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TORTOISES IN SOUTHERN TURKEY

Morphological and ecological differences (*Testudo ibera* PALLAS 1814 & *Testudo ibera anamurensis* WEISSINGER 1987) and the description of a new tortoise species.

With 15 photographs.

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PREFACE

Up until the recent years it was thought that the Mediterranean tortoises are representatives of the genus *Testudo* LINNAEUS 1758 only. In his revision Robert Mertens (1946) classified *T. ibera* PALLAS 1814, *T. zarudnyi* NIKOLSKI 1896 and *T. floweri* BODENHEIMER 1935, all of which had been originally described as full, separate species by their respective authors, as subspecies of *Testudo graeca* LINNAEUS 1758. Heinz Wermuth (1958) revised the *T. graeca* complex again in 1958. He states to believe that *T. floweri* is a synonym of the same species which Forsskål (1775) refers to as "Testudo terrestris" (= "land dwelling tortoise", of which no description is being given whatsoever). Noteworthy enough, Wermuth in his revision does not give a description for his *Testudo graeca terrestris* either. The photographs of two alleged *T. g. terrestris* specimens (one from Syria and the other from Libya) published in Wermuths's revision are clearly two structurally separate species. Highfield (1993) has investigated Wermuth's original museum specimens and he is convinced that the series consists of not one but several different morphologic types. In spite of poor evidence, lack of a satisfactory series of specimens - of which the origin is not known in all cases - or, on the other hand, in spite of poor or no personal knowledge of the animals at all, the four subspecies theory of Mertens and Wermuth has gained general acceptance up until the end of the 1980's.

Highfield & Martin (1989b) proved that *Testudo whitei* BENNET 1836, a later synonym of *T. graeca*, deserves its original status as a full species. After an osteological analysis Highfield (1990b) separated *T. whitei* from the genus *Testudo* and put it, as well as he did his later discovery, a small Tunesian species, in a new proposed genus *Furculachelys*. The shared structural key feature for both *Furculachelys whitei* and *Furculachelys nabeulensis* HIGHFIELD 1990 is the characteristic suprapygal construction which separates the genus *Furculachelys* from *Testudo* (among other morphologic and morphometric diagnostic features). Highfield & Martin (Highfield, 1990, 1990a, 1990b, 1993) also described a new species from Libya, the miniature tortoise *Testudo flavominimaralis* HIGHFIELD & MARTIN 1989. The genus *Furculachelys* is now being accepted in Europe by some chelonologists, researchers in the US remain sceptical.

The revision of *Testudo graeca* by Mertens (1946) and Wermuth (1958) cannot be accepted by the present author according to later scientific research, of which the most valuable in this respect are the immuno-serological works of Obst & Ambrosius (1971), a comparative morphologic analysis of scull structures by Bour (1989), the various analytical works by Highfield & Martin (1989a/b), Highfield (1990a/b & 1993) - all of which not only deal with the usual morphologic/morphometric dilemmas, but are inclusive of comparative studies of etological and physiological problems as well - and the research conducted by the present author.

The taxonomic status of the alleged subspecies *Testudo graeca terrestris* FORSSKÅL 1775 (of which there is absolutely no scientific description being published ever!) is intolerable, and the scientific name must be considered invalid.

It is also important to note that Bour (1987) pointed out and revised the taxonomic errors made by Wermuth (1952) concerning the subspecies of *Testudo hermanni*.

The Tortoise Trust (Highfield, pers. comm., 1995) and the Nederlandse Schildpadden Vereniging (Bruekers, pers. comm., 1995) are currently doing DNA-analyses to the Mediterranean tortoise species. The results may prove to be interesting.

TORTOISES OF TURKEY

Until the 1960's, common belief was that *Testudo (graeca) ibera* PALLAS 1814 was the only tortoise species to be found in the Asiatic part of Turkey. Later (e.g.) Herrn and Eiselt & Spitzenberger (1967) refer to the mysterious *T. graeca terrestris*, of which they tell that it is to be found (among other locations) in the southernmost part of Turkey near the Syrian border. The distribution of the Balkan race *Testudo hermanni boettgeri* GMELIN 1789 is limited to the European part of Turkey (Eiselt & Spitzenberger, 1967), where it occurs sympatrically with *T. ibera*. As far as the information for the occurrence of *Testudo marginata* SCHOEPFF 1792 in the vicinity of Ephesos (Brinckmeier et al., 1989) is concerned, one must be very cautious on this matter. My strong belief is that either the authors have made a false identification, or the specimen was transported in that particular location by man.

1987 the picture of the Turkish tortoise fauna changed again, when late Heinz Weissinger described a new subspecies *Testudo graeca anamurensis* from southern coastal Turkey. Weissinger classified the new race according to Mertens' & Wermuth's old concept as a subspecies of *Testudo graeca*.

For the original description of the subspecies *Testudo graeca anamurensis* WEISSINGER 1987, please see article "*Testudo graeca anamurensis* ssp. nov. aus Kleinasien"; ÖGH-Nachrichten, Wien 10/11: 14-18 (Weissinger, 1987).

The measurements given by Weissinger (1987) for his type and paratype specimens are as shown below.

***Testudo graeca anamurensis* ssp. nov.**

Type specimen NMW 30795:1
Female, Anamurium
Straight-line carapace length 260 mm
Carapace width 160 mm
Carapace height 105 mm

Paratype NMW 30795:3
Female, Side
SCL 210 mm
Width 135 mm
Height 88 mm

OBSERVATIONS AND MORPHOMETRIC DATA

Weissinger soon died after completing his description, and there are only a few reports on his alleged subspecies from the recent years. Highfield visited the Terra typica shortly in 1993. In his report (1994) he fully agrees with Weissinger's observations but considers *anamurensis* to be a subspecies of *Testudo ibera*, not *T. graeca*. Highfield notes the elongated body form, the exceptional flaring and serration of the rear marginal scutes, the considerable length of the males and the mottled plastral markings. The longest male recorded by him measured 235 mm SCL. Highfield is not satisfied with the distribution of *anamurensis* as published by Weissinger. His studies in the Antalya-Finike area provided no evidence of any other tortoises than the common *T. ibera*.

Jaco Bruekers (pers. comm., 1995) has observed *anamurensis* occurring sympatrically with *T. ibera* in the westernmost corner of the main distribution area described by Weissinger. If *anamurensis* were to be given a subspecific status this kind of a parallel distribution is quite annoying, because the situation doesn't correlate with the taxonomic rules for subspecies.

I have investigated the tortoises of southern Turkey three times: In March 1994 and in April and October 1995. All specimens encountered were measured and photographed, and diagnostic data of key characteristic features was carefully collected for the final analysis. In the data collecting work the main concept that was used was the one published by Highfield (1990b).

Research was conducted in the following areas (the number of encountered specimens in brackets), [c = coast, m = mountain].

Side (1), 60 km to the west from Alanya [c]; Konakli (7), 15 km to the west from Alanya [m/c]; Alanya (14)[m]; Mahmutlar (32), 15 km to the east from Alanya [c]; Anamurium (16), 120 km to the east from Alanya [c]; Anamur (1), [c], 130 km to the east from Alanya; Mamure Kalesi (3), 20 km to the east from Anamur [c]. 74 specimens were recorded in these locations altogether.

The measurements taken from the inspected specimens and several mathematical indexes derived from that data were compared with each other as with the original description of *T. ibera* (Pallas, 1814). Pallas gives the following dimensions for the species and his holotype specimen: a) carapace height (Ch) of the **species** about twice within its length; b) length (SCL) of the **holotype** specimen (female?) about 211 mm, carapace height (Ch) about 107 mm; c) the maximum width of the **species** (not the holotype specimen) about 152 mm.

Indexes for different populations (females/males):

Straight-line Carapace Length/Height (SCL/Ch)

1) Konakli + Alanya (11/10)

females: 1.912 = 52.30% (height 52.3% of the length)

males: 2.063 = 48.47%
all: 1.988 = 50.30%

Length of the specimens recorded: 86-220 mm, 4 individuals (of which 1 male) over 200 mm.

