



A review on AIV and NDV strains circulating worldwide with particular reference to the characterization of virus strains isolated in Africa

Giovanni Cattoli

*OIE/FAO Reference Laboratory for avian influenza & Newcastle disease
Istituto Zooprofilattico Sperimentale delle Venezie
Legnaro (Padova), Italy*



Diseases known since long ago...

- First documented evidence of HPAI in Italy at the end of 19^o century (fowl plague)
- Considered uncommon until 15 years ago
- ND first documented in Java and England in 1926 and 1927 respectively.
- Reports of a disease similar to ND in Central Europe and Scotland back to 1912 and 1896 respectively

...but their control is an increasing challenge



NDV-Geographical distribution

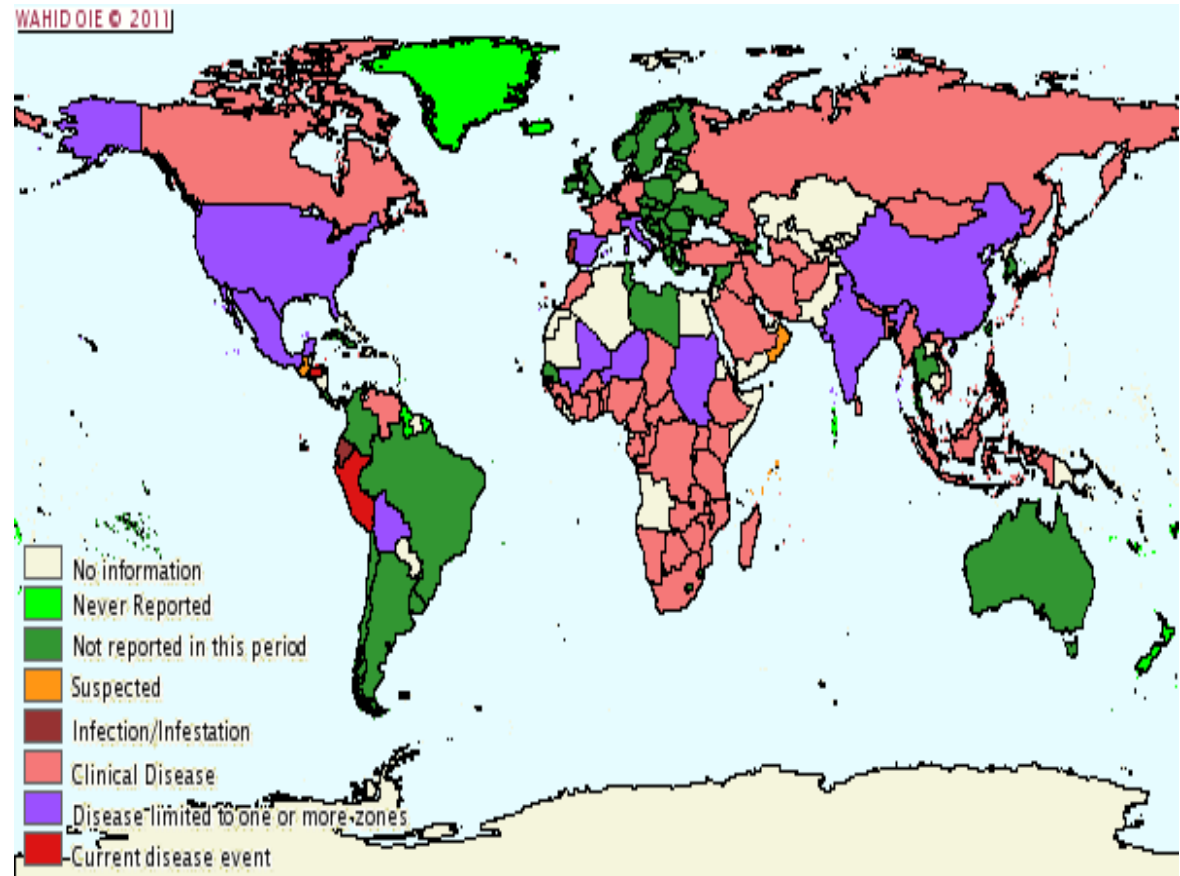
Velogenic ND is
OIE-notifiable

Distributed worldwide

Endemic in many
Countries

**16 countries in the
world**

never reported ND
outbreaks (2010)





NDV in Africa (2009-2011)

42 African countries

Reported suspected or confirmed cases of ND.

