

Scientific Note

Intraspecific variations and additional information about *Cheletomimus (Hemicheyletia) wellsi* (Baker, 1949) (Trombidiformes: Cheyletidae) from Brazil

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Abstract. In this paper, we presented additional information to the description of *Cheletomimus (Hemicheyletia) wellsi* (Baker, 1949) (Acari: Cheyletidae) collected on *Vitis vinifera* L. (Vitaceae), *Ruellia angustiflora* (Ness) Lindau ex Rambo (Acanthaceae) from Dois Lajeados, Marques de Souza and Pantano Grande municipalities in Rio Grande do Sul state, and on *Malus domestica* Borkh (Rosaceae) in Campo do Tenente municipality, Paraná state, Brazil. The specimens examined presented intraspecific variations from those described previously. These variations will be discussed herein. A key to the known Brazilian species of the genus is provided.

Keywords: morphology, Cheyletinae, Trombidiformes, taxonomy.

The family Cheyletidae Leach, 1815 (Trombidiformes: Cheyletoidea) includes over 440 species in 75 genera (Bochkov & Abromov 2016; Salarzehi et al. 2018). This family comprises species that are free-living predators, parasites of birds and mammals and some of them can be both (Bochkov & Fain 2001; Bochkov 2009; Walter et al. 2009). One of the most representative genera within Cheyletidae is *Cheletomimus*, which was erected by Oudemans (1904) who designated *Cheletes berleseii* Oudemans as type species (Baker 1949; Summers & Price 1970; Fain et al. 2002). This genus comprises 36 species that can be found on plants playing an important role in pest control (Fain et al. 2002). They are known from all the continents, except Antarctica, but mostly from the warmer climatic regions (Fain et al. 2002; Bochkov & Sidorchuk 2016).

Fain et al. (2002) reduced *Hemicheyletia* and *Philippicheyla* Corpuz-Raros to a subgenus of *Cheletomimus*. Thus, the genus *Cheletomimus* now consists of three subgenera, namely *Philippicheyla*, *Hemicheyletia* and *Cheletomimus* s.str. These subgenera differ from each other by: Hysteronotum with a pair of lateral shields in *Cheletomimus* s.str.; hysteronotum with a single shield in *Hemicheyletia*; and hysteronotum without shield in *Philippicheyla*.

The genus *Cheletomimus* can be easily distinguished by the following characteristics: Palp: palpal tarsi with 4 setae and a short solenidia; 2 dorsal comb-like setae with numerous teeth and 2 sickle-like ventral setae; palpal claw with teeth in the basal part; palpal tibia with 3 setae, dorsal and outer ventral setae variable in shape from hair-like to serrate lanceolate, inner seta always fine, hair-like; peritremes arch-like. Dorsum: with eyes present; propodonal shield present, granulated; hysteronotal shield present or lacking, variable in shape; all dorsal setae homeomorphic (fan-like or lanceolate) or median setae aberrant, staghorn-like, bulb-like, cloud-like, dendrite-like; number and shape of median setae variable. Genital: genital region with three aggenital, two genital and three pseudoanal setae respectively. Legs: tibia I with four or five setae; tarsus I with elongate solenidium.

Three *Cheletomimus* species are reported for Brazil: *C. (C.) duosetosus* (Muma, 1964) (Feres & Flechtmann 1995); *C. (H.) wellsi* (Baker, 1949) (Chiavegato 1980); and *C. (H.) gracilis* Fain, Bochkov &

Corpuz-Raros, 2002 (Da Silva et al. 2013).

Recently, *C. (H.) wellsi* has been found on *Vitis vinifera* L. (Vitaceae) (Johann et al. 2009; Da Silva et al. 2020), on *Malus domestica* Borkh (Rosaceae) (personal communication), in rubber trees (Hernandes & Feres 2006), in bird nests (Silva et al. 2018), in poultry systems (Horn et al. 2018), and in natural environments of the Southern Pampa Biome (Toldi et al. 2021). In this paper, we complement the description of *C. (H.) wellsi*, analyzing specimens collected in southern Brazil, presenting measurements of the structures that were not previously measured and described. We also reported intraspecific variation in the morphological characters of *C. (H.) wellsi*. Furthermore, a key to the Brazilian species of the genus is provided.

