

Foto 1. Eierlegendend vrouwtje / Egg-laying female.  
Foto: Ulf Olsen.



Foto 2. Uitkomende eieren / Hatching eggs. Foto:  
Ulf Olsen.

THE CORN SNAKE (*ELAPHE GUTTATA GUTTATA*) IN THE WILD AND IN THE TERRARIUM, PART III: THE BREEDING.

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Contents: My first corn snakes - My first breeding  
- The incubation of the eggs - Hatching problems - The young snakes - The terrarium - The food - The first meal - Growth of the young snakes - Later breedings - Albinos - Epilogue.

### MY FIRST CORN SNAKES

I purchased my first Corn snake in May 1973: an adult, wild caught female of about 120 cm length. I do not know how old she was then, but judging from her length and bulk, she must have been at least five years old. My "old female" as I call her, after another eleven years, still lives in perfect health, though her age cannot be disguised: her once magnificent colouration has faded somewhat, but what does that matter - we ourselves do not get any more handsome with the years. That indeed counts for many snakes: as they grow older, the intensity of their colour somewhat diminishes, and they get darker.

After the old female had been alone for a year, I acquired two smaller males in the spring of 1974, also wild caught and perhaps two years old. In those days it was not easy to obtain Corn snakes. One male soon appeared to have problems. That is why he received an injection of vitamins at the Agricultural University (I myself did not have any knowhow in this sphere yet). It looked as if this treatment had been successful, as the signs of mouth rot disappeared and digestion seemed to be all right at first sight, but unfortunately only

at first sight, for after some months the snake showed signs of a failing digestion again. A week after his last feed and after regurgitating the prey, the snake died. An autopsy at the Agricultural University proved that the undigested skull of a mouse had been stuck in the intestinal entrance. Reconsidering the events now, I come to the conclusion that the snake could have been saved if it had been treated not only with vitamins, but also with antibiotics. Then the inflammation of the stomach, which caused the deficient digestion, would have been stopped, and not only been slowed down.

The other male, however, was without any problem, and like my old female still lives and thrives. During the year 1974 he grew well, reaching a length of more than a meter in 1975. The female was housed in the terrarium which I described and illustrated in Part II, and now the male was introduced. Both snakes quite soon accustomed to the terrarium and to each others' behaviour. After some time they appeared to take shelter in their hiding places less and less. Also, they were no longer disturbed when the terrarium doors were opened. On the contrary, they became more and more daring, examining everything that moved for potential edibility. From the moment I introduced the couple, I was anxious to determine if I would succeed in breeding from them. During the spring of 1975 I often looked expectantly in the terrarium, hoping to perceive some signs of courtship, but nothing unusual happened. They both took their (more or less weekly) meals, and appeared healthy, but I saw no mating activity. The two did actually deceive me, though I am not complaining! In those days I was inexperienced and my ability to notice every small detail of their behaviour was not acute. Of course I would have noticed the male chasing the female, but they did it in a more dis-

creet fashion probably mating secretly during the night, unnoticed.

Anyhow, I was surprised that the girth of the female increased largely during the course of April, her appetite decreasing proportionally at the same time. Only at the end of April, when she could not be tempted to accept even a small mouse, did I understand what was happening. She had become very restless now, looking everywhere in the cage for a place with the right temperature and humidity for the eggs that were now imminent. As it is not customary to have a heap of decaying plants in the terrarium, the snake may never find a satisfactory place to deposit the eggs, but will search separately for a location. But where will it lay the eggs? As lack of humidity is more usually a problem than lack of temperature, the snake will often choose the water basin, with disastrous consequences. Partial submergence of the eggs results in a defective oxygen flow through the porous shell, killing the embryo. The water basin should always be taken away some days before the laying of the eggs, and be replaced by a small cup of water to prevent the snake from egg laying in it. The terrarium keeper must also provide a suitable place for egg deposition. My way of solving this problem has been working well for many years. Only once it failed, when a Leopard snake (*Elaphe situla*) still appeared to have chosen the water basin, though she had seemed to approve my artificial nest.