20 countries reported ND in the first 6 months of this year

Source: WAHID





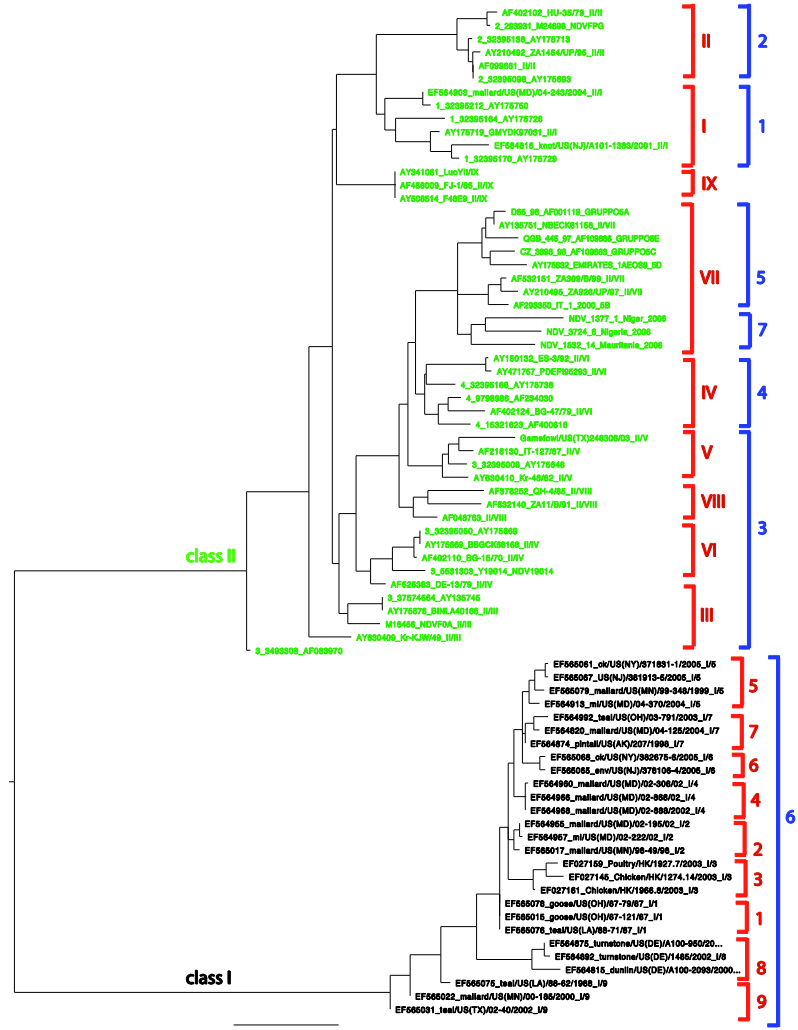
Genetic variability – NDV

Intra-class genetic variability

Class I (lineage 6): 9 genogroups

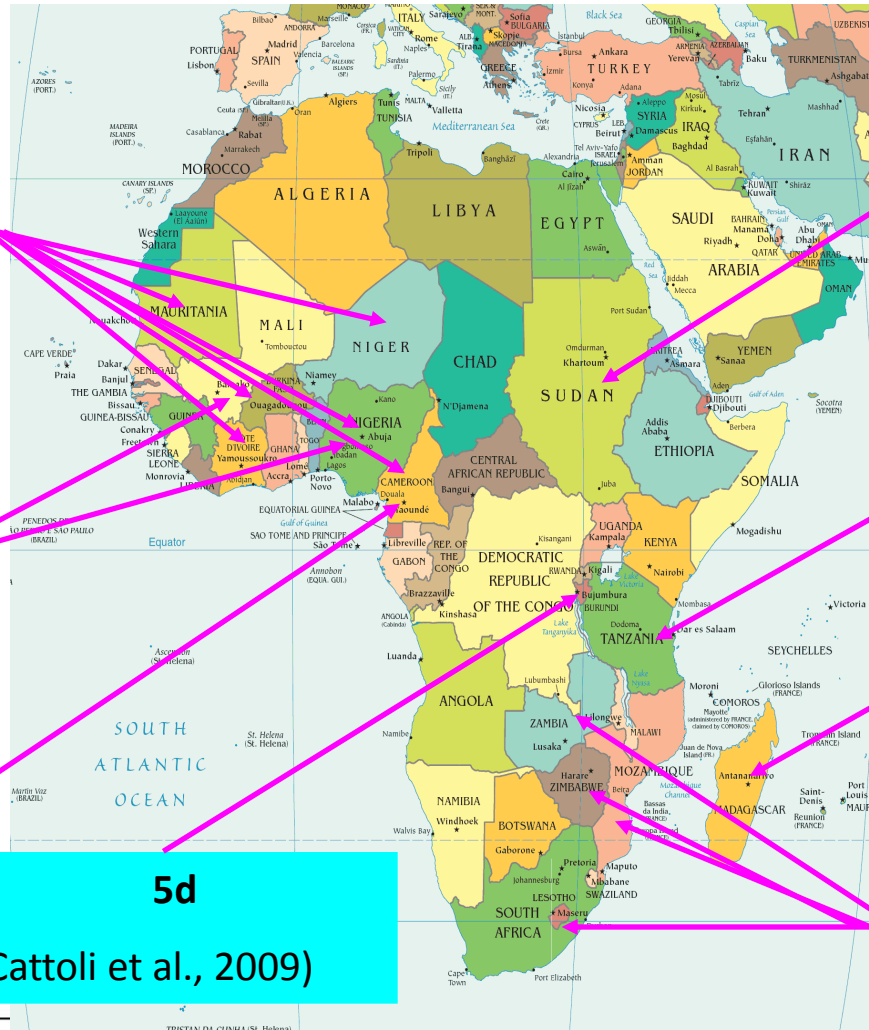
Class II: 11 genotypes (7 distinct lineages)

Several distinct subgroups within lineages





APMV-1 in sub-saharan Africa



7
(Cattoli et al., 2009)

3b, 5d
(Aldous et al., 2003;
Hassan et al., 2009)

3, 4, 7(?)
(Snoeck et al., 2009;
De Almeida et al.,
2009)

3c, 4a
(Aldous et al., 2003)

1
(Snoeck et al., 2009)