Three specimens were collected from *V. vinifera* in Dois Lajeados (28° 59' 01" S, 51° 50' 13" W) 'Rainha Itália' variety; one from *V. vinifera* in Marques de Souza (29° 19' 39" S, 52° 05' 33" W) 'BRS Vitória' variety; one specimen collected from *Ruellia angustiflora* (Ness) Lindau ex Rambo (Acanthaceae) in Pantano Grande (30° 19' 45.00" S, 52° 20' 50.00" W), all from the state of Rio Grande do Sul; and one from *M. domestica* in Campo do Tenente (25° 56' 37.0" S, 49° 42' 50.0" W), Paraná state. Individuals were collected between 2017-2019. Specimens were slide-mounted in Hoyer's medium (Jeppson et al. 1975). Photographs and measurements were studied using a phase contrast microscope (Microscope Zeiss Imager Z2 phase). The drawings were prepared using a camera lucida. All measurement units were made with Zeiss Zen and are given in micrometers (µm). Drawings were edited using Corel Draw X3. Morphological terminology and generic classification follow Gerson et al. (1999) and Fain et al. (2002). Idiosomal setation follows Grandjean (1939) as adapted by Kethley (1990) for Prostigmata and then adapted for Cheyletidae by Skvarla et al. 2014. The nomenclature for leg setae follows Grandjean (1944). All females were deposited at Museu de Ciências (ZAUMCN), Universidade da Vale do Taquari - Univates, Lajeado, Rio Grande do Sul state, Brazil.

The diagnosis of the examined species is as follows: **Female** (n=6) (Fig. 1); **Dorsum** (Fig. 1A) 304 (302-350) length (without gnathosoma) and 279 (259-290) width. Propodonal shield 128 (112-130) length and 193 (163-193) width, measured at the level of setae *sci*; hysteronotal

shield 125 (113-128) long and 157 (127-157) wide measured at level of setae *e2*. All the propodonal dorsolateral setae are fan-like and subequal in length and width, 22 (21-23) long and 13 (12-14) wide, while the fan-like setae on the hysteronotal shield are 16 (16-20) long and 12 wide. All specimens with four lateral fan-like and four median pairs of staghorn-like setae on the propodonal shield, and four pairs of lateral fan-like setae and two median pairs of staghorn-like setae on the hysteronotal shield. Setae *h3* situated off the hysteronotal shield as well as *c2* and *d2*. Setae *c2* and *d2* 21 (20-21) and *h3* 18 (18-20) are on individual plates. Dorsal shields are well punctuated and interscutal areas are striate-granulate. The ornamentation between median setae on propodonal shield varies between punctuated and bands of dashes (Fig. 1C, D). **Venter** (Fig. 1B). With three setaceous pairs of setae (*ic1*, *ic3* and *ic4*) subequal in length, 21 (20-23). The ventral cuticle is finely striated. Pseudoanal setae *ps1* 6 (5-8), *ps3* 6 (5-8) that may appear smooth or slightly serrated, and smooth *ps2* 8 (7-11), genital *g1* and *g2* 7 (6-8) and aggenital setae *ag1*, *ag2* and *ag3* smooth 11 (10-14). **Gnathosoma** 151 (129-165) long. Peritreme form an inverted U with six pairs of links, the first link is curving outward. Palptarsus with two comb-like setae, outer comb. with 15 to 18 teeth and 52 (46-54) long, inner comb. with 18 to 22 teeth and 25 (25-32) long, two smooth sickle-shape setae and one small solenidia. Palptibia claw with 6-7 teeth, with one thick serrated seta dorsally and one outer ventral setae serrated; palptibia may present an inner lobe or not (Fig. 1E, F). Palpfemur has two fan-like setae dorsally, two smooth setae ventrally on a shield-like area. Palpfemur shield is striated and granulated. Gnathosoma with three pairs of ventral setaceous setae (*n*, *ro1* and *ro2*). **Legs**. Leg I with claws smaller than those of other legs; empodium is present in all legs (Fig. 1A); all legs have setaceous, barbed and fan-like setae; all tarsi with setae *tc''*, *tc''*, *a'*, *a''*, *p'* and *p''*. Setal formulae of legs I-IV: (Tarsus - Coxa). Tarsi: 7(1) - 7(1) - 7 - 7; Tibiae: 4(1) - 4(1) - 4 - 4; Genua: 2(1) - 2 - 2 - 2; Femora: 2 - 2 - 2 - 1; Trochanters: 1 - 1 - 2 - 1; Coxae: 2 - 1 - 2 - 2. Leg I: 222 (221-250) long, ω_1 20 (15-22), ω_2 5 (3-6), ω_3 3 (2-3); Leg II: 166 (162-175), ω 15 (14-17); Leg III: 180 (169-200); Leg IV: 182 (176- 204).

