Rhopalocera of Turkey. 9. Morphological and biological aspects of *Maniola telmessia* (Lepidoptera: Satyridae)

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Abstract: The morphological variation of *Maniola telmessia* is discussed and compared with *M. jurtina*. Biological aspects of field observations and rearing are presented. The subspecies *M. t. kurdistana* and *M. t. marinigrans* are synonymised with *M. telmessia*. The taxonomic status of *Maniola halicarnassus* is discussed.

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Introduction

Maniola telmessia was described by Zeller in 1847 on the basis of 2 males and 4 females from the Greek Island of Rhodes and from the south coast of Turkey, "Makri" (Fethiye at present) and "Mermeriza" (Marmaris). The species is very common in the southern part of Turkey and probably also in nearby parts of Iran, Iraq and Syria. It is very surprising therefore that little has been published about its morphological variation and biology.

This paper is based on material collected during 27 expeditions to Turkey between 1977 and 1989, and on several rearing experiments. About 1500 specimens of Turkish *M. telmessia* from several collections were studied as well as material from the Greek Islands Ikaria (1 ♀, Kos (2 ♀♀), Lesbos (19 ♀♀, 13 ♂♂), Samos (127 ♀♀, 88 ♂♂), Karpatos (4 ♀♀, 3 ♂♂) and Rhodes (43 ♀♀, 6 ♂♂). Turkish localities are depicted in fig. 1.

Related species

Maniola telmessia is very close to *M. jurtina* (Linnaeus). Both species fly sympatrically and almost synchronously in the overlapping part of their area of distribution. There are distinct differences in morphology (dimensions, colour pattern, shape of the male genitalia, larva and egg structure), in flying behaviour and in habitat. Therefore there can be no doubt that *M. telmessia* and *M. jurtina* are distinct species.

Recently two new species have been described, *M. chia* Thomson being endemic for the Greek island Chios (Thomson, 1987) and *M. halicarnassus* Thomson from the province of Mugla, West Turkey (Thomson, 1990). *Maniola chia* was separated from *M. jurtina* and *M. halicarnassus* from *M. telmessia.*

Two other closely related species are *M. nurag* (Ghiliani, 1852) and *M. cypricola* (Graves, 1928), described from the islands of Sardinia and Cyprus respectively. On the basis of morphological and biological aspects, and the fact that *M. telmessia* has not been recorded from the island of Cyprus, we tend to consider *M. cypricola* rather as subspecies of *M. telmessia*, but further investigation is necessary.

Morphological variation

Maniola telmessia has a large morphological variation locally and geographically. The markings of both male and female gradually changes from the Greek island Rhodes and the nearby Turkish south coastal area inland to the Sultandaglari in the provinces of Konya and Afyon, and eastward along the coastal area and through Mesopotamia to the province of

Fig. 1. Distribution of *Maniola telmessia* in Turkey.

Hakkari. The populations of the western provinces in both sexes show markings with slightly less contrast than in the population of the province of Antalya. The gradual change in markings is illustrated in table 1, where the relative occurrence of some features is shown for populations of several provinces or groups of provinces in Turkey, in comparison with the populations of the Greek islands Rhodes and Samos. The extremes can be found on Rhodes and on the nearby coastal area of Turkey at one end, and in the province of Hakkari on the other end. A further description of the morphological variation is given with emphasis on the extremes for both sexes hereafter.

Male

Wingspan: 30-44 (37.7) mm (n = 600). Little variation in average value from 36.2 mm in poor dry inland biotopes, to 40.6 mm west of Bodrum, South-West Turkey.

Upper side: (1) On the forewing the black apical spot, which always has a white centre, is on the average slightly larger in the Rhodes population. A small second spot is present in about 70% of the Rhodes specimens, 25% of the specimens in the west and south coastal area of Turkey and in 5% of the inland populations. (2) The reddish yellow patch on the forewing extends maximally in the postdiscal band from intervenosa 1b to 5, around the apical spot, and in intervenosa 3 and partly in 4 inwards just into the cell. The reddish yellow patch can be more or less darkened. Complete darkening except around the apical spot varies from 0% in the populations of Rhodes and in the provinces of Antalya, Içel and Hatay up to about 50% in populations of South-East Turkey.