2) Mahmutlar (15/17)

females: 2.064 = 48.45%
males: 2.166 = 46.17%
all: 2.115 = 47.28%

Length of individuals: 48-245 mm; only 4 individuals under 90 mm, 17 individuals (of which 8 males) over 200 mm.

3) *Anamurium, Anamur + Mamure Kalesi (9/11)*

females: 2.174 = 46.00%
males: 2.219 = 45.07%
all: 2.197 = 45.52%

Length of specimens: 218-267 mm.

4) *Pallas' T. ibera holotype specimen*

female(?): 1.972 = 50.71%

In the Terra typica (Anamurium) and locations nearby, the individuals, when compared to their length, are significantly lower domed than in the areas westwards from the Terra typica. Also their SCL/Ch indexes differ considerably from the index derived from the original holotype specimen by Pallas, to which - on the contrary - individuals from Alanya and Konakli correlate quite perfectly.

Length/Maximum width at Marginals (SCL/MwM)

1) *Konakli + Alanya*

females: 1.361 = 73.48% (MwM 73.48% of the length)
males: 1.300 = 76.92%
all: 1.331 = 75.13%

Maximum widths at marginals: 64-162 mm (the 162 mm wide male showed all characteristics of a *T. g. anamurensis*.

2) *Mahmutlar*

females: 1.365 = 73.26%
males: 1.338 = 74.74%
all: 1.352 = 73.96%

Range of MwMs: 56-183 mm. Both six females and six males had a MwM greater than 160 mm.

3) *Anamurium, Anamur + Mamure Kalesi*

females: 1.391 = 71.89%
males: 1.404 = 71.22%
all: 1.398 = 71.53%

Range of MwMs: 156-188 mm.

Pallas does not give width measurements for his holotype specimen, but he states that the species itself never exceeds a total width of 152 mm. A 230 mm (SCL) long male recorded by myself in Anamurium had a maximum marginal width of 178 mm, a huge 267 mm SCL female from Mamure Kalesi showed a MwM of no less than 188 mm (weight 3340 g).

The further away one is from the Terra typica, the greater are the shares of the MwMs of the animals' total length, which is a proof of the animals' rounder overall shape in the western

populations, although the eastern individuals are in fact longer and wider than specimens in Alanya and its surrounding. In addition, in populations near Alanya the hind marginals of males are much wider compared to females, which is not the case with the eastern populations, in which both males and females have very wide posterior marginals.

Maximum width at Marginals/Median body width (MwM/Mw)

1) Konakli + Alanya

females: 1.011 = 98.91% (median width 98.91% of MwM)

males: 1.055 = 94.78%
all: 1.033 = 96.81%

2) Mahmutlar

females: 1.049 = 95.33%
males: 1.080 = 92.59%
all: 1.065 = 93.90%

3) Anamurium, Anamur + Mamure Kalesi

females: 1.057 = 94.61%
males: 1.078 = 92.76%
all: 1.068 = 93.63%

The MwM/Mw indexes show clearly that, when moving from the west to the east, the width of the rear marginals in comparison with the median body width gradually becomes greater in the eastern populations.

Length/Median body width (SCL/Mw)

1) Konakli + Alanya

females: 1.399 = 71.48% (Mw 71.48% of the total length)

males: 1.444 = 69.25%
all: 1.421 = 70.37%

2) Mahmutlar

females: 1.446 = 69.16%
males: 1.454 = 68.78%
all: 1.450 = 68.97%

3) ***Anamurium, Anamur + Mamure Kalesi***

females: 1.471 = 67.98%
males: 1.469 = 68.07%
all: 1.470 = 68.03%

In the west, the individuals' median body width in comparison with their total length is greater than in the east. In the east the differences of the SCL/Mw indexes between both sexes are minor than in the west.

During my latest field excursion I visited the ancient ruins of Side, the westernmost border of *Testudo graeca anamurensis'* main distribution area according to Weissinger's original paper. It is the exact location where Bruekers (pers. comm., 1995) observed *Testudo ibera* occurring sympatrically with *anamurensis*.

Because of a severe long lasting draught in summer and autumn 1995 practically all tortoises in the areas where field work was executed were in aestivation and hence were very hard to locate. In Side, after half a days intensive searching, I could find one female hiding in the bushes. This specimen seemed to correlate with the definition of *anamurensis*, not *ibera*. The diagnostic indexes for this 212 mm SCL individual are as follows: SCL/Ch: 2.078 = 48.12%; SCL/MwM: 1.404 = 71.23%; MwM/Mw: 1.034 = 96.71%; SCL/Mw: 1.452 = 68.87%. They correlate quite well with data derived from specimens from the Mahmutlar region. Also the tortoise from Side, as shown in a photograph published in the article "De Moorse landschildpad" (Bruekers & Zwartepoorte, 1995, p. 22), is very identical with specimens in Mahmutlar. It is a pity that no adequate series of mathematical data of the tortoises in Side has been published ever. Practically all information of the tortoises there are based on analyses by the eye.

ANALYSIS

I am convinced that it is proven that *Testudo graeca anamurensis* WEISSINGER 1987 clearly is a geographic subspecies in its own right. I presume that the main distribution area of the genetically clean *anamurensis* can be defined on a comparatively small isolated area around the Terra typica in the vicinity of Anamurium. The Terra typica, quite the opposite to the statement made by Florack (fide Bruekers, 1996), is situated in the historical Cilicia, an area completely isolated by mountains. In former times it was inaccessible even for man by any other means but vessels. Even today the minor 130 km trip by car from Alanya to Anamur along the mountain road lasts at least 3-4 hours. The most isolated region is bordered to the mountains at Gazipasa in the west, and to the mountains east of Ovacik in the east. In the north the border is the Cilician Taurus, which separates the Terra typica from the Anatolian highlands. In the south lays the Mediterranean.

It is necessary to do more specific research on the distribution of *anamurensis*, but the material collected by myself indicates that the further one moves westwards from the area isolated by mountains, the clearer *anamurensis* intergrades with the nominate species *Testudo ibera*. Although the animals belonging to the Mahmutlar population could roughly be defined as *anamurensis*, it is obvious that they critically analysed must be considered intergrades between *T. ibera* and the subspecies described by Weissinger.

The tortoises in Konakli and Alanya (except for one individual), by their proportions, markings and colouration, represent clearly *T. ibera*, but - annoyingly enough - further away from the Terra typica in Side, besides *Testudo ibera*, one can observe tortoises that differ from that species quite radically. The explanation could be as follows: From its main distribution area surrounded by mountains, *anamurensis* spreads along the coast both to the east and the west, gradually intergrading with the dominant species *Testudo ibera*. *T. ibera* does not normally occur in biotopes such as sandy beach stretches, on the other hand, *anamurensis* seems to prefer such biotopes (on the dunes at Anamurium, there are numerous tortoise tracks cruising all around the beach [Perälä, unpubl. notes, 1994 & 1995; Highfield, 1994]). This biotope-preference could be the key for the fact that on suitable stretches close to the sea, the

anamurensis genotype has survived as far from the main distribution area as to e.g. Side in the west. Further inland, under the genetic pressure of *T. ibera*, the intergradation occurs geographically closer to the center of the main distribution area of *anamurensis*.

According to extensive field studies, statistics and mathematical indexes derived from both individual specimens and whole populations, it is obvious that *Testudo graeca anamurensis* WEISSINGER 1987 must be considered a geographical subspecies of *Testudo ibera* PALLAS 1814, and not a subspecies of the North African *Testudo graeca* LINNAEUS 1758 as proposed by its original author Weissinger, who, in his original description uses the old Mertens & Wermuth hypothesis of the four subspecies of *T. graeca*. In spite of considerable morphological and proportional differences between *ibera* and *anamurensis*, the latter clearly is morphologically closer to *T. ibera* than the North African *T. graeca*, from which it differs dramatically (for more information of the obvious differences between *T. graeca* and *T. ibera*, please see: Highfield & Martin, 1989a/b; Highfield, 1990a, 1990b, 1993). I am strongly of the opinion that the evidence provided by this study adds significantly to the contributions of former researchers (see: Preface) who contradict with the concept of Mertens (1946) and Wermuth (1958) and adequately proves their hypothesis of being intolerable. The present author therefore proposes that, according to taxonomic nomenclature rules, the species being discussed in this study should correctly be revised and referred to as *Testudo ibera* PALLAS 1814 and *Testudo ibera anamurensis* WEISSINGER 1987.