An important topic to be discussed is the difference between *C. (H.) wellsii* and *C. (H.) wellsina*. Following the original description provided by Baker (1949), *C. (H.) wellsii* have a narrow and slightly serrated setae on palptibia; on the other hand, *C. (H.) wellsii* as redescribed by Fain et al. (2002) have the palptibia setae smooth. The main difference to distinguish these two species in Fain et al. (2002) is the shape of the outer ventral palptibia setae, and due to this contradiction in Baker (1949) and Fain et al. (2002) makes the identification very confusing.

Another confusing topic is the number of dorsomedian setae. Baker (1949) and Fain et al. (2002) observed that the number of dorsomedian setae is variable and cannot be used to differentiate species. In *C. (H.) wellsii* description, the number of dorsomedian setae on the propodonal shield can vary from one to five pairs. In Baker's additional material, namely, the two specimens from Puerto Rico, one of them has one pair of setae and the second has two pairs, while in two specimens from Mexico, one has three pairs and the other one has four pairs of setae. In the original description of *C. (H.) wellsina*, it is mentioned that the propodonal shield has two to three pairs of dorsomedian setae, this is also mentioned in Fain et al. (2002). In all six specimens analyzed here, the palptibia has three setae, a ventral smooth setae, an outer ventral and a dorsal setae serrated; also all presented four pairs of dorsomedian aberrant setae on the propodonal shield. Thus, it is difficult to determine if the analyzed species are *C. (H.) wellsii* or *C. (H.) wellsina*. First, because there are no records of *C. (H.) wellsina* with four pairs of dorsal median setae on the propodonal shield (only one to three) and two pairs of median setae on the hysteronotal shield (only one), and secondly, because in Fain et al. (2002) they describe the ventral palptibia setae as smooth, while in Baker (1949) as serrated. It seems as if the latter two observations may contradict each other and thus need further investigation if the shape of the ventral setae is strong enough to separate these two species.

In our examined material, the palptibial claw bears 6-7 teeth, outer comb. with 15 to 18 teeth and 52 (46-54) long, inner comb. with 18 to 22 teeth and 25 (25-32) long while in Baker (1949), the palptibial claw

can have up to eight teeth, outer comb with 15 and inner 20 teeth, respectively. The ventral palptibia seta in our individuals is thick and smooth, the outer ventral and dorsal setae are serrated; in Baker (1949) it is described the same shape for the palptibia setae. All specimens with four pairs of dorsomedian setae on the propodonal shield and the hysteronotal shield have two pairs of median setae; on the other hand, the propodonal shield may have up to five pairs of dorsomedian setae (can vary from one to five) in Baker (1949). Pseudoanal setae are simple, smooth to slightly serrated and the same is given in the original description. Dorsal body with 350 long and solenidium 22, and in Baker (1949) is 363. Later, Summers & Price (1970) described the length of dorsal body 407, and the pattern of the microtubercles on the propodonal shield as preponderantly of one size with a few microtubercles in the central area becoming elongated and forming several whorls of "dotted" striae, more transverse than longitudinal, but in our examined material the specimens were presented with more longitudinal pattern than transverse.

If the number of dorsomedian setae are not strong enough to determine species as given in Baker (1949) and Fain et al. (2002) due to their variation among specimens collected, why the shape of ventral palptibia setae could be? Can the shape of this setae vary as well? They clearly can vary in the genital region sometimes? If yes, *C. (H.) wellsina* may be a synonym for *C. (H.) wellsii* with intraspecific variation, but this is only a supposition. The same case is observed in *C. (H.) greenwoodi* and *C. (H.) bregatovae* as they differ from each other by the shape of ventral palptibia setae [smooth in *C. (H.) greenwoodi* and plume-like in *C. (H.) bregatovae*] and also by two hysteronotal setae that are 'narrower' than on the propodonal shield in *C. (H.) greenwoodi*. This shape of setae can be seen in our material as well and may be due to the mounting process. In this publication we refrain from considering these species as synonyms until the examination of the type specimens and collect the information on the degree of intraspecific variability of those characteristics.

