THE OLDEST HATCHERIES ARE STILL IN USE

By: Dr. Elio Corti and Elly Vogelaar
With our thanks to Dr. Olaf Thieme PhD/ Food and Agricultural Organization of the United Nations (FAO) for his kind cooperation and for supplying the photos.

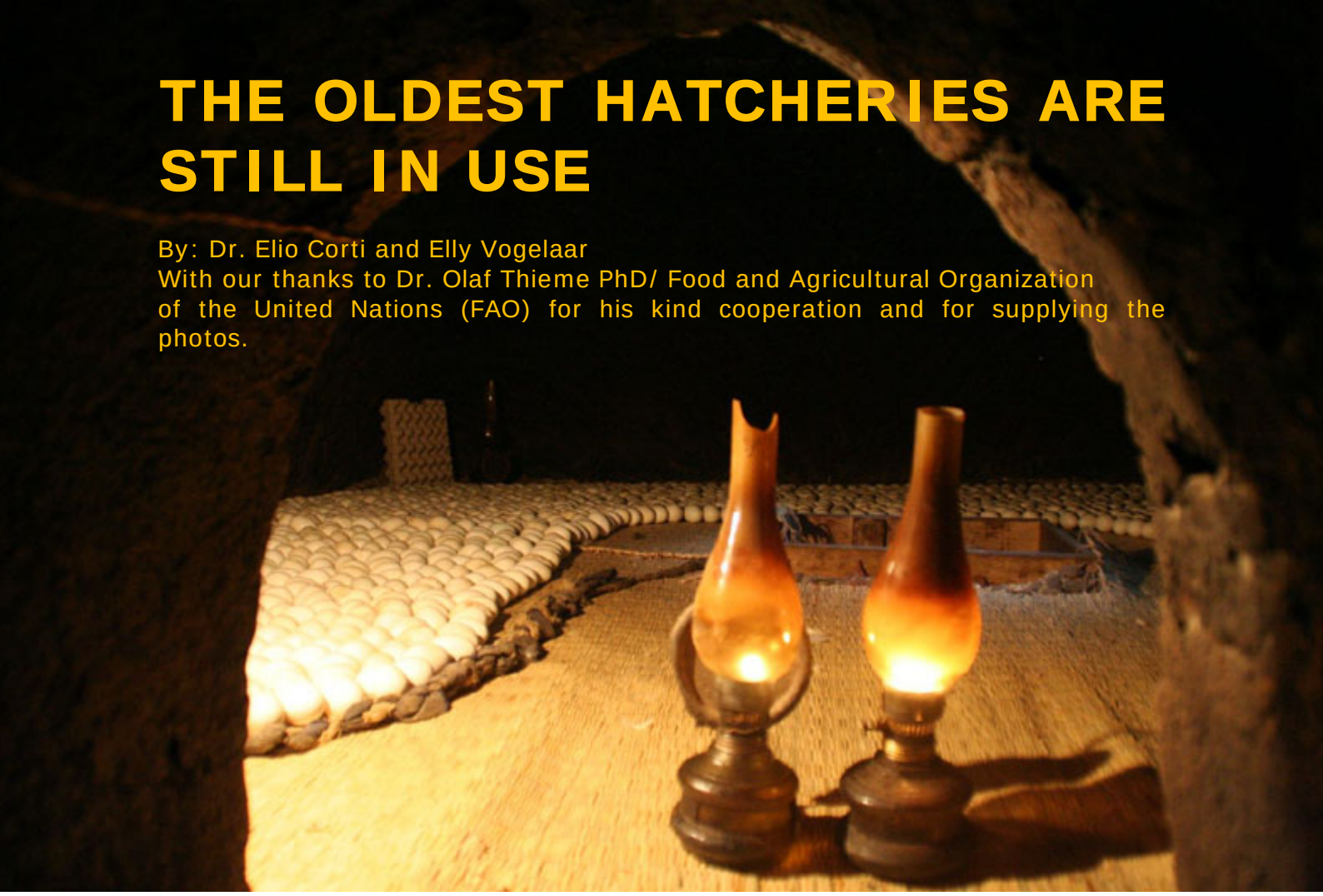
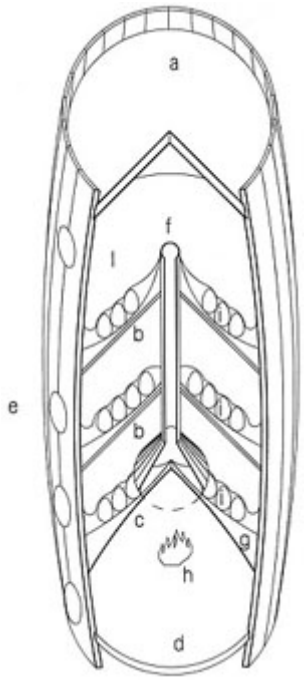


Photo above: Lenny Hogerwerf

In present-day poultry books we are still reading a statement according to which the oldest method known for artificial breeding was an invention of the Egyptians. Diodorus Siculus [a Greek historian] wrote about it in his time - he lived from about 80 to about 20 BC. More ancient writers, such as Aristotle and Pliny, wrote that the Egyptians had been using, for a long time, a particular type of 'ovens' to hatch the poultry eggs, but nobody knew the details of this procedure. The only thing known was that camel manure was used to provide the heat needed for hatching.



