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Current Situation of HPAI in The Middle East

Update from the WOAH HPAI reference laboratory

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Regional Coordination meeting on HPAI situation in the Middle East and action plans guided by Global HPAI Strategy
17-19 December 2024
(Amman, Jordan)

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- **Genetic characterization & vaccination**
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- **Conclusions and Recommendations**

Region: THE MIDDLE EAST

- Countries that are considered endemic in poultry: Egypt
- Surveillance in poultry: YES
- Surveillance in wild birds: Limited
- Surveillance in mammals: No
- Vaccination in poultry: Egypt
- Genomic sequencing available in the country: Many
- Disease reporting challenges: YES
- Any observed changes/updates in epidemiology: NO

Current situation of Avian Influenza viruses

THE MIDDLE EAST

Country	Patho Type	Subtype	Host	Positive cases
Egypt	HPAI	H5N1/H5N8	Domestic	34
Israel	HPAI	H5N1	Wild/Domestic	16
Iraq	HPAI	H5N1	wild	1
Algeria	HPAI	H5	Domestic	1
Cyprus	HPAI	H5N1	wild	1
Turkey	HPAI	H5N1	Domestic	6

Current situation of H5 avian influenza in Egypt

Outbreaks in poultry

- 2 commercial farms
- 2 household birds
- 30 live bird markets

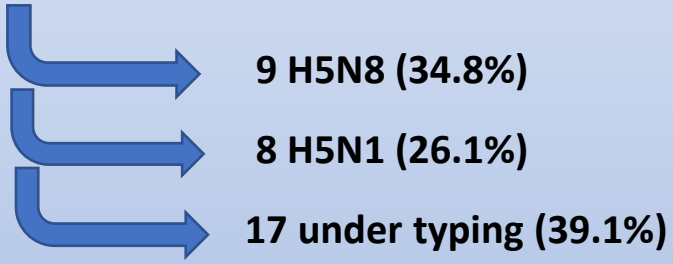
- A total of **34** cases from **11** Egyptian governorates

Human cases

There is no human cases since 2017

Total number of examined cases of avian influenza virus during 2024

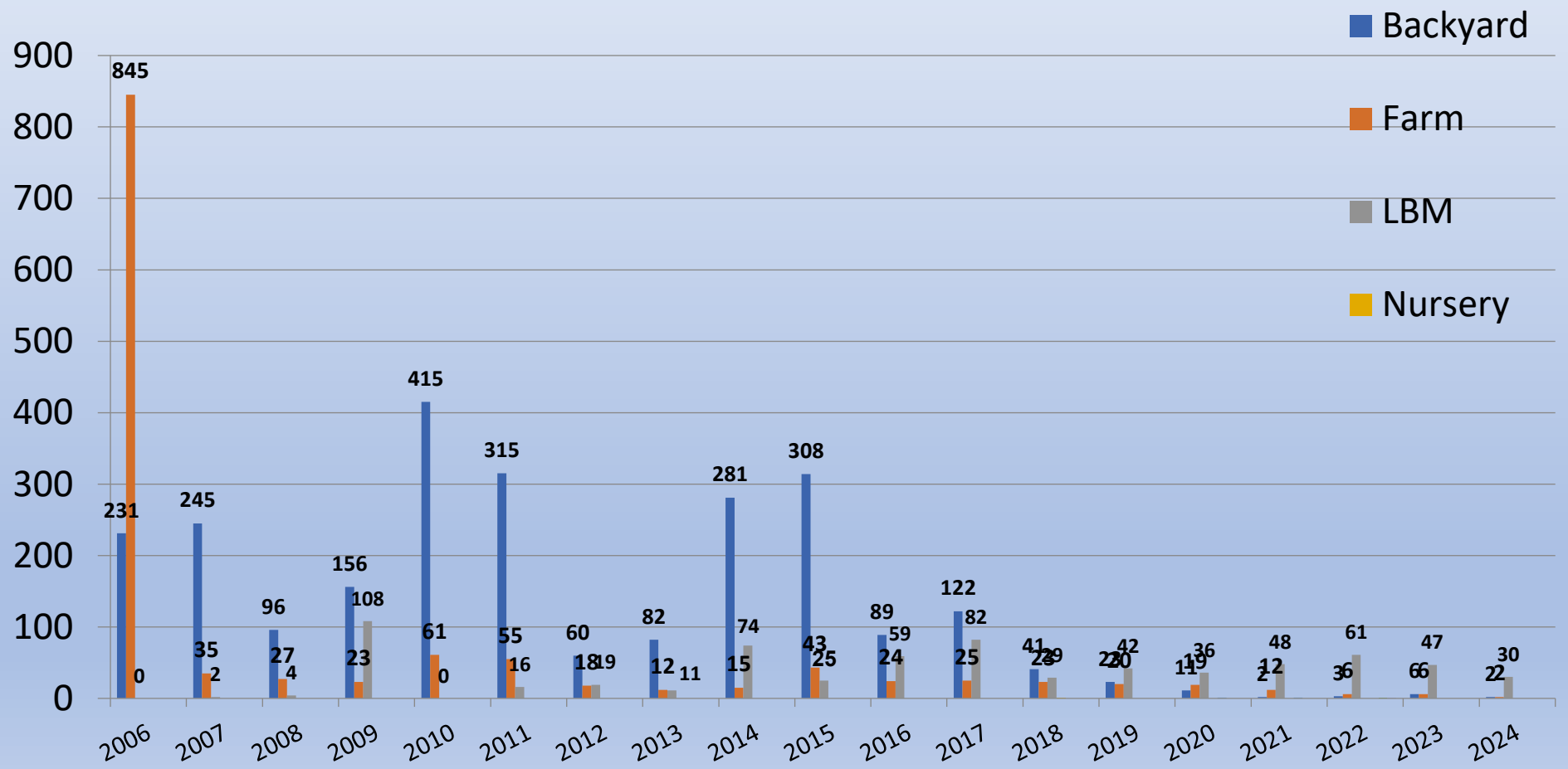
- **More than 6000** cases were received for testing for avian influenza in **2024** by PCR.
- **34 (0.5%)** outbreaks of the highly pathogenic avian influenza virus H5 were recorded



