



Systematic revision and evolution of the Tithonian family Chitinoidellidae TREJO, 1975

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Abstract: Several new genera and species of the family Chitinoidellidae TREJO, 1975, were erected by POP (1997, 1998a, 1998b). Some of these taxa are justified, but others are inadequately defined, and require revision. I discuss herein the non-validity of some taxa and propose a new systematic classification and an evolutionary framework for the family Chitinoidellidae, with two subfamilies: 1) Dobeninae, which include small-sized chitinoidellids, with the genera *Borziella* POP, 1997, *Carpathella* POP, 1998a, *Daciella* POP, 1998a (amended), *Dobenilla* n. gen., and *Popiella* REHÁKOVÁ, 2002, and 2) Bonetinae, which includes larger-sized chitinoidellids, with the genera *Bermudeziella* n. gen., *Bonetilla* n. gen., and *Furrazolalia* n. gen.. These two families are separated in time. Small species of the subfamily Dobeninae characterise the Dobeni Subzone (Ponti ammonite Zone) and disappear immediately before the occurrence of the larger specimens of the subfamily Bonetinae, which characterise the Boneti Subzone (*Microcanthum p.p.* ammonite Zone).

Key-words:

- Chitinoidellidae;
- Dobeninae;
- Bonetinae;
- systematic revision;
- Jurassic;
- lower/upper Tithonian boundary

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Résumé : Révision systématique et évolution de la famille tithonienne des Chitinoidellidae TREJO, 1975.- Plusieurs nouveaux genres et espèces de la famille des Chitinoidellidae TREJO, 1975, ont été créés par POP (1997, 1998a, 1998b). Certains de ces taxons sont justifiés, mais d'autres sont mal définis et nécessitent une révision. Je discute ici la non-validité de certains taxons et je propose une nouvelle classification systématique et un cadre évolutif pour la famille des Chitinoidellidae, avec deux sous-familles : 1) Dobeninae, qui regroupe des chitinoïdèles de petite taille, avec les genres *Borziella* POP, 1997, *Carpathella* POP, 1998a, *Daciella* POP, 1998a (amendé), *Dobenilla* n. gen. et *Popiella* REHÁKOVÁ, 2002, et 2) Bonetinae, qui regroupe des chitinoïdèles de plus grande taille, avec les genres *Bermudeziella* n. gen., *Bonetilla* n. gen. et *Furrazolalia* n. gen.. Ces deux sous-familles sont séparées dans le temps. Les espèces de petite taille de la sous-famille des Dobeninae caractérisent la Sous-Zone à Dobeni (Zone à Ponti des ammonites) et disparaissent immédiatement avant l'apparition des spécimens de plus grande taille de la sous-famille des Bonetinae qui, quant à eux, caractérisent la Sous-Zone à Boneti (Zone à *Microcanthum p.p.* des ammonites).

Mots-clefs :

- Chitinoidellidae ;
- Dobeninae ;
- Bonetinae ;
- révision systématique ;
- Jurassique ;
- limite Tithonien inférieur/ supérieur

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1. Introduction

Chitinoidellids (POP, 1997) or calpionellids with microgranular lorica constitute a small, but interesting, micoplanktonic fossil group of the lower/upper Tithonian boundary interval. They have often been reported in pelagic deposits from both, southern and northern, Tethyan margins, at least from Iran to Mexico, and more recently in the southwestern Pacific margin, Neuquén Basin of western Argentina (KIEZMANN, 2017; KIEZMANN et al., 2018).

Chitinoidellids have long been considered as a single genus, *Chitinoidella* DOBEN, 1963, within the family Calpionellidae BONET, 1956. TREJO (1975) erected the family Chitinoidellidae, with a single genus: *Chitinoidella*. BORZA (1969, 1984), GRANDESSO (1977), BORZA & MICHALÍK (1986), and BENZAGGAGH & ATROPS (1995) distinguished within the genus *Chitinoidella* two groups: *Chitinoidella* gr. *dobeni* BORZA and *Chitinoidella* gr. *boneti* DOBEN, which can be clearly distinguished based on their lorica size and their stratigraphic range. The first group is restricted to the late early Tithonian time period, and includes chitinoidellids with small sized-lorica, with four classical species: *Chitinoidella dobeni* BORZA, 1966; *Ch. colomi* BORZA, 1966; *Ch. slovenica* BORZA, 1969; and *Ch. tithonica* BORZA, 1969. The second group is restricted to the early late Tithonian time period, and includes chitinoidellids with larger sized-lorica, with four classical species: *Ch. boneti* DOBEN, 1963; *Ch. cristobalensis* (FURRAZOLA-BERMÚDEZ, 1965); *Ch. cubensis* (FURRAZOLA-BERMÚDEZ, 1965); and *Ch. bermudezi* (FURRAZOLA-BERMÚDEZ, 1965). Each of the two groups defines a chitinoidellid subzone: Dobeni and Boneti respectively, and they correspond to excellent markers of the lower/upper Tithonian boundary interval.

POP (1997, 1998a, 1998b), in his revision of the chitinoidellids from Romania, erected several new genera and species. Some of these taxa are legitimate; but some others are inadequately defined leading to confusion in the generic and specific attributions of several illustrated specimens in later published works. Because of these confusions and in order to state in a clear and objective way the definition of certain genera and species of chitinoidellids, it becomes necessary to revise the systematics of this microfossil group.

Based on the study of my own material and the revision of the growing number of illustrated chitinoidellid specimens in numerous published work, I discuss herein the non-validity of certain taxa and I propose a new systematic classification and evolutionary patterns of the family Chitinoidellidae around the lower/upper Tithonian boundary, with two subfamilies: Dobeninae, which includes small-sized chitinoidellids of the Dobeni Subzone, with the genera: *Borziella* POP, 1997, *Carpathella* POP, 1998a, *Daciella* POP,

1998a (amended), *Dobeniella* n. gen., *Popiella* REHÁKOVÁ, 2002, and Bonetinae, which includes larger-sized chitinoidellids of the Boneti Subzone, with the genera: *Bermudeziella* n. gen., *Bonetilla* n. gen., and *Furrazolaia* n. gen.

It should be noted that the proposed subdivision of the family Chitinoidellidae into two subfamilies is based on the lorica size and the stratigraphic range of the two chitinoidellid groups. According to BORZA (1969, Abb. 4), BORZA (1984), GRANDESSO (1977, Fig. 1), BENZAGGAGH (1988), BENZAGGAGH & ATROPS (1995, Fig. 3), BENZAGGAGH (2000), BENZAGGAGH et al. (2010), REHÁKOVÁ (2002, Figs. 2-4), PETROVA et al. (2012, Fig. 4), and LAKOVA & PETROVA (2013, Pls. 1, 5), small chitinoidellid species of the *dobeni* group disappear at the top of the Dobeni Subzone immediately before the occurrence of the larger chitinoidellid species of the *boneti* group, at the base of the Boneti Subzone. As a result, species of the two groups cannot belong to the same genera.

2. Discussion on some taxa of the family Chitinoidellidae

Dobeniella POP, 1997

POP (1997) erected the genus *Dobeniella* for chitinoidellids showing, according to this author, a composite collar consisting of two pieces: the outer one corresponds to the extension of the lorica wall; the inner is of variable shape: rounded, comma-like, lens-like or irregular.

However, while POP's drawings (POP, 1997, Fig. 1.1-3) unambiguously illustrate the composite collar of the so-called genus *Dobeniella*, none of the figured specimens by the author [e.g., op. cit., *Dobeniella cubensis* (FURRAZOLA-BERMÚDEZ), Fig. 2, photos 5-6, *D. bermudezi* (FURRAZOLA-BERMÚDEZ), Fig. 2, photos 7-8, and *D. tithonica* (BORZA), Fig. 2, photo 9] clearly show such a composite collar with two separated pieces. Most of the illustrated specimens show a partially or totally undivided, thick collar and, on several specimens, the thickening can affect the whole lorica wall (op. cit., Fig. 2, photos 5, 9).

It should be noted that the notion of composite collar for the chitinoidellids was first reported by FURRAZOLA-BERMÚDEZ (1965), who gave drawings with composite collar for his two new species: *Tintinnopsella cubensis* and *T. bermudezi* [op. cit., Lam. 1, figs. 1.a-c and 2.a-c, respectively]. However, the illustrated specimens of the two aforementioned species [op. cit., Lam. 2, figs. 1-8; Lam. 3, fig. 1; Lam. 5, figs. 1-2] all show either a collar of the same thickness as the lorica wall [op. cit., Lam. 2, Fig. 6. (Fig. 3.A herein), Lam. 2, figs. 7-8 (Fig. 3.B herein), Lam. 5, fig. 2], or slightly thicker than the lorica wall [op. cit., Lam. 3, fig. 1] or an undivided globular collar [op. cit., Lam. 2, figs. 1 (Fig. 3.M herein), 3-5, and Lam. 5, fig. 1].



Analysis of the most figured specimens of *Tintinnopsella bermudezi* by FURRAZOLA-BERMÚDEZ (1965), shows that the collar piece in comma shape, corresponds to spots of micrite or iron oxides of diagenetic origin jointed to the collar and giving the impression of a composite collar [e.g., *op. cit.*, specimen Lam. 2, fig. 8, with two small diagenetic subtriangular pieces on both sides of the collar; specimen Lam. 5, fig. 2, with two strange thick elongated black diagenetic pieces on both sides of the collar; also the specimens of *Tintinnopsella cubensis* (Lam. 2, fig. 1; Lam. 5, fig. 1) showing a small black diagenetic piece jointed to the collar, especially on the right side, giving the impression of a composite collar].

Note what FERRAZOLA-BERMÚDEZ (1965, p. 17) wrote about the collar of *Tintinnopsella bermudezi*: "unas commas (...), lo que constituye el carácter distintivo de esta especie. Tal estructura presenta una textura y una composición diferentes a las del resto del material que compone la loriga, incluso presenta una coloración pardo-rojiza, distinta a la de las paredes de la loriga".

Moreover, none of the subsequently illustrated specimens later assigned by authors to the genus *Dobeniella*, clearly show a double collar, consisting of two separate pieces, like, for example, the collar of the genus *Remaniella* of the family Calpionellidae. There are often thickenings restricted to the collar, or a part of it, or sometimes affecting the whole lorica wall.

Such thickenings, often irregular, perhaps reflect palaeo-environmental factors or, alternatively diagenetic processes, such as secondary precipitations of micrite or iron oxides around the collar or the whole lorica wall. These thickenings can be clearly seen in several illustrated specimens, among others: POP (1997, Fig. 2, photos 5, 9, 12), POP (1998b, Pl. 1, figs. 1-2, 4-8, 20, 23, 25-30), SALLOUHI *et al.* (2011, Pl. 1.2, 1.5-7, 1.9, 1.11, 1.13), and LAKOVA & PETROVA (2013, Pl. 1.7-8, 1.15, 1.25-26; Pl. 5.27, 5.29, 5.31-32).

From the above remarks, it becomes obvious to consider the genus *Dobeniella* POP (1997) as invalid, because: 1) the notion of composite collar is not evident on any figured specimens attributed to the genus *Dobeniella* and 2) the chitino-dellids assigned to this genus included specimens of different size and belonging to two distinct chitino-dellid groups: *dobeni* and *boneti* [e.g., *Dobeniella tithonica* from the Dobeni Subzone, and *D. cubensis* and *D. bermudezi* from the Boneti Subzone].

***Longicollaria* Pop, 1997**

Longicollaria Pop is defined as a genus including specimens with long collar, equal to one-half of the total lorica length, and showing distal thickening and acute aboral pole ending with a caudal appendage. This genus so defined includes specimens with heterogeneous collar shape, arched or straight. It also includes specimens of

small to larger lorica from both the *dobeni* and *boneti* groups, such as: small specimens with long collar of *Chitinoidella dobenci* or *Ch. colomi* from the Dobeni Subzone; and larger specimens of *Ch. cristobalensis*, *Ch. bermudezi* or *Ch. insueta* ŘEHÁNEK, 1986, from the Boneti Subzone.

***Cubanella* Pop, 1997**

Cubanella Pop (1997) is defined as a genus including specimens with a long cylindrical to sub-cylindrical collar, often equal to one-half of the total lorica length, terminated by a long caudal appendage.

This genus, like the two previous genera, includes specimens with long collar and caudal appendage belonging to the two different chitino-dellid groups: for instance, some specimens of *Ch. colomi* or *Ch. dobenci* from the Dobeni Subzone, and some others of *Ch. cristobalensis* of the Boneti Subzone.

This generic name was already occupied by an insect taxon (FENNAH, 1948), resulting in its later replacement by the following genus, *Almajella* Pop (1998b).

***Almajella* Pop, 1998b**

Pop (1998b, p. 11) erected the genus *Almajella* to replace the genus *Cubanella* Pop 1997, but the author does not give any definition of this new genus (*Almajella*) and the reason for this change (pre-occupied generic name). Note also that both genera were erected on the same holotype (that is, type specimen of *Chitinoidella cristobalensis*). Consequently, it is logical to consider the genus *Almajella* Pop, 1998b, as invalid.

***Cylindrella* Pop, 1997**

According to the author, this genus is characterised by a more or less an oval lorica bowl, with rounded aboral pole and a long cylindrical collar, longer than the total length of the lorica bowl. The single species of this genus, *Chitinoidella insueta* ŘEHÁNEK, 1986, was subsequently assigned to the genus *Aninella* Pop 1998b (genus without any definition) by Pop (1998b), then to the genus *Longicollaria* by REHÁKOVÁ (2002) and KOWAL-KASPRZYK (2014). Actually, considering its straight and long collar, its wide and rounded aboral pole, without caudal appendage, *Ch. insueta* cannot indeed belong to the genus *Longicollaria* or even the genus *Aninella* Pop 1998b, since this author did not provide any definition for his new genus.

***Daciella* Pop, 1998a**

Daciella Pop (1998a) is defined as a genus showing characteristic swellings located below the collar, on each side of the aperture, likewise the swellings of the genus *Crassicollaria*. But, while Pop's drawings (Pop, 1998a, Fig. 1.2-5) perfectly illustrate the so-called swellings, the figured specimens by Pop (1998a, Fig. 2, photos 6-20; 1998b, Pl. I, figs. 5-15) rarely show the presence of such swellings, which can be considered as a



constant morphological feature. There are rather irregular thickenings, often of diagenetic origin, of a part or the whole lorica wall. In addition, most of Pop's figured specimens (Pop, 1998a, 1998b) are of poor quality and do not illustrate in a clear way the presence of such swellings. Actually, most of the specimens attributed to the genus *Daciella* are indeed characterised by an elongated oval-shaped lorica often with an acute aboral pole and a wide aperture with or without pre-oral swellings.

Note that the specimens qualified as *Daciella banatica* (Pop, 1998a, Fig. 2, photos 7, 10) are rather specimens of *Chitinoidella slovenica* and *Ch. tithonica*, respectively, and the drawings (Pop, 1998a, Fig. 1.2-5) of the four new chitino-dellid species: *Daciella banatica*, *D. almajica*, *D. danubica*, and *D. svinitensis*, were perfectly modeled on the basis of the four species of the genus *Crassicollaria*: *Cr. brevis*, *Cr. intermedia*, *Cr. parvula*, and *Cr. massutinia*, also respectively.

From that, Pop (1998a, p. 822) assumed that the four species of the genus *Daciella* gave rise to the four species of the genus *Crassicollaria*. According to REMANE (1971), BENZAGGAGH & ATROPS (1995), and BENZAGGAGH (2020), the four species of the genus *Crassicollaria* appeared gradually in time and derived from a single ancestor of primitive *Crassicollaria*.

Chitinoidella lubimovae

FURRAZOLA-BERMÚDEZ & KREISEL, 1973,
and *Ch. pinarensis*

FURRAZOLA-BERMÚDEZ & KREISEL, 1973

- ***Chitinoidella lubimovae*. Lam. II, fig. 2:** this figure shows two specimens of *Ch. boneti* (in axial and oblique sections), that by chance had been joined by their aperture in a similar arrangement than the two *Ch. boneti* specimens (*op. cit.*, Lam. I, fig. 2) of the same authors.
- **Lam. II, fig. 4:** this figure also shows a specimen of *Ch. boneti* with a diagenetic black spot of iron oxides or micrite joint at the right side of the collar, which definitely does not belong to the lorica.
- **Lam. II, fig. 3** (Fig. 3.AC herein): this specimen is a typical *Ch. boneti* with a collar extended on both sides by a strange, thick elongated concretion, most likely of iron oxides from the matrix, and two other, thin and long black, lines extending the extremity of the collar on both sides.
- ***Chitinoidella pinarensis*. Lam. II, fig. 5** (Fig. 4.AO herein): this figure shows a specimen with lorica and collar shapes similar to those of the holotype of *Tintinnopsella cristobalensis* FURRAZOLA-BERMÚDEZ, 1965 (Fig. 4.AL herein).

Consequently, these two species, *Chitinoidella lubimovae* FURRAZOLA-BERMÚDEZ & KREISEL, 1973, and *Ch. pinarensis* FURRAZOLA-BERMÚDEZ & KREISEL, 1973, are invalid.

3. Systematics

As discussed above, the current systematics of the family Chitino-dellidae suffers from several drawbacks and makes the correct specific and generic attributions difficult and the use of chitino-dellids as an excellent microfossil marker group for the lower/upper Tithonian boundary interval. Consequently, the systematics of this fossil group requires revision. Based on the lorica size and the stratigraphic distribution, two groups of chitino-dellids can be distinguished, each one having a subfamily rank, designated herein as: Dabeninae and Bonetinae.

A - Dabeninae n. subfam.

Type species: *Chitinoidella dobenci* sp. nov. – BORZA (1966), Pl. IX, figs. 1-2.

Derivatio nominis: The name of this subfamily derives from *Chitinoidella dobenci*, which is the most common and typical chitino-dellid species of the Dobeni Subzone.

Diagnosis: This subfamily includes chitino-dellids with small-sized lorica, ca 40 µm-long, and variable shape of the collar.

Occurrence: Species of the subfamily Dabeninae are exclusively restricted to the Dobeni Subzone (late early Tithonian). They are known on both margins of the Tethys Realm: southern Europe, North Africa, and on the southwestern Pacific margin, western Argentina.

Dabenilla n. gen.

Type species: *Chitinoidella dobenci* sp. n. – BORZA (1966), Taf. IX, figs. 1-2.

Derivatio nominis: The name of this genus derives from *Chitinoidella dobenci*, which is the most common and typical chitino-dellid species of the Dobeni Subzone.

Remark: Specimens of this genus were often attributed to the genera: *Dobeniella* Pop, *Longicollaria* Pop, *Almajella* Pop, and *Cubanella* Pop.

Diagnosis: Conical to slightly oval-shaped lorica, with arched to slightly straight collar, equal to or greater than one-third of the total lorica length, with or without a distal thickening; rounded to acute aboral pole, with or without a caudal appendage.

Dabenilla dobenci (BORZA, 1966) n. comb.

(Figs. 1.A-D, 2.A-R)

Holotype: *Chitinoidella dobenci* sp. n. – BORZA (1966), Taf. IX, figs. 1-2.

Amended Diagnosis: Conical to slightly oval-shaped lorica, with arched collar, equal to or greater than one-third of the total lorica length, with or without a distal thickening; rounded to acute aboral pole, with or without a caudal appendage.

