WHY NON-TOXIC...

Trapping, Proofing, Remote Monitoring

SHYAM LAKHANI



RESISTANCE

ANTICOAGULANT RESISTANCE

- First discovered in Scotland in 1950's warfarin-resistant Norway rats¹
- Identified in Norway rats, roof rats, house mice
- Occurs world-wide
- Can occur with FGARs and SGARs



¹BOYLE, C. Case of Apparent Resistance of *Rattus norvegicus* Berkenhout to Anticoagulant Poisons. *Nature* **188**, 517 (1960).



Rodenticide Resistance Action Committee (RRAC)

- Helps compile information to track
 resistance
- Accepts rodent tissue samples to screen for resistance mutations
- Provides resistance management & prevention strategies





https://rrac.info/

ANTICOAGULANT RESISTANCE

- Many definitions of resistance
 - Rodenticide Resistance Action Commitee (RRAC) describes anticoagulant resistance using these criteria:

Major loss of efficacy in practical conditions where anticoagulant has been applied correctly...Due to rodents with <u>heritable</u> reduced sensitivity to the anticoagulant

Use genetic testing to identify mutations that can cause resistance



ANTICOAGULANT RESISTANCE

Literature Reports on Resistance

Large amount of scientific research reports



- Lab Studies
 - In vitro determine mutant VKOR/anticoagulant interactions
 - Animals create mutant strains and test biological effects of anticoagulants
- Field Studies
 - Collect rodent tissue (tails) or extract DNA and look for mutations in vkor gene
 - Determine sequence of *vkor* and look for known or novel mutations
 - Screening of rodents in an area with suspected resistance or random sites
 - Several recently published studies around the world (see references)



How Do Populations Become Resistant to ARs?

Rat with a resistance mutation in VKOR passes it to the next generation to produce heterozygous carriers

Heterozygous breeding will produce additional resistant offspring

If warfarin is used, sensitive rodents die, leaving the resistant ones to pass the trait on to the next generation

Continued use of the AR on a population can help to enrich the number of resistant rodents



RRAC: Rodenticide Use Recommendations for Common Mutant Strains

Norway Rat

- Based on data/testing, calculating "resistance factors"
- Develop/ mutant strains in lab and do blood clotting response assays

	VKOR	Compounds recommended (+) and not recommended (-) for control					
	Strain	FGARs	Bromadiolone	Difenacoum	Brodifacoum	Flocoumafen	Difethialone
	L120Q	-	-	-	+	+	+
	L128Q	-	-	+	+	+	+
	Y139C	-	-	-	+	+	+
	Y139F	-	-	+	+	+	+
	Y139S	-	+	+	+	+	+

https://guide.rrac.info/rodenticide-molecules/norway-rat.html

ANTICOAGULANT RESISTANCE

How BIG of a Problem is Resistance?

- Difficult to define the prevalence of resistance from resistance mutation screening surveys
 - Having a mutation does not always mean an animal will have the trait of resistance
 - -Genetic "modifiers" can change gene expression and affect the trait
 - Sampling biases small sample numbers, collecting tissue from rodents in areas of known/suspected resistance





ANTICOAGULANT RESISTANCE

Preventing Resistance



Guideline on Best Practice in the Use of Rodenticide Baits as Biocides in the European Union



- Avoid under-baiting/not replenishing quickly enough
- Bait Rotation important for locations with continuous baiting (ex: farms)
 - Problematic for countries with limited number of registered active ingredients
 - Combine toxic bait with harborage/food/water reduction, traps/non-toxic monitoring bait
- RRAC Best practices guide
- Suspected anticoagulant resistance?
 - Use the RRAC interactive checklist for advice or need to have samples evaluated
 - https://checklist.rrac.info/



BURROW BAIING

BURROW BAITING

RODENT CONTROL TECHNOLOGY

RODENTICIDES

Out of the three commensal rodents, **NORWAY RATS** will typically nest in burrows

Rat burrows typically have one main entrance that is used most frequently, and several escape holes







BURROW BAITING

Norway rats will typically burrow, and roof rats will nest up high (attics, palm trees, in between walls...)

Roof rats will also nest in burrows in some cases.







