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A new lizard of the genus *Mesalina* from Mt. Sinai, Egypt (Reptilia: Squamata: Sauria: Lacertidae)*

With 7 Tables and 9 Figures

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Kurzfassung. Eine neue Eidechse der Gattung *Mesalina* vom Mt. Sinai, Ägypten (Reptilia: Squamata: Sauria: Lacertidae). – Eine *Mesalina*-Population aus dem Gebirge der südlichen Sinai-Halbinsel wird als neue Art, *M. bahaeldini* n. sp. beschrieben. *M. bahaeldini* ähnelt *M. guttulata* in konventionellen Schlüsselmerkmalen. Konsistente Unterschiede existieren in folgenden Merkmalen: Färbung gestreift (statt ozeilliert) und bräunlich (statt grau getönt); im Durchschnitt weniger Supralabialia; quer über die Körpermitte gezählt weniger Dorsalia; weniger Ventralia-Querreihen; weniger Subdigital-Lamellen unter der 4. Zehe; dennoch längere Zehen relativ zur Hinterbeinlänge; einzelne Subdigital-Lamellen relativ zur Körpergröße länger. Die Serie von neun Syntypen von *Lacerta guttulata* LICHTENSTEIN, 1823 aus dem Zoologischen Museum Berlin, von HEMPRICH und EHRENBERG in Ägypten und Nubien gesammelt, ist heterogen und enthält nur sechs Exemplare, die mit der Artbeschreibung übereinstimmen. Daher wird ein Lectotypus designiert und eine Redeskription der Art vorgestellt. Die endemische *M. bahaeldini* und die weitverbreitete *M. guttulata* sind geographisch zwar sympatrisch, meist jedoch nicht syntop. *M. bahaeldini* kommt über 600-1000 m NN vor, *M. guttulata* in zahlreichen verschiedenen Höhenlagen, wobei das Vorkommen in identischen Höhenlagen unklar bleibt.

Abstract. A population of *Mesalina* on the mountains of the southern Sinai peninsula is described as a new species, *M. bahaeldini* n. sp. *Mesalina bahaeldini* resembles *M. guttulata* in conventional key characters but differs from it in consistently being striped (rather than ocellated) and brownish (rather than greyish); having on average fewer supralabials; fewer dorsals in a transverse count at midbody; fewer transverse rows of ventral plates; fewer subdigital lamellae under the fourth toe; but longer toes, relative to hindlimb length; individual subdigital lamellae are longer, relative to body size. The series of nine syntypes of *Lacerta guttulata* LICHTENSTEIN, 1823, in the Zoologisches Museum, Berlin, collected by HEMPRICH and EHRENBERG in Egypt and Nubia, is heterogeneous, only six fitting the description of the species. Therefore a lectotype is designated and the species redescribed. The endemic *M. bahaeldini* and the widespread *M. guttulata* are geographically sympatric but usually not syntopic. The former occurs only above 600-1000 m a.s.l., the latter at a wide range of altitudes but its occurrence at the same high altitudes is unclear.

Key words. Reptilia, Squamata, Sauria, Lacertidae, *Mesalina bahaeldini* n. sp., *Mesalina guttulata*, lizard, mountains, HEMPRICH & EHRENBERG, sexual dimorphism, Egypt, Sinai.

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Introduction

The lacertid genus *Eremias* was divided by BOULENGER (1921) into "sections"; his section *Mesalina* was given generic status by SZCZERBAK (1974), who included in it six species distributed in southwestern Asia and northern Africa, which are jointly distinguished by having the ventral plates in rows paralleling the midline.