Underside: (1) The hind wing with maximum contrast in the Rhodes population. In populations of South-East Turkey and of the Sultandaglari the hind wing has hardly any contrast and is slightly paler greyish brown. (2) Grey scales are present in the postdiscal band of the hind wing and in the apical area of the forewing in most specimens from Rhodes and Samos, and of the Turkish west and south coastal area. They are absent in most inland specimens. (3) The postdiscal band on the hind wing is most pronounced on Rhodes and the least in the province of Hakkari. This is illustrated by the absence of the shadow line between the discal field and the postdiscal field in 14% of the Rhodes specimens compared to 70% in the province of Hakkari (table 1). (4) The postdiscal spots on the hind wing are most pronounced and most frequently present in the Rhodes population (table 2). The spots in intervenosa 3 and 6 are often pupilled white, more frequently present and often more pronounced than other spots in any population. If present the spots in intervenosa 2, 3 and 7 normally are very small in populations of the Turkish mainland. Only two specimens from South-West Turkey display a small spot in intervenosa 5. Complete absence of spots has not been found in specimens from Rhodes, Samos, the west coast and the Sultandaglari, but of the specimens of the south coastal area and the province of Hakkari 13 and 40% showed the absence of these spots respectively.

Table 1. Geographical variation of some markings of populations of *M. telmessia* (in percentages). Values between brackets are based on small samples.

	Sex	Rhodes (Greece)	Samos (Greece)	Sultan daglari	West coastal area	Prov. of Antalya	Prov. of Hatay and Adana-Low	West Mesopotamia	Central Mesopotamia	Prov. of Elazig Tunceli	Prov. of Hakkari
Number of specimens	♂	43	128	70	99	29	82	58	61	76	47
	♀	6	88	5	63	40	133	47	159	32	52
Complete darkening of discal field of forewing upperside	♂	7	34	81	66	7	10	36	80	81	81
Darkening of discal field of forewing upperside for more than about 50%	♀	(17)	17	(40)	6	33	28	15	80	78	92
Complete darkening of post discal band of forewing upperside	♂	0	5	27	17	0	0	9	44	28	49
Darkening of postdiscal band of forewing upperside for more than about 50%	♀	(0)	2	(0)	4	10	0	0	64	70	80
Complete darkening of post discal band of hind wing upperside	♀	(0)	9	(60)	17	5	15	50	88	88	90
No shadowline between discal field and postdiscal band on hind wing underside	♂	14	33	50	8	27	25	47	60	46	70
Little contrast on hind wing underside	♀	(17)	9	(20)	27	10	3	4	24	3	38
Clearly yellow scales in postdiscal band of hind wing underside	♀	(67)	23	(0)	17	12	3	10	3	0	0
Marginal band on hind wing underside clearly distinguishable as in *M. jurtina*	♀	(0)	12	(20)	12	15	19	19	10	41	10

Female

Wingspan: 37-51 (45.0) mm (n = 590). Variation in average value from 43.6 mm in poor dry biotopes to 46.6 mm along the west coast.

Upper side: (1) The reddish yellow on the forewing covers the postdiscal band and the discal field maximal as in *M. jurtina*, but it can be more or less darkened (table 1). In the west and south coastal area the populations have the least darkening. In up to 5% of the specimens in the eastern provinces there is an almost complete darkening, leaving only some oval patches of reddish yellow between the nerves in the postdiscal band. (2) The postdiscal band of the hind wing can be partly reddish yellow as frequently displayed in *M. jurtina*, in which the yellow is less reddish. Often this reddish yellow is darkened transparently. Complete darkening is found in only 5% of the specimens of the province of Antalya and in 90% in the province of Hakkari (table 1).

Underside: (1) On the average much more

Table 2. Relative appearance of spots in *Maniola telmessia* males (in percentages).