DESCRIPTION

Weissinger's (1987) original description of *anamurensis* is rather sparing, and the dimensions he gives for his holotype and paratype specimens are very peculiar, if not unreliable. Weissinger does not tell how his measurements were taken, and the only verifiable measure for his individuals is the length, for which he states to use the "Stockmass" (= SCL, Straight-line Carapace Length). The indexes derived from his two type specimens do not correlate with my data.

The following measurements of two females were taken by the present author. The geographical locations are the same as for Weissinger's specimens, and the individuals' lengths differ not more than by a few millimetres in both studies.

1) Female (Anamurium)

Length: 265 mm SCL
Mw: 183 mm
MwM: 186 mm
Ch: 117 mm

2) Female (Side)

Length: 212 mm
Mw: 146 mm
MwM: 151 mm
Ch: 102 mm

It is possible that Weissinger took his width measurements from the narrowest point of the animals' body, and that he only measured the height of the carapax (starting at the point where the marginals make a fold between the carapace and the plastron). Otherwise Weissinger's measuremts seem to be quite inexplicable. Anyway, by no means do they represent the majority of individual tortoises to be found in the coast-line area.

I would like to fill in Weissinger's (1987) original description by the following points:

Testudo ibera anamurensis WEISSINGER 1987

On the average, the height (Ch) of *Testudo ibera anamurensis* is 2.2 times within its length, only exceptionally 2.5 times. Its median body width (Mw) is about 1.5 times, and its maximum width at (the posterior) marginals (MwM) 1.4 times in its length. The narrowest point of the body is located about at the 5th and 6th marginal suture. The body then suddenly widens, especially in males, anteriorly to the pectoral-abdominal seam. The males have extraordinarily long and wide anterior marginals, which contribute to the optic illusion of a very narrow mid-body. The 1st marginal scutes are often anteriorly projected beyond the nuchal scute in males. Compared to *Testudo ibera*, the posterior marginals are very long and wide in both sexes, and strongly serrated in males. They project posteriorly beyond the supracaudal scute usually by several millimetres (in both sexes). Both the anterior and posterior marginals differ from those of a T. ibera already in very young juveniles (at a weight of 30 g). In comparison, even at this early stage of growth they are more projected, and the 2nd & 3rd in particular differ morphologically from those to be found in *T. ibera* hatchlings.

In adults, the four posterior peripherals (8th, 9th, 10th & 11th) are serrated and have spike-like formations (spinules) in the middle of each bone. Both sexes show xiphiplastral kinesis and attain considerably larger dimensions than it is usual for *T. ibera* (the largest male measured by myself: 245 mm SCL, 2750 g [location Anamurium]; the largest females: 267 mm SCL, 3340 g and 265 mm SCL, 3570 g respectively [location Mamure Kalesi]).

Colouration and markings: A 30 g, 48 mm SCL juvenile (in Mahmutlar) showed no plastral markings whatsoever (unlike *T. ibera*). According to Florack (fide Bruekers, 1996) captive bread, genetically clean *anamurensis* hatchlings do not have plastral markings. A slightly larger (68 mm SCL, W 85 g) individual (in Mahmutlar) had clearly visible dark blotches in the posterior inner corners of the abdominal scutes. The carapace markings of the smaller juvenile's individual scutes were not as definite as they tend to be in *T. ibera*. A slight rectangular blotch was visible in the 2nd vertebral, also shades of brownish markings with irregular borders were to be seen in the costal scutes, but these were not longish rectangular as is typical to *T. ibera*. The colour of the carapace could be defined as milk chocolate brown.

The basic colour of the adults' carapace is a hue of yellowish brown. The dominant features in every scute of the carapace are the dark brown or almost black markings which produce a highly regular pattern: As a rule, the areola of every scute is covered up with an irregular blotch from which dark, broad, regular stripes (bands) continue to every direction over the scute to the seam separating the scutes. These beams never cross each other and can be observed in the vertebrals, costals and marginals. They are most evidently defined in the anterior vertical faces and the lower horizontal edges of the scutes. Very old specimens become completely dark and their markings are hence lost. The tendency in the adult specimens' plastral markings is, if the plastron is not completedy dark, that dark brown blotches are centered almost as mirror images of their counterparts on both sides of the pectoral-abdominal and abdominal-femoral sutures. The anterior parts of the gulars and humerals and the posterior parts of the anals are likely to be dark brownish. Many *Testudo ibera anamurensis* individuals have yellowish scutes among the brown or black ones in their heads and forelegs.

About 50 percent of the tortoises located in the Terra typica and adjacent areas have double spurs (2 x 2) or even triple spurs (3 x 2) on their thighs, which is an indicator for strong homogeneity of the subspecies in question. The spurs (thigh tubercles) measure 10 x 8 mm (length x base width) on the average. In addition, the males tend to have a couple of long, sword-like scutes on their heels.

Testudo ibera anamurensis WEISSINGER 1987 is a geographical subspecies of *Testudo ibera* PALLAS 1814, with apparently a highly limited distribution. It is essential to preserve the natural biotopic habitats of this subspecies, and the present author would certainly welcome any carefully planned conservation actions against habitat destruction in the valley and coastal areas close to the city of Anamur. Authorities in Turkey and chelonian researchers and wild life conservationists around the world are hereby invited to take conservation measures into account before this little-known tortoise is lost forever.

PART II

A NEW TORTOISE SPECIES FROM THE MIDDLE-EAST

A preliminary report.

During my third field excursion to Mediterranean Turkey I visited Antakya (= Hatay) in the extreme southern part of the country. In the beginning of this century Antakya was still under Syrian reign, until Turkey occupied the city and the adjacent areas in 1939. Antakya is the location where Herrn (fide Eiselt & Spitzenberger, 1967) and Eiselt & Spitzenberger (1967) tell to have been inspecting *Testudo graeca terrestris* FORSSKÅL 1775, a subspecies that on the grounds of basic taxonomic criterions should not exist at all (see: Preface).

I searched for tortoises in the mountains east of the city near the Cave-Church of St Peter (Senpiyer Kilisesi). In the 1960's, Eiselt & Spitzenberger had collected research material on the gentle, lower slopes just infront of the church, but this area nowadays consists of buildings and scrub land. Andy Highfield has conducted field work in the Samandag beach area some 30-40 kilometres east of Antakya, and he states (Highfield, 1994) that the tortoises he found there, in spite of their comparatively small overall size and the yellow scutellation of the legs and head, otherwise are morphologically identical with *Testudo ibera* specimens of the same size. In my opinion, in this case it is not logical to draw too many conclusions out of such comparisons (between individuals of the same size only) because of the fact that the adult size of the tortoises in the Antakya region equals the size of a normal growing *T. ibera* from other geographical locations, and proportions of juvenile chelonians differ quite dramatically from those of the adults - as also indicated by the present author's experiments, in which transparent plates showing morphologic key diagnostic features are being transfigurated into a common scale for comparisons (Perälä, unpublished notes). Highfield (personal communication, 1996) also says to having inspected only a handful of specimens in Samandag.

After a couple of hours of searching, at 9.30 a.m., I could locate a very yellow, clearly adult, 161 mm SCL tortoise in a bush. This individual had pale yellow scutes in its forefeet and hindlegs, also most of the head was of the same colour. This individual had dark brown horizontal stripes in the lower parts of the vertebrals and costals, in addition, the areoles of the same scutes featured dark brown blotches with highly distinctive borders.