In the Sinai Peninsula, Egypt, four species of *Mesalina* are well known: *M. brevirostris*, *M. guttulata*, *M. olivieri* and *M. rubropunctata* (WERNER 1973, 1982, SALEH 1997). These species, of similar size, differ in pholidosis and coloration and are easily identified (BONS & GIROT 1962, WERNER 1973: Appendix, SALEH 1997, Fig. 1). Of these species, *M. brevirostris* occurs only in the extreme southern tip of the peninsula, *M. guttulata* is widespread throughout Sinai on firm or rocky soils, *M. olivieri* lives on sandy soils, hence occurs widely in the north of the peninsula and around its circumference, and *M. rubropunctata* is known only from a few points scattered throughout Sinai (WERNER 1973 and unpublished data in the Hebrew University collection, SALEH 1997).

But the collection of the Hebrew University of Jerusalem contains some specimens of *Mesalina* from the south Sinai mountains, that, while defined as *M. guttulata* by all key characters, markedly deviate in both pattern and colour (Fig. 2). These specimens, collected by Hebrew University re-

search teams in 1956-57 and 1967-1982 (when Sinai was administered by Israel), are striped rather than ocellated, and brown rather than grey. Their uniqueness was noticed already in the field (WERNER 1973). A cursory search of other museums revealed additional specimens of the same coloration from the same area, which everywhere had been identified as *M. guttulata*.

In this paper we examine these "striped *Mesalina guttulata*" and conclude that they represent a new species, which we describe. As a prerequisite to its description we examined the syntypes of *Mesalina guttulata* (LICHTENSTEIN, 1823). It transpired that this type series was heterogeneous, necessitating our designation of a lectotype and redescription of the species. In our descriptions we present only those synonyms which show the development of the current names; further synonyms are listed in ANDERSON (1898) and BOULENGER (1921).

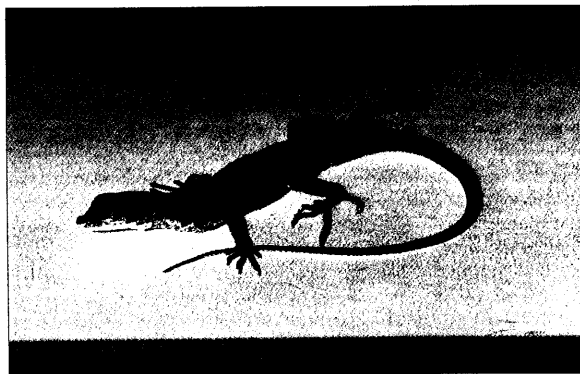
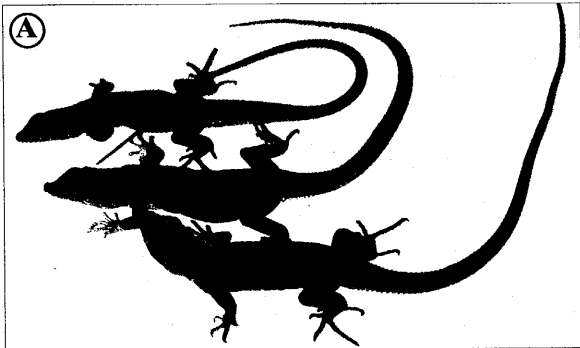


Fig. 1: The four species of *Mesalina* formerly known from Sinai. (A) From top to bottom: *M. olivieri* (from Mishor Rotem, Israel), *M. rubropunctata* (S shore of Murrah As Sughra, Sinai, Egypt), *M. guttulata* (Judean Desert, Israel). (B) *Mesalina brevirostris* (Nabq, Sinai, Egypt).

Material and Methods

Abbreviations

♀	female
♂	male
juv.	juvenile
percra	Percents of ra (WERNER 1971)
ra	Rostrum-anus length (WERNER 1971)
W.	Wadi
BMNH	Natural History Museum, London
FMNH (CNHM)	Field Museum of Natural History, Chicago
HUJ-R	Zoological Museum, Hebrew University of Jerusalem, Herpetology
MTD	Museum für Tierkunde Dresden
NMP6V	National Museum (Natural History), Prague
ZMB	Zoologisches Museum, Humboldt Universität, Berlin

