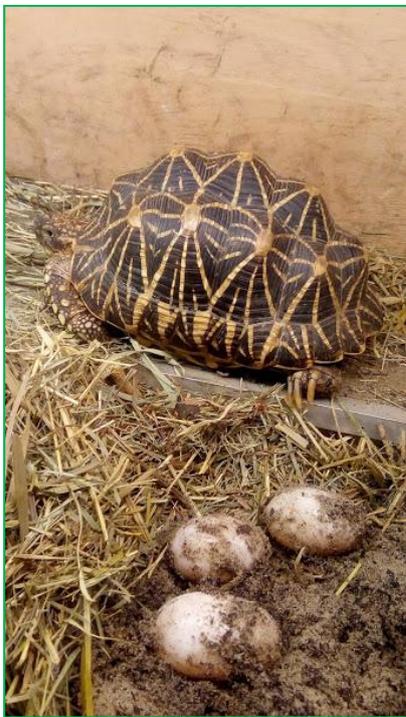


Indian star tortoise (*Geochelone elegans* Schoepff, 1795): keeping and breeding at BION Terrarium Center

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DESCRIPTION, DISTRIBUTION AND BIOLOGY

Indian star tortoise (*Geochelone elegans*) inhabits south-eastern areas of Pakistan, India (from Odisha state in the east to Sindh and Kutch states in the west) and Sri-Lanka. They prefer dry lowland areas and scrub forests, artificial gardens and grasslands. Due to their popularity in exotic pet trade, these tortoises' protection status was upgraded to CITES Appendix I in 2019 (threatened with extinction), giving this species the highest level of international protection from commercial trade. Also this species is listed in IUCN Red List as "Vulnerable". Size, appearance and personality are the key factors making them popular among hobbyists and valuable animals in herpetoculture. Adult females can have length of up to 25 cm (10 inches), while males are usually under 20 cm (8 inches) long. The most active growth happens in the first 10 years of life. Their average lifespan is about 30 years, but the current record is 55 years in their natural habitat. However some literature resources indicate that they can live up to 80 years in captivity. Adult specimens can weigh up to 6.6 kg.

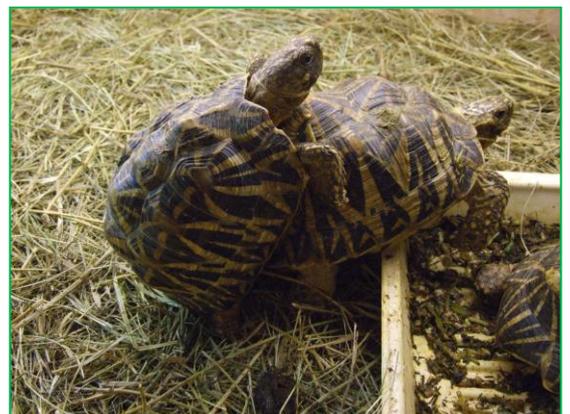


G. elegans carapace is very convex, with dorsal shields that often form humps. The lateral margins are almost vertical; the posterior margin is somewhat expanded and strongly serrated. Nuchal scute is absent, and the supracaudal is undivided, and curved inward in the male; the shields are strongly striated concentrically. The plastron is large, truncated or openly notched in front, and deeply notched and bifid behind; the suture between the humerals is much longer than that between the femorals; the suture between the pectorals is very short; the axillary and inguinal sutures are rather small. The head's size is moderate, with the forehead swollen, convex, and covered with rather small and irregular shields; the beak is feebly hooked, bi- or tricuspid; the edges of the jaws are denticulated. The carapace is black, with yellow areolae and numerous radiating narrow yellow streaks. The plastron likewise has black and yellow, radiating streaks (Boulenger, 1890). The shape of this tortoise is presumed to be specially adapted to naturally assist it to return to a stable stance after it has been turned over, that was proved mathematically

(Varkonyi, Domokos, 2006). Despite being very attractive and bright, their coloration patterns help them remaining unseen in scrubs and high grass.

Females are easy to sex due to their considerably larger sizes and much flatter plastrons, while males have a concave plastron shape and are generally smaller. Males have considerably longer tails as well.

Juveniles have much brighter coloration than adults. As they grow, bright yellow patterns extend into narrow star rays, pointing in all directions from the center of each shield. *G. elegans* tend to be a little more shy than most of Mediterranean tortoises, so they do not need so much attention. They can be quite sedentary, with a significantly lower



walking speed, and can comfortably be kept in smaller spaces than equally sized Mediterranean tortoises. They are intelligent enough to bond with their owners. Sometimes they can bite brightly colored objects, for example painted nails, to investigate whether they are food items. *G.*



elegans is not a good pet for children, they should be handled infrequently.

They are herbivorous, eating fallen fruits, grass, flowers and so on. Sometimes they can consume carrion, but one should not give them any meat food in captivity.

KEEPING AT BION TERRARIUM CENTER

ADULTS

Breeding stock (1:2) was officially imported from Jordan in 2005.

