

A review of the genus *Platycleis* Fieber, 1853 (Orthoptera: Tettigoniidae) in the Maltese Islands

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ABSTRACT. The presence of the genus *Platycleis* in the Maltese Islands is reviewed on the basis of existing literature and specimen records from research collections. Of the five species treated, three - *Platycleis affinis* Fieber, *P. intermedia* (Serville), and *P. sabulosa* Azam - are confirmed and two – *P. albopunctata* (GOEZE) and *P. grisea* (FABRICIUS) - are rejected, based on morphometric and anatomical assessment.

KEY WORDS. Platycleidini, Malta, biometrics, habitat fragmentation, biodiversity conservation.

INTRODUCTION

The genus *Platycleis* Fieber, 1853 is represented across much of the Palaearctic, comprising, sensu stricto, some thirty species (CIGLIANO *et al.*, 2020) that occur within a fairly broad range of habitat-types; diverging opinions among taxonomists have led to various taxa of the tribe Platycleidini Brunner von Wattenwyl, 1893 being accorded subgeneric rank within *Platycleis*, thus inflating the number further (MASSA & FONTANA, 2011). Within the Mediterranean Basin, where the genus is fairly widespread, species mostly occur in steppe and other xeric environments. Some are also known to occur in mesic habitats that harbour dense shrubbery, on agricultural and marginal land, as well as within the aerohaline subzone of coastal locations. The nearest landmass, Sicily, with which the Maltese Islands were physically connected (albeit intermittently) via a terrestrial corridor during Pleistocene lowstands, boasts of no less than seven species, among them two endemics (MASSA *et al.*, 2012; IORIO *et al.*, 2019). Apart from the disparity in spatial extent, Sicily also supports a far greater habitat gradient than the Maltese Islands, primarily due to the presence of perennial fluvial systems, an altitude that extends beyond the thermo-Mediterranean zone and a prevailing rich array of soil-types (CASSAR *et al.*, 2008; CASSAR, 2010). Such factors result in a considerably richer floral and habitat diversity.

To-date, the genus *Platycleis* has not been afforded exclusive attention in the scientific literature relating to the Maltese Islands. Early works (VALLETTA, 1954, 1955; LANFRANCO 1955) dealt with the Order Orthoptera as a whole and, consequently, both authors included *Platycleis affinis* Fieber, 1853 in their respective lists. BACCETTI (1973), in a publication based on a field visit in 1972 to the main three islands, namely, Malta, Gozo and Comino, dismissed the presence of *P. affinis* as a misidentification, further citing the presence of *Platycleis intermedia* (Serville, 1838) on both the islands of Gozo and Comino. CILIA (1976), in a contribution to the local popular press, entitled “Grasshoppers, Locusts and Bush Crickets Part 1”, listed *Platycleis affinis*; this article presumably relies on secondary literature. SCHEMBRI & EBEJER (1983), in their review of Maltese Tettigoniidea, listed *Platycleis grisea*, *P. affinis*, and *P. intermedia*. Moreover, the authors referred to the views

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expressed by BACCETTI (1973) on the question of *P. affinis* and verified that the specimen in Valletta's collection had, on re-examination, been correctly assigned to *P. affinis* (SCHEMBRI & EBEJER, 1983). The present author, in a paper entitled "Notes on rare and infrequent Orthoptera of the Maltese Islands" (CASSAR, 1990), listed *Platycleis albopunctata*. The specimens in question were determined by a taxonomist at the BMNH, who had, at the time, expressed some concern in respect to the nomenclatorial discordance associated with *P. grisea* and *P. albopunctata*, but was inclined to follow HARZ (1969), despite marked anatomical divergences (W.J. Reynolds, *pers. comm.*, 1985; CASSAR, 1990). It should nonetheless be noted that these are somewhat difficult species to separate and while some scientific workers consider *grisea* a subspecies of *albopunctata* (WILLEMSE, KLEUKERS & ODÉ, 2018), others treat the two as separate species in view of discernible anatomical characters, such as the shape of the female subgenital plate and ovipositor and the male titillators (HARZ, 1969; MASSA *et al.*, 2012).

