

***Poecilimon gerlindae* spec. nov. – a new bushcricket species of the *Poecilimon propinquus*-group (Orthoptera: Phaneropteridae) from Greece**

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Abstract

Poecilimon gerlindae spec. nov. from Greek mainland is described. The new species is the eight known member of the *P. propinquus*-group (sensu Lehmann AW 1998). It is distinct with respect to male cerci, the corresponding female basal fold, body colouration, number of teeth on the stridulatory file and the number of pulses in the song. Otherwise it resembles *P. propinquus* in body size and general song pattern.

Zusammenfassung

Poecilimon gerlindae spec. nov. vom griechischen Festland wird beschrieben. Die neue Art ist das achte bekannte Mitglied der *P. propinquus*-Gruppe (sensu Lehmann AW 1998). Die Art unterscheidet sich in den männlichen Cerci, den korrespondierenden weiblichen Basalgruben, der Körperfärbung, der Zahl der Zähnchen auf der Schrilleiste und der Zahl von Pulsen in Gesang von den anderen Arten. Die Art ähnelt *P. propinquus* in der Körpergröße und der generellen Gesangsstruktur.

Introduction

The genus *Poecilimon* is one of the most species-rich genera of Orthoptera in the Palaearctic. Like the other members of the subfamily Barbistinae all species are micropterous and not able to fly. This fact is certainly in part responsible for the high number of species. The orthopteran fauna of Greece is comparatively well studied (WILLEMSE 1984, 1985a, 1985b) and especially the Greek *Poecilimon* species have been received taxonomic attention (WILLEMSE 1982, HELLER 1984, 1988, WILLEMSE & HELLER 1992). Even though new taxa are continuously described (HELLER & REINHOLD 1992, 1993, FONTANA 2004, HELLER et al. 2005). This genus is very interesting due to its extraordinary high species number. Furthermore, many species have been used to study the evolution of mating behaviour and sperm competition in insects by the former working group at the University of Erlangen (see HELLER 1997 for a partial review).

Here one further new species, belonging to the *Poecilimon propinquus*-group of species, is described. All eight species in this group are parapatrically distributed in Greece and adjacent Macedonia (LEHMANN AW 1998). The *P. propinquus*-group is defined by the following characters:

- I) Habitus: small but comparatively bulky.
- II) Male subgenital plate short, not protruding between the Cerci.
- III) Cerci of males apically with more than five teeth.
- IV) Song: Each verse, which is produced by a rapid closing movement of the wings, contains less than twenty pulses. The whole song consists of single verses or short multi-syllable verses less than one second in duration (HELLER 1984, 1988, 1990, WILLEMSE & HELLER 1992, LEHMANN GUC & HELLER 1998).
- V) Females with squamipterous tegmina, not overlapping on the back. This secondary loss of female song production is found in European *Poecilimon* species in the *propinquus*- (LEHMANN AW 1998, LEHMANN AW & HELLER 1998), *ampliatatus*- (HELLER & LEHMANN 2004), *anatolicus*- (*P. anatolicus*, *heinrichi* and further species from Turkey, Lehmann unpubl. data) and *tauricus*-group. An independent loss of female reply songs is found within the Caucasian *heroicus*-group (HELLER et al. 2006).
- VI) Spiracle size small in both sexes (STUMPNER & HELLER 1992), but three to five-times larger than in the *ampliatatus*-group (LEHMANN et al. submitted).
- VII) The lateral sclerites of the upper ovipositor valve (= female basal fold) are concave, forming a leading groove with a bulb at the lower border.

***Poecilimon gerlindae* spec. nov.**

Locus typicus: Greece, Eláda Stereá, Nomos Fthiótida, Domokos.

Holotypus: ♂ 21.05.1995, CL 3037.

Paratypi: same locality, collecting data see below 32♂♂, 28♀♀ CL 3003-3063, 50♂♂, 18♀♀ CH 0419, 2500-2501, 2794-2804, 4113, 4396-4448 (two specimens in CW, two specimens in Zoological Museum Berlin).