Summary of material

We examined the specimens of "striped *M. guttulata*", listed and described below as the type series of the new taxon ($n = 30$; 28 for mensural characters). Data for a control group of "normal *M. guttulata*" from the area of sympatry ($n = 21$; 17 for mensural characters; Appendix 1) were derived from a larger pre-existing data base (KOSWIG et al. 1976), which also provided information on sexual dimorphism in *M. guttulata* (Tab. 1). In the listings of specimens, those used for mensural characters (i. e., adults), are identified by an asterisk (*). Further we had at our disposal assorted field notes and photographs, including colour diapositives, of live lizards and radiographs of museum specimens, of both "morphs". We examined the syntypes of *Lacerta guttulata* LICHTENSTEIN, 1823 ($n = 9$).

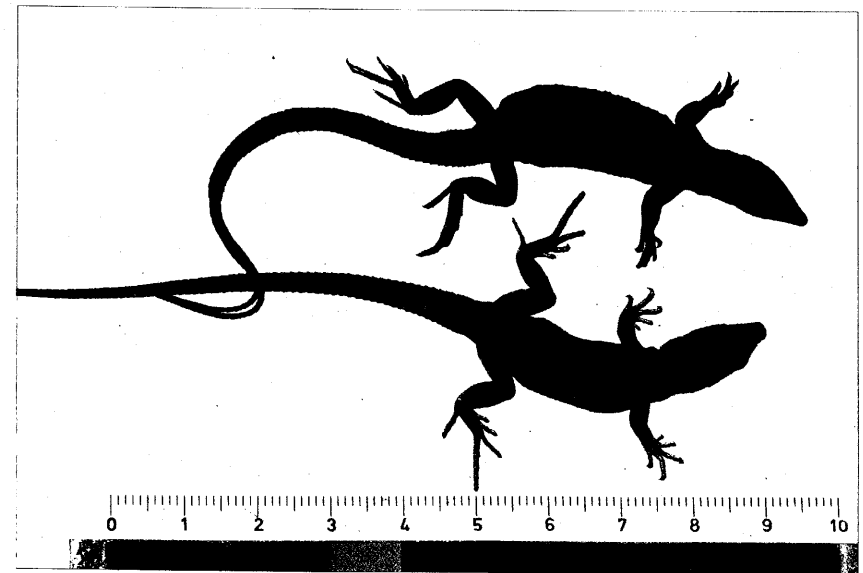


Fig. 2: Top, *Mesalina bahaeldini* n. sp., ♀ (from the peak of Jabal Sirbal, Sinai, Egypt); bottom, *Mesalina guttulata*, ♀ (Be'er Mash'abbim, Negev, Israel).

Character	N		Mean		P
	Males	Females	Males	Females	
ra (mm)	29	24	43.0	44.3	0.19
Head length	21	18	23.9	21.6	0.00
Head width	21	18	14.6	14	0.94
Head depth	21	18	11.1	9.9	0.003
Forelimb length	20	18	35.3	32.5	0.00
Hindlimb length	21	18	63.9	56.8	0.00
Fourth toe length	21	18	28.1	24.8	0.00
Tail length	13	3	196.3	183.3	0.48
Head index	21	18	164.6	154.6	0.04
Scales across back	29	24	47.5	47.6	0.87
Scales across belly	29	24	9.6	9.2	0.18
Gular scales	29	23	24.2	22.8	0.01
Scales, ventralia	29	24	30.6	31.7	0.02
Supralabialia	29	24	10.5	10	0.85
Femoral pores	28	22	12.9	12.7	0.84

Tab. 1: Sexual dimorphism in *Mesalina guttulata* from the Negrev (Israel) and Sinai (Egypt). Measurements in percrea (except ra and head index). P, significance of the difference between males and females.

Characters

Where possible, we examined the following mensural, meristic (pholidotic and osteological), computed and qualitative characters in all specimens investigated.

Mensural characters

Except for ra and tail length, which were measured to the nearest 0.5 mm, all characters were measured to the nearest 0.1 mm. Except ra, all are presented as percrea.

