

PAOLO FONTANA (*) & BAUDEWIJN ODÉ

A NEW SPECIES OF *EPHIPPIGER* BERTHOLD, 1827
FROM THE NORTHERN APENNINES IN ITALY
(Insecta Orthoptera Bradyporidae)

ABSTRACT - FONTANA P. & ODÉ B., 2003 - A new species of *Ephippiger* Berthold, 1827 from the Northern Apennines in Italy (Insecta Orthoptera Bradyporidae).

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Ephippiger carlottae n. sp. from Northern Apennine is described. The authors briefly present the status of the knowledge in Italy concerning the genus *Ephippiger* and in particular of the taxa of the *Ephippiger ephippiger* group. The new species is characterised by the subrectangular supragenital plate, the stout and short cerci and the medium length of titillators. *Ephippiger carlottae* n. sp. at present is known from the Emilia Romagna region and Tuscany only; it is a submontane to montane species and lives on bushes especially of *Rubus* sp. The bioacoustics of the species is described and illustrated by oscillograms. Several photos and drawings illustrate the main morphological characters and their variability, the *habitat* in the *locus typicus restrictus* and the distribution of the new species.

KEY WORDS - *Ephippiger carlottae* n. sp., *Ephippiger ephippiger* group, Morphology, Bioacoustics.

RIASSUNTO - FONTANA P. & ODÉ B., 2003 - Una nuova specie di *Ephippiger* Berthold, 1827 dell'Appennino settentrionale in Italia (Insecta Orthoptera Bradyporidae).

Viene descritto *Ephippiger carlottae* n. sp. dell'Appennino settentrionale. Gli autori presentano una breve rassegna sulle conoscenze relative al genere *Ephippiger* in Italia ed in particolare sui taxa del gruppo dell'*Ephippiger ephippiger*. La nuova specie è ben caratterizzata dalla forma subrettangolare della lamina sopragenitale, dai cerci corti e tozzi e dai titillatori di lunghezza media. *Ephippiger carlottae* n. sp. risulta fino ad oggi noto solo in Emilia Romagna e Toscana; è una specie di ambienti da submontani a montani e vive su cespugli, in particolare di *Rubus* sp. La bioacustica della specie è descritta ed illustrata da oscillogrammi. Vengono illustrati, con fotografie o disegni,

(*) Dr. Paolo Fontana: Dipartimento di Agronomia Ambientale e Produzioni Vegetali – Entomologia, Università di Padova.

gli esemplari dal vivo, le principali caratteristiche morfologiche con la rispettiva variabilità, l'*habitat* nel *locus typicus restrictus* e l'areale di distribuzione.

PAROLE CHIAVE - *Ephippiger carlottae* n. sp., Gruppo dell'*Ephippiger ephippiger*, Morfologia, Bioacustica.

INTRODUCTION

The genus *Ephippiger* Berthold 1827 in Italy is represented by several taxa, most of them endemic. The *Checklist delle specie della fauna italiana* (FAILLA *et al.*, 1994) lists 9 species, but has recently been supplemented with a newly described species from Sicily (FONTANA & MASSA, 2000) (Tab. 1). The identity of the Italian species of *Ephippiger* is well known, and the separation of the different taxa is generally clear. Only the subspecies of *E. terrestris* are difficult to discern, but after the revision of NADIG (1980) and the study of our material, the typical form seems to be absent from Italian territories, while *E. terrestris bormansii* Brunner von Wattenwyl, 1882 and *E. terrestris caprai* Nadig, 1980 are present in Italy. *Ephippiger vicheti* Harz, 1966 has to be considered a distinct species (NADIG, 1987; FAILLA *et al.*, 1994; FONTANA *et al.*, 2002), even though several authors still consider it a subspecies or a junior synonym of *Ephippiger ephippiger* (Fiebig, 1784).

Taxa	Distribution
<i>E. apulus apulus</i> (Ramme, 1933)	Southern Italy
<i>E. apulus italicus</i> La Greca, 1959	Southern Italy
<i>E. camillae</i> Fontana & Massa, 2000	Sicily (Italy)
<i>E. cavannai</i> (Targioni Tozzetti, 1881)	Southern Italy
<i>E. carlottae</i> n. sp.	Northern Apennine (Italy)
<i>E. discoidalis</i> (Fieber, 1853)	North-eastern Italy, Balkan peninsula
<i>E. melisi</i> Baccetti, 1958	Southern Apennine, Italy
<i>E. perforatus</i> Rossi, 1790	Western part of north and central Italy, France
<i>E. ruffoi</i> Galvagni, 1955	Central and Southern Apennine, Italy
<i>E. terrestris bormansii</i> Brunner v. W., 1882	Alps, Italy, Switzerland
<i>E. terrestris caprai</i> Nadig, 1980	Western Alps
<i>E. vicheti</i> Harz, 1966	Southern Alps (Italy and Switzerland)
<i>E. zelleri</i> (Fisher, 1854)	Western part of Central Italy

Tab. 1. The taxa of the genus *Ephippiger* at present known from Italy.

In fact the identity of *Ephippiger ephippiger* is extensively discussed and several taxonomic solutions have been proposed during last decades (HARTLEY & WARNE, 1984; OUDMAN *et al.*, 1990; DUJIM, 1990 and 1992; RITCHIE *et al.*, 1997; RITCHIE *et al.*, 2001). We agree with GALVAGNI (1956) and NADIG (1987) and consider *Ephippiger ephippiger ephippiger* (Fiebig, 1784) the typical subspecies (*terra typica* Wien), distributed in the eastern range and *Ephippiger ephippiger vitium* (Serville, 1831) (*terra typica* Paris) the western form, as a more or less distinct subspecies. The identity of the subspecies and species described within the range of both the former taxa is difficult to evaluate without a general revision of the whole *Ephippiger ephippiger* group (Tab. 2). Most of the published records concerning the Italian distribution of *Ephippiger ephippiger* demonstrated to be based on misidentifications. All the data concerning the Alps must be referred to *Ephippiger vicheti* or even to taxa, not related to the group of *Ephippiger ephippiger*, (FONTANA *et al.*, 2002). Furthermore, old records of *Ephippiger ephippiger* from the Italian Apennines (ZANGHERI, 1927, BACCETTI, 1954 and 1963, ROBERTI *et al.*, 1965) have been considered misidentifications of *Ephippiger perforatus* (Rossi, 1790), *E. vicheti* or other Italian endemic taxa. Hence, *Ephippiger ephippiger* is not listed in the *Checklist delle specie della fauna italiana* (FAILLA *et al.*, 1994).

