Chemoprophylaxis and Immunoprophylaxis of chicken coccidiosis

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Recent techniques for diagnosis of chicken coccidiosis

- **Estimation of litter oocyst density (OPG)**
- ***In-vitro* Sporulation of coccidia**
- **Lesion Scoring Technique (GLS/MLS)**
- **Immunodiagnosis of chicken coccidiosis**
- **Biochemical and Molecular detection of coccidiosis**

Chemoprophylaxis and Immunoprophylaxis of chicken coccidiosis

Curative and prophylactic drugs
Anticoccidial drugs – Classification & Mode of action
Common anticoccidials : Chemicals Vs Ionophorous Antibiotics
Immunoprophylaxis : Need for Anticoccidial vaccine
Live, Attenuated , Precocious line vaccines
Recombinant / Sub unit vaccine

TREATMENT OF CHICKEN COCCIDIOSIS

Anticoccidials are divided into following groups,

A) Curative drugs - Coccidiostatic drug
Coccidiocidal drug

B) Prophylactic / preventive drugs

I. Sulphonamides :

Coccidiostatic – Acts by Folate antagonists and inhibitors

(A) Sulphadimidines: 0.4 % feed, 0.2 % water

Effective against II Generation Schizonts

Increase the dose for I schizonts and gamonts

Treatment Course: 3 days treatment, 2 days rest, and then 3 days treatment.

(B) Sulphaquinoxaline : 0.043 % water
2 treatments for 2 days with 3-5 day interval between them.

2. Thiamine Analog:

AMPROLIUM – 0.0125 % as prophylactic
It can be used as singly or combined withethopabate
(Vitamin-B1 should not be given along with Amprolium)

3. Nitrobenezamides:

Zoalene – coccidiostatic if used for 5-6 days & prolonged use it is coccidiocidal

Nitromide (DOT – Dinitro –O – Tolumide)
(DOT is commonly added as prophylatic in feed especially in starter ration in broilers @ 0.5 kg / ton feed)

4. Nitrofurans:

Nitrofurazone - 0.022 % curative
Furazolidone - 0.0055 % in feed
Nitrofurazone + furazolidone
(0.0053 % + 0.0008 %) marked coccidiostatic

5. Substituted Carbanilides: Nicarbazin, Trithiadol.

6. Robenidine: Bisguanidine

7. Benzylpurines: ARPINOCID – It affects intracellular stages and sporulation of oocysts

8. Ionophorus Antibiotics :

Fermentation products of Streptomyces albus

Acts by fail to transport Na+ and K+ ions across the membrane

Monensin - 0.01 %

Lasolocid - 0.005 - 0.0075 %

Salinomycin - 0.01 %

Maduramicin. - 5-6 ppm (derived from Actinomadura yumaensis)

Alborixcin - 50 ppm

9. Polystat - Combined products : 0.002 %feed

10. Halofuginone, Clopidol

11. Antibiotics such as Aureomycin (CTC), OTC and Chloromphenicol

12. Other current drugs

Sulpha chlorpyrazine (ESb3) - Therapeutic drug at levels of 1.5 to 2 grams of the drug in 1 litre of drinking water.

Diclazuril (Clinacox) - 1 ppm in feed.

Toltrazuril (Baycox 2.5 %) – 7 mg/kg body weight for 2 consecutive days / 1-2 treatment 25 ppm

Semduramicin (Aviax, Pfizer) - 25 -50 mg/kg feed

Drugs for Treatment of Coccidiosis in Chickens

	Feed or Water	Active Ingredient: Treatment, Duration
Amprolium	Water	0.012 - 0.024%, 3-5 days; 0.006%, 1-2 wk
Chlortetracycline	Feed	0.022% + 0.8% calcium; not more than 3 wk
Oxytetracycline	Feed	0.022% + 0.18 - 0.55% calcium; not more than 5 days
Sodium sulfachloropyrazine monohydrate	Water	0.03%, 3 days
Sulfadimethoxine	Water	0.05%, 6 days
Sulfamethazine (sulfadimidine)	Water	0.1%, 2 days; 0.05%, 4 days
Baycox 2.5%	Water	7 mg/kg, 2 days