Evidently, some species of *Platycleis* can be very similar in appearance (Fig. 1), especially to the naked eye, making it quite challenging to determine one species from another without resorting to a thorough biometric examination. Even this approach is not considered completely fail proof, since morphological features have been found to vary considerably within and among species, for example, as a result of environmental conditions and genetic factors. Two reliable methods to determine Platycleids include (i) anatomical assessment, which in male specimens would require dissection of the terminalia, while determination in females can be minimally invasive, through the use of an appropriately powered hand-lens or microscope in the field or laboratory; and (ii) bioacoustics assessment, which entails relatively non-intrusive audio recording of in situ stridulation (sound communication) by means of specialised equipment. Different species of Orthoptera produce distinct sounds through the process of stridulation or crepitation, the echeme-sequence (chirping) of which is unique to each individual species (RAGGE, 1990; ROBINSON & HALL, 2002).



Figure 1: An undetermined *Platycleis* male specimen (not collected) at a site on the Dingli clifftop (11.vi.2008. Photo: G. Bonett).

MATERIALS AND METHODS

This contribution is based upon published records (reviewed in the introduction above), as well as on data included in specimen labels within historical and research collections. Some of the more interesting specimens in the Orthoptera collection of Anthony Valletta were given to the present author shortly before the gentleman passed away, while between 2005 and 2009, a number of collections consisting of dry-preserved local orthopterous fauna were donated to the author by Guido Lanfranco, Guido Bonett and Stephen P. Schembri, respectively. This allowed for a thorough anatomical and biometric examination of the specimens contained therein, including numerous examples of *Platycleis*. In addition to the records published in SCHEMBRI & EBEJER (1983), 54 *Platycleis* specimens, comprising the afore-mentioned donated material and the author's own specimens, together with other specimens loaned for the purpose, were re-examined. Procedures entailed both 'naked eye' biometric assessment, using an electronic digital caliper (resolution: 0.01mm/accuracy: ± 0.02), and the use of a trinocular stereo zoom microscope (8 \times -50 \times) fitted with a 12 MP digital camera. In some cases, male specimens were dissected with a view to examine anatomical characters, in particular, the titillators. Tissue maceration of these sclerotized copulatory structures, considered key taxonomic characters in determining *Platycleis* species, was carried out using KOH solution; subsequently, the titillators were mounted for examination under the microscope. The species listed below follow the classification and systematic order applied in MASSA *et al.* (2012) and IORIO *et al.* (2019); consequently, *Platycleis albopunctata* and *P. grisea* were treated as separate species. The species list presented in the results section comprises only unpublished data, while previously published records are represented by means of relevant citations (Literature records) for each species; all these records², numbering 72, were subsequently integrated into a records' distribution map for the Maltese Islands (Fig. 7), which was produced with QGIS, an open-source geographic information system application. Where deemed appropriate, annotations were included, as in the case of *P. albopunctata* and *P. grisea*. Material examined is only listed for confirmed species, while specimen data of rejected taxa is included with the species under which these have been assigned. Information on the distribution of individual Platycleid species included in the results section was mainly adapted from Orthoptera Species File (OSF) V.5.0/5.0 (CIGLIANO *et al.*, 2020), but also referred to MASSA (2011), MASSA *et al.* (2012), and IORIO *et al.* (2019). All material examined is deposited in the present author's collections, with the exception of seven loaned specimens collected by Thomas Cassar, which are now housed in the latter's private collection. Collectors (leg.) are abbreviated as follows: Carmel J Aquilina – CJA; Guido Bonett – GB; Louis F Cassar – LFC; Thomas Cassar – TC; Guido Lanfranco – GL; Stephen P Schembri – SPS.

RESULTS

On the basis of morphometric and anatomical assessment, five species of *Platycleis* are treated in this contribution, of which three are confirmed (*Platycleis affinis*, *P. intermedia* and *P. sabulosa*), and the remaining two species (*P. albopunctata* and *P. grisea*) are rejected.