Taxa	Type locality
<i>E. ephippiger ephippiger</i> (Fiebig, 1784)	Austria, Wien
<i>E. ephippiger mischtschenkoi</i> Harz, 1966	Ukraine, Kanew, near Kiev
<i>E. ephippiger usi</i> Adamovic, 1973	Serbia, Miroč Mountains, Veliki Strbac
<i>E. ephippiger harzi</i> Adamovic, 1973	Serbia, Troglav Mts., Bogutovacka Banja
<i>E. ephippiger balkanicus</i> Andreeva, 1985	Bulgaria, near Belogradchik
<i>E. ephippiger varnensis</i> Andreeva, 1985	Bulgaria, Pobity Kamani, county of Varna
<i>E. ephippiger vitium</i> Serville, 1831	France, near Paris
<i>E. ephippiger moralesagacinoi</i> Harz, 1966	Spain, Virgen de Ares (Puerto Payas, Lerida)
<i>E. cunii</i> Karsch, 1887	Spain, near Barcelona
<i>E. vicheti</i> Harz, 1966	Italy, Storo (Trento)
<i>E. camillae</i> Fontana & Massa, 2000	Italy, Sicily, Madonie Mountains
<i>E. carlottae</i> n. sp.	Italy, Emilia Romagna, Northern Apennines

Tab. 2. The taxa of the *Ephippiger ephippiger* group.

After studying material we received from Italian colleagues and after new collections we made recently, we can now confirm that in the Northern Apennine a quite common taxon of *Ephippiger* is present that must be assigned to the group of *Ephippiger ephippiger*. In our opinion this taxon has to be considered a new species, that we consequently describe as *Ephippiger carlottae* n. sp.

DESCRIPTION

Ephippiger carlottae n. sp.

Examined material: ITALY, **Emilia Romagna** region, Modena province, Appennino Tosco-Emiliano, SS 486, 3,5 km south of Piandelagotti, 1270 m, 01.X.2001 (locality 5), 2 males (*Holotype* and 1 *paratype*) and 3 females (*Allotype* and 2 *paratypes*), leg. P. Fontana, F. M. Buzzetti, B. Odè, coll. P. Fontana and coll. F. M. Buzzetti (1 female *paratype*); Bologna province, Appennino Tosco-Emiliano, Castel del Rio, 250 m, 13.VI.2000 (collected as nymphs: adults in VII.2000), 4 males (*paratypes*) and 1 female (*paratype*), leg. P. Fontana, coll. P. Fontana and coll. F. M. Buzzetti (1 male); Grizzana (= Grizzana Morandi), 8.IX.1925, 1 male (*paratype*), coll. P. Fontana; Mongardino, 20.VIII.1974, 1 male (*paratype*), leg. P. Pisi, coll. P. Fontana; Camugnano, 16.IX.1969, 1 male (*paratype*), leg. M. Bughetti, coll. P. Fontana; Parma province, Varano de' Melegari, 250 m, 12.IX.1999, 1 female (*paratype*), leg. S. Beretta, coll. P. Fontana; Piacenza province, Passo Penice, 8.VIII.1964, 1 female (*paratype*), coll. P. Fontana; **Tuscany**, Lucca province, Appennino Tosco-Emiliano, SS 324, west of Passo Radici, 1350 m, 01.X.2001 (locality 4), 1 female (*paratype*), leg. P. Fontana, F. M. Buzzetti, B. Odè, coll. P. Fontana; Florence province, Firenzuola, 650 m, 17.IX.1995, 1 male (*paratype*), leg. A. Gourov, coll. P. Fontana.

Type locality (Locus typicus restrictus): ITALY, **Emilia Romagna** region, Modena province, Appennino Tosco-Emiliano, SS 486, 3,5 km south of Piandelagotti, 1270 m.

Male description: Living specimens are bright green to olive green-brown with a yellow lateral stripe. Darker colours seem more common later in the season. Not one of the examined specimens shows a dark pattern on the body (figs. 1-4).

Head with acute, moderately prominent fastigium; eyes subspherical, occipital region black.

Pronotum subtrapezoidal, with dilatated and elevated metazona (as

usual in the genus *Ephippiger*), with a moderate variability (figs. 5-16). Pro-, meso- and metazona are clearly divided by typical furrows. The surface of Prozona and mesozona are transversally rugose while the metazona is characterised by more or less longitudinally-areolate sculpture. Tegmina light brown with campus marginalis dark.

Supragenital plate subrectangular to subtrapezoidal, with barely protruding lateral corners (figs. 17-22).

Cerci with subcylindrical basal part and short, conical apical part; inner tooth small, acute and black, inserted at the end of the second third of the total length of the cerci (figs. 23-28).

Subgenital plate trapezoidal, with short styli and a posterior margin with an obtuse to acute incision between them (figs. 29-32).

Titillators, in a dorsal view, with straight apical part, toothed for most of its length. Teeth are not as dense as in *E. vicheti* but there is a moderate variability in their distribution (fig. 33-38). Basal part well developed, sometime reaching just above the apex of apical part; apical part of titillators, in a lateral view, moderately to clearly curved.

Measures are shown in table 3.

Measures	Range	Average	Standard deviation
Total length (from vertex to hind femur apex)	24,48 - 32,13	29,05	2,70
Pronotum length (in a lateral view)	6,47 - 9,18	7,95	1,06
Pronotum maximum width (from above)	7,19 - 9,18	8,26	0,67
Hind femur length	13,70 - 18,66	17,04	1,71
Cerci total length	1,22 - 1,68	1,42	0,17
Cerci basal part length (from base to inner tooth)	0,48 - 0,96	0,73	0,15
Cerci apical part length (from inner tooth to apex)	0,52 - 0,84	0,67	0,10
Cerci width behind inner tooth	0,67 - 0,76	0,70	0,03
Titillator apical part length	1,36 - 1,70	1,47	0,09