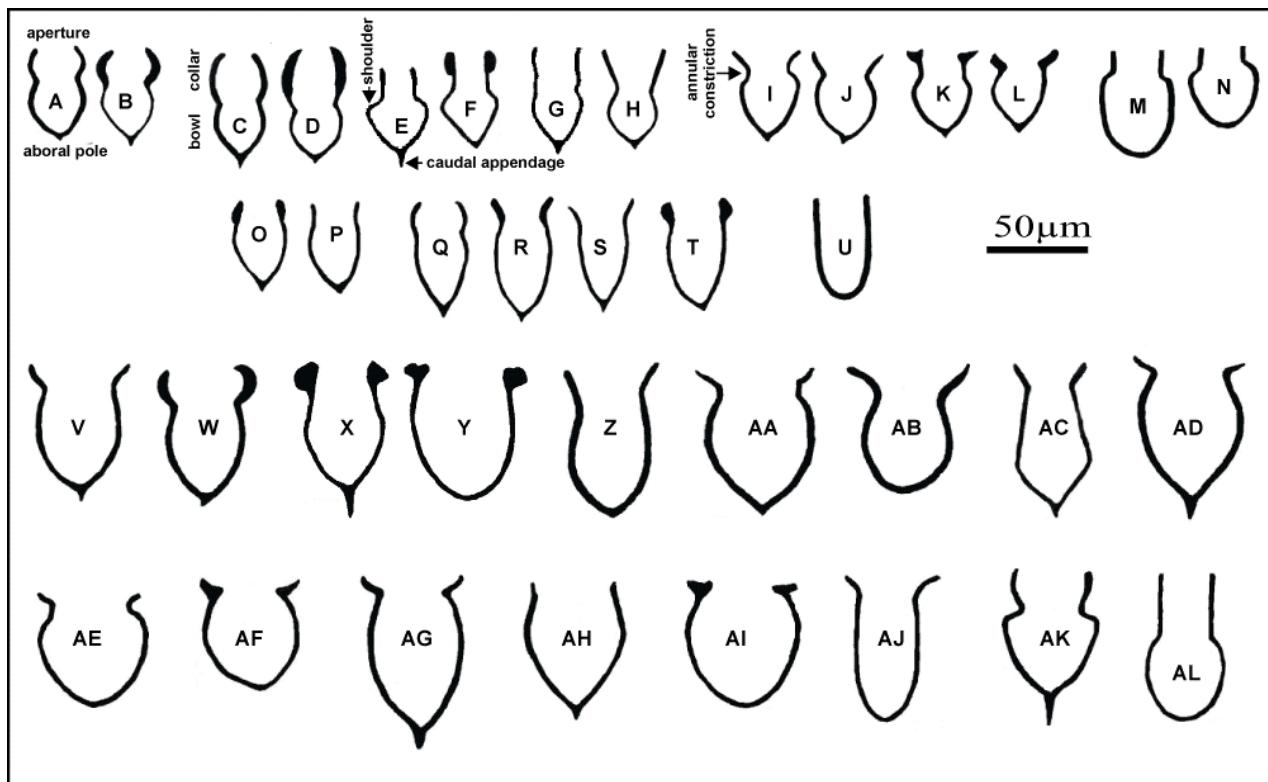


Figure 1: Longitudinal schematic sections of the revised chitinoidellid species. **A-D.** *Dohenilla dobenci*; **A-B.** *Dohenilla dobenci* var. *dobenci*, **B.** with thick collar; **C-D.** *Dohenilla dobenci* var. *longidobenci*, **D.** with thick collar; **E-H.** *Dohenilla colomi*; **E-F.** *Dohenilla colomi* var. *colomi*, **F.** with thick collar; **G-H.** *Dohenilla colomi* var. *longicolomi*; **I-J.** *Borziella slovenica*, **I.** with annular constriction; **K-L.** *Borziella tithonica*, **K.** with annular constriction; **M.** *Carpathella longirumanica*; **N.** *Carpathella rumanica*; **O-P.** *Daciella banatica*, **P.** with thick collar; **Q-T.** *Daciella danubica*, with variable collar shape; **U.** *Popiella oblongata*; **V-W.** *Bermudeziella bermudezi*, **W.** with thick collar; **X-Y.** *Bermudeziella cubensis*; **Z.** *Bonetilla boneti*; **AA.** *Bonetilla carthagensis*; **AB.** *Bonetilla curva*; **AC.** *Bonetilla elongata*; **AD.** *Bonetilla germanica*; **AE.** *Bonetilla lehegarati*; **AF.** *Bonetilla miniboneti*; **AG.** *Bonetilla popi*; **AH.** *Bonetilla praeboneti*; **AI.** *Bonetilla sphaerica*; **AJ.** *Bonetilla svinitensis*; **AK.** *Furrazolaia cristobalensis*; **AL.** *Furrazolaia insueta*.

N.B. Figs. 1.A-AL were drawn from the specimens of the Figs. 2-4.

- 1966 *Chitinoidella dobenci* sp. n. - BORZA, Taf. IX, figs. 1-12; Taf. X, figs. 1-3.
- 1969 *Chitinoidella dobenci* BORZA - BORZA, Taf. LXV, figs. 5, 6 (Fig. 2.I herein), 7, 8 (Fig. 2.A herein), 12-13, 16.
- 1969 *Chitinoidella colomi* BORZA - BORZA, Taf. LXVI, figs. 4 (Fig. 2.K herein), 5, 7.
- 1977 *Chitinoidella dobenci* BORZA - GRANDESSO, Tav. II, fig. 12 (Fig. 2.B herein).
- 1986 *Chitinoidella dobenci* BORZA - BORZA & MICHALÍK, Pl. II, fig. 13.
- 1991 *Chitinoidella dobenci* - CECCA & ŘEHÁNEK, Fig. 2.7.
- 1991 *Chitinoidella* sp. - CECCA & ŘEHÁNEK, Fig. 2.8.
- 1993 *Chitinoidella dobenci* BORZA - ŘEHÁNEK & CECCA, Pl. 1, fig. 7 (Fig. 2.C herein).
- 1993 *Chitinoidella* sp. - ŘEHÁNEK & CECCA, Pl. 1, fig. 8.
- 1995 *Chit. dobenci* - BENZAGGAGH & ATROPS, Fig. 4.1 (Fig. 2.D herein).
- 1995 Forme de passage *Chit. dobenci-Chit. colomi* - BENZAGGAGH & ATROPS, Fig. 4.2 (Fig. 2.L herein).
- 1997 *Doheniella cubensis* (FURRAZOLA-BERMÚDEZ) - POP, Fig. 2, photos 5-6.
- 1997 *Longicollaria dobenci* (FURRAZOLA-BERMÚDEZ) - POP, Fig. 2, photos 12 (Fig. 2.M herein), 13.
- 1997 *Chitinoidella dobenci* BORZA - IVANOVA, Pl. 1, fig. 20.
- 1998b *Longicollaria dobenci* (BORZA) - POP, Pl. I, figs. 1-4.
- 1998b *Doheniella bermudezi* (FURRAZOLA-BERMÚDEZ) - POP, Pl. I, figs. 23-24.
- 1998b *Doheniella cubensis* (FURRAZOLA-BERMÚDEZ) - POP,
- Pl. I, fig. 29.
- 2000 *Chitinoidella dobenci* BORZA - BENZAGGAGH, Pl. 5, fig. 1.
- 2000 *Chitinoidella colomi* BORZA - BENZAGGAGH, Pl. 5, fig. 2 (Fig. 2.J herein).
- 2002 *Doheniella tithonica* (BORZA) - REHÁKOVÁ, Fig. 3.11 (Fig. 2.E herein).
- 2002 *Doheniella colomi* (BORZA) - REHÁKOVÁ, Fig. 4.1-3.
- 2002 *Doheniella dobenci* (BORZA) - REHÁKOVÁ, Fig. 4.5 (Fig. 2.H herein).
- 2009 *Doheniella tithonica* BORZA - BOUGHDIRI et al., Fig. 8.17
- 2009 *Doheniella cubensis* BORZA - BOUGHDIRI et al., Fig. 8.18.
- 2009 *Longicollaria dobenci* BORZA - BOUGHDIRI et al., Fig. 8.21.
- 2010 *Chitinoidella colomi* BORZA - BENZAGGAGH et al., Fig. 8.1 (Fig. 2.R herein).
- 2010 *Chitinoidella dobenci* BORZA - BENZAGGAGH et al., Fig. 8.2.
- 2011 *Longicollaria dobenci* (BORZA) - SALLOUHI et al., Pl. 1.1 (Fig. 2.N herein), 1.2.
- 2011 *Doheniella tithonica* (BORZA) - SALLOUHI et al., Pl. 1.4.
- 2011 *Doheniella cubensis* (FURRAZOLA-BERMÚDEZ) - SALLOUHI et al., Pl. 1.7 (Fig. 2.F herein), 1.8.
- 2011 *Doheniella bermudezi* (FURRAZOLA-BERMÚDEZ) - SALLOUHI et al., Pl. 1.11.
- 2012 *Doheniella colomi* (BORZA) - JACH et al., Fig. 12.H.
- 2012 *Doheniella dobenci* (BORZA) - JACH et al., Fig. 12.I.



- 2012 *Longicollaria dobeni* (BORZA) - PETROVA et al., Fig. 4.2 (Fig. 2.O herein).
- 2013 *Longicollaria dobeni* (BORZA) - LAKOVA & PETROVA, Pl. 1, figs. 11-12.
- 2013 *Dobeniella colomi* (BORZA) - LAKOVA & PETROVA, Pl. 1, figs. 13 (Fig. 2.P herein), 14, 15 (Fig. 2.G herein), 16 (Fig. 2.Q herein); Pl. 5, fig. 14.
- 2013 *Longicollaria dobeni* (BORZA) - LAKOVA & PETROVA, Pl. 5, figs. 18-20.
- 2014 *Longicollaria dobeni* (BORZA) - KOWAL-KASPRZYK, Fig. 3.R.
- 2015 *Chitinoidella dobeni* BORZA - BENZAGGAGH et al., Fig. 5.A-B.
- 2015 *Chitinoidella colomi* BORZA - BENZAGGAGH et al., Fig. 5.C.
- 2016 *Longicollaria dobeni* (BORZA) - MICHALÍK et al., Fig. 8.A.
- 2017 *Longicollaria dobeni* - PETROVA et al., Fig. 3.1.
- 2017 *Daciella almajica* - PETROVA et al., Fig. 3.7.
- 2017 *Daciella banatica* - PETROVA et al., Fig. 3.10.
- 2017 *Daciella danubica* - PETROVA et al., Fig. 3.11.
- 2018 *Dobeniella colomi* (BORZA) - KOWAL-KASPRZYK, Fig. 9.N.
- 2018 *Longicollaria dobeni* (BORZA) - KOWAL-KASPRZYK, Fig. 9.O.
- 2018 *Dobeniella cf. tithonica* (BORZA) - KOWAL-KASPRZYK, Fig. 9.P.
- 2019 *Longicollaria dobeni* - PETROVA et al., Fig. 4.1-4.
- 2020 *Chitinoidella dobeni* BORZA - BENZAGGAGH, Fig. 6.A-B.
- 2020 *Chitinoidella colomi* BORZA - BENZAGGAGH, Fig. 6.C.

Description: Polymorph species, with conical to slightly oval-shaped lorica, as high as wide, to slightly higher than wide; convex lorica walls, with maximum width immediately below the collar; arched collar equal to, or greater than, one-third of the total lorica length, showing in axial section two parallel to slightly convergent branches, with or without distal thickening; rounded to acute aboral pole, with or without a caudal appendage. The junction between the collar and the lorica bowl is marked by a constriction or, rarely, a small shoulder.

Variability: This species shows variability in shape of the lorica bowl, from conical to slightly oval elongated; shape of the aboral pole, rounded to slightly acute, with or without caudal appendage; junction between the collar and the lorica bowl, in form of a constriction or a small shoulder; and especially in length of the collar, equal to, or greater than, one-third of the total lorica length, with or without a distal thickening. The length of the collar allows to distinguish two varieties:

- ***Dobeniella dobeni* (BORZA) var. *dobeni* n. var.**, with collar of one-third to less than one-half of the total lorica length, with or without a distal thickening, and often with rounded to slightly acute aboral pole (Figs. 1.A-B, 2.A-H);
- ***Dobeniella dobeni* (BORZA) var. *longidobeni* n. var.**, with collar equal or higher than one-half of the total lorica length, with or without a distal thickening, and often with acute aboral pole, ending or not by a caudal

appendage (Figs. 1.C-D, 2.I-R ; **Holotype**, Fig. 2.I).

Occurrence: This species is known in the Dobeni Subzone of the central West Carpathians, western Balkans, Poland, Slovakia, Bulgaria, Romania, Serbia, Italy, northern Tunisia, and northern Morocco.

***Dobeniella colomi* (BORZA, 1966) n. comb.**

(Figs. 1.E-H, 2.S-AC)

Holotype: *Chitinoidella colomi* sp. nov. – BORZA, 1966, Taf. X, figs. 4-5.

Amended diagnosis: Conical to slightly oval-shaped lorica, with rectilinear to slightly arched collar, equal to or greater than one-third of the total lorica length, with or without a distal thickening; acute aboral pole, with or without a caudal appendage.

- 1966 *Chitinoidella colomi* sp. n. - BORZA, Taf. X, figs. 4-7.
- 1969 *Chitinoidella dobeni* BORZA - BORZA, Taf. LXV, figs. 10-15.
- 1969 *Chitinoidella colomi* BORZA - BORZA, Taf. LXVI, figs. 1 (Fig. 2.S herein), 2, 3 (Fig. 2.T herein), 8.
- 1977 Forma di transition tra *Chitinoidella dobeni* BORZA e *Chitinoidella colomi* BORZA - GRANDESSO, Tav. II, fig. 11 (Fig. 2.U herein).
- 1977 *Chitinoidella colomi* BORZA - GRANDESSO, Tav. II, Fig. 10 (Fig. 2.Y herein).
- 1995 *Chit. colomi* - BENZAGGAGH & ATROPS, Fig. 4.3.
- 1997 *Cubanella cristobalensis* (FURRAZOLA-BERMÚDEZ) - POP, Fig. 2, photos 10 (Fig. 2.V herein), 11 (Fig. 2.Z herein).
- 1998b *Dobeniella cubensis* (FURRAZOLA-BERMÚDEZ) - POP, Pl. I, figs. 27, 29.
- 1998b *Almajella cristobalensis* (FURRAZOLA-BERMÚDEZ) - POP, Pl. I, figs. 30-31.
- 1999 *Chitinoidella dobeni* BORZA - LAKOVA et al., Pl. 1, fig. 1.
- 2002 *Dobeniella dobeni* (BORZA) - REHÁKOVÁ, Fig. 4.6.
- 2009 *Dobeniella colomi* BORZA - BOUGHDIRI et al., Fig. 8.19 (Fig. 2.W herein).
- 2011 *Dobeniella tithonica* (BORZA) - SALLOUHI et al., Pl. 1.3.
- 2011 *Dobeniella bermudezi* (FURRAZOLA-BERMÚDEZ) - SALLOUHI et al., Pl. 1.12.
- 2011 *Dobeniella colomi* (BORZA) - SALLOUHI et al., Pl. 1.14, 15 (Fig. 2.AB herein), 16.
- 2012 *Dobeniella colomi* (BORZA) - PETROVA et al., Fig. 4.6-8.
- 2013 *Dobeniella colomi* (BORZA) - LAKOVA & PETROVA, Pl. 5, figs. 14, 15 (Fig. 2.AC herein), 20.
- 2018 *Daciella danubica* POP - KOWAL-KASPRZYK, Fig. 9.L-M.
- 2019 *Dobeniella colomi*, PETROVA et al., Fig. 4.25 (Fig. 2.X herein), 4.26-28.
- 2020 *Chitinoidella colomi* DOBEN - BENZAGGAGH, Fig. 6.D (Fig. 2.AA herein).

Description: Polymorph species, with conical to slightly oval-shaped lorica, as high as wide, to slightly higher than wide; convex lorica walls, with maximum width located immediately below the collar; rectilinear to slightly arched collar, equal to or greater than one-third of the total lorica length, showing in axial section, two parallel or divergent branches, with or without a distal



thickening. The junction between the collar and the lorica bowl is often marked by a more or less developed shoulder; acute aboral pole, often with a more or less developed caudal appendage.

Variability: This species shows variability in shape of the lorica bowl, from conical to slightly oval elongated; shape of the aboral pole, acute, with or without a caudal appendage; more or less developed shoulder; and, especially, in length of the collar equal to or great than one-third of the total lorica length, with or without a distal thickening, and its shape, rectilinear to more or less divergent. The length of the collar allows distinguishing two varieties:

- ***Dobenilla colomi* (BORZA) var. *colomi* n. var.**, with collar of one-third to less than one-half of the total lorica length, with or without a distal thickening, and with or without a caudal appendage (Figs. 1.E-F, 2.S-W);
- ***Dobenilla colomi* (BORZA) var. *longicollomi* n. var.**, with collar equal to or greater than one-half of the total lorica length, with or without a distal thickening, and with or without a caudal appendage (Figs. 1.G-H, 2.X-AC ; **Holotype**, Fig. 2.Y).

Comparison: *Dobenilla colomi* (BORZA) is distinguished from *Dobenilla dobenci* (BORZA) by its rectilinear collar, often forming a well-developed shoulder with the lorica bowl; and its acute aboral pole, often with a more or less long caudal appendage.

Occurrence: This species is known in the Dobeni Subzone of the central West Carpathians, western Balkans, Slovakia, Romania, Bulgaria, Serbia, Poland, Italy, northern Tunisia, and northern Morocco.

***Borziella* POP, 1997**

Type species: *Chitinoidella slovenica* sp. nov. - BORZA (1969), Taf. LXVI, fig. 9 (Fig. 2.AD herein).

***Borziella slovenica* (BORZA, 1969)**

(Figs. 1.I-J, 2.AD-AI)

Holotype: *Chitinoidella slovenica* sp. nov. - BORZA (1969), Taf. LXVI, fig. 9 (Fig. 2.AD herein).
1969 *Chitinoidella slovenica* sp. nov. - BORZA, Taf. LXVI, figs. 10-13, 14 (Fig. 2.AE herein), 15-16.
1977 *Chitinoidella* cf. *tithonica* BORZA - GRANDESSO, Tav. II, fig. 7 (Fig. 2.AF herein).
1977 *Chitinoidella slovenica* BORZA - GRANDESSO, Tav. II, figs. 8-9.
1986 *Chitinoidella slovenica* BORZA - BORZA & MICHALÍK, Pl. II, fig. 14.
1995 *Chit. slovenica* - BENZAGGAGH & ATROPS, Fig. 4.4 (Fig. 2.AG herein).
1998a *Daciella banatica* sp. nov. - POP, Fig. 2, photo 7.
1998b *Daciella banatica* sp. nov. - POP, Pl. I, figs. 11-12.
1998b *Borziella slovenica* (BORZA) - POP, Pl. I, figs. 16-17.
2000 *Chitinoidella slovenica* BORZA - BENZAGGAGH, Pl. 5, fig. 3.