Rostrum-anus length (ra): Distance from tip of snout to cloaca.

Head length: Distance from tip of snout to the posterior edge of the ear, measured parallel to long axis of body with special callipers (GOREN & WERNER 1993).

Head width: Greatest width of head.

Head depth: Greatest depth of head.

Forelimb length: From axilla to tip of distal claw.

Hindlimb length: From groin to tip of distal claw.

Fourth toe length: From insertion of 5th toe, claw included.

Tail length: From cloaca to tip of tail, if original.

Meristic pholidotic characters

We examined certain meristic characters bilaterally and compared the right and left sides, testing for possible directional asymmetry (WERNER et al. 1991). These characters are indicated by an asterisk (*) in the character list below.

*Supralabials, total: Number of supralabials from the most posterior clearly enlarged plate, to (excluding) the rostral, including the suborbital.

Gulars: Number of gular scales in a straight median series.

Plates in collar: Number of larger scales in collar.

Dorsals: Number of dorsal scales across midbody.

Ventrals across belly: Number of ventral scales in longest row across belly.

*Transverse rows of ventrals: Number of transverse series of ventral scales, counted along the ventral side to (and excluding) the level of the femoral pores.

*Femoral pores.

*Subdigital lamellae: Along underside of fourth toe, defined by their width, the one touching the claw included.

Meristic osteological characters

New material of both morphs was radiographed with a Faxitron X-ray Corp. Cabinet X-ray System, at 22 kV, 30 s, on polaroid film. The sample of the ocellated morph was enhanced with some radiographs from elsewhere in Sinai and the Negev on file. Because the quality of some radiographs precluded the certain identification of rib types, we counted vertebrae only in two broad regions of the vertebral column: precaudal vertebrae, total; and caudal vertebrae (if complete), total.

Computed characters

Head index = 100 x Head length divided by head width. Toe index = 100 x fourth toe length divided by total hindlimb length. Lamella percrea = fourth toe length in percrea divided by the number of subdigital lamellae under that toe.

Geographical names and Mapping

As far as possible, geographical names in Egypt are spelled following the U.S. BOARD OF GEOGRAPHIC NAMES (1959) and those elsewhere follow the TIMES ATLAS (1997). Topographical co-ordinates in Sinai refer to the Israel Grid, in 6 digits to the nearest km or in 8 digits to the nearest 0.1 km. The maps of locality records within the survey area of Israel and Sinai (WERNER 1988) were prepared according to the manual method described by WERNER (1977). The map of *Mesalina guttulata* is based on the specimens in HUJ-R; the map of the new species is based on the type material listed here.

Results

Research strategy

First we tested for each of the two coloration morphs the symmetry of the four characters examined bilaterally. There was no significant asymmetry. Therefore we present here only the counts on the right side.

Next, because of the widespread sexual dimorphism in Lacertidae generally (BÖHME 1981) and in *Eremias* (PETERS 1964), we verified in the pre-existing data base that in *Mesalina guttulata* several mensural and two meristic characters were indeed sexually dimorphic (Tab. 1). Thereupon we investigated the mensural characters separately in males and females, and ex-