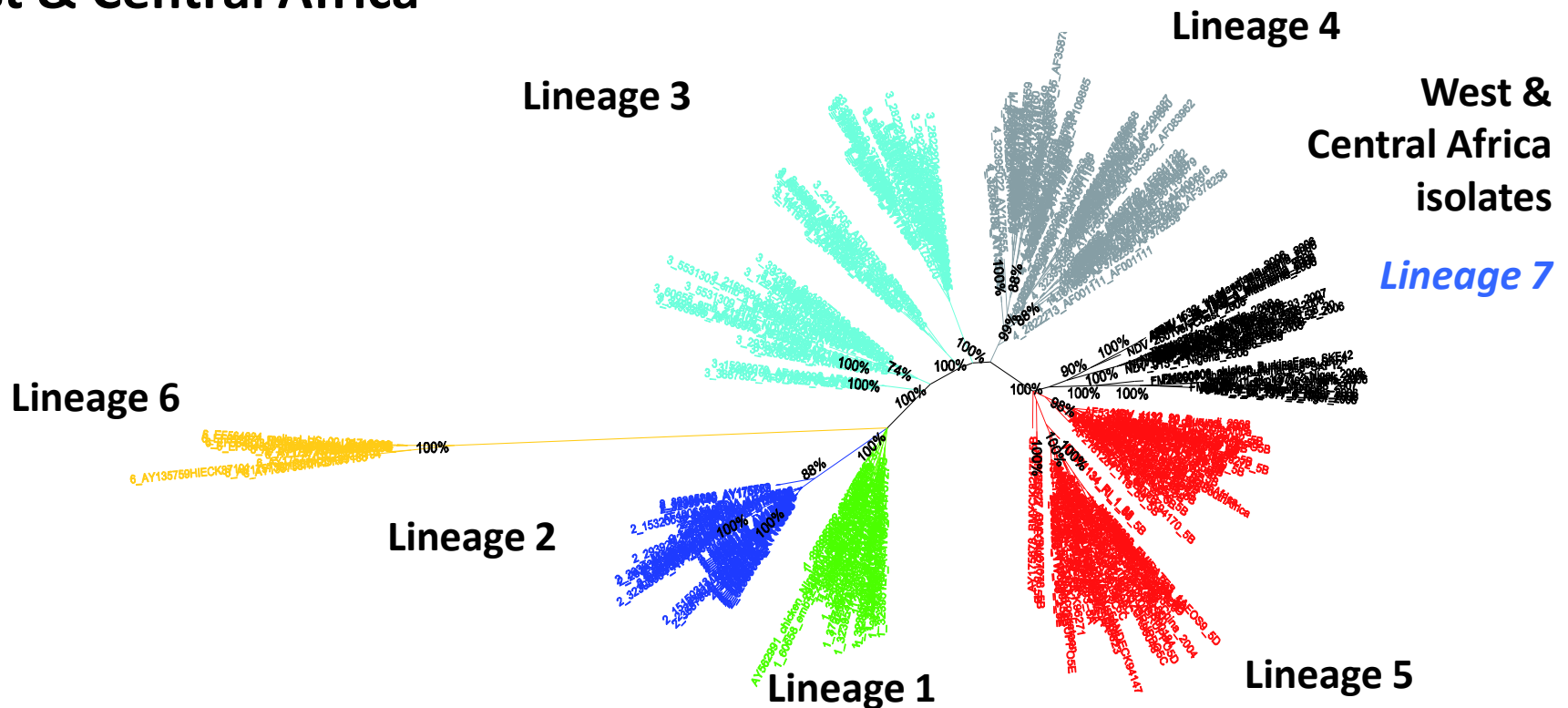
1, 2, 3, 5
3g
(Maminaina et al., 2010)

5d
(Cattoli et al., 2009)

1, 2, 4, 5b, 5d
(Aldous et al., 2003;
Abolnik et al., 2004)



Distinct class II lineage (7) in West & Central Africa



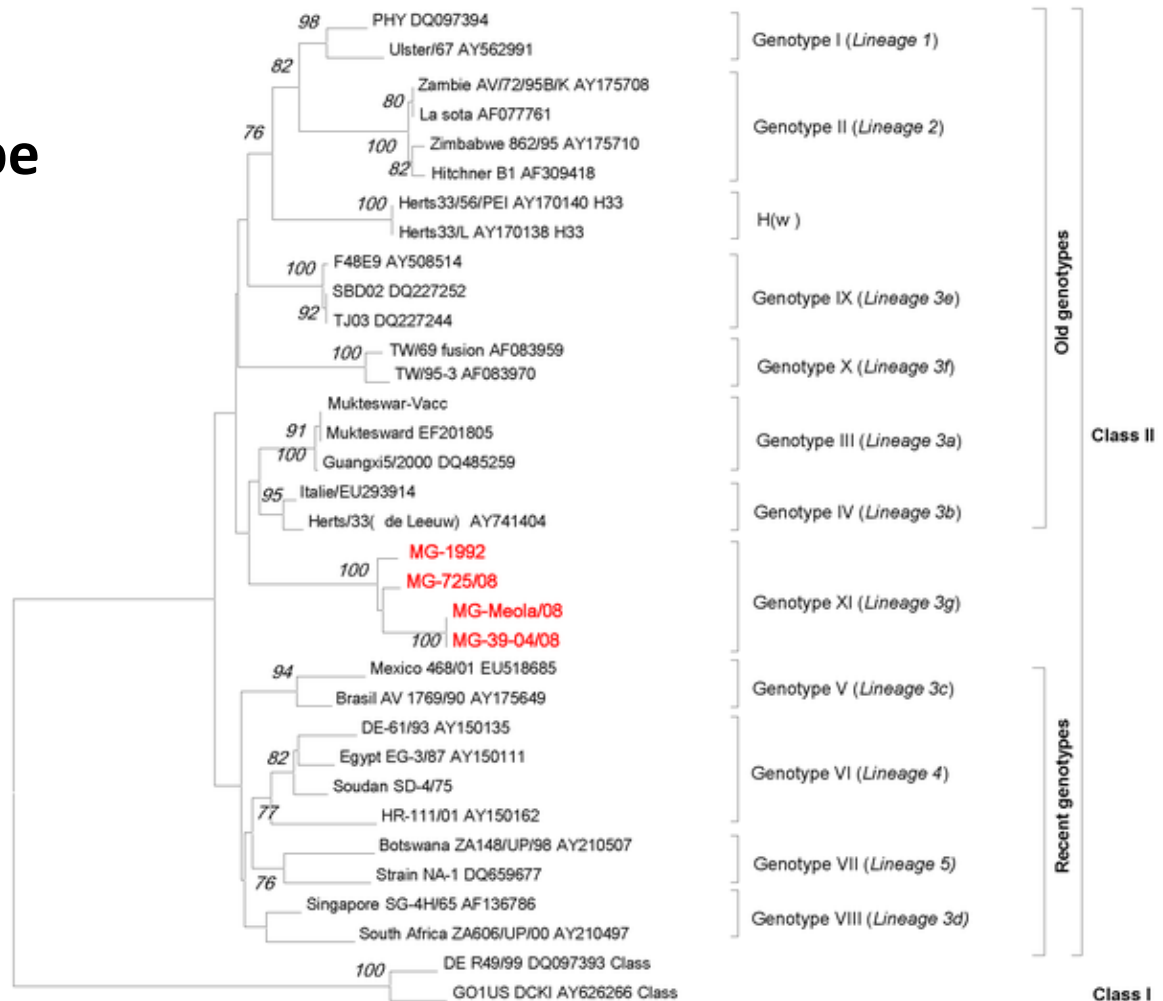
(Cattoli et al., 2009)



Distinct Class II genotype (3g) in Madagascar

ICPI 1.9

(Maminaina et al., 2010)



0.05



**CONFIRMED CASE OF NEWCASTLE DISEASE IN IMPORTED BIRDS
FROM WEST AFRICA SUCCESSFULLY PICKED UP IN UK QUARANTINE
(2003)**

Defra's quarantine arrangements have successfully identified Newcastle disease in two birds imported from Mali in West Africa.