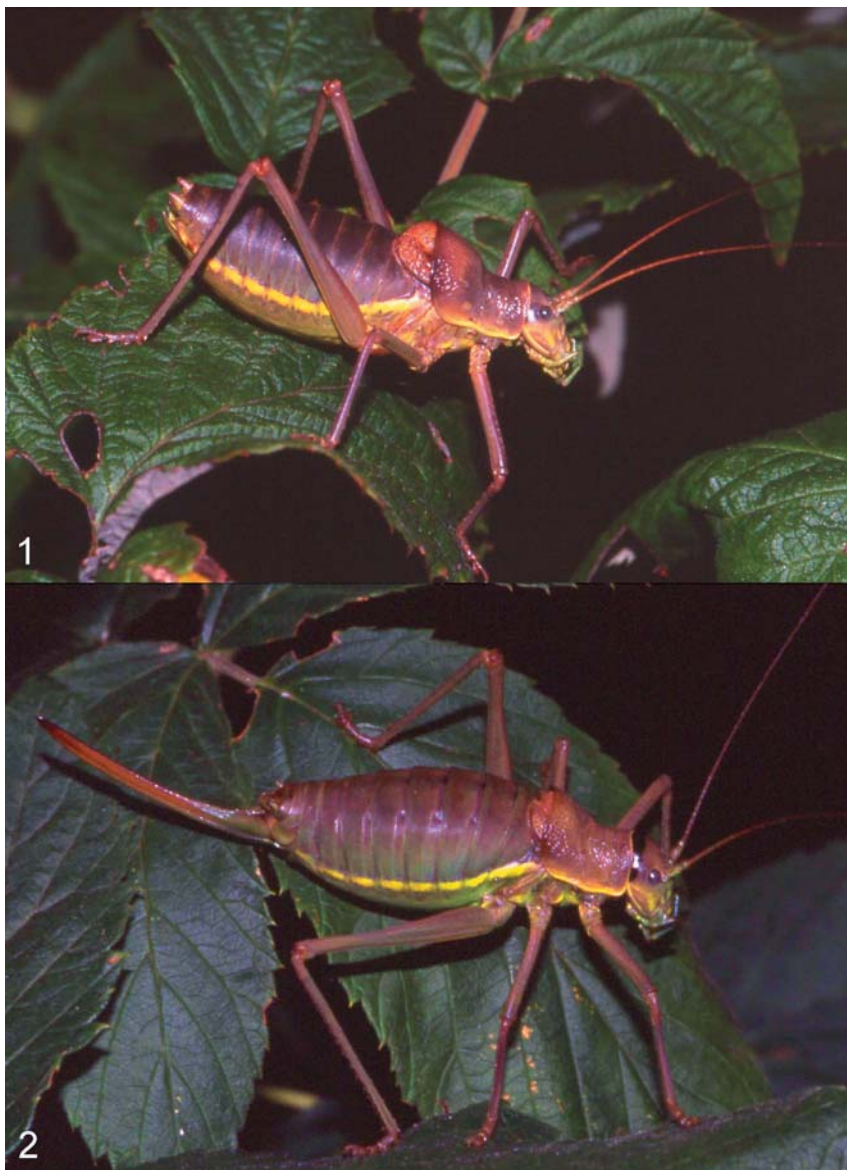
Tab. 3. Main measures (in mm) of *E. carlottae* n. sp. males (based on 10 specimens).

Female description: colour and general features as in the male.

Pronotum subrectangular, slightly dilatated posteriorly but with metazona well elevated (figs. 39-44).

Tegmina barely extending beyond the posterior margin of the pronotum; campus marginalis dark, as in the male.

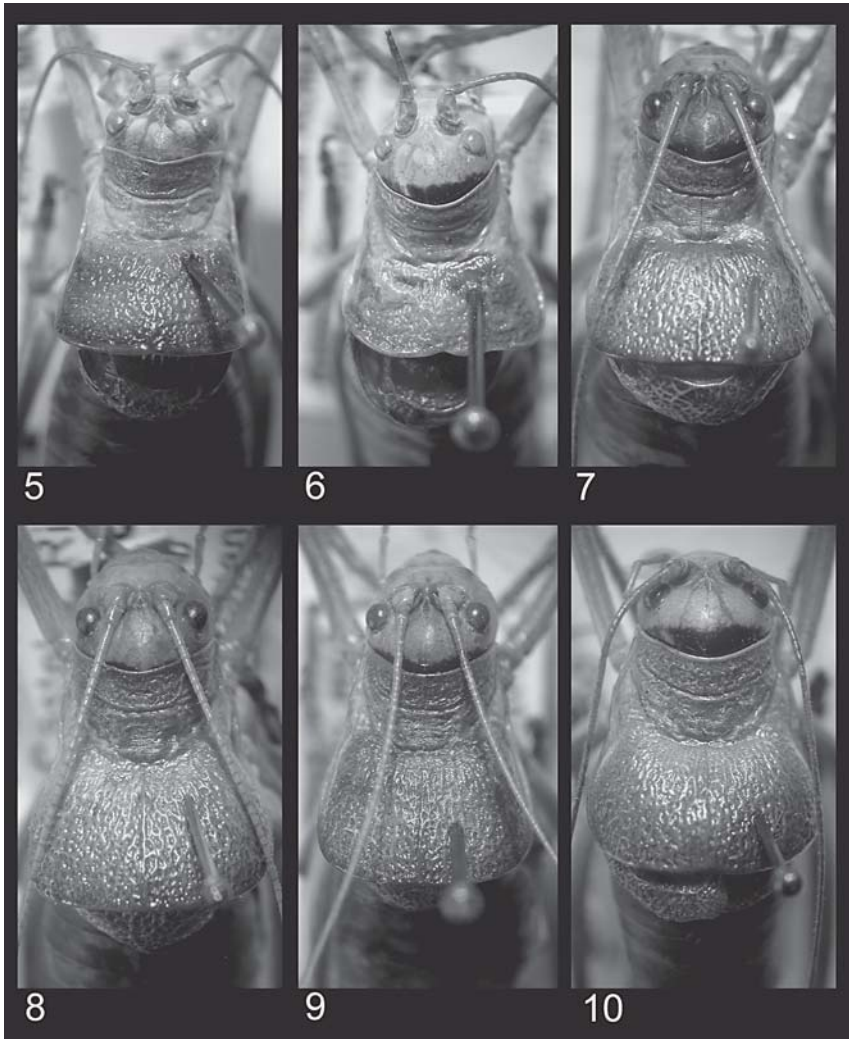
Supragenital plate subtriangular, with rounded apex, with a median longitudinal depression. Cerci conical, shorter than supragenital plate, with a acute apex (fig. 45).



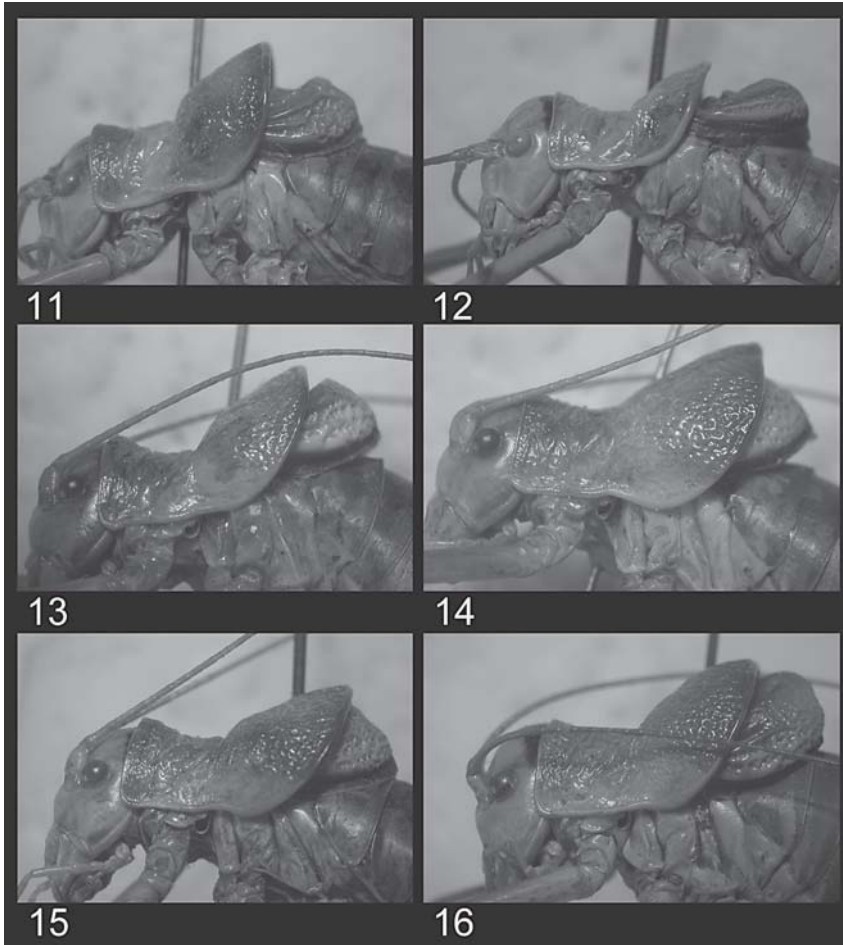
Figs. 1-2. *Ephippiger carlottae* n. sp.: male *holotype* and female *paratypes*, 3,5 km south of Piandelagotti, 1270 m, 01.X.2001. Photos P. Fontana.