Character	Percra (Mean, SD, Range)			P
	<i>M. bahaeldini</i>	<i>M. guttulata</i>	Syntypes	
ra (mm)	45.2 ± 2.84	46.1 ± 4.11	42.0 ± 1.0	0.57
	43.0 - 52.0	40.0 - 52.0	41.0 - 43.0	
Head length	24.36 ± 0.90	23.66 ± 1.86	27.39 ± 1.00	0.29
	23.02 - 26.14	21.59 - 26.96	26.98 - 28.54	
Head width	15.94 ± 3.85	15.18 ± 1.66	16.37 ± 1.69	0.54
	14.11 - 27.53	12.69 - 17.75	15.12 - 18.29	
Head depth	11.17 ± 0.71	10.69 ± 0.64	12.23 ± 1.36	0.11
	10.32 - 11.96	9.62 - 11.60	10.95 - 13.66	
Head index	158.08 ± 24.63	157.70 ± 22.18	168.05 ± 11.32	0.97
	148.65 - 192.19	125.35 - 193.94	156.00 - 178.46	
Forelimb length	34.58 ± 1.64	34.01 ± 2.95	36.53 ± 1.61	0.59
	31.82 - 37.21	29.79 - 40.00	34.88 - 38.10	
Hindlimb length	58.47 ± 3.69	61.49 ± 6.36	62.66 ± 4.08	0.21
	51.92 - 65.12	51.92 - 71.25	60.98 - 69.05	
4 th toe length	27.32 ± 1.83	26.70 ± 3.80	30.13 ± 2.13	0.65
	23.91 - 30.59	22.83 - 33.75	28.57 - 32.56	
Toe index	46.85 ± 3.69	43.34 ± 2.76	46.76 ± 4.88	0.02
	37.93 - 51.85	36.84 - 47.37	41.38 - 50.91	
Tail length	207.10 ± 22.42	210.62 ± 23.06		0.87
	180.23 - 238.82	194.31 - 226.92		

Tab. 2: Comparison of mensural characters among male *Mesalina bahaeldini* n. sp. (n = 12; 6 for tail length), sympatric *M. guttulata* (n = 10; 2 for tail length) and syntypes of *M. guttulata* (n = 3; 0 for tail length). Measurements in percra (except ra, head index and toe index). P, significance of the difference between the *M. bahaeldini* and *M. guttulata* samples.

cluded the juveniles which could bias body proportions; for the meristic characters we initially (see below) pooled the sexes and ages.

All specimens of "*Mesalina guttulata* sensu lato" were either brown and striped or grey and ocellated, and no intermediate individuals occurred. In order to decide, whether these are two conspecific morphs or two sympatric species, we tested for additional correlated differences. Since the conventional preservation of reptilian museum specimens involves fixation with formalin, genetic comparisons were precluded. We compared the quantitative morphological characters (listed above) of the two groups by univariate statistics. The results included several significant differences between the two coloration morphs, despite the small samples. Of the ten mensural characters, only one, toe index, differed between the morphs, and this was significant only in the males (Tab. 2-3). But of the eight pholidotic characters, four differed significantly between the morphs, when these were

Character	Percra (Mean, SD, Range)			P
	<i>M. bahaeldini</i>	<i>M. guttulata</i>	Syntypes	
ra (mm)	43.2 ± 4.75	45.0 ± 2.36	42.0 ± 0.71	0.36
	37.0 - 50.0	40.5 - 47.0	41.5 - 42.5	
Head length	22.26 ± 1.54	21.89 ± 1.24	24.51 ± 1.94	0.62
	19.60 - 24.11	19.77 - 23.33	23.13 - 25.88	
Head width	14.59 ± 0.48	14.61 ± 1.22	13.58 ± 0.90	0.98
	13.60 - 15.24	12.34 - 15.80	12.94 - 14.22	
Head depth	10.95 ± 0.82	10.32 ± 1.06	10.01 ± 0.84	0.22
	10.22 - 12.70	8.18 - 11.36	9.41 - 10.60	
Head index	152.42 ± 7.38	150.61 ± 13.63	181.36 ± 26.37	0.76
	143.94 - 166.04	129.85 - 175.86	162.71 - 200	
Forelimb length	33.29 ± 1.99	32.15 ± 2.12	33.37 ± 3.93	0.31
	30.43 - 35.71	29.79 - 35.80	30.59 - 36.14	
Hindlimb length	56.34 ± 4.21	56.81 ± 3.81	57.18 ± 4.33	0.83
	48.89 - 61.90	54.26 - 62.96	54.12 - 60.24	
4 th toe length	26.74 ± 1.77	26.13 ± 2.66	26.82 ± 4.66	0.61
	23.00 - 28.57	23.40 - 29.63	23.53 - 30.12	
Toe index	47.63 ± 3.89	45.98 ± 3.45	46.74 ± 4.61	0.4
	41.07 - 54.55	43.14 - 53.06	43.48 - 50	
Tail length	212.48 ± 9.99	206.48 ± 12.83	216.87	0.32
	204.26 - 224.66	205.55 - 207.40		