Citations:

Poecilimon propinquus [partim] (WILLEMSE & HELLER 1992) – Tijdschr. Entomol. 135: p. 314. [Fig. 18 Cercus].

Poecilimon propinquus (HELLER & HELVERSEN 1993) – J. Insect Behav. 6: 361-377 [Song data].

Poecilimon nova species (LEHMANN AW 1998) – Ph.D. Univ. Erlangen-Nürnberg: p. 54 [Fig. 18 song, Fig. 22 Cercus].

Poecilimon nova species (HELLER 2006) – [Fig. 9.5 song].

Etymology: Named in honour of the first authors wife Dr. Gerlind U.C. Lehmann, who is working on the evolutionary biology of the *Poecilimon propinquus*-group (LEHMANN GUC 1998, LEHMANN & FESTING 1998, LEHMANN GUC & HELLER 1998, LEHMANN & LEHMANN 2000a, 2000b, 2006, accepted, LEHMANN et al. 2001, see www.guclehmann.de for comparison).

Description

Male (Fig. 1-2) and female (Fig. 5) small but bulky (Table 1), with the general appearance of the *propinquus*-group.

Colouration: The integument glossy, even as nymphs. Body yellowish-green, with typical black and white patterns on the dorsal tergites. Sternites and intersegmental skins white or yellowish. The whole body dotted with black spots. Legs yellow-brown, knees more or less reddish. Antennae narrow ringed black and white. Less colourful than *P. propinquus*, not so much red and black on abdomen. Rarely completely green males.

Pronotum: Pronotum in males slightly raised in the metazona, distinctly behind the sulcus (Fig. 3, see Fig. 4 *P. propinquus* for comparison). The raised area with reddish flush, not with the clear red markings of *P. propinquus* males. Pronotum in females cylindrical from above, straight, not raised or widened. Ventral margin white, in males also the dorso-ventral edge white.

Wings: Male tegmina with basal half covered by pronotum, apical half reaching the end of the first abdominal segment. Wings yellow with a longitudinal black stripe; this characteristic stripe is lacking only in the rare totally green males. Females with largely reduced wings, the short tegmina totally covered by the pronotum. Alae exist only as short stipples.

Stridulatory file: The stridulatory file with the general appearance as in the *P. propinquus*-group. In the middle section comparatively massive teeth, which are moderately reduced in size towards both ends. The teeth number is the lowest in the *P. propinquus*-group, with 37 teeth (see HELLER 1988, LEHMANN 1998 for comparison of the other species). This low teeth number corresponds with the low pulse number in the songs (see below). The whole stridulatory file roughly 3 mm long, with 16 teeth per millimetre in the central area.

Cercus: Cercus yellow with flattened, serrated blackish apex (Fig. 6-7). The apical margin of the male cercus is slightly convex. If viewed from behind, it has two rows of teeth.

Female basal fold: Basal fold of dorsal margin of lower ovipositor valve lamelli-form. In its form it corresponds to the structure of the male cerci (Fig. 8).

Table 1: Parameters of body size of *Poecilimon gerlindae spec. nov.* from six populations, measured in the field on live specimens. Populations are sorted from north to south. Measurements in mm given as means \pm standard deviation.

Locality	n	Males			Females			
		Hind femur	Pronotum	Fore tibia	n	Hind femur	Pronotum	Fore tibia
Pygi	12	15.55 \pm 0.59	5.88 \pm 0.28	6.77 \pm 0.36	19	17.41 \pm 0.82	6.16 \pm 0.29	7.30 \pm 0.31
Fársala	1	13.75	5.06	5.86				
Domokos	23	15.58 \pm 0.74	5.53 \pm 0.25	6.49 \pm 0.36				
Perivoli					1	14.81	5.00	5.71
Livanates	9	15.34 \pm 0.64	5.48 \pm 0.21	6.45 \pm 0.29				
Alíartos	2	17.12 \pm 0.24	5.76 \pm 0.24	7.26 \pm 0.13				
Sum	47	15.55 \pm 0.78	5.61 \pm 0.30	6.57 \pm 0.39	20	17.28 \pm 0.99	6.10 \pm 0.38	7.22 \pm 0.47



Figure 1: *Poecilimon gerlindae* spec. nov.- ♂ habitus, dorsolateral view.



