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A significant novelty for the Palaearctic entomofauna: *Sphaeropsocopsis* (*Italopsocopsis* n. subgen.) *utriusquemariaechristinae* n. sp. (Insecta Psocodea Troctomorpha Sphaeropsocidae), a new synanthropic psocid living in northern Italy

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ABSTRACT Based on specimens of both sexes, *Sphaeropsocopsis* (*Italopsocopsis* n. subgen.) *utriusquemariaechristinae* n. sp. (Insecta Psocodea Troctomorpha Sphaeropsocidae), a new tiny sphaeropsocid found in buildings in two towns in northern Italy - Piacenza and Cremona - is described. The new taxon, collected by means of sticky traps, was found relatively frequently in the rooms of institutions preserving items of cultural heritage. At a global level, this is the second sphaeropsocid which has been found living in an indoor environment; the first, *Badonnelia titei* Pearman, 1953, is also the only recent previous species of the same family known for the Palaearctic region (*B. titei* occurs in northern and central Europe), but it is not believed to be autochthonous, because the other congeneric species have a Neotropical distribution. In the case of the new species here described (perhaps also of Neotropical origin), there is not sure evidence that it is an introduced alien taxon; its discovery is, in any case, of clear zoogeographic interest. Some bio-ecological observations on the new sphaeropsocid are provided.

KEY WORDS Insects; sphaeropsocids; indoor environment; cultural heritage; Europe.

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INTRODUCTION

To date, 8 genera - for the most part found and described only in the last twenty years - have been ascribed to the family Sphaeropsocidae (Insecta Psocodea Troctomorpha): these genera are mostly known on the basis of either only fossils or only current finds, while only one genus is known based on both fossil and recent specimens; about 20 recent species are currently known, all - like the fossils - very small, just above or a little less than 1 mm in length; in the last two years no significant knowledge has been added for the family at the taxonomic level (Lienhard & Smithers, 2002; Lienhard, 2016, 2021a, 2021b, 2022, 2023) after the work of de Moya et al. (2021) on the phylogenomics of Psocodea.

The genera *Asphaeropsocites* Azar, Engel et Grimaldi, 2010, *Sphaeropsocites* Grimaldi et Engel, 2006, *Sphaeropsocoides* Grimaldi et Engel, 2006

are known only as fossils; the first described genus, *Sphaeropsocus* Hagen, 1882, is known on the basis of both fossil and recent species; the genera *Badonnelia* Pearman, 1953, *Prosphaeropsocus* Mockford, 2009, *Sphaeropsocopsis* Badonnel, 1963, *Troglosphaeropsocus* Mockford, 2009 are only known as recent (Hagen, 1882; Hickman, 1934; Pearman, 1953; Badonnel, 1963; Grimaldi & Engel, 2006; Mockford, 2009; Azar et al., 2010; Mockford, 2013). Another fossil genus, *Globopsocus* Azar et Engel, 2008, was in the past included in Sphaeropsocidae (Azar & Engel, 2008; Lienhard, 2016) but, according to Mockford (2013) and Mockford et al. (2013), it does not belong to this family, but rather to the Electrentomoidea (within Amphientometae). As far as is known at present, the current species of the family are distributed mainly in the southern hemisphere, in much smaller numbers in the Nearctic region; a single synanthropic species, *Badonnelia titei* Pearman, 1953, is present in northern and central Europe (Mockford, 1991; Lienhard, 1998), where it was probably introduced, because it belongs to a genus including several species with a Neotropical distribution; this species has also been found in the western hemisphere (USA: Alaska) (Mockford, 2005, 2009). As noted by Grimaldi & Engel (2006), the Sphaeropsocidae, a very ancient, mostly 'Gondwanan', family, are in a certain sense the coelacanths among the psocids: discovered and first described as fossil insects, well preserved in mid-Eocene Baltic amber (Hagen, 1882; Grimaldi & Engel, 2005), they were found not only as further fossil specimens, but also as recent species starting from the 1930s, with a chronology similar to that which characterized the discovery of living coelacanth fish species.

During research carried out starting a few years ago on insects and other arthropods infesting or simply living in environments where items of cultural heritage belonging to institutions located in Piacenza and Cremona are preserved, a good number of psocids were found which in 2023 I recognized as belonging to the family Sphaeropsocidae, hitherto unknown for Italy, and to a species new to science: *Sphaeropsocopsis utriusquemariaechristinae* n. sp.; peculiar features which distinguish it from other species of the genus led me to establish the subgenus *Italopsocopsis* n. subgen. for it.

In addition to the primary interest of the find itself, i.e. that of having found a further small 'living fossil' among psocids, it is of interest for at least three other significant reasons:

a) after the gen. *Badonnelia*, this is the second recent genus of the family to be found in the Palaearctic region, while the remaining non-fossil genera have so far been found either in the southern hemisphere or in the Nearctic region; the presence in Europe of the only species *B. titei*, congeneric of other exclusively South American species, is estimated to derive from accidental passive introduction; in the case of the new species here described (perhaps also of Neotropical origin), there is not sure evidence that it is an introduced alien taxon; its discovery is, in any case, of clear zoogeographic interest. About fifteen years ago, Mockford wrote that, in his opinion, the lack of data on the presence of Sphaeropsocidae - if we exclude the probably introduced synanthropic species *B. titei* - in the Palaearctic region is due to a lack of research in appropriate habitats, rather than to actual absence (Mockford, 2009). As regards the present Italian find of Sphaeropsocidae in an indoor environment, C. Lienhard (*in litteris*) recently expressed the following thoughts to me: "*Mockford (1993: 64) mentioned the introduction of* Sphaeropsocopsis argentina *to USA with plant material. Some exotic sphaeropsocids may occasionally also be introduced to Europe, as it probably happened with* B. titei*. Especially in ecclesiastical institutions the probability of introduction of exotic domestic insects with books or documents may be relatively elevated, for example due to missionary activities. Once introduced locally, the exchange between institutions may contribute to their dispersal. Therefore some doubts remain about the autochthonous origin of this Italian domestic population*".

b) The new species is, as far as is currently known, at the global level the second - after *B. titei* itself - to be associated with an indoor environment, living inside old or ancient buildings in which there are suitable shady conditions and sufficient relative humidity.

c) The relative abundance of specimens collected, including a non-negligible number of males, allows a morphological study and description of both sexes of the new subgenus and species, in contrast with some other taxa of the same family, for which the lack of males has allowed description only on the basis of (often few) females.

MATERIAL AND METHODS

The material was collected during research aimed at studying insects and other at least potentially harmful arthropods that inhabit buildings and rooms in which heterogeneous cultural heritage items are preserved (ancient books, ancient paper documents, parchment or other materials, tapestries, paintings, wooden artifacts, zoological collections, etc.): libraries, archives and museums of mainly ecclesiastical institutions, in two towns in northern Italy, Piacenza (Emilia-Romagna) and Cremona (Lombardy), less than 30 km from each other as the crow flies and located in the Po Valley, on the right and left banks respectively of the Po river. The institutions under study were the following five: Piacenza - San Lazzaro: Collegio and Galleria "Alberoni"; Cremona: Biblioteca del Seminario Vescovile; Archivio Diocesano; Museo Diocesano; Museo Civico "Ala Ponzone", mainly comprising an art gallery.