	Rhodes	Samos	West coastal area	South coastal area	Sultan daglari	Meso-potamia
Number of specimens	33	133	99	182	45	202
Spots: none	0	0	0	13	0	30
cell 2	75	29	34	13	18	4
cell 3	94	98	99	84	95	62
cell 4	67	29	38	12	2	2
cell 6	97	98	99	87	100	65
cell 7	54	14	24	7	9	3

contrastingly coloured than in the male. Most contrast in the south coastal area of Turkey and slightly less contrast in the high inland populations. Little contrast, with the postdiscal band hardly distinguishable, can be found in less than 10% of the specimens in the coastal provinces and in 38% in the province of Hakkari (table 1). (2) The greyish brown of the hind wing can be more or less yellowish brown, sometimes as in *M. jurtina*. Specimens with coloration similar to *M. jurtina* can be found in almost all populations, a maximum of about 10% has been found on the Greek island of Samos. (3) Yellow scales may be present at the inner side of the postdiscal band of the hind wing in more than 25% of the specimens on the Greek islands and west of Bodrum, South-West Turkey, and in less than 12% on the rest of the Turkish mainland. (4) In most specimens the postdiscal band merges gradually with the darker marginal band. A clearly distinguishable marginal band, as common in *M. jurtina*, has been found in up to 20% of the specimens in almost the entire distribution area with a higher score of 41% in the provinces of Elazig and Tunceli.

Morphological differences with *Maniola jurtina*

Generally *Maniola telmessia* can be clearly distinguished from *M. jurtina*, but there is an overlap in the range of morphological variation. Sometimes it is difficult therefore to identify *M. telmessia* on the basis of external morphological characters only. In poor biotopes the darkest male *M. telmessia* can be quite similar to small male *M. jurtina*, and then the genitalia need to be investigated for identification. Particularly in West Turkey and on the Greek island of Samos the lightest female *M. telmessia* is quite similar to female *M. jurtina*. The small shift in the start of the flight period, *M. jurtina* starts 2 or 3 weeks later, may help in the identification of difficult specimens in case other specimens are available from the same locality at the same time.

Due to the large overlapping variation of the morphological characters of both species in general only a limited number of criteria can be found to distinguish *M. telmessia* from *M. jurtina*:

– Male: On the average distinctly smaller, with an often slightly rounder shape of forewing apex and margin. Upper side: the reddish yellow postdiscal patch on the forewing often extended inwards into the discal field, but sometimes completely darkened as in *M. jurtina*. Underside: often greyish scales in apical area of forewing and in postdiscal band of hind wing in populations of the west and south coastal area, hind wing and marginal band of forewing almost always more greyish or less yellowish. Although it has a wide variation the male genital is smaller and clearly distinguishable from *M. jurtina*, as indicated by, among others, Le Cerf (1912) and Tauber & Tauber (1968).

– Female: Forewing apex usually with slightly rounder shape. Upper side: reddish yellow in postdiscal band and in discal field more reddish. Underside: reddish yellow in discal field of forewing more reddish, usually with greyish

scales in apical area of forewing and in postdiscal band of hind wing, hind wing and marginal band of forewing usually greyer or less yellowish and often fine-marbled brownish, in general no sharp transition between postdiscal band and darker marginal band.

Pre-imaginal stages: Investigation of ova, larva and pupa by magnifications of 25-200x only displayed a distinct difference in the number of meridional ribs on the ova: 13-16 for *M. telmessia* compared to 17-20 for *M. jurtina*. The white linear lateral marking of the larvae as well as the marking of the pupae (fig. 2) on the average are less pronounced in *M. telmessia*.