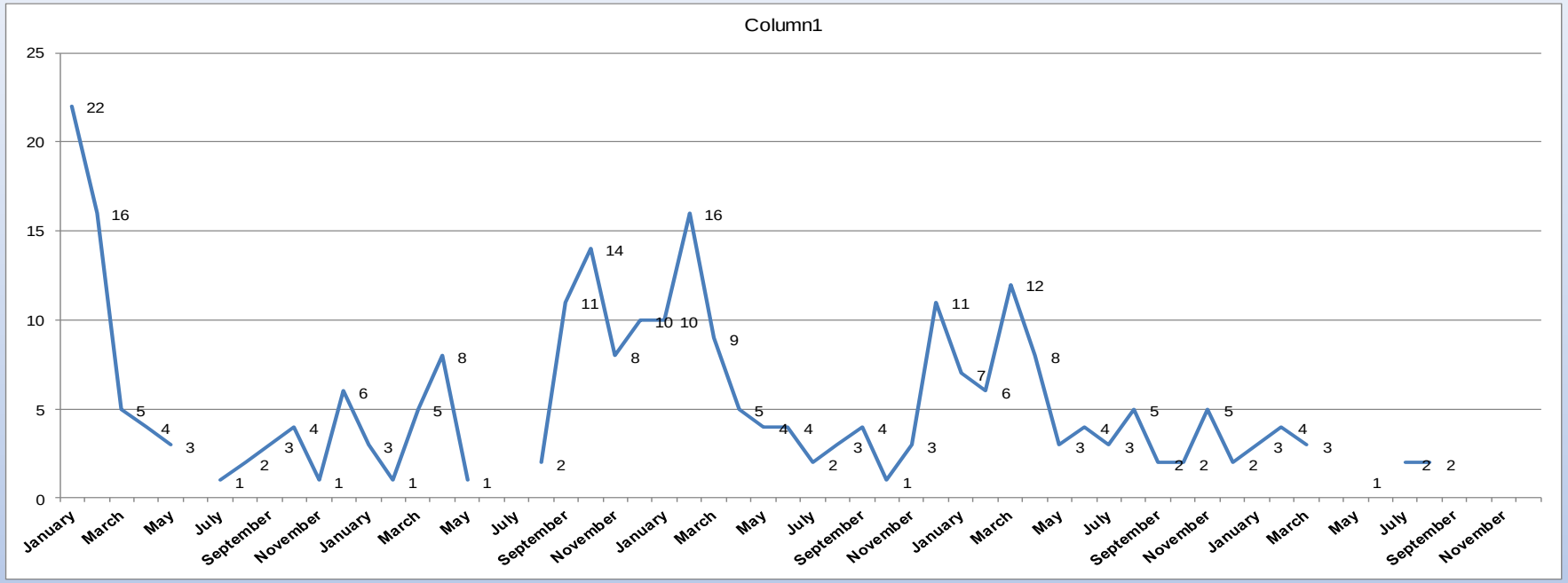
HPAI H5 in Egypt

Year	Farm	backyard	LBM	Nursery	Slaughter houses	Export	Frozen	customs	Total
2017	25	123	82						230
2018	23	41	29	1					94
2019	20	23	42						85
2020	19	11	36			1			67
2021	11	2	56				1		70
2022	6	3	61		1			1	72
2023	6	6	47						59
2024	2	2	30						34