During two days in the field I managed to make careful notes of 15 living specimens which also were photographed from different angles. Finally, at a quite high altitude on a rather inaccessible mountain slope I found the shell of a dead individual. Unfortunately, the scull or remaining bones from the extremities could not be located in spite of intensive searching. In later investigations, after removing the outer keratin layer in order to make an osteological structure analysis of the specimen, it was found that under the 5th vertebral scute the suprapygal construction of this particular individual demonstrated the same character state which, as a rule, is to be found in the Tunesian species *Furculachelys nabeulensis* HIGHFIELD 1990 (Highfield, 1990, 1990b, and personal communication, 1995 and '96). The suprapygal consists of two parts, the first fully encloses a second, which in turn forms a half circle. Accordind to the generally accepted definition of the genus *Testudo* (Loveridge & Williams, 1957), the species in that genus frequently have one suprapygal, if two, they are typically separated by a straight transverse suture. Although chelonian researchers have classified paleontologic material into different genera by using the suprapygal shape as a criterion, it cannot be justified to run into too definite conclusions drawn from a single specimen, which may represent structural abnormality differing from the normal morphology of the species in concern. Pritchard in personal communication with Bruekers (Bruekers, pers. comm., 1996) has stated that a "*Furculachelys* suprapygal" (which is very identical with the structure to be found in the genus *Homopus*; see: Loveridge & Williams, 1957) is quite commonly found as an aberration in various chelonian species. Highfield (pers. comm., 1995) points out that also *Geochelone pardalis* specimens have been encountered having a *Testudo* suprapygal, and vice versa. On the other hand, the shell as well as the living specimens from Antakya show many additional characteristics shared by *Furculachelys nabeulensis*, like the supracaudal

scute typically projecting far beyond the posterior marginals (as is the case with *Testudo kleinmanni* LORTET 1883 also), and the distinctive excavation of the epiplastron, but characteristic differences are numerous too.

Taxonomically it is highly important and relevant to realise that the tortoises in Antakya, by their morphological key characteristics, differ significantly from both *Testudo ibera* and *Testudo graeca* anyway, and therefore - according to evidence shown in this paper - cannot be referred to as either *T. ibera* (or a subspecies) or as *Testudo graeca terrestris* as suggested by Eiselt & Spitzenberger (1967).

KEY CHARACTERISTICS AND COMPARISONS

In the generally accepted definition of the genus *Testudo*, Ernest Williams, in Loveridge & Williams (1957) writes:

1) **"Outer side of the third costal scute about as long as, or longer than, that of fourth."** (See also Pritchard 1979; Ernst & Barbour, 1989). This is the genuine pattern in *Testudo graeca* and *Testudo ibera*.

- **All** Antakyan tortoises recorded by the present author had the outer side of the fourth costal scute longer than that of the third. Highfield (1990b) states that without exception all *T. hermanni boettgeri* specimens, of which he has data of, have the fourth costal outer suture at least equal to and in the vast majority of cases wider than the third. He notes the same character state in the limited number of *T. horsfieldiis* he had records of at the time of writing. According to my personal, quite comprehensive data of *T. horsfieldii* individuals the vast majority have the outer side of the 3rd costal scute longer than that of fourth. The 4th costal longer than 3rd relation to be found in the Antakyan tortoises is also the typical character state for species of the genus *Geochelone*. *Geochelone* species do not, however, have a movable xiphiplastral hinge, unlike the Antakyan tortoise and *Testudo* species with the exception of *T. hermanni* and *T. horsfieldii*.

2) **"Frequently a single suprapygal, if two, they are typically separated by a straight transverse suture."**

- The single shell of a dead tortoise from Antakya I have had acces to represents the typical *Furculachelys nabeulensis* suprapygal construction as defined by Highfield (1990b), for details, see former text and photograph appendage. Because I have not a series of osteological material for comparisons I do not use the suprapygal structure as a diagnostic feature here.

3) **"Typically the anterior neurals alternately octagonal and quadrilateral."**

- In the Antakyan specimen the neurals are configured 6-8-4-8-4-6-4-6, hence there are 8 neurals altogether. *Testudo graeca* and *Testudo ibera* normally have 7 neurals. Individual specimens show often, according to several sources, quite an amount of character variation of morphological features, which as a rule are being regarded constant. These aberrations can be diagnosed in the bony shell too. In this respect the neural series of the inspected specimen can be untypical for the whole population or not.

In the definition of *Testudo graeca* (Loveridge & Williams, 1957) it is said:

1) **"Tail without, or with a poorly developed terminal clawlike tubercle."**

- **All** inspected individuals in Antakya had a clearly definable, round terminal tubercle that was divided by a central seam at the tip.

2) **"Supracaudal undivided, rarely divided, not projecting beyond the marginals, slightly incurved in males, occasionally in females." This statement is true for Turkish *T. ibera* as well.**

- **In all** the Antakyan tortoises the supracaudal projects considerably beyond the posterior marginal scutes, as it does in *T. hermanni, Furculachelys nabeulensis* and *Testudo kleinmanni* (but in *T. kleinmanni* the pectorals, in contrast to the Antakyan specimens, are larger than the femorals). **Unlike in every currently recorded Mediterranean tortoise species, in the Antakyan individuals the projection of the supracaudal is far stronger in females than in males. The females' supracaudal scute is also more incurved than it is in males.** These characters, in my opinion, should be regarded as highly distinctive and significant, if not unheard of. One male out of 16 specimens had a divided supracaudal. Of *Testudo flavominimaralis* Highfield (1990b) says that its supracaudal zone is not at all projected posteriorlaterally and is not introflexed ventrally.
- Ernst & Barbour (1989) state that *Testudo graeca* (inclusive of the subspecies as defined by Mertens and Wermuth, *T. ibera* referred to as *T. g. ibera*) has the fifth vertebral scute narrower than the 4th. In *Testudo hermanni* the 4th is narrower than the 5th.
  - **In all** the Antakyan individuals the 5th vertebral is clearly and considerably broader than any other vertebral scute. I believe that this characteristic feature - in addition to the incurved, projecting supracaudal, the slightly lumpy vertebrals, the (vertically) broad costals and, in old individuals, the *Testudo hermanni boettgeri*-like carapacial markings of the tortoises to be found in Antakya - explain the mystery of a certain single specimen in the collections of the British Museum. In the "Key to the Circum-Mediterranean Species of *TESTUDO*" Loveridge & Williams (1957, p. 260) write of *Testudo hermanni* the following: "... As Lortet (1887: 6) distinctly states that he never collected this species in Syria, the specimen from Antakia, Syria, allegedly collected by Lortet, and recorded as "graeca", i.e. *hermanni* by Boulenger (1889a: 177) requires confirmation." In Boulenger (1889, p. 177) one can read that this particular "Testudo graeca" i.e. *Testudo hermanni*, collected in Antakia, Syria, presented to the British Museum by Lortet, is a male and preserved in spirit. Unfortunately, I have not had the chance of studying this specimen in the British Museum collections, but I am quite certain that this specimen in fact is not a *Testudo hermanni* at all - as also stated by Lortet that he never collected this species from Syria, and as is known nowadays, in reality does not occur there - but that it is a representative of the same tortoises I have collected data of in Antakya, Turkey i.e. Lortet's Antakia, Syria. Lortet's specimen is preserved in alcohol, and therefore the incorrect analysis and labeling by Boulenger is understandable, as there are certain common characteristics in *Testudo hermanni* and the Antakyan tortoises as described above. Significantly enough, Lortet's specimen is not labeled *Testudo graeca* (under current taxonomy) i.e. Boulenger's "Testudo ibera", which indicates the strong differences between the Antakyan tortoises and the true North African *Testudo graeca* LINNAEUS 1758.
  - In comparison, the anterior, upper surface of the epiplastron of the adult Antakyan specimens is much higher located than the one of an adult *Testudo graeca* of North Africa (rise of epiplastron compared to specimen's total carapace length). The anterior epiplastron of the Antakyan tortoise resembles the tip of a ski.
  - In every recorded individual (10 males and 6 females, all of breeding age) the posterior marginals do not exceed the median body width of the animal. In one specimen (female) the maximum width at the posterior marginals equals the median body width. *Testudo*

ibera, Testudo graeca, Testudo flavominimaralis and *Furculachelys nabeulensis* typically show the opposite character state.

