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CAMPUS DE SÃO JOSÉ DO RIO PRETO

“Estudos taxonômicos e filogenéticos de *Tenuipalpus* Donnadieu (sensu stricto e sensu lato) e *Colopalpus* Pritchard & Baker (Acari, Tenuipalpidae)”

Elizeu Barbosa de Castro

DOUTORADO

BIOLOGIA ANIMAL PÓS-GRADUAÇÃO

PÓS GRADUAÇÃO EM BIOLOGIA ANIMAL

UNIVERSIDADE ESTADUAL PAULISTA
"JÚLIO DE MESQUITA FILHO"
Campus de São José do Rio Preto

Elizeu Barbosa de Castro

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Tese apresentada como parte dos requisitos para obtenção do título de Doutor em Biologia Animal, junto ao Programa de Pós-Graduação em Biologia Animal, do Instituto de Biociências, Letras e Ciências Exatas da Universidade Estadual Paulista "Júlio de Mesquita Filho", Campus de São José do Rio Preto.

Orientador: Prof. Dr. Reinaldo José Fazzio Feres

São José do Rio Preto

2016

Castro, Elizeu Barbosa de.
Estudos taxonômicos e filogenéticos de Tenuipalpus Donnadieu (sensu stricto e sensu lato) e Colopalpus Pritchard & Baker (Acari, Tenuipalpidae) / Elizeu Barbosa de Castro. -- São José do Rio Preto, 2016
283 f. : il., tabs.

Orientador: Reinaldo José Fazzio Feres
Tese (doutorado) – Universidade Estadual Paulista “Júlio de Mesquita Filho”, Instituto de Biociências, Letras e Ciências Exatas

1. Biologia. 2. Ácaro - Classificação. 3. Ácaro - Filogenia. 4. Tenuipalpus. 5. Quetotaxia. I. Feres, Reinaldo José Fazzio. II. Universidade Estadual Paulista "Júlio de Mesquita Filho". Instituto de Biociências, Letras e Ciências Exatas. III. Título.

CDU – 595.42

Ficha catalográfica elaborada pela Biblioteca do IBILCE
UNESP - Câmpus de São José do Rio Preto

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29 de março de 2016

Dedicatória

“Aos meus pais, João Barbosa de Castro e Maria Aparecida Carvalho Castro, que sempre me apoiaram e enviaram muita força, mesmo de muito longe. Por todo carinho, amor e compreensão, porque sem eles eu não teria chegado aqui. Vocês são tudo pra mim”.

“Ao meu filho, Caio Henrique I. de Castro, minha maior inspiração e alegria de vida. Aquele que está em meus pensamentos e orações todos os dias. Por ter sido meu parceiro durante o período desse curso e desenvolvimento do meu trabalho. Por toda compreensão nos períodos de ausência”.

“Aos meus irmãos, Eliana Barbosa de Castro, Eleomar Barbosa de Castro e Erineu Barbosa de Castro, por todo apoio e carinho que me deram para enfrentar todos os desafios e dificuldades que apareceram durante esse trabalho, e que me fizeram crescer, como pessoa e profissional”.

Agradecimentos

“Ao meu orientador, Prof. Dr. Reinaldo José Fazzio Feres (UNESP – Universidade Estadual Paulista, São José do Rio Preto, Brasil), por todos os ensinamentos, direcionamentos, e disposição para resolver e ajudar em todos os problemas que apareceram durante a realização desse trabalho; por toda a disponibilidade em me atender quando surgiram dúvidas e dificuldades, e principalmente, pela confiança e amizade”.

“Ao Dr. Ronald Ochoa (USDA-ARS – United States Department of Agriculture, Agricultural Research Service, Beltsville, Estados Unidos), pelos ensinamentos; por ter sido tão atencioso no período que estive nos Estados Unidos, ajudando em tudo o que precisei; por toda ajuda e paciência no período de finalização dos manuscritos que fazem parte desse trabalho; por ser meu coorientador (apesar de não oficialmente) e, principalmente, um amigo”.

“Ao Prof. Dr. Antonio Carlos Lofego (UNESP – Universidade Estadual Paulista, São José do Rio Preto, Brasil), pelos ensinamentos e conversas que colaboraram para meu crescimento pessoal e profissional durante todos estes anos de trabalho no Laboratório de Acarologia”.

“Ao Dr. Gary Bauchan (USDA-ARS – United States Department of Agriculture, Agricultural Research Service, Beltsville, Estados Unidos), por toda ajuda e ensinamento durante o desenvolvimento do meu trabalho em seu laboratório; pela paciência com meu inglês e por todos os momentos de descontração que ajudaram no meu período de trabalho no exterior”.

