Avian influenza seroprevalence in North Vietnam

Stéphanie Desvaux[1], Marisa Peyre[1], Pham Thi Thanh Hoa[2], Nguyen Tien Dung[3], François Roger[1]
1 CIRAD (AGIRs), Montpellier, France
2 National Institute of Animal Husbandry-CIRAD, Hanoi, Vietnam
3 National Institute of Veterination Research, Hanoi, Vietnam

UR AGIRs
Animal et Gestion Intégrée des Risques
TA C 22/E Campus International
de Baillarguet
34398 Montpellier cedex 5
France

Contact: stephanie.desvaux@cirad.fr

Highly Pathogenic Avian Influenza (HPAI), subtype H5N1, is now endemic in Vietnam. Surveillance and control of the virus circulation in poultry remain a challenge. In 2005, the Government of Vietnam decided to launch a massive vaccination campaign to control the number of outbreaks and the transmission to Humans. The domestic poultry are currently vaccinated against H5N1 virus using a H5N1 inactivated vaccine and following a national program with 2 main vaccination periods during the year (October-November and April-May). The objective of the national services being to reduce the size of the susceptible population with at least 50% of the flocks to be vaccinated.

SAMPLING METHOD

In order to study the pattern of seroprevalence over one year time, repeated population-based cross sectional surveys were conducted on domestic poultry in the Red River Delta in North Vietnam.
Fours sampling periods were defined: mid december 2008 (C1), end January 2009 (C2), end March 2010 (C3) and early June 2010 (C4).
Around 1000 birds were sampled for each campaign with the farms (for farm poultry) or villages (for backyard poultry) being randomly selected in our study area (see Figure 1). 15 birds were sampled for each selected epidemiological unit.

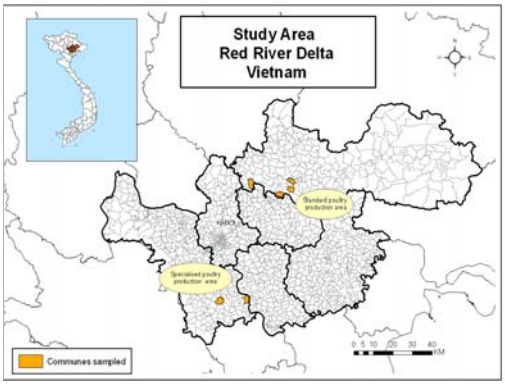

Figure 1: Localization of sampled communes (orange areas)
Two types of poultry production area were selected (standard and specialized) to be representative of the Red River Delta production basin.

SEROLOGICAL DIAGNOSIS METHOD

Influenza A seroprevalence was estimated using a competition Elisa kit that detects antibodies against the internal nucleocapsid of influenza A virus (ID-Screen® Influenza A Antibody Competition). A subtype specific Elisa was also used to compare the results with HIH5 (ID-Screen ® Influenza H5 Antibody Competition).
Influenza H5 seroprevalence was estimated using Hemagglutination Inhibition test (HI test). All sera with a titer ≥ 4log2 were defined as positive.

H5 SUBTYPE SEROPREVALENCE

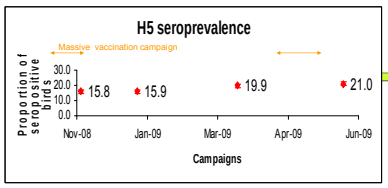

Figure 2. Individual H5 seroprevalence over the 4 sampling periods

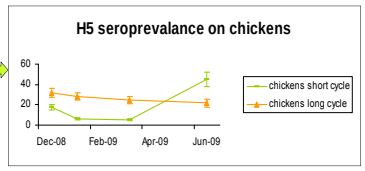

Figure 3. Individual H5 seroprevalence over the 4 sampling periods for chickens population

HI H5 tests performed on all sampled collected. N=4357

Short cycle populations (broiler) show a lower vaccination coverage than breeder-layer as illustrated by the figure 2 for chicken population. Only the campaign 4 shows a higher coverage that is difficult to explain by the vaccination campaign (private vaccination of the Day Old Chicks?)

Seroprevalence ↗ among the non vaccinated birds from the C1 to the C3 (data not presented) giving an indication of possible virus circulation during that period.

INFLUENZA TYPE A SEROPREVALENCE

	n	Seroprevalence with 95% CI
All species	1103	42.79% (40.3 - 45.3)
Chicken	415	32.29% (29,2-35,3)
Duck	392	69.1% (62,3-75.9)
Muscovy Duck	210	24.8% (21.5-28.1)

Table 1. Repartition of the seroprevalence of influenza A per species

Elisa tests performed on a randomly selected sample from all sera collected. N=1103

TESTS' PERFORMANCE

Low agreement between HIH5 and Elisa H5
Kappa for chicken breeder = 0.498 (n=123)
Kappa for duck breeder = 0.303 (n=143)
⇨**Problem of specificity of Elisa H5?**
⇨**Problem of validation for different species?**
⇨**Needs a third test to better evaluate the tests' performance**

Estimation of the Se and Sp of the tests using bayesian methods on chicken breeder population results

PRIORS (best guess)

	95% confidence	
Prevalence	sup 25%	mode 30%
Se ELISA	sup 90%	mode 95%
Sp ELISA	sup 80%	mode 90 %
Se HI	sup 70%	mode 80 %
Sp HI	sup 90%	mode 95%

Posterior distribution for true prevalence

Minimum	0.1925
2.50%	0.2516
Median	0.307
97.50%	0.368
Maximum	0.4403
Mean	0.3076
SD	0.0297
Iterations	20000

Probability interval	Sensitivity Elisa H5	Specificity Elisa H5	Sensitivity HIH5	Specificity HIH5
Minimum	0.8516	0.4864	0.5229	0.8876
2.50%	0.9167	0.581	0.6233	0.9322
Median	0.9581	0.673	0.7392	0.966
97.50%	0.9831	0.7645	0.8406	0.9862

Table 2. Posterior distribution of the Se and Sp of Elisa H5 and HIH5 tests using one population (chicken breeders)

CONCLUSIONS

Seroprevalence of type A on domestic poultry is not only due to H5 subtype in Vietnam and demonstrates a high circulation of influenza virus on ducks (especially H9 – data not shown).

The global individual vaccination coverage of domestic poultry in the Red River Delta is around 20% of the birds whatever the period of the year (close or not from the mass vaccination campaign). This protection level is much lower than coverage expected from a massive vaccination but may be explained by:
- population turn over
- duration of the immunity
- practical implementation of the vaccination.

As a consequence of the population turn over, the protection of the broiler population is lower than the breeder-layer population (same for ducks, data not shown).

Difference between vaccination and infection may be suggested for some animals said not have been vaccinated but showing seroconversion.

PERSPECTIVES

The serological diagnosis tests need to be better evaluated for the different species. Seroneutralisation test is going to be used on two populations and Se and Sp will be evaluated using Bayesian or frequentist methods.

Correlation between seroconversion and protection needs to be better investigated for ducks.

GRIPAVI PROJECT
Funded by French Ministry of Foreign and European Affairs

Aknowledment to ID-Vet laboratory for supplying Elisa kits