Discussion on *Maniola halicarnassus* Thomson

Almost at completion of this publication we received the description of *Maniola halicarnassus* Thomson, 1990, type locality 3 km West of Bodrum, South-West Turkey. We were able to study a series of 29 ♂♂ and 37 ♀♀ of *M. telmessia* collected by A. Olivier at the type locality in 1988. Part of this series agrees with Thomson's description of *M. halicarnassus*. Although this material attracks attention because of some relatively large males which are completely dark on the upperside, the series falls almost completely within the wide range of variation of *M. telmessia*. We have the following comment on the differences with *M. telmessia* as mentioned by Thomson (1990). The relative large size of the males of *M. halicarnassus* may well be caused by local circumstances. Males of the same size have been found on the island of Samos and occasionally at other locations widely distributed over Turkey. Males with almost complete darkening of the wing upperside have been found in almost the entire distribution area in Turkey. The androconial band in the male appears only marginally different from average *M. telmessia* in a part of the largest specimens. The male genital drawn by Thomson (1990) falls completely within the range of variation of *M. telmessia*. The number of meridional ribs on the eggs, 18 compared to 13-16 as we have found yet for *telmessia*, is an extreme indeed. The incidental 6th instar of larvae is not considered to be a valid argument for separation because, although not yet in *M. telmessia*, we have found a variable number of instars in other species, e.g. *Melitaea didyma* Esper and *M. persea* (Koll) both with 5-7 instars. The intermediate forms of *M. telmessia* and *M. halicarnassus* which Thomson (1990) found at the type locality do not support appointing specific rank to *M. halicarnassus*. We agree with Thomson's suggestion that the *M. halicarnassus* population evolved in very recent times. But apparently the geographical separation, required for such an evolution, was not long enough for the population to develop to a separate species. We have been informed by Thomson that further investigations to prove the status of *M. halicarnassus* are in progress.

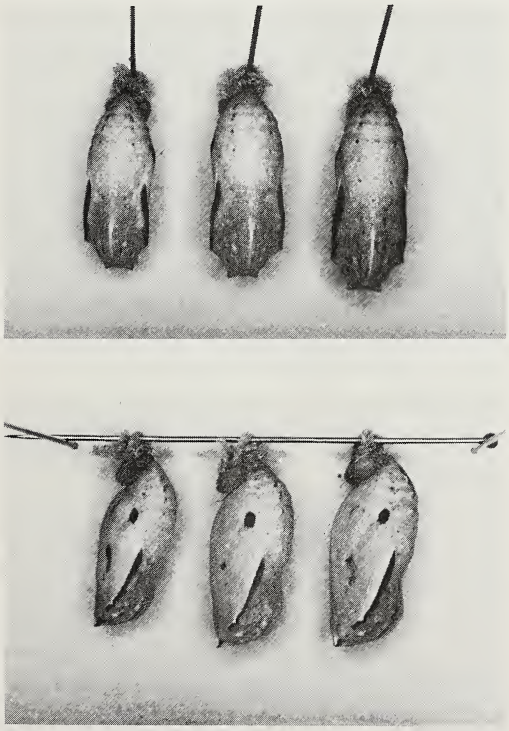

Fig. 2. Pupae of *Maniola telmessia*.

Discussion on subspecies of *Maniola telmessia*

Two subspecies have been described from Tur-

key: *Maniola telmessia kurdistana* as a "variation" from Kurdistan by Heyne & Rühl (1894) on the basis of the reduced reddish yellow patches in the submarginal band of the female's forewing upperside, and *M. t. marinigrans* as a "race" from Aksehir, province of Konya, by Verity (1937) on the basis of dark forewing upperside of the male.

Because *M. telmessia* appears to be rather common in the entire distribution area in Turkey without clearly separated populations, and because of its large variation, locally and geographically, but without any distinct transition in morphological markings, we conclude that there is no reason for appointing subspecific rank to any population of *M. telmessia* in Turkey. We conclude therefore that both *M. telmessia* var. *kurdistana* (Heyne & Rühl, 1894) and *M. telmessia* race *marinigrans* (Verity, 1937) are synonymous to *Maniola telmessia telmessia* (Zeller, 1848).

Two subspecies were described from Iran: *Maniola telmessia oreas* (Le Cerf, 1912) and *M. t. maniolides* (Le Cerf, 1912).