H5	Farms	Backyard	LBM	Total
2023	6	6	47	59
2024	2	2	30	34



Positive H5 cases in poultry from 2020 - 2024



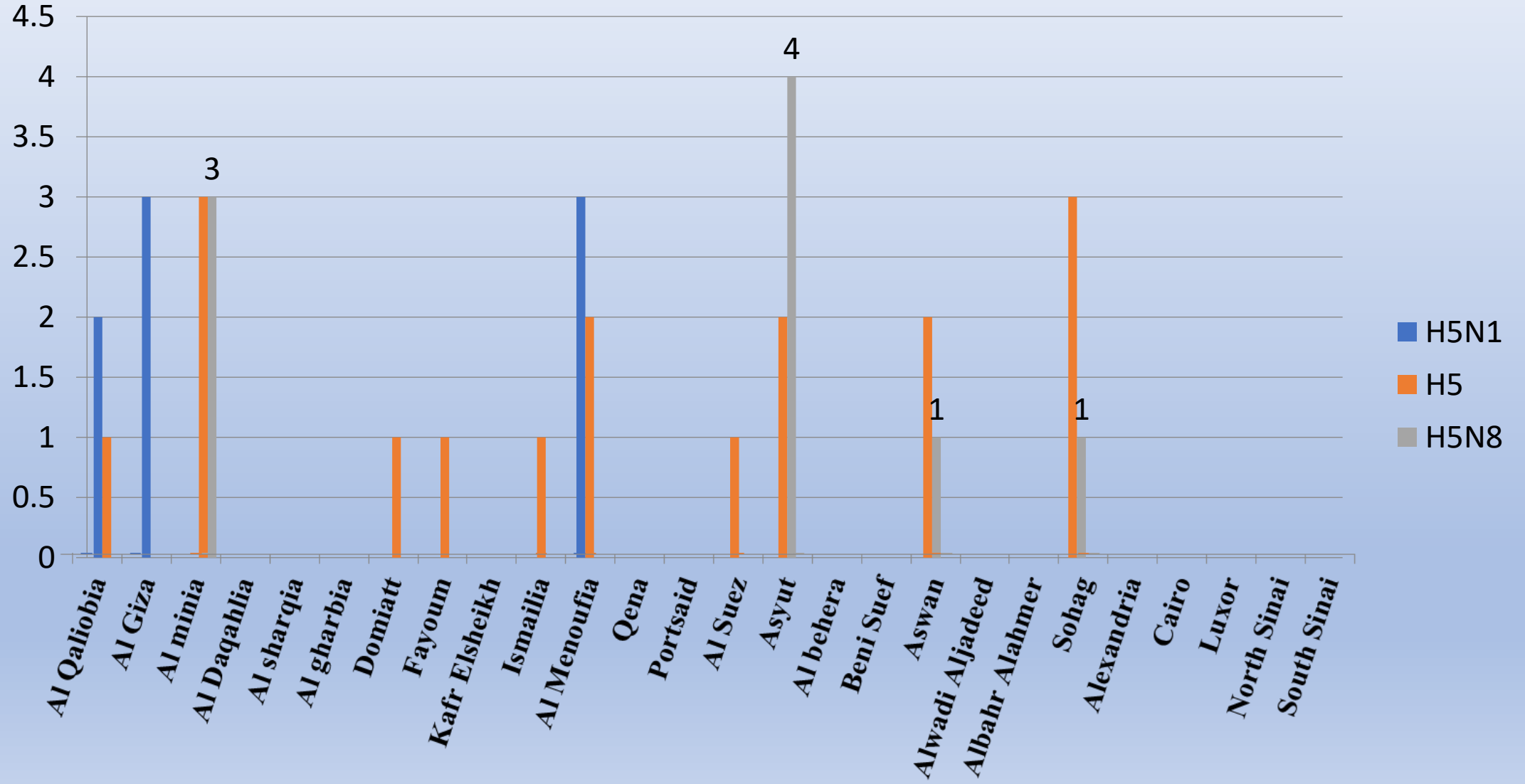
2020	2021	2022	2023	2024

Geo-prevalence of HPAI H5

There were **34** HPAI H5 foci recorded in **11** Egyptian governorates

- **There were 9** cases confirmed as **H5N8** from 6 live bird markets, 1 farm and 1 backyard
- **8 cases** confirmed as **H5N1** from 6 live bird markets
- **17** cases were not completed N subtyping.

H5 Distribution in Egypt in 2024



- **Clade 2.3.4.4b A(H5N1)**
- They expanded to Europe, North America Asia and Africa in the autumn of 2023, mainly through wild migratory birds.
- there were no clear antigenic variants existed from this clade of viruses

- **Clade 2.3.4.4b A(H5N8)**
- Remained endemic in Egypt
- Co-circulating with H5N1

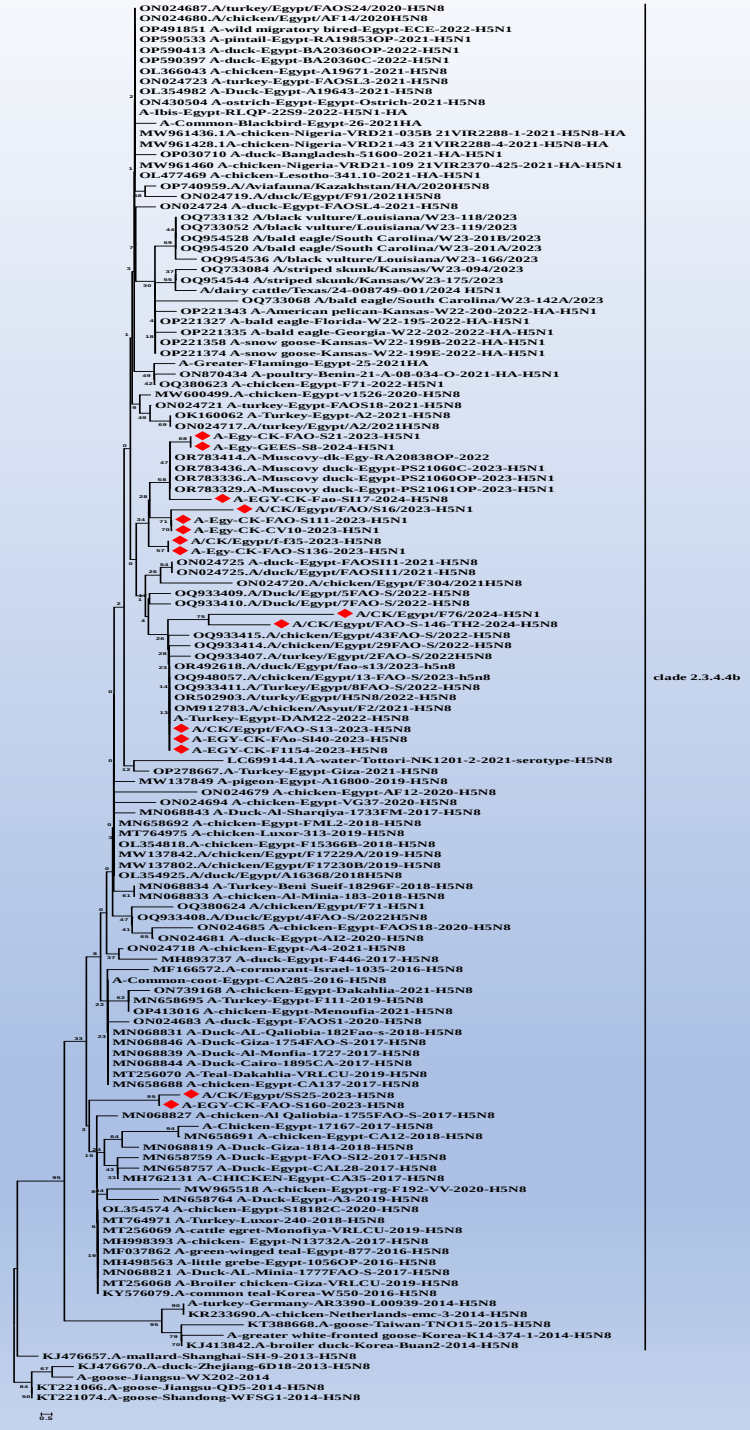
Genetic Characterization of Egyptian HPAI
(A/H5N8)