The investigation started in 2019 and went ahead despite some irregularity and interruptions due partly to the health pandemic emergency and lockdown caused by Coronavirus. It was designed following the criteria reported in the European standard EN 16790:2016 – Conservation of Cultural Heritage – Integrated Pest Management (IPM) for protection of cultural heritage. The primary objective was the qualitative and quantitative monitoring of insects harmful to preserved goods as follows: using sticky traps for monitoring mainly silverfish (Zygentoma Lepismatidae); using pheromone traps for monitoring wool moths (Lepidoptera Tineidae) and wood and book worms (Coleoptera Anobiidae) (Bertonazzi et al., 2023; Reguzzi et al., accepted). The sticky traps ("SIS Group Disinfestazioni srl - Abano Terme, Padua – Monitoring crawling insects" traps, with a rectangular adhesive surface of approx. 10 x 5 cm) were placed along the perimeter of the floors in the monitored rooms and at the base of the dihedral corners of the walls, and replaced mostly on a fortnightly to monthly basis (but sometimes with a much lower frequency) throughout the year.

In addition to Zygentoma, the sticky traps (not used in the Museo Diocesano, Cremona) captured other arthropods which have also been the subject of study and, among these, the interesting sphaeropsocids. For the parts of the floor of the Biblioteca del Seminario Vescovile where the presence of the greatest number of sphaeropsocids was observed, an attempt was made, although only in the most recent months, to capture or attract further specimens in ways that allow an easier study: use of a portable battery-powered vacuum cleaner (September 2023), but without positive results; placement of small damp and moldy wooden surfaces, presumably attractive (October 2023), which however until now (November) have also been unsuccessful in obtaining specimens. These collecting methods can be perfected in the future for use together with others currently hypothesized but not tested, in the continuation of research on this psocid.

The very small size and extreme delicacy of the sphaeropsocids on the one hand, and the availability only of specimens at least partially glued to sticky surfaces and mostly already dried on the other, made the study of the new taxon rather difficult. The following methods were adopted, none of which proved alone optimal for a complete morphological examination of each specimen: 1) leaving the sphaeropsocid on the adhesive surface, cutting out a limited triangular or quadrangular portion of the surface comprising the specimen from the cardboard trap and pinning it with an entomological pin, like an entomological card; samples of this kind were: a) partly preserved as such, for observation under a stereomicroscope; b) partly mounted on a stub and metallized for observation by means of a scanning electron microscope (SEM); 2) after placing the sample for a short time in a relaxing chamber for initial partial rehydration to temporarily restore flexibility to the joints, the sphaeropsocid was detached from the surface by immersing the adhesive surface plus specimen in 'Avio' solvent (a liquid stain remover, comprising a mixture of methylpentane, methyl acetate, methanol); the detached specimen was then immersed in an aqueous solution of lactic acid (10%) to clarify and further rehydrate it, and subsequently positioned in a drop of glycerol for observation under a stereomicroscope. Some of the samples treated with the latter procedure were then permanently mounted on glass slides, using Faure's fluid as embedding medium.

The measurements (total body length, length of the head, maximum width of the same measured at eye level - including the protrusion of the latter -, length of the antenna, length of the forewing, length of some segments of legs, length of the phallosome) were carried out, on a rather small number of specimens: a) partly using a Zeiss Discovery.V8 photo-

stereomicroscope with Axiocam Zeiss 208 color, using dried specimens, rehydrated specimens placed in glycerol, and specimens prepared on slides in Faure's fluid; b) partly by SEM (FEI model Quanta FEG 250 Esem) on directly metallized dry specimens. A significant degree of approximation by default occurs with regard to the total length of the body when measured on dry males and females.

The reported coloring derives from observations on dried specimens retained on adhesive surfaces.

The wings of female sphaeropsocids detach from the body very easily: on the surfaces of the sticky traps, females which had not lost their wings, females with wings remaining glued not far from their body, and females without wings were found. Sometimes several females were found close together on an adhesive surface, and in this case it can be difficult to reconnect each wing present - but separate on the surface - to its specimen. The specimens stuck on traps quite often have incomplete or non-recoverable appendages (antennae, palpi, legs); furthermore, by detaching them with 'Avio' solvent it is easy to separate head or/and appendages from the rest of the body accidentally. It was very difficult to observe the ventral surface of the head, including palpi, and, as regards the abdomen and partly due to the very modest degree of sclerotization, male and female genital structures, especially when the gut contained food residues which hide them. For these reasons, the following descriptions were prepared by integrating observations carried out on several specimens, using the methods set out above.

The drawings of the morphological details were made by the author mainly using a drawing tube mounted on compound microscope Olympus BH-2.

RESULTS AND DISCUSSION

In addition to the description of the new subgenus and new species, the few bio-ecological data available to date on the new taxon are reported. The females and males of sphaeropsocids collected are here considered conspecific, in the absence of elements that might suggest otherwise, as they were found together, in good numbers.

***Sphaeropsocopsis* (*Italopsocopsis* n. subgen.)**
https://www.zoobank.org/30DD5B67-C8D2-4901-8C29-69DA2BC68FB2

TYPE SPECIES. *Sphaeropsocopsis* (*Italopsocopsis* n. subgen.) *utriusquemariaechristinae* n. sp.; monotypical subgenus, on the basis of current knowledge.

DIAGNOSIS. Very small psocid (Figs. 1–32); body size quite similar to that of the other congeneric species and of other genera in the same family. Male subapterous, bicolored. Female almost monochromatic, with convex, elytriform forewings covering the abdomen entirely. The new subgenus can be distinguished from other recent genera of the same family known so far on the basis above all of features relating to the female forewing: wing with large lateral area without veins between external margin and radial vein (R) (interpretation of wing venation according to Grimaldi & Engel (2006); these Authors distinguish Radius (R), Radial sector (Rs), Media anterior (MA), Media posterior (MP), Cubitus (Cu), Anal (A). The interpretation by Mockford (2013), who follows Yoshizawa (2005), is rather different) and with humeral area not bulging forwards; overall 5 longitudinal veins (but sometimes only 4) arriving very close to the margin of the wing and at least in part reaching it fully; anal vein (A) absent. Hindwing absent. Legs rather long, slender, with tarsi longer in males.

DESCRIPTION. Total body length: from slightly less than 1 mm (males) to approx. 1 mm (females). Male only slightly convex, neotenic, with very short and small forewing pads; pale ocher-yellowish in color, but with dark (blackish-brown) abdomen in the proximal third. Female strongly convex due to elytriform forewings covering the abdomen entirely; rather pale (from yellow ocher to hazelnut) in color. On each side of the head, in both sexes, black ocular area and black ommatidia. Cuticle weak, very slightly sclerotized except for male and female head, female forewings and subgenital plate.