The birds, which were discovered dead during route post-import quarantine checks, were part of a mixed consignment of finches and shrikes that arrived from Mali on April 16, 2003.



Avian Influenza



NAI in poultry reported in the period January-June 2011

(source OIE/WAHID)

LPAI reports

<u>Country</u>	<u>Subtype</u>
1. Taipei	H5N2, H7N3
2. Iran	?
3. Nepal	?
4. Palestine	?
5. Papua New Guinea	?
6. Seychelles	?
7. USA	H7N9
8. Dominican Rep.	?
9. Haiti	?
10. France	? (H5N3 ?)
11. The Netherlands	H7N1, H7N7
12. Germany	H7N7
13. Italy	H7N3, H5N2

HPAI (H5N1) reports

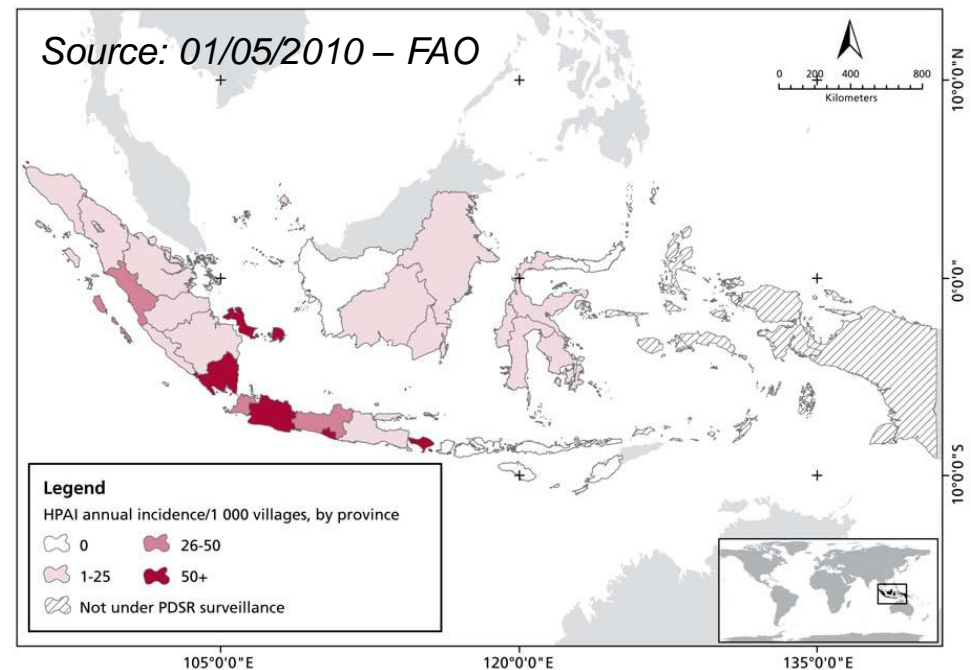
<u>Country</u>
1. Bangladesh
2. Cambodia
3. Vietnam
4. India
5. Japan
6. Mongolia
7. Palestine
8. Israel
9. Egypt



H5N1 endemicity

To date H5N1 HPAI is declared or considered **endemic in 6 countries**, at least.

1. Indonesia
2. PR China
3. Bangladesh
4. Vietnam
5. India
6. Egypt





Continuing evolution of H5N1 HPAI viruses

Clade 1 in the Mekong River Delta,

Clade 2.1.3 in Indonesia,

Clade 2.2 in India/Bangladesh,

Clade 2.2.1 in Egypt,

Clades 2.3.2, 2.3.4 and 7 in Asia

requires assignment of divergent HA genes to new second, third, and/or fourth **order clades**.