Figure 2: *Poecilimon gerlindae* spec. nov.- Holotypus ♂, dorsal view (CL 3037).

Figure 3:
Poecilimon gerlindae spec. nov.:
♂ pronotum in lateral view.

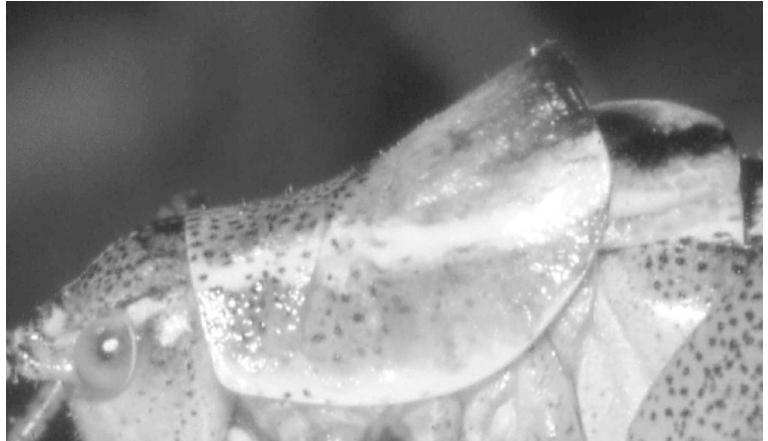


Figure 4:
Poecilimon propinquus:
♂ pronotum in lateral view
(CL 3150 Halkida).

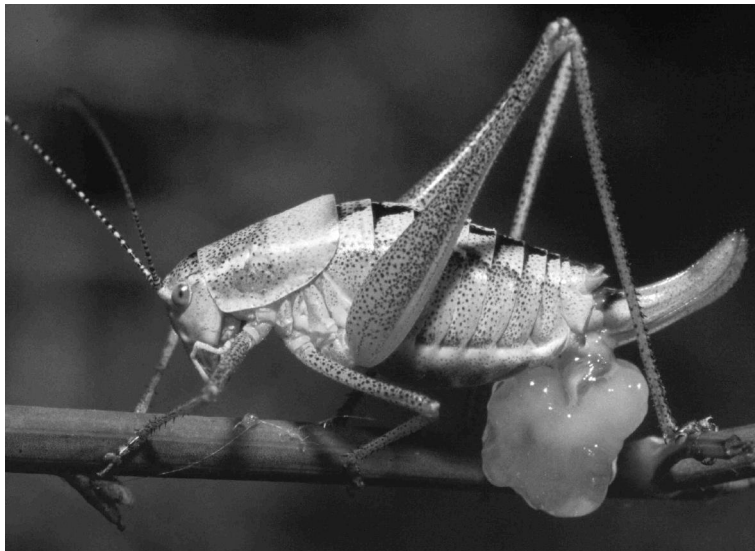


Figure 5:
Poecilimon gerlindae spec. nov. - ♀ habitus,
lateral view. This female has freshly mated,
with the huge spermatophore visible at its
genital opening.



Figure 6:
Poecilimon gerlindae
spec. nov. - Holotypus ♂,
left cercus, dorsal view.

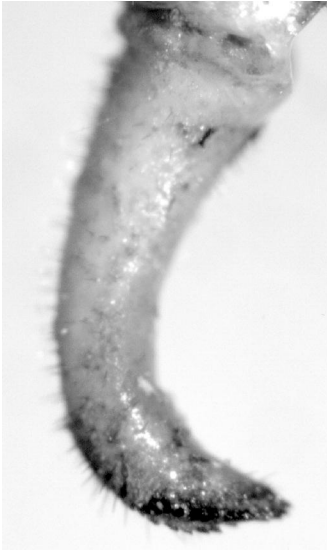


Figure 7 (left):
Poecilimon gerlindae spec. nov.-
Paratypus ♂ left cercus, dorsal
view.