Tab. 3: Comparison of mensural characters among female *Mesalina bahaeldini* n. sp. (n = 8; 5 for tail length), sympatric *M. guttulata* (n = 7; 3 for tail length) and syntypes of *M. guttulata* (n = 2; 1 for tail length). Measurements in percra (except ra, head index and toe index). P, significance of the difference between the *M. bahaeldini* and *M. guttulata* samples.

compared without distinction of sex or age (Tab. 4). Because two of the pholidotic characters were known for sexual dimorphism (Tab. 1), these were also tested for separate sexes: The number of gulars (greater in males) did not differ significantly between the morphs when tested for pooled sexes (Tab. 4), for males (P = 0.21) or for females (P = 0.87). The number of transverse rows of ventrals (greater in the females) differed significantly between the morphs, when the samples comprised the pooled sexes (Tab. 4). When each sex was tested separately, the difference between the morphs was insignificant (males, P = 0.098; females, P = 0.42).

Because the striped morph had longer toes than the ocellated morph, but nevertheless fewer subdigital lamellae than the latter, we computed Lamella percra = fourth toe length in percra divided by the number of subdigital lamellae under that toe. This combination character differed significantly between the females of the two morphs (Tab. 5).

Character	Mean, SD, Range			P
	<i>M. bahaeldini</i>	<i>M. guttulata</i>	Syntypes	
Supralabials	9.3 ± 0.76 8 - 11	10.5 ± 1.21 8 - 13	9 ± 0.71 8 - 10	0.0006
Gulars	22.2 ± 1.68 18 - 25	22.5 ± 1.83 19 - 26	25 ± 2.35 23 - 29	0.567
Plates in collar	11.2 ± 0.73 10 - 12	11.4 ± 0.81 10 - 13	10.2 ± 1.1 9 - 11	0.382
Dorsals	43.9 ± 2.5 39 - 49	46 ± 2.97 40 - 51	45.4 ± 4.56 41 - 50	0.012
Ventral across belly	9.9 ± 0.49 8 - 11	10 ± 0.63 9 - 12	10 ± 0 10	0.535
Transverse rows of ventrals	30.1 ± 1.80 26 - 34	31.5 ± 1.78 28 - 36	29.6 ± 4.28 24 - 36	0.0104
Femoral pores	12.7 ± 1.15 10 - 14	12.9 ± 1.07 11 - 15	12.6 ± 0.55 12 - 13	0.533
Subdigital lamellae	21.4 ± 0.72 20 - 23	22.6 ± 1.25 20 - 25	21.8 ± 1.64 20 - 23	0.0001

Tab. 4: Comparison of meristic characters among *Mesalina bahaeldini* n. sp. (n = 30; 29 and 28 for the two counts of ventrals), sympatric *M. guttulata* (n = 21) and syntypes of *M. guttulata* (n = 5). P, significance of the difference between the *M. bahaeldini* and *M. guttulata* samples.

The number of precaudal vertebrae (included in Tab. 6-7) did not differ between the morphs. In summary the two qualitative coloration morphs, which discontinuously differed in both colour and pattern, also significantly differed (at least in one sex) in six quantitative characters, so that they warranted taxonomic recognition. Because geographically they were sympatric (see below, Fig.8), we considered them to be separate species. But because both species fit the traditional key definition of *Mesalina guttulata*, it was necessary to ascertain which of the two matched the original description and the type series, and should retain the original name.