Drugs for Prevention of Coccidiosis in Poultry

	Use level (% in feed)
	Chickens
Amprolium	0.0125 - 0.025
Amprolium + ethopabate	0.0125 - 0.025 + 0.0004 - 0.004
Chlortetracycline	0.022
Clopidol or meticlorpindol	0.0125 - 0.025
Decoquinate	0.003
Dinitolmide (zoalene)	0.004 - 0.0125
Halofuginone hydrobromide	0.0003
Lasalocid sodium	0.0075 - 0.0125
Maduramicin ammonium	0.0005 - 0.0006
Monensin sodium	0.01 - 0.0121
Narasin	0.006 - 0.008
Narasin + nicarbazin	0.003 - 0.005 (of the combination)
Nicarbazin	0.0125
Oxytetracycline	0.022
Robenidine hydrochloride	0.0033
Salinomycin sodium	0.0044 - 0.0066
Semduramicin	0.0025
Sulfadimethoxine + ormetoprim	0.0125 + 0.0075

- In practise, care should be taken to with draw the drug before marketing, since each drug has its own withdrawal period.
- 5 days before slaughter
- Selection of anticoccidial is based on the ability of the drug to
- improve weight gain and
- feed conversion and
- to suppress the development of lesion.

CONTROL OF CHICKEN COCCIDIOSIS

IMMUNOPROPHYLAXIS

ANTICOCCIDIAL VACCINES

What is the need for anticoccidial vaccines?

- Resistance to coccidia has developed to all of the anticoccidial drugs
- Concerns about drug residues in poultry products
- Consumer desire to ban drugs from animal feeds

Types of anticoccidial vaccine

- **Non-attenuated vaccines**

  (Coccivac, Immucox, Nobilis COX ATM and VAC M)

- **Attenuated vaccines**

  Livacox and Paracox

Non-attenuated vaccines

- **Coccivac"** vaccine (American Scientific Laboratories Inc.)
- **Coccivac D** *(E. acervulina, E. brunetti, E. maxima, E. mitis, E. necatrix, E. praecox and E.tenella)*
- **Coccivac B** (*E. acervulina, E. maxima, E. mitis, E. tenella)*
- **Immucox"** vaccine (Vetech Laboratories) (*E. acervulina, E. maxima, E. necatrix and E. tenella*)

Live - attenuated vaccines

- **Paracox" vaccine – Precocious line – (Schering- Plough Veterinary Ltd) (*E. acervulina, E. brunetti, E. maxima, E. mitis, E. necatrix, E. praecox* and *E. tenella*)**
- **Livacox" vaccine (Biopharm) - Egg adapted vaccine**
- **Livacox – T *(E. acervulina, E. maxima and E. tenella)***
- **Livacox – D *(E. acervulina and E. tenella*)**