From females collected in southern Brazil, the present study contributes to the original description and illustration of *C. (H.) wellsii*. Different morphological characteristics were analyzed, such as variations related mainly to the ventral palptibial setae and the number of dorsomedial setae. It is extremely important that researchers, when describing or redescribing species, provide drawings and measurements of all mite structures. This information, when present, helps taxonomists to identify species more accurately and also to determine intraspecific variations when present. Clearly, individuals of the genus *Cheletomimus* may present intraspecific variations, whether in terms of size or shape in some cases. One of the solutions to solve these taxonomic problems would be to do molecular analysis with species from around the world and see the level of similarity between them.

Key to females of *Cheletomimus* species in Brazil (Based on Fain et al. 2002)

- Propodonal shield with 4 pairs of lateral fan-like setae and one or more pairs of median aberrant setae..... 2
- Propodonal shield with 4 pairs of lateral setae and 1 pair of median fan-like setae; hysteronotum with one pair of median setae.....
Cheletomimus (Cheletomimus) duosetosus (Muma, 1964)
- Tibia I with 4 setae excluding solenidium and setae *ps1* hair-like to serrated ***Cheletomimus (Hemicheyletia) wellsii (Baker, 1949)***
- Tibia I with 5 setae excluding solenidium and setae *ps1* fan-like
Cheletomimus (Hemicheyletia) gracilis Fain, Bochkov & Corpuz-Raros, 2002