#### MY FIRST BREEDING

The artificial nest I provide is just an ordinary bread-bin, or a box for food preservation or some other plastic box with a lid, of appropriate size in relation to the size of the snake. The box is to be filled with moist peat moss (without



fertilizing supplement), that has been boiled to kill all living organisms, especially fungus spores and bacteria. You should ensure the snake can get in and out of the box easily, either by not closing the lid on one side, or by cutting a hole in the lid. The lid has two functions: first the snake will find the box more attractive if it has an enclosed feel to it, secondly, the lid will ensure that evaporation of the moist peat moss will be negligible, so that it will remain moist for several days.

As soon as the gravid female shows signs of restlessness, the box should be placed in the terrarium, preferably in a moderately warm part of it, so that the temperature within the box will be maintained at an appropriate level. For most of the snakes of this family this should be about 26-28°C. It will be noticed that the pregnant female will examine the contents of the box very thoroughly, and will lie in it periodically for some time. Though she will naturally still be restless, this will be significantly less than she would have been without a box, and she will not try to burrow and to escape as frequently, as she has already found a suitable place to lay her eggs. Her instinctive urge to assure the place is still there, will be the reason why she will visit her box a number of times every day, until at last 12-24 hours before the laying, she will definitely nestle in the box. Some females deposit the eggs on top of the moist peat moss, but most of them try to have them at least partially buried.

On 6 May 1975 my "old female" laid 16 eggs. The first was laid about six o'clock in the morning, the last was squeezed out by two o'clock in the afternoon. No doubt it had been a strenuous task, for she kept laying motionless and looked terribly worn out. As she was still lying there in the evening, not moving from her place at all, I care-

fully raised her head a little and offered her some water, which she immediately drank greedily. This way of lying still to recover for a while after egg laying is quite normal for snakes. The eggs are rather moist initially and will stick together when dried for a short time. In most cases they can be separated carefully, but this inevitably will weaken a piece of the surface of the shell. When they are glued together more than on a small spot, one should leave them that way. One should also take care to examine the female well, to determine whether there are any eggs left inside her body. These can be felt easily. It is important that all eggs have left the body. When remaining eggs cannot be removed by pressing them in the direction of the cloaca, there is generally a need to resort to surgical removal. This should not be postponed too long, certainly not longer than two or three weeks. Fortunately eggs are rarely left in the oviduct, but it is a known phenomenon. My own experience is restricted to one case of a Californian kingsnake (*Lampropeltis getulus californiae*) that I had to help squeezing the last egg (which was abnormally large) to the cloaca: this being done, the snake managed to squeeze it out after some hours by herself. When an egg remains in the oviduct, one of two things will happen: the egg is resorbed and all is well, or it will start to decay within some weeks and the snake will eventually die. The same occurs in viviparous snakes.

#### THE INCUBATION OF THE EGGS

There are as many ways to hatch the eggs as there are people who have done this. My incubating equipment consists in a silicon glued aquarium, in which two layers of bricks are placed, the water level being about 1 - 1½ cm under the upper edge

of the bricks. On top of the bricks two rows of flower pots of unglazed pottery are placed, each covered with metal mesh and above that a glass panel (for fresh air and at the same time protection of the eggs from dripping water from the glass cover of the aquarium.

With the first clutch of Corn snake eggs, I have tried four different ways to fill the flower pots:

1. filled for two thirds with moist, boiled peat moss;
2. filled for two thirds with moist, boiled gravel;
3. filled for two thirds, the lower third consisting in moist, boiled peat moss, the upper third in moist, boiled gravel;
4. the same as 3, but with a small piece of polystyrene above the gravel.

All eggs were placed exposed on the substrate in small hollows made with a finger. When polystyrene was used, the pits were hollowed out with a knife. After two weeks it became clear that the eggs in flower pot 3 were developing better than the other eggs. In flower pot 1 the substrate was too moist, in flower pot 2 it was too dry. Yet I think that the eggs in both cases would do well, but the eggs on the polystyrene substrate, however, were shrinking heavily already. All flower pots were changed to combination 3, and after a week the eggs which were placed on the polystyrene substrate, were normal again. I use the combination of even shares of peat litter and gravel successfully to this day.