²The map excludes any records listed by BACCETTI (1973) for Malta and Gozo, since the said author failed to include the names of localities for species he encountered. In the case of the island of Comino, however, Baccetti had concentrated his efforts around Santa Maria and Wied l-Ahmar (Baccetti *pers. comm.*, 1999).

Platycleis affinis Fieber, 1853

Literature records: VALLETTA, 1954; LANFRANCO, 1955; CILIA, 1975; SCHEMBRI & EBEJER, 1983; CASSAR, EBEJER & MASSA, 2020.

Material examined. MALTA: Wied Mejxu, 11.v.1952, 1♂ (GL); Wied Incita, 25.v.1952, 1♂ (GL); Ghadira sand dune area, 17.vi.1983, 1♂ (LFC); Dingli, 17.v.2015, 1♂ (TC); Girgenti, 01.vi.2014, 1♀ (TC); 28.vi.2015, 1♂ (TC).

Distribution: Fairly widespread across the Western Palaearctic, particularly in the region's southern segment, including much of the Mediterranean; it also extends eastward into and beyond the Irano-Turanian subregion.



Figure 2: *Platycleis affinis* - Female subgenital plate and sternite VII (Italy: Latium, Castelporziano, 27.vii.2004, leg. P. Maltzeff, coll. B. Massa).

Platycleis albopunctata (Goeze, 1778)

Literature records: CASSAR, 1990; CASSAR, EBEJER & MASSA, 2020.

Rejection of records on the basis of anatomical examination of the specimens' titillators.

Annotation: 2 ♂♂ were reported (CASSAR, 1990), which were subsequently re-examined anatomically and biometrically by the present author for the purpose of this review. Genital

structures of both specimens were dissected, prepared and examined under the microscope, on the basis of which, both individuals have been assigned to *Platycleis sabulosa* Azam, 1901. It may also be of interest to note that *P. albopunctata* does not occur within the central Mediterranean area (MASSA *et al.*, 2012; IORIO *et al.*, 2019).

Distribution: Western Europe, including parts of the Mediterranean and the Black Sea, but excluding much of the Italian peninsula (with the exception of a single locality in Piedmont, in northwest Italy at the foot of the Alps) and the central Mediterranean area. It is also known from the Eastern Palaearctic, where it maintains a patchy presence.

Platycleis grisea (Fabricius, 1781)

Literature records: SCHEMBRI & EBEJER, 1983; CASSAR, 1990; CASSAR, EBEJER & MASSA, 2020.

Rejection on the basis of taxonomic re-examination of Ghadira specimen.

Annotation: 2 ♀♀ were reported, respectively from Balzan and Ghadira (SCHEMBRI & EBEJER, 1983). The Ghadira specimen (which was included in the material donated by S.P. Schembri) was re-examined by the present author and it transpired that this specimen was *P. sabulosa*. The Balzan specimen, on the other hand, was not available for re-examination; it was not included in the material donated by Schembri and nor was it traced in the collection of his co-author, Martin Ebejer (Ebejer *pers. comm.*, 2020; CASSAR, EBEJER & MASSA, 2020). Until new evidence to the contrary comes to light, it is hypothetically presumed that this was a case of misidentification.

Distribution: A Mediterranean species with a fragmentary presence within the Basin. It is notably absent from the Hyblean plateau in Sicily, as also from the circum-Sicilian islands, and is restricted to high elevation montane ecosystems in north-eastern Sicily.

Platycleis intermedia intermedia (Serville, 1839)

Literature records: BACCETTI, 1973; SCHEMBRI & EBEJER, 1983; CASSAR, 1990; CASSAR, EBEJER & MASSA, 2020.

Material examined. MALTA: Bahar ic-Caghaq, 14.viii.1972, 1♀ (GB); Wied Incita, 22.vi.1975, 1♀ (SPS); Buskett, 10.x.1982, 1♂ (SPS); v.1983, 2♂♂5♀♀ (SPS); Ghadira – xero-halophile assemblage, 03.viii.1976 1♀ (LFC); vii.1984, 2♂♂2♀♀ (LFC); Gharghur, 15.vi.1983, 1♀ (LFC); Ghadira marshland, 19.vii.1977, 1♂ (SPS); Wied is-Sewda, 13.v.1978, 1♂ (SPS); 14.v.1978 2♂♂ (SPS); Zabbar, v.1983, 5♀♀ (SPS); Salina, 04.vii.1989, 1♀ (SPS); Dingli, 29.ix.2013, 2♀♀ (TC); Gircanti, 27.ix.2015, 1♀ (TC); Bahrija, 03.x.2015, 1♀ (TC). GOZO: Ta' Sarraflu, v.1983, 1♀ (SPS).