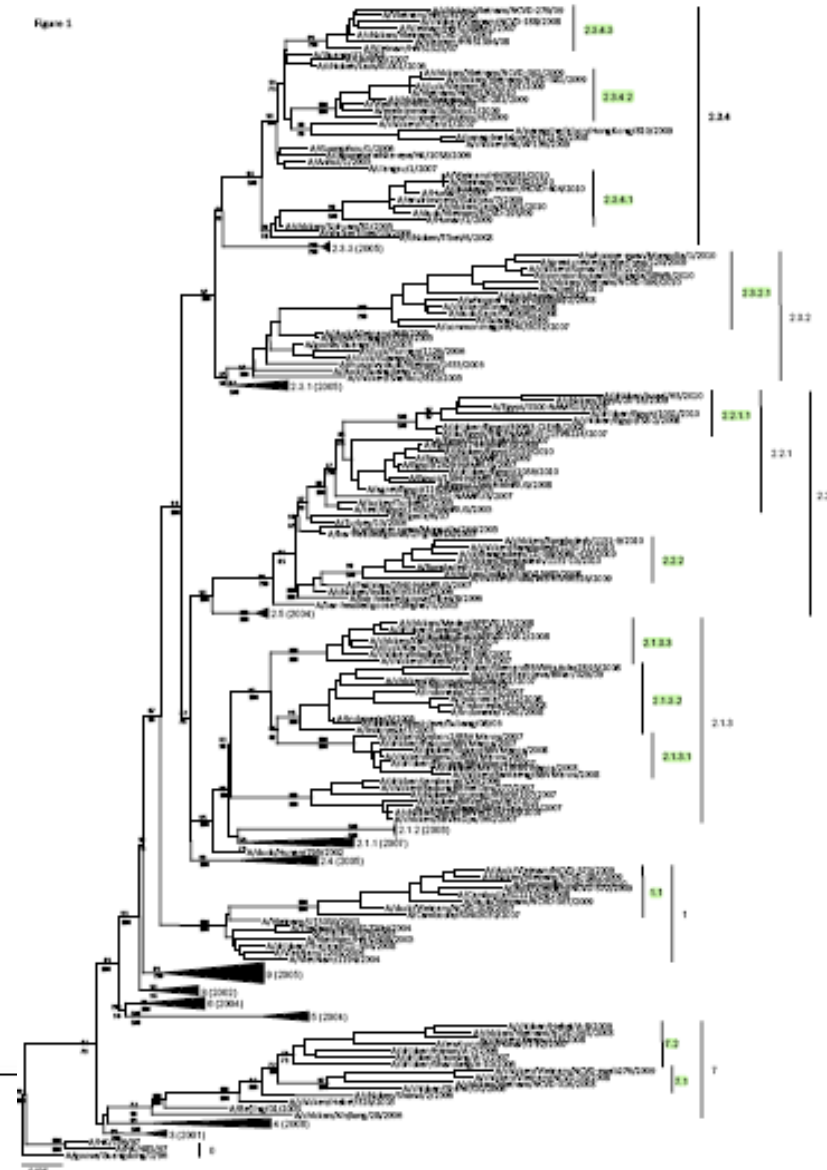
Clades 0, 3, 4, 5, 6, 8, 9 and

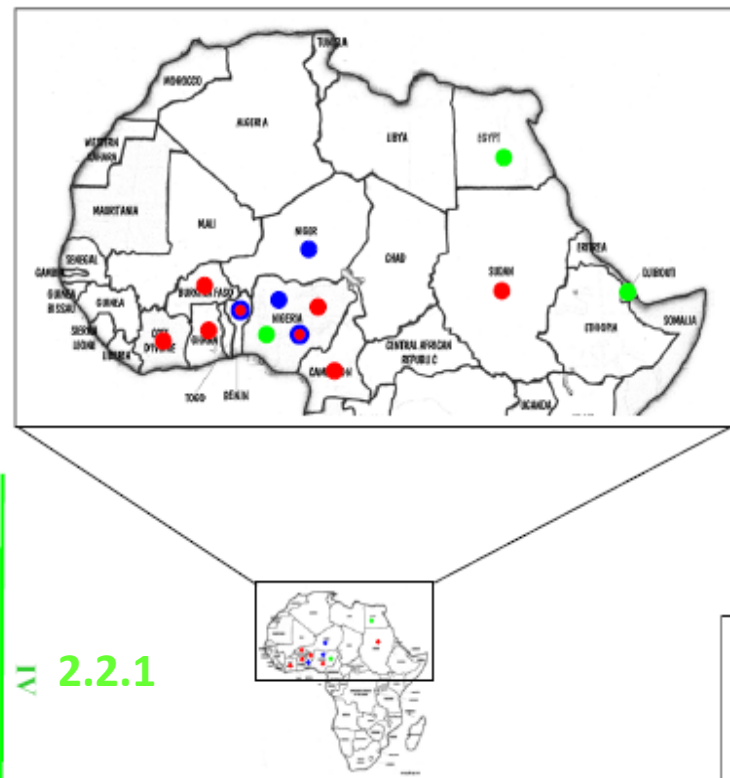
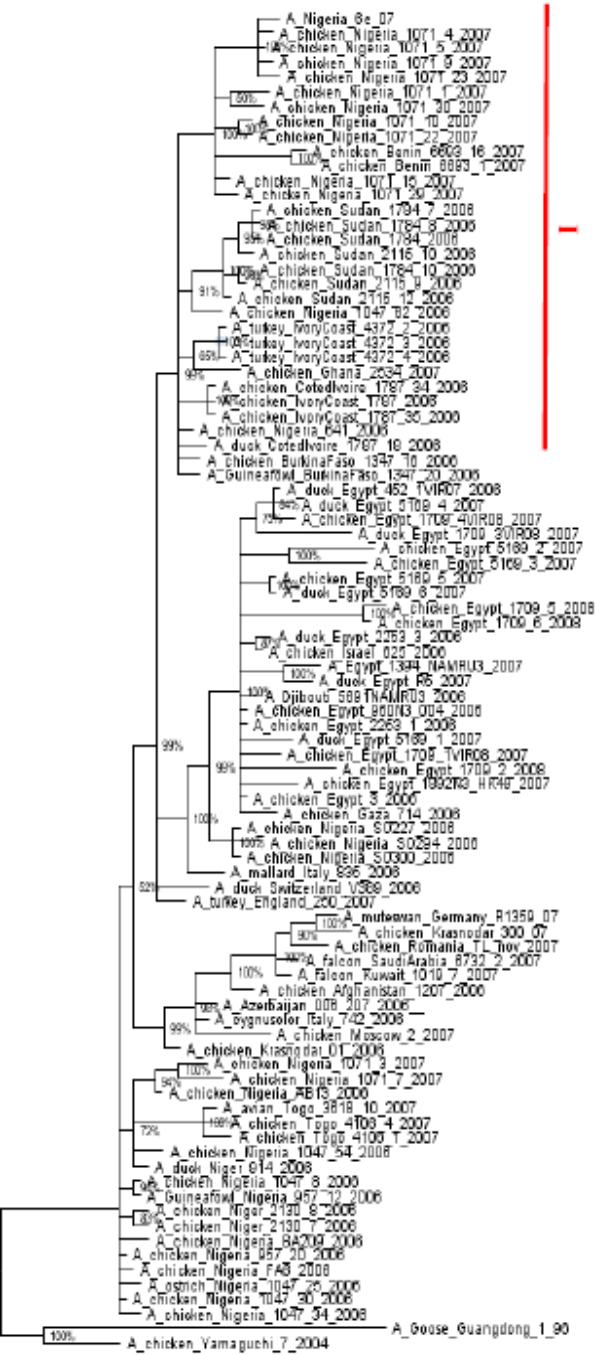
several second and third-order groups from clade 2

have not been detected since 2008 or earlier.