Head (Figs. 1–4, 11, 12, 18, 19) subprognathous, rounded subtrapezoidal, wider at the back (in specimens prepared on a microscope slide, due to slight anterior flattening, the shape of the head is proportionally less narrowed towards the front); posterior edge of the vertex, on the midline, with a slight inlet, therefore the head appears moderately bilobed at the back; postclypeus markedly convex; temples wide; gula only partially sclerotized transversally. Antenna (Figs. 5, 20): scapus and pedicel short and stout; 12–13 flagellomeres, of which the proximal

Figures 1–3. *Sphaeropsocopsis* (*Italopsocopsis* n. subgen.) *utriusquemariaechristinae* n. sp., dry specimens on sticky traps. Fig. 1: adult male (paratype), dorsal view. Figs. 2-3: adult females, dorsal (holotype) and dorsal-lateral (paratype) view.

ones - from the 1st to the 3rd (in the male also the basal part of the 4th) - distinctly ringed; male antenna approximately as long as the body, female antenna shorter than the body considered with wings; male flagellomeres proportionally longer; in addition to long, setiform sensilla present on the flagellomeres, limited number of short, club-shaped subterminal sensilla on some flagellomeres (Figs. 5, 13, 20). Compound eyes protruding on the sides, each with three ommatidia close together but not in contact with each other (Fig. 14). Ocelli absent. Mouthparts: asymmetric mandibles; lacinia with at least 2-3 apical teeth; maxillary palpus tetramere; fourth palpomere, equipped with various sensilla, longer than each of the previous three, of which the longest is the second (Figs. 8, 23). Labial palpus monomere, with some trichoid sensilla.

Thorax (Figs. 4, 19, 27) very short, wider and more transverse in female, which on each side of the mesonotum has a raised area corresponding to the insertion of the forewing (Fig. 27); prothorax relatively narrow; meso- and metathorax slightly wider, welded together; in the male, at the posterior edge of the mesonotum, transverse wing pads, very short, rather rounded; they are separated from each other by a median inlet, their surface is not separated from that of the mesonotum (Fig. 15). Mesonotum of the female not divided into two (right and left) areas. Legs rather long, with tarsi longer in males; prothoracic legs shorter, metathoracic longer, mesothoracic of intermediate length; each tibia in the female is provided with a pair of very short and not very stout distal spurs (Fig. 31), thinner and less evident in the male (Fig. 16); tarsi trimerous, with the first tarsomere longer than each of subsequent ones, particularly in metathoracic legs, where it clearly exceeds in length the second and third tarsomere considered together (Figs. 9, 24); claws provided with a preapical tooth (Fig. 17). Female forewings wide and convex, in contact with each other proximally, along the midline, while they may diverge distally; the wings cover the entire abdomen including on the sides (Fig. 18). Each wing has 5 longitudinal veins (sometimes only 4) which run subparallel or slightly convergent and extend very close to the posterior wing margin, or merge with it; the two most lateral (external) veins, R and Rs, originate from a common stem, as do the two subsequent ones, Ma and Mp, whose common stem is usually shorter than the previous one and is joined with it at the base; more medially, the simple Cu vein originates proximally from the same stem as Ma and Mp, and runs parallel near the medial margin of the wing (Figs. 18, 28–30). Between the outer

edge of the wing and R there is a very large area, which narrows towards the posterior, without veins; it corresponds to the part of the wing facing downwards on the side of the metathorax and the abdomen (Fig. 29). Anal vein (A) absent (Fig. 30). Transverse venules absent. The forewings detach from the mesothorax very easily. Hindwings absent.

Abdomen (Figs. 4, 19) ovoid, rather flattened, wider in the female, with a predominantly membranous consistency, especially dorsally. In the male the abdomen is more convex ventrally than dorsally, where four separations between urites are recognizable. Female: proximal part of the abdomen only slightly pigmented or almost depigmented, semitransparent; subgenital plate wider than it is long, more sclerotized and pigmented than the rest of the abdomen. Female ectodermal genital structures partly difficult to recognize because they are not very sclerotized or are membranous. Male: large phallosome with basal struts fused anteriorly to form a single process (Fig. 10).

ETYMOLOGY. The Latinized name of the new subgenus, *Italopsocopsis*, a feminine noun, has as its basis the Latinized term *psocopsis*; the addition of the prefix *Italo-* (from the Latin adjective *Italus*, *-a*, *-um* = Italic) indicates its currently known geographical distribution.

REMARKS. The genus *Sphaeropsocopsis* (10 species previously known, all from the southern hemisphere or central America) is rather heterogeneous, always characterized by lack of anal vein in the wing. The new subgenus distinguishes a particular new species in which: a) the humeral area is slightly bulging, unlike other congeneric species in which the wing is known, because in these the humeral area seems to be rather strongly bulging (see key in Mockford, 2013); unfortunately, the wing is not known in several described species of *Sphaeropsocopsis*; b) there is a particularly wide area lacking veins between the anterior (external) margin of the wing and radial (R) vein, this part of the wing enveloping the abdomen laterally and partly ventrally (only the wing of *S. reisi* Badonnel, 1971, from Angola, is described by its Author as "plus enveloppante" (than in the Chilean species); the male of *S. reisi* is also micropterous, but with a scale-shaped wing that is easily detached (Badonnel, 1971); c) the number of wing veins is usually 5, sometimes 4 (reaching at least in part the wing edge); in other species of *Sphaeropsocopsis* the number is often 4 (M is generally simple) or fewer, but 4–5 veins characterize e.g. *S. microps* Badonnel, 1963, which has a decidedly bulging humeral area (Badonnel, 1963). Generally, in *Sphaeropsocopsis* the veins do not reach the wing margin; furthermore, sometimes the nearby veins are fused to each other distally. In *S. myrtleae* Lienhard et Ashmole, 1999, a completely blind species, the female is brachypterous, the male subapterous; *S. insularum* Lienhard et Ashmole, 2011, has 3 ommatidia per eye, but the head microsculpture differs from that of the new species described here (Lienhard & Ashmole, 1999, 2011). In non-blind species of *Sphaeropsocopsis*, the number of ommatidia per compound eye is rather variable (from 3 to 10 according to Mockford, 2009). Most of the above comparative notes were kindly communicated to me by C. Lienhard (*in litteris*).

