

# A new character for the identification of populations of the Hermann's tortoise, *Testudo hermanni* GMELIN, 1789 (Chelonii, Testudinidae)

ROGER BOUR

## Abstract

The arrangement of the scales (scalation) which cover the anterior face of the forearm of *Testudo hermanni* appears to be a reliable character for identifying distinct populations of the species. Besides the commonly recognized western and eastern subspecies, other separate taxa could be established, for instance in the Peloponnese.

## Introduction

For a long time the conformation of scales (scalation or pholidosis) on the anterior face of the forearm has been used to distinguish the various species of Mediterranean tortoises (genus *Testudo* LINNAEUS, 1758, sensu WILLIAMS in LOVERIDGE & WILLIAMS 1957: 254). DUMÉRIL & BIBRON (1835: 63) wrote: "La face antérieure des bras de cette espèce [*T. hermanni* GMELIN, 1789] est loin d'être protégée par des tubercules squameux, aussi forts que ceux qui revêtent les mêmes parties chez les Tortues Moresque [*T. graeca* LINNAEUS, 1758] et Bordée [*T. marginata* SCHOEPPF, 1793]". ("The face of the arms of this species [*T. hermanni*] is far from being protected by horny tubercles, as stout as those which cover the same parts in the Moorish [*T. graeca*] and the Marginated [*T. marginata*] tortoises"). Differentiation of these three species had clearly been made only two years earlier by BIBRON & BORY (1833), following the "Expédition en Morée" (i. e., "the Peloponnese Expedition" in 1829). Consequently, many authors adopted this character, and it was regularly included in determination keys (e. g. SIEBENROCK 1906, LOVERIDGE & WILLIAMS 1957).

Much later WERMUTH (1952) distinguished two subspecies within Hermann's tortoises, *T. h. hermanni* (eastern) and *T. h. robertmertensi* WERMUTH, 1952 (western); his features of identification are primarily founded on the colour pattern. STEMMLER (1968) proposed morphometric indices using the medial lengths of the humeral, pectoral and femoral scutes of the plastron. Both kinds of characters were used by BOUR (1987) to identify the two recognized subspecies, and to modify their nomenclature, starting from the rediscovery of the holotype of *Testudo hermanni*: *T. h. hermanni* (western) and *T. h. boettgeri* MOJSISOVICS, 1889 (eastern). More recently, it became obvious that the taxonomic situation was more complex, and that several distinct populations could be identified. The proceedings of the international congress "*Testudo*", which were published by Söptom one year after the 2001 meeting in Hyères, presented several articles exposing the positive points, but also the problems arising, from the study of the status of various *T. hermanni* populations, for example "Plastral seams in *T. hermanni*" (PERÄLÄ 2002b: 43). Among other novelties, it appears that *Testudo hermanni boettgeri* may deserve specific status (BOUR 2004, in press).

The fieldwork, carried out for twelve years in the south of Peloponnese with MAURICE VANDERHAEGE to study *Testudo weissingeri* BOUR, 1995, showed that the local populations of *T. hermanni* presented some discrete but constant differences compared to both *T. h. hermanni* and *T. h. boettgeri*, or more exactly to the individuals of the western Balkans attributed to the latter taxon. Identity and even the authorship of *T.*

*weissingeri* have been questioned (e. g. BRINGSØE et al. 2001). However recent works by PERÁLA (2002b, 2002c) confirm the taxonomy and nomenclature used here.

## Materials and methods

In addition to the usual diagnostic characters (size, shape of the carapace, colour pattern, scutes of the plastron), one characteristic drew my attention: the singular arrangement of the scales which cover the anterior (i.e. antero-lateral) face of the forearm, starting from the hand. Therefore, I examined these scales on all individuals at my disposal, most of them belonging to three quite distinct populations: Var (Massif des Maures, regarded to represent the nomino-typical subspecies), western Balkans (former Yugoslavia, Montenegro the most common in captivity), and southern Peloponnese (region of Mani, between Kardamyli and Gythion). I examined at least ten individuals of each sex, as well as juveniles, from each population. This study made it possible to check the validity of this character, and to recognize its importance because of its constancy within populations.