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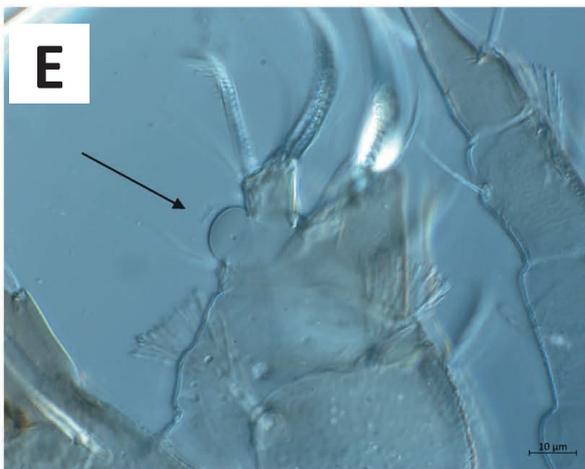
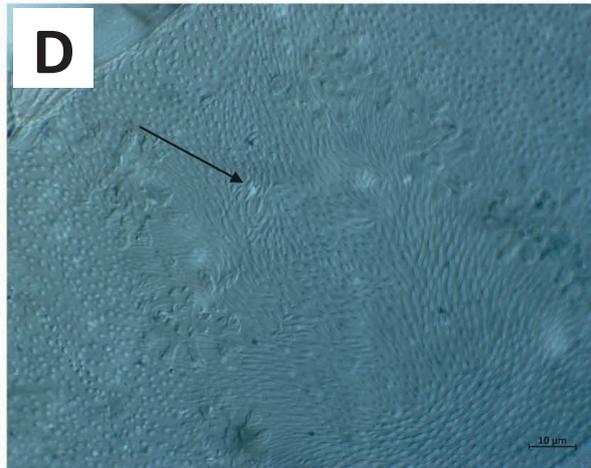
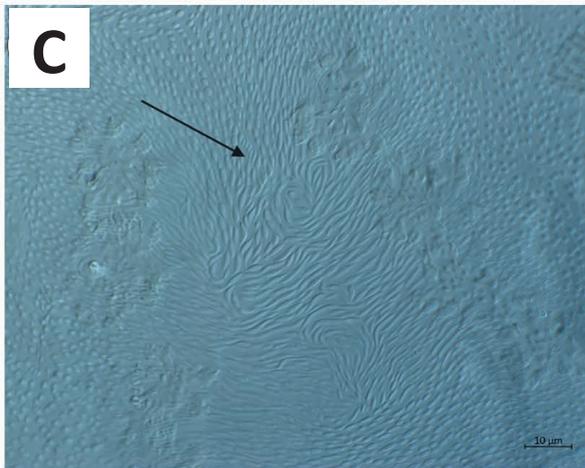
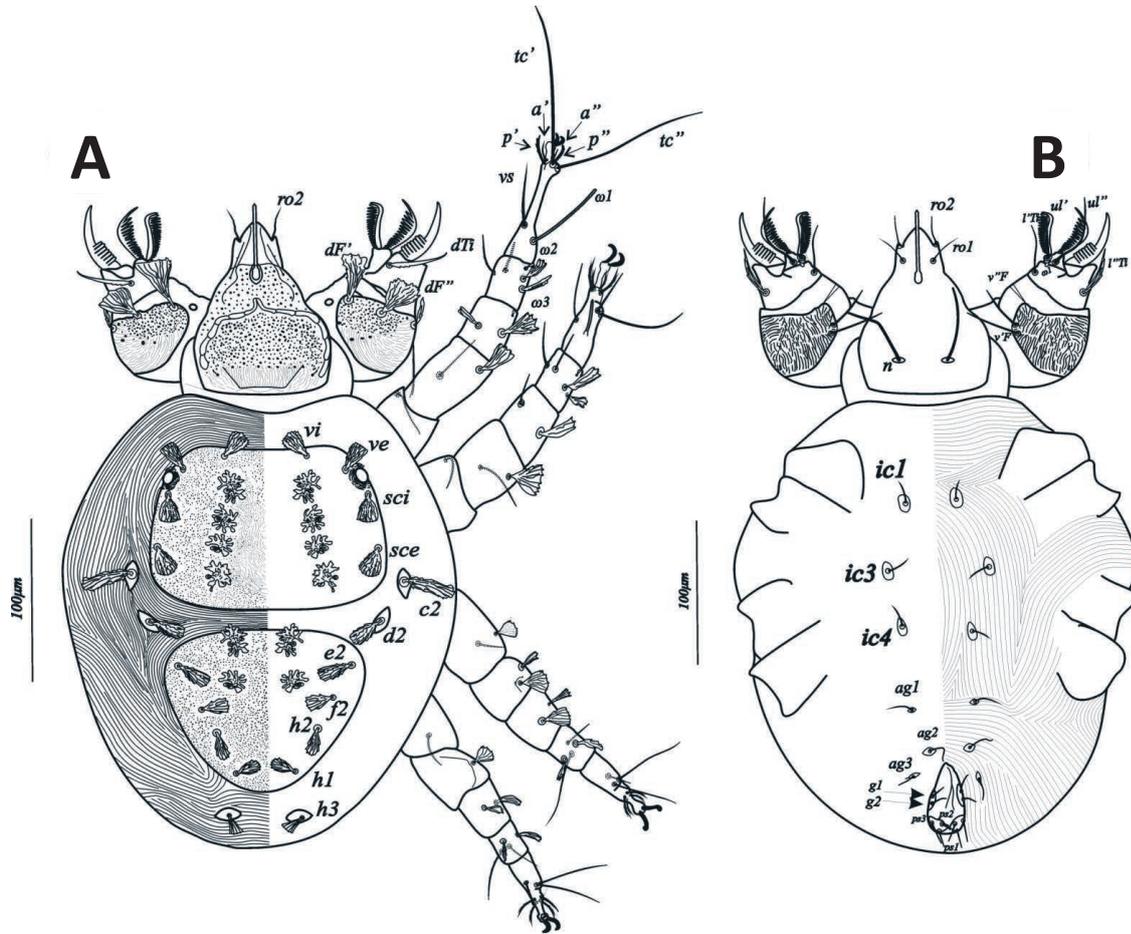


Figure 1. *Cheletomimus (Hemicheyletia) wellsi* (Baker, 1949) (Trombidiformes: Cheyletidae) from Brazil: (A) Female dorsal view of idiosoma, gnathosoma and legs; (B) Ventral view of idiosoma and capitulum; (C) Propodonotal shield with median transverse serpentine; (D) Propodonotal shield with median longitudinal small dots; (E) Palptarsus with a basal lobe; (F) Palptarsus without lobe.

Authors' contributions

GLB and GLS contributed with analysis, researches, drawings, identifications, photos and writing processes; LJ contributed with revisions and gave support with working tools; RTLS, EAU and NJF contributed with major revisions.

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