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Bimodality of Laying–Hatching Times in *Testudo elegans* Schoepff (Chelonia)

A FEMALE and three male Indian starred tortoises (*Testudo elegans* Schoepff)[1] have been kept since August 1962 in Bhubaneswar in a yard which is only partially paved. All the tortoises were obtained from dealers in Calcutta.

The eggs and young observed are listed in Table 1. 62I and 63I were resting on grass. 62I was put on damp blotting paper in a glass jar. It was discarded after it had cracked and become malodorous. The eight eggs 63I and 64I–VII were also put individually in glass jars and buried 6–8 cm deep in soil which was not moistened afterwards.

Table 1

No.	Laid	Where	Size (cm)	Hatched	Incubation period	Hatching weight (g)
62I	17/10/62	Surface	5·1 × 3·7			
63I	26/3/63	Surface		15/7/63	111	13·87
64V	18/4/64	Buried	4·25 × 3·5	4/6/64	47	16·13
II	18/4/64	Buried	4·35 × 3·55	4/6/64	47	18·94
VI	18/4/64	Buried	4·4 × 3·55	11/6/64	54	21·53
I	18/4/64	Buried	4·05 × 3·15	18/8/64	122	14·43
III	18/4/64	Buried	3·95 × 3·1	22/8/64	126	11·93
VII	18/4/64	Buried	4·4 × 3·3	29/8/64	133	13·77
IV	18/4/64	Buried	4·65 × 3·4	12/9/64	147	15·22
				Found		Weight when found
VIII				26/6/64		20·66
IX	One at least buried with XII			3/7/64		19·14
X				3/7/64		19·07
XI				3/7/64		20·74
XII	Buried			Died near term		

On April 18, 1964, at about 6 p.m., the female was found digging with her hind feet. About 1 h later, she was seen sitting quietly with her hind parts in the pit thus made. At midnight, she was more than 8 m away from this place, which was marked and excavated next morning. The soil was swarming with ants and had to be flooded before it could be handled. The eggs were buried 5–15 cm deep, each touching at least another. The numbers given to them unfortunately do not record the order in which they were taken from the pit. Though we extended this pit for at least 10 cm in all directions from this group of eggs, we found no more.

The female has not since had mud on her hind parts as she had after burying these eggs. However, four other baby tortoises have been found in the yard. The three young, 64IX–XI, were found virtually simultaneously and within a few metres of the previous egg pit. Very near the site of our previous excavation, we found a freshly opened cylindrical hole, about the diameter of a young tortoise, descending vertically. This contained fragments of egg-shell and an egg containing a putrid embryo very near term. As such a hole would have been quickly washed away in the rain then falling, and as the three young were so near to it, we have little doubt that we found them within a few minutes of their leaving the soil.

The laying to hatching periods of the 1964 eggs given in Table 1 show the young falling into two groups, the quick developers and the slow developers, and that the hatching weights of the former are greater than those of the latter. Their weights confirm that the four young found after hatching are plausibly quick developers, and that 63I is a slow developer.

It is known that the period between laying and hatching of reptile eggs is very variable within a species. This is attributed to their dependence on external temperatures, which vary from season to season and in different parts of the species range[2]. A range of laying–hatching times differing by a factor of 3 (which is, incidentally, larger than any listed by Goin and Goin[2]), together with its bimodality, suggests that the differences observed among the littermates 64I–VII kept in apparently identical conditions are genetically determined. The two groups may represent the sexes.

Here we are somewhat isolated from the literature and would be grateful to learn of any comparable variation in laying–hatching time in any other vertebrate. Like variation in time needed to reach sexual maturity, it may be characteristic of long-lived, and correspondingly infertile species. Wynne-Edwards[3] discusses the adaptive value of such patterns of development.

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'Metarchon': a New Term for a Class of Non-toxic Pest Control Agents

CONCERN over the contamination of the environment by pesticide residues is directing attention to the possibility of combating insect pests by means of chemical or other influences which, without being toxic, are able to affect an organism adversely by inducing deviations from the normal behaviour. Insect repellents and insect attractants (both chemical and optical) are familiar examples, but they do not exhaust the possibilities. For example, a sex-attractant scent could be distributed broadcast in order to confuse or attenuate the male response, and other olfactory signals might be used to induce a female to oviposit at the wrong time or place. Other possibilities no doubt remain to be discovered.

Since no single term denotes agents using this principle, I suggest that behaviour-modifying influences purposefully applied as a means of pest control be given a special name, 'metarchon', from the Greek meta, a prefix indicating change (as in metamorphosis), and archon, ruler or controller (as in monarchy or anarchy).

'Metarchons' are defined as external stimuli artificially introduced into the environment of an organism for the