An authentic account of the incubation methods of the Egyptians comes from 'The Travels of Sir John Mandeville' - about the year 1356.
From that time, many inventors have tried to build an egg incubator based on the method used in Ancient Egypt. The first known attempt was in 1588 by Jean Baptiste Della Porta from Italy. He was forced to abandon his work during the Spanish Inquisition.

Left: The chicken incubator designed by Della Porta, reconstructed by the Italian architect Claudio De-angelis in Valenza, 1996 - based on the data in Della Porta's documents, which however were not always easy to understand.

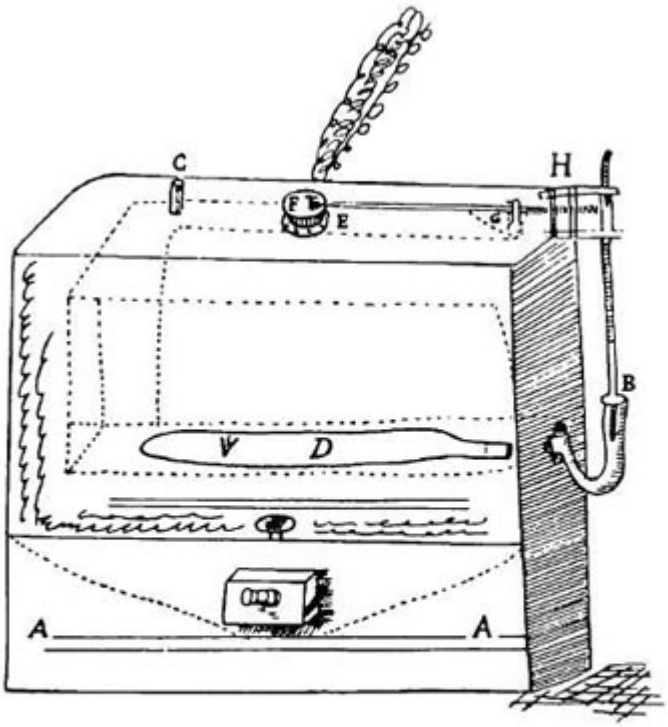


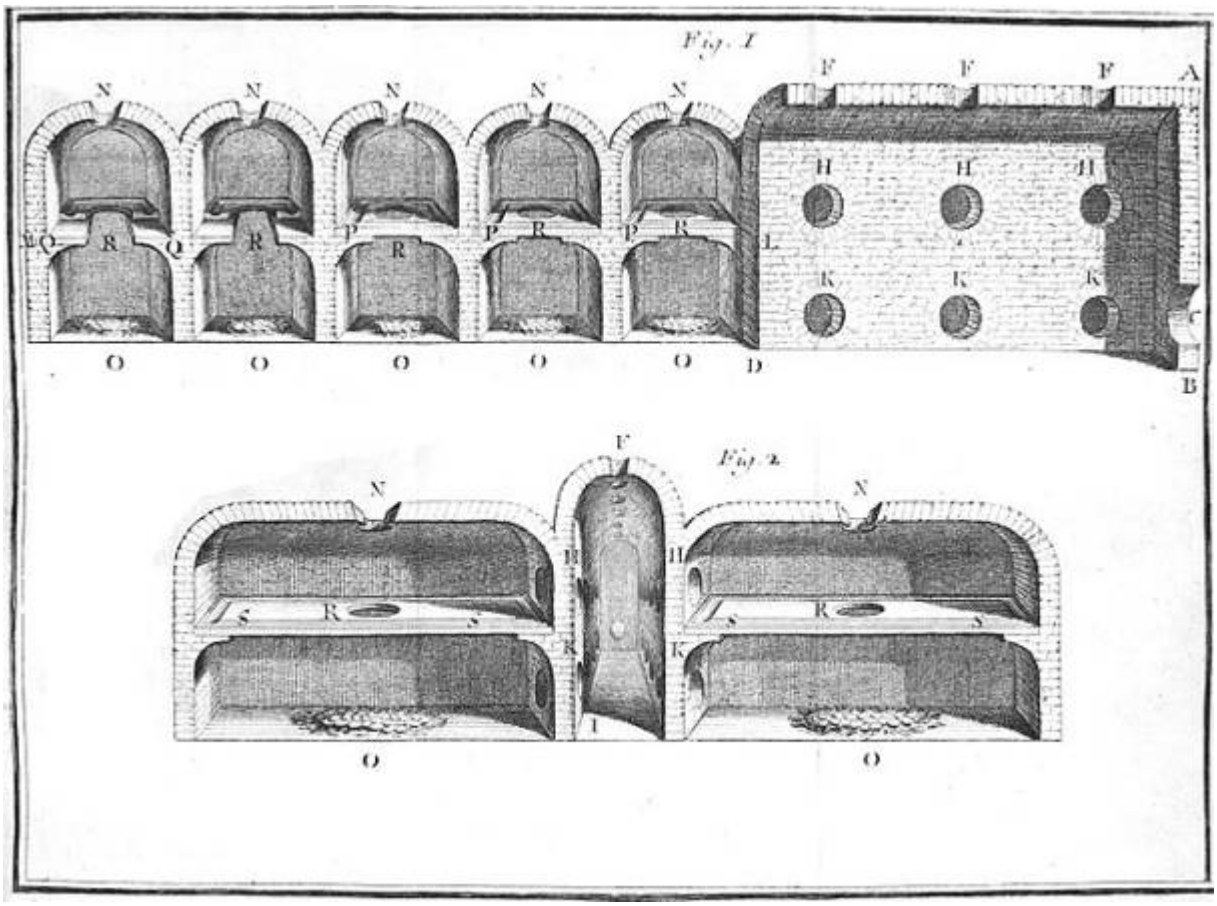
FIGURE 88.—Cornelis Drebbel's chicken incubator with temperature regulation, about 1620. Reprinted with permission of the Cambridge University Library from MS 2206, part 5, fol. 218.

