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Systematic status of the Chilean genus *Carlota* Arias-Bohart,
2014 (Coleoptera: Elateridae: Agrypninae: Agrypnini)

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Systematic status of the Chilean genus *Carlota* Arias-Bohart, 2014 (Coleoptera: Elateridae: Agrypninae: Agrypnini)

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Abstract. The click beetle genus *Carlota* Arias-Bohart (Coleoptera: Elateridae: Agrypninae: Agrypnini) was considered as a junior synonym of *Candanius* Hayek recently. However, there are deep morphological differences between these genera which justify the validity of *Carlota*. The morphology of this genus was re-examined in detail and based on the short and shallow antennal grooves, strongly serrate antennae from antennomeres 3 through 10, subquadrate pronotum with four distinct subcircular depressions, and straight prosternal process not bent dorsally, I resurrect the genus *Carlota* from synonymy.

Key words. Chile, *Candanius*.

ZooBank registration. urn:lsid:zoobank.org:pub:75AD9558-7B1A-460E-8D9A-49AEBD08CAEF

Introduction

During several expeditions in Chile (Arias et al. 2007), we collected numerous specimens of Elateridae, many of which appeared to be unknown to science. Based on this material, I described the monotypic genus *Carlota* with *C. coigue* as the type species (Arias-Bohart 2014).

Pineda (2019) considered *Carlota* as a junior synonym of *Candanius* Hayek, 1973, and based the proposed synonymy of these two genera on the following shared traits: the presence of pronotal depressions characteristic for *Carlota* in several species of *Candanius*; a broader subquadrate pronotum in some females of *Candanius* partly resembling *Carlota*; the prosternal process bent dorsally in both genera; and an excavate mesoventral process resembling *Carlota*.

However, after a detailed re-examination of the morphology of *Carlota*, I here report profound morphological differences between *Carlota* and *Candanius* which support separate positions as originally proposed by Arias-Bohart (2014). Therefore, I resurrect *Carlota* as a valid genus and illustrate supportive generic characters that differentiate these genera.

Materials and Methods

I have examined the material here discussed. Type specimens and other material are indicated. Codens of institutions and private collections follow Arnett et al. (1993).

- ANIC** Australian National Insect Collection, CSIRO, Canberra, Australia
EMEC Essig Museum of Entomology, University of California, Berkeley, California, USA
ETA Elizabeth Arias-Bohart, (private collection), Berkeley, California, USA
FMNH Field Museum of Natural History, Chicago, Illinois, USA
JEBC Juan Enrique Barriga Tuñón, (private collection), Curicó, Chile
MNHN Muséum National d'Histoire naturelle, Paris France
MNNC Colección Nacional de Insectos, Museo Nacional de Historia Natural, Santiago, Chile
RBINS Collections Nationales Belges d'Insectes et d'Arachnides, Institut royal des Sciences Naturelles de Belgique, Brussels, Belgium
SRC Sergio Riese, (private collection), Genoa, Italy.

Terms for adult morphology follow Platia (1994), Calder (1996), and Lawrence et al. (2010). Spellings and locality data of the material studied cite the original label data. Juan Enrique Barriga Tuñón's collection labels include the URL <http://www.coleoptera-neotropical.org>, which I have excluded from the label information.

Scanning electronic microscopic micrographs were taken by Julien Cillis at the Institut royal des Sciences Naturelles de Belgique (RBINS), and Obie Sage at the California Department of Food and Agriculture, Sacramento. Color photos of type material were made by Yves Laurent, Isabelle Bachy and Camille Locatelli at the Institut royal des Sciences Naturelles de Belgique. The type material studied from photographs is from RBINS Virtual Collections. <http://virtualcollections.naturalsciences.be/virtual-collections/entomology/coleoptera/elateridae/agrypninae/anius-gracillimus-candeze-1889>.

Drawings were made using a camera lucida on a Leica MZ7 dissecting scope.