Figure 8 (right):
Poecilimon gerlindae spec. nov.-
Paratypus ♀, base of ovipositor,
left lateral view.

Acoustic

In all *Poecilimon*-species only the down stroke of the wings produces a sound, the opening of the wings is sound-less. The original sound pattern in the *P. propinquus*-group is produced by a single closing movement of the wings, which gives a mono-syllabic verse. The three members of the *P. propinquus*-group *P. veluchianus*, *P. zimmeri* and *P. thessalicus* produce a calling song consisting of single syllables separated by intervals of about one to three seconds. This type of song represents the ancestral song pattern within the *P. propinquus* group (LEHMANN 1998). In *P. gerlindae* spec. nov. exists a tendency to repeat the mono-syllabic verses quite continuously over minutes (Figure 9 top), with in mean 2.5-5.5 syllables per second, a character shared with *P. propinquus*. The verses are short, around 25-70 ms long at 18-24 °C (Figure 9 bottom) and the pauses between the verses are longer than the verses themselves. Each syllable contains 8-10 pulses, the first 1-3 separated from the rest. The pulse number is distinctly greater in *P. propinquus* with in mean 10-15 pulses per verse. Correspondingly, the syllables were longer in *P. propinquus* (40-140 ms at 18-24 °C). After compensating for temperature effects, these differences were statistically significant (bioacoustic data from 15 males (n=962 syllables) of *P. gerlindae* and 16 (n=829) of *P. propinquus*). Like the other species of the *P. propinquus*-group, *P. gerlindae* spec. nov. sings only at night. However, due to the high syllable repetition rate *P. gerlindae* spec. nov. produces much more syllables per night (about 60000) than the mono-syllabic singing *P. veluchianus* and *P. zimmeri* (less than 10000; HELLER & HELVERSEN 1993 as *P. propinquus*) or the poly-syllabic species *P. mariannae* (less than 20000; LEHMANN & LEHMANN 2006).

Genetic distance

The new species *P. gerlindae* is genetically quite distinct from *P. propinquus* (Lehmann AW 1998). The mean genetic distance between *P. gerlindae* and *P. propinquus* using mtDNA of the COI region was 0.058. This difference is larger than between other closely related species within the *propinquus*-group (*mariannae* vs. *chopardi* mean 0.016, *aegaeus* vs. *propinquus* 0.024).