In 1609, Cornelis Drebbel from the Netherlands invented the "Athenor" - an incubator fitted with a thermostat, consisting of a coal-fired cabinet in which hot air circulated around an inner box containing eggs. He succeeded to keep the temperature fairly constant and did hatch some chicks, but eventually shifted the focus onto other inventions.

Left: The chicken incubator of Cornelis Drebbel, met temperature regulation.

Around 1750, the interest in artificial breeding revived, when René-Antoine Ferchault de Réaumur from France came with a very accurate description of hatcheries that at the time were in use among the Egyptians. In the second edition of his book “Art de faire éclorre et d'élever en toute saison des oiseaux domestiques” (1751), (Breeding and rearing domestic chicks in all seasons), he describes, in a simple and pleasant style, everything that was known about the mega-incubators in Egypt. He himself had visited Egypt and achieved permission to observe several different hatcheries and their capacity.

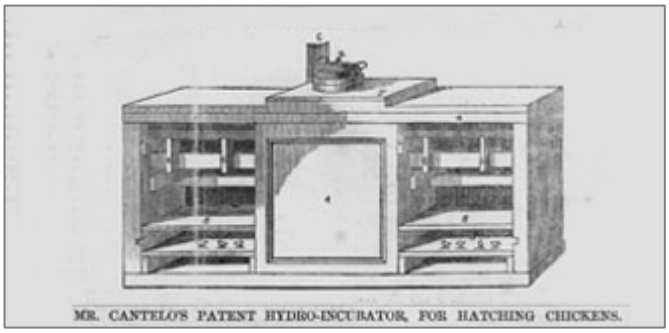
Concise description of the ovens by Réaumur
Réaumur wrote that the people working in the ovens were almost as a caste and came from the same village and region: Bermé in the Nile Delta. The workers from Bermé learned this art handed down from father to son. One man was enough to operate a hatchery, which was active for six months in succession, for a total of eight of hatching rounds of incubated chicken eggs. It was a heated brick structure, formed by a central corridor provided with openings, which gave access on both sides to a number of compartments in two tiers - an average of 5 per side - in each of which were lying 4500 eggs at the ground floor. Both the upper and lower chamber communicated with the corridor through an opening that allowed access to a man. In the lower chamber were the eggs, arranged on mats or on tow, and communicated with the upper chamber through a central opening whose dimensions are such as to allow the heat from above, to reach the eggs in the incubation chamber. In the upper chamber, in a peripheral groove, cow dung or dromedary dung was burnt, which had been dried and mixed with straw and then compressed. They used this kind of fuel in order to obtain a smoldering fire, which was lit twice daily, morning and evening, and only for the first 8-10 days of incubation. To prevent the escape of the heat, tow mats were applied to a half of the vent hole of the upper chamber, so that the hot air was forced to pass through the corridor. Every day the eggs were turned, transferred to any other point warmer or cooler, when needed, and partly transferred into the upper chamber when the fire was no longer lit.
The man in charge of the hatchery was such an expert that he did not need a thermometer - although, they were nonexistent. The temperature of the eggs was checked by holding the egg against the cheek or against an eyelid. Two-thirds of the incubated eggs hatched.



Above: Scheme of an Eyptian hatchery, by Réaumur.