- In 2024 Egyptian viruses were grouped within clade 2.3.4.4b.
- The HA had 95.8-98.2% amino acid identities to H5N8 viruses reported in Egypt from 2016 to 2024.
- basic amino acid pattern of HPAI type **PLREKRRKR/GLF** at the HA cleavage site, as indicated by hemagglutinin (HA).

Genetic Characterization of Egyptian HPAI (A/H5N1)

- Egyptian viruses were clustered to clade 2.3.4.4b
- The H5N1 had amino acid identities of 96.2-99.2 to H5N1 viruses reported in Egypt from 2022 to 2024.
- Molecular analysis of the Hemagglutinin (HA) revealed the presence of multiple basic amino acid motif **PLREKRRKR/GLF** at the HA cleavage site in all 2021/24 isolates, confirming a highly pathogenic status.
- **The receptor binding pocket** of the HA protein of all sequenced Egyptian isolates revealed amino acids of avian-like α2,3-sialic acid receptor binding preference.

Phylogenetic tree of the HA gene of the Egyptian H5N8 and H5N1*viruses*



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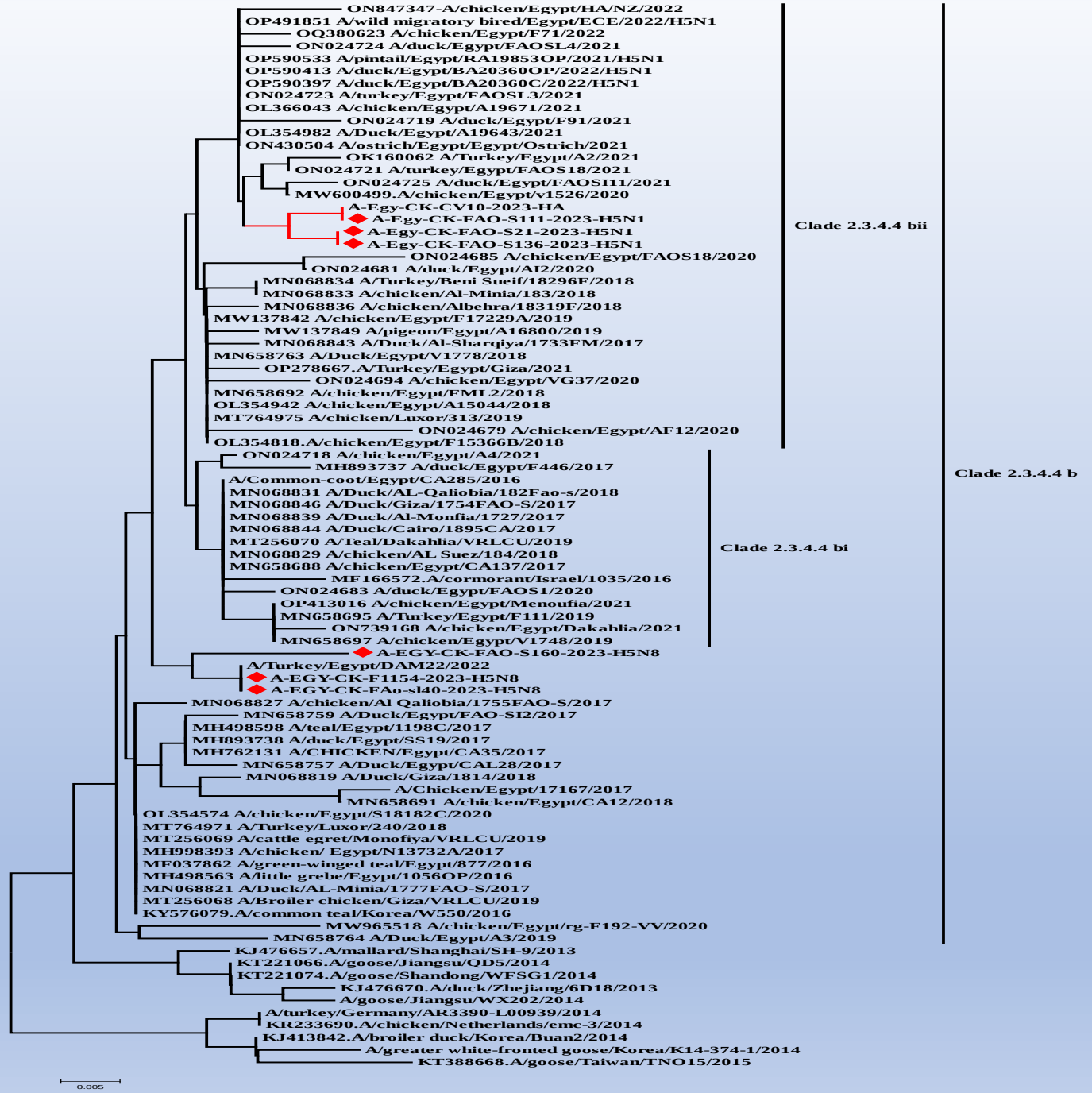