- 2002 *Borziella slovenica* (BORZA) - REHÁKOVÁ, Fig. 2.9-10, 2.11 (Fig. 2.AH herein), 2.12.
2009 *Borziella slovenica* BORZA - BOUGHDIRI et al., Fig. 8.20.
2010 *Chitinoidella slovenica* BORZA - BENZAGGAGH et al., Fig. 8.4.
2011 *Borziella slovenica* (BORZA) - SALLOUHI et al., Pl. 1.18, 20-21.
2013 *Borziella slovenica* (BORZA) - LAKOVA & PETROVA, Pl. 1, figs. 9-10; Pl. 5, figs. 6-7.
2017 *Borziella slovenica* (BORZA) - KIETZMANN, Figs. 4.16 (Fig. 2.AI herein), 4.17-18, 5.7-8.
2018 *Borziella slovenica* (BORZA) - KIETZMANN et al., Fig. 3.a.
2018 *Borziella slovenica* (BORZA) - KOWAL-KASPRZYK, Fig. 9.Q.
2019 *Longicollaria dobenci* - PETROVA et al., Fig. 4.5-8.
2020 *Chitinoidella slovenica* BORZA - BENZAGGAGH, Fig. 6.E.

Description: Conical to slightly oval-shaped lorica, as high as wide to slightly higher than wide; convex lorica walls; short collar outwardly deflected, forming or not a well-marked annular constriction with the lorica bowl; rounded to slightly acute aboral pole, without caudal appendage.

Variability: This species shows variability mainly in presence (Figs. 1.I, 2.AD, 2.AF-AH) or not (Figs. 1.J, 2.AE, 2.AI) of a more or less developed annular constriction below the collar.

Occurrence: This species is known in the Dobeni Subzone of the central West Carpathians, western Balkans, Bulgaria, Poland, Slovakia, Romania, Italy, northern Tunisia, northern Morocco, and western Argentina.

***Borziella tithonica* (BORZA, 1969) n. comb.**

(Figs. 1.K-L, 2.AJ-AN)

- Holotype:** *Chitinoidella tithonica* BORZA - BORZA (1969), Taf. LXVII, fig. 1 (Fig. 2.AJ herein).
1969 *Chitinoidella tithonica* sp. nov. - BORZA, Taf. LXVII, fig. 2.
1986 *Chitinoidella* cf. *tithonica* BORZA - ŘEHÁNEK, Pl. 1, Fig. 6.
1995 *Chit. tithonica* - BENZAGGAGH & ATROPS, Fig. 4.5 (Fig. 2.AK herein).
1997 *Dobeniella tithonica* (BORZA) - POP, Fig. 2, photo 9.
1998a *Daciella banatica* sp. nov. - POP, Fig. 2, photos 7, 10.
1998b *Daciella danubica* sp. nov. - POP, Pl. I, Fig. 6.
1998b *Dobeniella tithonica* (BORZA) - POP, Pl. I, fig. 25.
2000 *Chitinoidella tithonica* BORZA - BENZAGGAGH, Pl. 5, fig. 4.
2002 *Dobeniella tithonica* (BORZA) - REHÁKOVÁ, Fig. 3.10, 3.12 (Fig. 2.AL herein).
2009 *Dobeniella tithonica* (BORZA) - MICHALÍK et al., Fig. 3.9 (Fig. 2.AM herein).
2010 *Chitinoidella tithonica* BORZA - BENZAGGAGH et al., Fig. 8.3.
2011 *Dobeniella tithonica* (BORZA) - SALLOUHI et al., Pl. 1.5 (Fig. 2.AN herein).
2014 *Daciella danubica* (POP) - KOWAL-KASPRZYK, Fig. 3.Q.
2019 *Dobeniella tithonica* - PETROVA et al., Fig. 4.29.
2020 *Chitinoidella tithonica* BORZA - BENZAGGAGH, Fig. 6.F.



Description: Conical to oval-shaped lorica, higher than wide; convex lorica walls; wide aperture surrounded by a thick and short half-crescentic collar, deflected outwards and forming a right or slightly obtuse angle with the lorica wall. Its junction with the lorica bowl is marked or not by a more or less developed annular constriction; acute aboral pole, with or without a short caudal appendage.

Variability: This species shows variability mainly in presence (Figs. 1.K, 2.AJ, 2.AL-AN) or not (Figs. 1.L, 2.AK) of a well-developed annular constriction below the collar.

Comparison: *Borziella tithonica* (BORZA) differs from *Borziella slovenica* (BORZA) by its thick and short half-crescentic collar forming almost a right angle with the lorica bowl.

Occurrence: This species is known in the Dobeni Subzone of the central West Carpathians, Slovakia, Romania, Poland, northern Tunisia, and northern Morocco.

***Carpathella* Pop, 1998a**

Type species: *Carpathella rumanica* sp. nov. - Pop (1998a), Fig. 2, photo 2 (Fig. 2.AR herein).

***Carpathella longirumanica* n. sp.**

(Figs. 1.M, 2.AO-AP)

Holotype: *Chitinoidella* sp. - BORZA (1969), Taf. LXIX, fig. 5 (Fig. 2.AO herein).

Derivatio nominis: The name of the species derived from the elongated shape of the lorica.

Diagnosis: Cylindrical elongated-shaped lorica, higher than wide, with a straight collar, forming a well-marked shoulder with the lorica bowl; wide and rounded aboral pole.

- 1997 *Cylindrella insueta* (ŘEHÁNEK) - Pop, Fig. 2, photo 16.
2017 *Carpathella rumanica* Pop - KIETZMANN, Fig. 5.9, 5.11 (Fig. 2.AP herein), 5.13.
2018 *Carpathella rumanica* Pop - KIETZMANN et al., Fig. 3.f.

Description: Cylindrical elongated-shaped lorica, higher than wide, rectilinear to slightly convex lorica walls; straight collar, forming a well-marked shoulder with the lorica bowl; wide and rounded aboral pole, without caudal appendage.

Occurrence: This species is known in the Dobeni Subzone of Slovakia, Romania, and western Argentina.

***Carpathella rumanica* Pop, 1998a**

(Figs. 1.N, 2.AQ-AT)

Holotype: *Carpathella rumanica* sp. nov. - Pop (1998a), Fig. 2, photo 2 (Fig. 2.AQ herein).

- 1997 *Borziella slovenica* (BORZA) - Pop, Fig. 2, photos 14 (Fig. 2.AR herein), 15.
1998a *Carpathella rumanica* sp. nov. - Pop, Fig. 2, photos 1, 3-5.
1998a *Daciella danubica* sp. nov. - Pop, Fig. 2, photo 16.
1998b *Carpathella rumanica* Pop - Pop, Pl. I, figs. 18-20.

- 2002 *Carpathella rumanica* Pop - REHÁKOVÁ, Fig. 2.13, 2.14 (Fig. 2.AS herein), 2.15-16.
2002 *Longicollaria dobenci* (BORZA) - REHÁKOVÁ, Fig. 4.4 (Fig. 2.AT herein).
2013 *Longicollaria dobenci* (BORZA) - LAKOVA & PETROVA, Pl. 1, figs. 9-10.
2017 *Carpathella rumanica* Pop - KIETZMANN, Fig. 5.12.
2017 *Daciella danubica* - PETROVA et al., Fig. 3.12.

Description: Rounded to slightly oval-shaped lorica, as high as wide to slightly higher than wide; straight, more or less elongated collar, forming a well-marked shoulder with the lorica bowl; wide and rounded aboral pole, without caudal appendage.

Variability: This species shows variability mainly in length of the collar.

Comparison: *Carpathella rumanica* Pop differs from *Carpathella longirumanica* n. sp. by its rounded and less elongated lorica.

Occurrence: This species is known in the Dobeni Subzone of the central West Carpathians, western Balkans, Romania, Bulgaria, northern Tunisia, western Cuba, and western Argentina.

***Daciella* Pop, 1998a**

Type species: *Daciella banatica* sp. nov. - Pop (1998a), Fig. 2, photo 6 (Fig. 2.AV herein).

Amended diagnosis: Oval elongated-shaped lorica, higher than wide; wide aperture with or without preoral swellings, followed or not by a short collar; acute aboral pole, with or without a short caudal appendage.

***Daciella banatica* Pop, 1998a**

(Figs. 1.O-P, 2.AU-AY)

Holotype: *Daciella banatica* sp. nov. - Pop (1998a), Fig. 2, photo 6 (Fig. 2.AU herein).

Amended diagnosis: Oval elongated-shaped lorica, with L/W ratio around 1.5; wide aperture with or without preoral swellings; rounded to acute aboral pole.

- 1969 *Chitinoidella* sp. - BORZA (1969), Taf. LXIX, figs. 3 (Fig. 2.AV herein), 6.
1998a *Daciella danubica* sp. nov. - Pop, Fig. 2, photos 15, 18.
1998a *Daciella banatica* sp. nov. - Pop, Fig. 2, photo 9.
1998b *Daciella danubica* sp. nov. - Pop, Pl. I, fig. 7.
1998b *Daciella banatica* sp. nov. - Pop, Pl. I, fig. 10.
1998b *Almajella cristobalensis* (FURRAZOLA-BERMÚDEZ) - Pop, Pl. I, fig. 33.
2002 *Daciella danubica* Pop - REHÁKOVÁ, Fig. 2.17-18, 2.19 (Fig. 2.AW herein), 2.20.
2011 *Daciella danubica* Pop - SALLOUHI et al., Pl. 1.17 (Fig. 2.AX herein).
2012 *Dobiella colomi* (BORZA) - PETROVA et al., Fig. 4.6, 4.7 (Fig. 2.AY herein), 4.8.
2012 *Daciella banatica* Pop - PETROVA et al., Fig. 4.9.
2012 *Daciella danubica* Pop - PETROVA et al., Fig. 4.10-11.
2013 *Daciella danubica* Pop - LAKOVA & PETROVA, Pl. 1, figs. 1, 3-5; Pl. 5, figs. 9-13.
2013 *Daciella* sp. - LAKOVA & PETROVA, Pl. 5, fig. 16.
2019 *Daciella banatica* Pop - PETROVA et al., Fig. 4.13-16.
2019 *Daciella danubica* Pop - PETROVA et al., Fig. 4.17-20.



Description: Polymorph species, with oval elongated-shaped lorica, higher than wide, with L/W ratio around 1.5; wide aperture, with or without preoral swellings, followed or not by a short straight or outwardly deflected collar, with or without a distal thickening; convex lorica walls; rounded to acute aboral pole, with or without a short caudal appendage.

Occurrence: This species is known in the Dobeni Subzone of the central West Carpathians, western Balkans, Serbia, Bulgaria, Romania, Slovakia, and northern Tunisia.

Daciella danubica Pop, 1998a

(Figs. 1.Q-T, 2.AZ-BH)

Holotype: *Daciella danubica* sp. nov. - Pop (1998a), Fig. 2, photo 14 (Fig. 2.AZ herein).

Amended diagnosis: Oval elongated-shaped lorica, with L/W ratio around 2; wide aperture with or without preoral swellings; acute aboral pole.

- 1969 *Chitinoidella* sp. - BORZA, Taf. LXVI, Fig. 6. (Fig. 2.BD herein).
1969 *Chitinoidella* sp. - BORZA, Taf. LXVII, Fig. 4.
1997 *Chitinoidella elongata* sp. nov. - Pop, Fig. 2, photo 4 (Fig. 2.BA herein).
1997 *Dobeniella bermudezi* (FURRAZOLA-BERMÚDEZ) - POP, Fig. 2.7-8.
1998a *Daciella danubica* sp. nov. - Pop, Pl. I, Fig. 1, photo 16.
1998a *Daciella almajica* sp. nov. - Pop, Fig. 2, photos 11 (Fig. 2.BG herein), 13.
1998a *Daciella svinitensis* sp. nov. - Pop, Fig. 2, photo 20.
1998b *Daciella danubica* sp. nov. - Pop, Pl. I, fig. 5.
1998b *Daciella svinitensis* sp. nov. - Pop, Pl. I, fig. 9.
1998b *Daciella almajica* sp. nov. - Pop, Pl. I, fig. 14.
1998b *Aninella insueta* (ŘEHÁNEK) - Pop, Pl. I, fig. 21.
1998b *Dobeniella bermudezi* (ŘEHÁNEK) - Pop, Pl. I, figs. 22-23.
2011 *Daciella svinitensis* Pop - SALLOUHI et al., Pl. 1.19 (Fig. 2.BF herein).
2002 *Daciella svinitensis* Pop - REHÁKOVÁ, Fig. 3.1-3.
2012 *Daciella svinitensis* Pop - PETROVA et al., Fig. 4.3, 4.5.
2013 *Daciella danubica* Pop - LAKOVA & PETROVA, Pl. 1, figs. 1 (Fig. 2.BC), 2 (Fig. 2.BE); Pl. 5, figs. 9 (Fig. 2.BB herein), 10-13.
2013 *Daciella svinitensis* Pop - LAKOVA & PETROVA, Pl. 1, figs. 6-8; Pl. 5, figs. 1-2, 3 (Fig. 2.BH herein), 4-5.
2019 *Daciella almajica* - PETROVA et al., Fig. 4.9-12.
2019 *Daciella svinitensis* - PETROVA et al., Fig. 4.21-24.

Description: Polymorph species, with oval elongated-shaped lorica, higher than wide, with L/W ratio around 2; wide aperture, with or without preoral swellings, extended or not by a short collar of variable shape: straight, arched or outwardly deflected, with or without distal thickening; acute aboral pole, with or without a short caudal appendage.

Comparison: *Daciella danubica* Pop differs from *Daciella banatica* Pop mainly by its more elongated lorica.

Occurrence: This species is known in the Dobeni Subzone of the central West Carpathians, western Balkans, Romania, Slovakia, Serbia, Bulgaria, and northern Tunisia.

***Popiella* REHÁKOVÁ, 2002**

***Popiella oblongata* REHÁKOVÁ, 2002**

(Figs. 1.U, 2.BI-BL)

Holotype: *Popiella oblongata* sp. nov. - REHÁKOVÁ (2002), Fig. 4.10.

- 1986 *Chitinoidella* sp. - ŘEHÁNEK, Pl. 1, fig. 5 (Fig. 2.BJ herein).
2002 *Popiella oblongata* sp. nov. - REHÁKOVÁ, Fig. 4.10, 4.11 (Fig. 2.BI herein), 4.12.
2011 *Popiella oblongata* REHÁKOVÁ - SALLOUHI et al., Pl. 1.22 (Fig. 2.BK herein).
2020 *Popiella oblongata* REHÁKOVÁ - BENZAGGAGH, Fig. 6.G (Fig. 2.BL herein).

Description: Cylindrical elongated-shaped lorica, higher than wide, with straight and parallel walls; wide aperture without collar; rounded to slightly acute aboral pole.

Occurrence: This species is known in the Dobeni Subzone of the central West Carpathians, Slovakia, northern Tunisia, and northern Morocco.

B - Bonetinae n. subfam.

Type species: *Chitinoidella boneti* sp. nov. - DOBEN (1963), Taf. 6, Abb. 1-5.

Derivatio nominis: The name of this subfamily derives from *Chitinoidella boneti*, which is the most common and typical chitinoidellid species of the Boneti Subzone.

Diagnosis: This subfamily includes chitinoidellids of larger size, ca 80 µm-long, with variable size and shape of the collar.

Occurrence: Species of the subfamily Bonetinae range from the base of the Boneti Subzone to the base of the Crassicollaria Zone (AO or Chitinoidellids/Primitive Calpionellids Subzone, BENZAGGAGH, 2020). They are known on both margins of the Tethyan Realm, from Iran to Mexico and in the southwestern Pacific margin (western Argentina).

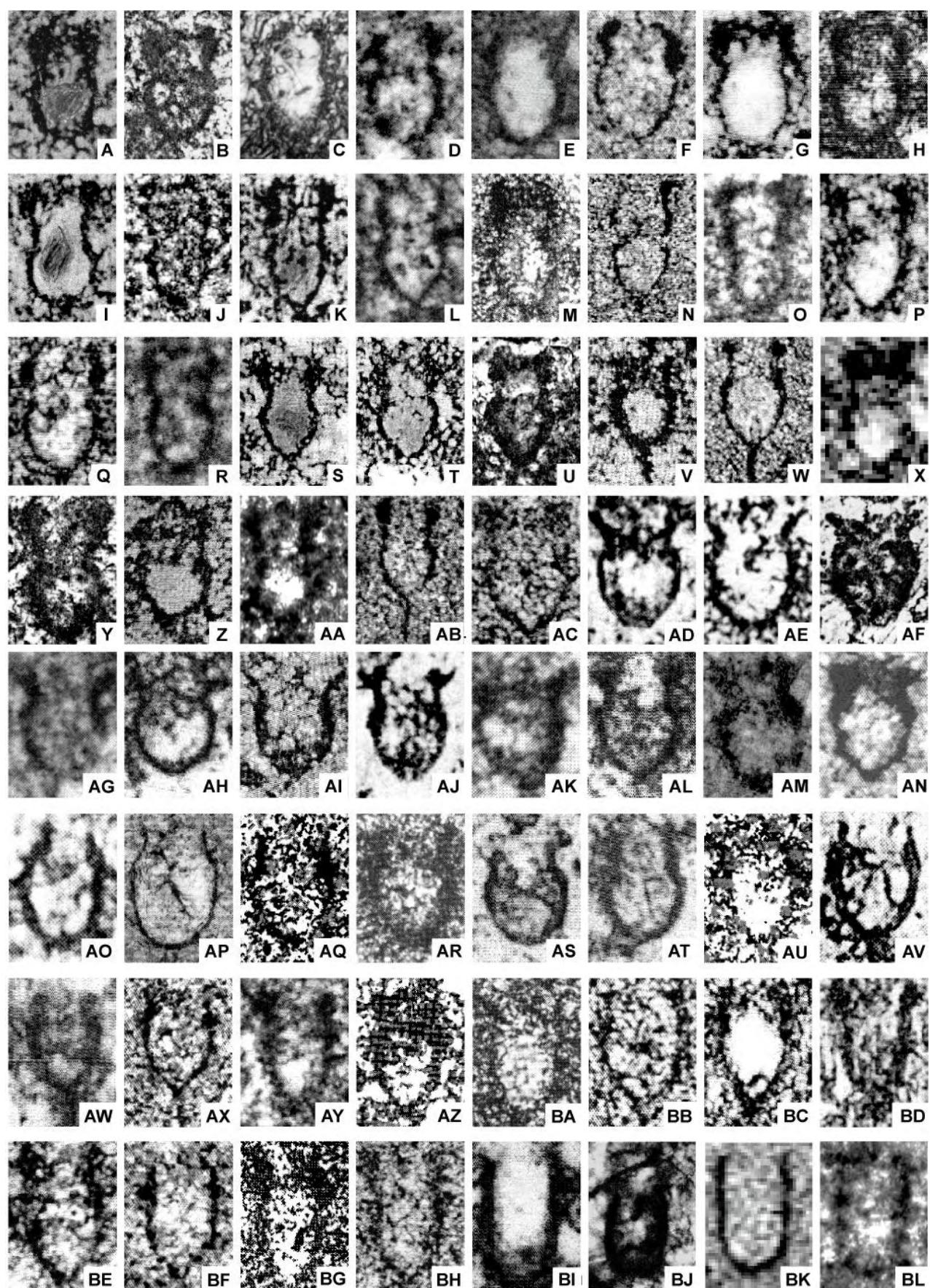
***Bermudeziella* n. gen.**

Type species: *Tintinnopsella bermudezi* sp. nov. - FURRAZOLA-BERMÚDEZ (1965), Lam. 2, Fig. 6. (Fig. 3.A herein).

Remark: Specimens of this genus were often attributed to the genera: *Dobeniella* Pop, *Longicollaria* Pop, *Almajella* Pop, and *Cubanella* Pop.