When back in France, Réaumur started testing the Egyptian method, with some variations. He could not use the same method as in Egypt, due to climate differences. First he used barrels with horse dung. Later he used the wood fired ovens of the Paris bakers, controlled by a thermometer that he also invented. After Réaumur's death, this incubator was further developed by Abbé Jean-Antoine Nollet and later by Abbé Copineau, who improved Réaumur's design by using alcohol lamps for warming the eggs, which helped regulating the temperature more precisely.
The French Court took interest in the subject, intrigued by the idea of having chicks the year round. Between 1778-1793 Jean Simon Bonnemain, a French physicist, built an incubatory, in which the ovens were supplied with heat diffused from hot-water pipes and a fire. This was reputed to be a success, however, the experiments had to be stopped due to food shortage during the French Revolution.

Artificial incubation was a desideratum in many countries. Around the same time, in London, England, John Champion constructed an 'incubator room', through which there were heated pipes, the eggs being placed on a table in the centre of the room.



Right: Hydro-Incubator by Cantelo.

Another serious attempt to introduce a hatchery in England dates back to 1851, when William James Cantelo showed his egg incubator to the public at the First Great Exhibition, in London. Cantelo's incubator was simple, having the appearance of a piece of furniture, and might be used in a parlour. His hatching

method was called ‘Hydro Incubation’ and based upon ‘top contact heat’ as in Nature, created by a current of warm water flowing over an impermeable or waterproof cloth, beneath which the eggs were placed. According to Mr. Cantelo, the machine already had produced almost every variety of birds, the common sparrow, mudhen, ducks, geese, etc., up to the gigantic crane and ostrich; the two last were produced at the late Lord Derby’s great aviary in England. But he failed, too, as the apparatus proposed by him was uneconomical. Neither Wright nor Tegetmeier sided with this technology that was still in its infancy, unaware of what would happen shortly thereafter.

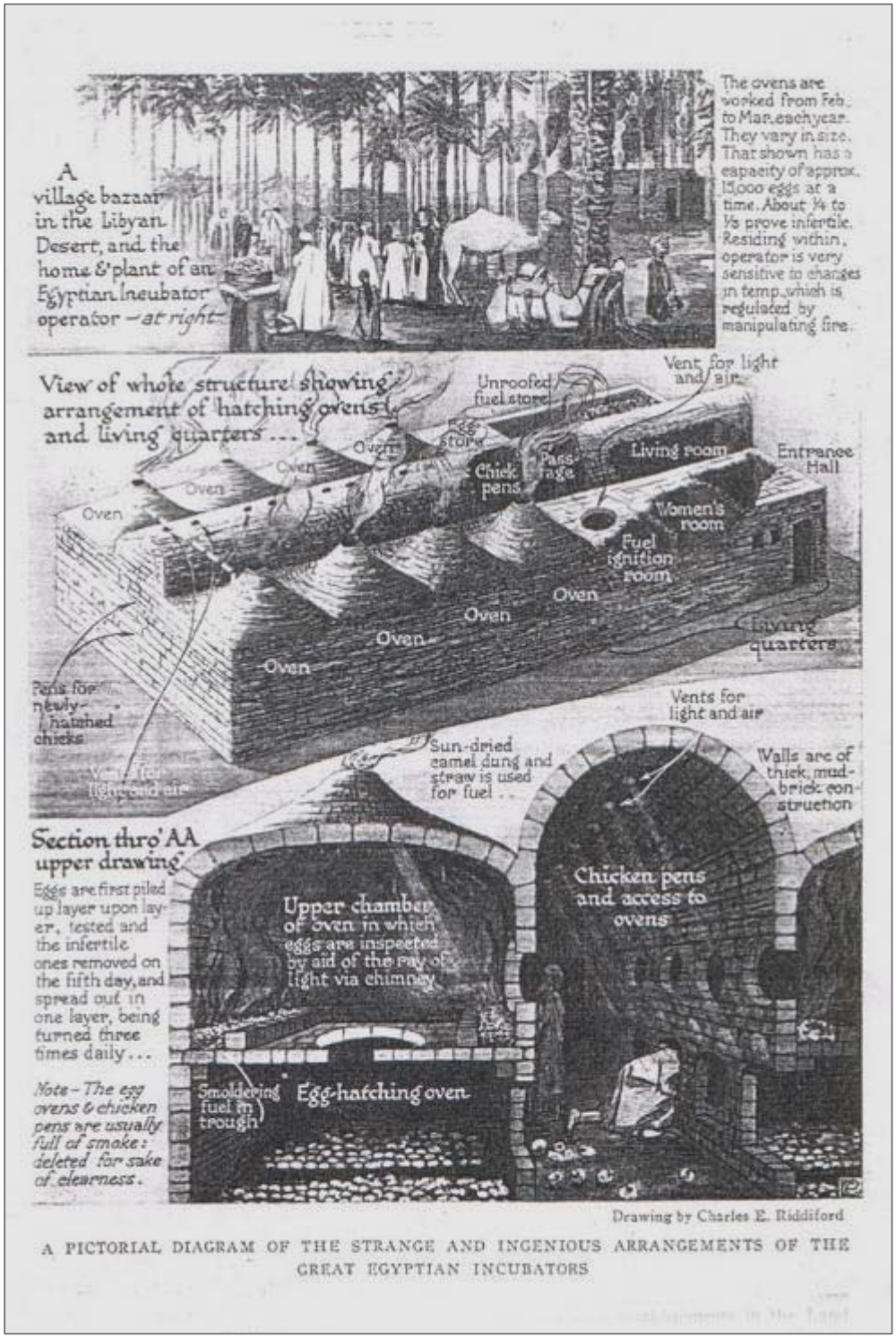
Improvements continued to be made and new incubators were put on the market, each having something to recommend it, but they did not come into general use by the poultry-keepers until 1877, when T. Christy brought out an incubator which was an improvement compared to all previous ones, as it could maintain a fairly steady supply of heat; nonetheless, the method by which this was done was a somewhat laborious. It was improved by C. Hearson with a thermostatic capsule and patented in 1881. This incubator was the first to become of actual utility to the poultry-keeper.