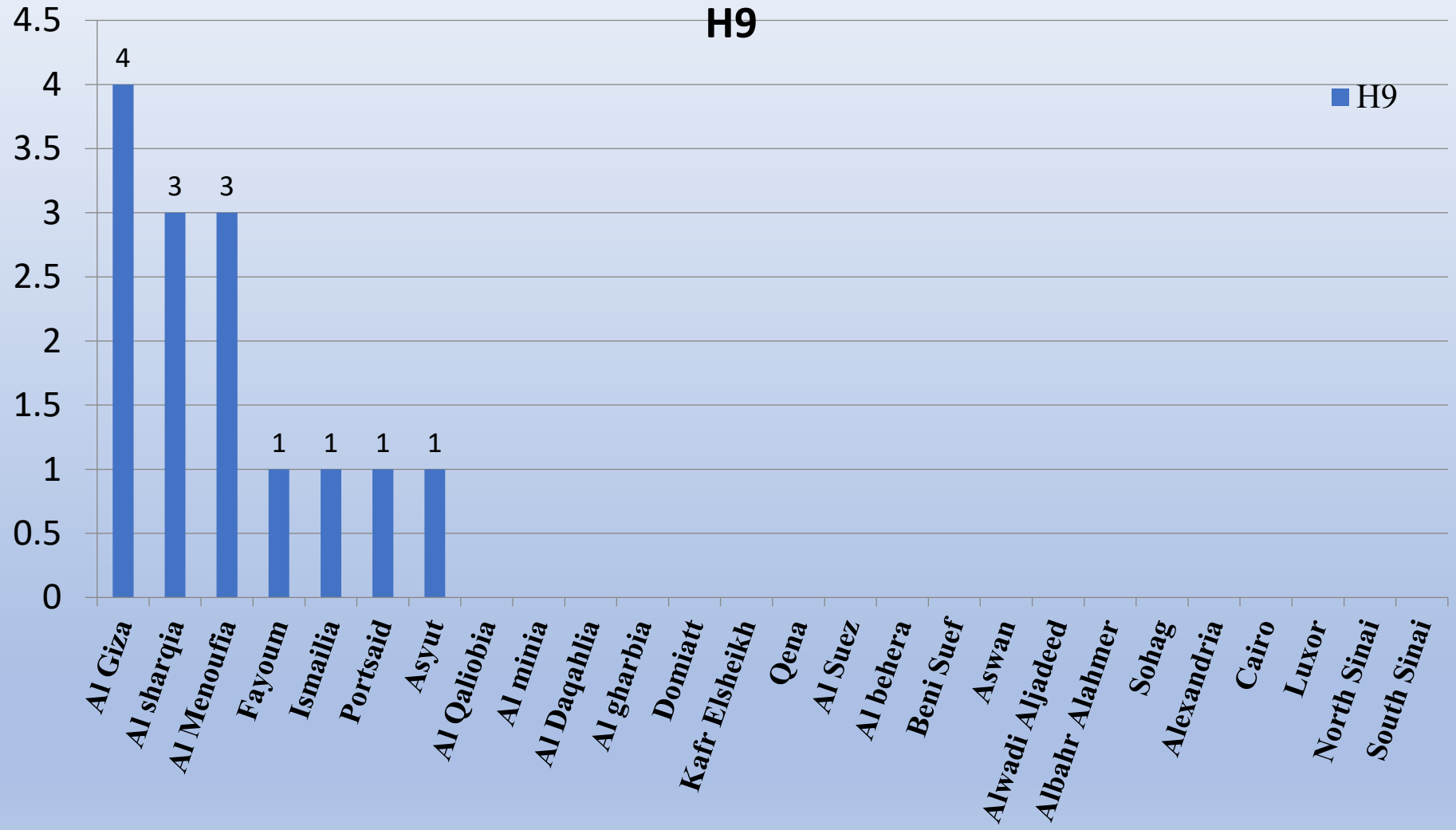
LPAI H9N2 in Egypt

- **14** /5703 **(0.2%)** cases of low pathogenic avian influenza (H9) were recorded
- From 7 governorates (4 Giza, 3 Sharkia, 3 Menofyia, 1 Fayoum, 1 Ismailia, 1 Port Saied and 1 Assyut)
- From 8 commercial farms and 6 LBM)

