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A superspecies in the genus *Amaurobius* on Crete, and additional records from Greece (Araneae: Amaurobiidae)

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Abstract
Amaurobius candia n.sp. and *A. geminus* n.sp. are described from eastern Crete, together with the female of *A. cretaensis* Wunderlich. The three species, which seem closely related and exhibit a parapatric distribution pattern, should be grouped together as a superspecies. Additional records are presented for four further species. *A. atticus* Thaler & Knoflach is proposed as a junior synonym of *A. pelops* Thaler & Knoflach. The range of *A. pelops* extends therefore from north-eastern Peloponnese to Evvoia and Mt. Iti.

Key words: *Amaurobius*, taxonomy, Crete, endemism, superspecies

INTRODUCTION

During the last decade the inventory of Greek *Amaurobius* species has increased stepwise through the discovery of six new and probably endemic species from Peloponnese and the mainland. Three further species were diagnosed from Corfu, Crete, and Naxos (Thaler & Knoflach 1991, 1993, 1995, 1998, Wunderlich 1995). On the mainland the new species show a vicariance pattern covering the main mountain regions, see our distribution map (1998). More recent excursions in 1998-2000 produced only a slight modification, expanding the range of *A. pelops* Thaler & Knoflach, 1991 (= *A. atticus* Thaler & Knoflach, 1995, n.syn.) northwards to Evvoia and Mt. Iti. The fauna of the islands is less known. The search for the hitherto unknown female of *A. cretaensis* Wunderlich, 1995 led surprisingly to the discovery of two further new species in western Crete, closely allied to *A. cretaensis*. These three species show allopatry at a narrow geographic scale, probably forming a superspecies (Mayr 1953).

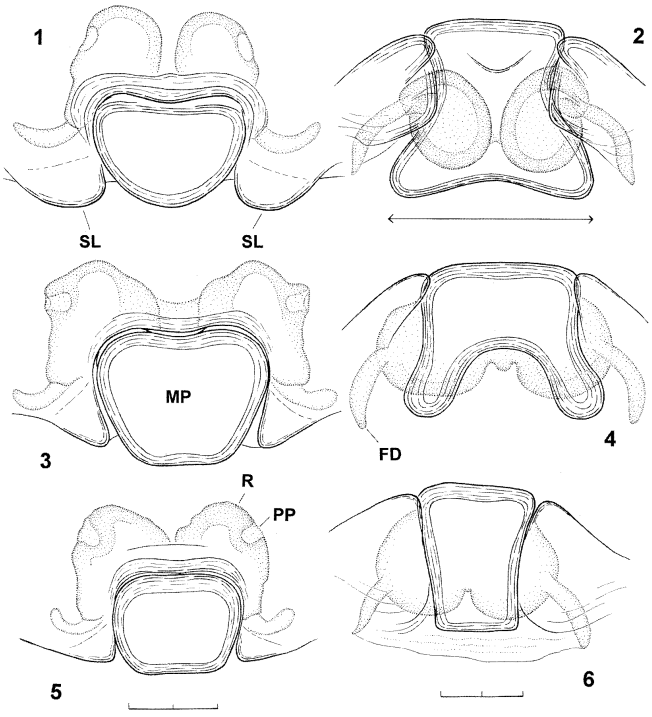
Specimens have been deposited as follows: CB Bosmans collection, CD Deeleman collection, CTh Thaler collection; MHNG Muséum d'histoire naturelle, Genève; NMB Naturhistorisches Museum Basel; NHMC Natural History Museum of Crete, Iraklio; NMW Naturhistorisches Museum Wien; NRS Naturhistoriska Riksmuseet Stockholm. Specimens were collected by the authors, if not indicated otherwise. Several juveniles were kept alive until they reached maturity, as indicated additionally. All measurements are in mm.

DESCRIPTIVE PART

Amaurobius cretaensis Wunderlich, 1995 (Figs. 3-4, 11-13, 17, 20, 24)

Wunderlich (1995): n.sp., ♂. Greece, Crete, type locality Mesa Potami, road Tzermiado/Neapoli, 2♂ Feb. 1982, leg. Malicky (Holotype and paratype in collection J. Wunderlich, not examined).

