

Blue Green Algae Toxicoses

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Blue Green Algae Workshop
March 2008

College of Vet Med
U of M

Who Am I ?

Veterinary Toxicologist

College of Veterinary
Medicine

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Organisms

Exposure

Toxins

Cases

Questions

Organisms

Blue Green Algae

Cyanobacteria

Cyanophyta

Energy via Photosynthesis

Nitrogen Cycle

Organisms

Blue Green Algae

Today's Focus

Anabaena sp

Aphanizomenon sp

Microcystis sp

Exposure

Surface Fresh Water

Food Supplement

Exposure

Conditions of Bloom Formation

Wind

Temperature

pH

Nutrients

Exposure

Conditions of Bloom Formation

Wind = leeward side

Exposure

Conditions of Bloom Formation

Temperature

➤ 25°C

➤ (77°F)

Exposure

Conditions of Bloom Formation

pH

➤ 7.5 – 9.0

Exposure

Conditions of Bloom Formation

Nutrients

Nitrogen, Phosphorous

Zinc, Iron

Exposure

Conditions of Bloom Formation

Nutrients

Nitrogen > 1.0 mg/L

Phosphorous > 0.1 mg/L

Zinc

Iron

➤ 2.5 uM = growth

➤ < 2.5 uM = toxin

Toxins

Microcystins

Anabaena sp

Microcystis sp

Planktothrix sp

Nostoc sp

Anabaenopsis sp

Toxins

Anatoxin

Anabaena sp

Aphanizomenon sp

Toxins

Saxitoxins

Anabaena sp

Aphanizomenon sp

Toxins

Cylindrospermopsins

Aphanizomenon sp

Toxins

Focus

Microcystin

Microcystis aeruginosa

Toxins

Microcystis aeruginosa

Not all strains produce microcystin

Production varies during season

Intra- vs extra-cellular location

Toxins

Microcystin

80 congeners

Microcystin-LR

Toxins

Microcystin

Toxicity

Biochemistry

Organ

Clinical Signs

Dose

Toxins

Microcystin

Biochemistry

Inhibition of Ser/Thr protein
phosphatases 1 & 2A

Toxins

Biochemistry

Inhibition of Ser/Thr protein phosphatases 1 & 2A

Inhibition of cytoskeleton structure

Apoptosis

Cell death

Toxins

Organ

Uptake

organic anion transporting polypeptides

Oatp1b2, 1B1, 1B3

Hepatic

Necrosis, endothelium, bile canaliculi

Renal

Toxins

Clinical Signs

Jaundice, shock, colic, weakness,
vomiting, rapid pulse, death

Toxins

Dose

IP

IV

Oral

Toxins

Dose

IP

LD₅₀ =

122 ug/kg rats

65.4 ug/kg mice

Toxins

Dose

IV

Lethal dose

72 ug/kg – swine

100 ug/kg – rats

Toxins

Dose

Oral

LD 50 =

10.9 mg/kg – mice

5.7 mg/kg – trout

0.4 mg/kg – carp

Cases

Dog

Cat

Cases

Dog

October 2

Morning hunt – vomit slew water

4 hours later – depressed, anorexia

3 hours later – seizure, colic

DVM - necropsy

Cases

Dog

Pathology

Massive hepatic necrosis

Renal tubule degeneration

Cases

Dog

Water

Microcystis aeruginosa

Microcystin LR, YR, RR

Cases

Cat

July 13

normal blood values

ALT = 20

Cases

Cat

July 15 - ALT = 5,924 IU

July 16 - ALT = 3,925 IU

July 17 - ALT = 2,071 IU

Cases

Cat

July 14 – 2 BG Algae Tablets

Cases

Cat

Capsule = 780 ng/g dw

Microcystin

LC/MS/MS

Cases

Anatoxin – a

Dogs (6)

Seizure & death
1 hour after swimming
in water
with anatoxin

Questions ?

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