WHO H5N1 Evolution Working Group, 2011

Figure 1

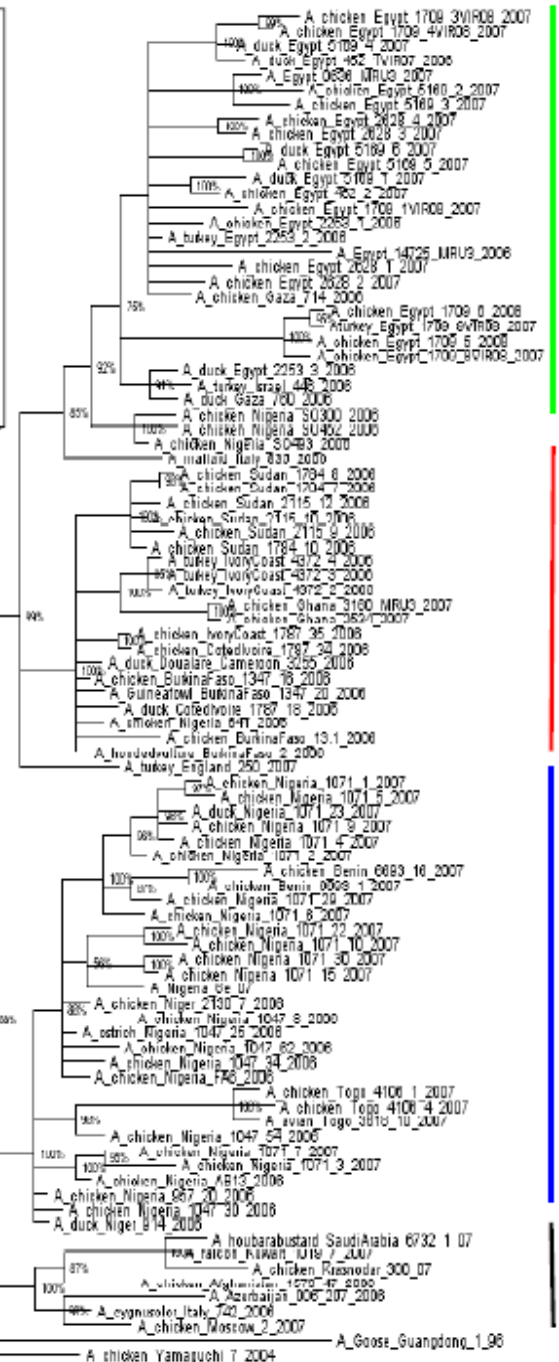




≈ 2.2.1

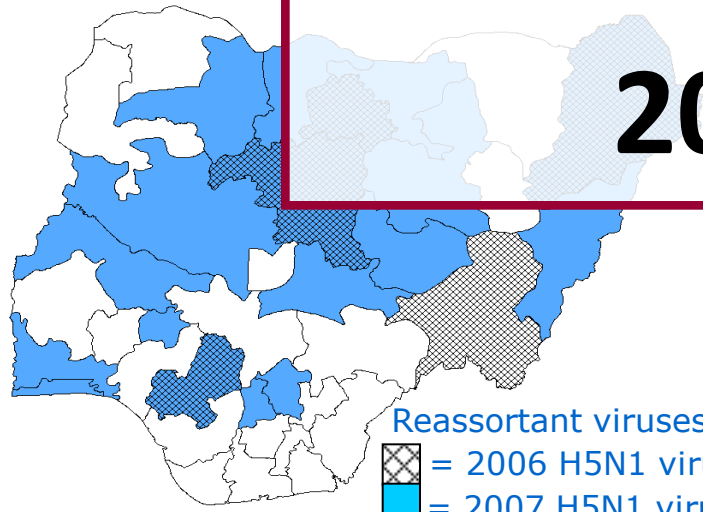
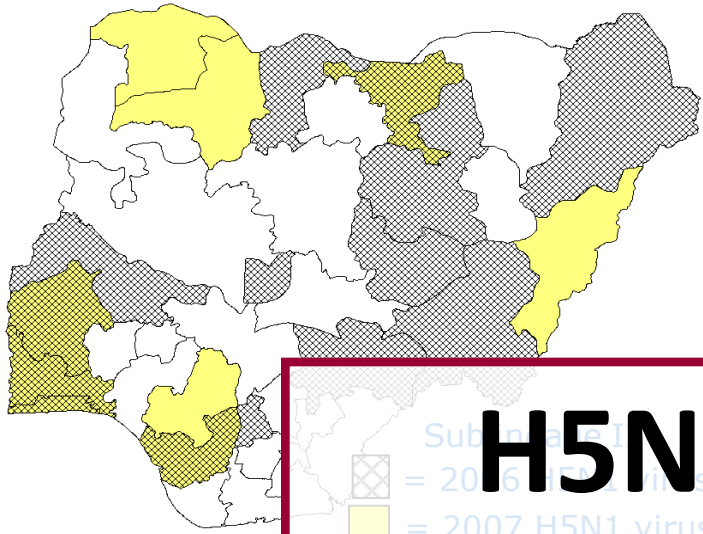
Multiple introductions of H5N1 HPAAI in Africa (clade 2.2)