Methods for attenuation

- **Embryo passage**

  Possible for *Eimeria tenella*

  Disadvantages: Not possible to grow other species of Chicken Eimeria in embryos

- **Precocious strains**

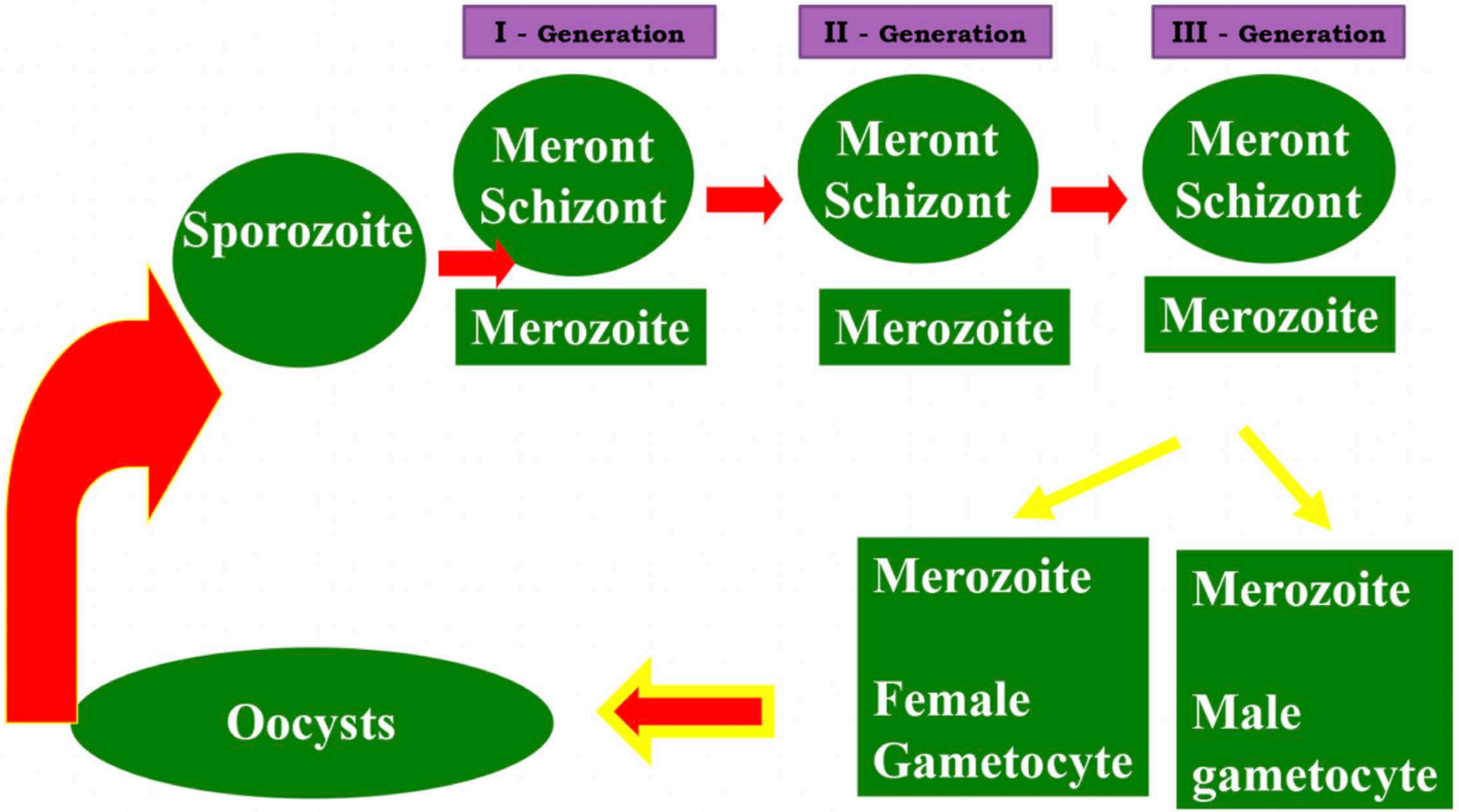
  Widely used method

  Advantages: Precocious lines of all *Eimeria spp.* of the fowl have been produced