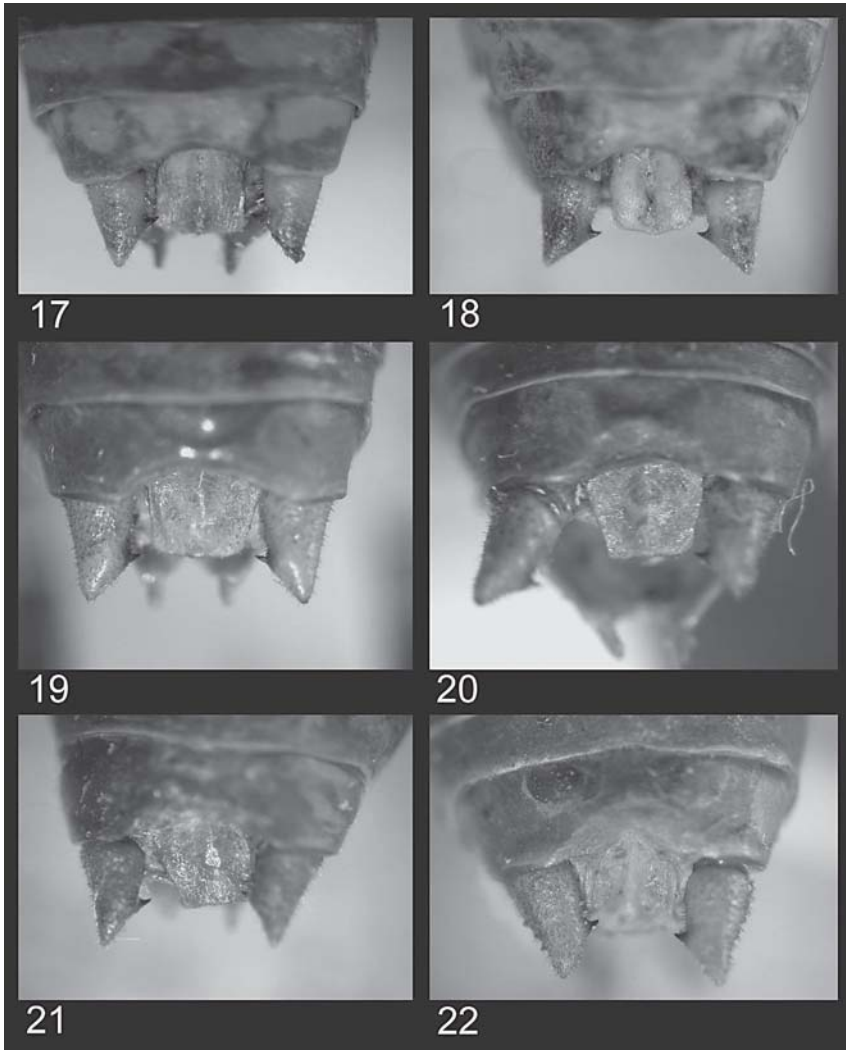
Figs. 3-4. *Ephippiger carlottae* n. sp.: male and female *paratypes*, Castel del Rio, 250 m, VII.2001. Photos P. Fontana.



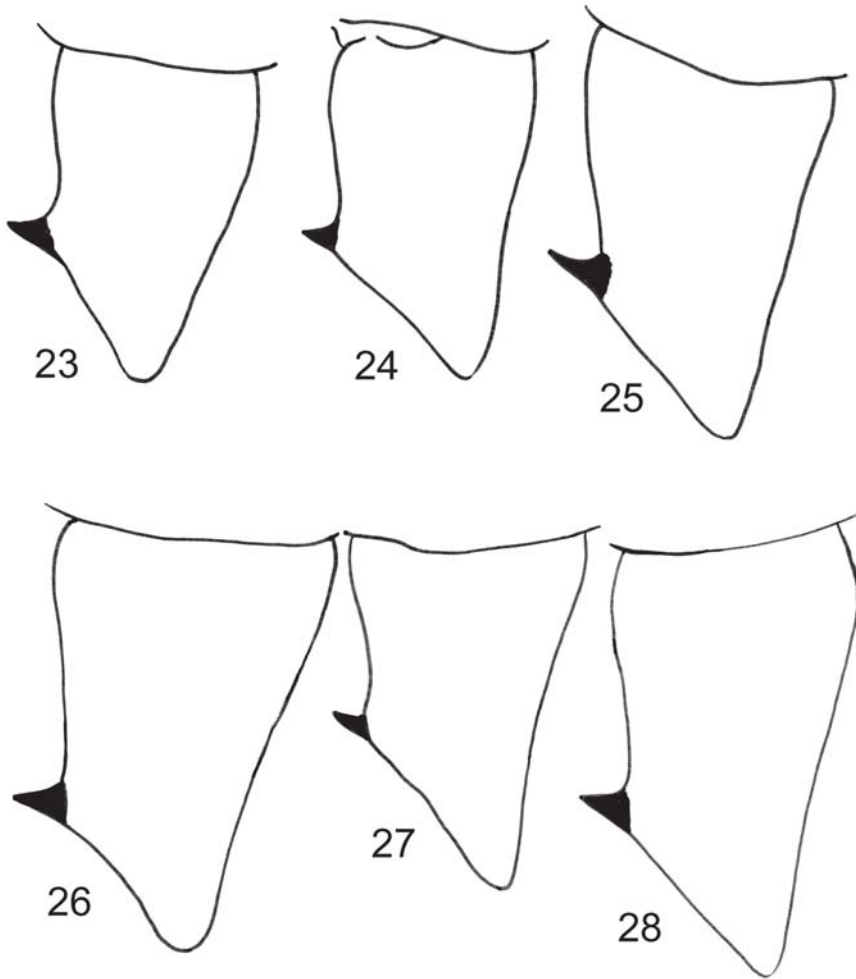
Figs. 5-10. *Ephippiger carlottae* n. sp., male pronotum from dorsal view: fig. 5, *holotype*, south of Piandelagotti; fig. 6, *paratype* (male with teratologic pronotum), same locality; figs. 7, 8, *paratypes*, Castel del Rio; fig. 9, *paratype*, Firenzuola; fig. 10, *paratype*, Mongardino. Photos P. Fontana.



