Blowfly resistance.
The “Nimmitabel strain” and its implications for fly control

Patrick Kluver1, Peter Rolfe2, Ashley George2, Kathleen Vanhoff2, Justin Bailey1, Kim Baker2

1 Novartis Animal Health Australasia Pty Limited, 54 Waterloo Road, North Ryde, Sydney, Australia
2 Novartis Animal Health Australasia Pty Limited, Yarrandoo R&D Centre, 245 Western Road, Kemps Creek, New South Wales 2178, Australia
Nimmitabel strain

• History of resistance *Lucilia cuprina* Australian Sheep Blowfly
  – What resistance really looks like.

• Nimmitabel
  – Field history
  – Laboratory follow up
    • EMAI
    • Yarrandoo
  – Field Study
  – Larval Implant Study

  – Current recommendations.
Blow fly resistance

- *Lucilia cuprina* has rapidly developed resistance to all the predominant fly strike chemicals within 5-6 years of introduction with the exception of cyromazine (Vetrazin®) and dicyclanil (CLiK®)

- Why? *L cuprina*
  - Biological potential (reproductive ability)
  - a strict almost obligate parasite
  - Our intolerance of fly strike
  - Genetic diversity in the fly and other factors?
Fly resistance

- **Organochlorines** - DDT, Dieldren
  - Fly strike protection completely lost by 1958

- **Organophosphates** - Diazinon, malathion
  - Fly strike protection reduced
    - 12 weeks to only 2-4 weeks
  - Extensive use and selection 98% of blowflies resistant by 1970
  - Main fly chemical until Vetrazin (1979)

- **Benzoylphenyl ureas (BPUs)** - diflubenzuron
  - 1993 released - 2001 resistance reported and
  - 2006 Tara property no protection
  - 2008 all products fly claim removed
What do these products have in common?

• All were used for both fly and lice.
  – Tara strain were used for 4 consecutive lice and fly treatments over 2 years before resistance developed.

• “Cross resistance” existed to all 3 chemicals
  1. from completely different chemical groups
  2. different modes of action
VETRAZIN Spray-On®

- 6% cyromazine
- provides up to 11 weeks protection
- quick and easy to apply
- minimum 6 weeks wool
- 2 month wool withholding period
CLiK® Spray-on

• 5% dicyclanil
• Water-based spray-on
• Only product registered for season-long protection 18-24 weeks
• No field resistance detected
• Any length wool (3 month withhold)
• 120 day ESI
• Rain-Lock Technology
CLiKZiN® Spray-on

- 1.25% dicyclanil
- Water-based spray-on
- up to 11 weeks protection
- 1 month wool withhold
- 3 weeks ESI
- 7 day meat WHP
• Three published studies looking at efficacy of CLiK® in unmulesed sheep.


CLiK® –

Studies in un-mulesed sheep

- Registration studies conducted in mulesed sheep
- Independent studies in VIC & NSW – 10 farms/ 3028 sheep
- Good fly pressure (moderate to high)
- Wide range of sheep type, breeds, ages, climates & treatment timing
- CLiK® in un-mulesed sheep as effective as mulesed sheep (0.23% @ 28 weeks)
CLiK® – Studies in un-mulesed sheep

- 380 mixed sex, un-mulesed, Merino weaners (most susceptible group) at Longreach
- Sheep were made susceptible and 100 larval implants applied
- All treated groups were significantly different from the control group at 3 & 4 mths (18 weeks)
- CLiK in un-mulesed as effective as mulesed

Pick your CLiK.
Cyromazine

- No resistance seen
  - 1979 until today

- Why?
  - Not used for lice?
    - Dual use of chemicals in short and long wool probably contributed to resistance to OC’s, OP’s and BPU’s
  - Clues from laboratory induced resistant flies
    - Resistant flies less fit or robust or lethal gene
    - Genetically incomplete dominance
    - Narrow selection window
    - Resistance offered little advantage over fully susceptible flies.
What is resistance?

- International Resistance Action Committee (IRAC) define insect resistance as
  
  "a heritable change in the sensitivity of a pest population that is reflected in the repeated failure of a product to achieve the expected level of control when used according to the label recommendation for that pest species."