As pointed out above, the new subgenus can be distinguished from other recent genera known so far on the basis above all of features relating to the female wing. In *Badonnelia* (the only other genus known so far as also living in indoor environment, having Neotropical - and secondarily also European - distribution) the wing is weakly sclerotized and has only two longitudinal veins. The genus *Troglosphaeropsocus*, Nearctic in distribution, has a rather rudimentary, reduced wing venation, very different from *Italopsocopsis* n. subgen.; furthermore the legs are shorter, less slender. In *Sphaeropsocus* (genus with Nearctic recent distribution) and *Prosphaeropsocus* (Nearctic), both with some affinity with the new subgenus, there are 5 longitudinal forewing veins, as frequently in the only species of the new subgenus; however, in these two Nearctic genera a short anal vein is recognizable; furthermore, in the first genus the 5 veins mostly clearly reach the distal margin of the wing, in the second none reach it, and in both of them there is a rather bulging humeral area; in the new subgenus, however, the veins mostly (but not always) come very close to the edge of the wing and some fully reach it, while others do not because they stop a little earlier; furthermore the anal vein is missing, the humeral area is not pronounced and - as mentioned above - there is a large lateral area, progressively narrowing towards the rear, between the external edge of the wing and the radial vein. Male characteristics are useful for purposes of discrimination for the few genera and species in which males are also known: in *Italopsocopsis* n. subgen. the male is subapterous (not completely

apterous), with short mesothoracic wing pads well welded to the mesonotum (not rudimentary scale-shaped wings, instead present in males of e.g. *S. reisi* and *S. spinosa* Badonnel, 1972); the morphology of the phallosome is also discriminating (see e.g. Badonnel, 1972; Lienhard, 1998; Mockford, 2009; Lienhard & Ashmole, 2011). Further differentiating structural features (e.g. as regards distribution and types of sensilla on the body and antennae, micro-sculpture patterns on head and thorax, etc.) will be evidenced better in the future after examination of a greater number of specimens by means of further microscope preparations, including by SEM.

As regards exclusively fossil genera, *Italopsocopsis* n. subgen. seems to be rather close to *Sphaeropsocoides*, in which, however, there is an anal vein in the wing and the number of ommatidia is less reduced (Grimaldi & Engel, 2006).

***Sphaeropsocopsis* (*Italopsocopsis* n. subgen.) *utriusquemariaechristinae* n. sp.**
https://www.zoobank.org/BC2ED6C3-22AF-4E31-B49B-B4E22430BF16

Type material. Holotype ♀ (Fig. 2): Cremona, Biblioteca del Seminario Vescovile, 25.V-14.VII.2022, sticky trap, M.C. Bertonazzi leg. (preserved dry, on quadrangular portion of adhesive surface); this will be deposited in the collections of the Museo Civico di Storia Naturale "Giacomo Doria", Genoa. Paratypes (46 specimens: 18 ♂♂, 28 ♀♀; e.g. Figs. 1, 3): mostly preserved dry on portions of sticky traps; partly detached, prepared and mounted on microscope slides; partly detached, clarified, rehydrated and preserved in microvials with glycerol. Paratypes (all M.C. Bertonazzi leg., by means of sticky traps) will be deposited in the following institutions and collections: Museo Civico di Storia Naturale "Giacomo Doria", Genoa; Museo Civico di Scienze Naturali "Enrico Caffi", Bergamo; Di.Pro.Ve.S. Facoltà di Scienze Agrarie, Alimentari e Ambientali, Università Cattolica, Piacenza; Nicoli Aldini collection, Bologna: Piacenza, San Lazzaro, Collegio and Galleria "Alberoni": 1 ♂ 30.IX.2022–12.VII.2023; 2 ♂♂ 12.VII.2023-22.VIII.2023; 1 ♂ 22.VIII.2023–12.X.2023. Cremona, Biblioteca del Seminario Vescovile: 1 ♀ 30.VII.2019–14.VIII.2019; 1 ♂ 14.VIII.2019–17.XII.2020; 2 ♀♀ 17.XII.2020 – approx. 20.V.2021; 1 ♂, 1 ♀ 7.X.2021–12.XI.2021; 1 ♀ 17.XII.2021–20.I.2022; 1 ♀ 25.V.2022–14.VII.2022; 1 ♀ 5.IV.2023–5.V.2023; 7 ♂♂, 10 ♀♀ 26.V.2023–14.VII.2023; 4 ♀♀ 19.IX.2023–18.X.2023. Cremona, Archivio Diocesano: 3 ♂♂, 4 ♀♀ 28.VII.2023–1.IX.2023; 1 ♂, 2 ♀♀ 1.IX.2023–15.IX.2023; 1 ♂ 6.X.2023-3.XI.2023. Cremona, Museo Civico "Ala Ponzone": 1 ♀ 5.VII.2022–14.VI.2023.

Other material examined. Some specimens (approx. 15), all collected in the same buildings, are not included in the typical series, either because they were metallized and used for SEM observations, or because they were largely incomplete, fragmented, or poorly preserved.

Description of the male (Figs. 1, 4–17). Characteristics reported for the genus, plus the following. Dimensions: total body length 0.65–0.75 mm (dry specimens, on adhesive surfaces), 0.80–0.85 mm (rehydrated specimens); head length 0.24–0.31 mm, maximum head width 0.22–0.28 mm; total length of the antenna approx. 0.72 mm; length of the metathoracic tibia approx. 0.29 mm; length of the metathoracic tarsomeres together approx. 0.17 mm; length of the phallosome approx. 0.23 mm. Coloring (Fig. 1): basic body color from yellowish-ochraceous to pale hazelnut, with a more intensely pigmented head; antennae and legs very pale. Basal third of the abdomen dark brown pigmented; the dark, blackish coloration, shaded towards the posterior, extends more towards the back on the sides, and longitudinally, towards the midline (dorsally and/or ventrally), it tends to reduce in a shaded manner (Fig. 4).

Head large, subtrapezoidal, a little longer than wide and wider at the back; dorsal chaetotaxis of the head as in Fig. 11; dorsal micro-sculpture of the cephalic capsule as in Fig. 12. Antenna about as long as the body or slightly longer; flagellomeres (13) as in Fig. 5; on the flagellomeres there are long and thin setiform sensilla, and shorter, club-shaped sensilla (e.g. Fig. 13), the latter distributed (observations by means of SEM) on 6th (2 sensilla), 8th (1 sensillum) and 10th (2 sensilla) flagellomere (Fig. 5). Mouthparts: mandibles as in Fig. 6; lacinia with 3 clearly visible apical teeth and a fourth tooth not very distinct (Fig. 7); maxillary palpus as in Fig. 8.

Thorax very short. Prothorax narrow, meso- and metathorax wider, welded together; as reported above, mesonotum provided on each side, backwards, with short and wide wing pads (Fig. 15). Tibiae and tarsi rather elongated (e.g. Fig. 9).

Abdomen rather short, ovoid, slightly angular at the tip, more convex ventrally than dorsally. In dry males (Fig. 1), the dorsal part of the abdomen lies on the ventral part which is longitudinally convex downwards, giving the back a strongly concave appearance longitudinally, and its sides lift upwards and curve inwards, so that the abdomen seems narrower and with subparallel sides. Four transverse sutures, somewhat sinuous, separating tergites are recognizable. Phallosome (Fig. 10) large, slightly sclerified, with the basal struts fused forward to form a single median process.

