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OBSERVATIONS ON *TESTUDO MARGINATA* IN CAPTIVITY

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We bought our first two *Testudo marginata,* a male and a female, in 1970, newly imported, at a pet shop in Crawley, Sussex. We already owned two small *Testudo graeca* and one *Testudo hermanni* and we were attracted by the appearance of the *marginata.* The female looked very much older than the male as her shell was almost smooth and her splayed margin not as pronounced as his, which was beautifully formed and his shell clearly marked with growth rings. The adult *marginata* are readily identified by the elongate carapace, the rear marginals of which are splayed out to form a flat, plate-like area. They are the largest members of the genus in Europe and can exceed a foot in carapace length. Ours were both almost unrelieved black in colour. Both were suffering from an infestation of ticks in their armpits and in a short time their droppings revealed the presence of nematode worms. These problems we dealt with promptly.

The female had been laying eggs in the yard of the shop and indeed we saw evidence of this. *Marginata* eggs are almost complete spheres.

In 1971 we bought another *marginata* male from the same shop. It had been brought to the shop as an unwanted pet, very light in weight for its size although much smaller than the other two. Its colouring also was lighter, having large areas of yellowish colour.

Unfortunately the larger male died during hibernation in the winter of 1972/73 although having appeared perfectly healthy.

To begin with the tortoises were kept in a breeze block enclosure, one and a half bricks high, about 8 x 8 ft with a box for shelter and large stones to climb over, but the large male found escape from this quite easy by choosing a corner where another tortoise was resting, then climbing on its back and levering himself over the edge. We have never seen the female make any attempt to escape, either then or since.

More space was then provided for them and about half the length of one side of the garden was wire netted and bricked off, an area about 20 x 40 ft. A shelter was situated for them in a spot that was sunny in the evening. It is obvious that the larger the area provided for them, the more contented the tortoises are to graze over the whole area and do not spend their time patrolling the perimeter.

On moving house and having many more tortoises, all *graeca* and *hermanni,* we were fortunate to be able to provide them with the freedom of the whole garden, which is mainly lawn with shrubby borders, rockeries, concrete and gravel areas, a large compost heap which many love, plus a long open-sided barn for shelter from the sun or rain or to sleep at night if they choose to ignore the house arranged for them. This is a four brick high frame 8ft x 3ft, with a movable corrugated plastic roof projecting over the front for protection from rain. It is kept filled with straw, frequently changed when soiling occurs. This shelter is again situated in a position that is sunny during late afternoon and evening.

The *marginata* eat large amounts of food, although we have noticed that the female appears restless and hardly touches food when she is close to egglaying time. Their diet is composed of cabbage and other brassicas, lettuce, clover, dandelion, plaintain, watercress, milk thistle, cucumber, tomato, apple, pear, banana (including skin occasionally), strawberries, runner beans, courgette, melon, grapes, yellow flowers (dandelion and buttercups) and magnolia flowers. They also like the sedums and sempervivums on the rockery and were last year seen enjoying the petunias. Tinned cat food is appreciated now and again, especially by the babies.

We give them a small feed in the morning when they have warmed up, then they browse over the garden for the rest of the day until about 4 pm when we gather them together

for a large feed closer to their sleeping quarters, to which they retire shortly afterwards.

A shallow pool has been cemented into the garden for them to walk into for drinking and bathing. It needs to be very frequently brushed out and refilled as it is nearly always soiled when being used. The tortoises sometimes drink for several minutes at a time (we have recorded twenty minutes) and the young ones drink very often.

The female and her first mate were sexually very active from the time we first had them. In fact the vigorous courtship displayed by the male quite alarmed us at first as, apart from the ritual dance and leg and head biting, he would turn the female over and attack her when she was more vulnerably exposed. Copulation was seen to take place, but she did not attempt to dig a nest for the first few years except on one occasion when they had been moved to another garden while we were on holiday and she tried unsuccessfully to dig at the foot of an apple tree. Each year eggs were dropped at random over the garden, 3 in 1972, 11 in 1973, another 11 on 3 June 1974, but 5 in a nest on the 24 June. All these eggs were unsuccessful as we then had no idea of looking after them properly. In the summer of 1973 our second male took over as the female's mate. Mating takes place daily in fine weather from the time they come out of hibernation to when they go to sleep. Some days repeated mating occurs, often one act immediately following another. The *marginata* males have never shown any interest in other mature female *graeca* or *hermanni*, although smaller *grceca* males have attempted copulation with the female, which always appears unsuccessful as the sizes are so ill-matched and she is generally unco-operative. We have observed our seven year old male (?) attempting to mate with his sister (?), but the courtship display is singularly lacking and the episode brief. We are not certain of the sex of these seven year olds.