“A Dra. Jennifer J. Beard e ao Dr. Owen Seeman (Queensland Museum, South Brisbane, Australia), por todos os ensinamentos passados mesmo de longe, que me estimularam a aprofundar meus estudos e conhecer mais sobre os ácaros planos; por todos os comentários, correções e sugestões feitas nos

manuscritos durante as revisões, que ajudaram muito na qualidade das publicações; por sua disponibilidade e atenção sempre que precisei".

"Ao biólogo Felipe A. M. Ramos, pela importante ajuda na realização desse trabalho, principalmente na elaboração dos capítulos 2 e 4; por toda a dedicação e atenção com as atividades realizadas durante sua Iniciação Científica".

"Ao amigo José Marcos Rezende (PPG em Biologia Animal, UNESP – Universidade Estadual Paulista, São José do Rio Preto, Brasil), companheiro de república no Brasil e nos Estados Unidos; pela amizade em todos esses anos; pela ajuda no inglês durante o período nos Estados Unidos; pela força e companhia nos momentos complicados".

"Ao Dr. Gregory Evans (USDA-ARS – United States Department of Agriculture, Agricultural Research Service, Beltsville, Estados Unidos), pela amizade no tempo que estive nos Estados Unidos; pelas músicas que animaram nossas noites; e por todas as correções de inglês realizadas nos manuscritos e na tese".

"A Chris Pooley (USDA-ARS – United States Department of Agriculture, Agricultural Research Service, Beltsville, Estados Unidos) pela ajuda com ajustes das fotografias e desenhos para publicações".

"Ao Dr. Bob Blinn, NCSU Insect Museum, Department of Entomology, North Carolina State University, Dra. Laura Leibensperger, Department of Invertebrate Zoology, Museum of Comparative Zoology - (MCZ), Harvard University, Dr. Carlos H.W. Flechtmann, The Acarology Collection - USP-ESALQ, pelo empréstimo de material para estudos durante meu tempo nos Estados Unidos e no Brasil".

“Ao Prof. Dr. Gilberto José de Moraes (ESALQ-USP – Escola Superior de Agricultura “Luiz de Queiroz”, Universidade de São Paulo, Piracicaba, Brasil), pelo empréstimo de parte de coleção de Tenuipalpidae da Coleção de Acari DEES, ESALQ-USP, que foi fundamental para a realização desse trabalho; além de toda a atenção disponibilizada sempre que foi preciso”.

“A Coordenação e ao Programa de Pós Graduação em Biologia Animal (UNESP, São José do Rio Preto), por todo apoio durante a realização desse trabalho”.

“Aos atuais colegas de laboratório, meus amigos: Alexandre Mondin, Felipe Micali Nuvoloni, Felipe Santa Rosa do Amaral, Gustavo Cauê Oliveira Piccoli, José Marcos Rezende, Mizael de Melo Ferreira, Marcel Santos de Araújo, Paulo Vittor Parecis Silva e Thafarel Pitton, pela amizade em todos estes anos”.

“Aos amigos e Drs. Fábio Akashi Hernandes (UNESP, Rio Claro), Peterson Rodrigo Demite, (IF Goiano – Instituto Federal Goiano, Urutaí, Brasil), e Rodrigo Damasco Daud (UFG, Goiânia), pelos ensinamentos, estímulos e boas conversas desde minha chegada ao Laboratório de Acarologia de Rio Preto”.

“Aos Dr. Fabio Akashi Hernandes (UNESP, Rio Claro), Dr. Henri André (Musée royal de l’Afrique centrale, Belgium, pesquisador aposentado), Dr. Wouter Dekoninck (Institut royal des Sciences naturelles, Belgium) and Dr. Mark Judson (Muséum national d’Histoire naturelle, France), pelas informações sobre o neótipo de *T. caudatus*”.

“A Angel e Rosa Bethancourt, donos do apartamento onde morei nos Estados Unidos, pela amizade, ajuda e atenção nos meses que estive por lá”.

“A Nit Malikul e Debra Creel (USDA-ARS – United States Department of Agriculture, Agricultural Research Service, Beltsville, Estados Unidos) por toda a ajuda na remontagem de espécimes e localização do material da coleção de Acari pertencente ao Smithsonian Institution, porém localizada na unidade da USDA; por toda ajuda com a bibliografia utilizada nesse trabalho”.

Muito Obrigado!