Figs. 11-16. *Ephippiger carlottae* n. sp., male pronotum from left lateral view: fig. 11, *holotype*, south of Piandelagotti; fig. 12, *paratype* (male with teratologic pronotum), same locality; figs. 13, 14, *paratypes*, Castel del Rio; fig. 15, *paratype*, Firenzuola; fig. 16, *paratype*, Mongardino. Photos P. Fontana.



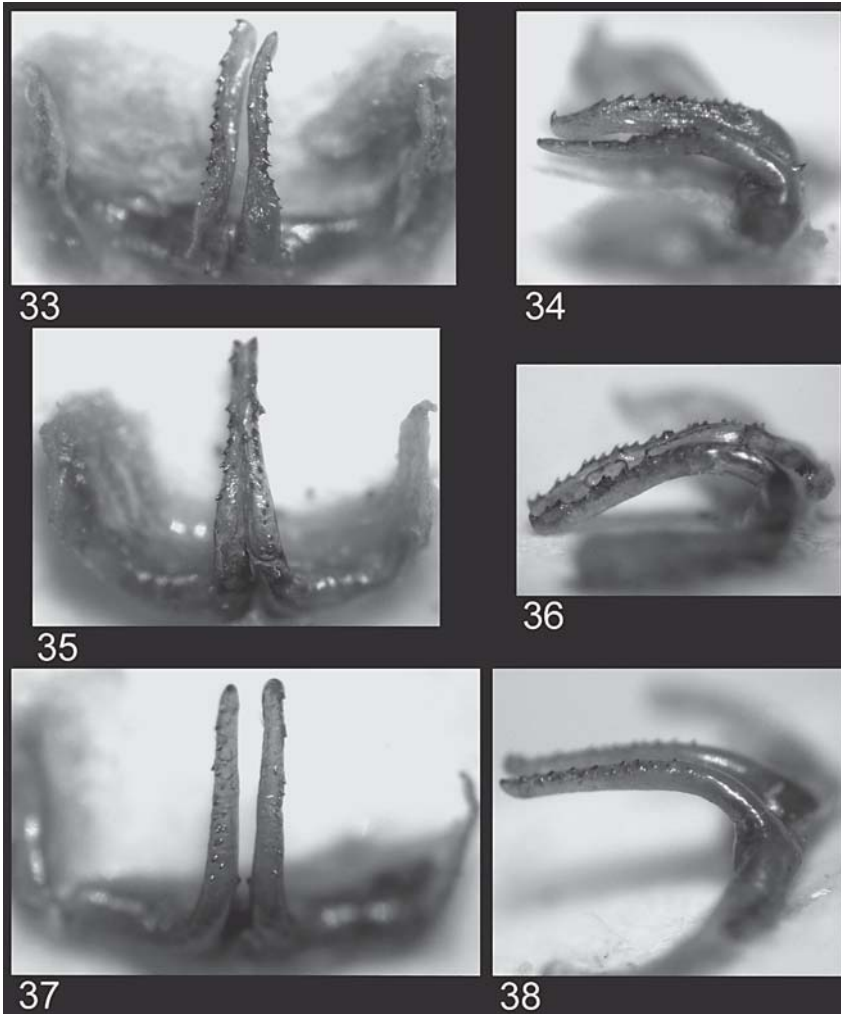
Figs. 17-22. *Ephippiger carlottae* n. sp., male supargenital plate and cerci from dorsal view: fig. 17, *holotype*, south of Piandelagotti; fig. 18, *paratype*, same locality; figs. 19, 20, *paratypes*, Castel del Rio; fig. 21, *paratype*, Firenzuola; fig. 22, *paratype*, Mongardino. Photos P. Fontana.



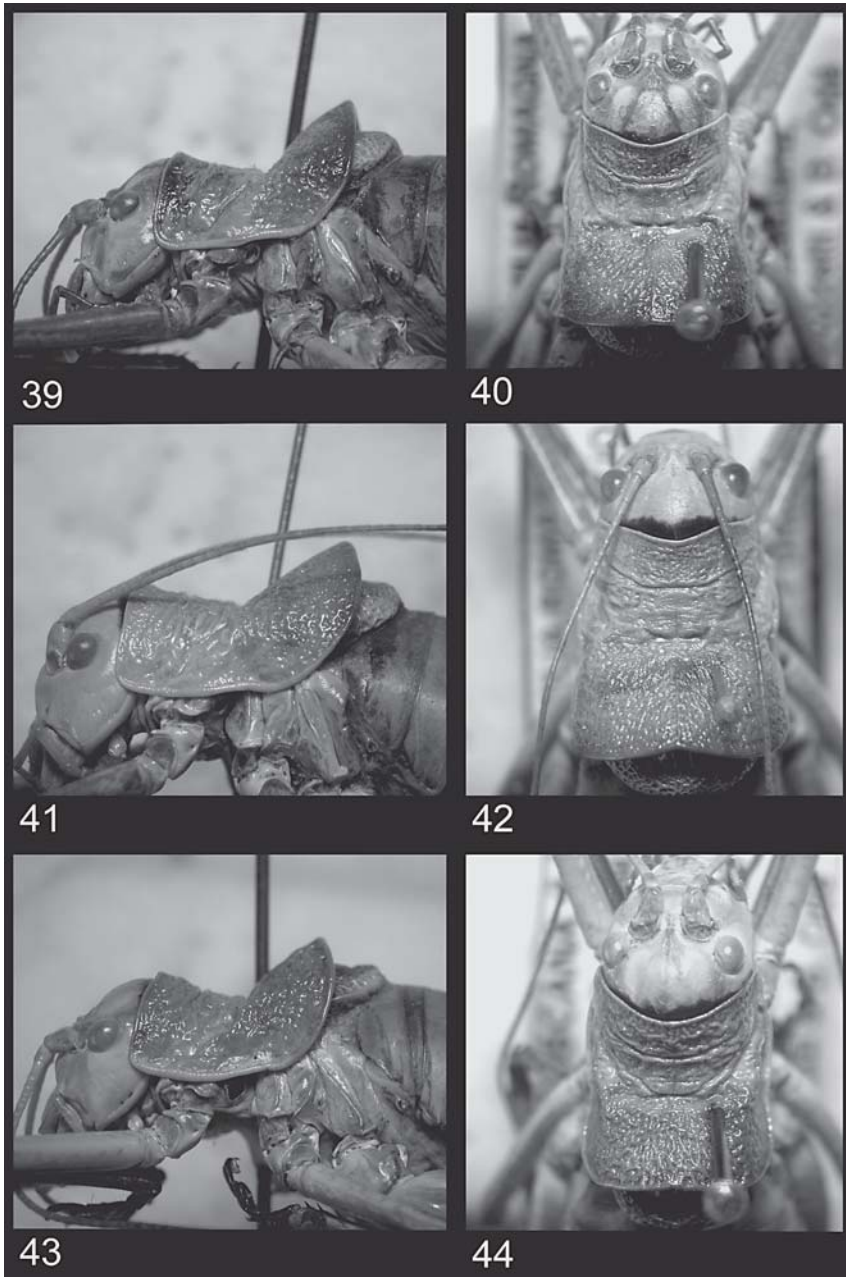
Figs. 23-28. *Ephippiger carlottae* n. sp., male right cerci from dorsal view: fig. 23, *holotype*, south of Piandelagotti; fig. 24, *paratype*, same locality; figs. 25, 26, *paratypes*, Castel del Rio; fig. 27, *paratype*, Firenzuola; fig. 28, *paratype*, Mongardino. Drawings by P. Fontana.