Material examined: Eastern Crete, Dikti Mts.: Lassithiou region, Mt. Selena 1550 m a.s.l., in scree 2♂ 2♀ (CTh) 7 April 1998. Tzermiado, track to Mt.



Figs 1-6. *Amaurobius geminus* n.sp. (1-2, Mt. Afendis Stavromenos), *A. cretaensis* Wunderlich (3-4, Kera), *A. candia* n.sp. (5-6, Skinaras). Epigynum, ventral (1, 3, 5), aboral (2, 4, 6). In Fig. 2 measurement of width of median plate is indicated. Scale lines 0.20 mm. - FD fertilization duct; MP median plate; PP primary pore; R seminal receptacle; SL side lobe.

Selena, around Ag. Timios 1100-1200 m a.s.l., 3♀ (CTh) 10 April 1998, 1♀ (NMW) 21 Sept. 1998, 1♂ (NMW), adult Oct. 1998, 1♀ (NMW), adult 4 Oct. 1998. Tzermiado, litter in dry river bed, 7♂ 14♀ (CB) 17 Oct. 1998, leg. Bosmans. Kera 700 m, 1♂ 4♀ (CTh) 8 April 1998. Krasi, litter in dry river bed, 1♂ 3♀ (CB) 16 Oct. 1998. Katharo plain above Kritsa 1000 m, 3♂ 10♀ (CTh, NMB) 1 Oct. 1998. Males, Sarakinas gorge 200 m a.s.l., 1♂ 2♀ (MHNG) 28 Sept. 1998, 4♀, adult Dec. 1998 - Feb. 1999.

Diagnosis: This species can be readily distinguished by the dorsal apophysis of the male palpal tibia and by the lack of an intermediate apophysis (Figs 11-13). The epigynum is characterized in aboral view by strong and even protruding dorsal angles of the median plate (Fig. 4).

Description (♀, n = 5): Total length 5.4-6.6, prosoma length 2.5-3.05, width 1.7-2.05, femur I 2.1-2.4. Prosoma and legs brownish yellow, legs not annulated. Abdomen greyish, with indistinct pattern of light spots. Epigynum and vulva: Figs 3-4. Median plate and side lobes strongly developed, median plate in ventral view cordiform, in aboral view rectangular, but concave, with strongly projecting dorsal angles. Copulatory ducts very short, receptacles globular.

♂ palp: Figs 11-13, 17, 20, 24. Tibia without intermediate apophysis, prolateral apophysis strong, distally tapering to a finger-like process, its anterior surface smooth and concave. Bulbus: tegulum globular, tegular process triangular, tegular apophysis strong, conductor fleshy, embolus short and bent.

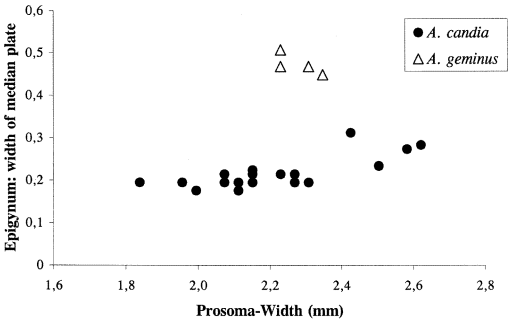
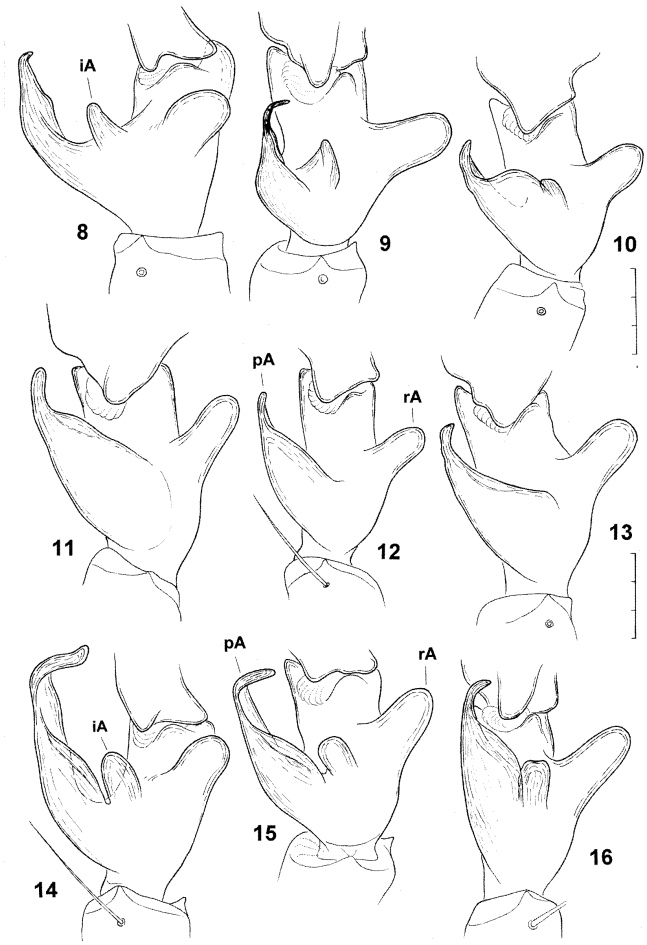