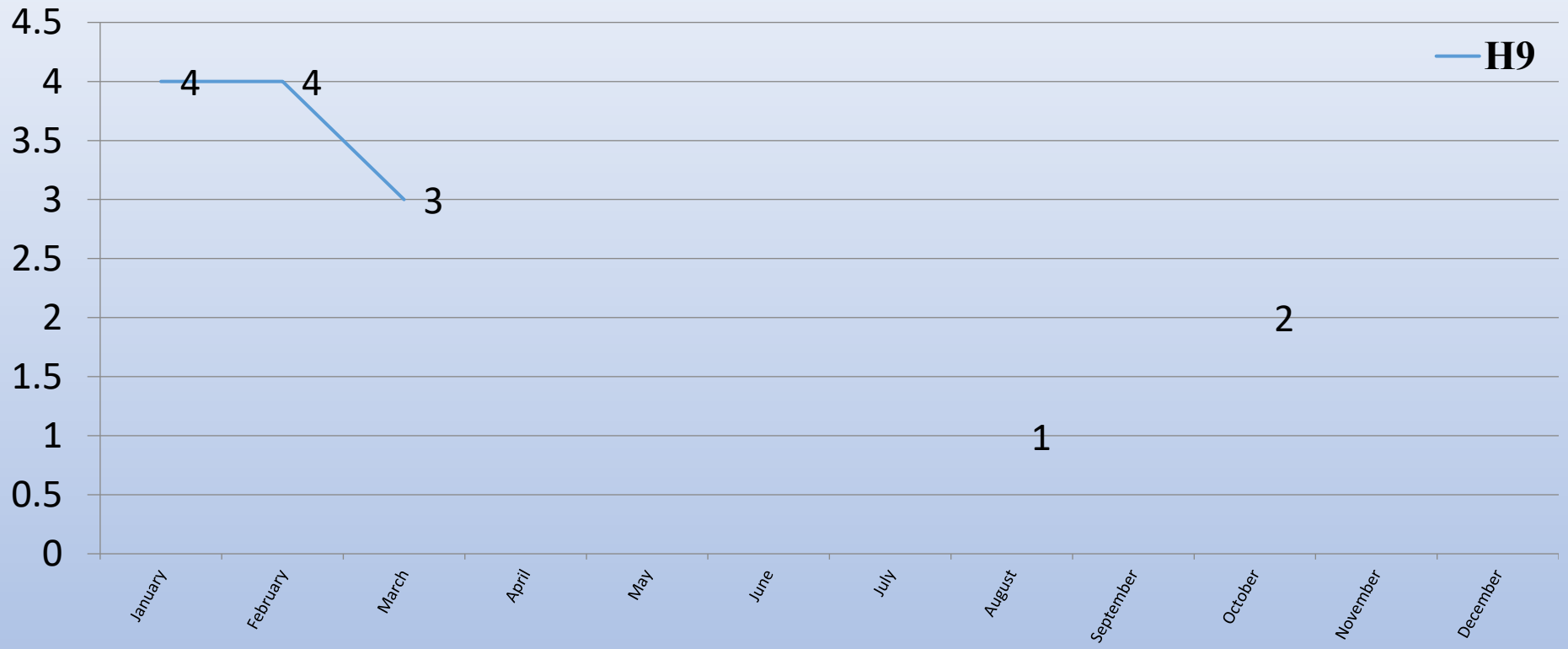
LPAI H9N2 in Egypt

Year	Farm	backyard	LBM	Shops	Wild birds	Nursery	Total
2017	235	19	64		1		319
2018	320	14	17	5		2	358
2019	221	4	44	8			277
2020	**183**	**4**	**32**				**219**
2021	**72**	**1**	**56**				**129**
2022	**104**	**1**	**46**				**151**
2023	**8**	**2**	**5**				**15**
2024	**8**		**6**				**14**