Figs. 29-32. *Ephippiger carlottae* n. sp., male subgenital plate from ventral view: fig. 29, *holotype*, south of Piandelagotti; fig. 30, *paratype*, same locality; figs. 31, 32, *paratypes*, Castel del Rio. Photos P. Fontana.



Figs. 33-38. *Ephippiger carlottae* n. sp., titillators from dorsal and left lateral view: figs. 33, 34, *holotype*, south of Piandelagotti; figs. 35, 36, *paratype*, same locality; figs. 37, 38, *paratype*, Castel del Rio. Photos P. Fontana.



Figs. 39-44. *Ephippiger carlottae* n. sp., female pronotum from dorsal and lateral view: figs. 39, 40, *paratype*, south of Piandelagotti; figs. 41, 42, *paratype*, Castel del Rio; figs. 43, 44, *paratype*, Passo Radici. Photos P. Fontana.

Subgenital plate membranose, with straight to moderately incised posterior margin and two oblique lateral furrows (fig. 46).

Ovipositor slightly curved upwards (figs. 49-51); in most of the specimens one subtriangular dilatation is visible in the basal part of every ventral valve (fig. 47). In living specimens this dilatation probably is covered by the subgenital plate; a situation that has only been observed in one mounted specimen (figs. 48, 51).

Eggs elongated and transversally flattened (fig. 52).

Measures are shown in table 4.

Measures	Range	Average	Standard deviation
Total length (from vertex to hind femur apex)	27,23 - 32,13	29,61	1,71
Pronotum length	6,57 - 8,72	7,29	0,84
Pronotum maximum width (from above)	6,12 - 7,65	6,81	0,55
Ovipositor length	17,59 - 20,65	19,01	1,07
Hind femur length	16,06 - 18,36	16,70	1,29
Egg length	5,20 - 5,50	5,33	0,13
Egg median width	1,07 - 1,68	1,32	0,17

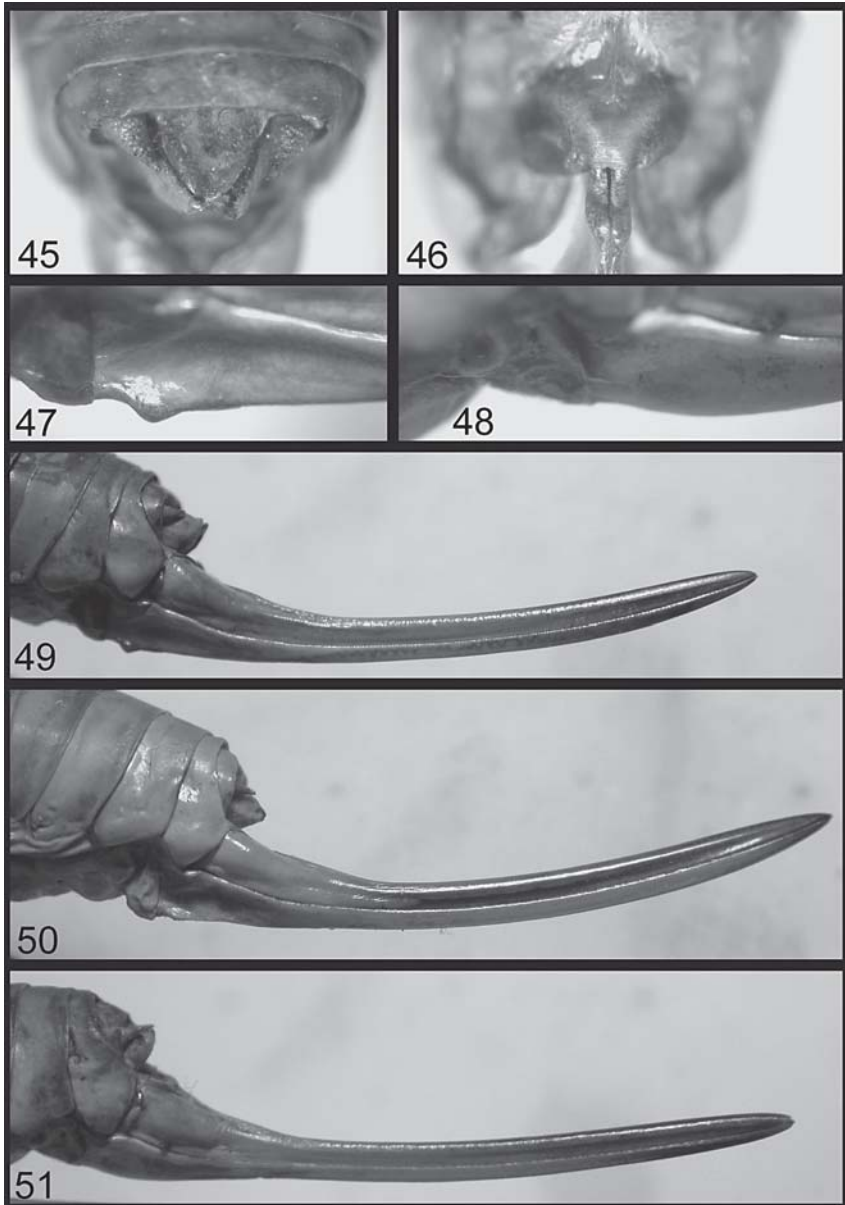
Tab. 4. Main measures (in mm) of *E. carlottae* n. sp. females (based on 7 specimens and 10 eggs).

Derivatio nominis: the new species is named after Carlotta Fontana, the 6 years old daughter of the first author, for her active help in entomological excursions and for her enthusiasm for insects and the whole animal kingdom.

BIOACOUSTICS

Song of *Ephippiger carlottae* n. sp. was recorded between 2000 and 2001 in the laboratory. Males were recorded separately to restrict interactions. A digital recorder with condenser microphone was used and sampled fragments (44.1 kHz, 16 bits) from the recordings were analysed.