Abbreviations: MZS - Zoological Museum of Strasbourg; SMF - Naturmuseum und Forschungsinstitut Senckenberg, Frankfurt am Main.

## Results

Schematically (Fig. 1), the scales of the anterior face of the forearm of *Testudo hermanni* are limited distally by the fold of the wrist, proximally by the articulation

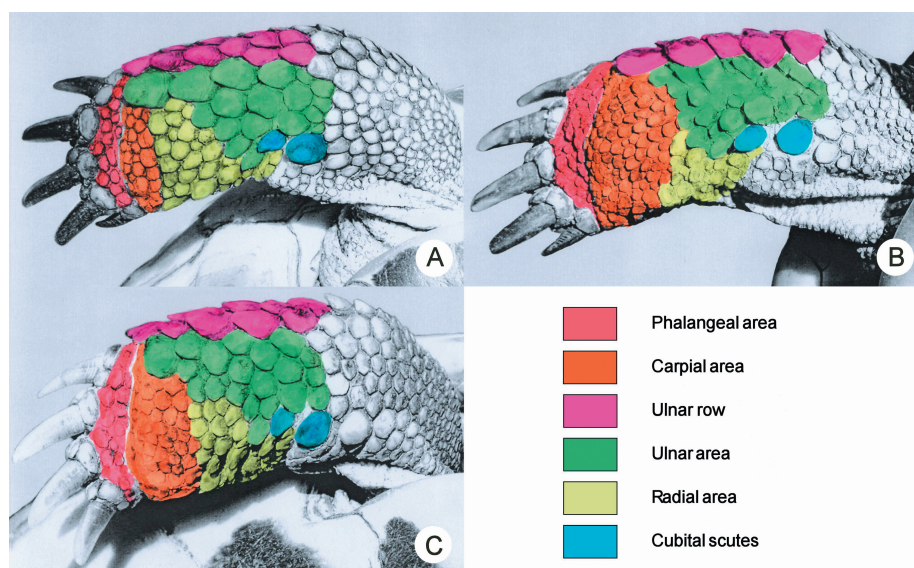


Fig. 1. Nomenclature of the scalation on the anterior face of the forearm with reference to three distinct populations of *Testudo hermanni*. A: Var; B: Yougoslavia; C: southern Peloponnese.

Nomenklatur der vorderen Unterarmbeschuppung mit Bezug auf drei getrennte Populationen von *T. hermanni*. A: Var; B: Jugoslawien; C: Südlicher Peloponnes.