- The outer, long sides of the (longer than broad) gular scutes of the tortoises in Antakya are concave, unlike those of a typical *T. graeca*. The gulars of *Furculachelys nabeulensis* of Tunisia are broader than long (Highfield, 1990b, 1993).
- The costals of the Antakyan individuals are (vertically) much broader than the vertebrals (as is the case with *T. hermanni*), unlike those of *T. graeca* or *T. ibera*, in which species the costals usually are about as broad as the vertebrals.

- **INDEXES DERIVED FROM ANIMALS IN ANTAKYA (6 females, 10 males):**

Straigth-line Carapace Length/Height (SCL/Ch)

females: 1.892 = 52.85%
males: 1.910 = 52.36%
all: 1.901 = 52.60%

Highfield (1990b) gives the following average SCL/Ch indexes for *F. nabeulensis*: Females 1.870, Males 2.160. The dimorphism noticable in *F. nabeulensis* does not exist in the Antakyan tortoise.

Straigth-line Carapace Length/Max. width at Marginals (SCL/MwM)

females: 1.384 = 72.25%
males: 1.428 = 70.03%
all: 1.406 = 71.12%

Max. width at Marginals/Median body width (MwM/Mw)

females: 0.988 = 101.21% !!!
males: 0.966 = 103.52% !!!
all: 0.976 = 102.46% !!!

Straigth-line Carapace Length/Median body width (SCL/Mw)

females: 1.364 = 73.31%
males: 1.380 = 72.46%
all: 1.372 = 72.89%

- **HEIGHT/WIDTH INDEXES FOR TORTOISES IN S. TURKEY (fem./males):**

Carapace height x 100/Max. total width (Mertens, 1946)

T. ibera (Konakli + Alanya), (11/10)

females: 693
males: 642
all: 668

T. ibera anamurensis *(Mahmutlar), (15/17)*

females: 662
males: 603
all: 633

T. ibera anamurensis (Anamurium & surrounding), (9/11)

females: 645
males: 612
all: 629

Antakyan tortoise (Antakya), (6/10)

females: 724
males: 723
all: 724

- The "official" plastral formula for *Testudo graeca* (inclusive of the subspecies as defined by Mertens and Wermuth) is, in all its irrelevance, the following: "Abd>(g.h.p.f.an: very variable)", (Loveridge & Williams, 1957), or Abd>hum><gul><an><pect><fem as defined by Ernst & Barbour (1989). As one can see, according to the former authors, the plastral formula of *Testudo graeca* can be practically any combination of factors, and the variation of this formula in perspective seems to be greater than in any other chelonian species in the world. Normally chelonian species have quite distinctive and relatively unvariable plastral formulas by which close species and subspecies quite easily and reliably can be separated from each other. In the following, I present plastral formulas for certain tortoises to be found in Mediterranean Turkey. The formulas are based on the present author's data collected in the field, and they represent **averages** derived from whole populations. It is useful to note that in all cases there is dimorphism between sexes.

T. ibera (Konakli & Alanya)

females: abd>hum>an>gul>fem>pect
males: abd>hum>gul>an>fem>pect

T. ibera anamurensis *(Anamurium)*

females: abd>hum>an>gul>fem>pect
males: abd>gul>hum>fem>an>pect

Antakyan tortoise (Antakya)

females: abd>an>hum>gul>fem>pect
males: abd>hum>an>gul>fem>pect

Of *Furculachelys nabeulensis* we know that a) when the femoral suture is subequal to the anal suture = female, b) when the femoral suture is equal to or exceeds the anal suture = male (Highfield, 1990b).

Of the alleged species *Testudo floweri* BODENHEIMER 1935 we do not know much. Bodenheimer's original description, "The tiny variety found in the Negeb may be called *T. floweri*, in the honor of the well known Zoologist", is of no scientific value, but there are persisting reports of a true **dwarf species** inhabiting Israel. Mertens (1946) revised this tiny animal - without ever even seeing one, on the basis of papers by Tristram (1885), Flower (1933) and personal correspondence - as *Testudo graeca floweri*. Photographic evidence (Geffen in Bruekers, 1995) and the video of the actual holotype (Highfield, 1993) supports my view that *T. floweri* is a very much smaller and lower domed species than the tortoise to be found in Antakya, from which it also differs by its markings, and actually there seems to be a certain resemblance between *T. floweri* and *T. kleinmanni*.

The 16 Antakyan specimens recorded by the present author measured: Males 120-161 mm, females 137-162 mm SCL.

According to comparisons, which are being presented in the former text, after carefully weighing the analytical value of the different key characteristic features, I have come to the conclusion that the tortoise living in Antakya differs so significantly from other land tortoises of South Europe and North Africa that it must be regarded as a full and separate, independent biological species in its own right.

PROPOSED NEW SPECIES FROM ANTAKYA, TURKEY

***Testudo antakyensis* sp. nov.**

Holotype: 1 shell, female, JP1095013, Antakya, currently in the custody of the author.

Diagnosis of the Holotype

Length (SCL): 141 mm
L. over curve: 177 mm
Height (Ch): 70 mm
Width (Mw): 100 mm
Width (MwM): 100 mm
Sceletal mass: 170 g

Length of plastron (after Schleich, 1984) 119 mm; length of plastral scutes at the mid-seam: gular 17.5 mm, humeral 18 mm, pectoral 4 mm, abdominal 43 mm, femoral 8 mm, anal 22 mm; length of plastral bones at mid-seam: epiplastron 12.5 mm, entoplastron 21 mm, hyoplastron 18.5 mm, hypoplastron 31.5 mm, (the concave) xiphiplastron 31 mm; the posterior part of the entoplastron does not cross the humero-pectoral seam but is 2.5 mm anterior of it; the upper surface of the epiplastron (inside the shell) strongly excavated, the excavation continues to under the gular lip; the epiplastron rises significantly at its anterior edge, when the shell rests on a smooth surface the epiplastron is maximally 18 mm above the horizontal axis; the pecto-abdominal seam is connected to the 6th marginals, 1/3 of the marginals are located anteriorly to the seam; a movable xiphiplastral hinge; gulars longer than broad (19 x 15 mm), concave at the longer (lateral) edges, they do not project beyond the anterior part of the nuchal scute but are on a simultaneous plane with it; aksillaries small, they apparently do not contact the humerals; inguinals long, in contact with 7th and 8th marginals and abdominals.

Vertebrals (5) broader than long, lumpy behind the center, the 5th being broader than any other, 1st vertebral angular; costals (4 pairs) much broader than vertebrals, the 4th costal from its outer seam (at marginals) longer than the 3rd; the 1st costal contacts marginals 1-5, the second contacts marginals 5-7, the 3rd marginals 7-9 and the 4th marginals 9-11; the undivided supracaudal projects considerably beyond the posterior marginals, the upper edge of supracaudal smooth (males have a wave-like upper edge in their supracaudal); nuchal scute 5.5 x 12 mm; posterior marginals do not exceed the median body width but equal it; marginals 11 pairs.

Neurals 8 (configured 6-8-4-8-4-6-4-6); suprapygal like in *Furculachelys nabeulensis*: 2 parts, the larger anterior part encloses a smaller posterior part between two symmetrical rami, on its anterior face the smaller part is of the shape of a half circle; pygal oblong; peripherals 11 pairs; pleurals 8 pairs; width of nuchal bone 36.5 mm.