In the US , Lyman Byce, a 26-year-old Canadian, who had moved to Petaluma for his health, invented a practical temperature-controlled chicken incubator in 1879 in collaboration with Isaac Dias, a local dentist. Byce’s father raised chickens using cow manure to heat the barn. Keeping that primitive system in mind, he invented a way to artificially hatch the chicks. This incubator was a breakthrough in the US poultry industry, soon putting Petaluma on the map as ‘World’s Egg Basket’.

Below: Part of the mural in Petaluma, picturing Lyman Byce with his incubator. See for complete mural http://www.svn.net/artguy/bigpet.htm

With the success of the new practical incubators, the poultry keepers were no longer interested in the Egyptian hatcheries. Around 1900, even the Encyclopedia Britannica contained but scant information on the subject, and dismissed it with the remark that “... the secrets of the process are regarded with religious zeal and the individuals who practice it are held under plighted word not to divulge them”. Still it remained an intriguing subject and from time to time, travelers that had been to Egypt, reported on the miraculous hatching

method. In The Hawera and Normanby Star (a New Zealand newspaper) Saturday December 6, 1913, Mr. E.T. Brown, editor of the Illustrated Poultry Record, was quoted: “It is estimated that at the present time in Lower Egypt there are several hundreds of these hatching establishments, and that in many cases they have a capacity of 40,000 eggs at one time. A few years ago the American Consul-General in Egypt estimated that upwards of 90,000,000 chickens were hatched annually in the egg ovens of that country. There is usually considerable difficulty in persuading an owner of a *‘mamel el firakh’* to show a foreigner, or even an Egyptian, over one of these primitive incubators, though they are quite numerous and are found throughout the Nile Valley.” A similar text was published in *The Lewiston Daily Sun*, January 9, 1914. Then in April 1927, the *National Geographic Magazine* published Harry R. Lewis’ famous story: “America’s Debt to the Hen”, describing the incubator of Lyman Byce, but also referring to the ancient Egypt Hatcheries, including a detailed drawing by Charles E. Riddiford, titled: “A pictorial diagram of the strange and ingenious arrangements of the great Egyptian incubators.” (See below)



A PICTORIAL DIAGRAM OF THE STRANGE AND INGENIOUS ARRANGEMENTS OF THE GREAT EGYPTIAN INCUBATORS

In the same year, at the third World's Poultry Congress - held at Ottawa, Canada, July 27th - August 4th, 1927 - the Egyptian Government showed a model of a traditional hatchery of considerable size.

Egyptian Exhibit

An Egyptian incubator, such as was used 4,000 years before Christ, was exhibited. It consisted of four egg ovens and two rooms and held 6,000 eggs. The only heat used in this incubator comes from smouldering straw mixed with pulverized ashes. It was stated that of the 6,000 eggs set 1200 are usually infertile or did not hatch. After the 10th day no fire is used and a thermometer is never used. The total cost of hatching 6,000 eggs is $2.10 and the chicks sell for $2.25 per hundred. One man devotes his full time to the operation of the machine, often spending fifteen hours a day inside of the heated room changing the eggs around and assisting the chicks out of the shells.

However, this could not prevent that the interest in the Egyptian hatcheries fully receded into the background. For present-day poultry keepers it is only a historical fact.
So you can imagine our surprise to discover a recent publication on the internet in which we read that the traditional hatchery system in Egypt is still in place in a similar way as hundreds of years ago, and more so when we read the hatchery workers are from Berma village, where skilful incubation has long been the specialty! [Réaumur mentioned the village of Bermé.]