RODENT CONTROL TECHNOLOGY

RODENTICIDES

BURROW BAITING

THE CORRECT BAITING OF RAT BURROWS IS IMPORTANT FOR 3 REASONS

Maximize safety to people, pets, and non-target wildlife.

To maximize the eradication of the rats living within the burrows.

To allow for accurate follow-up and monitoring of the burrow system long term and follow up treatments as needed.



RODENT CONTROL TECHNOLOGY

RODENTICIDES

SEWER BAIING



"The goal of sewer rat control programs is to costeffectively <u>*suppress</u> <i>a sewer rat population." -Dr. Bobby Corrigan*</u>





- Rats enjoy sewer systems due to the food and shelter they provide.
- It is important to create a strategy prior to baiting, utilizing pre-known suspected catch-basins & manholes as a starting point.
 - Pre-assessment, Baiting & Maintenance Baiting are all critical components to a successful program.
- Old brick systems are more susceptible to rat issues, due to toe-holds that make it easier for rats to climb and travel.



NORWAY RAT

Rattus norvegicus



Reddish-brown fur, blunt nose, small eyes & ears, thick body



All rats have 4 digits on each front paw and 5 on each back paw

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SEWER

BAITING

NORWAY RAT

Rattus norvegicus



SEWER BAITING

FOOD CONSUMPTION PER DAY

*Images of blocks are not intended to represent toxicant treated bait.



WATER CONSUMPTION





NORWAY RAT *Rattus norvegicus*

SEXUAL MATURITY



GESTATION PERIOD

22 Days



Values may vary based on environment

SEWER BAITING

LIFESPAN

9 - 18 Months



OFFSPRING PER LITTER

6 – 12 Offspring





NORWAY RAT

Rattus norvegicus

MOST ACTIVE



SEWER BAITING

Great climbing abilities

Tend to travel along lines

Excellent jumpers

Distinct hierarchy

Fearful of new objects

WHERE THEY CAUSE DAMAGE



Indoors & Outdoors



WHERE THEY NEST

Burrows, 90-450 ft. from food & water

PREBAITING

To allow the rats to get accustomed to the traps, place them backwards against the wall, and bait them without setting for 3-7 days







PREBAITING

Once the rats get used to the traps, return to bait, and set them with the mouth open towards the wall







PREBAITING What to use as bait

TRAPPING

Pre-bait using: Detex

Provoke









PREBAITING







PREBAITING/TRAP COMBO

Detex & Provoke and T-REX





- Step 1- After a few days of feeding on Detex blox from wire hanger(s)
- Step 2 insert unset T-Rex's with Detex bait and Provoke Rat (on the inside top side of the closed trap as well as the exposed back side of the trap to the left or the right of the clasp mechanism).
- Step 3 After 2-3 additional days, come back and remove any Detex Blox left hanging on the wire(s) and place the traps (T-Rex) into "fire mode" with Detex bait and Provoke Rat in the bait cup.
- Step 4 The next day or two retrieve dead bodies in traps!







Secured to pipes













TRAPPING

Inside bait stations











Inside bait stations





Secure vertically or horizontally





In rafters



NEVER CHECK AN EMPTY TRAP AGAIN



- Check whether or not trap has been triggered via Bell Sensing app
- Place in hard to reach locations
- Magnetic sensor detects whether trap is set or closed





T-REX IQ



Great for hard-to-reach locations



PLACE IQ TRAPS ANYWHERE







MOUSE SNAP TRAPS

- For severe mouse infestations, traps should be placed close together
- Use snap traps in pairs. Some mice react to new objects by jumping, double traps will help to capture jumpy mice
- In areas where there are many food sources, bait the traps with nesting materials, such as cotton balls or toothpicks
- For a professional look, place traps inside tamper resistant bait stations
- Pre-bait for mice, just like you would for rats







MOUSE SNAP TRAPS

- January, 2016: Dr. Matt Frye of Cornell University discussed a mouse snap trap research study that suggests for optimum performance, 6 snaps per every mouse intended to catch
- MOVE snap traps every visit
- Leave gaps not evenly spaced
- Use in pairs end to end





SNAP TRAP STRATEGIES

- Identify active runways and place mechanical traps in dark areas along walls and behind objects
- Ideal placements in residential facilities are:
 - Attics
 - Garages
 - Behind stove/refrigerator
 - Behind appliances
 - Under sink by pipes
 - Fence lines









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