The basic carapace colour of the Holotype, which clearly represents an animal of high age, is a yellow horn-colour (very much darker than in younger specimens). The plastral scutes are missing (for except of the gulars which are of the same colour as the carapacial scutes), hence nothing can be said about their colouration. The vertebrals have black markings. These, in the 1st vertebral consist of broad stripes which run along the anterior edge and continue up along the sides of the scute reaching laterally 2/3rds of the scute. In the center of the 1st vertebral, parallelly on either side of the neural line are two central blothes with highly distinguishable borders. In all other vertebrals, the anterior stripes continue to go laterally all the way to the posterior corners of each scute and tend to become browner towards the center of the scute. The 2nd, 3rd, 4th and 5th vertebrals all have single central spots with definite borders. The posterior faces of all 5 vertebral scutes have no markings whatsoever. The first costal does not have a stripe in its anterior side facing the 1st vertebral, but all other costals have a black, vertical stripe running from the marginals to the vertebrals in the anterior part of the scute. These stripes are approximately ¼ parts of the length of the scute. On the other hand, the 1st costal has brownish black irregular markings at the seam facing the 1st, 2nd and 3rd marginals. All costals feature black, irregular central blotches, in addition to smaller, roundish, irregularly spread spots near the central blotches. The 1st, 2nd and 3rd costals also have triangular, vertical (slightly posteriorly oriented), saw-tooth like markings starting at the marginal seam and continuing upwards, maximally to sligthly over the vertical median line of each scute (the 1st costal features 1, the 2nd two and the 3rd costal also two such triangular markings). The supracaudal otherwise is black (becoming more brown towards the center), but features an irregularly rectangular yellowish horncolour center. There is also but hardly visible pigmentation at the anterior central face of the scute at the seam to the 5th vertebral. The 1st, 2nd, 3rd and 4th marginals have almost black anterior faces, as well as do the posterior marginals 9, 10 and 11. The marginals 5, 6, 7 and 8 inbetween feature very irregular markings of various forms and sizes.

Terra typica: The mountains to the east of Antakya in southern Turkey.

Distribution: Unknown.

The species is referred to the genus *Testudo* LINNAEUS 1758 in spite of some characteristics contradicting with the currently accepted definition of the genus (Loveridge & Williams, 1957), as shown earlier. Since no further osteological material is at hand, and there is no evidence of the distinctive suprapygal construction of the Holotype being a normal, constant feature of the species, I will have to regard the genus *Testudo* as the most obvious reference group for the proposed species. The specific name is derived from the Terra typica, Antakya.

Paratype: male, JP1095001, Antakya, alive in the Terra typica.

Diagnosis of the Paratype

Length (SCL) : 161 mm
L. over curve: 218 mm
Height (Ch) : 83 mm
Width (Mw) : 113 mm
Width (MwM) : 110 mm
Weight : 785 g

Length of plastral scutes at mid-seam: gul. 19.5 mm, hum. 22 mm, pect. 10 mm, abd. 46 mm, fem. 12 mm, an. 18 mm (hence differing from the average plastral formula of males).

Width of vertebrals: 1st 46 mm, 2nd 37 mm, 3rd 42 mm, 4th 40 mm, 5th 47 mm, thus the 5th vertebral being broader than any other. Vertebrals but slightly lumpy posteriorly.

Supracaudal divided, wave-like at its upper seam, projects beyond the posterior marginals, slightly introverted.

Nuchal scute 12 x 1.5 mm.

Length of costal scutes at marginal seams: 1st 40 mm, 2nd 31 mm, 3rd 29.5 mm, 4th 31 mm, hence the 4th costal from its outer seam longer than the 3rd.

Width of marginal seams (in costal contact) from nuchal to supracaudal: 26 mm, 13.5 mm, 7 mm, 14 mm, 14.5 mm, 18.5 mm 14 mm, 12 mm, 14 mm, 17 mm ja 22.5 mm. A total marginal suture series width of 173 mm and an average marginal suture width of 15.73 mm.

Maximum width at posterior marginals (110 mm) less than median body width (113 mm), which is typical for males.

A round tail tubercle, divided at the tip by a seam.

Small thigh tubercles.

Basic colour of carapace pale yellow. Dark brown stripes in the anterior faces of vertebrals and costals and in anterior, vertical faces of costals. Costals with dark brown saw-tooth markings. Dark spots in the areoles of the vertebrals and costals.

Plastron brownish yellow. Brown blotches in the central, posterior part of the abdominals. Xiphiplastron slightly grey. Most parts of anal scutes almost black.

Colouration of head, chin and extremities: pale yellow. Tympanum dark. Dark brown "head mask". Anterior face of forelegs, from the elbow downwards, 3-4 rows of scutes both vertically and horizontally (most individuals have scutes in 5 vertical and 4 horizontal rows). Forelegs with 5 and hindlegs with 4 claws in each. The tips of the claws are yellowish transparent. 3 enlarged scutes on each heel.

As far as the whole population is concerned, old individuals tend to be darker than younger but already adult individuals. This is true for the entire visible anatomy (shell, head and legs). The yellow pigmentation of the shell tends to turn into a greenish horn colour. Almost all individuals possess a dark brown "head mask" or "Schnautzendreieck" as defined by Eiselt & Spitzenberger (1967). Usually the marginals feature clear, highly characteristic, dark saw-tooth markings, but these can gradually become mottled. The round thigh tubercles seem to be small in males but considerably larger in old females.

If investigations in the future provide evidence of the suprapygal construction found in the Holotype specimen of the proposed species *Testudo antakyensis* to be a constant morphologic character for the whole species, it is necessary to consider a revision of its taxonomy. In that hypothetic situation the most obvious reference group for the species would be the lately erected genus *Furculachelys* HIGHFIELD 1990 - which I, according to morphologic and morphometric evidence (Highfield, 1990, 1990b, 1993 and personal communication, 1996), accept - but which unfortunately still lacks a comprehensive definition.

I would like to thank the following persons, who have been of great help in the field, or otherwise have contributed to the making of this paper.

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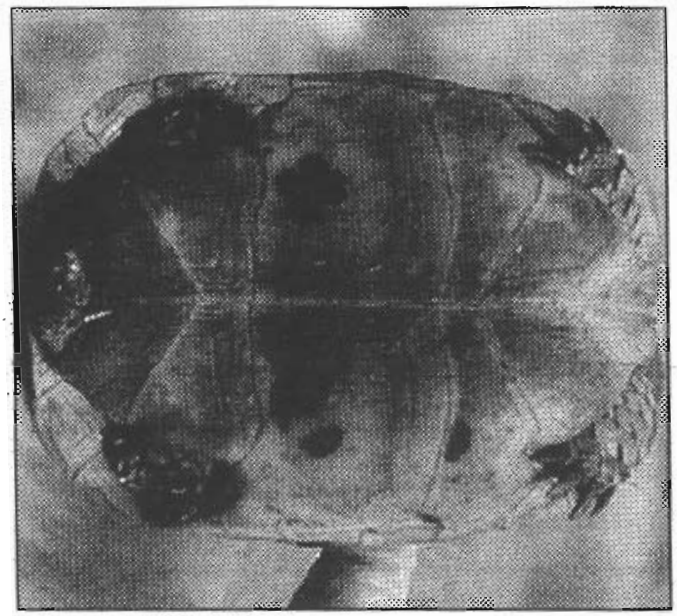
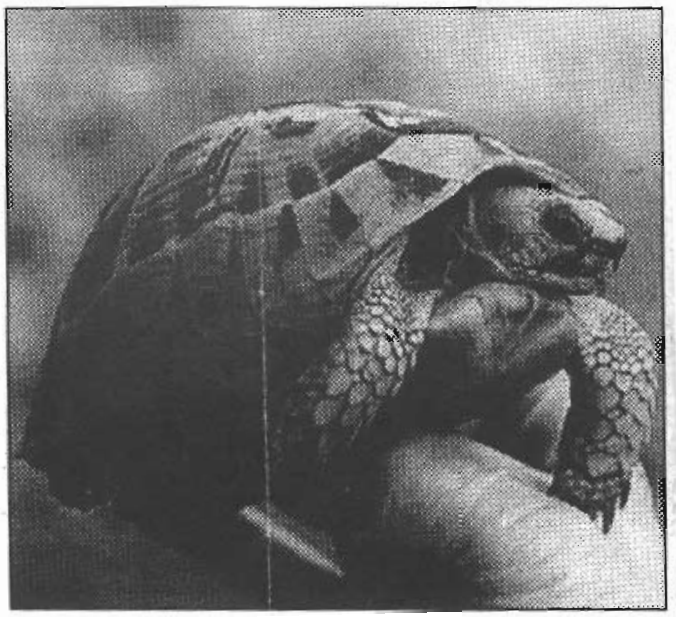