In 1975 we decided it was time to obtain some knowledge of the incubation of tortoise eggs and bought the Foyles Handbook by Ivor and Audrey Noel-Hume. So, in preparation for the arrival of eggs, we constructed an incubator from a small Stewarts plastic plant propagator, an aquarium thermostat and a 40 watt blue electric light bulb. This was to be placed in the airing cupboard and connected to a plug there. It was also thought better to provide a more suitable spot for the female to dig as she was seen to try scraping at the lawn without making any impression. A wooden wine bottle box 18" sq was filled with sand and placed near the base of a tree. That summer each time we saw her trying to dig we lifted her onto the sand box. At first she did not care for it, but we persisted and she became used to the feel of the soft, warm sand. A few days later she began in earnest to dig her nest. It was about midday and leaning her front legs on the raised edge of the box she began to scrape with first one hind foot, then the other. Digging took about half an hour until the hole was approximately 4" deep. Seven eggs were laid, taking 23 minutes. When they had been covered and the female had climbed down, apparently quite tired, we uncovered the eggs, pencilled a spot on the top of each to keep them upright and transferred them to margarine pots of sand in the incubator. The temperature was set at around 75°F.

In September, eleven weeks after being laid, our first two babies hatched. We later found that of the remaining five eggs there was one dead baby and four infertile eggs. The babies were transferred to a larger size propagator with a light bulb and thermostat, chicken gravel, stones and newspaper on the floor and small cardboard boxes for shelter. We later dispensed with the gravel as it was difficult to keep clean, using larger flatter stones instead. The second baby started eating chopped lettuce within 10-15 minutes after hatching and only then did the first one take food also, although arriving twenty four hours earlier.

Small plastic lids are ideal for food and water containers, being easily cleaned and renewable. At first we always chopped food for them but now it does not seem necessary: the babies appear quite capable of tearing leafy food and learning to grip it whilst eating. Harder foods like apples we crush or grate. They do seem to like eggshell, especially when very young, and this we provide by pounding chicken eggshells to a fine gritty texture and placing it in small heaps with their food. Water is much appreciated both for drinking and sitting in, especially as it gets warm.

It was not until a week or two after the hatching when we were trying to find out all we

Table 1. Egg Laying and Incubation

Year	No. Laid	No. Hatching	Place Laid	Date	Time Taken	Date of Hatching
1972	3	0	on garden			
1973	11	0	on garden			
1974	11	0	on garden	3 June		
"	5	0	nest	24 June		
1975	7	2	sand box nest	25 June	egg laying time 12.15 – 12.38	1 5 Sept 2 6 Sept (1 baby dead, 4 yolks)
1976	9	6	sand box nest	24 June	digging & laying 12.05 – 13.20	1/2 27 Sept 3 1 Oct 4 2 Oct 5 3 Oct 6 9 Oct
"	9	0	sand box nest	11 July	digging & laying 17.00 – 18.40	
1977	7	7	sand box nest	3 June	digging & laying 12.10 – 13.40	1 12 Aug 2 13 Aug 3/4 14 Aug 5/6 15 Aug 7 18 Aug (opened)
"	10	4	sand box nest	7 July	digging & laying 16.20 – 17.40	1 27 Sept 2 29 Sept 3 1 Oct 4 2 Oct
1978	7	2	rockery nest	8 June	laying time 16.14 – 17.05	1 19 Aug 2 26 Aug
"	10	1	sand box nest	20 Aug	digging & laying 10.45 – 12.30	1 8 Jan '79 (opened eggs, several dead)
1979	7	5	sand box nest	23 June	digging & last egg 11.10 – 12.34	1 31 Aug 2 2 Sept 3 7 Sept 4 8 Sept 5 11 Sept
"	9	9	sand box nest	25 July	digging time 15.00 – 16.20 laying time 16.34 – 17.55	1/2 7 Oct 3 9 Oct 4/5 10 Oct 6/7/8 11 Oct 9 12 Oct
1980	11	6	sand box nest	4 June	digging & laying 12.10 – 13.15	1 12 Aug 2/3 14 Aug 4 15 Aug 5/6 23 Aug (eggs opened, 4 yolks)

could about the care of the young ones that we had the opportunity of talking to someone who had also been successful but had later suffered disappointment by losing babies with "soft shell". This, we realised, was a serious problem and we then sought advice from a colleague who was warden at the I.L.E.A. Teachers Centre at Regent's Park. He recommended the use of the "Truelite" strip lights and gave us the address to contact. These lights have been very successful and easy to fit, so we use them all the year round, except for the short time we have hibernated the young ones in the last three or four years. Since joining the British Chelonia Group and reading of hibernating very young tortoises, we have for the past two years hibernated all the young over a year old for a period of between six to nine weeks. During the coldest weather the youngest group of babies are put in a shoebox or similar in the airing cupboard for the night.

We have hatched *marginata* now for the last seven years, though unfortunately none last year. The female showed no signs of egglaying although mating took place so we are wondering if perhaps she is now too old. The female has only once been seen to urinate on the nest when digging. We try to dampen the sand slightly when she shows signs of using it, so that the sides do not keep slipping in.

