BIO120: WHAT DARWIN SAW

20160921

DARWIN

AGE 22,
SHIP'S NATURALIST
→ BEAGLE

A GEOGRAPHICAL PERSPECTIVE ON BIODIVERSITY AND ADAPTATION.

1. CONTRASTS BETWEEN TROPICAL & TEMPERATE ECOSYSTEMS
2. BIOTIC AND ABIOTIC INTERACTIONS IN TROPICAL AND TEMPERATE ECOSYSTEMS
3. GALÁPAGOS ISLAND AS EVOLUTIONARY LABORATORY

TROPICAL FORESTS IN BRAZIL

- VERY HIGH SPECIES DIVERSITY
- MULTITUDE OF BIOTIC INTERACTIONS, ESP. COEVOLVED MUTUALISMS BETWEEN PLANTS AND ANIMALS

ANIMAL POLLINATION PLAYS A BIGGER ROLE

- YEAR-ROUND WARMTH RESULTS IN RAPID GROWTH OF INSECT AND MICROBIAL POPULATIONS => PEST AND DISEASE PRESSURES ON PLANTS MORE INTENSE

TROPICAL FOREST

MADE MIGHE SPECIES DIVERSITIES AND INDIVIDUALS OF THE SAME SPECIES ARE WIDELY SEPARATED

DANIEL JANZEN

TROPICAL ECOLOGIST

- USED MARK-RECAPTURE TECHNIQUES TO DEMONSTRATE THAT BEES TRAVEL UP TO 23 KM DURING A DAY
- DESCRIBED 'TRAPLINE' FORAGING

JANZEN'S SEED PREDATION HYPOTHESIS

PREDICTS THAT TROPICAL TREE SEEDLINGS ARE LESS LIKELY TO ESTABLISH CLOSE TO THE MATERNAL PARENT.

DISTANCE MATTERNS

?HAPLOID

?DIPLOID

ANT-PLANT MUTUALISM IN ACACIA

- ANTS PROTECT PLANTS AGAINST HERBIVOROUS INSECTS
- THORNS - NESTING SITES
- BELTIAN BODIES - PROTEIN
- EXTRAFLORAL NECTARIES - SUGAR

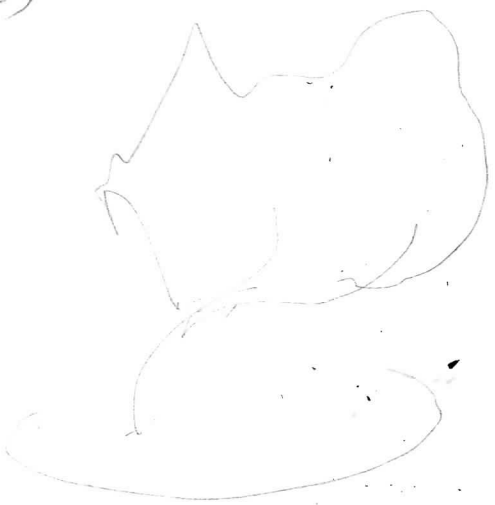
A CAREFUL EXPERIMENT

TANGLEFOOT DRUG AGAINST ~~ANTS~~ ⇒ BUSHES WERE DEFOLIATED WITHIN A WEEK

EXPERIMENTAL STUDIES OF ANT-PLANT MUTUALISM

MEGAN FREDERICKSON (EEB)

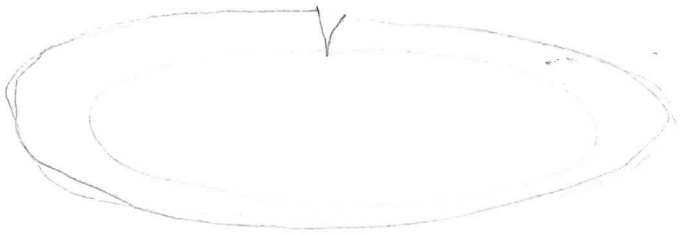
CONDUCTED EXPERIMENTS IN PERU DEMONSTRATING THAT ANTS DEFEND THEIR HOSTS AGAINST PLANT COMPETITOR USING FORMIC ACID AS A HERBICIDE THUS BENEFITTING FROM MORE NEST SITES

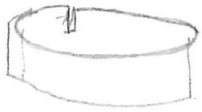


DEVIL'S GARDEN - FARMING SITES FOR ANTS

NEST SITE IN HOST STEM

GIANT AMAZON WATER LILY - SPOT THE DIFFERENCE





EPIPHYTES ARE COMMON
IN THE TROPICS
INCREASING SPECIES
DIVERSITY

EPIPHYTIC LIFE FORM
HAS EVOLVED INDEPENDENTLY.