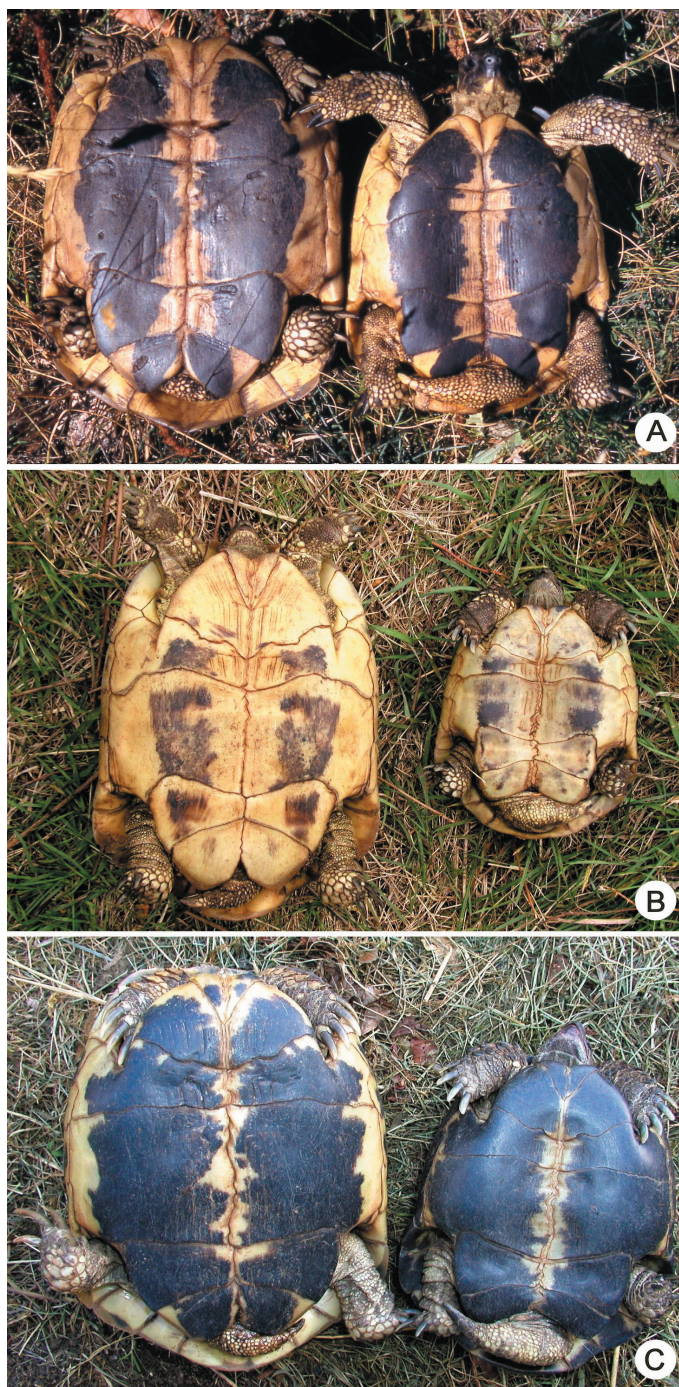


Fig. 2. Ventral view of three pairs of *Testudo hermanni* exhibiting the fore-arms. A: Var; B: Yougoslavia; C: southern Peloponnese.

Ventralansicht dreier Paare von *T. hermanni* mit Blick auf die Unterarme. A: Var; B: Jugoslawien; C: Südlicher Peloponnes.



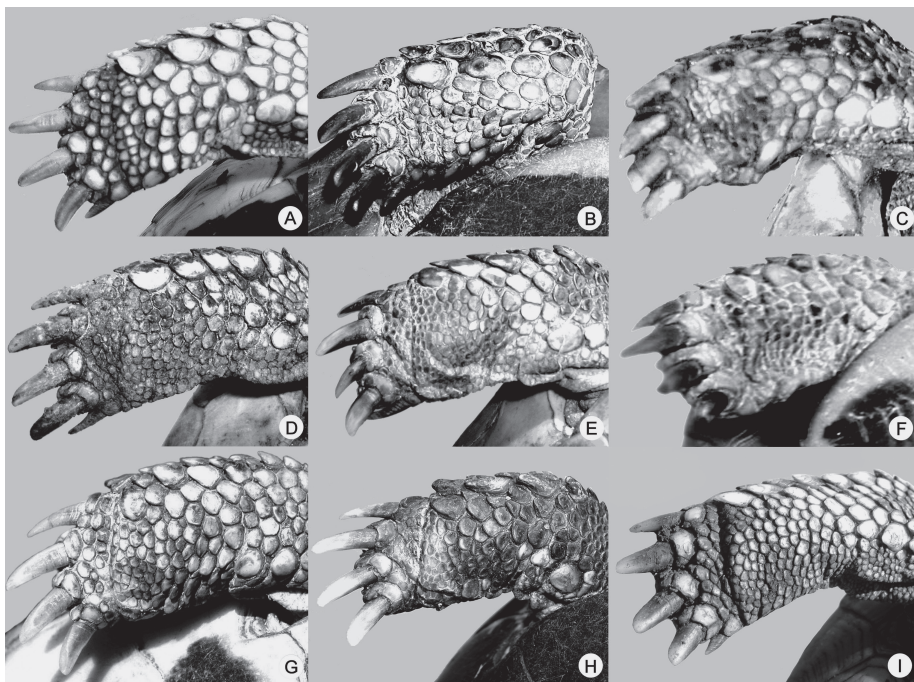


Fig. 3. Close view of the forearms of *T. hermanni*. A: Var, female; B: Var, male; C: holotype of *T. hermanni* (MZS 111); D: Yougoslavia, female; E: Yougoslavia, male; F: lectotype of *T. g. var. boettgeri* (SMF 7836), female; G: S Peloponnese, female; H: S Peloponnese, male; I: hybrid *T. hermanni* × *T. horsfieldii*, female.