DESCRIPTION OF THE FEMALE (Figs. 2, 3, 18–31). Characteristics reported for the genus, plus the following. In dry females without wings, the distal part of the abdomen often bends and lifts vertically upwards, or upwards and forwards, making any measurement of the total length of the body from the anterior margin of the head to the end of the abdomen impossible or not at all significant. Dimensions: total body length 0.88–0.95 mm (dry specimens, with wings, on adhesive surfaces), 0.83-0.98 mm (rehydrated specimens, but without wings; live females, including wings, are probably up to just over 1 mm long); head length 0.29–0.34 mm; maximum head width 0.26–0.31 mm; total length of the antenna 0.69–0.70 mm; forewing length 0.63–0.79 mm; length of the metathoracic tibia 0.34–0.35 mm; length of the metathoracic tarsus 0.14–0.15 mm. Coloring (Figs. 2, 3): body color from ochraceous-yellowish to hazelnut, head more intensely pigmented than the rest of the body; antennae and legs pale. Wings very light in color, hazel-grey or pale sand, semi-transparent; veins pale, ocher-yellowish, sometimes light or medium brown. Proximal part of the abdomen transparent or semi-transparent, depigmented or poorly pigmented; distal part of the abdomen rather pale.

Head large, subtrapezoidal, wider at the back, slightly longer than its maximum width. Dorsal chaetotaxis of the head rather similar to that of the male, as well as the micro-sculpture. Antenna (Fig. 20) shorter than the body; flagellomeres (12–13) with setiform sensilla and shorter, club-shaped sensilla, the latter distributed (observations by means of SEM) on 6th (2 sensilla), 8th (1 sensillum) and 10th flagellomere (2 sensilla) (Fig. 20); last flagellomere as in Fig. 26. Mouthparts: mandibles as in Fig. 21; lacinia with two clearly visible apical teeth and an almost indistinct third tooth (Fig. 22); maxillary palpus as in Fig. 23.

Thorax short. Prothorax narrow, meso- and metathorax wider, welded together; on each side of the mesonotum there is an incomplete dome-shaped area, corresponding to the insertion of the wing (Fig. 27). Tarsi shorter than those of male (Figs. 18, 24). Forewing (Figs. 18, 28-30) with the features described for the subgenus. Micro-sculpture of the wing (network of polygonal areolae) as in Fig. 30.

Abdomen ovoid, rather short (Fig. 19). Subgenital plate transverse, rather ovoidal or semicircular. Ovipositor valvulae as in Fig. 25; the figure also shows a rather triangular median sclerite with the apex pointing posteriorly, quite different from the T-shaped sclerite related to the subgenital plate, typical of female sphaeropsocids; sclerite observed in some female specimens. In the specimens examined it was not possible to recognize the typical T-shaped sclerite.

VARIABILITY. The variability observed concerns antennae and wing veins. The number of flagellomeres does not appear strictly stable: only 10 flagellomeres have been observed in a male antenna. Typically, in forewing there are 5 longitudinal veins, but in some females there are only 4 in one or both wings, due to the lack of bifurcation of the M stem (M not forked). In the left wing of a female, MA and MP were observed converging distally and joining together a little before the posterior edge of the wing, without reaching it. In the left wing of another female, M stem was observed running half way up the wing, then bifurcating. A female having only three longitudinal veins in one wing has been excluded from the typical series even though it is most likely an anomalous specimen of the same species.

ETYMOLOGY. The Latinized name of the new species, *utriusquemariaechristinae*, singular feminine genitive, means: of one and another Maria Cristina, of both Maria Cristinas. It is formed from the genitive singular *utriusque* of the Latin pronoun and adjective *uterque*, *utraque*, *utrumque* (= the one and the other, both) and from the feminine first name Maria Cristina (Latinized *Maria Christina*), also declined in the genitive singular. In recognition of our friendship, the new species is dedicated to the two colleagues who took part in the research: Dr. Maria Cristina Bertonazzi and Dr. Maria Cristina Reguzzi, PhD, both for decades esteemed colleagues in Entomology at the Faculty of Agriculture, Università Cattolica. In addition to planning the research in the

Cremona institutions mentioned above, M.C. Bertonazzi carried out the entire five-year activity of placing, replacing and examining the traps in both towns, and during checks showed me specimens of the tiny psocid which immediately aroused my interest: she is responsible for the discovery. M.C. Reguzzi, participating in the logistic and scientific aspects of this as well as other previous research relating to insects harmful to cultural heritage, was the first, in the second half of the last decade, to give new impulse to a line of investigation previously started at the same Faculty by Prof. Elisabetta Chiappini, with the establishment of a research center (CPBC: Centro per la Protezione dei Beni Culturali) for the protection of cultural heritage items from biodeteriogenic agents; the center was active from 2005 to 2016.