T. antakyensis sp. nov.



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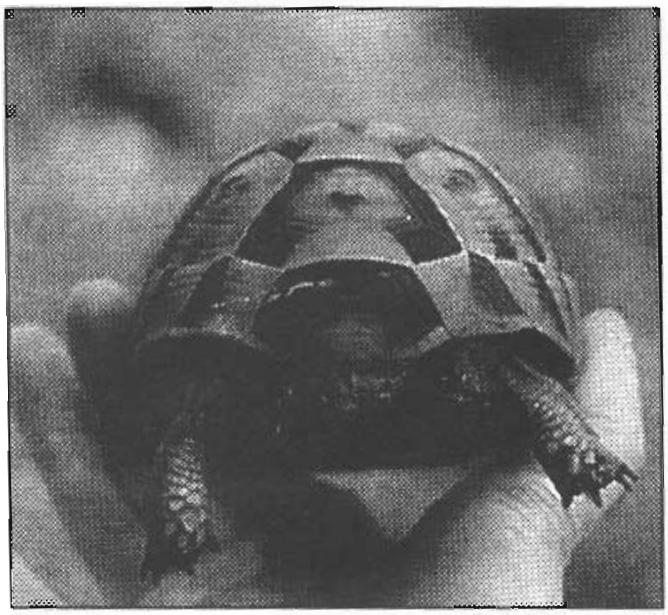

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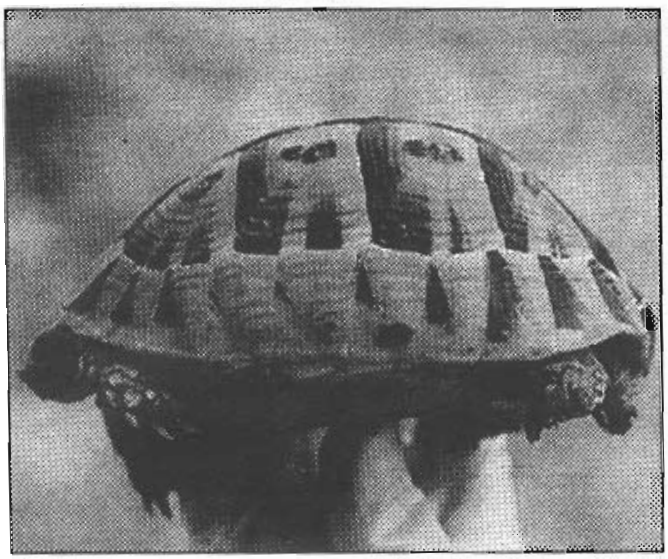

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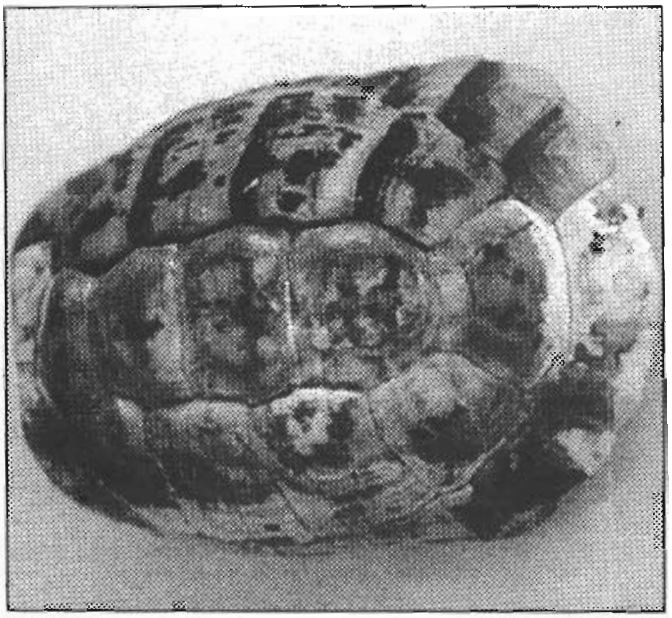
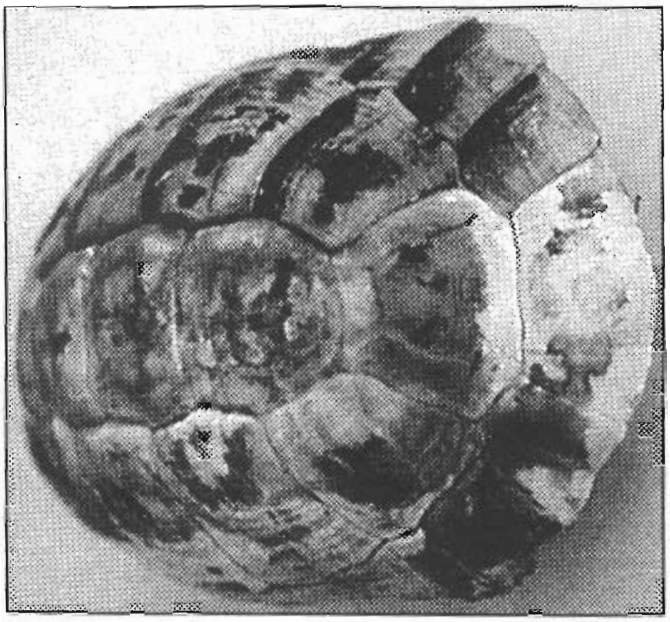


T. antakyensis. Holotyyppi. ♀



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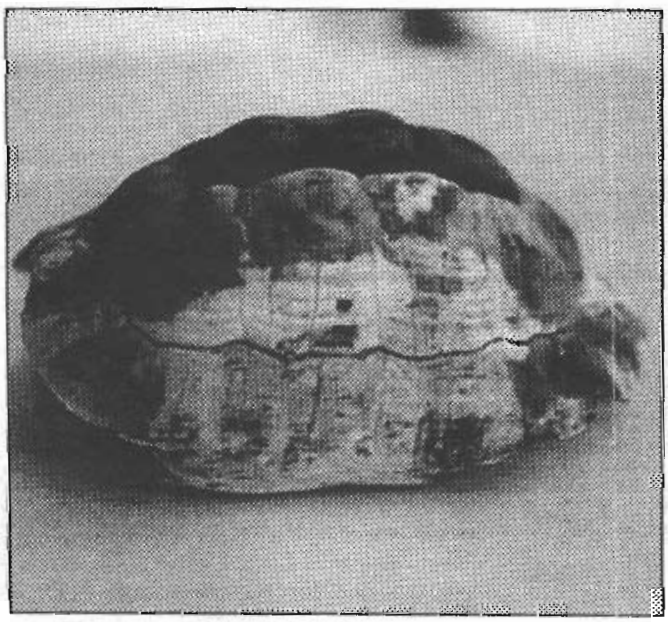