Derivatio nominis: This genus is dedicated to Dr. FURRAZOLA-BERMÚDEZ who discovered and described three chitinoidellid species of the *boneti* group: *Tintinnopsella cubensis*, *T. bermudezi* and *Calpionella cristobalensis*.

Diagnosis: Oval elongated-shaped lorica, with arched collar, with or without a partial or total distal thickening.



— 50µm



◀ **Figure 2:** Main genera and species of the subfamily Dobeniinae (Chitinoidellidae) from the Dobeni Subzone (late early Tithonian). **A-R. *Dobeniella dobenci* (BORZA):** **A-H.** *Dobeniella dobenci* (BORZA) var. *dobenci* n. var.: **A.** *Chitinoidella dobenci* BORZA, excerpt of BORZA, 1969, Taf. LXV, fig. 8; **B.** *Chitinoidella dobenci* BORZA, excerpt of GRANDESSO, 1977, Tav. II, fig. 12; **C.** *Chitinoidella dobenci* BORZA, excerpt of ŘEHÁNEK & CECCA, 1993, Pl. 1, fig. 7; **D.** *Chitinoidella dobenci*, excerpt of BENZAGGAGH & ATROPS, 1995, Fig. 4.1; **E.** *Dobeniella tithonica* (BORZA), excerpt of REHÁKOVÁ, 2002, Fig. 3.11; **F.** *Dobeniella cubensis* (FURRAZOLA-BERMÚDEZ), excerpt of SALLOUHI et al., 2011, Pl. 1.7; **G.** *Dobeniella colomi* (BORZA), excerpt of LAKOVA & PETROVA, 2013, Pl. 1, fig. 15; **H.** *Longicollaria dobenci* (BORZA), excerpt of REHÁKOVÁ, 2002, Fig. 4.5; **I-R.** *Dobeniella dobenci* (BORZA) var. *longidobenci* n. var.: **I.** *Chitinoidella dobenci* BORZA, excerpt of BORZA, 1969, Taf. LXV, Fig. 6 (**Holotype**); **J.** *Chitinoidella colomi* BORZA, excerpt of BENZAGGAGH, 2000, Pl. 5, fig. 2; **K.** *Chitinoidella colomi* BORZA, excerpt of BORZA, 1969, Taf. LXVI, fig. 4; **L.** Forme de passage *Chitinoidella dobenci*-*Chitinoidella colomi*, excerpt of BENZAGGAGH & ATROPS, 1995, Fig. 4.2; **M.** *Longicollaria dobenci* (BORZA), excerpt of POP, 1997, Fig. 2.12; **N.** *Longicollaria dobenci* (BORZA), excerpt of SALLOUHI et al., 2011, Pl. 1.1; **O.** *Longicollaria dobenci* (BORZA), excerpt of PETROVA et al., 2012, Fig. 4.2; **P.** *Dobeniella colomi* (BORZA), excerpt of LAKOVA & PETROVA, 2013, Pl. I, fig. 13; **Q.** *Dobeniella colomi* (BORZA), excerpt of LAKOVA & PETROVA, 2013, Pl. I, fig. 16; **R.** *Chitinoidella colomi* BORZA, excerpt of BENZAGGAGH et al., 2010, Fig. 8.1. **S-AC. *Dobeniella colomi* (BORZA):** **S-W.** *Dobeniella colomi* (BORZA) var. *colomi* n. var.: **S.** *Chitinoidella colomi* BORZA, excerpt of BORZA, 1969, Taf. LXVI, fig. 1; **T.** *Chitinoidella colomi* BORZA, excerpt of BORZA, 1969, Taf. LXVI, fig. 3; **U.** Forma di transition tra *Chitinoidella dobenci* BORZA-*Chitinoidella colomi* BORZA, excerpt of GRANDESSO, 1977, Tav. II, fig. 11. **V.** *Cubanella cristobalensis* (FURRAZOLA-BERMÚDEZ), excerpt of POP, 1997, Fig. 2.10; **W.** *Dobeniella colomi* BORZA, excerpt of BOUGHDIRI et al., 2009, Fig. 8.19; **X-AC.** *Dobeniella colomi* (BORZA) var. *longicolomi* n. var.: **X.** *Dobeniella colomi*, excerpt of PETROVA et al., 2019, Fig. 4.25; **Y.** *Chitinoidella colomi* BORZA, excerpt of GRANDESSO, 1977, Tav. II, fig. 10 (**Holotype**); **Z.** *Dobeniella cristobalensis* (FURRAZOLA-BERMÚDEZ), excerpt of POP, 1997, Fig. 2, photo 11; **AA.** *Chitinoidella colomi* BORZA, excerpt of BENZAGGAGH, 2020, Fig. 5.20; **AB.** *Dobeniella colomi* (BORZA), excerpt of SALLOUHI et al., 2011, Pl. 1.15; **AC.** *Dobeniella colomi* (BORZA), excerpt of LAKOVA & PETROVA, 2013, Pl. 5, fig. 15. **AD-AI.** *Borziella slovenica* (BORZA): **AD.** *Chitinoidella slovenica* BORZA, excerpt of BORZA, 1969, Taf. LXVI, fig. 9 (**Paratype**); **AF.** *Chitinoidella slovenica* BORZA, excerpt of GRANDESSO, 1977, Tav. II, fig. 8; **AG.** *Chitinoidella slovenica* BORZA, excerpt of BENZAGGAGH & ATROPS, 1995, Fig. 4.4; **AH.** *Borziella slovenica* (BORZA), excerpt of REHÁKOVÁ, 2002, Fig. 2.11; **AI.** *Borziella slovenica* (BORZA), excerpt of KIETZMANN, 2017, Fig. 4.16. **AJ-AN.** *Borziella tithonica* (BORZA): **AJ.** *Chitinoidella tithonica* BORZA, excerpt of BORZA, 1969, Taf. LXVII, fig. 1 (**Holotype**); **AK.** *Chitinoidella tithonica*, excerpt of BENZAGGAGH & ATROPS, 1995, Fig. 4.5; **AL.** *Dobeniella tithonica* (BORZA), excerpt of REHÁKOVÁ, 2002, Fig. 3.12; **AM.** *Dobeniella tithonica* (BORZA), excerpt of MICHALÍK et al., 2009, Fig. 3.9; **AN.** *Dobeniella tithonica* (BORZA), excerpt of SALLOUHI et al., 2011, Pl. 1.5. **AO-AP.** *Carpathella longirumanica* n. sp.: **AO.** *Chitinoidella* sp., excerpt of BORZA, 1969, Taf. LXIX, fig. 5 (**Holotype**); **AP.** *Carpathella rumanica* POP: **AQ-AT.** *Carpathella rumanica* POP: **AQ.** *Carpathella rumanica* POP, excerpt of KIETZMANN, 2017, Fig. 5.11 (**Paratype**); **AT.** *Longicollaria dobenci* (BORZA), excerpt of REHÁKOVÁ, 2002, Fig. 2.14; **AT.** *Chitinoidella elongata* POP, excerpt of POP, 1997, Fig. 2.14; **AS.** *Carpathella rumanica* POP, excerpt of REHÁKOVÁ, 2002, Fig. 4.4. **AU-AY.** *Daciella banatica* POP: **AU.** *Daciella banatica* POP, excerpt of POP, 1998a, Fig. 2, photo 6 (**Holotype**); **AV.** *Chitinoidella* sp., excerpt of BORZA, 1969, Taf. LXIX, fig. 3; **AW.** *Daciella danubica* POP, excerpt of REHÁKOVÁ, 2002, Fig. 2.19; **AX.** *Daciella danubica* POP, excerpt of SALLOUHI et al., 2011, Pl. 1.17; **AY.** *Dobeniella colomi* (BORZA), excerpt of PETROVA et al., 2012, Fig. 4.7; **AZ-BH.** *Daciella danubica* POP: **AZ.** *Daciella danubica* POP, excerpt of POP, 1998a, Fig. 2.14 (**Holotype**); **BA.** *Chitinoidella elongata* POP, excerpt of POP, 1997, Fig. 2.4; **BB.** *Daciella danubica* POP, excerpt of LAKOVA & PETROVA, 2013, Pl. 1, fig. 1; **BD.** *Chitinoidella* sp., excerpt of BORZA, 1969, Taf. LXVI, Fig. 6; **BE.** *Daciella danubica* POP, excerpt of LAKOVA & PETROVA, 2013, Pl. 1, fig. 2; **BF.** *Daciella svinitensis* POP, excerpt of SALLOUHI et al., 2011, Pl. 1.19; **BG.** *Daciella almajica* POP, excerpt of POP, 1998a, fig. 2, photo 11; **BH.** *Daciella svinitensis* POP, excerpt of LAKOVA & PETROVA, 2013, Pl. 5, fig. 3. **BI-BL.** *Popiella oblongata* REHÁKOVÁ: **BI.** *Popiella oblongata* REHÁKOVÁ, excerpt of REHÁKOVÁ, 2002, Fig. 4.11; **BJ.** *Chitinoidella* sp., excerpt of ŘEHÁNEK, 1986, Pl. I, fig. 5; **BK.** *Popiella oblongata* REHÁKOVÁ, excerpt of SALLOUHI et al., 2011, Pl. 1.22. **BL.** *Popiella oblongata* REHÁKOVÁ, excerpt of BENZAGGAGH, 2020, Fig. 6.G).

***Bermudeziella bermudezi*
(FURRAZOLA-BERMÚDEZ, 1965) n. comb.**
(Figs. 1.V-W, 3.A-L)

Holotype: *Tintinnopsella bermudezi* sp. nov. - FURRAZOLA-BERMÚDEZ (1965), Lam. 2, Fig. 6. (Fig. 3.A herein).

Amended diagnosis: Conical to oval elongated-shaped lorica, with arched collar, with or without a partial or total distal thickening.

- 1965 *Tintinnopsella bermudezi* sp. nov. - FURRAZOLA-BERMÚDEZ, Lam. 2, figs. 7-8 (Fig. 3.B herein); Lam. 3, fig. 1; Lam. 5, fig. 2.
1969 *Chitinoidella cubensis* (FURRAZOLA-BERMÚDEZ) - BORZA, Taf. LXVIII, figs. 14 (Fig. 3.C herein), 15.
1969 *Chitinoidella bermudezi* (FURRAZOLA-BERMÚDEZ) - BORZA, Taf. LXIX, fig. 1.

- 1973 *Chitinoidella bermudezi* (FURRAZOLA) - FURRAZOLA-BERMÚDEZ & KREISEL, Lam. 1, figs. 3-4, 5 (Fig. 3.F herein).
1977 *Chitinoidella cubensis* (FURRAZOLA-BERMÚDEZ) - GRANDESSO, Tav. II, fig. 4 (Fig. 3.D herein).
1977 *Chitinoidella bermudezi* (FURRAZOLA-BERMÚDEZ) - GRANDESSO, Tav. II, fig. 5 (Fig. 3.E herein).
1997 *Chitinoidella bermudezi* FURRAZOLA-BERMÚDEZ - GRÜN & BLAU, Pl. I, Fig. 6.
2002 *Dobeniella bermudezi* (FURRAZOLA-BERMÚDEZ) - REHÁKOVÁ, Fig. 3.7-8, 3.9 (Fig. 3.G herein).
2010 *Chitinoidella cristobalensis* (FURRAZOLA-BERMÚDEZ) - BENZAGGAGH et al., Fig. 8.9.
2010 *Dobeniella cubensis* (FURRAZOLA-BERMÚDEZ) - PSZCZÓLKOWSKI & MYCZYŃSKI, Fig. 12.11.
2011 *Dobeniella bermudezi* (FURRAZOLA-BERMÚDEZ) - SALLOUHI et al., Pl. 1.13 (Fig. 3.H herein).
2012 *Chitinoidella cubensis* (FURRAZOLA-BERMÚDEZ) - BENZAGGAGH et al., Fig. 6.D (Fig. 3.I herein).



- 2013 *Dobeniella bermudezi* (FURRAZOLA-BERMÚDEZ) – LAKOVA & PETROVA, Pl. 1, fig. 26; Pl. 5, fig. 27 (Fig. 3.J herein).
- 2013 *Dobeniella cubensis* (FURRAZOLA-BERMÚDEZ) – LAKOVA & PETROVA, Pl. 5, figs. 30-31.
- 2017 *Dobeniella cf. pinaraensis* (FURRAZOLA-BERMÚDEZ & KREISEL) – KIETZMANN, Fig. 5.14 (Fig. 3.K herein).
- 2017 *Dobeniella colomi* – PETROVA et al., Fig. 3.16-17.
- 2017 *Dobeniella bermudezi* – PETROVA et al., Fig. 4.7 (Fig. 3.L herein).
- 2017 *Almajella cristobalensis* – PETROVA et al., Fig. 4.12.
- 2019 *Dobeniella bermudezi* – PETROVA et al., Fig. 5.10-11.
- 2019 *Dobeniella cubensis* – PETROVA et al., Fig. 5.15.
- 2019 *Almajella cristobalensis* – PETROVA et al., Fig. 5.17, 5.19.
- 2020 *Chitinoidella bermudezi* (FURRAZOLA-BERMÚDEZ) – BENZAGGAGH, Fig. 6.AA.

Description: Conical to oval elongated-shaped lorica, higher than wide; convex lorica walls, with maximum width towards the mid-lorica bowl; wide aperture, surrounded by a more or less developed arched collar, showing in longitudinal section two parallel or divergent branches, with or without distal thickening, forming with the lorica bowl a small constriction; rounded to slightly acute aboral pole, with or without a caudal appendage.

Comparison: *Bermudeziella bermudezi* differs from *Dobeniella dobini* by its larger lorica, with maximum width towards the mid-lorica bowl, and its collar often shorter than one-third of the total lorica length; and its stratigraphic range.

Occurrence: This species is known in the Boneti Subzone of the central West Carpathians, western Balkans, Bulgaria, Slovakia, Italy, Iran, northern Tunisia, northern Morocco, Cuba, and western Argentina.

Bermudeziella cubensis
(FURRAZOLA-BERMÚDEZ, 1965) n. comb.
(Figs. 1.X-Y, 3.M-S)

Holotype: *Tintinnopsella cubensis* sp. nov. – FURRAZOLA-BERMÚDEZ (1965), Lam. 2, fig. 1; Lam. 5, fig. 1 (same specimen (Fig. 3.M herein).

Amended diagnosis: Conical to oval elongated-shaped lorica, with short arched collar, forming a globular piece.

- 1965 *Tintinnopsella cubensis* sp. nov. – FURRAZOLA-BERMÚDEZ, Lam. 2, figs. 2-5.
- 1969 *Chitinoidella cubensis* (FURRAZOLA-BERMÚDEZ) – BORZA, Taf. LXVIII, fig. 16 (Fig. 3.N herein).
- 1973 *Chitinoidella cubensis* (FURRAZOLA) – FURRAZOLA-BERMÚDEZ & KREISEL, Lam. 1, figs. 6 (Fig. 3.Q herein), 7.
- 1989 *Chitinoidella cf. cubensis* (FURRAZOLA-BERMÚDEZ) – CECCA et al., Pl. 6, fig. 3 (Fig. 3.O herein).
- 1989 *Chitinoidella boneti* DOBEN – CECCA et al., Pl. 6, Fig. 6.
- 1995 *Chit. cubensis* – BENZAGGAGH & ATROPS, Fig. 4.8 (Fig. 3.P herein).
- 1997 *Chitinoidella boneti* DOBEN – IVANOVA, Pl. I, fig. 18.
- 2000 *Chitinoidella cubensis* (FURRAZOLA-BERMÚDEZ) – BENZAGGAGH, Pl. 5, fig. 8.
- 2002 *Dobeniella cubensis* (FURRAZOLA-BERMÚDEZ) – REHÁKOVÁ, Fig. 3.4, 3.6.

- 2013 *Dobeniella cf. cubensis* (FURRAZOLA-BERMÚDEZ) – LAKOVA & PETROVA, Pl. 1, figs. 24, 25 (Fig. 3.R herein).
- 2013 *Dobeniella cubensis* (FURRAZOLA-BERMÚDEZ) – LAKOVA & PETROVA, Pl. 5, fig. 29 (Fig. 3.S herein).
- 2017 *Dobeniella cubensis* – PETROVA et al., Fig. 4.11.
- 2019 *Dobeniella cubensis* – PETROVA et al., Fig. 5.13-14.
- 2020 *Chitinoidella cubensis* (FURRAZOLA-BERMÚDEZ) – BENZAGGAGH, Fig. 6.N-O.

Description: Conical to oval elongated-shaped lorica, higher than wide; convex lorica walls, with maximum width towards the mid-lorica bowl; wide aperture surrounded by a small arched collar forming a globular piece; rounded to acute aboral pole, with or without a caudal appendage.

Variability: This species shows variability in the collar shape, forming a more or less developed globular piece; as well as the aboral pole, rounded acute, with or without a caudal appendage.

Comparison: *Bermudeziella cubensis* differs from the other species of the subfamily Bonetinae by its short collar forming a globular piece. It differs from *Dobeniella dobini* by its larger lorica, with maximum width towards the mid-lorica bowl; its shorter collar and its stratigraphic range.

Occurrence: This species is known in the Boneti Subzone of the central West Carpathians, western Balkans, Bulgaria, Slovakia, south-eastern France, northern Morocco, and Cuba.

***Bonetilla* n. gen.**

Type species: *Chitinoidella boneti* sp. nov. – DOBEN (1963), Taf. 6, Abb. 3-4 (Fig. 4.H herein).

Derivatio nominis: The name of this genus derives from *Chitinoidella boneti*, which is the most common and typical chitinoidellid species of the Boneti Subzone.

Diagnosis: Oval elongated-shaped lorica; wide aperture, surrounded by an outwards deflected collar, forming a variable angle with the lorica bowl.

***Bonetilla boneti* (DOBEN, 1963) n. comb.**

(Figs. 1.Z, 4.H-O)

Holotype: *Chitinoidella boneti* sp. nov. – DOBEN (1963), Taf. 6, Abb. 3-4 (Fig. 4.H herein).

Remarks: DOBEN (1963) gave in his Taf. 6, four specimens of *Chitinoidella boneti* n. sp., with two different lorica shape. The specimen, figured in Taf. 6, Abb. 3 (*op. cit.*, "holotype", Fig. 4.H herein), shows an elongated lorica with a L/W ratio equal to 2, a maximum width at the lower third of the lorica bowl, a well-marked preoral narrowing, and a more developed outwardly deflected collar. This specimen is close to the holotype of *Chitinoidella elongata* POP (1997, Fig. 3). The specimens of Taf. 6, Abb. 1 (the two specimens) and Abb. 2 (*op. cit.*, "Paratypoide", Fig. 3.T herein) display a wide lorica, with L/W ratio



around 1.5, maximum width located at the mid-lorica bowl, and a wide aperture, surrounded by shorter outwardly deflected collar. These two specimens of *Chitinoidella boneti* should be regarded as two separate species. Although the majority of *Chitinoidella boneti* figured by authors are consistent with the paratypes (*op. cit.*, Taf. 6, Abb. 1-2, 5) but because they are not consistent with holotype (*op. cit.*, Taf. 6, Abb. 1-2, 5), one should consider that they belong to a discrete species (*i.e.*, *Bonetilla germanica* n. sp.).