To get the right temperature, I placed two heating elements suitable for aquariums, together with a thermostat, under the water surface, and I adjusted the thermostat. The temperature was a constant 28°C. I no longer use this method. Now the thermostat is adjusted in such a way that the temperature drops a few degrees at night. The eggs are exposed to fluctuations of temperature of

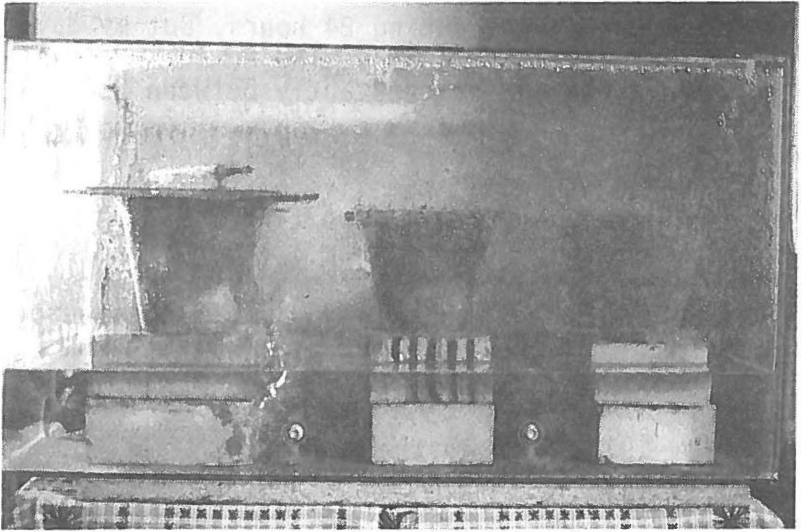


Foto 3. Incubator for *Elaphe* eggs. Foto: Ulf Olsén.

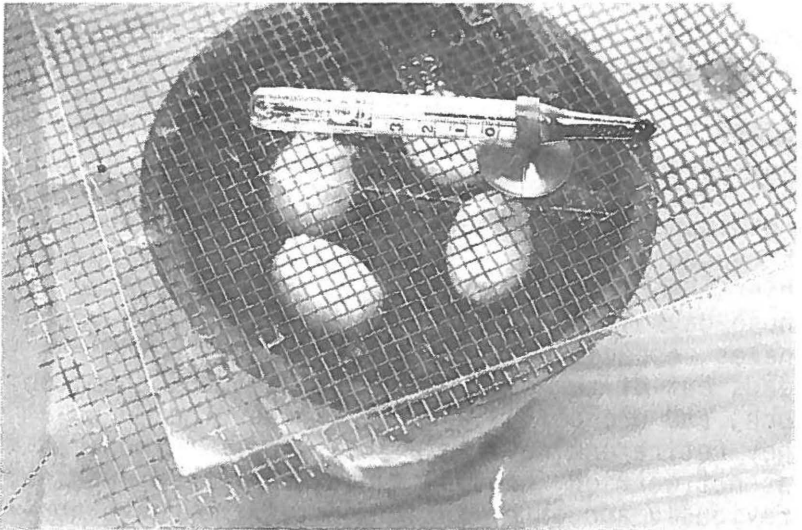


Foto 4. Incubation of the eggs. Foto: Ulf Olsén.

three to four degrees during 24 hours. But by day, the temperature is still 28°C. The humidity of the air in the flowerpot is constantly between 92 and 98%.

After about six weeks most eggs still looked taught, white and well, but five of them were somewhat discoloured. They were tinged a little with pink and with some of them I had difficulties in keeping the mould away. These five eggs were not tense and had not grown. All these signs were indications that the eggs were not fertile, which was proved true later on.