Because the markings of the few specimens of *M. telmessia* we saw from Iran fall completely within the range of variation in South-East Turkey we think that the subspecific forms *oreas* and *maniolides* may be put as well as synonyms to *M. telmessia*. Additional investigation of Iranian material is necessary to confirm this opinion.

Biology

Maniola telmessia generally has one generation, which depending on climatological conditions emerges from mid April to early July. Results of rearing experiments, however, indicate that incidentally a partial second generation may occur under favourable conditions during the period from October to December. On the average the males emerge one or two weeks earlier than the females, as is usual in many other species. At the same localities *M. telmessia* emerges 2-3 weeks earlier than *M. jurtina*.

The females copulate within a few days after emergence. One may observe fresh females copulating with worn males. The males on the average live much shorter than the females. The males vanish completely in the hotter areas during July, whereas there are a very limited number of records from areas with moderate climate during August and September. The females show low activity during the hot months and hide themselves for the heat of the sun in wood or brushwoods, often *Quercus* sp.. After aestivation the females lay eggs within a period of roughly 2 weeks from early September to half October (rearing observations) and have been observed to be active to early November. The eggs are laid on the leaves and stems of grasses, as is usual with *M. jurtina*, although in captivity the eggs preferably are laid against the top of the cage and sometimes on the soil. A single female in captivity can lay as many as 120-210 eggs.

The egg stage lasts between 14 and 25 days at moderate temperatures of 17-25 °C. *Maniola telmessia* has five larval stages compared to six in *M. jurtina*. The first stage lasts two or three weeks. Most larvae are still in the second stage, some in the third, when cold weather sets in about November. Feeding activities become very low when the temperature falls below 10 °C. The larvae hibernate in a question mark shape against the stems of grasses. On higher grounds where the temperature falls well below 0 °C the larvae stay in the second stage during hibernation. In the area along the south and west coast, where temperatures are moderate, the third and possibly the fourth stage is entered during the winter, with short periods of inactivity alternating with periods of low feeding activity.

Habitat

Maniola telmessia has been found in a wide range of habitats. We found the species both in areas with poor and rich vegetation, on rocky slopes as well as between poorly cultivated fields, in almost open areas as well as between open brushwood. Although *M. jurtina* has been found in almost identical habitats *M. jurtina* has a clear preference for areas with

richer grass growth than observed in habitats of *M. telmessia*. At localities where both species were observed *M. jurtina* was always found under wetter and more shaded conditions.

Rearing results

Oviposition. After several attempts to obtain eggs from *Maniola telmessia* we succeeded in keeping a female, collected near Mardin, South-East Turkey on 7.vi.1985, alive with solutions of sugar and honey during 4 months. After more than 16 weeks in captivity about 50 eggs were laid between 27 and 29.ix.1985. Later attempts were even more successful by collecting females later in the season or by applying an artificial reduction of the daylight period, as advised by Thomson. By applying artificial light, which was reduced in time by 2 minutes every day, a female, collected on 6.vi.1986 in the province of Bingöl, was induced to lay more than 200 eggs within 3 weeks. Because all other attempts under normal daylight conditions had led to oviposition only in the period from the last week of August to the first week of October we conclude that shortening daylength is one of the parameters affecting the oviposition.

Rearing conditions. The ova and first instar larvae were kept under room temperature conditions in alle cases. Several conditions have been investigated during further development. Part of the trials were entirely made under room temperature conditions with both daylight and artificial light, and always with fresh grass as food. More natural conditions were simulated by keeping the larvae in the second and third instar at a constant temperature of 4 °C during two months or by keeping them outside during the coldest period of the winter or even during the entire development. By applying full sheltering also dryer and poorer feeding conditions could be simulated outdoors.