Nahaufnahme der Unterarme von *T. hermanni*. A: Var, Weibchen; B: Var, Männchen; C: Holotypus von *T. hermanni* (MZS 111); D: Jugoslawien, Weibchen; E: Jugoslawien, Männchen; F: Lectotypus von *T. g. var. boettgeri* (SMF 7836), Weibchen; G: S Peloponnes, Weibchen; H: S Peloponnes, Männchen; I: Hybrid *T. hermanni* × *T. horsfieldii*, Weibchen.

of the elbow (its fold bordered on the inner side of the arm by two larger projecting scales, the cubital scutes), laterally, on the external edge, by a double line of twelve to 16 slightly overlapping quite large scales (the ulnar row). One can recognize on this surface several more or less distinct zones, based on the size, the shape and the "thickness" of the scales, very variable in extent (Fig. 1). The edge of the fold of the wrist is bordered by two or more rows of very small scales (the carpal area), similar to those which border the same fold above the claws (the phalangeal area). A roughly triangular or rectangular area of 20 to 30 larger and irregular scales, distinctly smaller (except sometimes the outer row) than those of the ulnar row, extends along this row towards the cubital scutes (the ulnar area). Above the carpal area one can identify a smaller area which includes along the internal or radial fold rows of medium-sized, often slightly projecting scales (the radial area); this area may be indistinct, being replaced by an extension of either the carpal area or the ulnar area. It is possible that a sexual dimorphism exists within this scalation, the scales (especially on the radial area) being smaller in the males than in the females. In older specimens, the scalation

as a whole appears to be rougher. Incidentally, I noticed that the hybrids *T. hermanni* × *T. horsfieldii* have their own pattern, with much more regular but small scales (Fig. 3 I)

- In the Var tortoises (Fig. 1 A, Fig. 2 A, Fig. 3 A-B), as well as the tortoises of the western range that I personally examined on the field in Ampurdan, Corsica and Tuscany, therefore populations currently considered as belonging to the nominotypical subspecies *Testudo hermanni hermanni*, the carpal area includes only two or three lines of about ten flattened scales on each one; the ulnar area and the radial area, each including about 20 scutes, are either clearly distinguished by the size of their scales, or the ulnar area extends well over the radial area, the major part of the anterior face of the forearm being covered by large polygonal scutes. These two kinds of conformation do not seem to be connected with the geographical origin or with the sex of the tortoise; all kind of intermediates are observed.
- In the SW Yugoslavian tortoises (Fig. 1 B, Fig. 2 B, Fig. 3 D-E), the carpal area is roughly triangular, including at least six (outer side) to twelve (inner side) irregular rows of twelve to 15 very small and more or less granulous scales; proximally this area is almost imperceptibly followed by a radial area of small similar scales, projecting or not, and then by the small scales of the arm. The ulnar area includes quite irregular, medium to large scales; along the ulnar row, there are no very large scales reaching the wrist.
- Finally in the Peloponnese tortoises (Fig. 1 C, Fig. 2 C, Fig. 3 G-H), the situation seems to be roughly intermediate; the carpal area includes five or six rows of ten to twelve scales. This feature reduces the extent of the radial zone which is more or less quadrangular, quite distinctly, but moderately, made of slightly projecting narrow scales. This pattern, strangely, is rather close to the pattern of some Var tortoises which also exhibit a distinct radial area of small scales.

## Discussion

This preliminary study confirms the polymorphism of the “superspecies” *Testudo hermanni* (which actually is not a “true” *Testudo* from a phylogenetic point of view: cf. DE LAPPARENT 2001; PERĂLĂ 2002a), from which *Testudo hercegovinensis* WERNER, 1899 was recently extracted (PERĂLĂ 2002b). The latter taxon is not included in the present work, because I lacked relevant material. The study emphasizes in particular the identity of the Peloponnese tortoises, which was already pointed out about 17 years ago (BOUR 1987), and more recently confirmed (BOUR 1995), starting from morphometric and morphological criteria, for example the small size of the males, colour pattern, shape of the dorsal scutes, proportion of the scutes of the plastron, and the enlargement of the caudal nail. However, presently this set of features only fully relates to the southern Peloponnese population (region of Mani); more data are needed for specimens of central Peloponnese. A formal taxonomical description of the southern Peloponnese population is in the process of being published.