On 5 July 1975, late in the afternoon, after 60 days, the eggs at last began to hatch. From two eggs one could see the tip of a nose peeping out of an incision, which the young snake had cut with its sharp egg tooth. The following day three further eggs hatched, followed by four more the next day. On 8 July, late in the evening, the last two eggs hatched. Young snakes never leave their eggs immediately after hatching, and in some cases they took five days to leave the egg. Usually, however, it takes between ten and forty hours. During this time the young snakes recover their strength and digest the rest of the yolk that is still connected to the animal by the umbilicus. At this stage one should not disturb the young snakes more than necessary. I learned this three years ago through bitter experience. In those days I took often photographs of some young snakes, especially those who peeped with their heads out of the eggs. When one disturbs them too much, and probably I did disturb one too much, they retire entirely into their eggs. Anyhow, I was not worried, because I had seen this reaction previously and after a few minutes the snake normally puts its nose out of the egg again. This time, however, this did not happen. When I came



Foto 6. Kast met verwarmingsplaten / Cupboard with heating plates. Foto: Ulf Olsen.

back half an hour later, no nose was to be seen and neither were there any air bubbles at the incisions. I was a bit worried and merely carefully opened the upper half of the egg to see where the young snake had hidden its head. He had tried to stick its head through the egg shell, about one cm away from the place where it had made some incisions the first time. To do so, it had to push its head between two of its own coils. In doing so its mouth had opened and the snake was stuck with open mouth in one of the coils; it could not go forwards or backwards anymore. Under such strain energy consumption increases heavily and that is why the snake stifled relative quickly. I still believe that the accident is just an isolated case and in the future I will keep photographing young snakes which just hatched, but of course with more care than before.

#### HATCHING PROBLEMS

Of the eleven fertile eggs from 1975, the time between hatching and leaving the egg varied between 18 and 32 hours. All young snakes, except two, looked healthy and well proportioned. Their length varied between 25 and 29 cm, their weight was about 5.5 to 7.75 g.

As said before, two of the eleven snakes were not well formed. One was heavily deformed on the spinal column, about 5 cm from the head and the same deformation occurred in the abdomen, just before the cloaca. The other snake was less deformed in the abdominal region. The first snake could not leave the egg on its own and died after half a day. The other snake, however, did very well and grew up without problems. Such deformations are a well known phenomenon. Though the cause is not entirely clear, there is no doubt, that a somewhat too high temperature during the incubation has a





Foto 5. Deformed young. Foto: Ulf Olsen.

certain influence. Of the many young Corn snakes, which I bred after that first litter, I never again encountered deformed hatchlings. Furthermore it is the experience of others and myself that eggs of Corn snakes are relatively robust. As long as the eggs are good and healthy, they can endure relatively rough treatment as well as strong fluctuations in temperature. They also can tolerate considerable dehydration, but after a few days they should have the opportunity to pick up enough moisture from their surroundings to rehydrate and become round and tense again. An example: in 1978

I sent fresh eggs from Florida to Denmark. The eggs were wrapped in moist kitchen paper and put in a cloth bag. In Denmark they were incubated under the circumstances mentioned before. None of the eggs were damaged during the transport and all snakes were healthy.

Apparently the developing embryos are not damaged by rotation, which can easily happen if one does not mark the upper side of the eggs. Still, I advise people not to turn the eggs, especially during the last five or six weeks prior to hatching. In that case one is absolutely sure that the embryos will not be damaged.

### THE YOUNG SNAKES

Newly hatched Corn snakes have relatively big heads and their colours differ from the colours of adult snakes. The saddle-like spots are somewhat darker and tinted more brown than red. The areas between the saddle-like spots are relatively bright, because they tend to be a soft yellow-orange, mixed with some pink, and edged by white or light grey. As the snakes grow older, the colours change and once the snakes become sexually mature, they have acquired their final colours. Unlike many other *Elaphe* species, where both colours and markings of the young snakes differ enormously from the adult snakes, there is no change of marking in *Elaphe guttata*, so that their marking remains the same all their life.

It is noticeable that many young snakes are, compared to adult snakes, somewhat nervous and quick-tempered. The behaviour manifests itself in hiding for a long while. At the slightest disturbance they vibrate their tails heavily and fly out at the molester a few times in order to warn him. For young snakes this aggressive behaviour is the best way of winning the struggle to survive, since in



Foto 7. Jong aan de maaltijd / Eating young. Foto: Ulf Otsen.

nature there are many animals that like young Corn snakes for breakfast. By hiding, being watchful and by trying to defend themselves in a threatening way, many young Corn snakes survive.