Fig. 7. Relation between prosoma width and width of median plate of the epigynum (aboral view, mm, see Fig. 2) in *Amaurobius candia* n.sp. and *A. geminus* n.sp.



Figs 8-16. *Amaurobius geminus* n.sp. (8-9, Mt. Afendis Stavromenos, same specimen), *A. cretaensis* Wunderlich (11-13, Kera [11], Katharo plain [12], Sarakinas [13]), *A. candia* n.sp. (10 Kato Chorio, 14-16, Youchtas [14], Afrati [15], Skinaras [16]). Male palpal tibia, retrolateral (8), dorsal (9-16). Scale lines: 0.30 mm. - iA, pA, rA intermediate, prolateral and retrolateral tibial apophysis.

Affinities: *A. cretaensis* is very similar and probably closely related to other two taxa from eastern and central Crete, which are here described, *A. geminus* n.sp. and *A. candia* n.sp. These three species differ clearly in their prolateral tibial apophysis and tegular process from *A. ferox* (Walckenaer, 1830), which was cited as a possible relative of *A. cretaensis* by Wunderlich (1995). However, there is apparently an overall similarity in the epigyna. Remarkably, in *A. candia* n.sp. and *A. geminus* n.sp. an intermediate apophysis is present in the male palpal tibia, as in most other members of *Amaurobius*, the *A. ferox* group excepted. The intermediate apophysis therefore has presumably been lost secondarily in *A. cretaensis*. The species of the *ferox* group are apparently concentrated in peninsular Italy and in the southern Alps (Pesarini 1991), Italy being probably the origin of *A. ferox*, which is now widely distributed owing to its synanthropic occurrence.

Distribution: Fig. 27, eastern Crete. The localities are grouped in the northern and eastern parts of Dikti region, with Tzermiado standing in the centre, at the border of Lassithiou plain. Krasi, Kera and Mesa Potami are situated on the northern and eastern slopes of Mt Selena respectively, while Katharo plain and Sarakinas gorge are on the eastern slope of Dikti Mts. Specimens were confined to sheltered microhabitats in an arid landscape, such as a gorge, rock crevices and the scree system, which provide a humid atmosphere and moderate temperature.

Amaurobius candia n.sp. (Figs 5-6, 10, 14-16, 18, 21-22, 25-26)

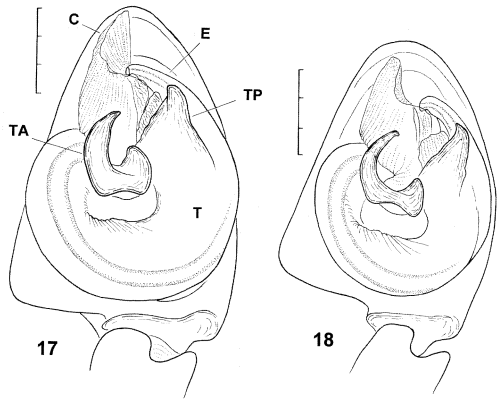
Type material: 1♂ Holotype (NMW): Greece, central Crete, Ida Mts., road Anogia to Ideo Andro, bifurcation to Skinaras *c.* 1400 m, 23 Sept. 1998; Paratypes: 3♂ 14♀ , same data as holotype (2♀ NMW; 1♂ 2♀ MHNG; 2♀ NHMC; 2♀ NMB; 2♀ NRS; 2♂ 4♀ CTh).