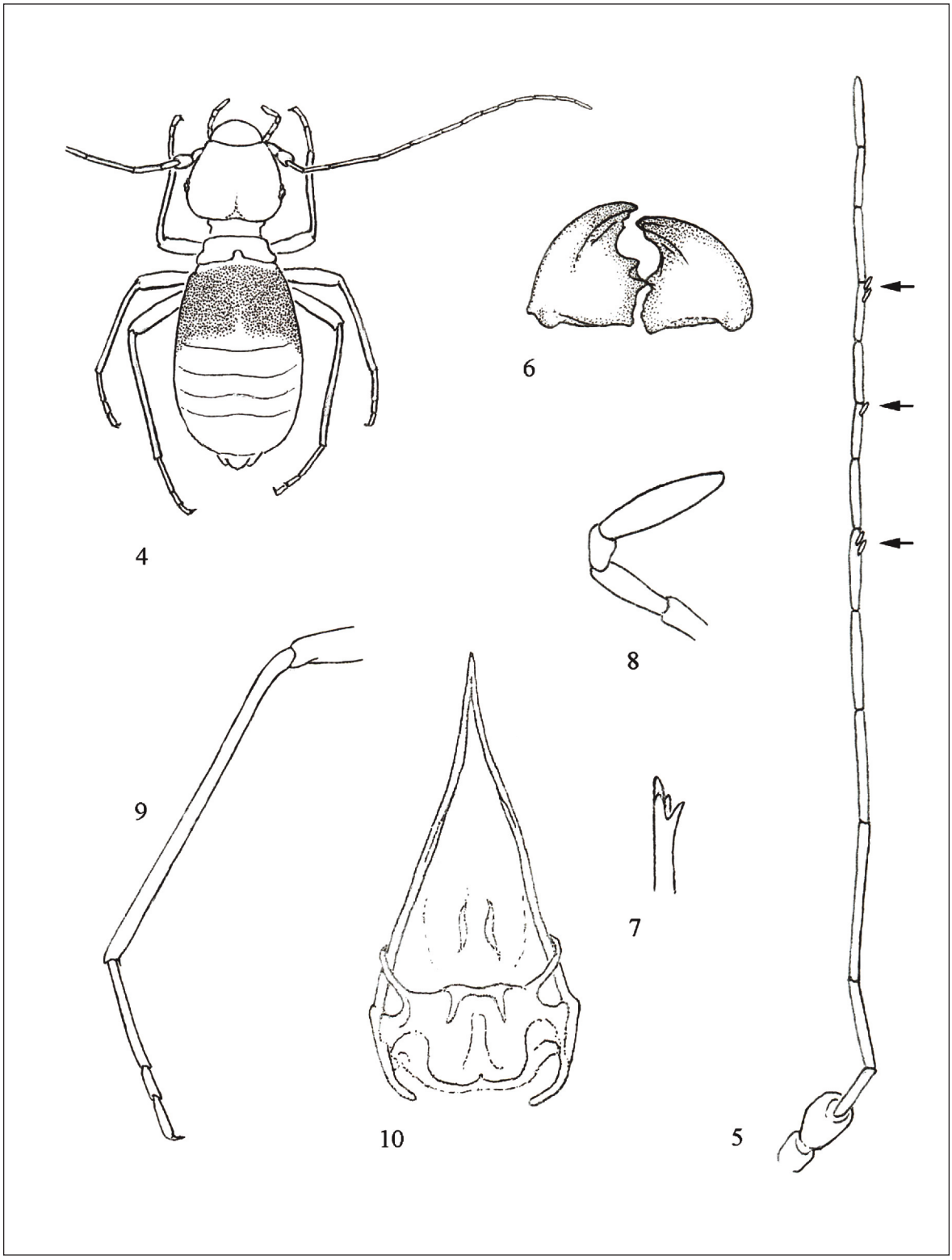
Biology. The new species, as far as is known so far, is associated with the indoor anthropic environment, in rooms used for the conservation of cultural heritage items in libraries, archives and museums located in old or ancient buildings where there are micro-habitats characterized by shade (the reduced number of ommatidia of the new species denotes adaptation to poorly-illuminated environments) and sufficiently high relative humidity. The possible presence of this species will have to be further investigated, in these localities and in others at least in northern Italy, in similar environments as well as outdoors, e.g. in micro-habitats under the bark of tree trunks or corresponding to leaf litter and debris at the foot of trees and bushes, as the habitat of other sphaeropsocids: the finding in an outdoor environment could be indicative of an autochthonous origin. On sticky traps, this psocid was found almost exclusively at the edge of the adhesive surface: when approaching, it immediately becomes stuck, often adhering only with the front part of the body.

In the same environments, by using the same sticky traps, Arachnida (Araneae, Pseudoscorpiones, Acari) and Hexapoda belonging to other orders (Collembola, Zygentoma, Blattodea, Thysanoptera, Rhynchota, Neuroptera, Hymenoptera, Lepidoptera, Diptera, Coleoptera) were captured. As regards Psocodea, a very low number of Liposcelididae (adults and juvenile stages) belonging to the gen. *Liposcelis* Motschulsky, 1852 were collected and - but only in the Museo Civico "Ala Ponzone" - one adult of *Dorypteryx domestica* (Smithers, 1958) (Psyllipsocidae), an alien species already known in Italy for some decades (Locatelli & Ottoboni, 1987).

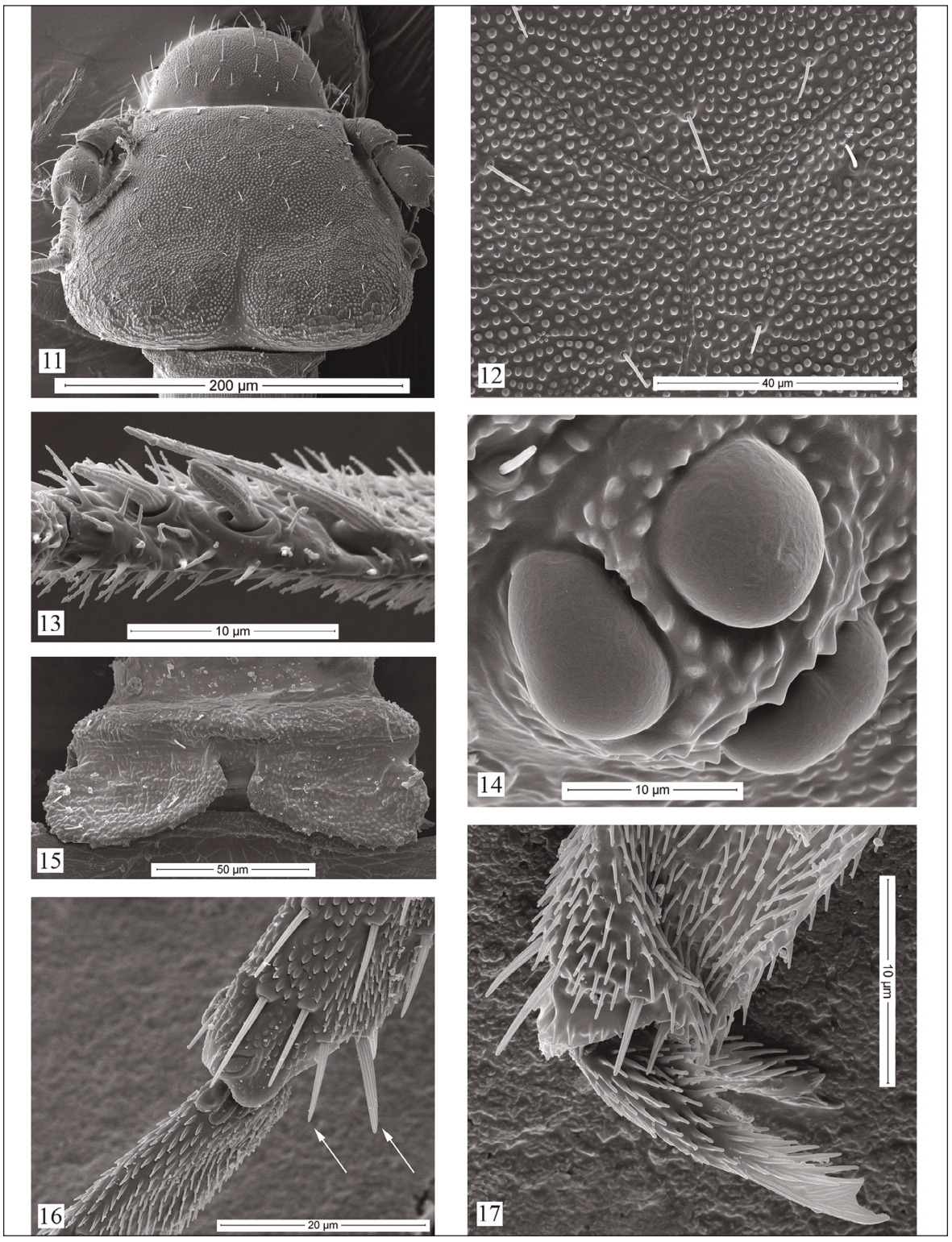
Phenology. The adults of this new species were found on traps during most of the year, i.e. with certainty from April-May to December-January. The greatest number of specimens was collected between June and September. It is not possible to infer the voltinism of the species based on the numerical data available so far. A monitoring activity with sticky traps is necessary, involving regular and frequent replacement of them, in the sites where the new taxon has been found to be more abundant. Juvenile stages, very poorly pigmented and referable to this species, have also been captured, in much more limited numbers, using sticky traps. An interesting morphological detail (head with mouthparts, ventrally) from a preimaginal individual of unknown sex is illustrated in Fig. 32.