In captivity, however, their aggressive behaviour decreases rapidly when the snakes become used to the attendant. Some individuals, however, do not change their behaviour until they are grown up. Keeping this behaviour of the young snakes in mind one can reach conclusions about the required terrarium. It is not a good idea to keep all the young snakes in one terrarium. Not only it is difficult to check on the frequency and quantity of food each snake gets, it is also possible that "unmeant cannibalism" appears. It can happen that two snakes grasp the same prey and that one snake not only swallows the prey, but also the other snake. It is also possible that one of the snakes, during the search for prey, grasps one of its

brothers or sisters when he or she makes a fast movement. One should also keep in mind that snakes are not social-living animals, but solitary animals. If one keeps more snakes in a terrarium, the most nervous snakes will feel uneasy by the presence of the others and the urge for security will not be satisfied. The snake lives under pressure and will not eat.

The best way to keep the young snakes is by giving them their own mini-terrarium. Years of experience have shown that these terraria should not be too large. As far as I can see, this is connected with their urge for shelter.

### THE TERRARIUM

The size of the terrarium, suitable for young Corn snakes and other similar species is shown in photograph No. 6. A Swiss friend of mine shows his shelf with young snakes. The shelf can contain 45 mini-terraria in the shape of small plastic boxes as are used in refrigerators. The shelf is fitted with a thermostat which is adjusted to 26-27°C. Under the shelf there is a heat-cable which warms a metal plate. In this way the terraria floors are mildly heated. In the lids of the boxes there are ventilation holes which are covered with a metal gauze. This gauze can be melted to the lid with a soldering-iron. In the terrarium a water basin and hiding places are necessary. I think that a newspaper (one page folded in two) is most appropriate but other materials, like moss, can also be used. As the snakes grow, they must be placed in larger terraria and after six months to one year they can be kept in normal sized terraria. I have to remark that this way of keeping young snakes is not suitable for arboreal species.

## THE FOOD

I personally believe, that this is the best way to keep young snakes. This is demonstrated by the fact that most young snakes eat voluntarily and regularly under these circumstances. A further reason why it is often difficult to persuade young snakes to eat, is that we are not able to give them the prey that they would seek in the wild. From our point of view it would be unacceptable to feed young snakes on small lizard and frog species. Furthermore, a young snake that is raised on young lizards, will take six months or more to begin to accept young rodents for the first time and until then must be fed with one or two young lizards every week. That is a total of about seventy-five lizards. Thus a clutch of ten hatchlings (a quite realistic number for a terrarium keeper that breeds with one or two pairs of snakes) would consume about sevenhundred and fifty young lizards per year. Terrarium keepers should not deplete wild stocks of vertebrates for food uses. The food animals have to be bred for that purpose. In practice mice and rats prove most convenient. For snakes which prefer lizards and frogs when they are young, there are fortunately ways of persuading them to take young mice. The young snakes are fooled by rubbing the mouse on a frog or a lizard, or sometimes with the intestines, brains or blood of a mouse. These are only a few of the most commonly used methods. One frog or lizard, for example a wounded specimen obtained from pet shop, can be preserved in a freezer for several months. You only have to defrost it for a short time when you use it. When one does not succeed in fooling the snake, then there is only one solution: force-feeding. You can use little strips of oxheart, possibly greased with egg-yolk, or even better, young mice or possibly together with a small fish, complete or liquidised.

## THE FIRST MEAL

The newly hatched Corn snakes are not immediately ready for their first meal. First they have to slough for the first time, seven to ten days after their hatching. Then it is time for the first meal - normally a new born mouse. The author recommends that one offers it, alive <sup>1)</sup>, in the evening, just before the light turns off. If the mouse has not been eaten by the next evening, you have to kill it and offer it again. If it still is not eaten, then there is still no need to despair. The young snakes are well provided with egg-yolk when they leave the egg and some of them have no urge to take food before they have used up their reserve, something that can last for two or three weeks. I would suggest that you do not wait more than three or four weeks before you start force-feeding. Nevertheless I have waited several times until hatchlings were six weeks old before force-feeding without any evil consequences. Eight weeks is surely too long, as I found in 1977 with three young. When I started force-feeding after eight weeks, all seemed well, because all three snakes digested the newborn mice well. They were force-fed every third day. But after five weeks of force-feeding one of them died and a week later another one did. Of course how long a young snake can remain healthy without getting food varies from one individual to another, and is dependant upon many internal and external factors.