Other material examined: Central Crete: Iraklio, wall outside town, ruderal vegetation, 1♀ (NRS) 15 April 1975, leg. Waldén. Mt. Youchtas, 1♂ (CTh) Jan. 1996, leg. Chatzaki. Ida Mts., road Anogia to Ideo Andro, 1300 m, 3♀ 23 Sept. 1998. Eastern Crete: Kastelli, litter bordering irrigated garden, 1♂ (CB) 19 Oct. 1998, leg. Bosmans. Road Kastelli/Viannos, Afrati, in olive grove, 1♂ (CTh) 5 April 1998, adult 25 Dec. 1998. Dikti Mts., road Kaminaki/Embaros, stones in grassland, 1♂ (CB) 19 Oct. 1998, leg. Bosmans. Pefkos, pine forest, 2♀ (CD) 6 May 1986, leg. C.L. & P.R. Deeleman. Base of Thripti Mts., near Kato Chorio 100 m, overgrown stone wall on agricultural land, 1♂ (CTh) 26 Sept. 1998, adult Dec. 1998.

Etymology: *Candia*, noun in apposition, hence invariable. Obsolete name for Iraklio (and Crete).

Diagnosis: *A. candia* n.sp. can be clearly distinguished from *A. cretaensis* by the absence of projecting angles on the median plate of the epigynum (Fig. 6) and by the presence of an intermediate apophysis of the male palpal tibia (Figs 14-16). It is separated from *A. geminus* n.sp. by the width of the median plate (aboral view, Fig. 7) and by the prolateral tibial apophysis of the male, with inner margin broadened (Figs. 9 vs. 14-16).

Description (♂/♀, n = 4/5, specimens from type locality): Total length 5.6-6.6/5.6-8.2, prosoma length 3.0-3.4/2.8-3.8, width 2.1-2.3/1.8-2.6, femur I 3.3-3.8/2.5-3.2. Colour and pattern as in *A. cretaensis.* Palp: Figs. 16, 18, 22, 26. Tibia with intermediate apophysis, prolateral apophysis broad, distally oblique, its inner edge prolonged into a finger-like process, anterior surface smooth and concave. Bulbus: tegulum, tegular process, tegular apophysis, conductor, and embolus similar to *A. cretaensis*. Epigynum and vulva: Figs. 5-6. Close to *A. cretaensis*, but dorsal



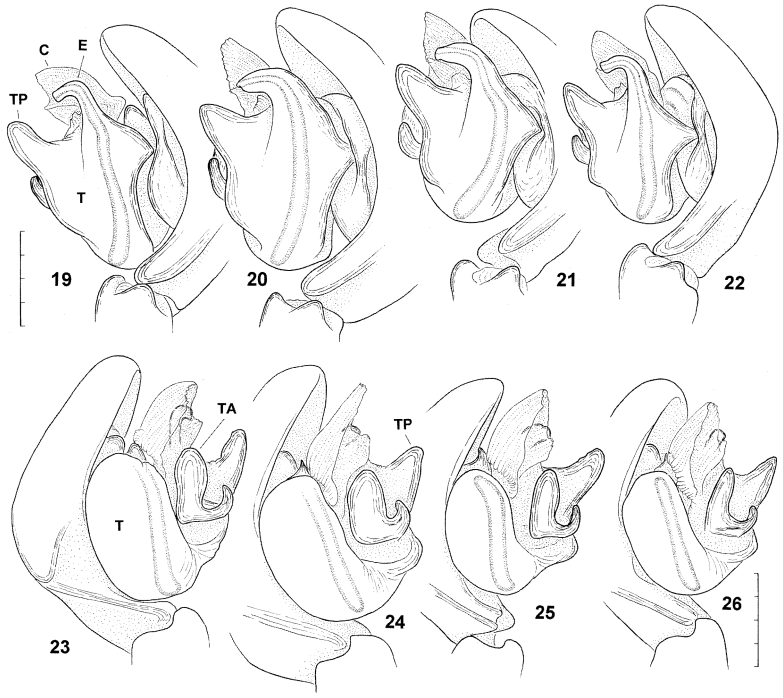
Figs 17-18. *Amaurobius cretaensis* Wunderlich (17, Kera), *A. candia* n.sp. (18, Skinaras). Male palpal organ, ventral (17-18). Scale lines: 0.30 mm. - C conductor; E embolus; T tegulum; TA tegular apophysis; TP tegular process.