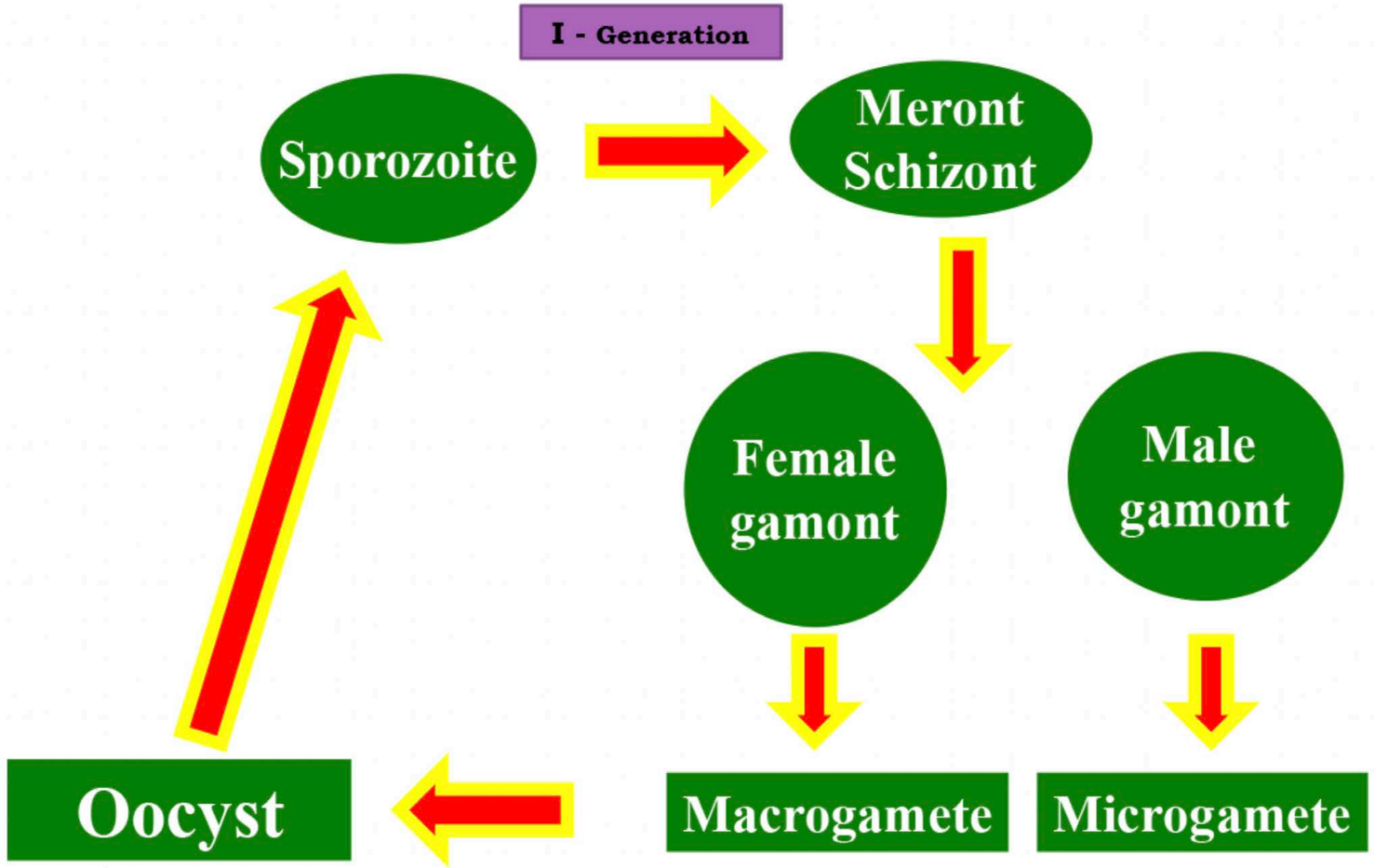
What are precocious strains?

- Precocious strains are so called because, in comparison to their parents, their life cycle is shorter.
- Precocious lines are derived by repeated passage using early produced oocysts (shorter)
- Fewer asexual stage parasites are produced in the intestine
- Less damage is caused to the intestine
- Fewer oocysts are shed in the litter during each round of infection
- Stable and limited recycling in the flock.

Wild type strains



Precocious lines



Key point for successful live coccidiosis vaccination

1. Coccidial vaccines contain organisms that are alive and pathogenic. Vaccine reaction in flocks must be carefully monitored from day 6 through 28 post-vaccination.

2. Excessive vaccine reactions frequently produce a reduction in weight gain and occasionally an increase in mortality.

3. Adverse effects can be minimized with the administration of a low dosage of amprolium for two consecutive days to flocks between 10 and 14 days of age.

4. Vitamin supplementation (particularly the fat-soluble vitamins A, E, D, and K) during the second through fifth week has been shown to be helpful in overcoming the potential negative effects of the vaccine reaction.

5. Many management factors can influence the success of the coccidiosis vaccination program, including partial house brooding, the use of built-up litter, litter moisture, adequate nutrition (particularly protein, Vitamin E and zinc) and the control of immunosuppressive factors.