Sex ratio. With reference to the Cremona stations in which the numbers of adult specimens found were higher (Biblioteca del Seminario and Archivio Diocesano), the sex ratio (♂♂/♀♀) varies between 4.0/10 and 4.3/10: total males just under half the total for females.

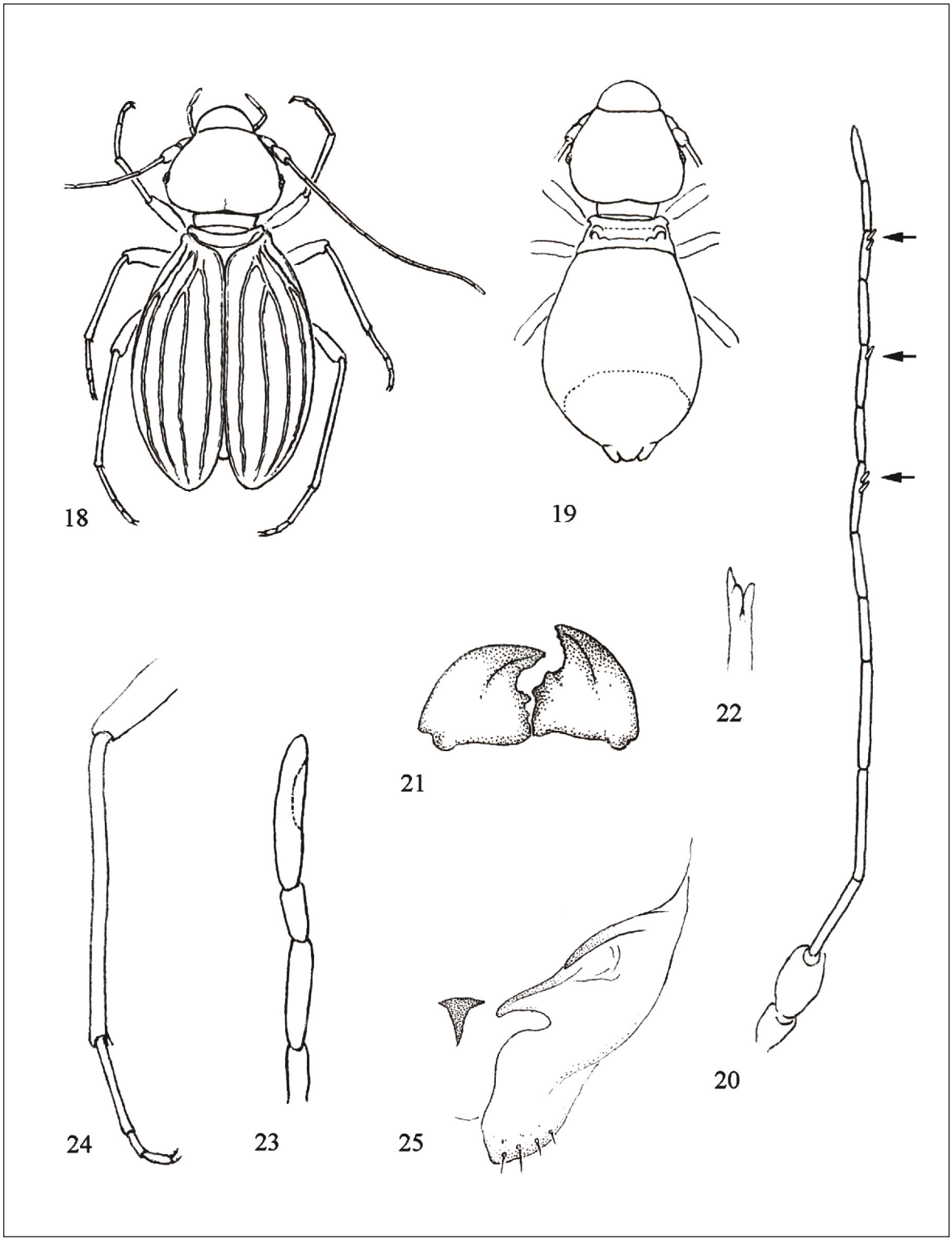
Feeding habits. On sticky traps, males and females of the new species were frequently found in proximity to other arthropods which were stuck on the traps, especially silverfish and spiders: it is likely that the carcasses of other arthropods exert an olfactory food attraction on this species - which is very probably also zoonecrophagous - as on other psocids. SEM examination of a male specimen with a widely fractured abdomen permitted observation of the presence, inside, of a large number of subspherical structures that can be interpreted as fungal spores, each with a diameter of a few μm. In some microscope preparations on slides, in addition to fungal spores, the contents of the gut appeared to include organic fragments whose hypothetical identification requires further study. Günther (1974), on the basis of examination of the contents of the gut of *B. titei*, observed the presence of organic debris, fungal spores and the remains of dead arthropods. When continuing the research in rooms used as libraries or archives it will be useful to place sticky traps not only on the floors, but also on the shelves, to investigate whether there could be a relationship, perhaps even trophic, between this sphaeropsocid and paper, books, book binding materials, ancient documents etc., a feeding habit well-known for other psocids, with possible modest damage.