angles of median plate not projecting, median plate narrower than in *A. geminus* n.sp. (Fig. 7).

Variation: The distal finger-like process of the prolateral apophysis of the male palp is longer in specimens from Mt Youchtas (Fig. 14) and from the western slopes of Dikti Mts. (Fig. 15) than from Ida Mts. (fig. 16). The intermediate apophysis is more closely attached to the prolateral apophysis in the peripheric ♂ from Kato Chorio (Fig. 10) than in other ♂. All these ♂ are accepted here as conspecific, as in the corresponding females no further separation was indicated (fig. 7).

Affinities: Closely related to *A. cretaensis* and *A. geminus* n.sp.

Distribution: Fig. 27. Localities are mainly grouped along the lowland between Dikti Mts. and Ida: around Iraklio, at the base of the western (Kastelli, Afrati, Embaros) and southern (Pefkos) slopes of Dikti Mts., and in Ida Mts. *c.* 1400 m a.s. l. One male from a peripheric site at base of Thripti Mts., c. 30 km East of Pefkos, was also assigned to this species. *A. candia* n.sp. is probably widely distributed along the southern coast of Crete. Like *A. cretaensis*, specimens were found at microhabitats providing humid and moderate conditions in an arid environment, as at Ida Mts. among scree in a semi-cavern and at the base of an overhanging rock, from where a film of water was still pouring out in late Sept. Other speci-



Figs 19-26. *Amaurobius geminus* n.sp. (19, 23, Mt. Afendis Stavromenos), *A. cretaensis* Wunderlich (20, 24, Kera), *A. candia* n.sp. (21-22, 25-26, Youchtas [21, 25], Skinaras [22, 26]). Male palpal organ, prolateral (19-22), retrolateral (23-26). Scale lines 0.40 mm. - C conductor; E embolus; T tegulum; TA tegular apophysis; TP tegular process.

mens were taken at low elevation and on cultivated land.

Amaurobius geminus n.sp. (Figs 1-2, 8-9, 19, 23)
Type material: 1♂ Holotype (NMW): Greece, eastern Crete, Thripti Mts., Mt. Afendis Stavromenos 1470 m a.s.l., 25 Sept. 1998. Paratypes: 2♂ 4♀, same data as holotype (2♀ NMW; 1♂ 2♀ CTh).

Etymology: The specific name is a latin adjective, meaning twin.

Diagnosis: *A. geminus* n.sp. can be clearly distinguished from its sibling species by the median plate of the epigynum, which is broad, without projecting angles (Figs 2, 7). Males can be separated from *A. candia* n.sp. by the prolateral tibial apophysis of the palp, which is gradually tapering (Fig. 9).

Description (♂/♀, n = 2/4): Total length 5.8, 6.2/7.2-8.2, prosoma length 2.8, 3.3/3.4-3.6, width 2.1, 2.4/2.2-2.4, femur I 3.2, 3.6/2.7-2.9. Colour and pattern as in *A. cretaensis.* Palp: Figs 8-9, 19, 23. Tibia with intermediate apophysis, prolateral apophysis more slender than in its allies, almost cylindrical, gradually tapering. Bulbus: close to *A. cretaensis*. Epigynum and vulva: Figs 1-2. Close to *A. cretaensis*, but dorsal angles of median plate not projecting, lateral lobes broad, median plate wider than in *A. candia* n.sp. (Fig. 7).

Affinities: Closely allied to *A. cretaensis* and *A. candia* n.sp., probably a restricted endemic species in Thripti Mts.