LPAI in different governorates, Egypt 2024



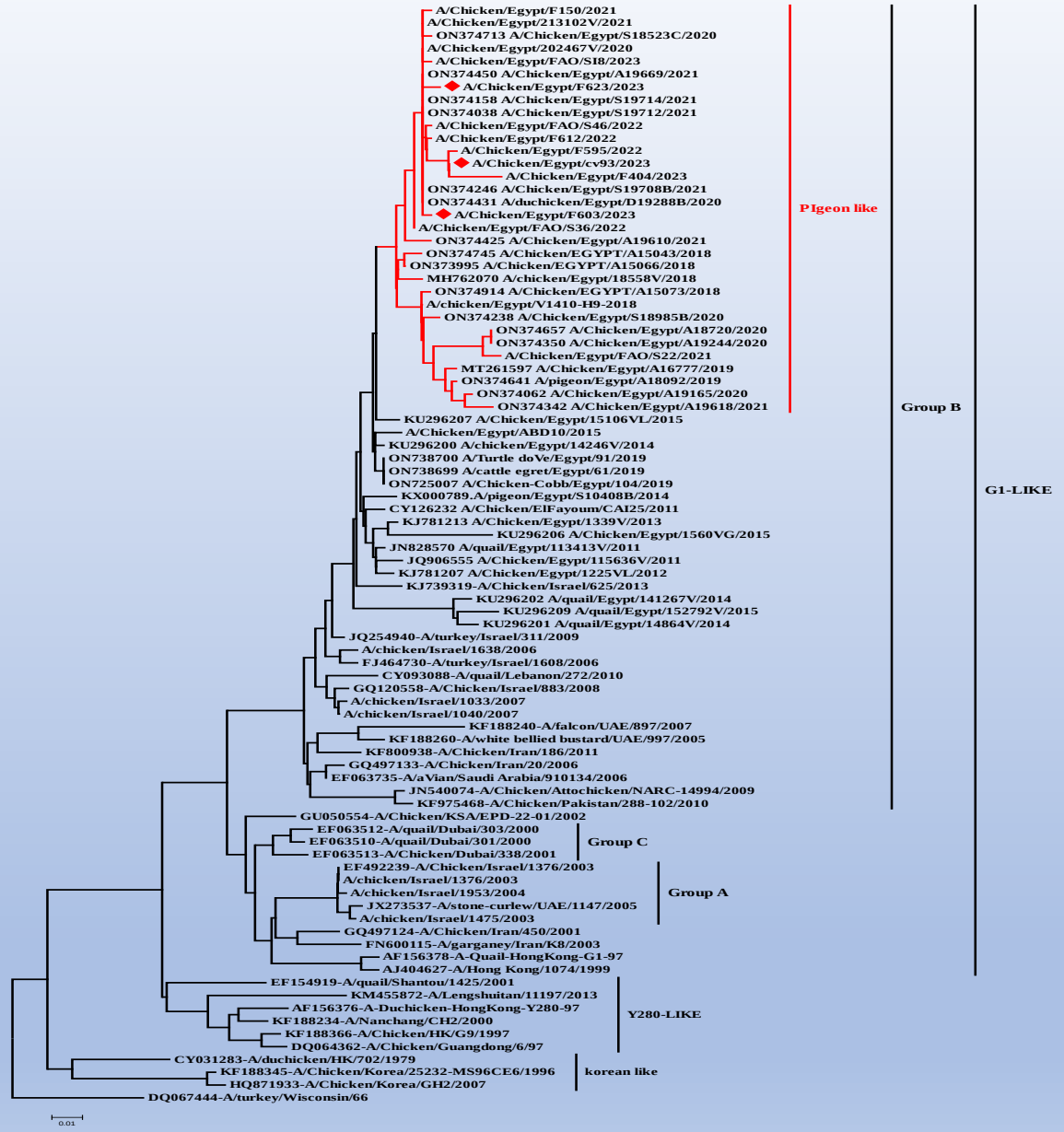
LPAI H9N2 in Egypt 2024



Genetic characterization of isolated AI (H9N2) viruses

- The genetic analysis of H9N2 isolates revealed that they are low pathogenic and track the G1-lineage of Asian viruses that spread in the Middle East.
- Cleavage site motif of Egyptian LPAI H9N2 viruses (PARSSR/GLF).
- All 2024 strains related to each other with nucleotide identity percent ranging from 95.9 to 99.2%.

Phylogenetic tree of the HA gene of the Egyptian H9N2



Vaccination Strategy

- Vaccination is employed as part of a control strategy to limit disease.

- Vaccination should be part of an integrated strategy with other outbreak management tools recommended in the Terrestrial Code and Terrestrial Manual.

Criteria for vaccine suitability

- inexpensive;
- usable in multiple avian species;
- provide protection after a single dose;
- can be applied by low-cost mass application methods;
- allow easy identification of infected birds within the vaccinated population;
- produce a protective humoral response in the presence of maternal antibodies;
- be applied at one day of age in hatchery or in ovo; and
- be antigenically close to field virus.

[Swayne and Sims]

Preparedness actions for good vaccination

- Ensure quality vaccines to be used which minimize or stop virus shedding (recent stain used in evaluation)

- Ensure the implementation of proper vaccination to standardize actions among commercial sectors of all levels (guidance, follow up)

- Implementation of post vaccination monitoring to follow on effective immunity (lab testing)

Commonly used Vaccines

- Inactivated vaccines
- Vector vaccines

These use live virus vectors (like HVT) containing an HA gene insert (i.e. H5)

- AI recombinant vaccines based on baculovirus expressing recombinant protein (expressing HA protein).

(As a recombinant protein, a subunit vaccine possesses low immunogenicity and requires high dosage, frequent boosters, and adjuvants to enhance the protective response)

Common vaccines

Vaccine subtype	Seed virus	clade	Origin	Technology
H5N2	A/chicken/Mexico/232/1994 (H5N2)	classic	Mexican	Inactivated
H5N1	RG A/duck/Anhui/1/2006(H5N1) (Re-5)	2.3.4	China	Inactivated
H5N6/H5N8	Re6+Re8	2.3.2.1	China	Inactivated
H5N1	RG A/chicken/Egypt/18-H/2009 (H5N1)	2.2.1.1	Egypt	Inactivated
H5N3	A/chicken/Vietnam/C58/2004 (H5N3)	1	Vietnam	Inactivated
H5	A/Swan/Hungary/499/2006	2.2.1	Hungary	Recomb-HVT
H5+ND	A/duck/China/E319-2/03	2.3.2	China	Bacluovirus
H5N2+ND	A/duck/Potsdam/1402-6/1986(H5N2)	classic	Germany	Inactivated
H5N1+ND	RG A/duck/ Egypt /M2583D /2010 (H5N1)	2.2.1.2	Egypt	Inactivated
H5N1	local	2.2.1.2	Egypt	Inactivated
H5N1+H5N8	local	2.3.4.4	Egypt	Inactivated

- Widely used vaccines in Egypt include RG A/duck/Anhui/1/2006 (H5N1) (Re-5) clade 2.3.4 virus, A/chicken/Mexico/232/1994 (H5N2) classical virus and A/ chicken/Vietnam/C58/2004, H5N3 clade 1 virus. RGA/chicken/Egypt/M2583D/2010(H5N1), RGA/chicken/Egypt/Q1995D/2010(H5N1)

- The vaccines are evaluated against recent circulating virus H5N8/H5N1(2023)

H5 Vaccine Distribution & Usage

- For broilers Most of flocks vaccinated during the winter cycle (around 80%)
- During the summer months they refrain the usage to overcome the production cost (around 40%)
- Layer and breeders used the H5 vaccines all over the year regardless the seasons

Percentage of Usage

20%	40%	40%
Reassortment HVT vaccines	Local inactivated	Imported inactivated

Vaccines used Vs virus clade

Year	Virus subtype	clade	Common Vaccines	Efficacy
2006-2008	H5N1	2.2.1	H5N2-H5N1(Re-1) H5N9	Effective (Variable)
2008-2014	H5N1	2.2.1	H5N2-H5N1(Re-1, Re-5)- Eg-Var	Variable
	H5N1	2.2.1.1		Vaccine failure (Var-2007)
2014-2017	H5N1	2.2.1.2	H5N2-H5N1(Re-1, Re-5)- H5N3- Recomb-HVT-Baculovirus	Effective (Low coverage)
2017-2024	H5N8	2.3.4.4	Re6+Re8- H5N2- Recomb-HVT- Baculovirus- Eg-H5N1-Eg-H5N8	Effective (stable)
	H5N1	2.3.4.4		