The song terminology follows RAGGE & REYNOLDS (1998): *Calling song* (the song produced by an isolated male); *Syllable* (the sound produced by one complete opening and closing movement of the fore wings); *Hemisyllable* (the sound produced by one unidirectional movement (opening or closing) of the fore wings); *Echeme* (a first-order assemblage of syllables).



Figs. 45-51. *Ehippiger carlottae* n. sp., female: figs. 45, 46, *paratype*, south of Piandelagotti, supra- and subgenital plates; fig. 47, *paratype*, south of Piandelagotti, subgenital plate and ovipositor basal portion from left lateral view; fig. 48, *paratype*, south of Piandelagotti, subgenital plate and ovipositor basal portion from left lateral view; fig. 49, *paratype*, south of Piandelagotti, ovipositor from left lateral view; fig. 50, *paratype*, Castel del Rio, ovipositor from left lateral view; fig. 51, *paratype*, Passo Radici, ovipositor from left lateral view. Photos P. Fontana.

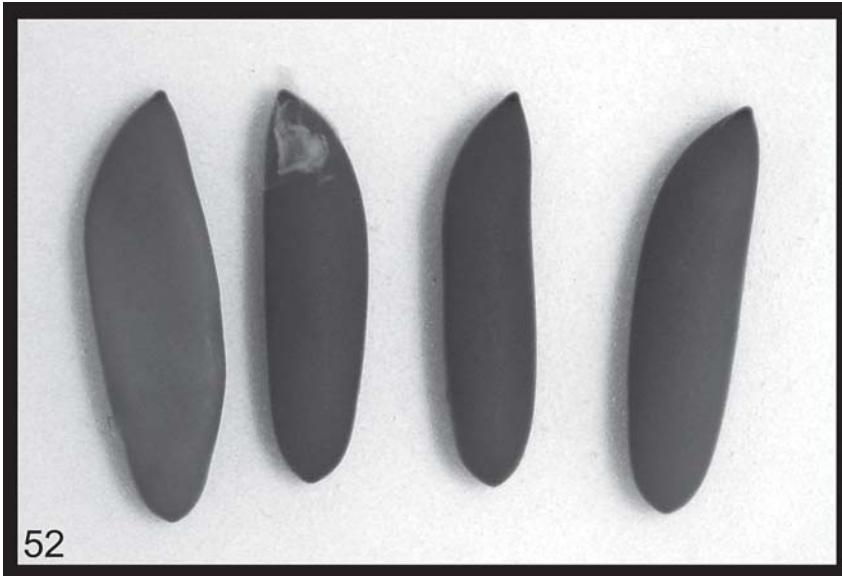


Fig. 52. *Ephippiger carlottae* n. sp., eggs extracted from a *paratype* female, south of Piandelagotti. Photo P. Fontana.

The calling song of *Ephippiger carlottae* n. sp. is very similar to the song of the *E. ephippiger* group. It consists of a series of single syllables, repeated at intervals of about 1-2 s. Syllables occur either single (Fig. 53 A1-2, B1-2) or may be grouped in a simple echeme of two syllables (Fig. 53 A3-4, B3-4). Syllables last for about 100-200 ms and clearly consist of a weaker and shorter opening hemisyllable and a louder and longer closing hemisyllable. In the closing hemisyllable about 50 peaks may be visible, each corresponding with a single tooth stroke of the stridulatory file.

Variation in the number of syllables grouped into echemes is well known within *Ephippiger ephippiger*, even within populations. In Western Europe the song of the northern populations of *Ephippiger ephippiger* usually consists of single syllables, whereas southern populations generally group syllables into short echemes (DUIJN, 1990).

Twosyllabic echemes in *Ephippiger carlottae* n. sp. may occur more frequently at higher temperatures and with social interaction, but our recorded material so far is insufficient to verify this.

DISTRIBUTION

Ephippiger carlottae n. sp. at present appears to be endemic in the Northern Apennine, more specifically from eastern Appennino Ligure to the Appennino Tosco-Emiliano, where it has been found in the Modena, Bologna, Parma, Piacenza (Emilia Romagna region), Lucca and Florence (Tuscany) provinces (fig. 54).

ECOLOGY

E. carlottae n. sp. is a bush-cricket typically living on bushes of *Rubus* spp. or on ferns (*Pteridium aquilinum*) along the wood borders or on bushy slopes and in bushy meadows (fig. 55). It must be considered an ecotone species, that sometimes penetrates abandoned meadows, when *Rubus* (especially *Rubus idaeus*) or ferns begin to invade them. *E. carlottae* n. sp. is a montane to submontane species that occurs at altitudes between 250 to 1350 m and prefers fresh and moderately wet habitats. It often lives with *Pholidoptera aptera goidanichi* Baccetti, 1963, *Eupholidoptera chabrieri chabrieri* (Charpentier, 1825) and *Nemobius sylvestris* (Bosc, 1792).

CONCLUSIONS

E. carlottae n. sp. is a well characterised species: the main morphological characters are detectable in all the specimens we studied, coming from a wide range of localities and environmental conditions. It thus is easily discernable from all the Italian species of the genus, especially in comparison with the taxa of the *Ephippiger ephippiger* group. A reliable identification is possible with the combination of characters of the subrectangular supragenital plate, without lateral expansions, the stout and short cerci with short apical part and the shape of the

Fig. 53 (A-B). Oscillograms of the song of four male specimens of *E. carlottae* n. sp. (A: overview of 10 s; B: detail of 500 ms): 1, ITALY, Emilia Romagna region, Modena province, Appennino Tosco-Emiliano, SS486, 3,5 km south of Piandelagotti, 1270m 01.X.2001, *holotype*; 2, idem, *paratype*; 3, ITALY, Emilia Romagna region, Bologna province, Appennino Tosco-Emiliano, Castel del Rio, 250_m, 13.VI.2000, *paratype*; 4, idem, *paratype*. 1-2: studio recording by B. Odé, 22 ÚC; 3-4: studio recordings by P. Fontana, 26 ÚC. Oscillograms by B. Odé.