Taxonomy

***Carlota* Arias-Bohart, 2014, revalidated status**

(Figures 1, 3, 5, 7, 9, 11)

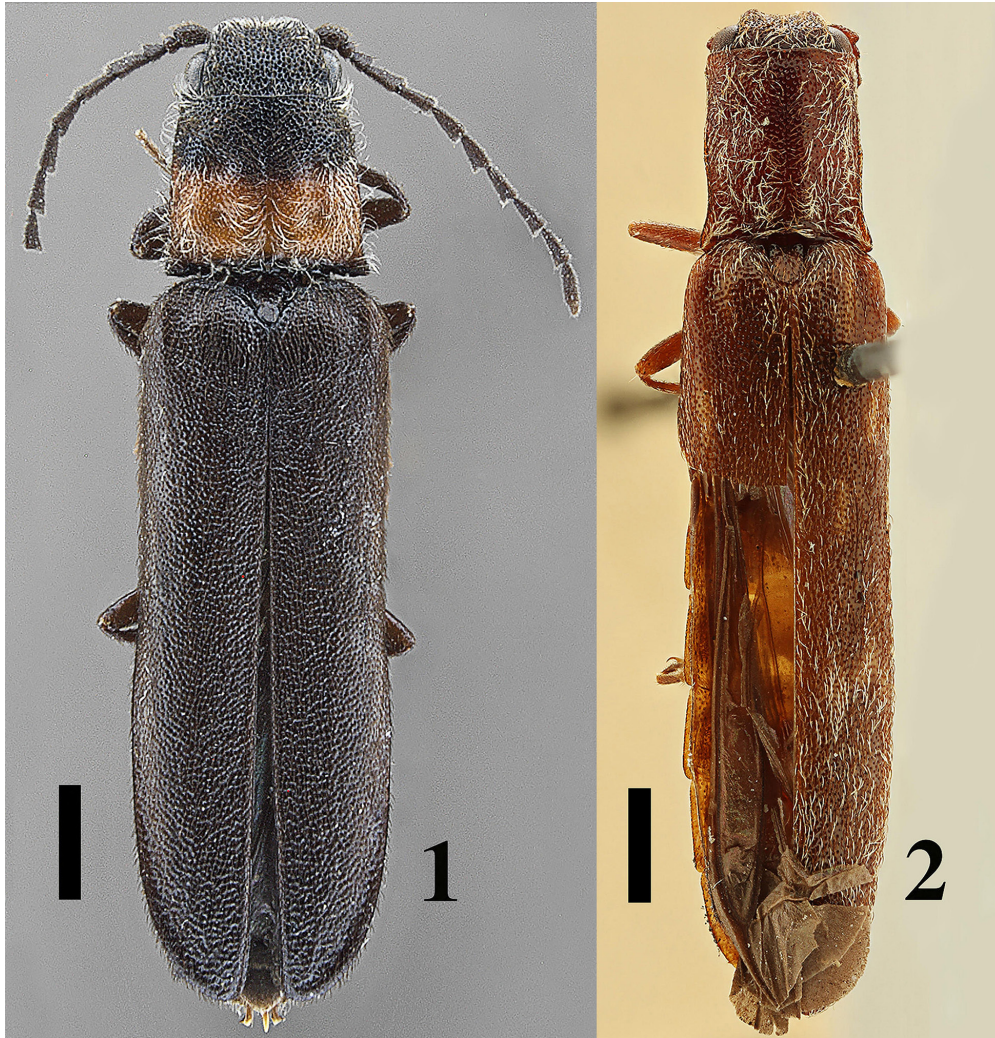
The genus *Carlota* (Fig. 1) exhibits the following characters: antennae strongly serrate from antennomere 3 through 10, with stout shape like a tea-cup; antennomere 2 subcircular and about 0.6 times the length of antennomere 3, antennomere 3 about 0.5 times the length of antennomere 4, antennomere 4 and 5 about as long as wide (Fig. 3). Pronotum subquadrate with four distinct subcircular depressions; posterior pronotal angles short, acute and divergent (Fig. 5). Antennal grooves short, shallow and incipient (Fig. 7, 9). Prosternal process strongly narrowed between procoxae, straight and somewhat inclined, not bent dorsally (Fig. 7, 9, 11). Mesoventral cavity oval, mesanepisternum forming part of mesoventral cavity; mesoventral process pointed, not lobate; mesocoxal cavity diameter about 3 times mesocoxal distance (Fig. 7, 9). Wing venation with R cell short, MP3+4 bent towards MP1+2, not branching towards MP4+CuA1.