RECENT APPROACHES IN ANTICOCCIDIAL VACCINES

- **Maternal immunization**
  (Intrayolk sac injection of hatching chicks)
- ***In-ovo* vaccination**
  In ovo **injection of INOVOCOX with the Embrex® INOVOJECT® System**
- **A novel subunit vaccine for broiler breeders**

A New Subunit vaccine (CoxAbic)

- First developed subunit vaccine
- Comprises of a purified protein isolated from gametocytes of *E. maxima*
- Vaccine is injected twice into breeder pullets before point of lay, stimulating the production of antibodies
- Antibodies are transferred to their offspring via the egg yolk

CoxAbic vaccine

- **Storage:**
  vaccine should be kept under regular refrigeration at +2°C to +8°C.

- **Method of Administration:**
  Breeder pullets are vaccinated twice intramuscularly before point-of-lay:
  1st - 12-16 weeks
  2nd - 18-20 weeks

- **Dose per each bird:** 0.5ml / inj

Live Anticoccidial Vaccines Developed for Chickens Potentially Exposed to *Eimeria* Species

Vaccine	Bird type	Species	Attenuation	Administration	Age of chicks	Manufacturer	First registration
Coccivac®-B	Heavy broilers	*Ea, Emax, Emiv, Et*	Non-attenuated	Hatchery spray/ ocular/water/feed	Single dose at 1 to 14 days	Schering-Plough Animal Health (USA)	1952 (USA)
Coccivac®-D	Breeders/layers	*Ea, Eb, Eh, Emax, Emiv, En, Ep, Et*		Hatchery spray/ ocular/water/feed			
Immucox® C1	Broilers/breeders	*Ea, Emax, En, Et*	Non-attenuated	Water/oral gel.	Single dose at 1 to 4 days	Vetech Laboratories (Canada)	1985 (Canada)
Immucox® C2	Broilers/breeders	*Ea, Eb, Emax, Emit, En, Ep, Et*		Water/oral gel.			
Livacox® D	Caged Chicken	*Ea, Et*	All attenuated by selection for precocity, except Et (embryo passaged)	Water	Single dose at 1 to 10 days	Biopharm (Czech Republic)	1992 (Czech Republic)
Livacox® T	Broilers/breeders	*Ea, Emax, Et*		Water/ocular			
Livacox® Q	Broilers	*Ea, Eb, Emax, Et*		Water/ocular			
Nobilis® COX ATM	Broilers	*Ea, Emax x 2, Et* (ionophore resistant)	Non-attenuated	Hatchery spray/ water	Single dose at 1 or 3 days	Intervet (The Netherlands)	Registration in progress
Paracox®	Broilers/breeders/ layers	*Ea, Eb, Emax x 2, Emit, En, Ep, Et*	All attenuated by selection for precocity	Water/feed	Single dose at 1 to 9 days	Schering-Plough Animal Health (UK)	1989 (The Netherlands)
Paracox®-5	Broilers/breeders/ layers	*Ea, Emax x 2, Emit, Et*		Feed spray			
VAC M®	Broilers	*Emax*	Non-attenuated	Oral gavage	Single dose at 1 day old	Elanco (USA)	1989 (USA)
Advent®	Broilers	*Ea, Emax, Et*	Purified oocysts	Hatchery spray/ on feed	Single dose at 1 day old	Novus (USA)	2004 (USA)

Ea = E. acervulina; Eb = E. brunetti; Eh = E. hagani; Emax = E. maxima; Emit = E. mitis; Emiv = E. mivati*; En = E. necatrix; Ep = E. praecox; Et = E. tenella*

Emax x 2 = two antigenically different lines of *E. maxima*.

* validity of species not generally accepted.

Manufacturers' technical bulletins; Shirley & Long, 1990; Shirley, 1993; Bedrnik *et al.*, 1995; Schetters *et al.*, 1999; Chapman, 2000; Vermeulen *et al.*, 2000a

Recombinant Vaccine Research In Progress

- Microneme – associated, thrombospidin – related protein
- Rhoptry associated proteins
- Aspartyl proteinase
- Merozoite proteins
- Proteins of significance: Eala and Mzp 5-7
- Expression of MZP 5-7 in *vaccinia* virus

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Thank you