOWEL. THEN IT BEGINS TO SPIN A COCOON AROUND ITSELF.

THE TIMESPAN THEN FROM THE EGG LAID DATE TO THE COCOONING DATE WAS 45.97 DAYS.

ONCE COCOONED THE LARVA BECOMES A PUPA. THE PUPA IS IN DIAPAUSE, A STATE LIKE HIBERNATION. THE PUPA CONTINUES TO DEVELOP AND IN ABOUT SIX TO EIGHT WEEKS IT BECOMES A FULLY FORMED BEE WHILE STILL IN THE COCOON.

FROM THE DATE OF ITS COCOONING UNTIL MID NOVEMBER IT IS IMPORTANT TO THE DEVELOPMENT OF THE BEE THAT THE COCOON BE KEPT AT AMBIENT TEMPERATURES.

GENERALLY BETWEEN MID NOVEMBER AND LATE DECEMBER THE BEE IN THE COCOON GOES INTO A PHASE OF DIAPAUSE CALLED DEEP DIAPAUSE.

IN DIAPAUSE, IF THE AMBIENT TEMPERATURE INCREASES THE BEE'S METABOLISM RATE INCREASES AND IT BURNS UP ITS BODY FAT MORE QUICKLY.

IN THE PERIOD CALLED DEEP DIAPAUSE, AMBIENT TEMPERATURES DO NOT AFFECT THE BEE'S METABOLISM RATE.

THIS IS THE PERIOD OF TIME WHEN THE COCOONS SHOULD BE EXTRACTED FROM THE NESTING DEVICES AND THEN CLEANED TO REMOVE PARASITES AND DEBRIS (PICS 49 - 55) . THE CLEANED COCOONS CAN THEN BE STORED UNTIL THE NEXT SPRING.

THE CLEANED COCOONS CAN BE STORED IN A COOL GARDEN SHED OR AN UNHEATED AND UNINSULATED GARAGE.

THE CLEANED COCOONS CAN ALSO BE REFRIGERATED TO ASSURE A LOW METABOLIC RATE.

IN THE SPRING WHEN DAILY OUTDOOR TEMPERATURES CONSISTENTLY RISE TO ABOVE 55 DEGREES THE MASON BEES WILL BEGIN TO EMERGE FROM THEIR COCOONS AND THE ANNUAL CYCLE REPEATS ITSELF.

IF THE COCOONS HAVE BEEN REFRIGERATED, THEY CAN BE SET OUTSIDE WHEN TEMPERATURES ARE ABOVE 55 DEGREES AND ADEQUATE NECTAR AND POLLEN RESOURCES (BLOSSOMS) ARE DEFINITELY PRESENT. I USE OREGON GRAPE BLOSSOMS AS MY INDICATOR.

GIVEN THE ONGOING DECLINE OF ALL BEE SPECIES IT IS IMPORTANT THAT THE

**POPULATIONS OF NATIVE POLLINATORS BE
BETTER UNDERSTOOD AND CARED FOR.**

**WE SHOULD MINIMIZE OR ELIMINATE OUR
USE OF PESTICIDES AND INSECTICIDES. WE
SHOULD CONSERVE NATIVE HABITAT AND
MAKE BETTER USE OF POLLINATOR
FRIENDLY PLANTS IN OUR LANDSCAPING.**

**APPROXIMATELY A THIRD OF THE
AMERICAN DIET IS DEPENDENT ON BEE
POLLINATION.**

**OVER 70% OF THE WORLD'S 125 MAJOR
AGRICULTURAL CROPS REQUIRE BEE
POLLINATION.**

**MOST LIVESTOCK ALSO DEPEND UPON BEE
POLLINATION TO PROVIDE THEIR FEED.**

75% OF THE WORLD'S CROPS PRODUCING FRUITS AND SEEDS FOR HUMAN CONSUMPTION DEPEND IN PART ON BEE POLLINATION.

87% OF THE WORLD'S 300,000 SPECIES OF FLOWERING PLANTS DEPEND UPON BEE POLLINATION.

(PICS 56 - 57) HERE IS WHAT A PRODUCE DEPARTMENT WOULD LOOK LIKE IF WE LOST BEE POLLINATION.