PlosOne, 2009

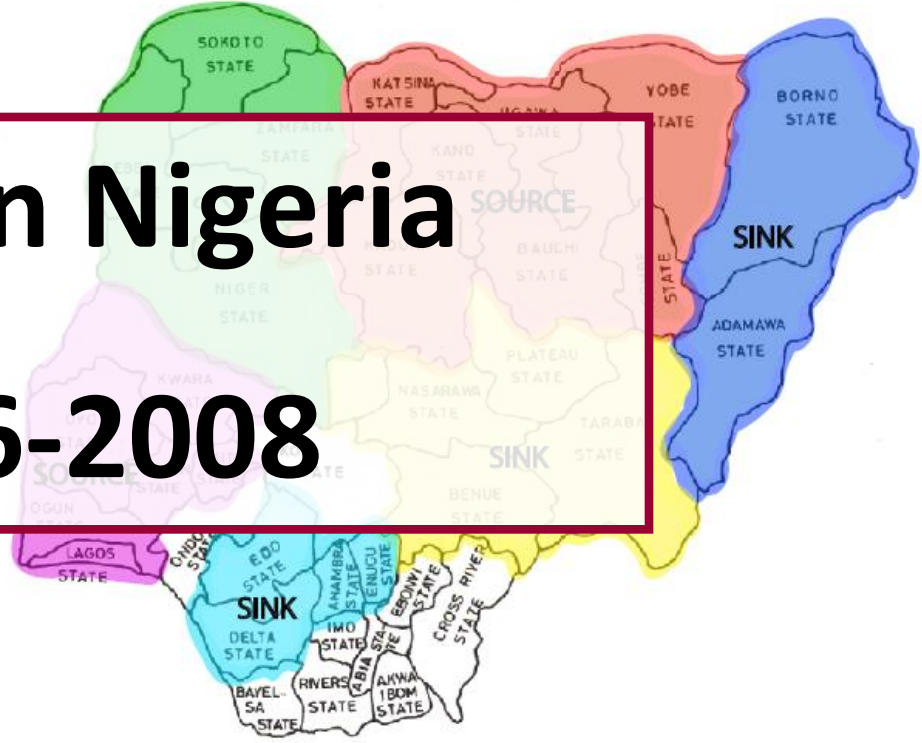




H5N1 in Nigeria: 2006-2008



H5N1 in Nigeria
2006-2008



Subtype H5N1 viruses
 = 2006 H5N1 viruses
 = 2007 H5N1 viruses

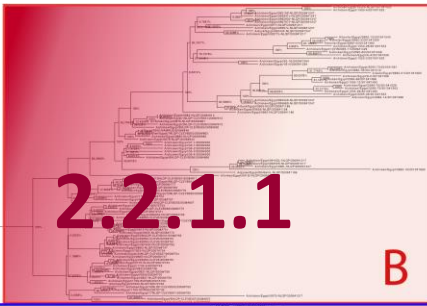
Reassortant viruses(I/II)
 = 2006 H5N1 viruses
 = 2007 H5N1 viruses

J Virol, 2010



2.2.1

100

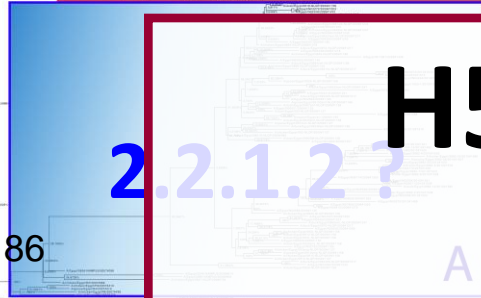


2.2.1.1

B →

2008 -2010
 Monophyletic group
 Bootstrap value of 100%
 Average percentage pairwise nt distance within clade:1.5%
 Average percentage pairwise nt distance between clades: 2.9%

86



2.2.1.2 ?

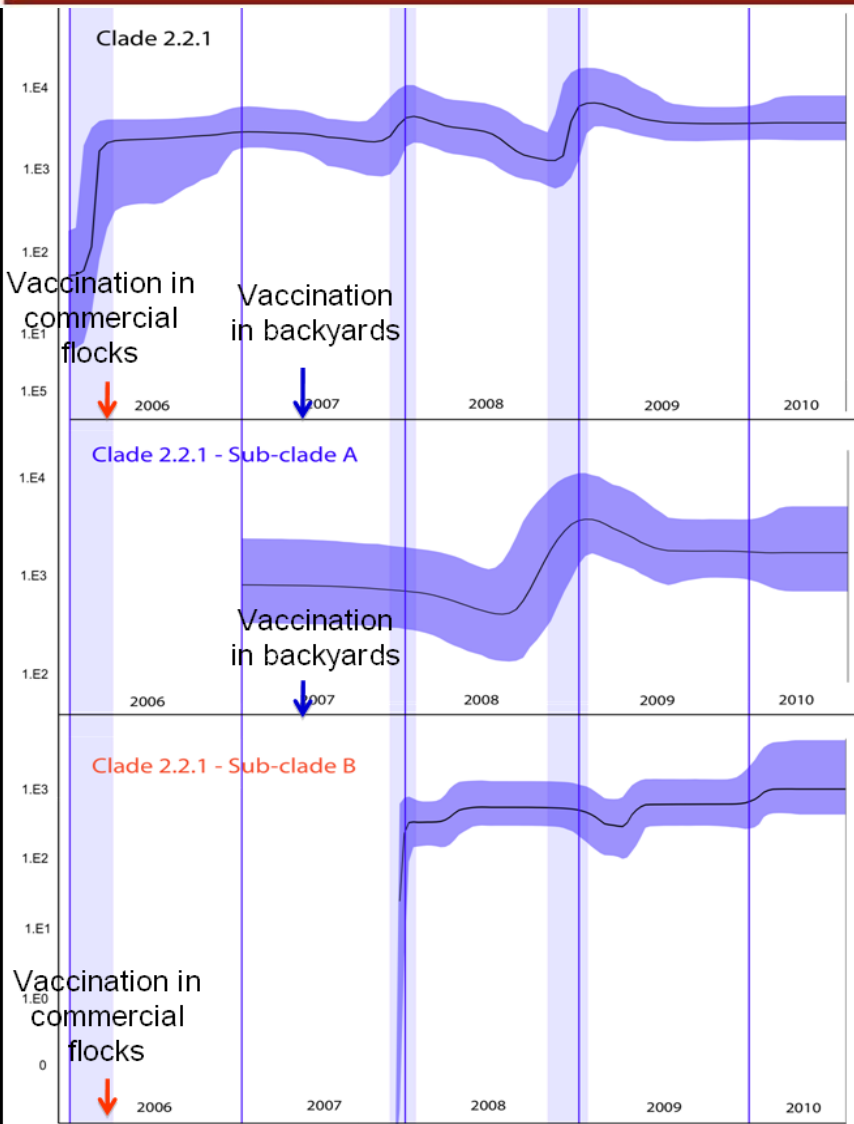
A →

H5N1 in Egypt

2006-2011

2007-2011
 Monophyletic group
 Bootstrap value of 86%
 Average percentage pairwise nt distance within clade: 1%
 Average percentage pairwise nt distance between clades:

Vaccine, 2011a



Clade 2.2.1 in Egypt

2.2.1 B viruses **drifted away** from the vaccine strain most commonly applied in commercial poultry
(Avian Pathol., 2010; Vaccine, 2011; J Virol, 2011)