<sup>1)</sup> Please note under United Kingdom law one can be prosecuted for offering live vertebrates to reptiles. I would certainly not advocate the use of live prey. Adam Wright.

## GROWTH OF THE YOUNG SNAKES

Young snakes have to be fed more frequently than adult specimens and with fairly small amounts at one time. In their first year of life, Corn snakes have to have at least one and at most two young mice per week. An average of one and a half mouse per week will be enough, assuming that when the snake grows, the mice offered are larger. It is not problematic to miss a week, but after this week you should feed the snakes again after an interval of two or three days. There are people who let their young snakes eat as much as they want. In this way a Corn snake reaches a sexual maturity (at about 80-90 cm) in the course of twelve or fourteen months. The result is a snake with a small head and a fat, overfed body. In other words a product that deviates essentially from wild Corn snakes, which normally take about three years to reach this size. Particularly in the United States of America, during the last fifteen to twenty years, there were many examples of such fat snakes that were bred in captivity. Experience has shown that such animals, in general, were short-lived in comparison to specimens with a slower growth-rate.

## LATER BREEDINGS

My "old female" and the male certainly have not been resting in the years following 1975. In the period 1975 to 1982 the female laid a total of 153 eggs, with a result of 134 young. Only a few of the eggs were infertile, In later years another four Corn snakes laid 78 eggs, resulting in 75 young. These four females are successively a female from 1975 (F1), a female from 1978 (F2), a female from one of the eggs I have sent home from Florida in 1978 and a female from South Carolina, a captive bred animal from 1979 from an acquaintance in the United States of America.



From the schedule of breeding results (Table 1) of my old female appears that in the years 1978 and 1981 the snake "double-clutched". This also happens sometimes in the wild. Except for when the female is in extremely good condition, I would advise keepers to separate the partners till late summer. Two clutches in succession uses so much energy in the female, that she has to be fed with extremely good food and has to have much rest for a long period to compensate for the loss of weight.

As for her great age the old female has been placed on the retired list, so the eleven eggs she laid in 1982 were her last. Apart from that the other females have the opportunity, in turns, to copulate: in 1982 there were two hatches and in 1983 one hatch. For 1984 I also had planned only one hatch.

## ALBINOS

Particularly in the United States of America there has existed for some years a rivalry to have something that the neighbour does not possess. One trend is to have so-called "intergrades", which means descendants from parents from two different, but related genera, or from two different subspecies. Another craze is a passion for albinos or partial albinos of all kinds of species. Personally I do not care for these forms, because in my opinion they have little to do with nature. The Corn snake did not escape from these "fashions". In fact, the albino-fever started about fifteen years ago with these snakes. Now there hardly passes a year without one or more snake species being added to the list of captive-bred albinos. Nowadays in the United States of America there are for certain ten times more albino Corn snakes in different tints kept in captivity than there are what I call