Distribution: Widespread across much of the Palaearctic region. It occurs in many parts of the Mediterranean, ranging from the Iberian Peninsula and Morocco to Anatolia, including Sardinia, southern Italy, Sicily, and most of its surrounding islands.



Figure 3: *Platycleis intermedia intermedia* ♀ detail of subgenital plate and sternite VII (Malta: Zabbar, v.1983, leg. SPS; coll. LFC).

***Platycleis sabulosa* Azam, 1901**

Literature record: CASSAR, EBEJER & MASSA, 2020.

Material examined. MALTA: Bahar ic-Caghaq, 17.vii.1969, 1♀ (GL); Buskett woodland, 09.viii.1972, 3♂♂ (GB); 14.viii.1972, 1♂ (GB); Buskett – Wied il-Luq, 24.ix.1978, 2♂♂ (CJA); Bahrija Valley, 25.vii.1978, 2♂♂1♀ (SPS); Madliena, vi.82, 1♂ (LFC); Ghadira marshland, 09.viii.1977, 1♀ (SPS); Ghadira marshland, 01.vii.1983, 1♀ (LFC); Salina marshland, vi.1990, 1♂1♀ (LFC). **GOZO:** Ic-Cnus clifftop, 08.v.1977, 1♀ (LFC). **COMINO:** Santa Maria Bay hinterland, 19.viii.1977, 1♀ (SPS).

Annotation: It should be noted that although biometric assessment can be quite useful, reliance upon morphological (including anatomical) characters tends to be more dependable (Figures 4 - 6b). In fact, it was noted that some biometric features of a small number of specimens did not match up with the conventional morphometric range proposed in MASSA *et al.* (2012) and IORIO *et al.* (2019).

Distribution: Characteristically Mediterranean, extending across both sub-Basins from the Iberian Peninsula to Israel; the species is also present on all the islands of the Canaries. It is known to occur in southern Italy, Sardinia, Sicily, and Linosa.

The data of specimens referred to in figures 4, 5a, 5b, 6a and 6b are reported as new records in CASSAR, EBEJER & MASSA (2020), and included in the distribution map (Fig. 7).