Distribution: Fig. 27. Known only from the type locality, the summit region of Mt. Afendis. Specimens were found at its crest, in rock crevices and holes facing north, where moisture is provided by the clouds coming from the Cretan sea.

Amaurobius deelemanae Thaler & Knoflach, 1995
Thaler & Knoflach (1995): n.sp., ♂♀. Greece, type locality Naxos Island, 2♂ 1♀ 23 April 1984, leg. C.

L. & P.R. Deeleman (male holotype in MHNG). Additional specimens from Crete, Perama, and Rhodes, all leg. Deeleman.

Material examined: Western Crete, Georgiopouli 10-250 m a.s.l., in phrygana, pasture, 2♂ 2♀ (CTh) 27 March 1999; in olive grove, 1♂ 4♀ (NMW) 28 March 1999; in rift, in dense shrubs 4♂ 11♀ (CTh, MHNG, NMB) 29 March 1999. Lefka Ori 1650 m a.s.l., pitfalls, 4♂ (NHMC) 1992, leg. Lymberakis & Chatzaki. Hania, Vamvakades, 1♀ (CB) 10 May 1994, leg. J. Van Keer. Central Crete, road Anogia/Gonies, grassland along dry rivulet, 3♀ (CB) 17 Oct. 1998, leg. Bosmans.

Differentiation: *A. deelemanae* resembles *A. cretaensis* and its relatives in the tegular process. Males differ clearly in the embolus, which is long and strongly bent, and in the configuration and shape of the tibial apophyses. Females differ in the epigynum, the median plate being transverse, not cordiform, the side lobes less developed.

Remarks: Hitherto only known from islands in the Aegean Sea: Naxos (type locality, Kiklades Islands), Rhodes (further records in Thaler & Knoflach 1998) and Crete, apparently absent in the eastern part of this island, where it is replaced by *A. cretaensis* and *A. candia* n.sp. In western Crete it occurs across a wide range of altitude (10-1650 m), selecting moist microhabitats (Fig. 27).

Amaurobius erberi (Keyserling, 1863)

Material examined: Evvoia: Eretria, in stand of pines 100 m a.s.l., 1♂ (CTh) 19 Sept. 1997. Sporades Is., Skiathos: Moni, Troulos, pine forest 200 m a.s.l., 2♀ (CD) 28-30 April 1986, leg. P.R. Deeleman.

Remarks: Holomediterranean according to the literature, confined to lowland habitats and probably absent on Peloponnese and on the Aegean islands, where it is replaced by *A. deelemanae*.

Amaurobius pelops Thaler & Knoflach, 1991

A. atticus Thaler & Knoflach, 1995: Revue suisse Zool. 102: 48 (♂), **nov. syn.** (male holotype in MHNG)

A. cf. *pelops* - Thaler & Knoflach (1995): Revue suisse Zool. 102: 46 (♂♀).

Thaler & Knoflach (1991): n.sp., ♂♀. Greece, type locality Peloponnese, Feneos plain (male holotype in NMW).

Thaler & Knoflach (1998): ♂, further captures along Feneos plain.

Material examined: Evvoia: Dirfis Mts, Macrovouni, above Ag. Vlasios 1000 m, in stand of Greek fir (*Abies cephalonica* Loud.) 1000 m a.s.l., 6♂ 2♀ (CTh) 20 Sept. 1997; road Steni/Stropones, eastern slope, in stand of Greek fir 1000 m a.s.l., 46♂ 40♀ (CTh, MHNG, NMB, NMW) 21 Sept. 1997. Central Greece, Mt. Iti, above Ipati, in sparse pine forest 1800 m a.s.l., 2♂ 10♀ (CTh) 18 Sept. 1997.

Remarks: The ♂ holotype of *A. pelops* presents an aberrant intermediate apophysis. This was recognized from additional captures around the type locality, Feneos basin in northern Peloponnese (Thaler & Knoflach 1995, 1998). We now feel sure that *A. atticus*, which we described from 1♂ taken in a cave in Attiki and separated from *A. pelops* on details of its tibial apophyses, merely represents another variant and should be placed as a synonym of *A. pelops*. The new captures extend its distribution to the north. The species apparently occupies a narrow range from northeastern Peloponnese to Evvoia and Mt. Iti. Its neighbours are *A. longipes* Thaler & Knoflach, 1995 in the south, *A. ossa* Thaler & Knoflach, 1993 in the north and *A. timidus* in Pindos Mts. At Mt. Iti *A. pelops* and *A. timidus* occur in sympatry. There we found *A. timidus* at lower sites around 1400 m a.s.l. (Thaler & Knoflach 1998).