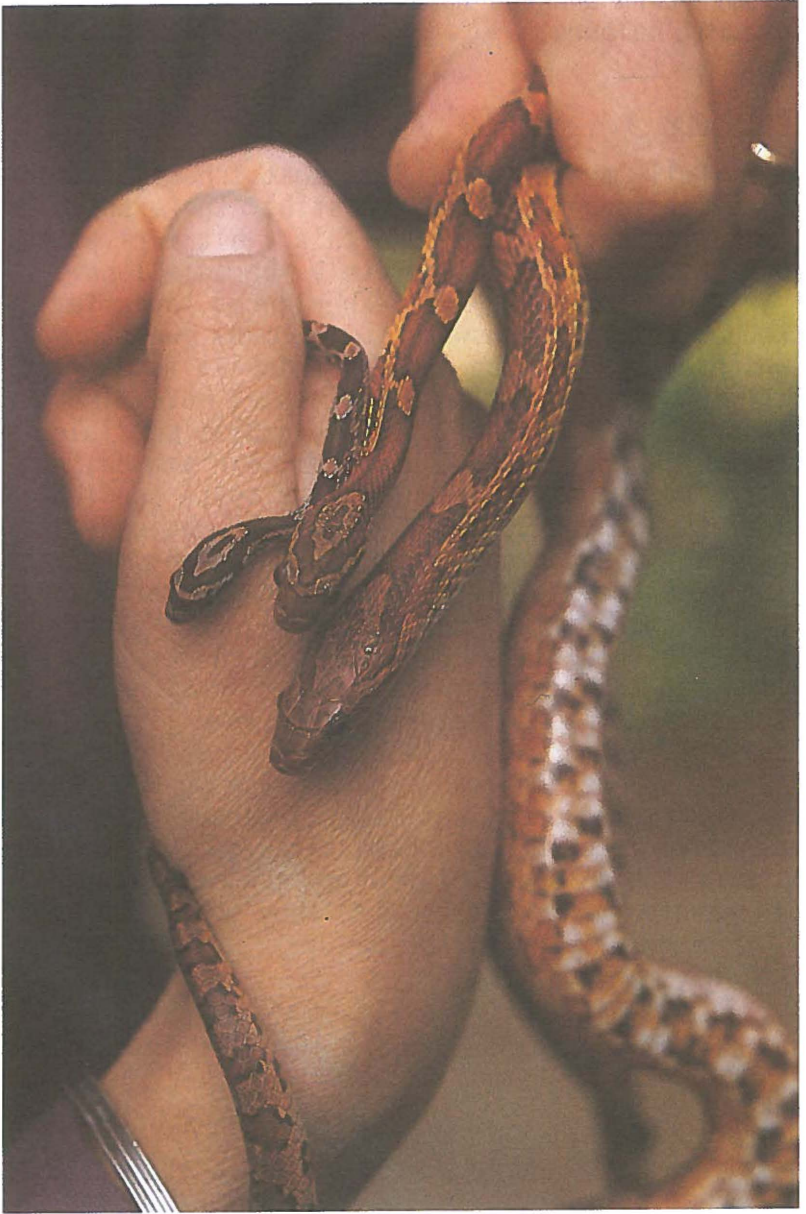


Foto 8. Drie jaar nakweek / Three years of reproduction. Foto: Ulf Olsen.

"real" Corn snakes, namely Corn snakes with natural colours.

## EPILOGUE

I am fully aware of the fact that I have entered into considerable detail; possibly the experienced terrarium keeper has found this a bit irritating. But this was done deliberately, because I have striven to help the less experienced terrarium keeper by giving answers to the many questions which always turn up and for which it is difficult to find the answers in one place. I have also tried to make the article as broad as possible, so that it cannot only be used for Corn snakes, but also for a great number of other snake species. Then I want to say something to the beginner, or may be those who doubt and those for who the keeping of snakes solely means the keeping of large constrictors. Give the Corn snake, or another, suitable colubrid snake species a chance. You will find out that these snakes are at least as interesting to keep, actually even more lively, more curious and more bold. They also do not grow that large, so everyone can find a place to keep them in the right conditions. The large constrictors can give insoluble problems after some time, when they reach a length of four to six meters. Many forget to think of this when they buy those little *Python molurus* or *Python reticulatus* of 60 to 70 cm. Have a good time!

Table 1. Breeding results with *Elaphe guttata* during 1975-1982.

Date of egg laying	Number of eggs	Date of hatching	Average incubation	Number of infertile eggs	Young dead in egg	Number healthy young	Number of quickly died young
6-5-75	16	5-7-75	60 d	5	-	11	2 (deformed)
17-4-76	16	19-6-76	63 d	1	-	15	3
4-5-77	17	5-7-77	62 d	1	-	16	2
11-4-78	19	13-6-78	63 d	2	-	17	-
23-6-78	13	24-8-78	62 d	-	-	13	-
27-4-79	21	30-6-79	64 d	1	1	19	2
30-4-80	16	14-7-80	76 d	3	1	12	1
22-4-81	12	26-6-81	66 d	-	-	12	1 (died in egg after photo)
10-7-81	12	10-9-81	62 d	1	1	10	-
27-5-82	11	31-7-82	65 d	-	-	11	-