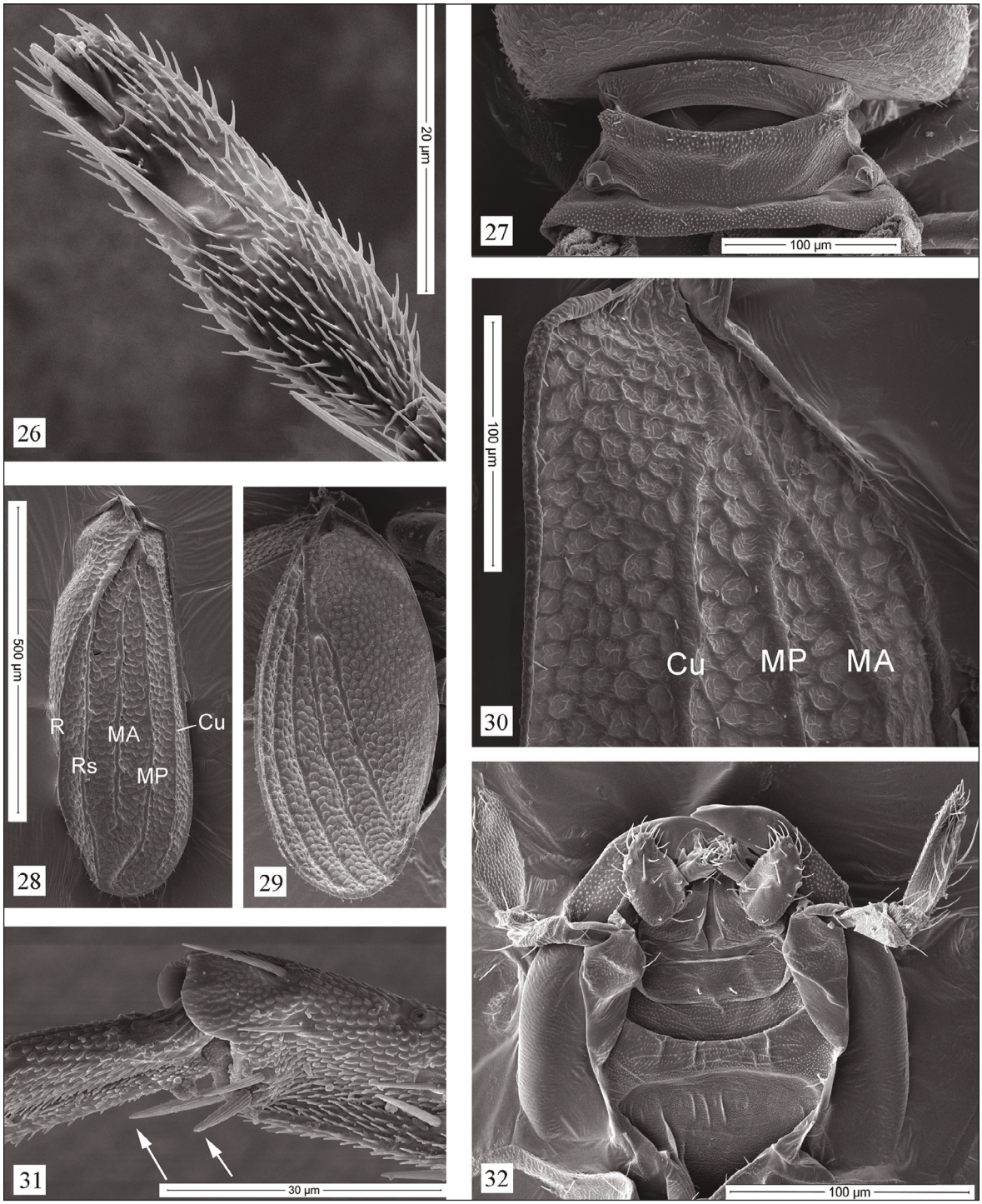
Figures 4–10. *Sphaeropsocopsis* (*Italopsocopsis* n. subgen.) *utriusquemariaechristinae* n. sp., adult male, morphological features (drawings, various magnifications). Fig. 4: habitus, schematic dorsal view. Fig. 5: antenna (the arrows indicate short, club-shaped sensilla; long, setiform sensilla omitted). Fig. 6: mandibles. Fig. 7: apex of lacinia. Fig. 8: maxillary palpus. Fig. 9: metathoracic leg, detail of tibia and tarsus. Fig. 10: phallosoma.



Figures 11–17. *Sphaeropsocopsis* (*Italopsocopsis* n. subgen.) *utriusquemariaechristinae* n. sp., adult male, SEM micrographs from dry specimens. Fig. 11: head, dorsal view. Fig. 12: dorsal micro-sculpture in the area of epicranial suture. Fig. 13: detail of the 10th flagellomere with two short, club-shaped sensilla. Fig. 14: right compound eye. Fig. 15: mesonotum with wing pads. Fig. 16: mesothoracic leg, tibiotarsal joint (the arrows indicate the two tibial spurs). Fig. 17: mesothoracic leg, pretarsus, claws with preapical tooth.



Figures 18–25. *Sphaeropsocopsis* (*Italopsocopsis* n. subgen.) *utriusquemariaechristinae* n. sp., adult female, morphological features (drawings, various magnifications). Fig. 18: habitus, schematic dorsal view. Fig. 19: habitus of the body without wings, dorsal view. Fig. 20: antenna (the arrows indicate short, club-shaped sensilla; long, setiform sensilla omitted). Fig. 21: mandibles. Fig. 22: apex of lacinia. Fig. 23: maxillary palpus. Fig. 24: metathoracic leg, detail of tibia and tarsus. Fig. 25: on the left, subtriangular median sclerite; on the right, ovipositor valvulae.



Figures 26-31. *Sphaeropsocopsis* (*Italopsocopsis* n. subgen.) *utriusquemariaechristinae* n. sp., adult female, SEM micrographs from dry specimens. Fig. 26: last flagellomere. Fig. 27: pro-, meso- (without wings) and metanotum. Fig. 28: dorsal view of the left forewing, showing 5 longitudinal veins (indicated using abbreviations). Fig. 29: right forewing in dorsal-lateral view, showing the wide area lacking veins between external margin of the wing and radial vein. Fig. 30: proximal part of the right forewing, showing the polygonal micro-sculpture and the lack of anal vein. Fig. 31: metathoracic leg, tibio-tarsal joint (the arrows indicate the two tibial spurs). Figure 32. *Sphaeropsocopsis* (*Italopsocopsis* n. subgen.) *utriusque-mariaechristinae* n. sp., preimaginal specimen (sex unknown): detail of the head, in ventral view, showing some mouthparts (maxillary and labial palpi, paraglossae).

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Work carried out as part of the still-ongoing, unfunded research project "Monitoraggio di artropodi dannosi a beni culturali, con particolare riferimento agli insetti", agreed with the heads of the respective institutions and started in 2019 in libraries, archives and museums mostly belonging to ecclesiastical bodies in Piacenza – San Lazzaro and Cremona (northern Italy). Participants registered in the project: M.C. Bertonazzi, R. Nicoli Aldini (scientific coordinator), M.C. Reguzzi.

The author with gratitude dedicates this publication to the Università Cattolica del Sacro Cuore on the 70th anniversary (2023) of the foundation of its Piacenza and Cremona site with the opening of the Faculty of Agriculture, an anniversary coinciding with the last full year of the author's activity there as researcher and professor, after almost thirty-five years of service. Due to the singular coincidence of the discovery of *Sphaeropsocopsis* (*Italopsocopsis* n. subgen.) *utriusquemariaechristinae* n. sp. in the towns of Piacenza and Cremona and of its recognition as a taxon new to science by the author in the initial months of 2023, the new tiny psocid - which, on the basis of its only environments known so far, could jokingly be defined as 'a true lover of culture' - is proposed here as the mascot for the 70th anniversary, with all best wishes for the future of the Università Cattolica.

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