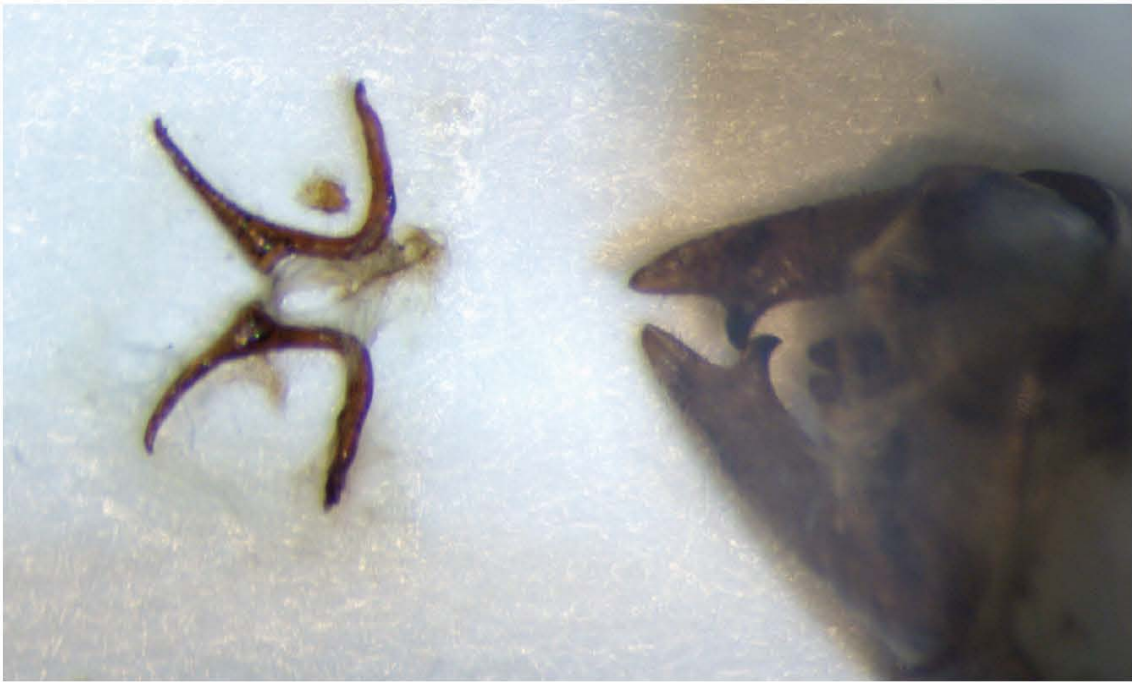


Figure 4: *Platycleis sabulosa* ♂ titillators and terminalia, showing cercus and inner tooth (Malta: White Tower Bay, 10.x.2017, leg. et coll. LFC).



Figures 5a-b: *Platycleis sabulosa* ♀. **a**; ventral view of subgenital plate and sternite VII. **b**; detail of sternite VII (Malta: Ghadira, 10.vi.1976, leg. SPS; coll. LFC).



Figures 6a-b: *Platycleis sabulosa* ♀. **a;** lateral view of terminalia. **b;** detail of subgenital plate and sternite VII [R] (MALTA: Buskett, 01.viii.1972, leg. GB; coll. LFC).

DISCUSSION AND CONCLUSIONS

The map (Fig. 7) shows where the three species in question, that is, *Platycleis affinis*, *P. intermedia* and *P. sabulosa*, have, so far, been recorded within the Maltese Islands. From the onset, it ought to be pointed out that the majority of these records were related to chance encounters or happenstance, since field visits were normally carried out in virtue of ease of accessibility or site partiality by the various scientific fieldworkers. The data, therefore, comprises a somewhat incomplete representation of distribution patterns of the Platycleid species that occur within the Maltese Islands and, consequently, additional fieldwork in other locations is merited, particularly on Gozo and in various other areas on mainland Malta.

From data collected thus far, *P. affinis* appears to be the least common of the three species and has only been encountered on the main island. Records also indicate that adults were only taken between May and June, with no recorded encounters later in the year. *P. intermedia* and *P. sabulosa* were recorded from all three inhabited islands (Malta, Gozo and Comino), with the former species having the more widespread distribution. *P. sabulosa*, which was initially identified by P. Canastrelli from S.P. Schembri's collection but never published, occurs in both coastal locations (as is the case in neighbouring Sicily and southern Italy) and in wooded locations (as is the case in Sardinia) such as Buskett, where sclerophyll woodland predominates (IORIO *et al.*, 2019).

Systematic field observations and monitoring can yield worthy information to better understand the status and distribution of species of this genus across the Maltese Islands. The use of specialised field recording equipment for bioacoustics may prove useful since such technique also limits disturbance a great deal. Although it is not the objective of the present contribution to quantify richness and abundance of *Platycleis* species in the Maltese Islands, without a doubt Platycleids have declined over the last decades. The reasons for this are various, but the more palpable causes would include: (i) obliteration of suitable habitats; (ii) habitat fragmentation, ranging from biotope break-up and increased edge effect to encroachment by light pollution as well as by persistent, bioaccumulative, and toxic contaminants used in agriculture in the recent past; (iii) changes in weather patterns, leading to a lack of naturally-occurring water in the system; and, (iv) a prolific increase in chameleon (*Chamaeleo chamaeleon*) numbers - this highly adaptable predatory lizard was introduced intentionally in historical times and is now quite widespread across a variety of habitats, where it effectively preys on invertebrates and even small reptiles both on the ground and within shrubbery.