Subclade A

Evolutionary rate: 4.07×10^{-3} sub/site/y

Subclade B

Evolutionary rate: 8.87×10^{-3} sub/site/y

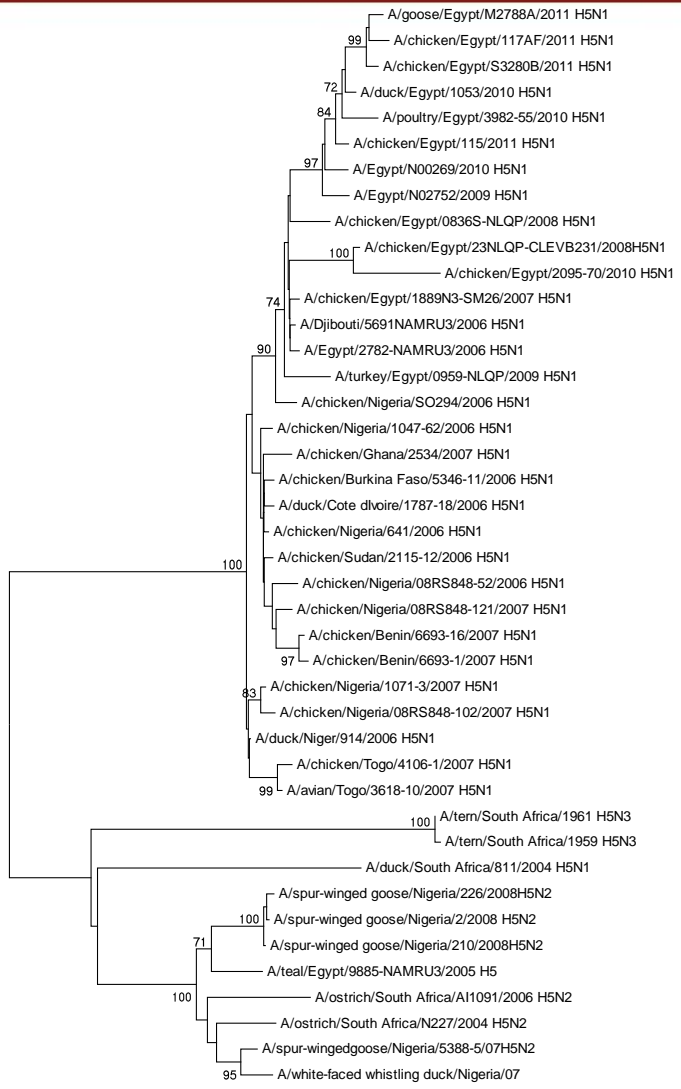
Vaccine, 2011



Notifiable Avian Influenza in Africa (other than HPAI H5N1)

From Olivier, 2006 - adapted

Year	Pathotype	Species	Country
1961	HPAI H5N3	Wild birds (terns)	South Africa
1991	LPAI H7N1	Ostrich	South Africa
1994	LPAI H5N9	Ostrich	South Africa
1995	LPAI H5N2	Ostrich	Zimbabwe
1996	LPAI H5N2	Ostrich	Zimbabwe
2004	H5N2	Wild birds	South Africa
2004	HPAI H5N2	Ostrich	South Africa
2004	H5N1-H5N3	Wild birds	South Africa
2005	H5N?	Wild birds	Egypt
2005	LPAI H7N7	Wild birds	Egypt
2006	H5N3	Wild birds	Mali
2007	HPAI H5N2	Wild birds	Nigeria
2008	LPAI H5N2	Wild birds	Nigeria
2011	HPAI H5N2	Ostrich	South Africa



**H5N1HPAI
2006-2011**

**H5N2
LPAI & HPAI
2004-2008**





Discussions - I

- NDV is present worldwide, with some virus lineages becoming dominant (e.g. 5 in Eurasia)
- In Africa, lineages 5 and 7 are the most common lineages causing the majority of the outbreaks in poultry



Discussions - II

- HPAI H5N1 is still circulating in several countries and it is endemic in 6 at least, including one African country (Egypt).
- NAI (H5 & H7) are sporadically reported in Africa, with the majority of cases being caused by the H5 subtype
- The idea of an “endemic” African circulation of related LP/HPAI H5N2 viruses in wild birds and poultry deserves further investigation



Discussions - III

- In Africa, monitoring and surveillance should aim to collect more information particularly (but not exclusively) on the epidemiology and ecology of HPAI H5N1 clades 2.2.1 & 2.3.2.1; LP/HPAI H5N2 and LPAI H9N2 as well as on lineages 5 and 7 of NDV.
- Information should be gathered in order to evaluate the efficacy of AI and ND vaccines currently available and applied in this continent and to implement appropriate control measures.

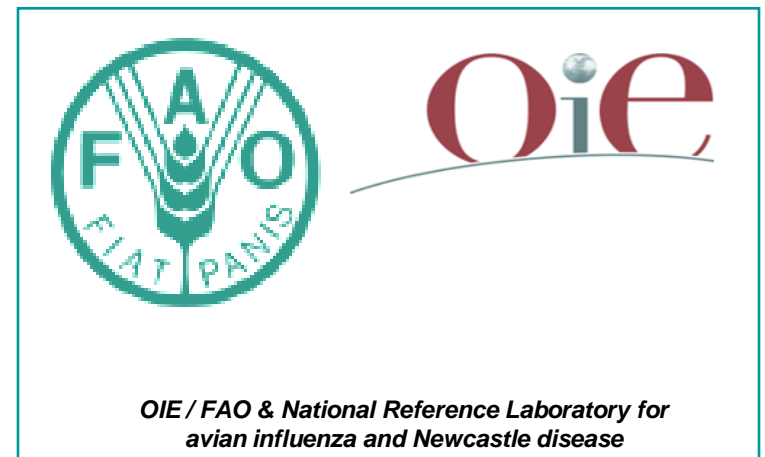


Acknowledgments





Thank you for the attention



Istituto **Z**ooprofilattico **S**perimentale delle **V**enezie

Giovanni Cattoli

Ph.: +39 049 8084384 | gcattoli@izsvenezie.it

www.izsvenezie.it