Vaccine efficacy Evaluation

- The poultry vaccination program was failing when used old vaccine seeds. (kayali et al 2016)

- Virus shedding reduction and protection efficacy of studied vaccines were variable and the field vaccine should be reconsidered. [Abd El-Moeid et al 2018]

- Although some of the commercial vaccines protected chickens from mortality, they failed to prevent chickens from shedding the virus. Accordingly, recommend updating and reinforcing the H5N8 prevention and control strategies in Egypt. The vaccination strategy should be reconsidered based on currently circulating viruses. [Kandeil et al 2018]

- The efficiency of current vaccines should be regularly evaluated and updated to fully protect poultry flocks in Egypt against H5N8 viruses. [Salaheldin et al 2021]

- Vaccination with the rHVT-H5 vaccine could provide a high level of clinical protection against antigenically drifted H5Nx HPAIV strains and suppress challenge virus shedding significantly.[Nasif et al 2020]

- The vaccination regime with prime/boost conferred the highest and earliest protection, and can hence be recommended for the broiler production sector in endemic and high HPAI H5N1 challenge areas. [Kilany et al 2015]

WOAH Ref Labs for Avian influenza

- WOAH has multiple AI Reference labs in All Continents to support virus detection and characterization and standardize protocols for virus diagnosis.

- WOAH recently approved RLQP/AHRI as a Reference Lab for AIV since 2021 for Africa and the Meddle East.

WOAH Ref Labs for Avian influenza

- Increasing demand for one health approach to face zoonotic diseases like avian influenza.

- WOAH encourages applications for funds from member countries for investment in veterinary services and to prevent pandemics

Activities of RLQP-AHRI as a new WOAH Reference lab for AIV

- Diagnostic services for rapid disease detection (PCR, HI, Sequencing).
- RLQP-AHRI, Egypt produces reference reagents (non-WOAH-approved) and other diagnostic reagents and is distributed locally.
- RLQP-AHRI, can provide on-site training on the diagnosis of AIV
- RLQP-AHRI, provides vaccine companies with updated strains as virus seeds for vaccine preparations (H5N1, H5N8, H9N2)

- Collaborative scientific and technical studies

- Information and data sharing

(scientific meetings and mutual projects)

- Quality Assurance: PT participation with WOAH Reference LAbs

Conclusion

- Egypt has both H5N1 and H5N8 co-circulating.
- LPAI H9N2 has a silent spread in the Area of The Middle East.
- Egypt is applying vaccination for HPAI H5 and LPAI H9 subtypes to control disease.

Conclusion

- widely used vaccines include (H5N1) (Re-5) clade 2.3.4 virus, (H5N2) classical virus and H5N3 clade 1 virus. And local Egyptian viruses clade 2.3.4.4

- The vaccines are evaluated against recent circulating virus H5N8-H5N1/2023

Conclusion

- Virological and serological monitoring of vaccinated flocks is of importance for evaluating the situation and for epidemiological mapping.
- Regular Vaccine evaluation against recent circulating viruses is important to measure protection/vaccine efficacy.
- Long-term or misused vaccination can develop variant strains causing vaccination failure.

Conclusion

- Vaccination can be useful for controlling the disease and preventing the sudden loss of birds due to a new virus introduction.

- Vaccine evaluation against recent circulating viruses is important to update knowledge about vaccine efficacy.

Recommendations

- Strengthening plans for avian disease surveillance and control.
- Enhance public awareness in various sectors.
- Enhance sequencing activity of whole genome sequence and genotyping.
- Sustainable professional Training in different sectors of poultry producers
- Sustainable fund resources for different activities for lab diagnosis
- Mutual collaboration between Research institutions and WOAH Reference labs to support data sharing and rapid response.

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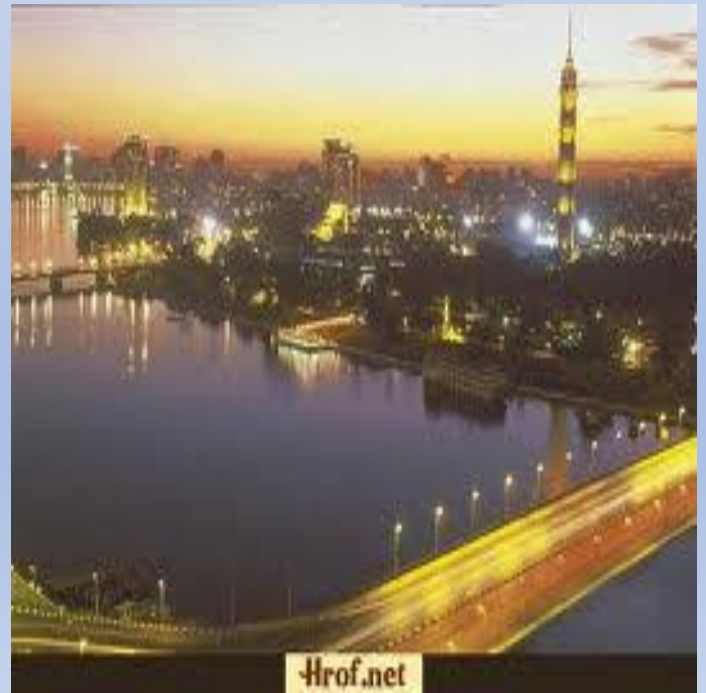
Thank You



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