If one refers to the type specimens of the already recognized taxa, it appears that the population of Montenegro is rather similar, regarding the character studied here, to the lectotype of *Testudo boettgeri* (SMF 7836; locality: Orșova, Banat, Romania; Fig. 3 F), which shows nevertheless some scales more prominent on the radial area. The examination of the holotype of *Testudo hermanni* as it was illustrated by SCHOEPPF (1792) shows a conformation of scales on the anterior forearm apparently close to that of the Peloponnese tortoises. Fortunately, the type specimen of *T. hermanni* was



Fig. 4. The holotype of *Testudo hermanni* (MZS 111). Dorsal, ventral and lateral views.  
Holotypus von *T. hermanni* (MZS 111). Dorsale, ventrale und laterale Ansicht.

recently found in its entirety (MZS 111; Fig. 3 C, Fig. 4), and its examination allows us to come to a more definite result: *Testudo hermanni*, through its onomatophore (name-bearing type specimen) according to this character also belongs according to this characters to the western morphotype, precisely to that one exhibiting a distinct radial area.

### Conclusions

On the one hand the arrangement of scales on the face of the forearm of *Testudo hermanni* (s. l.) represents an apparently stable character within a population, but it is notably variable therefore diagnostic from one population to another. Pertaining to

this character, this initial study confirms an obvious difference between a western (E Spain, S France, W Italy) and two eastern (Balkan Peninsula) populations, for which it will be probably necessary to alter the nomenclature. This study also offers an additional character to identify the population of the Peloponnese, for which a taxonomic work is pending. On the other hand, this character poses some questions about the evolution, the past history and the present phylogeography of the superspecies *Testudo hermanni*. For instance, are the similarities noted between the western and the Peloponnese populations the result of homoplasy (convergence), or the mark of direct relationship which may implicate anthropogenic introductions? I would appreciate receiving any comments or data in connection with this note.

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#### Ein neues Identifikationsmerkmal für Populationen der Griechischen Landschildkröte, *Testudo hermanni* GMELIN, 1789 (Chelonii, Testudinidae)

Die Beschuppungsmuster auf der Vorderseite der Unterarme der Griechischen Landschildkröte *Testudo hermanni* scheinen ein verlässliches Unterscheidungsmerkmal für verschiedene Populationen der Art zu sein. Neben den anerkannten Unterarten *T. h. hermanni* und *T. h. boettgeri* lassen sich auch Populationen, die bisher keinen Unterartstatus haben, z. B. von der Peloponnes, eindeutig identifizieren. Die Beschuppung der Unterarme ist innerhalb der Populationen konstant, zeigt aber deutliche Unterschiede zwischen den Populationen und ist daher als diagnostisches Merkmal geeignet. Es gibt dabei offensichtliche Unterschiede zwischen einer westlichen (Ost-Spanien, Südfrankreich und West-Italien) und zwei östlichen Populationen auf der Balkanhalbinsel. Für Letztere ist wahrscheinlich eine Änderung der Nomenklatur nötig. Die Studie bietet auch ein zusätzliches Merkmal zur Identifizierung der Population der Peloponnes, für die eine taxonomische Arbeit noch aussteht. *T. h. boettgeri* könnte Artstatus zukommen.

Das Merkmal stellt aber auch neue Fragen bezüglich Evolution, Geschichte und Phylogeografie der Art. So könnten die Gemeinsamkeiten der westlichen Unterart und der Population auf der Peloponnes das Ergebnis von Homoplasie (Konvergenz) oder das Zeichen einer direkten Verwandtschaft, möglicherweise durch anthropogene Einführung, sein. Kommentare oder zusätzliche Daten zu dieser Anmerkung sind herzlich willkommen.

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Author: ROGER BOUR, Laboratoire des Reptiles & Amphibiens, Muséum national d'Histoire naturelle, 25, rue Cuvier, F-75005 Paris, France, E-Mail: bour@mnhn.fr.