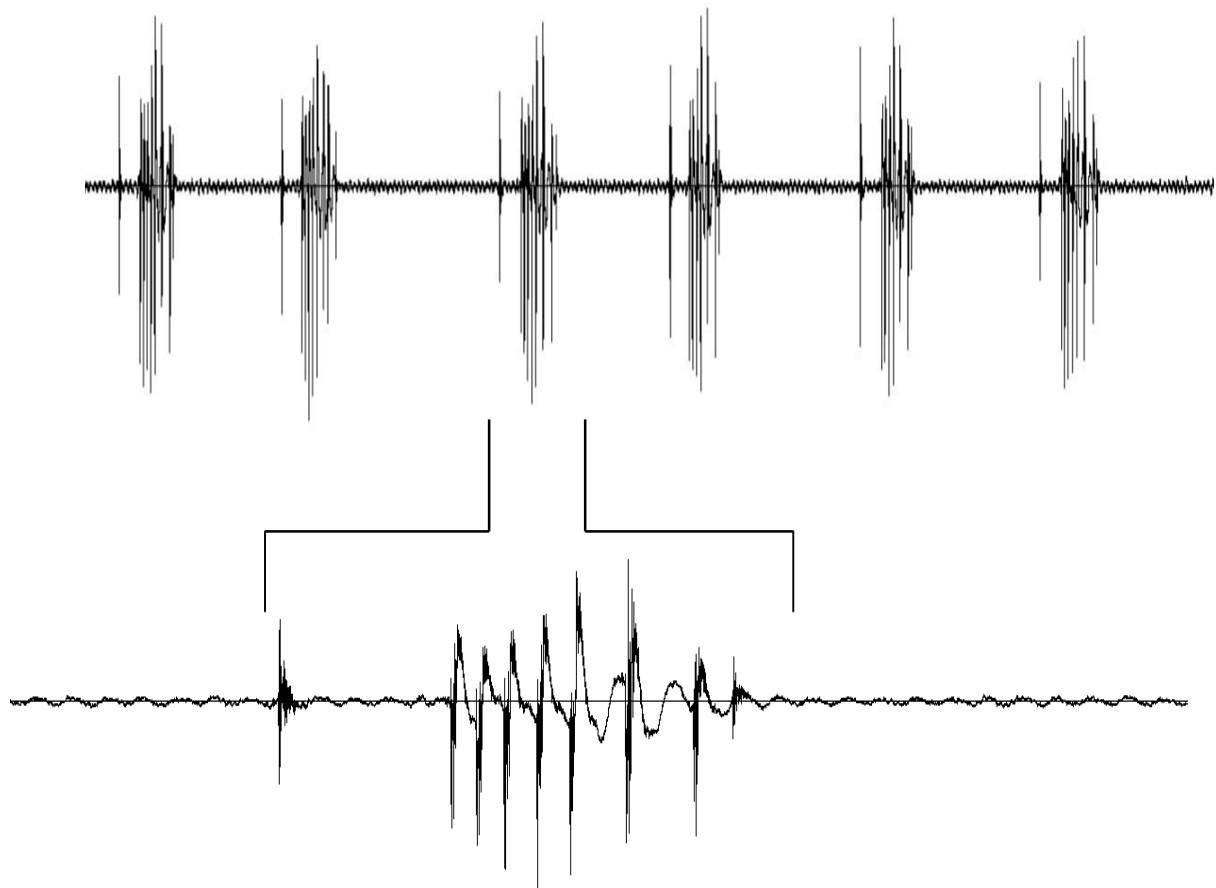


Figure 9: Song pattern of *Poecilimon gerlindae* from Livanates (CL 3066). In the top row six verses are shown from a continuous singing male. In the bottom row a magnified verse is shown, with a single pulse separated from the eight pulses of the main group.

Differential diagnosis

The new species *Poecilimon gerlindae* resembles the closely related *P. propinquus*. There are however major differences. Most obvious are the differences in the male cerci and the female basal fold. Both characters easily separate both species. Furthermore, males bear a longitudinal black stripe on the male tegmina, which is absent in *P. propinquus* males. The male stridulatory file with less teeth ($n=37$) than any other species of the *P. propinquus*-group, the song pattern with 10 or less pulses per syllable. *P. gerlindae* spec. nov. can be separated by its glossy integument, even as nymphs, from the dull looking and geographically bordering species *P. veluchianus* and *P. mariannae*.

Distribution

From 1994 to 1996 we surveyed the distribution of the species of the *Poecilimon propinquus*-group as part of the first author's doctoral thesis about acoustic communication and speciation of this group (LEHMANN AW 1998, LEHMANN AW & HELLER 1998). Earlier data of the new species are published in WILLEMSE & HELLER (1992). Up to now, no material from public museums is known. The first individuals were collected in 1989 and further material became available in the nineties.

CH = Collectio Klaus-Gerhard Heller, specimens numbered, song records under www.dorsa.de partly under *P. propinquus*; collected by Klaus-Gerhard Heller and Marianne Volleth, 1 ♂ by Holger Braun.

CL = Collectio Arne W. Lehmann, specimens numbered; collected by Arne W. Lehmann and Gerlind U.C. Lehmann.

CW = Collectio Willemse; material collected by Fer Willemse and Luc Willemse.