On our inquiry about Berma/Bermé, Olaf Thieme, Livestock Development Officer of the FAO Animal Production and Health Division and one of the authors of the publication, explained as follows: *"Our" Berma is in the Al-Gharbbiya province Northwest of Tanta and from all what people were telling us it must be the same place as the village of Bermé, mentioned by Réaumur. The problem with Arabic names is that the transcription sometimes changes and which makes recognition of places for non Arabic readers difficult. On Google Maps it is shown as Birma and as you can see, again another spelling of the name. The approximate location is 30°50'45.55" North and 30°54'35.50" East.*
Moreover, Olaf Thieme supplied us with extra photos that show how the hatcheries look today. From this publication we finally can learn all about the amazing way the Egyptians hatch eggs, like they have been doing since at least the Pharaohs' time.

The following text is taken from:
FAO. 2009. Mapping traditional poultry hatcheries in Egypt. Prepared by M. Ali Abd-Elhakim, Olaf Thieme, Karin Schwabenbauer and Zahra S. Ahmed.

MODERN EGYPT – TRADITIONAL HATCHERIES

Traditional Hatchery structure

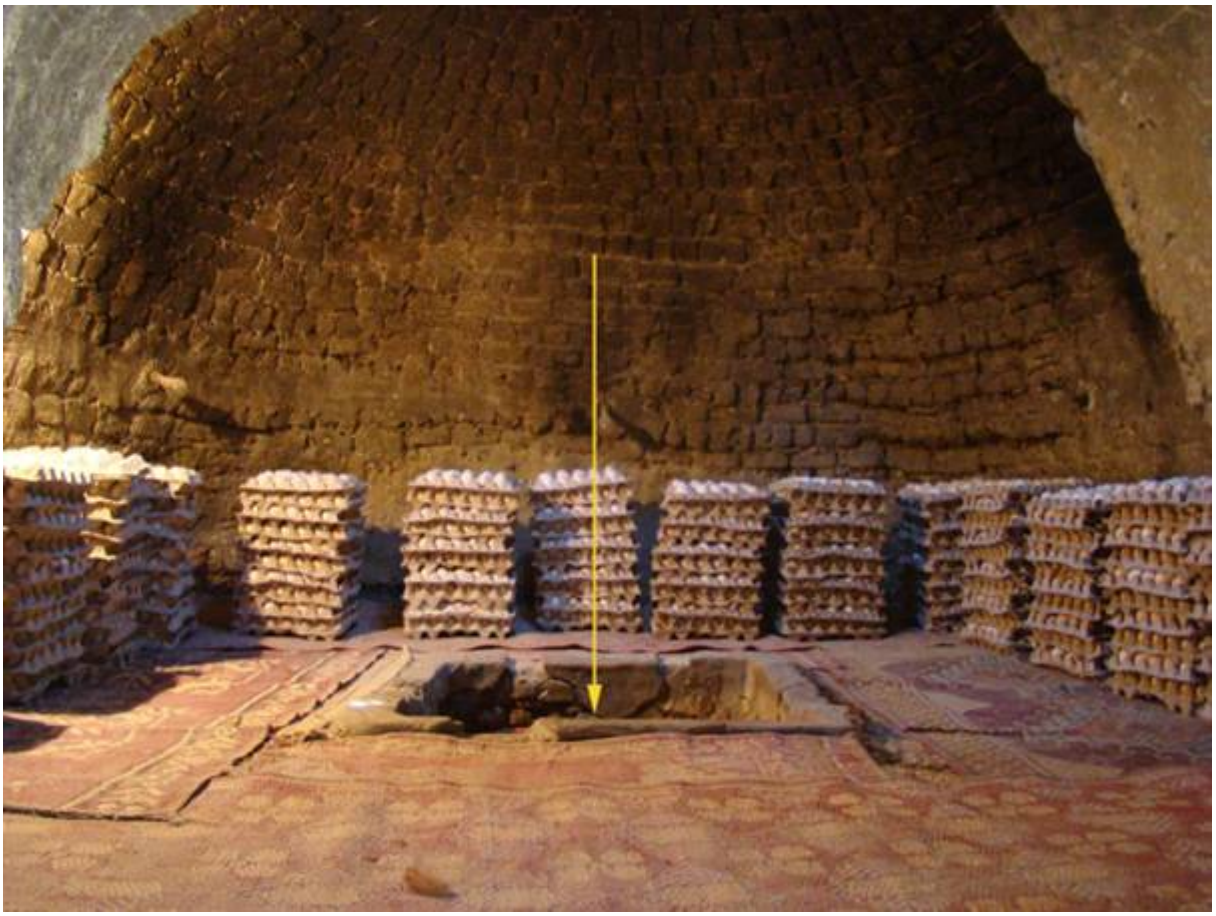
Most Traditional Hatcheries are dome-shaped structures. The foundations are of red bricks, while the rest of the building is of sun-dried mud bricks, which assist isolation and temperature regulation. The hatchery is divided longitudinally into two sections of egg houses (or ovens) with a mid-passage (called the *Qasaba*) between them. The Qasaba floor is concrete, to facilitate cleaning and disinfection, and is covered with a layer of wood shavings where the hatched birds are left until dispatch to dry and fluff out. The shavings minimize leg deformities resulting from the birds slipping.