Keeping. We keep adult Indian star tortoises lizards in horizontal enclosures that should be long enough to provide temperature gradient. We use space of 180*50 cm (70*20 in) for breeding stock (1:2). We use hay layer of coarse sand as a substrate. We also provide a box with coarse sand as a nesting place. We use no special decoration. If one wants to use any items for decoration they should be monolithic in order to prevent tortoises from eating their parts and thus harm their digestive tract. We provide shelter for hiding. It is big enough to allow tortoises to turn around inside and not to stuck. Pieces of chalk are also put inside the enclosure. Keeping them in outdoor enclosures in summer will positively affect their health.



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Lighting. Lighting period is 12/12 hours. The enclosure is lit up well. We use UV lamps and heat lamps (Solar Raptor) in one corner (hot corner). The opposite corner is “cold”, providing temperature

gradient.

Temperature. Ambient temperature don't exceed +26 - +30 °C at daytime and are not lower than +18 °C at nighttime. At basking place temperature is about +35 - +38 °C under the lamp.

Humidity. Humidity level is 50-60%.

Water. Shallow water dish (at least 1 cm deep) is always available in the enclosure. Tortoises drink using their nostrils. If permanent water dish can't be installed in the enclosure, than tortoises should be bathed in a shallow water bowl (water temperature should not exceed +25 - +28 °C) once a week. A tortoise should be left inside the bowl for 15-30 minutes.



Diet. These tortoises are herbivorous. Their diet should be as variable as possible. Our diet for *G. elegans* include chopped salad mix (dandelions, nettle, hemp, alfalfa, coltsfoot leaves and flowers, vine leaves, plantain, arugula, basil), zucchini, watermelon, pumpkin, tomatoes, carrots (in minimal quantities). Hay is required all year round serving both as substrate and food due to the high fiber content and the ability to cleanse the intestines. White cabbage should not be given.

We feed tortoises depending on the season and feed intake every 2-3 days. Uneaten food is removed on the next day.

BREEDING AND RAISING AT BION TERRARIUM CENTER

In the wild, Indian star tortoise males have been observed to reach maturity at around 6-8 years of age and females at 8-12 years. In captivity, tortoises tend to grow and mature faster. Captive bred Star tortoise males may start siring as young as 3-4 years of age. Captive bred females may start laying eggs as young as 5-6 years of age, but over 7 years is probably more typical for females.

We keep males and females together (1:2). Presence of second male will stimulate mating behavior. We do not provide any wintering period. In winter months we imitate rainy season by increasing the sprinkling sessions (but not making a swamp in the enclosure). Also we prolong daylight period from 12 to 14 hours. According to the



literature, gestation lasts about 60-90 days.

Female digs a hole in a nesting box (15-20 cm (5.9 – 7.9 in) deep) for eggs' laying. One female is able to make up to 3 clutches per year (2-6 eggs in each), however our females made only 1 clutch per year so far. The eggs are about 4 cm (1.57 in) long and about 3 cm (1.2 in) wide with average weight of 25.6 g. Each egg is marked with a date of the clutch. We use incubation temperature of +28 °C to get males and +32 °C to get females. Substrate for incubation: vermiculite. Humidity during incubation is 75–85%. Under the mentioned temperatures incubation period is about 210 days for males and about 134 days for females. After the hatchling appeared partially out of the egg it is important not to disturb it for a couple of days to let it retract the yolk remains that are essential for start of appropriate digestion.

Average hatchlings' weight is about 15 g, average length is about 3.7 cm (1.45 in),



carapace height is about 2 cm (0.78 in).

Temperature, lighting and humidity requirements for juveniles are the same as for adults. We keep juveniles from 1 clutch of the same sex together. For 3 individuals we use space of 90*45 cm (35.4*17.7 in). We use paper towels as substrate. We provide individual shelters, water dish with fresh, regularly renewable water and a ceramic plate at basking point. Diet for juveniles consists of the same ingredients in same rate as for adults. We use no calcium + D3 supplementation since UV-light is available. Food is provided daily. Uneaten food and excrements should be removed from the terrarium, but they will readily consume dried herbs, so

they can be left in the terrarium a bit longer. Juveniles should be bathed to allow them to drink once a week.

It is extremely important to control juveniles' weight gaining. They should be weighed approximately once a month since it is impossible to visually examine whether the animal is gaining or losing weight (Table 1).

Table 1. Weight measurements of 3 juvenile G. elegans babies during first several months of life

Number	Sex	25.08.2018 weight (g)	25.09.2018 weight (g)	25.10.2018 weight (g)	28.11.2018 weight (g)	27.12.2018 weight (g)	26.08.2019 weight (g)
1	M	15,85	21,51	25,97	32,98	40,87	62,06
2	M	15,86	20,84	27,28	33,83	37,9	61,95
Number	Sex	03.10.2018 weight (g)	25.10.2018 weight (g)	28.11.2018 weight (g)	27.12.2018 weight (g)	26.08.2019 weight (g)	
3	M	14,4	15,37	22,21	26,21	49,36	



Indian star tortoises are in good demand in herpetoculture and are becoming endangered in the wild (moved from CITES App. II to CITES App. I) due to climate change, habitat loss and transformation and illegal pet trade. BION Terrarium Center is one of the breeding centers where these tortoises are regularly bred. Sharing information about it and creating of captive breeding programs are essential for saving of wild populations and meet the needs of pet market at the same time. Responsible approach in herpetoculture based on information sharing and development of breeding programs is something that can improve the situation and help to save the species from extinction.

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