In Central Greece the new species occurs around Farsala and Domokos, extending into the Mt. Othris-region to the east. Additional records from Livanâtes and Alíartos are the southernmost known localities. The new species might be found in contact with its close relative *Poecilimon propinquus* at its southern boundary around Thiva, but we were unsuccessful in filling the gap of 20 km. The whole area is agricultural overformed and the populations of the contact zone might be expired (LEHMANN 1998). *Poecilimon gerlindae* has an overlapping distribution with *P. mariannae* Willemse & Heller, 1992, mainly in the Domokos and Farsala area. In the area around Makirrahi *P. veluchianus* Ramme, 1933 inhabits the woody slopes, *P. mariannae* the wetter plains, largely transformed into cornfields, and *P. gerlindae* the drier hills, and at some places the populations of the the different species are directly neighbouring.

Eláda Stereá – Nomos Fthiótida: Mt. Othris: Dívri 10.06.1994 (acoustic Lehmann), **Domokos (locus typicus)** 26.05.1989, 30.05.1990, 05+12.06.1992, 04.06.1998 50♂♂, 18♀♀ (CH 0419, 2500-2501, 2794-2804, 4113, 4396-4448; two specimens in CW, two specimens in Zoological Museum Berlin) 24.05.+05.06.1994, 04.+21.05.1995, 10-15.05.1996 33♂♂, 28♀♀ (CL 3003-3060), 28.05.1994 Domokos 4km N 7♂♂ (CH 3083-3089), Livanates 06.-07.05.1995 9♂♂, 5♀♀ (CL 3066-3079), Trilofo (Ag. Stefanos) 02.06.1989 1♂ (CH 2458), Xerovoúni (SW Domokos) 30.05.1994 1♂ (CH 3082, leg. Holger Braun), Xerovoúni/Panagria 25.05.1994 2♂♂ (CL 3082-3083). – Nomos Viotía: Alíartos 08.05.1995 2♂♂ (CL 3064-3065), Ipsilántis 08.05.1995 (acoustic Lehmann).

Thessalía – Nomos Kardítsa: Asimohóri 04.06.1994 (acoustic Lehmann), N Domokos 28.05.1994 6♂♂, 1♀ (CH 3083-3089), Ekára 04.06.1994 (acoustic Lehmann), Kato Ktiméni 03.06.1994 (acoustic Lehmann & Heller), Makirráhi-Perivoli 07.06.1995 1♀ (CL 3080). – Nomos Lárisa: Fársala 26.05.1989 3♂♂ (CH 2502-2504) + 25.05.1994, 10-15.05.1995, 10-15.05.1996 18♂♂, 13♀♀ (CL 3108-3138), Pygi 12-29.05.1995, 08-20.05.1996 10♂♂, 13♀♀ (CL 3084-3106), Vrissía 13.05.1996 1♀ (CL 3107), Zappion 03.06.1991 3♂♂ (CH 2700-2702). – Nomos Magnissía: Mt. Othris: Kokkotoi 1100-1500 m NN 22.-23.07.1991 16♂♂, 17♀♀ (CW) - Mt. Othris Anavra 13.06.1991 4♂♂, 1♀ (CH 2669-2673) + 22.06.1994 1♀ (CL 3081)

Ecology

Within its range the new species inhabits road verges and dry hillsides. These biotopes turn green due to spring rain, but the vegetation becomes brown very quickly. The bordering species *P. veluchianus* inhabits the woodland parts, which are much moister and the geographically bordering *P. mariannae* is largely restricted to the wetter plains. Probably as adaptation to the drier and hotter habitats inhabited by the new species, and as a consequence, *P. gerlindae* is adult two weeks earlier than *P. mariannae*. At the end of their season we observed obviously dehydrated individuals on gorse (*Spartium junceum*), where all flowers have been gone. The availability of appropriate plant material is a key requisite for the occurrence of the three species, which pick up their ecological niche by habitat choice and timing of their seasonal occurrence.

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