Diagnosis: Oval to elongated oval-shaped lorica, with more or less convex walls; wide aperture, surrounded by a curved outwardly deflected collar, forming an obtuse angle with the lorica bowl.

- 1969 *Chitinoidella boneti* DOBEN - BORZA, Taf. LXVII, fig. 14; Taf. LXVIII, figs. 8 (Fig. 4.K herein), 9, 10 (Fig. 4.I herein), 11-13.
1985 *Sturiella* cf. *oblonga* BORZA - ŘEHÁNEK, Pl. II, fig. 10.
1991 *Chitinoidella boneti* DOBEN - ALTINER & ÖZKAN, Pl. 3, figs. 1, 2 (Fig. 4.O herein).
2006 *Chitinoidella boneti* DOBEN - GRABOWSKI & PSZCZÓŁKOWSKI, Fig. 7.B.
2010 *Longicollaria insueta* (ŘEHÁNEK) - PSZCZÓŁKOWSKI & MYCZYŃSKI, Fig. 12.9 (Fig. 4.L herein).
2011 *Chitinoidella boneti* DOBEN - SALLOUHI et al., Pl. 1.24 (Fig. 4.J herein).
2012 *Chitinoidella bermudezi* (FURRAZOLA-BERMÚDEZ) - CECCA et al., Fig. 3.A (Fig. 4.M herein).
2012 *Chitinoidella boneti* DOBEN - CECCA et al., Fig. 3.B.
2012 *Chitinoidella boneti* DOBEN - BENZAGGAGH et al., Fig. 6.A.
2012 *Chitinoidella cristobalensis* (FURRAZOLA-BERMÚDEZ) - BENZAGGAGH et al., Fig. 6.C.
2012 *Chitinoidella bermudezi* (FURRAZOLA-BERMÚDEZ) - BENZAGGAGH et al., Fig. 6.E.
2012 *Dobeniella bermudezi* (FURRAZOLA-BERMÚDEZ) - PETROVA et al., Fig. 4.17
2013 *Chitinoidella boneti* DOBEN - LAKOVA & PETROVA, Pl. 1, fig. 18 (Fig. 4.N herein); Pl. 5, fig. 21.
2017 *Longicollaria dobenci* - PETROVA et al., Fig. 3.2.

Description: Oval to elongated-shaped lorica, higher than wide; with a L/W ratio greater than 1.5; sub-parallel to slightly convex lorica walls, with maximum width located between the median and the lower thirds of the lorica bowl; wide aperture, surrounded by a curved outwardly deflected collar, extending the lorica wall, and forming with this latter an obtuse angle (> 90°); rounded to slightly acute aboral pole, without caudal appendage.

Comparison: *Bonetilla boneti* (DOBEN, 1963) differs from *Bonetilla curva* n. sp. by its more elongated lorica with sub-parallel to slightly convex walls.

Occurrence: This species is known in the Bonetti Subzone of the western Balkans, Bulgaria, Slovakia, Poland, Italy, Turkey, Iran, and western Cuba.

Bonetilla carthagensis
(SALLOUHI et al., 2011) n. comb.

(Figs. 1.AA, 3.AE-AM)

Holotype: *Chitinoidella carthagensis* sp. nov. - SALLOUHI et al. (2011), Pl. 1.28 (Fig. 3.AE herein).

Amended diagnosis: Oval elongated-shaped lorica, higher than wide; convex to sub-parallel lorica walls, with maximum width located between the middle and the upper third of the lorica bowl; wide aperture surrounded by a half-crescentic collar, outwardly deflected and forming an annular constriction with the lorica bowl; rounded to acute aboral pole, with or without a short caudal appendage.

- 1969 *Chitinoidella boneti* DOBEN - BORZA, Taf. LXVII, figs. 3, 4 (Fig. 3.AG herein), 5-6, 8, 12 (Fig. 3.AM herein).
1975 *Chitinoidella* cf. *Ch. boneti* - LUGO, Lam. I, figs. 4-6 (same specimen); Lam. III, figs. 5 (Fig. 3.AH herein), 8.
1997 *Chitinoidella* sp. 1 - GRÜN & BLAU, Pl. I, fig. 7 (Fig. 3.AI herein).
2011 *Chitinoidella carthagensis* sp. nov. - SALLOUHI et al., Pl. 1.26-27.
2011 *Chitinoidella carthagensis* sp. nov. - SALLOUHI et al., Pl. 1.29 (Fig. 3.AF herein).
2011 *Chitinoidella hegarati* sp. nov. - SALLOUHI et al., Pl. 1.30-31.
2012 *Chitinoidella* sp. 2 SALLOUHI, BOUGHDIRI & CORDEY - PETROVA et al., Pl. 4.13.
2014 *Chitinoidella carthagensis* SALLOUHI, BOUGHDIRI & CORDEY - KOWAL-KASPRZYK, Fig. 3.D (Fig. 3.AJ herein).
2014 *Dobeniella tithonica* (BORZA) - KOWAL-KASPRZYK, Fig. 3.M.
2015 *Chitinoidella boneti* DOBEN - BENZAGGAGH et al., Fig. 5.E (Fig. 3.Ak herein).
2017 *Chitinoidella hegarati* SALLOUHI, BOUGHDIRI & CORDEY - KIETZMANN, Figs. 4.11, 4.12 (Fig. 3.Al herein), 5.1, 5.4.
2017 *Chitinoidella boneti* DOBEN - KIETZMANN, Figs. 4.10, 5.1.
2018 *Chitinoidella hegarati* SALLOUHI, BOUGHDIRI & CORDEY - KIETZMANN et al., Fig. 3.d.
2018 *Chitinoidella carthagensis* SALLOUHI, BOUGHDIRI & CORDEY - KOWAL-KASPRZYK, Fig. 9.C.
2019 *Chitinoidella carthagensis* - PETROVA et al., Fig. 5.25-30.
2019 *Chitinoidella hegarati* - PETROVA et al., Fig. 5.31-33, 5.35-36.
2020 *Chitinoidella carthagensis* SALLOUHI et al. - BENZAGGAGH, Fig. 6.Q-S.

Description: Elongated oval-shaped lorica, higher than wide, with a L/W ratio equal or greater than 1.5; convex to sub-parallel lorica walls, with maximum width located between the median and the upper thirds of the lorica bowl, wide aperture surrounded by a short half-crescentic collar, outwardly deflected and forming a right to slightly obtuse angle with the lorica wall. Its junction with the lorica bowl is marked by an annular constriction; rounded to acute aboral pole, with or without a short caudal appendage.



Variability: This species shows variability in more or less elongated lorica; shape of the aboral pole, rounded, acute, with or without a caudal appendage; and more or less developed collar.

Comparison: *Bonetilla carthagensis* is distinguished from *Bonetilla germanica* n. sp. by the presence of a constriction below the collar and its maximum width often located towards the upper third of the lorica bowl.

Occurrence: This species is known in the Boneti Subzone of the central West Carpathians, Slovakia, Serbia, Poland, Italy, northern Tunisia, northern Morocco, southeastern Mexico, and western Argentina.

***Bonetilla curva* n. sp.**

(Figs. 1.AB, 3.AN-AT)

Holotype: *Chitinoidella boneti* DOBEN - BORZA (1969), Taf. LXVII, fig. 12 (Fig. 3.AN herein).

Derivatio nominis: The name of the species derives from the curved shape of the collar.

Diagnosis: Rounded to slightly oval-shaped lorica; wide aperture surrounded by a curved and outwardly deflected collar, forming an obtuse angle with the lorica bowl.

- 1969 *Chitinoidella boneti* DOBEN - BORZA, Taf. LXVII, figs. 10, 13, 15-16.
1977 *Chitinoidella boneti* DOBEN - GRANDESSO, Tav. II, fig. 3.
1989 *Chitinoidella boneti* DOBEN - CECCA et al., Pl. 6, figs. 1, 2 (Fig. 3.AO herein), 4, 7.
2002 *Chitinoidella elongata* POP - REHÁKOVÁ, Fig. 2.1 (Fig. 3.AP herein).
2006. *Chitinoidella boneti* DOBEN - GRÜN & BLAU, Pl. I, fig. 5 (Fig. 3.AQ herein).
2007 *Chitinoidella boneti* DOBEN - ANDREINI et al., Pl. 1.5a (Fig. 3.AR herein).
2012 *Chitinoidella boneti* DOBEN - PETROVA et al., Fig. 4.14-15.
2013 *Chitinoidella boneti* DOBEN - LAKOVA & PETROVA, Pl. 5, fig. 23 (Fig. 3.AS herein).
2017 *Dobeniella bermudezi* - PETROVA et al., Fig. 4.8 (Fig. 3.AT herein).
2019 *Dobeniella bermudezi* - PETROVA et al., Fig. 5.8.
2020 *Chitinoidella bermudezi* FURRAZOLA-BERMÚDEZ - BENZAGGAGH, Fig. 6.L.

Description: Rounded to oval-shaped lorica, as high as wide, or slightly higher than wide; regularly convex lorica walls, with maximum width towards the mid-lorica bowl; wide aperture surrounded by a curved and outwardly deflected collar, extending the lorica wall and forming with this later an obtuse angle ($> 90^\circ$); rounded to slightly acute aboral pole, without caudal appendage.

Comparison: *Bonetilla curva* n. sp. differs from the other species of the genus *Bonetilla* by its long and curved collar, in continuity with the lorica wall and forming with this later an obtuse angle. It differs from *Borziella slovenica* by its larger size, the lack of an annular constriction below the collar, and its stratigraphic range.

Occurrence: This species is known in the Boneti Subzone of the central West Carpathians, western Balkans, Slovakia, Serbia, Poland, Bulgaria, Italy, southeastern France, northern Tunisia, and northern Morocco.

***Bonetilla elongata* (POP, 1997) n. comb.**

(Figs. 1.AC, 3.AU-AV, 4.A)

Holotype: *Chitinoidella elongata* sp. nov. - POP (1997), Fig. 2, photo 3 (Fig. 3.AU herein).

- 1969 *Chitinoidella* sp. - BORZA, Taf. LXIX, fig. 7.
1998b *Chitinoidella elongata* POP - POP, Pl. I, fig. 38.
2002 *Chitinoidella elongata* POP - REHÁKOVÁ, Fig. 2.5 (Fig. 3.AV herein), 2.6-8.
2013 *Chitinoidella elongata* POP - LAKOVA & PETROVA, Pl. 1, fig. 20.
2014 *Chitinoidella elongata* POP - KOWAL-KASPRZYK, Fig. 3.F (Fig. 4.A herein), 3.G.
2016 *Chitinoidella elongata* POP - MICHALÍK et al., Fig. 8.C.
2017 *Chitinoidella elongata* - PETROVA et al., Fig. 3.25-26.
2018 *Chitinoidella elongata* POP - KOWAL-KASPRZYK, Fig. 9.D-E.
2019 *Chitinoidella elongata* - PETROVA et al., Fig. 5.6.
2020 *Chitinoidella elongata* POP - BENZAGGAGH, Fig. 6.M.

Description: Oval elongated-shaped lorica, higher than wide, with a L/W ratio around 2, with maximum width located at the lower third of the lorica bowl; rectilinear to slightly convex lorica walls, converging towards the aperture; wide aperture, with a curved outwardly deflected collar of small to medium size, forming an obtuse angle ($> 90^\circ$) with the lorica bowl; rounded to acute aboral pole, terminated or not by a more or less developed caudal appendage.

Comparison: *Bonetilla elongata* differs from *Bonetilla germanica* n. sp. by its elongated lorica, with a greater L/W ratio; its maximum width located at the lower third of the lorica bowl, and its rectilinear to slightly convex lorica walls converging towards the aperture.

Occurrence: This species is known in the Boneti Subzone of the central West Carpathians, western Balkans, Romania, Slovakia, Serbia, Poland, Bulgaria, and southeastern France.

***Bonetilla germanica* n. sp.**

(Figs. 1.AD, 3.T-AD)

Holotype: *Chitinoidella boneti* sp. nov. - DOBEN (1963), Taf. 6, Abb. 2 (Fig. 3.T herein).

Derivatio nominis: The name of the species derives from the Bavarian Alps (Germany) where this species was first discovered and described by DOBEN (1963).

Diagnosis: Oval elongated-shaped lorica, with a L/W ratio around 1.5; wide aperture surrounded by a half-crescentic collar, outwardly deflected; acute aboral pole, with or without a caudal appendage.



- 1963 *Chitinoidella boneti* sp. nov. - DOBEN, Taf. 6, Abb. 1 (the two specimens), 2, 5.
- 1965 *Tintinnopsella* sp. - FURRAZOLA-BERMÚDEZ, Lam. 3, fig. 3.
- 1965 *Tintinnopsella carpathica* (MURGEANU & FILIPESCU) - FURRAZOLA-BERMÚDEZ, Lam. 4, fig. 2 (Fig. 3.Z herein).
- 1969 *Chitinoidella boneti* DOBEN - BORZA, Taf. LXVII, figs. 7, 9.
- 1969 *Chitinoidella boneti* DOBEN - BORZA, Taf. LXVIII, fig. 7.
- 1973 *Chitinoidella boneti* DOBEN - FURRAZOLA-BERMÚDEZ & KREISEL, Lam. I, figs. 1, 2 (the two specimens).
- 1973 *Chitinoidella lubimovae* sp. nov. - FURRAZOLA-BERMÚDEZ & KREISEL, Lam. II, figs. 2, 3 (Fig. 3.AC herein), 4.
- 1975 *Chitinoidella* cf. *Chitinoidella boneti* - LUGO, Lam. I, figs. 7-9; Lam. II, figs. 1-9; Lam. III, figs. 1-2.
- 1977 Forma di transizione tra *Chitinoidella boneti* DOBEN e *Praetintinnopsella andrusovi* BORZA - GRANDESSO, Tav. I, fig. 10.
- 1977 *Chitinoidella boneti* DOBEN - GRANDESSO, Tav. I, figs. 11 (Fig. 3.V herein), 12.
- 1977 *Chitinoidella boneti* DOBEN - GRANDESSO, Tav. II, fig. 1.
- 1986 *Chitinoidella boneti* DOBEN - BORZA & MICHALÍK, Pl. II, figs. 15-16.
- 1995 *Chitinoidella boneti* DOBEN - OLÓRIZ et al., Lam. I, fig. 3.
- 1995 *Chit. boneti* - BENZAGGAGH & ATROPS, Fig. 4.6 (Fig. 3.W herein).
- 1995 *Chit. aff. cristobalensis* (FURRAZOLA-BERMÚDEZ) - BENZAGGAGH & ATROPS, Fig. 4.9 (Fig. 3.AB herein).
- 1997 *Chitinoidella boneti* DOBEN - POP, Fig. 2, photos 1 (Fig. 3.X herein), 2.
- 1997 *Chitinoidella boneti* DOBEN - GRÜN & BLAU, Pl. I, figs. 1-4.
- 1998b *Chitinoidella boneti* DOBEN - POP, Pl. I, figs. 34, 36, 39.
- 1998b *Praetintinnopsella andrusovi* BORZA - POP, Pl. I, fig. 42.
- 2000 *Chitinoidella boneti* DOBEN - BENZAGGAGH, Pl. 5, Fig. 6.
- 2000 *Chitinoidella* aff. *cristobalensis* (FURRAZOLA-BERMÚDEZ) - BENZAGGAGH, Pl. 5, fig. 11.
- 2002 *Chitinoidella boneti* DOBEN - REHÁKOVÁ, Fig. 2.2 (Fig. 3.Y herein), 2.4.
- 2006 *Chitinoidella boneti* DOBEN - BOUGHDIRI et al., Fig. 2.2.
- 2007 *Longicollaria dobenci* (BORZA) - ANDREINI et al., Pl. 1.2a.
- 2007 *Dobeniella bermudezi* (FURRAZOLA-BERMÚDEZ) - ANDREINI et al., Pl. I.6a, 7a.
- 2007 *Dobeniella cubensis* (FURRAZOLA-BERMÚDEZ) - ANDREINI et al., Pl. I.8a.
- 2009 *Chitinoidella* sp. 1 - BOUGHDIRI et al., Fig. 8.22.
- 2010 *Chitinoidella boneti* DOBEN - BENZAGGAGH et al., Fig. 8.6-7.
- 2012 *Chitinoidella boneti* DOBEN - BENZAGGAGH et al., Fig. 6.B.
- 2013 *Chitinoidella boneti* DOBEN - LAKOVA & PETROVA, Pl. 5, figs. 22-23.
- 2013 *Dobeniella cubensis* (FURRAZOLA-BERMÚDEZ) - LAKOVA & PETROVA, Pl. 5, fig. 32
- 2014 *Chitinoidella boneti* DOBEN - KOWAL-KASPRZYK, Fig. 3.A, 3.C.
- 2015 *Chitinoidella boneti* DOBEN - BENZAGGAGH et al., Fig. 5.D, 5.F.
- 2017 *Chitinoidella boneti* DOBEN - KIETZMANN, Fig. 3.22-24.
- 2017 *Chitinoidella boneti* DOBEN - KIETZMANN, Fig. 3.c.
- 2018 *Chitinoidella* sp. indet. - KIETZMANN et al., Fig. 9.K.
- 2018 *Chitinoidella boneti* DOBEN - KOWAL-KASPRZYK, Fig. 9.A-B.
- 2018 *Chitinoidella popi* SALLOUHI et al. - KOWAL-KASPRZYK, Fig. 9.I, 9.J (Fig. 3.AD herein).
- 2018 *Chitinoidella* sp. indet. - KOWAL-KASPRZYK, Fig. 9.K.
- 2019 *Chitinoidella boneti* - PETROVA et al., Fig. 5.1, 5.3-4.
- 2019 *Chitinoidella elongata* - PETROVA et al., Fig. 5.7.
- 2020 *Chitinoidella boneti* DOBEN - BENZAGGAGH, Fig. 6.I, 6.J (Fig. 3.AA herein), 6.K, 6.AB.

Description: Oval elongated-shaped lorica, higher than wide, with a L/W ratio around 1.5; regularly convex lorica walls, with maximum width at the mid-lorica bowl; wide aperture, with a half-crescentic collar, outwardly deflected and forming a right to more or less obtuse angle with the lorica bowl; acute aboral pole, with or without a caudal appendage.

Variability: This species shows variability in size of the lorica, and its shape, more or less elongated; the more or less developed collar and the shape of the aboral pole, acute, with or without a more or less developed caudal appendage.

Occurrence: This species is the most common of the subfamily Bonetinae. It is known in the Boneti Subzone of the central West Carpathians, western Balkans, Poland, Romania, Slovakia, Italy, southeastern France, southeastern Spain, Iran, northern Tunisia, northern Morocco, Cuba, southeastern Mexico, and western Argentina.

Bonetilla lehegarati n. sp.