Amaurobius timidus Thaler & Knoflach, 1995

Thaler & Knoflach (1995): n.sp., ♂♀. Greece, type locality Peloponnese, Erimanthos, Kalendzi 1♀ 27 Sept. 1991, 3♂ 4♀ 20 Sept. 1992, leg. authors (male holotype in MHNG).

Material examined: Kefallonia: Mt. Enos, in stands of Greek fir 1200 m a.s.l., 1♂ 1♀ (CTh) 20 Sept. 1999, 1600 m a.s.l. 15♂ 21♀ (CTh, MHNG, NMB, NMW) 20-23 Sept. 1999.

Remarks: Widely distributed in mountain regions of northern Greece, in Pindos Mts. and Chalkidiki, also on Ionian islands. Southernmost station (and type locality) at Erimanthos Mts., north-western Peloponnese, northernmost station

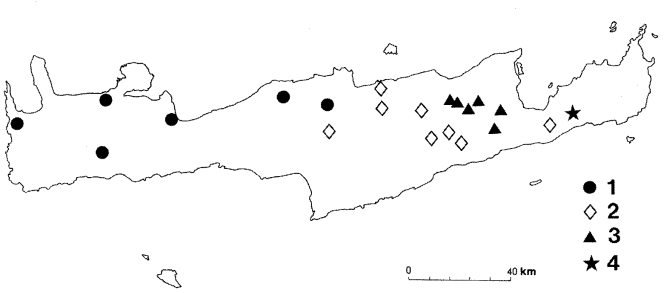


Fig. 27. Distribution of *Amaurobius* species in Crete: 1 *A. deelemanae* Thaler & Knoflach, 2 *A. candia* n.sp., 3 *A. cretaensis* Wunderlich, 4 *A. geminus* n.sp.

in Bulgaria. The northern limits of its range are not yet known.

CONCLUDING REMARKS

The thirteen species of the genus *Amaurobius* now established for Greece fall into various groups according to their ranges. Only two of them are common in Europe, *A. erberi* in the mediterranean region, and *A. fenestralis* (Ström, 1768) in mid- and northern Europe respectively. Another two show comparatively wide ranges, whose limits are not yet fully established: *A. timidus* in northern Greece and in Pindos Mts., *A. deelemanae* in the Aegean islands. Only known from their type localities are *A. phaeacus* Thaler & Knoflach, 1998 (Corfu) and *A. ausobskyi* Thaler & Knoflach, 1998 (Athos peninsula). Restricted endemic species occur in the mountains of Peloponnese and mid Greece: *A. pelops*, *A. paon* Thaler & Knoflach, 1993 (Taygetos Mts.), *A. longipes* (Parnon Mts.), *A. ossa* (Mt. Ossa, Mt. Olympos). All these species are well defined and do not form obvious groupings.

Surprisingly in eastern Crete three taxa occur, which appear closely allied in genitalic characters and show a parapatric distribution pattern (Fig. 27). Two are confined to mountain areas: *A. cretaensis*, which is most distinct, to the northern and eastern parts of Dikti Mts., *A. geminus* n.sp. to the summit region of Thripti Mts. The third species, *A. candia* n.sp., occurs along the southern and western slopes of Dikti Mts. and extends to Irakleio and also to Ida Mts. As *Amaurobius* species are confined to sheltered microhabitats providing humidity and moderate temperatures, their ranges should have oscillated in the Pleistocene according to the changes of macroclimate. In the more remote past at the end of the Tertiary, Crete was even separated into islands by marine transgression (Rögl & Steininger 1983). Therefore *A. cretaensis* and its allies might have speciated in the Pleistocene, each in a refugial area. They can be grouped together into a superspecies, according to their close affinities and parapatric distribution pattern.

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