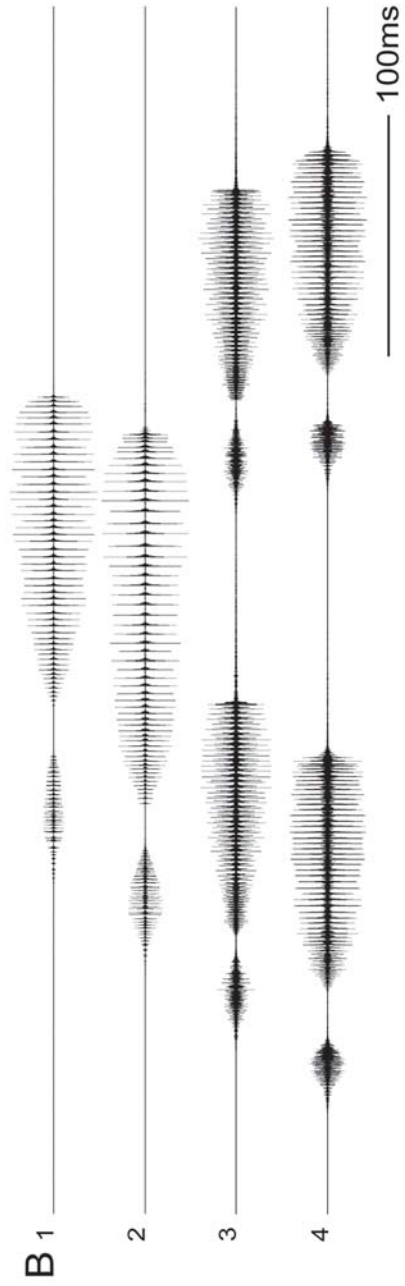
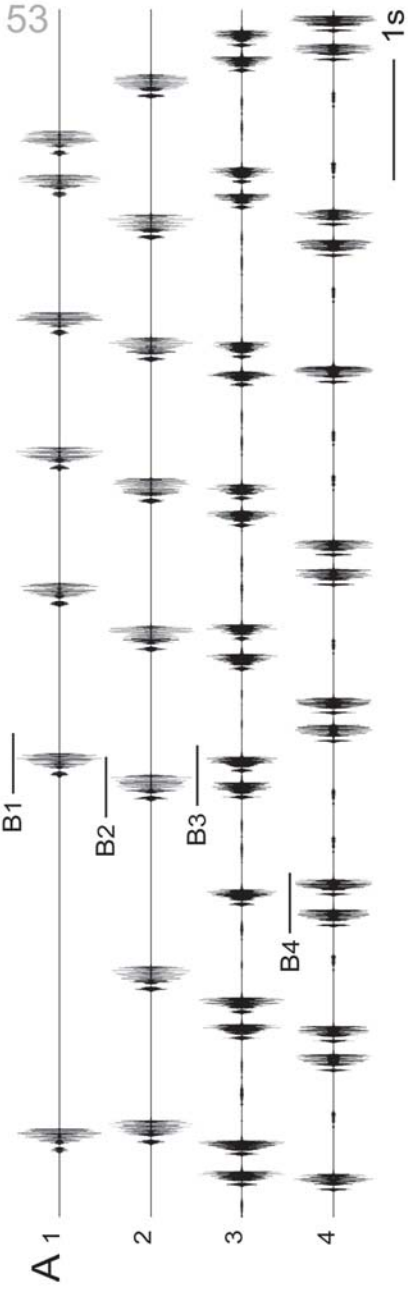




Fig. 54. *Ephippiger carlotta* n. sp., distribution map: 1, Passo Penice; 2, Varano dé Melegari; 3, Mongardino; 4, Grizzana Morandi; 5, south of Piandelagotti (*Locus typicus restrictus*); 6, Castel del Rio; 7, Passo Radici; 8, Camugnano; 9, Firenzeuola.

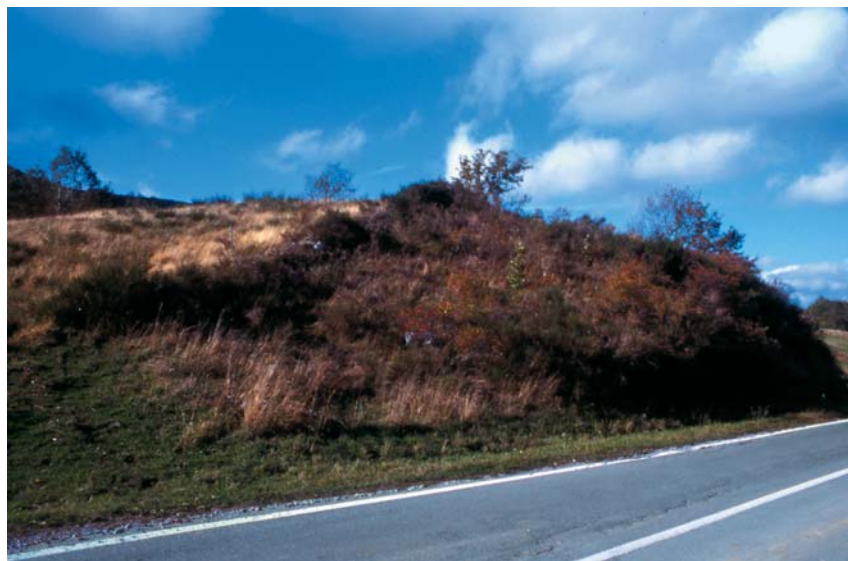


Fig. 55. *Ephippiger carlottae* n. sp., habitat at the *locus typicus restrictus*, Emilia Romagna region, Modena province, Appennino Tosco-Emiliano, SS 486, 3,5 km south of Piandelagotti, 1270 m, 01.X.2001. Photo F. M. Buzzetti.

titillators. The shape of pronotum and the general colour cannot be used for identification. Also the song is no useful character to distinguish *E. carlottae* n. sp. from many other taxa within the genus. Hearing the song nevertheless is an important tool to locate populations. We easily detected the species along the main roads that cross the Apennine, hearing the metallic male songs from the car. The beginning of October seems a good time to find the species this way.

The presence of a separate species of the *Ephippiger ephippiger* group in Northern Apennine confirms the penetration of this group in the Italian peninsula, that reached Sicily, where it produced, after isolation, *E. camillae* Fontana & Massa, 2000. A possible third taxon of the *Ephippiger ephippiger* group has been recorded from the southern Apennine (Gran Sasso mountain: M. San Franco) (LAURENZI & OSELLA (1996)). It has been identified by Marcello La Greca (La Greca, pers. comm.) on the basis of one specimen. This specimen could further confirm this penetration, but unfortunately has not yet been studied by us. The presence in Italy of possibly four distinct species of the *Ephippiger ephippiger* group and the presence of many other endemic taxa of the genus suggests a rich, not yet disclosed evolutionary history of the genus south of the Alps.

ACKNOWLEDGEMENTS

We would like to thank Klaus-Gerhard Heller (Erlangen, Germany) for providing very interesting material of different taxa of the *Ephippiger ephippiger* group and for suggesting important literature on this topic. Many thanks to Bruno Massa (Università di Palermo, Italy), Andrej Gourov (Padova, Italy) and Stefano Beretta (Vicenza, Italy) for providing material too, and to our dear friend Filippo Maria Buzzetti (Università di Padova, Italy) for accompanying us in collecting some of the type specimens of *E. carlottae* n. sp. and placing at our disposal the nice photo of the habitat.

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Indirizzi degli autori:

- Dr. Paolo Fontana, Università di Padova, Dipartimento Agronomia Ambientale e Produzioni Vegetali, (Entomologia), AGRIPOLIS, viale dell'Università, 16 - I-35020 Legnaro (Padova), Italia
e-mail: paolo.fontana@unipd.it
- Dr. Baudewijn Odé, P.C. Hoofstraat, 149 - NL-1071 BT Amsterdam, Olanda
e-mail: baudewijn.ode@hetnet.nl
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