(Figs. 1.AE, 4.B-G)

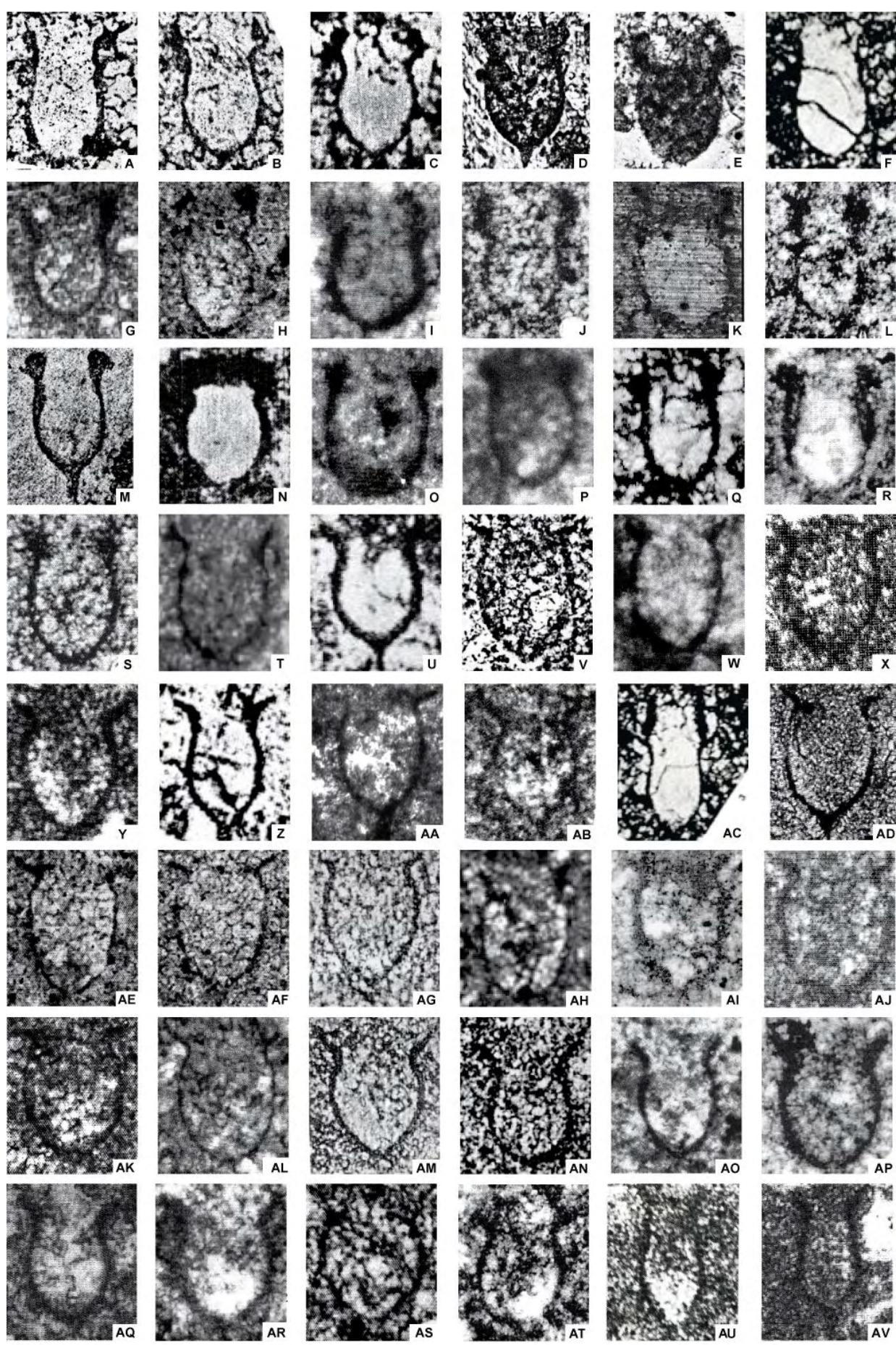
Remarks on *Chitinoidella hegarati* SALLOUHI et al., 2011: The holotype (Pl. 1.30) and the paratype (Pl. 1.31) of *Chitinoidella hegarati* SALLOUHI et al., 2011, both show an elongated lorica, with an acute aboral pole; they are very close to the holotype (Pl. 1.28) of *Chitinoidella carthagensis* of the same authors.

I designate their specimen, illustrated in Pl. 1.25, which has a rounded lorica and a rounded aboral pole, as the type of *Chitinoidella lehegarati* n. sp.

Holotype: *Chitinoidella hegarati* sp. nov. - SALLOUHI et al. (2011), Pl. 1.25 (Fig. 4.D herein).

Derivatio nominis: This species is dedicated to the late Dr Gérard LE HÉGARAT, Lyon, who introduced me to the study of the calpionellids, for his key contribution to the study of Berriasian calpionellids and ammonites from the Vocontian Through in southeastern France.

Diagnosis: Rounded to slightly oval-shaped lorica, almost as high as wide, or slightly higher than wide, showing an annular constriction below the collar, and a short outwardly deflected collar; wide rounded to slightly acute aboral pole, without caudal appendage.



— 50μm



◀ **Figure 3:** Main genera and species of the subfamily Bonetinae (Chitinoidellidae) from the Boneti Subzone (early late Tithonian). **A-L.** *Bermudeziella bermudezi* (FURRAZOLA-BERMÚDEZ): **A.** *Tintinnopsella bermudezi* FURRAZOLA-BERMÚDEZ, excerpt of FURRAZOLA-BERMÚDEZ, 1965, Lam. 2, Fig. 6. (**Holotype**); **B.** *Tintinnopsella bermudezi* FURRAZOLA-BERMÚDEZ, excerpt of FURRAZOLA-BERMÚDEZ, 1965, Lam. 2, fig. 8; **C.** *Chitinoidella cubensis* (FURRAZOLA-BERMÚDEZ), excerpt of BORZA, 1969, Taf. LXVIII, fig. 14; **D.** *Chitinoidella cubensis* (FURRAZOLA-BERMÚDEZ), excerpt of GRANDESSO, 1977, Tav. II, fig. 4; **E.** *Chitinoidella bermudezi* (FURRAZOLA-BERMÚDEZ), excerpt of GRANDESSO, 1977, Tav. II, fig. 5; **F.** *Chitinoidella bermudezi* (FURRAZOLA-BERMÚDEZ), excerpt of FURRAZOLA-BERMÚDEZ & KREISEL, 1973, Lam. I, fig. 5; **G.** *Dobeniella bermudezi* (FURRAZOLA-BERMÚDEZ), excerpt of REHÁKOVÁ, 2002, Fig. 3.9; **H.** *Dobeniella bermudezi* (FURRAZOLA-BERMÚDEZ), excerpt of BENZAGGAGH et al., 2012, Fig. 6.D; **I.** *Chitinoidella cubensis* (FURRAZOLA-BERMÚDEZ), excerpt of BENZAGGAGH et al., 2011, Pl. 1.13; **J.** *Dobeniella bermudezi* (FURRAZOLA-BERMÚDEZ), excerpt of LAKOVA & PETROVA, 2013, Pl. 5, fig. 27; **K.** *Dobeniella cf. pinaraensis* (FURRAZOLA-BERMÚDEZ & KREISEL), excerpt of KIETZMANN, 2017, Fig. 5.14; **L.** *Dobeniella bermudezi*, excerpt of PETROVA et al., 2017, Fig. 4.7. **M-S.** *Bermudeziella cubensis* (FURRAZOLA-BERMÚDEZ): **M.** *Tintinnopsella cubensis* FURRAZOLA-BERMÚDEZ, excerpt of FURRAZOLA-BERMÚDEZ, 1965, Lam. 2, fig. 1 (**Holotype**); **N.** *Chitinoidella cubensis* (FURRAZOLA-BERMÚDEZ), excerpt of CECCA et al., 1989, Pl. 6, fig. 3; **P.** *Chitinoidella cubensis*, excerpt of BENZAGGAGH & ATROPS, 1995, Fig. 4.8; **Q.** *Chitinoidella cubensis* (FURRAZOLA), excerpt of FURRAZOLA-BERMÚDEZ & KREISEL, 1973, Lam. 1, Fig. 6; **R.** *Dobeniella bermudezi* (FURRAZOLA-BERMÚDEZ), excerpt of LAKOVA & PETROVA, 2013, Pl. 1, fig. 25, recrystallised wall; **S.** *Dobeniella cubensis* (FURRAZOLA-BERMÚDEZ), excerpt of LAKOVA & PETROVA, 2013, Pl. 5, fig. 29. **T-AD.** *Bonetilla germanica* n. sp.: **T.** *Chitinoidella boneti* DOBEN, excerpt of DOBEN, 1963, Taf. 6, Abb. 2 (**Holotype**); **U.** *Chitinoidella boneti* DOBEN, excerpt of FURRAZOLA-BERMÚDEZ & KREISEL, 1973, Lam. I, fig. 1; **V.** *Chitinoidella boneti* DOBEN, excerpt of GRANDESSO, 1977, Tav. I, fig. 11; **W.** *Chitinoidella boneti*, excerpt of BENZAGGAGH & ATROPS, 1995, Fig. 4.6; **X.** *Chitinoidella boneti* DOBEN, excerpt of POP, 1997, Fig. 2, photo 2; **Y.** *Chitinoidella boneti* DOBEN, excerpt of REHÁKOVÁ, 2002, Fig. 2.2; **Z.** *Tintinnopsella carpathica* (MURGEANU & FILIPESCU), excerpt of FURRAZOLA-BERMÚDEZ, 1965, Lam. 4, fig. 2; **AA.** *Chitinoidella boneti* DOBEN, excerpt of BENZAGGAGH, 2020, Fig. 8.J; **AB.** *Chitinoidella aff. cristobalensis* (FURRAZOLA-BERMÚDEZ), excerpt of BENZAGGAGH & ATROPS, 1995, Fig. 4.9; **AC.** *Chitinoidella lubimovae* FURRAZOLA-BERMÚDEZ & KREISEL, excerpt of FURRAZOLA-BERMÚDEZ & KREISEL, 1973, Lam. I, fig. 3, see comment in the text; **AD.** *Chitinoidella popi* SALLOUHI et al., excerpt of KOWAL-KASPRZYK, 2018, Fig. 9.J. **AE-AM.** *Bonetilla carthagensis* (SALLOUHI et al.): **AE.** *Chitinoidella carthagensis* SALLOUHI et al., excerpt of SALLOUHI et al., 2011, Pl. 1.28 (**Holotype**); **AF.** *Chitinoidella carthagensis* SALLOUHI et al., excerpt of SALLOUHI et al., 2011, Pl. 1.29 (**Paratype**); **AG.** *Chitinoidella boneti* DOBEN, excerpt of BORZA, 1969, Taf. LXVII, Fig. 6; **AH.** *Chitinoidella cf. Ch. boneti*, excerpt of LUGO, 1975, Lam. III, fig. 5; **AI.** *Chitinoidella* sp. 1, excerpt of GRÜN & BLAU, 1997, Pl. I, fig. 7; **AJ.** *Chitinoidella carthagensis* SALLOUHI et al., excerpt of KOWAL-KASPRZYK, 2014, Fig. 3.D; **AK.** *Chitinoidella boneti* DOBEN, excerpt of BENZAGGAGH et al., 2015, Fig. 5.E; **AL.** *Chitinoidella hegarati* SALLOUHI et al., excerpt of KIETZMANN, 2017, Fig. 4.12. **AM.** *Chitinoidella boneti* DOBEN, excerpt of BORZA, 1969, Taf. LXVII, fig. 4; **AN-AT.** *Bonetilla curva* n. sp.: **AN.** *Chitinoidella boneti* DOBEN, excerpt of BORZA, 1969, Taf. LXVII, fig. 12; **AO.** *Chitinoidella boneti* DOBEN, excerpt of CECCA et al., 1989, Pl. 6, fig. 2; **AP.** *Chitinoidella boneti* DOBEN, excerpt of GRÜN & BLAU, 2006, Pl. I, fig. 5; **AQ.** *Chitinoidella boneti* DOBEN, excerpt of REHÁKOVÁ, 2002, Fig. 2.1; **AR.** *Chitinoidella boneti* DOBEN, excerpt of PETROVA et al., 2012, Fig. 4.15; **AS.** *Chitinoidella boneti* DOBEN, excerpt of LAKOVA & PETROVA, 2013, Pl. 5, fig. 23; **AT.** *Chitinoidella boneti* DOBEN, excerpt of PETROVA et al., 2017, Fig. 4.8; **AU-AV.** *Bonetilla elongata* (POP): **AU.** *Chitinoidella elongata* POP, excerpt of POP, 1997, Fig. 2, photo 3 (**Holotype**); **AV.** *Chitinoidella elongata* POP, excerpt of REHÁKOVÁ, 2002, Fig. 2.5.

- 1998b *Chitinoidella boneti* DOBEN - POP, Pl. 1.35 (Fig. 4.D herein).
- 1995 *Chit. bermudezi* - BENZAGGAGH & ATROPS, Fig. 4.7 (Fig. 4.C herein).
- 2000 *Chitinoidella bermudezi* (FURRAZOLA-BERMÚDEZ) - BENZAGGAGH, Pl. 5, fig. 7.
- 2007 *Borziella slovenica* (BORZA) - ANDREINI et al., Pl. 1.1a.
- 2007 *Chitinoidella boneti* DOBEN - ANDREINI et al., Pl. 1.3a (Fig. 4.E herein), 4a.
- 2010 *Chitinoidella cubensis* (FURRAZOLA-BERMÚDEZ) - BENZAGGAGH et al., Fig. 8.10 (Fig. 4.F herein).
- 2012 *Borziella slovenica* (BORZA) - PETROVA et al., Fig. 4.12.
- 2014 *Chitinoidella hegarati* SALLOUHI, BOUGHDIRI & CORDEY - KOWAL-KASPRZYK, Fig. 9.I-J.
- 2017 *Borziella slovenica* - PETROVA et al., Fig. 3.4-5.
- 2017 *Chitinoidella hegarati* SALLOUHI, BOUGHDIRI & CORDEY - PETROVA et al., Fig. 4.5-6.
- 2018 *Chitinoidella hegarati* SALLOUHI, BOUGHDIRI & CORDEY - KOWAL-KASPRZYK, Fig. 9.G, 9.H (Fig. 4.G herein).
- 2019 *Chitinoidella hegarati* - PETROVA et al., Fig. 5.34.

Description: Rounded to slightly oval-shaped lorica, as high as wide or slightly higher than wide; regularly convex lorica walls, with maximum width towards the mid-lorica bowl; wide aperture surrounded by a short half-crescentic collar, out-

wardly deflected and forming a right to slightly obtuse angle with the lorica bowl. Its junction with the lorica bowl is marked by an annular constriction; rounded to slightly acute aboral pole, without caudal appendage.

Comparison: *Bonetilla lehegarati* n. sp. is distinguished from *Bonetilla germanica* n. sp. by its rounded lorica, almost as high as wide; its rounded aboral pole and the presence of a constriction below the collar. It differs from *Bonetilla carthagensis* by having a rounded lorica, almost as high as wide, with rounded aboral pole, without caudal appendage.

Occurrence: This species is known in the Boneti Subzone of Slovakia, Romania, Serbia, Poland, Bulgaria, Italy, northern Tunisia, and northern Morocco.

***Bonetilla miniboneti* n. sp.**
(Figs. 1.AF, 4.P-R)

Holotype: *Chitinoidella boneti* DOBEN - BORZA (1969), Taf. LXVIII, Fig. 6. (Fig. 4.P herein).

Derivatio nominis: The specific name of this species derives from the similarity of its lorica with that of the paratype of *Chitinoidella boneti*



DOBEN, 1963, but differing in smaller size, rounded lorica shape, and low L/W ratio.

Diagnosis: Rounded-shaped lorica of medium size, almost as high as wide; wide aperture surrounded by a short half-crescentic collar; rounded to slightly acute aboral pole.

1969 *Chitinoidella boneti* DOBEN - BORZA, Taf. LXVIII, figs. 1-5.

1977 *Chitinoidella boneti* DOBEN - GRANDESSO, Tav. II, fig. 2 (Fig. 4.Q herein).

2017 *Chitinoidella boneti* DOBEN - LAKOVA et al., Fig. 1.A (Fig. 4.R herein).

2019 *Chitinoidella boneti* - PETROVA et al., Fig. 4.39-42.

Description: Rounded to slightly oval-shaped lorica of medium size, as high as wide, or slightly higher than wide, with a L/W ratio around 1.2; regularly convex lorica walls, with maximum width located at the mid-lorica bowl; wide aperture, surrounded by a short half-crescentic collar, forming a right to slightly obtuse angle with the lorica bowl; rounded to slightly acute aboral pole, without caudal appendage.

Comparison: *Bonetilla miniboneti* n. sp. is distinguished from *Bonetilla germanica* n. sp. by its smaller size, more rounded lorica, with a low L/W ratio and its rounded aboral pole without caudal appendage.

Occurrence: This species is known in the Boneti Subzone of Slovakia, Bulgaria and Italy.

Bonetilla popi
(SALLOUHI et al., 2011) n. comb.
(Figs. 1.AG, 4.S-W)

Holotype: *Chitinoidella popi* sp. nov. - SALLOUHI et al. (2011), Pl. 1.32 (Fig. 4.S herein).

1975 *Chitinoidella* cf. *Ch. boneti* - LUGO, Lam. I, fig. 12, 13 (Fig. 4.T herein).

2009 *Chitinoidella* sp. 2 - BOUGHDIRI et al., Fig. 8.23.

2010 *Chitinoidella boneti* DOBEN - BEN ABDESELAM-MAHDAOUI et al., Pl. II, fig. 1 (Fig. 4.U herein).

2011 *Chitinoidella popi* sp. nov., SALLOUHI et al., Pl. 1.33.

2011 *Chitinoidella* cf. *elongata* POP - SALLOUHI et al., Pl. 1, fig. 34.

2011 *Chitinoidella* sp. 1 - SALLOUHI et al., Pl. 1, fig. 34 (distorted specimen).

2014 *Chitinoidella popi* SALLOUHI, BOUGHDIRI & CORDEY - KOWAL-KASPRZYK, Fig. 3.K (Fig. 4.V herein), 3.L.

2015 *Chitinoidella boneti* DOBEN - BENZAGGAGH et al., Fig. 5.G.

2017 *Chitinoidella elongata* POP - KIETZMANN, Figs. 4.15, 5.5 (Fig. 4.W herein), 5.6.

2017 *Chitinoidella* sp. - PETROVA et al., Fig. 4.1-2.

2018 *Chitinoidella elongata* POP - KIETZMANN et al., Fig. 3.e.

2019 *Chitinoidella popi* - PETROVA et al., Fig. 5.21-24.

Description: Oval elongated-shaped lorica, higher than wide, with a L/W ratio > 2 ; regularly convex lorica walls, with maximum width towards the mid-lorica bowl; wide aperture surrounded by a short half-crescentic collar, outwardly deflected, forming a right to slightly obtuse angle with the lorica bowl; acute aboral pole, often with a more or less developed caudal appendage.

Comparison: *Bonetilla popi* is distinguished from *Bonetilla elongata* by its regular convex lorica walls, with maximum width at the mid-lorica bowl, and its shorter collar, forming a lesser obtuse angle with the lorica wall.

Occurrence: This species is known in the Boneti Subzone of Bulgaria, Poland, northern Tunisia, southeastern Mexico, and western Argentina.

***Bonetilla praeboneti* n. sp.**

(Figs. 1.AH, 4.X-Y)

Holotype: *Chitinoidella* aff. *boneti* - BENZAGGAGH & ATROPS (1995), Fig. 4.12 (Fig. 4.X herein).

Derivatio nominis: The species is named with reference to the primitive form of the *Chitinoidella boneti* group from the base of the Boneti Subzone.

Diagnosis: Rounded to slightly oval-shaped lorica, with reduced or undeveloped collar; rounded to slightly acute aboral pole.

2000. *Chitinoidella* aff. *boneti* DOBEN - BENZAGGAGH, Pl. 5, fig. 5.