The syntypes and original description of *Mesalina guttulata* (LICHTENSTEIN, 1823)

The type series of *Lacerta guttulata* LICHTENSTEIN, 1823, in the ZMB, collected by HEMPRICH & EHRENBURG's expedition to northeastern Africa, 1819-1826 (STRESEMANN 1954), comprises nine specimens and is heterogeneous both in characters (coloration and some of the key characters) and in geographical origin. Its interpretation in terms of currently recognised taxa, and of eligibility for designation of a lectotype, is not simple. LICHTENSTEIN's description expressly specifies a coloration with black and white dots and gives the area of origin as Egypt and Nubia. Only six of the syntypes possess or appear to have possessed, the ocellated or black-and-white dotted coloration: three of the four which are catalogued "Egypt" (ZMB 1117, 1119, 1120), the two catalogued "Nubia" (ZMB 1121,

Sex	N		Percra (Mean, SD, range)		P
	<i>M. bahaeldini</i>	<i>M. guttulata</i>	<i>M. bahaeldini</i>	<i>M. guttulata</i>	
Males	12	10	1.29 ± 0.19 1.09 - 1.46	1.18 ± 0.17 1.24 - 1.38	0.1
Females	6	8	1.29 ± 0.06 1.00 - 1.47	1.15 ± 0.11 1.02 - 1.31	0.01

Tab. 5: Comparison of the combined character "lamella percra" between the *M. bahaeldini* and *M. guttulata*. P, significance of the difference between the *M. bahaeldini* and *M. guttulata* samples.

631344), and the one catalogued "Sinai" (which at that time, as now, was part of Egypt) (ZMB 1062). The fourth specimen catalogued from "Egypt" (ZMB 1118), although possessing most key characters of *M. guttulata*, deviates in having a conspicuous striped coloration and in other ways, and will be dealt with elsewhere. Finally, two specimens catalogued "Suez" (ZMB 1122, 63004) have a semi-striped coloration (quite different from that of the specimens from the Sinai mountains) but a typical *guttulata*-type lower eyelid. These two probably cannot be interpreted without a thorough study of the relationships of *M. guttulata* and the *M. olivieri* complex (HAAS 1951), which in Israel appear to sometimes hybridise (WERNER, unpublished).

According to STRESEMANN's (1954: 170-171, 177) listing of the shipments from the HEMPRICH & EHRENBURG expedition, the type material of *Eremias guttulata* (LICHTENSTEIN, 1823) consisted of (or included?) five individuals from "Tscheile (el Achderieh) et Siva", which were part of the third shipment (shipping numbers 18, 25, 34-36). This shipment comprised material collected in 1820-21, and reached Berlin in 1821. But from the sequence of letters sent by the expedition (STRESEMANN 1954: 8-10) in combination with the above listing of shipments, it appears that also material collected in Nubia (seventh shipment) did reach LICHTENSTEIN in time to be included in his 1823 treatise. In contrast, from the same sources it seems highly unlikely that the expedition's material from Suez and Sinai could have reached LICHTENSTEIN in time for inclusion.

We conclude that it is most probable that LICHTENSTEIN based his *Lacerta guttulata* on the ocellated specimens from Egypt and Nubia, totalling five. We designate a relatively well-preserved female from Egypt as lectotype. The type locality is discussed below within the redescription of the species. This redescription is desirable also because in the literature the variation described for *M. guttulata* has included the characteristics of *M. olivieri* not only until HAAS (1951) distinguished these two species but sometimes also later (e. g., MARX 1968).

Redescription of *Mesalina guttulata* (LICHTENSTEIN, 1823)

(Figures 1-3, 8)

Lacerta guttulata LICHTENSTEIN, 1823: p. 101. (Type locality: Egypt and Nubia.)

Eremias guttulata; DUMÉRIL & BIBRON, 1839: p. 310.

Eremias guttulata forma typica; BOULENGER, 1921: p. 258.

Eremias guttulata guttulata; K. P. SCHMIDT, 1939: p. 65.

Mesalina guttulata; SZCZERBAK, 1974: p. 273. (Type locality: Egypt.)