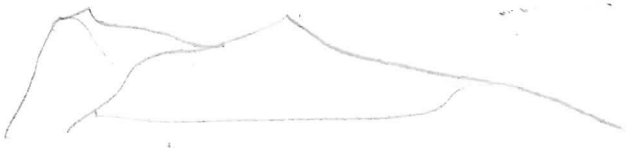
WHAT IS THE FUNCTION OF RED BRACTS?

COLOURED BRACTS
ATTRACT POLLINATORS
BUT HOW?

DARWIN FINDS FOSSILS OF EXTINCT MAMALS IN BRAZIL

PATAGONIA

STRIKINGLY DIFFERENT
ENVIRONMENTS WITH
RUGGED LANDSCAPE



ROUGH BORDER
OF INFERTILE PATCH
AT THE TOP

GALÁPAGOS ISLANDS

- 15 MAIN ISLANDS OF VOLCANIC ORIGIN; OLDEST 5-10 MILLIONS YEARS OLD
- FLORA AND FAUNA COLONIZED BY SPECIES CAPABLE OF LONG-DISTANCE DISPERSAL FROM SOUTH AMERICAN MAINLAND
- DISTINCT RACES AND SPECIES — EVIDENCE FOR ~~EARLY~~ SPECIATION
- PRICKLY PEAR CACTI ARE THE FIRST COLONIZERS

ADAPTIVE RADIATION

- THE EVOLUTION OF ECOLOGICAL AND PHENOTYPIC DIVERSITY WITH A RAPIDLY MULTIPLYING LINEAGE AS A RESULT OF SPECIES
- FROM A SINGLE COMMON ~~ONE~~ PROCESS RESULTS IN AN ARRAY OF SPECIES WITH DIFFERENT ATTRIBUTES ADAPTED TO ECOLOGICAL NICHES.

1. RECENT COMMON ANCESTRY FROM A SPECIES
2. PHENOTYPE - ENVIRONMENT CORRELATION
3. TRAIT UTILITY
4. RAPID SPECIATION

PETER & ROSEMARY GRANT

DAPHNE MAJOR – LOCATION OF 35-YR STUDY OF NATURAL SELECTION IN GALÁPAGOS FINCHES

→ LIVED IN A CAVE FOR MORE THAN 5 YEARS

→ SELECTION IS A PARAMETER WHICH CAN BE EXPERIMENTALLY MEASURED.

GALAPAGOS ISLAND GIANT TORTOISE

LONGEST TORTOIS IN THE WORLD— 880 KG, NEARLY 2 M LONG, OLDEST LIVING INDIVIDUAL 170 YRS

→ RAVAGED BY SAILORS WHO HANGED THEM ON RINGS FOR SEVERAL MONTHS WITHOUT FEEDING, WHILE THEY WERE ALIVE

MARINE IGUANAS

EXPEL SALT FROM SPECIAL NASAL GLANDS RESULTING IN SALT-CRUST ON THEIR HEADS

LOSS OF FLIGHT ON OCEANIC ISLANDS – WHY?

SEXUALLY DIMORPHIC FRIGATE BIRD

MALE

AUSTRALIA

- DISTINCT FLORA AND FAUNA WITH HIGH ENDEMISM AND MANY UNIQUE ADAPTATIONS.
- BIOLOGICAL UNIQUENESS DUE TO LONG HISTORY OF ISOLATION
- DRY FOREST COMPOSED OF EUCALYPTUS. — KOALAS CAN DETOXIFY PHENOLICS AND TERPENES IN LEAVES THAT ARE TOXIC TO OTHER ANIMALS.
- RODENT POLLINATED PLANTS