2010 *Chitinoidella* aff. *boneti* DOBEN - BENZAGGAGH et al., Fig. 8.5 (Fig. 4.Y herein).

2020 *Chitinoidella* aff. *boneti* DOBEN - BENZAGGAGH, Fig. 6.H.

Diagnosis: Rounded to oval-shaped lorica, slightly higher than wide; regularly convex lorica walls, with maximum width towards the mid-lorica bowl; wide aperture with reduced or lacking collar; rounded to slightly acute aboral pole, without caudal appendage.

Comparison: *Bonetilla praeboneti* n. sp. Differs from *Bonetilla germanica* n. sp. by its reduced or undeveloped collar.

Occurrence: This species is known in the base of the Boneti Subzone in several sections of northern Morocco.

***Bonetilla sphaerica* n. sp.**

(Figs. 1.AI, 4.Z-AF)

Holotype: *Chitinoidella* sp. - CECCA et al. (1989), Pl. 6, fig. 5 (Fig. 4.Z herein).

Derivatio nominis: The name of this species derives from the spherical shape of the lorica.

Diagnosis: Spherical-shaped lorica, as high as wide; wide aperture, with a short half-crescentic collar, outwardly deflected; wide and rounded aboral pole.

1998b *Chitinoidella boneti* DOBEN - POP, Pl. I, fig. 37 (Fig. 4.AA herein).

1999 *Chitinoidella boneti* DOBEN - LAKOVA et al., Pl. 1, fig. 2 (Fig. 4.AB herein).

2011 *Chitinoidella* sp. 2 - SALLOUHI et al., Pl. 1.36 (Fig. 4.AC herein).

2013 *Chitinoidella hegarati* SALLOUHI, BOUGHDIRI & CORDEY - LAKOVA & PETROVA, Pl. I, fig. 19.

2013 *Dobeniella* cf. *cubensis* (FURRAZOLA-BERMÚDEZ) - LAKOVA & PETROVA, Pl. 1, figs. 23 (Fig. 4.AD herein), 24.



- 2014 *Chitinoidella boneti* DOBEN - KOWAL-KASPRZYK, Fig. 3.B.
- 2014 *Dobeniella tithonica* (BORZA) - KOWAL-KASPRZYK, Fig. 3.N (Fig. 4.AE herein).
- 2014 *Dobeniella cubensis* (FURRAZOLA-BERMÚDEZ) - KOWAL-KASPRZYK, Fig. 3.O.
- 2017 *Chitinoidella* sp. - STRZEBOŃSKI et al., Fig. 6.T (Fig. 4.AF herein).
- 2019 *Chitinoidella bermudezi* - PETROVA et al., Fig. 5.2.

Description: Spherical-shaped lorica, as high as wide, to slightly higher than wide, with a L/W ratio around 1.2; regularly convex lorica walls; wide aperture, with a short crescentic collar, outwardly deflected, and forming a right to slightly obtuse angle with the lorica bowl; wide and rounded aboral pole, without caudal appendage.

Comparison: *Bonetilla sphaerica* n. sp. is distinguished from all other species of the genus *Bonetilla* by its spherical lorica, short collar, and its wide and rounded aboral pole.

Occurrence: The species is known in the Boneti Subzone of the western Balkans, Romania, Bulgaria, Poland, southeastern France, northern Tunisia, and western Argentina.

***Bonetilla svinitensis* (POP, 1998b) n. comb.**

(Figs. 1.AJ, 4.AG-AK)

Holotype: *Daciella svinitensis* sp. nov. - POP (1998a), Fig. 2, photo 19 (Fig. 4.AG herein).

Diagnosis: Elongated cylindrical-shaped lorica, higher than wide; wide aperture with a short half-crescent collar outwardly deflected; rounded to slightly acute aboral pole.

- 1998b *Daciella svinitensis* sp. nov. - POP, Pl. 1, fig. 8.
- 2012 *Chitinoidella elongata* POP. - PETROVA et al., Fig. 4.16.
- 2014 *Chitinoidella elongata* POP - KOWAL-KASPRZYK, Fig. 3.H.
- 2014 *Popiella oblongata* REHÁKOVÁ - KOWAL-KASPRZYK, Fig. 3.T.
- 2017 *Chitinoidella elongata* POP - KIETZMANN, Fig. 4.14 (Fig. 4.AI herein).
- 2017 *Popiella oblongata* - PETROVA et al., Fig. 3.27-28.
- 2017 *Daciella* sp. - PETROVA et al., Fig. 3.29, 3.30 (Fig. 4.AJ herein).
- 2017 *Longicollaria insueta* POP - PETROVA et al., Fig. 4.17 (Fig. 4.AYH herein).
- 2018 *Chitinoidella* sp. indet. - KOWAL-KASPRZYK, Fig. 9.F.
- 2018 *Popiella oblongata* REHÁKOVÁ - KOWAL-KASPRZYK, Fig. 9.S (Fig. 4.AK herein).
- 2019 *Daciella* sp. - PETROVA et al., Fig. 4.31-32.
- 2019 *Longicollaria insueta* - PETROVA et al., Fig. 4.34.
- 2019 *Popiella oblongata* - PETROVA et al., Fig. 4.37-38.

Description: Elongated cylindrical-shaped lorica, higher than wide, with parallel to sub-parallel walls; wide aperture, with a short half-crescent collar, outwards deflected, forming a right to slightly obtuse angle with the lorica bowl; rounded to slightly acute aboral pole, without caudal appendage.

Comparison: *Bonetilla svinitensis* differs from *Bonetilla elongata* and *Bonetilla popi* by its cylindrical lorica, with parallel to sub-parallel walls, and a shorter collar; it differs from *Bonetilla boneti* by its rectilinear lorica walls and its shorter

collar; and from *Popiella oblongata* by its larger size and the presence of a short collar.

Occurrence: This species is known in the Boneti Subzone of Romania, Slovakia, Poland, Bulgaria, and western Argentina.

***Furrazolaia* n. gen.**

Holotype: *Calpionella cristobalensis* sp. nov. - FURRAZOLA-BERMÚDEZ (1965), Lam. 3, fig. 5 (Fig. 4.AL herein).

Remark: Specimens of this genus were often attributed to the genera: *Dobeniella* POP, *Longicollaria* POP, *Almajella* POP, and *Cubanella* POP.

Derivatio nominis: This genus is dedicated to Dr. FURRAZOLA-BERMÚDEZ.

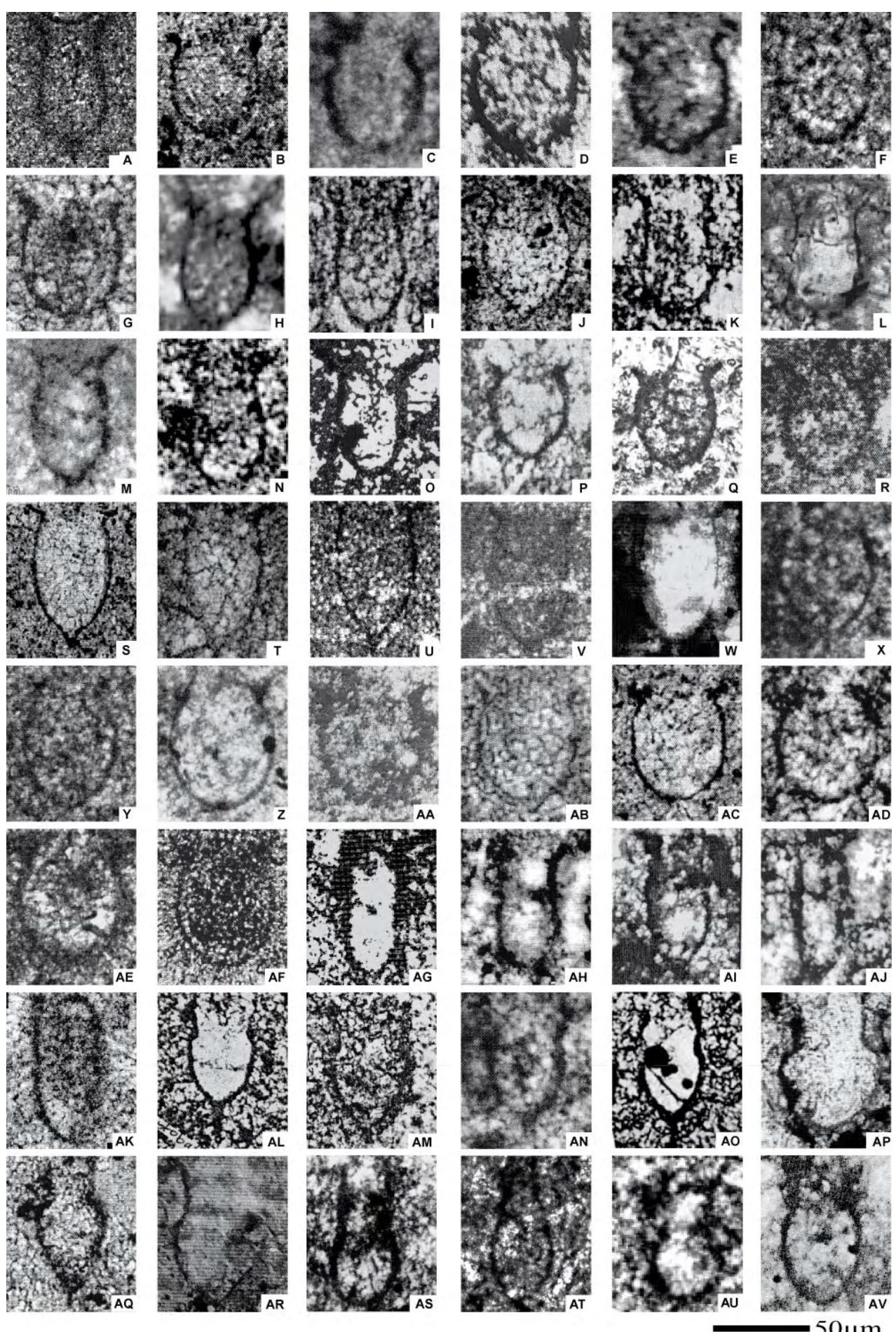
Diagnosis: Conical to slightly elongated oval-shaped lorica; wide aperture, with a long rectilinear to slightly arched collar, often forming a shoulder with the lorica bowl; acute aboral pole, with or without a caudal appendage.

***Furrazolaia cristobalensis* (FURRAZOLA-BERMÚDEZ, 1965) n. comb.**

(Figs. 1.AK, 4.AL-AR)

Holotype: *Calpionella cristobalensis* sp. nov. - FURRAZOLA-BERMÚDEZ (1965), Lam. 3, fig. 5 (Fig. 4.AL herein).

- 1965 *Calpionella cristobalensis* sp. nov. - FURRAZOLA-BERMÚDEZ, Lam. 3, figs. 5-8; Lam. 5, fig. 3.
- 1973 *Chitinoidella cristobalensis* (FURRAZOLA) - FURRAZOLA-BERMÚDEZ & KREISEL, Lam. I, fig. 8.
- 1973 *Chitinoidella pinaraensis* sp. nov. - FURRAZOLA-BERMÚDEZ & KREISEL, Lam. II, fig. 5 (Fig. 4.AO herein).
- 1977 *Chitinoidella cristobalensis* (FURRAZOLA-BERMÚDEZ) - GRANDESSO, Tav. II, Fig. 6. (Fig. 4.AM herein).
- 1995 *Chit. cristobalensis* - BENZAGGAGH & ATROPS, Fig. 4.10 (Fig. 4.AN herein), 4.11.
- 1997 *Chitinoidella boneti* DOBEN - IVANOVA, Pl. 1, fig. 17.
- 2000 *Chitinoidella cristobalensis* (FURRAZOLA-BERMÚDEZ) - BENZAGGAGH, Pl. 5, figs. 9-10.
- 2002 *Dobeniella cubensis* (FURRAZOLA-BERMÚDEZ) - REHÁKOVÁ, Fig. 3.5.
- 2010 *Chitinoidella cristobalensis* (FURRAZOLA-BERMÚDEZ) - BENZAGGAGH et al., Fig. 8.8.
- 2010 *Longicollaria dobenci* (BORZA) - PSZCZÓŁKOWSKI & MYCZYŃSKI, Fig. 12.10 (Fig. 4.AP herein).
- 2010 ?*Dobeniella pinarensis* (FURRAZOLA-BERMÚDEZ & KREISEL) - PSZCZÓŁKOWSKI & MYCZYŃSKI, Fig. 12.12.
- 2011 *Dobeniella cubensis* (FURRAZOLA-BERMÚDEZ) - SALLOUHI et al., Pl. 1.10.
- 2011 *Cubanella cristobalensis* (FURRAZOLA-BERMÚDEZ) - SALLOUHI et al., Pl. 1.23 (Fig. 4.AQ herein).
- 2013 *Almajella cristobalensis* (FURRAZOLA-BERMÚDEZ) - LAKOVA & PETROVA, Pl. 1, fig. 22.
- 2017 *Dobeniella cf. pinaraensis* (FURRAZOLA-BERMÚDEZ & KREISEL) - KIETZMANN, Fig. 5.15 (Fig. 4.AR herein).
- 2017 *Dobeniella tithonica* - PETROVA et al., Fig. 3.18.
- 2019 *Dobeniella lubimovae* - PETROVA et al., Fig. 5.12.
- 2020 *Chitinoidella cristobalensis* (FURRAZOLA-BERMÚDEZ) - BENZAGGAGH, Fig. 6.P.
- 2020 *Chitinoidella bermudezi* (FURRAZOLA-BERMÚDEZ) - BENZAGGAGH, Fig. 6.Z.



50µm



◀ **Figure 4:** Main genera and species of the subfamily Bonetinae (Chitinoidellidae) from the Boneti Subzone (early late Tithonian). **A.** *Bonetilla elongata* (POP), excerpt of KOWAL-KASPRZYK, 2014, Fig. 3.F; **B-G.** *Bonetilla lehegarati n. sp.*: **B.** *Chitinoidella hegarati* SALLOUHI et al., excerpt of SALLOUHI et al., 2011, Pl. 1.25 (**Holotype**); **C.** *Chitinoidella bermudezi*, excerpt of BENZAGGAGH & ATROPS, 1995, Fig. 4.7; **D.** *Chitinoidella boneti* DOBEN, excerpt of POP, 1998b, Pl. 1.35; **E.** *Borziella slovenica* (BORZA), excerpt of ANDREINI et al., 2007, Pl. 1.1a; **F.** *Chitinoidella cubensis* (FURAZOLA-BERMÚDEZ), excerpt of BENZAGGAGH et al., 2010, Fig. 8.10; **G.** *Chitinoidella hegarati* SALLOUHI et al., excerpt of KOWAL-KASPRZYK, 2018, Fig. 9.H. **H-O.** **Bonetilla boneti (DOBEN, 1963):** **H.** *Chitinoidella boneti* DOBEN, excerpt of DOBEN, 1963, Taf. 6, Abb. 3 (**Holotype**); **I.** *Chitinoidella boneti* DOBEN, excerpt of BORZA, 1969, Taf. LXVIII, fig. 10; **J.** *Chitinoidella boneti* DOBEN, excerpt of SALLOUHI et al., 2011, Pl. 1.24; **K.** *Chitinoidella boneti* DOBEN, excerpt of BORZA, 1969, Taf. LXVII, fig. 8; **L.** *Longicollaria insueta* (ŘEHÁNEK), excerpt of PSZCZOŁKOWSKI & MYCZYŃSKI, 2010, Fig. 12.9; **M.** *Chitinoidella bermudezi* (FURAZOLA-BERMÚDEZ), excerpt of CECCA et al., 2012, Fig. 3A; **N.** *Chitinoidella boneti* DOBEN, excerpt of LAKOVA & PETROVA, 2013, Pl. 1, fig. 18; **O.** *Chitinoidella boneti* DOBEN, excerpt of AL-TINER & ÖZKAN, 1991, Pl. 3, fig. 2. **P-R.** **Bonetilla miniboneti n. sp.:** **P.** *Chitinoidella boneti* DOBEN, excerpt of BORZA, 1969, Taf. LXVIII, Fig. 6. (**Holotype**); **Q.** *Chitinoidella boneti* DOBEN, excerpt of GRANDESSO, 1977, Tav. II, fig. 2; **R.** *Chitinoidella boneti* DOBEN, excerpt of LAKOVA et al., 2017, Fig. 1.A. **S-W.** **Bonetilla popi** (SALLOUHI et al.): **S.** *Chitinoidella popi* SALLOUHI et al., excerpt of SALLOUHI et al., 2011, Pl. 1.32 (**Holotype**); **T.** *Chitinoidella cf. Ch. boneti*, excerpt of LUGO, 1975, Lam. I, fig. 2; **U.** *Chitinoidella boneti* DOBEN, excerpt of BEN ABDESSELAH-MAHDAOUI et al., 2010, Pl. II, fig. 1; **V.** *Chitinoidella popi* SALLOUHI et al., excerpt of KOWAL-KASPRZYK, 2014, Fig. 3.K; **W.** *Chitinoidella elongata* POP, excerpt of KIETZMANN, 2017, Fig. 5.5. **X-Y.** **Bonetilla praeboneti n. sp.:** **X.** *Chitinoidella aff. boneti*, excerpt of BENZAGGAGH & ATROPS, 1995, Fig. 4.12 (**Holotype**); **Y.** *Chitinoidella aff. boneti* DOBEN, excerpt of BENZAGGAGH et al., 2010, Fig. 8.5. **Z-AF.** **Bonetilla sphaerica n. sp.:** **Z.** *Chitinoidella* sp., excerpt of CECCA et al., 1989, Pl. 6, fig. 5 (**Holotype**); **AA.** *Chitinoidella boneti* DOBEN, excerpt of POP, 1998b, Pl. I, fig. 2; **AC.** *Chitinoidella* sp., excerpt of SALLOUHI et al., 2011, Pl. 1.36; **AD.** *Dobeniella cf. cubensis* (FURAZOLA-BERMÚDEZ), excerpt of LAKOVA & PETROVA, 2013, Pl. 1, fig. 23; **AE.** *Dobeniella cf. cubensis*, excerpt of KOWAL-KASPRZYK, 2014, Fig. 3.N; **AF.** *Chitinoidella* sp., excerpt of STRZEBOŃSKI et al., 2017, Fig. 6.T. **AG-AK.** **Bonetilla svinitensis** (POP): **AG.** *Daciella svinitensis* POP, excerpt of POP, 1998a, Fig. 2, photo 19 (**Holotype**); **AH.** *Longicollaria insueta* POP, excerpt of PETROVA et al., 2017, Fig. 4.17; **AI.** *Chitinoidella elongata* POP, excerpt of KIETZMANN, 2017, Fig. 4.14; **AJ.** *Daciella* sp., excerpt of PETROVA et al., 2017, Fig. 3.30; **AK.** *Popiella oblongata* ŘEHÁKOVÁ, excerpt of KOWAL-KASPRZYK, 2018, Fig. 9.S. **AL-AR.** **Furrazolaia cristobalensis** (FURAZOLA-BERMÚDEZ): **AL.** *Calpionella cristobalensis* FURAZOLA-BERMÚDEZ, excerpt of FURAZOLA-BERMÚDEZ, 1965, Lam. 3, fig. 5 (**Holotype**); **AM.** *Chitinoidella cristobalensis* (FURAZOLA-BERMÚDEZ), excerpt of GRANDESSO, 1977, Tav. II, Fig. 6; **AN.** *Chitinoidella cristobalensis*, excerpt of BENZAGGAGH & ATROPS, 1995, Fig. 4.10; **AO.** *Chitinoidella pinaraensis* FURAZOLA-BERMÚDEZ & KREISEL, excerpt of FURAZOLA-BERMÚDEZ & KREISEL, 1973, Lam. II, fig. 5, see comment in the text; **AP.** *Longicollaria dobeni* (BORZA), excerpt of PSZCZOŁKOWSKI & MYCZYŃSKI, 2010, Fig. 12.10; **AQ.** *Cubanella cristobalensis* (FURAZOLA-BERMÚDEZ), excerpt of KIETZMANN, 2017, Fig. 5.15. **AS-AU.** **Furrazolaia insueta** (ŘEHÁNEK): **AS.** *Chitinoidella insueta* ŘEHÁNEK, excerpt of BENZAGGAGH, 2020, Fig. 6.T; **AU.** *Longicollaria insueta*, excerpt of PETROVA et al., 2017, Fig. 4.16; **AV.** *Dobeniella cf. pinaraensis* (FURAZOLA-BERMÚDEZ & KREISEL), excerpt of KIETZMANN, 2017, Fig. 4.20.