With the warmer weather and sunny days, the babies are put outside in small pens on patches of clover. They are given extra food, water and shelter and stay outside 'til about 5-6 o'clock when the garden becomes too shady and cool, when they are brought inside to their vivarium. If the weather is cold and/or wet they stay inside with their heater and ultra violet, the temperature being around 70°F, and their food is replenished when eaten during the day. We have three vivariums now so that the different year groups can be separated and a stronger one or two seem to develop faster in each group. It also gives the younger ones a chance of feeding without being pushed aside by the voracious older ones. Two of the vivariums are home-made, approximately 2ft 6in square, constructed of glass with wooden bases and removable tops. They are fitted with tubular heaters thermostatically controlled, plus a 2ft 40 watt "Truelite" strip. The third vivarium is a "Camplex" plant propagator 18in x 15in with a heated base, also fitted with a smaller "Truelite". The lights are between 4in and 8in from the floor and switched on from 9 am to 4 or 5 pm each day. The 5½ and 6½ year old youngsters live outside freely with the other tortoises. All the remainder are kept in pens when outside, in case they get lost in the garden when there is a particular cold or wet spell.

Experience has shown us that it was unwise to use a fine sand in which to bury the eggs, especially as we dampened it. The result of that was to compact the sand into a hard mass which prevented the movement of the eggs towards the surface at hatching time. We now use a coarse, gritty sand and leave it dry.

From 1975 to date eggs laid	96
Live tortoises hatched	42
Young sold to breeders	15
Deaths since hatching	5
Remaining with us	22

Five of the babies have died, showing loss of appetite and general deterioration, in spite of vitamin injections from the vet. The most recent one, a three year old, occurred this year quite suddenly two days after waking from its short hibernation.

For hibernation the babies are put into cardboard boxes, packed with crumpled newspaper and placed in a cold bedroom away from any heating. Regular checks are made to see if they are alright.

The *marginata* do not show any of the aggressive behaviour that our *hermanni* do. They have not succumbed to the runny nose that many of the *graeca* seem to be prone to. The hatchlings' shells have developed more normally than some other captive bred tortoises we have seen. Growth in some of the *marginata* is very rapid. Our second male grew from 2lb 13oz in May 1972 to 3lb 15oz in September of that year and in five years was 6lb 14oz. The first two babies, Alpha and Beta, have grown far more quickly than any of the other babies since.

Table 2. Weight Chart

Date	Male Simon	Female Victoria	Alpha b: 5.9.75	Beta b: 6.9.75	Gamma b: 27.9.76	Delta b: 27.9.76	Epsilon b: 1.10.76	Zeta b: 2.10.76
19. 3.72	2lb 13 oz	6lb 2oz						
25. 4.72	3 5½	6 9						
21. 5.72	3 6½	–						
13. 6.72	3 10	6 13						
12. 7.72	3 14	6 10						
19. 9.72	3 15	6 13						
20. 5.73	4 0	6 14						
30. 7.73	4 9	6 14						
26. 5.74	5 0	7 4						
23. 6.74	5 6	6 11						
5. 8.74	5 7	7 6						
5. 4.75	5 0	6 8						
27. 6.75	6 0	7 0						
27. 8.75	6 0	7 1						
13. 4.76	5 10	6 12						
4. 6.76	6 6	7 2						
11. 8.76	6 14	7 2½	0 7	0 5½				
13. 3.77	6 4	6 8	0 10	0 8				
9. 7.77	7 6	7 0	0 14	0 10½				
5. 9.77	7 4	7 1	0 15½	0 11½				
30. 3.78	6 12	6 14½	1 4	0 15½				
9. 5.78	7 6	7 11	1 4½	1 0				
30. 5.78	7 6	7 7	1 5½	1 0				
9. 7.78	8 0	7 8	1 9	0 15½				
20. 8.78	7 12	6 14	1 10	1 1				
11. 4.79	7 4½	6 15	1 10	0 14				
1. 6.79	7 14	7 6	1 12	1 1				
24. 6.79	8 1½	7 4	1 15	1 1½				
21. 8.79	8 5	7 8	2 5½	1 5				
–. 4.80	7 0	6 11	2 3	1 3				
18. 5.80	8 1	7 4	2 8	1 6				
12. 6.80	8 4	7 4	2 8	1 6½	0 12	0 10½	0 8	–
19. 7.80	8 9	7 4½	2 10	1 7	0 11½	0 11½	0 8½	0 7½
26. 8.80	8 1½	7 6½	2 13	1 9	0 14	0 13	0 10	0 9
26.10.80	7 12	7 3	2 12	1 7	–	–	–	–
27. 3.81	7 8½	6 14	2 9	1 7	–	–	–	–
11. 5.81	7 14	7 4	2 12	1 8	0 12	0 13½	0 9½	0 9½
6. 6.81	8 7	7 0	2 15	1 10	0 14½	0 13	0 9½	0 9
11. 7.81	8 13	7 8	3 0	1 12	0 15½	0 14	0 10	0 9½
2. 9.81	8 3	7 5	3 6	1 14	1 1½	0 15	0 10½	0 11
19. 4.82	8 4	7 6	3 4	1 15	1 3	1 0	0 12	0 12
Carapace Length May 1982	12 in	11 in	8 in	6¾ in	5¾ in	5½ in	4¾ in	4⅛ in

We have found it impossible to sex the young ones, the shells all look alike, similarly their tails.

All the tortoises, with the exception of the smaller babies, are weighed as regularly as we can at one or two monthly intervals throughout their waking period.