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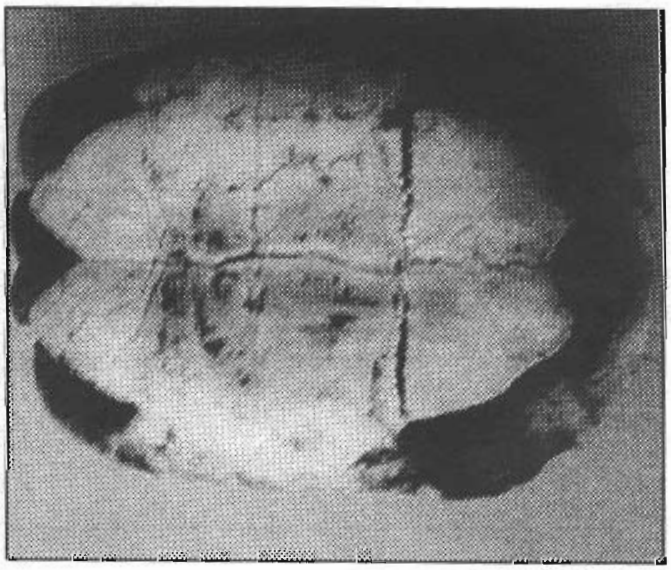
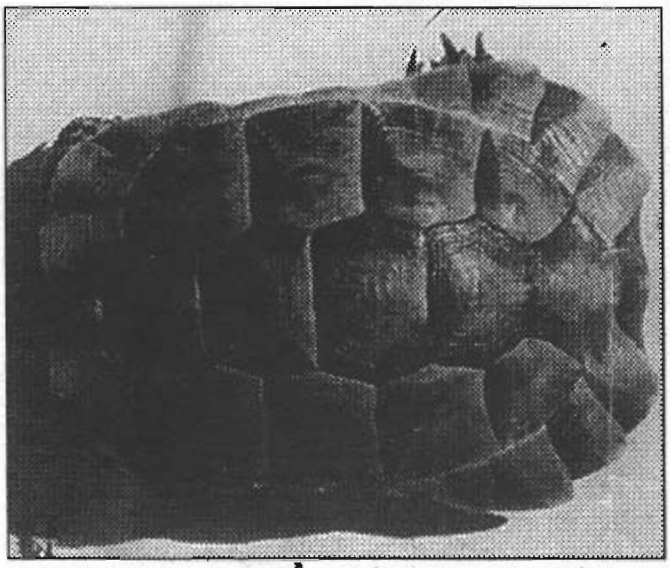
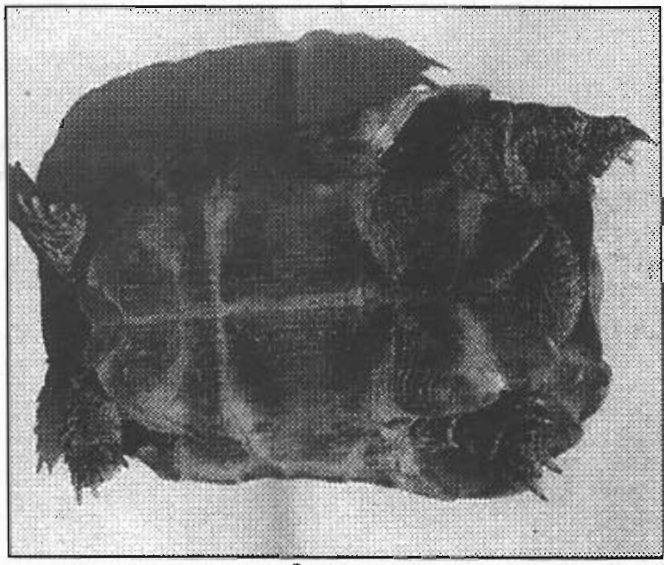


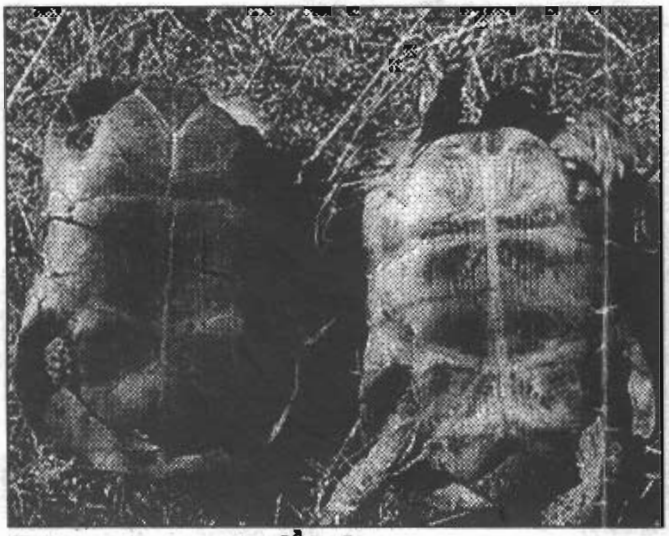
T. antakyensis. Holotyyppi. ♀



T. ibera anamurensis. ♂



T. ibera anamurensis. ♂



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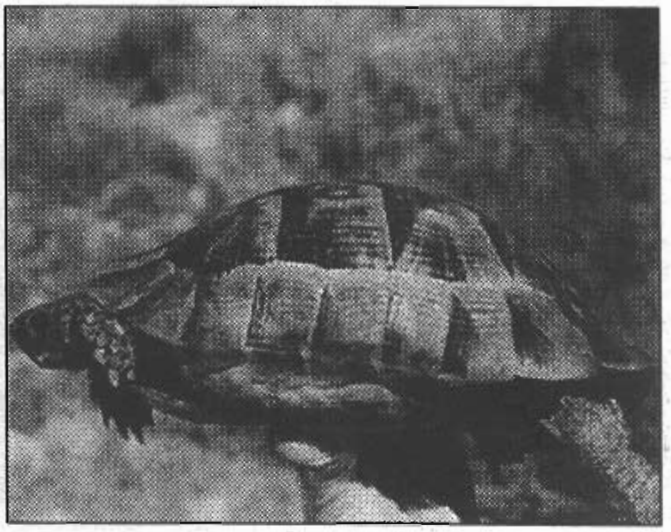

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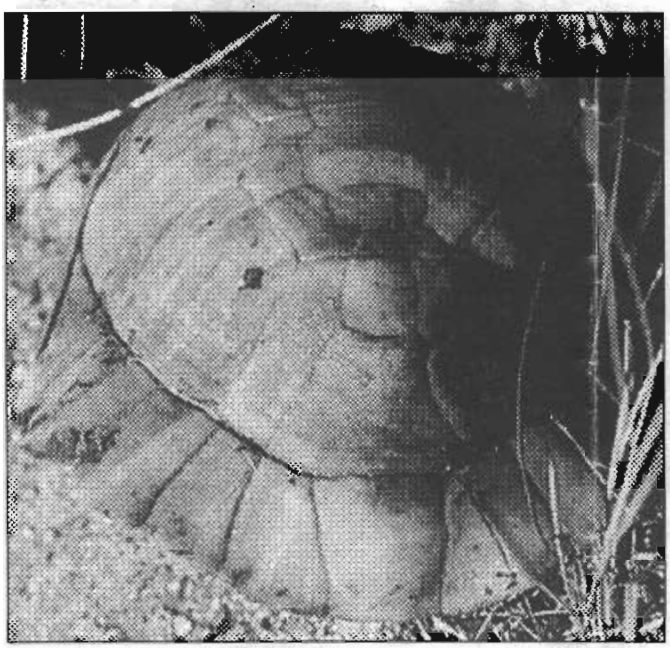

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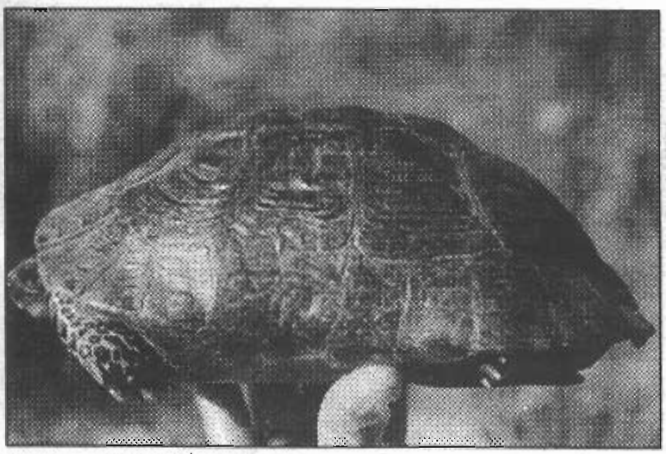

T. ibera anamurensis. ♀