Left:
Dome shaped, interior capture.
Photo: M. Ali Abd-Elhakim.

Below:
Mid-passage in between egg-houses, with the hatched birds.
Photo: M. Ali Abd-Elhakim.

On each side of the Qasaba, there are 3 to 13 egg houses, each approximately 3.5 m wide and long, and 3 m high. Each egg house (bait or oven) is divided into two levels (upper and lower units) by a wooden platform.

Below: Upper unit of egg house. Notice the central manhole to the lower unit, feathers and egg racks.
Photo: M. Ali Abd-Elhakim.



Above: Each egg house (*bait* or oven) is divided into two levels (upper and lower units) and has a separate entrance. Photos: Lenny Hogerwerf.

Each unit has a separate entrance (called the *Moadem*), and a trap door (the *Friz*) between the upper and lower units that allows workers to slip from one unit to the other to set and turn the eggs. The floor of each unit is covered with a layer of wood shavings and either straw or a plastic carpet (called the *Iasa*). These protect the eggs from damage during the turning process and prevent the hatched birds from slipping.

The roof of each egg house is humped in shape with a central hole (called the *Razona*) for ventilation and heat regulation. Two or three rooms connected to the hatchery provide workers' rest rooms and storage.

Left: One of the ventilating holes in an egg house. Photo: Lenny Hogerwerf.

Recently built Traditional Hatcheries are made of red bricks, with walls lined on both sides with gypsum that act as a heat isolator; the ceilings are flat and made of wood. All other features and dimensions are the same as for older Traditional Hatcheries.

Traditional Hatchery operations

Traditional Hatcheries usually operate throughout most of the year, with a break of one to three months for rest, thorough cleaning and disinfection, usually starting in September or December.

Before starting incubation, the egg house is warmed with electric lamps, as in all the surveyed hatcheries in Sohag governorate, or petrol lamps, as in Gharbia and Faiyoum governorates. Petrol lamps are preferred in these governorates because they are cheaper to run, easier to adjust for temperature control, movable to the coldest areas inside egg houses, and not at risk from the frequent power cuts that effect the electricity supply.

Each hatchery contains eggs and chicks at different stages of production, with one of its egg houses starting a new production cycle every three days or more. The capacity of each lower or upper unit is 4 000 to 5 000 chicken eggs or 2 000 to 2 500 duck eggs.

Hatching of all the eggs starts in the upper unit, then either all are incubated in the lower unit or divided equally between both units. The units are warmed for 12 or 14 days for chicken eggs or duck eggs respectively. Warming is stopped when the embryos' organs are complete and the embryos are producing enough of their own internal heat to continue the incubation process.

Right: Judging the proper egg temperature.
Photo: M. Ali Abd-Elhakim.

The hatchery worker judges when the egg has reached the proper temperature by placing it in his/her eye socket. Excessive egg temperature is reduced by spraying the eggs with warmed water from a perfo-

rated plastic bottle or the mouth. Duck eggs of 14 days or more are routinely sprayed two to four times a day until they hatch, because they produce more internal heat than chicken eggs, especially when there is an abnormal increase in the size of the air sac. No instruments are used to measure either temperature or humidity.

Below: The eggs are turned by hand, until two to three days before hatching. Photo: Lenny Hogerwerf.

The process of candling is used to identify infertile and/or dead eggs at five to seven days of incubation, using a simple wooden box – the candler – with an electric lamp inside and a small hole in one side to emit light. Working in the dark, the hatchery worker holds each of the eggs up to the light of the candler to observe its contents.

Above and left: Candling the eggs. Photos: M. Ali Abd-Elhakim.

Hatched birds are transferred to the mid-passage (*Qasaba*) to dry and await dispatch.

Traditional Hatchery worker

In Arabic, the word for hatchery worker is *Bermawy*, which means “man from Berma village”. A large hatchery of at least eight egg houses needs two workers, and a smaller hatchery needs a chief worker and an assistant. Most hatchery workers have obtained no or only a low level of education.

It was noticed that all the surveyed Traditional Hatcheries in Faiyoum and Sohag governorates are operated by workers from Sanabu or Kamboha, two small villages in the Dairot district of Asyut governorate. All the hatchery workers in Gharbia are from Berma village, where skilful incubation has long been the specialty of a group of old families who mastered and guarded the techniques of their profession, passing them from one generation to the next.