Auxílio Financeiro

Este trabalho recebeu o apoio financeiro da “Coordenação de Aperfeiçoamento de Pessoal de Nível Superior” (CAPES), através das concessões de bolsas de Doutorado regular, e estágio e pesquisa no exterior (Proc. n° BEX 7768/13-3).

“So many mites, so little time!”

Barry M. OConnor

RESUMO

A família Tenuipalpidae (Acari: Prostigmata) possui mais de 1.100 espécies incluídas em 40 gêneros. *Tenuipalpus* Donnadieu é o maior gênero desta família com mais de 300 espécies descritas. *Colopalpus* Pritchard & Baker é um pequeno gênero de Tenuipalpidae com cinco espécies conhecidas, e que até recentemente era considerado um sinônimo júnior de *Tenuipalpus*. Nesse estudo são apresentadas contribuições sobre o conhecimento da taxonomia e a sistemática desses dois gêneros. Os quatro primeiros capítulos apresentam a descrição de seis novas espécies de *Tenuipalpus*. O quarto capítulo também inclui a re-descrição de *T. heveae* Baker. O quinto capítulo apresenta a revalidação do gênero *Colopalpus*, com a re-descrição da espécie tipo, *C. matthyssei* Pritchard & Baker, e transferência de quatro espécies de *Tenuipalpus* para *Colopalpus*. O sexto capítulo apresenta a definição e *Tenuipalpus* sensu stricto, com a re-descrição da espécie tipo, *T. caudatus* (Dugès) (=*T. palmatus* Donnadieu), e a descrição de uma nova espécie. O último capítulo apresenta uma análise filogenética incluindo espécies dos gêneros *Tenuipalpus* (grupos sensu stricto e sensu lato) e *Colopalpus*. Os resultados aqui apresentados contribuem para o conhecimento desses dois gêneros, e também de toda a família Tenuipalpidae.

Palavras-chave: Prostigmata. Taxonomia. Sistemática. Desenvolvimento da quetotaxia. Low-temperature scanning electron microscopy.

ABSTRACT

The family Tenuipalpidae (Acari: Prostigmata) is comprised of more than 1,100 species belonging to 40 genera. Tenuipalpus *Donnadieu is the largest genus of Tenuipalpidae, with over than 300 described species.* Colopalpus *Pritchard and Baker is a small genus of Tenuipalpidae, with five species known, and until recently it was considered a junior synonymy of* Tenuipalpus*. There are advances presented here about the knowledge of the taxonomy and systematic of these two genera. The first four chapters present the description of six new species of* Tenuipalpus*. The chapter four also presents the redescription of* T. heveae *Baker. The chapter five presents the reinstatement of the genus* Colopalpus*, with the redescription of the type species,* C. matthyssei *Pritchard and Baker, and the transference of four species from* Tenuipalpus *to* Colopalpus*. The chapter six presents the definition of* Tenuipalpus *sensu stricto, with the redescription of the type species,* T. caudatus *(Dugès) (*=T. palmatus *Donnadieu), and the description of a new species. The last chapter presents a phylogenetic analysis including species of the genera* Tenuipalpus *(sensu stricto and sensu lato groups) and* Colopalpus*. The results presented here increase the knowledge about these two genera and all family Tenuipalpidae.*

Keywords: Prostigmata. Taxonomy. Systematic. Development of chaetotaxy. Low-temperature scanning electron microscopy.

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Chapter 7

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INTRODUCTION

The flat mites (Acari: Tenuipalpidae) are included in the superfamily Tetranychoidea, and within this superfamily are characterized mainly by suppression of the palptibial thumb-claw complex (Walter *et al.* 2009). It includes over 1,100 species belonging to 40 genera (Mesa *et al.* 2009; Beard *et al.* 2014; Castro *et al.* 2015a – chapter 5). All species of this family are phytophagous, some of which, as *Brevipalpus phoenicis* (Geijskes) and *Raoiella indica* Hirst, are considered pests of different crops worldwide (Moraes and Flechtmann 2008; Gondim Jr *et al.* 2012). In Brazil, *Tenuipalpus heveae* Baker is considered a pest mite in plantations of rubber trees in differents regions of the country (Hernandes and Feres 2006; Daud and Feres 2007).