Pick your CLIK.
History of Nimmitabel strain

What happened on the farm and why were these maggots tested for resistance?

A mob of unmulesed ewe lambs were struck 3-4 weeks after application of a generic Cyromazine spray-on (CSO).

• These lambs were treated on the breech and the body but were only struck on the breech.
  – concerns about the amount and application pattern of the product on the breech.

• Product was re-applied
• Maggots were collected as a precaution and sent to Dr Garry Levot’s lab at EMAI, NSW DPI.
Were there any other failures of flystrike preventative products on the property?

Wether lambs and adult ewes were treated with CLIK® which performed as expected despite very heavy fly pressure and significant rainfall events.

The ewe lambs were only struck on the breech and had no body strike and critically, Cyromazine Spray On worked as expected on both the body and the breech after it was reapplied.
Research/stewardship questions

1. Will the Nimmitabel strain affect the protective period of Novartis products?
2. Will the strain persist on farm?
Larval Implant studies

• Larval implant studies
  – an implant study was conducted using sheep treated with either Vetrazin® SO or CLiK® SO and then implanted with larvae from; the Nimmitabel strain or a triazine “susceptible” reference strain.

• Both the Nimmitabel strain and the reference strain performed as expected and there was no difference between strains
  – CLiK® 18 weeks (trial terminated)
  – Vetrazin® SO 13 weeks (strike established at 14 weeks)

• We expect no difference between the Nimmitabel strain as far as protective period for either Vetrazin® (we can’t conclude anything about generic cyromazines from this study) or CLiK®
Field studies 2011/12

- Original “Nimmitabel” property
- 385 lambs treated with Vetrazin® Spray On and 198 lambs treated with CLiK®, December 2011
- Continually monitored by producer and once every 4 weeks by producer and once every 4 weeks
- High fly challenge trial
- Fly Pressure-
  - monitored by fly traps
  - heavy fly pressure for most of trial
- Rainfall-
  - Significant rain in Dec-April (405 mLs)
- No strike in either group at 14 weeks
- At 18 weeks, 5 lambs with breech strike Vetrazin® SO
- No strikes in CLiK® group
Results

No strike established in either group at 14 weeks

At 18 weeks,

- 5 lambs with breech strike Vetrazin® SO (registered protective period 11 weeks)

No strikes in CLiK® group
Conclusions

- These studies demonstrated that, against this field isolate, under both field and controlled laboratory conditions, Vetrazin® spray-on and CLiK® each maintained the registered protective period after treatment.
- No sheep treated with CLiK® were struck within registered protective period.
- Clearly shows the importance of application to protective period
  - Protective Period = Active + Formulation + Application$^2$
Did the strain persist on farm?

• Why would this occur?
  – Resistant lab strains of *Lucilia cuprina* and *Musca domestica* (house fly) tend to die out of populations over a number of generations.

• Any evidence of it dying out.
  – The evidence is inconclusive
    • One larvae found of several 1000 cultured 11/12 (3-4% 2010)
    • possible reduction in the % of resistant strains in the population but the data is inconclusive at this stage.

• Survey of Neighbouring properties 2011/12
  – Found in low numbers in 3 out of 5 properties
    • No control failures in the area/district as measured by product complaints?
Recommendations

“No need to change your current practice most importantly do it once and do it right”
Current Flyboss recommendations

– Use Integrated Pest Management (IPM)
  • chemical and non chemical means of making sheep less attractive to fly

– Use a different chemical to treat fly struck sheep to the one you used to prevent fly strike (different mode of action) this breaks helps break cycle

– Use different chemicals for treatment of fly and lice

“Do it once and do it right”
Conclusion

• Resistance to cyromazine has been detected at the laboratory level in vitro tests.
• It is a mild resistance and has not caused any failure in the field of cyromazine based products.
• Field observations, trials and laboratory experiments suggest that we expect no reduction in protective period for CliK® or Vetrazin®.
• Producers should use fly products that suit their management in a sustainable manner, that maximises production and animal welfare.
Conclusion

Producers should use fly products that suit their management in a sustainable manner, that maximises production and animal welfare.
• Acknowledgements
  – The producers on the original Nimmitabel property
  – Dr Garry Levot EMAI cooperation and supply of Nimmitabel strain larvae