Chicken eggs incubated by Traditional Hatcheries

All the surveyed Traditional Hatcheries incubate the improved native breeds that have been developed since the mid-1940s from crossbreeding the native breeds Faiyoumi, Baladi, Dandarawy and Saini with the exotic breeds White Leghorn, Rhode Island Red, Plymouth and Isabrown. Owing to the continuous and uncontrolled crossbreeding among the resultant improved breeds (Dokki 4, Mandarh, Baheig, Matrouh, El-Salam, Golden Montazh and Silver Montazh) by the producers of eggs for hatching there are no clear definitions of different types of these breeds, which are all referred to as ‘improved Baladi’ or *meshaarre*.

Left: Pure Fayoumi breed raised by Ekthar Eldawagen Project.

Below: Ducklings hatching. Photo: Lenny Hogerwerf.

Duck eggs incubated

All traditional and modern hatcheries incubate either pure Peking ducks or a hybrid resulting from crossbreeding between Peking and Khaki Campbell. This hybrid is called Peking when the hatched ducks are white, or Baladi when they are mottled with black patches. The latter is similar in shape to the native Sudani breed but has better egg production and food conversion rates. Some Traditional Hatcheries in Gharbia governorate incubate Muscovy and mallard breeds.

Eggs transport

The eggs for hatching are transported at night from the parent flock farms to the hatcheries on the back of open pickup trucks. Each truck carries up to 30 000 Chicken eggs or 15 000 Duck eggs, which are protected with a waterproof cover. The distance to the Traditional Hatchery may be as long as 700 km or more (for example, between Qalyubia and Sohag governorates) and the journey may last more than ten hours.

Right: **Egg transport on the back of an open pickup.**
Photo: M. Ali Abd-Elhakim.

Day Old Birds transport

Day old birds are collected in plastic baskets or boxes. Each basket may carry up to 100 day-old chicks or 50 day-old ducklings.

Apart from the 1 or 2 percent that may be sold directly to villagers in neighbouring houses, all the day old birds produced are transported to poultry growing or nursery farms, where chicks are raised until they weigh either 150 g (in 15 to 20 days) or 325 g (in 40 to 45 days). Ducklings are raised until they weigh 400 to 600, in ten to 15 days. The birds are then sold by weight to direct buyers (by a door-to-door distributor), intermediaries or traders. Door-to-door distributors usually use palm-branch crates or open carts, and trade the birds in numbers, mainly on credit to village women, who usually choose their chicks and/or ducklings on the basis of good body size, healthy appearance and colours of feather.

Left: Door to door distributor.
Photo: M. Ali Abd-Elhakim.

Performance of Traditional Hatcheries

The hatchability percentage depends on many factors, such as the age, health and nutrition status of the producing flock, the egg storage conditions, egg transportation management, hatchery operating techniques (egg turning process, temperature and humidity control) and hatchery sanitary measure. However, the hatchability percentages of Traditional Hatcheries were significantly

lower than those of modern hatcheries incubating Baladi chicken or duck eggs, in both incubation seasons (summer and winter). In addition, the hatchability of both types of egg was significantly higher in winter than summer in the Traditional Hatcheries. The lower hatchability in Traditional Hatcheries could be attributed to poor or irregular temperature and humidity control, inefficient turning and limited sanitary measures. The difference in percentage hatchability between the two seasons could be attributed to Egypt's high summer temperatures (which may exceed 40 °C) affecting the productivity of the parent flock (nearly all egg producing flocks are kept in naturally ventilated buildings), the quality of eggs, egg storage, egg transportation, and temperature control in hatcheries.

Right: Door to door distributor. Photo: M. Ali Abd-Elhakim.

In conclusion

Day old birds from the Traditional Hatcheries show more dehydration and higher mortality rates in the first week of life. This reduced vitality could be attributed to inhomogeneous temperatures and relative humidity control, in addition to higher microbial load stresses resulting from a lack of sanitary practices.

Regarding disease risk factors, the mud bricks used in building the Traditional Hatcheries permit disinfection with fumigation only. The location of Traditional Hatcheries among village houses puts them at high risk from neighbouring backyard and household birds. Turning eggs by hand without gloves is considered a risk factor, as damage of thin-shelled eggs leads to the spread of embryo material to the surrounding eggs, favouring the growth of micro-organisms. Egg turning in this manner also facilitates the transmission of food-borne disease organisms from eggs to workers, and vice versa. Egg wetting with sanitized or unsanitized water to control temperature can result in contamination. Any moisture on warm eggshells evaporates, thus cooling the eggs, but lowering the internal pressure, which drives contaminants through the pores into the eggs. In the Gharbia and Faiyoum Traditional Hatcheries that incubate chicken and duck eggs at the same time, there is the risk that one species is resistant to or silently infected by a disease and could therefore act as a reservoir or carrier of the infection to the other susceptible species.

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Below: Door to door distributor. Photo: M. Ali Abd-Elhakim.