Description: Conical to elongated oval-shaped lorica, as high as wide, or slightly higher than wide, with maximum width located immediately below the collar; convex lorica walls, strongly converging towards the aboral pole; wide aperture surrounded by a rectilinear to slightly arched collar, equal to or slightly lesser than one-third of the total lorica length, showing in axial section two parallel or divergent branches of the same thickness as that of the lorica wall, forming a more or less developed shoulder; acute aboral pole, often with a caudal appendage.

Variability: This species shows variability in more or less developed shoulder at the junction between the collar and the lorica bowl; length and shape of the collar; and presence or not of a caudal appendage.

Comparison: *Furrazolaia cristobalensis* differs from *Bermudeziella cubensis* and *Bermudeziella bermudezi* in having a conical lorica, with maximum width located immediately below the collar; a longer collar, with the same thickness as that of the lorica wall; the presence of a shoulder at the junction between the collar and the lorica bowl, and a more acute aboral pole, often with a caudal appendage. It differs from *Dobeniella longicolomi* n. sp. by its larger size; its collar of the same

thickness as that of the lorica wall; and its stratigraphic range.

Occurrence: This species is known in the Boneti Subzone of the central West Carpathians, western Balkans, Bulgaria, Italy, Northeast Spain, Iran, northern Tunisia, northern Morocco, Cuba, and western Argentina.

***Furrazolaia insueta*
(ŘEHÁNEK, 1986) n. comb.**
(Figs. 1.AL, 4.AS-AU)

Holotype: *Chitinoidella insueta* sp. nov. – ŘEHÁNEK (1986), Pl. 1, fig. 2 (Fig. 4.AS herein).

Amended diagnosis: Cylindrical elongated-shaped lorica, with a long collar, equal to or greater than one-half of the total lorica length; wide and rounded aboral pole.

1969 *Chitinoidella* sp. - BORZA, Taf. LXVIX, fig. 7.

1986 *Chitinoidella insueta* sp. nov. - ŘEHÁNEK, Pl. 1, figs. 3-4.

2002 *Longicollaria insueta* (ŘEHÁNEK) - ŘEHÁKOVÁ, Fig. 4.7-9.

2014 *Longicollaria insueta* (ŘEHÁNEK) - KOWAL-KASPRZYK, Fig. 3.S.

2016 *Cylindrella insueta* (ŘEHÁNEK, 1986) - GRANIER et al., Fig. 2.A

2017 *Dobeniella pinarensis* - PETROVA et al., Fig. 4.14.

2017 *Longicollaria insueta* - PETROVA et al., Fig. 4.16



- (Fig. 4.AU herein).
- 2017 *Dobeniella cf. pinaraensis* (FURRAZOLA-BERMÚDEZ & KREISEL) - KIETZMANN, Fig. 4.20 (Fig. 4.AV herein).
- 2018 *Longicollaria cf. insueta* (ŘEHÁNEK) - KOWAL-KASPRZYK, Fig. 9.R.
- 2018 *Dobeniella cf. pinaraensis* (FURRAZOLA-BERMÚDEZ & KREISEL) - KIETZMANN *et al.*, Fig. 3.b.
- 2019 *Dobeniella* sp. - PETROVA *et al.*, Fig. 4.33.
- 2019 *Longicollaria insueta* - PETROVA *et al.*, Fig. 4.36.
- 2020 *Chitinoidella insueta* ŘEHÁNEK - BENZAGGAGH, Fig. 6.T (Fig. 4.AT herein).

Description: Cylindrical elongated-shaped lorica, with a L/W ratio > 2 , often wider at its posterior side; rectilinear to divergent collar, between one-half to two-thirds of the total lorica length, forming a constriction or a slight shoulder with the lorica bowl; wide and rounded aboral pole, without caudal appendage.

Comparison: This species differs from all other species of chitinoidellids by its longer and rectilinear collar forming a short shoulder with the lorica bowl.

Occurrence: This species is known in the Boneti Subzone of the central West Carpathians, Slovakia, Poland, Bulgaria, southeastern France, northern Morocco, and western Argentina.

4. Evolution of Chitinoidellidae and discussion

According to ÉNAY & GEYSSANT (1975), chitinoidellids appear at the top of the Fallauxi ammonite Zone and disappear in the upper part of the Microcanthum Zone. BORZA (1969, Abb. 4), GRANDESSO (1977, Fig. 1) and BORZA (1984, Tab. 1) reported the exclusive occurrence of small-sized chitinoidellids in the lower part of the Chitinoidella Zone and the exclusive occurrence of larger-sized chitinoidellids in the upper part of this same zone. On the basis of such a distribution, BORZA (1984, p. 544) and BORZA & MICHALÍK (1986, p. 137) divided the Chitinoidella Zone into two subzones, Dobeni and Boneti. These two subzones were correlated with the ammonite zones (BENZAGGAGH & ATROPS, 1995; BENZAGGAGH *et al.*, 2010). The first one corresponds to the Ponti Zone; the second to the Microcanthum *p.p.* Zone.

The stratigraphic distribution of the chitinoidellids in two groups and the two defined subzones were later demonstrated in several published works and from several remote localities of the Tethyan Realm. Amongst others: ŘEHÁKOVÁ (2002, Figs. 2-4), whose illustrated specimens of small-sized chitinoidellids all are from the Dobeni Subzone, except *Popiella oblongata?* and all larger specimens belonging to the Boneti Subzone; also PETROVA *et al.* (2012), whose small-sized chitinoidellids (*op. cit.*, Figs. 4.1-11) are from the Dobeni Subzone and those of larger size (*op. cit.*, Figs. 4.12-17) are from the Remanei Subzone; and LAKOVA & PETROVA (2013), whose small specimens (*op. cit.*, Pl. 1.1-16, Pl. 5.1-20) are from

the Dobeni Subzone and larger specimens (*op. cit.*, Pl. 1.17-26, Pl. 5.21-32) are from the Boneti Subzone to Praetintinnopsella Zone. See also KWAL-KASPRZYK (2018) and PETROVA *et al.* (2019).

Note that, in several sections of the External Rif, Morocco (see BENZAGGAGH, 2000), small chitinoidellids disappear at the top of the Dobeni Subzone, with the exception probably of *Borziella slovenica*, which gave rise at the base of the Boneti Subzone to a single species with a larger lorica, similar to that of *Chitinoidella boneti*, but without collar, or with a very atypical collar, qualified as *Chitinoidella aff. boneti* (BENZAGGAGH & ATROPS, 1995). This species gave rise, gradually, from the lower part of the Boneti Subzone to a different larger species of the *boneti* group.

Based on the resemblance of the lorica shape between some species of the Dobeni and Boneti subzones, several authors (POP, 1997, 1998a, 1998b; ŘEHÁKOVÁ, 2002; SALLOUHI *et al.*, 2011) considered that the evolution of the chitinoidellids around the Dobeni-Boneti subzonal boundary interval had gradually transitioned from small species of the *dobeni* group to larger species of the *boneti* group.

This phylogenetic interpretation is difficult to reconcile because: 1) chitinoidellid species of the Boneti Subzone appear gradually and after the disappearance of the small species of the Dobeni Subzone (Fig. 5); 2) the base of the Boneti Subzone is marked by the presence of a single species of chitinoidellids (*Bonetilla praeboneti* n. sp.); and 3) intermediate forms between the two chitinoidellid groups are notably absent, both at the top of the Dobeni and at the base of the Boneti subzones.

It seems very likely that these similarities between certain species of the two chitinoidellid groups, both in the collar and lorica shapes, represent rather morphological convergence than a gradual anagenetic evolution.

Note that the morphological convergences between species of calpionellids (*sensu lato*) widely separated in time and without any phylogenetic relationship are very common and recurrent at numerous stratigraphic levels.

Among several examples, we can report the strong likeness between the lorica of:

- *Carpathella rumanica* and *Carpathella longirumanica* of the Dobeni Subzone, and *Calpionella alpina* and *Calpionella elliptalpina* NAGY, 1986, of the Crassicollaria Zone, respectively;
- *Popiella oblongata* of the Dobeni Subzone and *Calpionellopsis simplex* (COLOM, 1939) of the Calpionellopsis Zone;
- *Bonetilla carthagensis* of the Boneti Subzone and *Tintinnopsella lehegarati* BENZAGGAGH *et al.*, 2012, of the Calpionellites Zone;

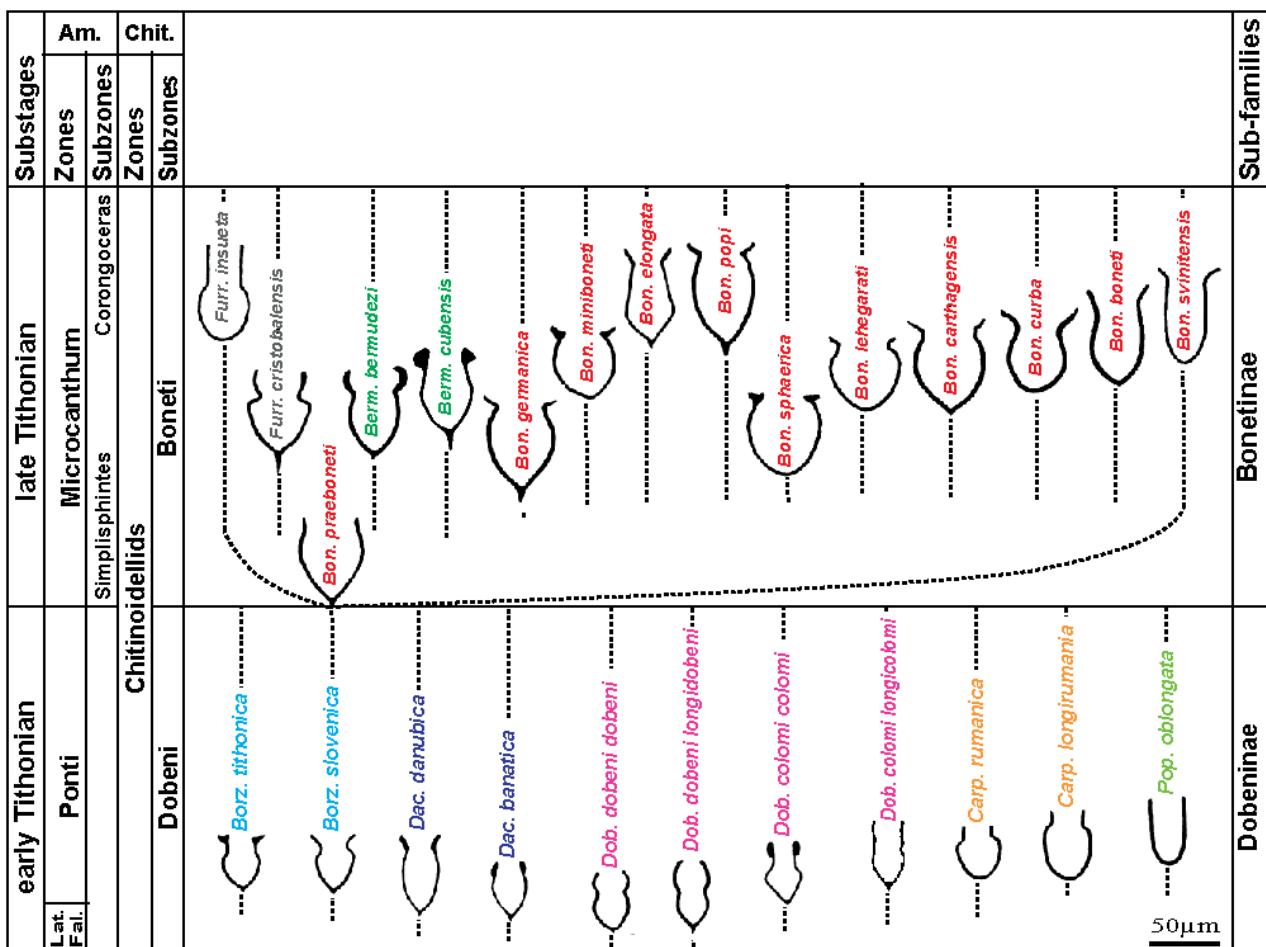


Figure 5: Stratigraphic distribution and evolution of the family Chitinoidellidae (subfamilies Dabeninae and Bonetinae) around the early/late Tithonian boundary interval. For the distribution and the evolution of chitinoidellids and calpionellids at the base of the Crassicollaria Zone, see BENZAGGAGH & ATROPS (1995), BENZAGGAGH *et al.* (2010) and BENZAGGAGH (2020).

N.B. Correlation between ammonite (zones and subzones) and chitinoidellids (zones and subzones) are from ÉNAY & GEYSSANT (1975), BENZAGGAGH & ATROPS (1995), BENZAGGAGH (2000).

- *Bonetilla popi* and *Bonetilla elongata* of the Boneti Subzone, and *Tintinnopsella carpathica* (MURGEANU & FILIPESCU, 1933) and *Tintinnopsella longa* (COLOM, 1939) of the Elliptica and Calpionellopsis zones, respectively;
- *Tintinnopsella remanei* BORZA, 1969, of the base of the Crassicollaria Zone and *Lorenziella hungarica* KNAUER & NAGY, 1963, of the Calpionellopsis Zone.

Actually, these morphological resemblances between loricae of some calpionellid species widely separated in time and without any phylogenetic relationship show that, because of their very simple bell-like lorica, calpionellids had often replicated during their evolution at several stratigraphic levels, lorica and collar shapes of some already extinct species.

5. Conclusion

As demonstrated above, specimens of the family Chitinoidellidae split into two groups: specimens of small-sized lorica of the *dobeni* group and specimens of larger-sized lorica of the *boneti* group. These two groups, which are separated in time, correspond to two subfamilies: Dabeninae and Bonetinae, respectively. Based on the lorica and the collar shapes, five genera (including one new genus) are characterised within the subfamily Dabeninae, which are: *Borziella* POP, *Carpathella* POP, *Daciella* POP, *Dobenilla* n. gen., and *Popielia* REHÁKOVÁ respectively, and three new genera within the subfamily Bonetinae: *Bermudeziella* n. gen., *Bonetilla* n. gen., and *Furrazolaia* n. gen. respectively. A total of twenty-four species (seven of them are new) are described and illustrated by several specimens from previous work (see Figs. 2-4), namely: *Dobenilla dobeni* (BORZA), with two new varieties (*Dobenilla dobeni* var.



dobeni n. var. and *Dobenilla dobenci* var. *longidobeni* n. var.), *Dobenilla colomi* (BORZA), with two new varieties (*Dobenilla colomi* var. *colomi* n. var. and *Dobenilla colomi* var. *longicolomi* n. var.), *Borziella slovenica* (BORZA), *Borziella tithonica* (BORZA), *Carpathella longirumanica* n. sp., *Carpathella rumanica* POP, *Daciella banatica* POP, *Daciella danubica* POP, and *Popiella oblongata* REHÁKOVÁ, of the subfamily Dobeninae respectively; and *Bermudeziella bermudezi* (FURRAZOLA-BERMÚDEZ), *Bermudeziella cubensis* (FURRAZOLA-BERMÚDEZ), *Bonetilla boneti* (DOBEN), *Bonetilla carthagensis* (SALLOUHI et al.), *Bonetilla curva* n. sp., *Bonetilla elongata* (POP), *Bonetilla germanica* n. sp., *Bonetilla lehegarati* n. sp., *Bonetilla miniboneti* n. sp., *Bonetilla popi* (SALLOUHI et al.), *Bonetilla praeboneti* n. sp., *Bonetilla sphaerica* n. sp., *Bonetilla svinitensis* (POP), *Furrazolaia cristobalensis* (FURRAZOLA-BERMÚDEZ), and *Furrazolaia insueta* (REHÁNEK) of the subfamily Bonetinae respectively.

The invalidity of certain chitinoidellid taxa is discussed and a new evolutionary pattern of the family Chitinoidellidae around the lower/upper Tithonian boundary interval is proposed.

This evolutionary pattern is characterised by the disappearance of the small chitinoidellids of the *dobeni* group at the top of the Dobeni Subzone, followed by a renewal of the chitinoidellid microfauna at the lower part of the Boneti Subzone from a single species (*Bonetilla praeboneti*), which gave rise to the different larger species of the *boneti* group, from the middle and the upper parts of the Boneti Subzone.

The resemblance in the lorica and collar shapes of some chitinoidellid species of the Dobeni Subzone with those of the Boneti Subzone, most likely represents a morphological convergence, rather than a gradual transition from small species of the *dobeni* group to larger species of the *boneti* group.

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Life Sciences Identifier (LSID)

<http://zoobank.org/References/A114F0DE-03BE-424B-AFBB-C7DBEE4986CA>

Family Group

- Bonetinae BENZAGGAGH, 2021 [Subfamily]

<http://www.zoobank.org/NomenclaturalActs/667e5330-423c-4cae-807e-50c06e64481e>

- Dabeninae BENZAGGAGH, 2021 [Subfamily]

<http://www.zoobank.org/NomenclaturalActs/e8d05fac-9dec-4422-be87-20def9a2c477>

Genus Group

- *Bermudeziella* BENZAGGAGH, 2021

<http://www.zoobank.org/NomenclaturalActs/9a2a92b7-5b1a-4992-9f44-7edf669e6bc0>

- *Bonetilla* BENZAGGAGH, 2021

<http://www.zoobank.org/NomenclaturalActs/f6593f36-771e-4255-85a6-34f3ca9b69c6>

- *Dabenilla* BENZAGGAGH, 2021

<http://www.zoobank.org/NomenclaturalActs/d7479958-8105-4aa6-81dc-821e29989be4>

- *Furrazolaia* BENZAGGAGH, 2021

<http://www.zoobank.org/NomenclaturalActs/72819107-0710-492a-bbea-80a8ce675a7b>

Species Group

- *Bonetilla curva* BENZAGGAGH, 2021

<http://www.zoobank.org/NomenclaturalActs/500f0112-8834-4f93-ba8c-fdd3bfc28d1f>

- *Bonetilla germanica* BENZAGGAGH, 2021

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<http://www.zoobank.org/NomenclaturalActs/05eb93bc-acd3-4fec-b330-e4e9e27ffd58>

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- *Carpathella longirumanica* BENZAGGAGH, 2021

<http://www.zoobank.org/NomenclaturalActs/ac041581-33d9-441e-9ba9-4ad4afe6821e>