Developing period. The larvae hatch after 14-25 days mainly depending on the temperature. At room temperature and with adequate food the following development periods were

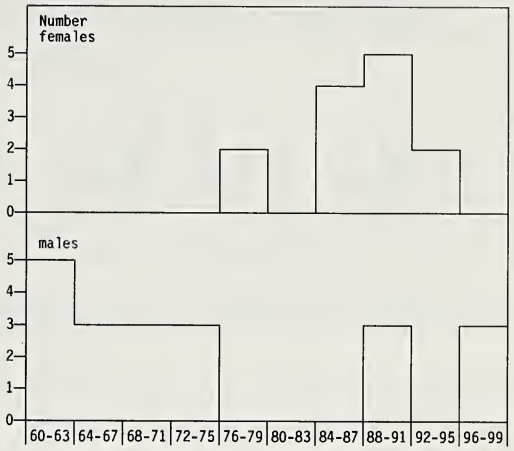

Fig. 3. Development time of adults of *Maniola telmessia* reared from one female under favourable conditions (high temperature and high food-supply).

observed: first instar 13-17 days, second instar 10-19 days, third instar 11-16 days, fourth instar 14-31 days, fifth instar 16-31 days, pupae 25-39 days. It is evident that especially the second to fourth instar will last longer under outdoor conditions with lower temperatures and generally a lower food supply. Including a hibernation period a total development period of 240 days between hatching of the larva and emergence of the imago has been observed. As in many other species we have found that on the average the males develop faster (10-14 days) than the females. In addition the males have a larger deviation in the moment of emergence (fig. 3). That observation was made on a badge of 80 larvae reared under the same favourable conditions which resulted in 20 males and 13 females after 60-98 days. Due to the relatively high mortality (60%) during this experiment, interpretation of the results is difficult but it supports the assumption that incidentally a partial second generation may occur under favourable conditions (rainfall during early September and temperatures of still 10-15 °C during November).

Feeding behaviour. The food consumption of two larvae was observed and recorded every day and night. The food consumption was estimated in relation to the size of the larvae by

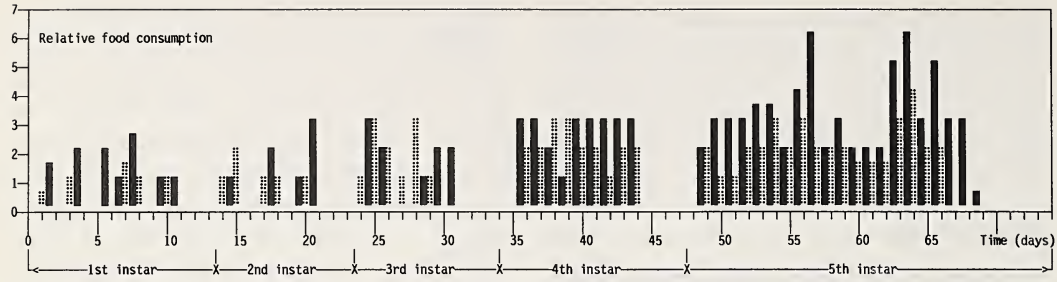

Fig. 4. Relative food consumption of one larva of *Maniola telmessia*. See text for explanation of method. Dotted bars: food consumption during day-time: black bars: food consumption during the night.

considering a grass leaf consumption equal to the projected area of the larva as one unit. After each count fresh grass leaves were supplied. The feeding behaviour of one larva is illustrated in fig. 4.

The larva starts feeding one or two days after hatching. Striking facts are:

- The periods of rest between the periods of food consumption last one or two days several times during the first two instars, whereas these periods last only about half a day during the last two instars.
- On the average about 65% of the feeding occurs during the night.
- The relatively large consumption during the last instar.

Conclusions. The different rearing experiments have led to the following conclusions:

- *M. telmessia* has one generation, although it is not excluded that a partial second generation may develop in areas where the winter temperature hardly falls below 8-10 °C and where the vegetation does not wither completely during the summer.
- Oviposition occurs from the end of August to early October, i.e. under shortening day-length conditions.
- The larvae start hibernating in either second, third or fourth instar as soon as temperature falls below 5-8 °C.
- The larvae continue to develop at temperatures above 8-10 °C.
- The larvae withstand dry cold winter conditions much better than the humidity during moderate winters.
- The males emerge from their pupal stage 10-14 days earlier than the females and have also a larger deviation of the moment of emergence.

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