Tenuipalpus Donnadieu is the largest genus of Tenuipalpidae, with over than 300 species described (Mesa *et al.* 2009; Ueckermann and Ripka 2015; Castro *et al.* 2015b – chapter 2). For a long time this genus was characterized only by the presence of a prodorsum wider than opisthosoma. Because of that, species morphologically dissimilar were included in *Tenuipalpus*. Mitrofanov (1973) proposed the division of *Tenuipalpus* into seven genera based mainly in the shape and presence of the dorsal setae. Meyer (1979) did not consider the characteristics used by Mitrofanov important enough to separate genera, and she proposed a division of *Tenuipalpus* in groups and subgroups of species based in characteristics similar of those used by Mitrofanov (1973). Despite some later modifications, this proposal was followed by Baker and Tuttle (1987) and Meyer (1993).

Recently, Castro *et al.* (2016a – chapter 6) proposed the division of *Tenuipalpus* into two groups: *Tenuipalpus* sensu stricto and sensu lato. These authors indicated the presence of a pair of lateral body projections associated with setae *c3* as a synapomorphy for the group sensu stricto. This division can be considered as a first step to improve the systematic of *Tenuipalpus* and to allow the comparison of possible new species with those morphologically similar. The sensu stricto group includes the type

species of the genus, *T. caudatus* (Dugès) (=*T. palmatus* Donnadieu), and other 39 species (Castro *et al.* 2016a; 2016b – chapter 3).

Pritchard and Baker (1958) erected the genus *Colopalpus* to accommodate the new species *C. matthyssei*, described from The Philippines. These authors mentioned that *Colopalpus* shares characteristics with the genera *Tenuipalpus* and *Brevipalpus*. Meyer (1979), in her major revision of Tenuipalpidae, considered *Colopalpus* as a synonym junior of *Tenuipalpus*. Recently, Castro *et al.* (2015 – chapter 5) reinstated the genus *Colopalpus* based in the study and redescription of the type species. These authors used characteristics of females and males (e.g. shape of the body and position of leg setae), to distinguish *Colopalpus* from *Tenuipalpus* and *Brevipalpus*.

According to Seeman and Beard (2011), the establishment of ontogenetic patterns in the development of leg setae may be useful in the definition of more robust groups in Tenuipalpidae. Herein, the ontogenetic development of leg setae is presented and discussed for some species of *Tenuipalpus*, and when possible, are performed comparisons with related taxa (Castro *et al.* 2015b; Castro *et al.* 2016b). Furthermore, micrographs of morphological characters were taken using low-temperature scanning electron microscopy (LT-SEM), and are presented in different chapters of this study. These images contribute to a better understanding of the morphology, biology and ecology of these groups of flat mites.

In this study, are presented advances about the taxonomic and systematic knowledge of the genera *Tenuipalpus* and *Colopalpus*, and also about the family Tenuipalpidae. The first four chapters show the description of six new species of *Tenuipalpus* from Brazil, and also the redescription of *Tenuipalpus heveae* Baker. The chapter five presents the reinstatement of the genus *Colopalpus*, with the redescritption of the type species of this genus. The chapter six presents the definition of *Tenuipalpus* sensu stricto, with the redescription of type species, and description of a new species from Costa Rica. Finally, the last chapter

presents a phylogenetic analysis including species of *Tenuipalpus* (sensu stricto and sensu lato groups) and *Colopalpus*.

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CONCLUSION

A considered advance about the taxonomic and systematic knowledge of the genera *Tenuipalpus* and *Colopalpus* was presented in this study. These results contribute for a more natural classification of this Tenuipalpidae group. Furthermore, the advances presented here also will allow the better comparison of potential new species with previously known taxa, and this decreasing the chance of creating synonyms.

The results supported the division of the genus *Tenuipalpus* into two groups: *T.* sensu stricto, which is well supported by presence of a pair of lateral projections associated with setae *c3*, considered a synapomorphy for this group; and a largest group, *T.* sensu lato, which comprises more than 250 known species, and still includes several morphologically dissimilar species. The identification of novel morphological characters will be useful for establishing a more natural classification for this last group.

The results also indicate that *Colopalpus* is a valid genus of Tenuipalpidae, and that characteristics present in females and males are important for the diagnosis of the species. Furthermore, it might be necessary the transference of species included in *Tenuipalpus* sensu lato group to *Colopalpus*. In this case, the study of type specimens is highly recommended, due to descriptions and illustrations with insufficient details (e.g. positions of leg setae).

Finally, studies about the ontogenetic development of leg setae in Tenuipalpidae are recent and limited just a few species. The knowledge of this characteristic for more taxa will allow a better understanding about possible ontogenetic patterns in the development of leg setae within of Tenuipalpidae. The identification of patterns of the development of leg setae may be useful in the separation of more robust groups in Tenuipalpidae (e.g. including these data in the phylogenetic analysis).