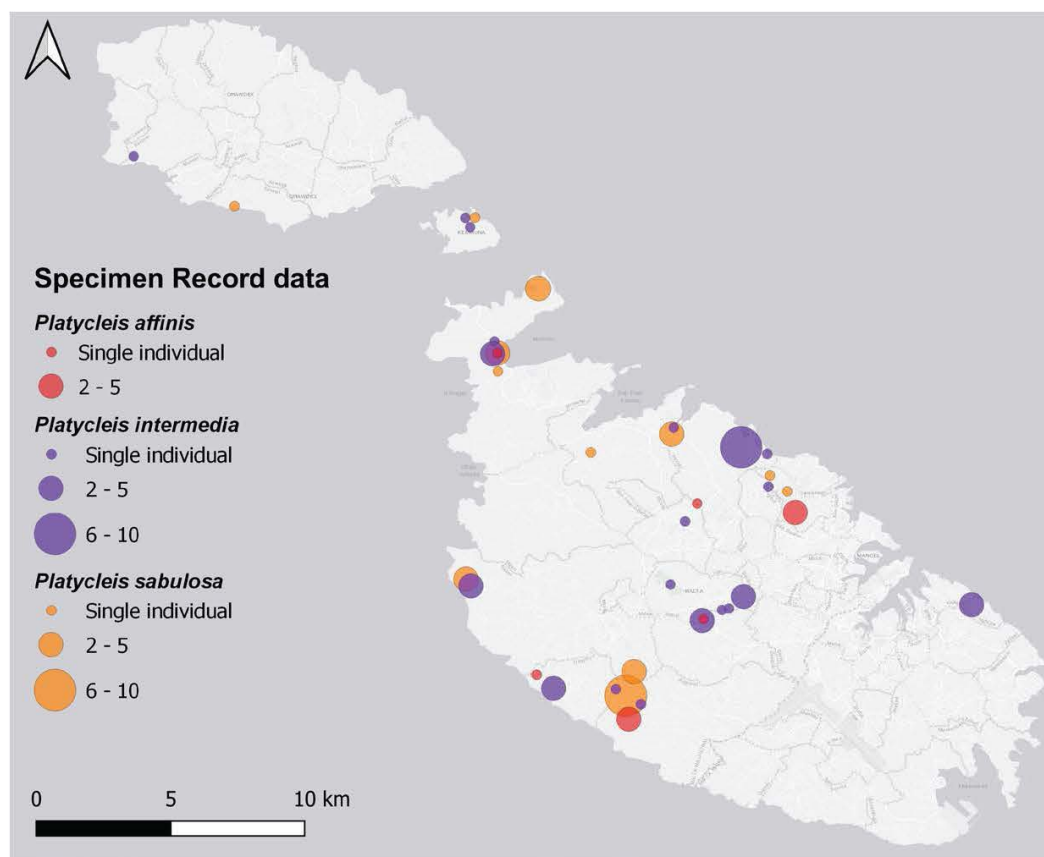


Figure 7: Map of the Maltese Islands showing approximate locations where specimens were recorded.

The attendant impacts from degradation and encroachment are already quite evident in other, more conspicuous biota, including charismatic fauna such as butterflies. The consequential pocketing of viable habitat into smaller fragmented patches of ecological refugia, with a much-reduced potential for connectivity, is expected to render such habitats wholly dependent on anthropic management-contingent practices rather than natural self-sustainability. Unless effective conservation measures are introduced to tangibly reverse current trends, it is envisaged that the already spatially limited natural and semi-natural areas within the Maltese Islands will continue to experience a marked decline in their indigenous biota, the result of which will be a negatively impacted biological diversity and the need for a more managed environment.

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clarification on one of the *Platycleis grisea* records cited in his co-authored 1983 paper. The author would like to extend his appreciation to Guido Lanfranco, Guido Bonett and Dr S P Schembri, for having donated their private Orthoptera collections, respectively, in 2005, 2007 and 2009; access to these specimens and historically important accompanying field data was of noteworthy significance to this publication. Finally, the author is grateful to the three anonymous reviewers for their helpful comments on an earlier version of this contribution.

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