Material studied

***Carlota coigue* Arias-Bohart 2014: 59**

CHILE IX Region [15]. Flor del Lago Ranch Villarrica. 39°12.63'S 72°15.55'W, 312 m. 12.XII.2003. Canopy Fogging 60cc/l. Arias et al UCB. HOLOTYPE. *Carlota coigue*. E. Arias-Bohart 2013. Male. EMEC10005989 [MNNC].

CHILE IX Region [15]. Flor del Lago Ranch Villarrica. 39°12.63'S 72°15.55'W, 312 m. 12.XII.2003. Canopy Fogging 60cc/l. Arias et al UCB. PARATYPE *Carlota coigue* E. Arias-Bohart 2013. Male (3 specimens). EMEC10005990 [ETA] EMEC10005991 [ANIC] EMEC10005992 [SRC]; (Chile) Shangrila. VIII Region 30-10-1988. Elizabeth Arias. PARATYPE. *Carlota coigue* E. Arias-Bohart 2013. Male. EMEC10005993 [ETA]; CHILE: Cautín P.R.: P.N. Conguillío, 1.5 km East/Laguna Captrén guard sta. 1365 m, 38°38.67'S, 71°41.37'W. 23.xii.1996–5.ii.1997. Deciduous spp., /*Araucaria*, with *Chusquea* understory/ FMHD #96-229, flight/ intercept trap. A.New- ton & M.Thayer 977. FIELD MUS. NAT. HIST. PARATYPE. *Carlota coigue* E. Arias-Bohart 2013. Male. EMEC10005994 [FMNH]; Chile Marimenuco. Lonquimay. 10–15.XII.1986. Coll. L.E. Peña. PARATYPE. *Carlota coigue* E. Arias-Bohart 2013. Male. EMEC10005996 [ETA]; Chile, prov. Curicó, 15 km. E. Potrero Grande, Puente Morongos, 25/ nov 2003, fogging *Nothofagus dombeyi* 35°12.96'S 70°58.62'W. leg. J. E. Barriga. Colección J. E. Barriga. CHILE 148098. PARATYPE. *Carlota coigue* E. Arias-Bohart 2013. Male. EMEC10005997 [MNHN]; Chile, prov. Curicó, 15 km. E. Potrero Grande. Camino El Relvo, 19. Leg. JE. Barriga T. N. *alpina*, N. *obliqua* 35°11.14'S 70°56.1'W. Colección J. E. Barriga. CHILE 163778. PARATYPE. *Carlota coigue* E. Arias-Bohart 2013. Male. EMEC10005998 [RBINS]; Chile Talca 1300 m. Altos de Vilches. 26.I.69 Valencia. Ex-colección. Jorge Valencia. JVCC. Chile 003660. Colección JEBC. Juan Enrique Barriga-Tuñón. Chile 0204053. PARATYPE. *Carlota coigue* E. Arias-Bohart 2013. Male. EMEC10005999 [JEB]; Chile Arauco. Pichinahuel. 15.I.59. G. Barria. Ex. Colección. Jorge Valencia. JVCC /Chile 003152. Valencia. Ex-colección. Jorge Valencia. JVCC Chile 003660. Colección JEBC. Juan Enrique. Barriga-Tuñón. Chile 0204684. PARATYPE *Carlota coigue* E. Arias-Bohart 2013.

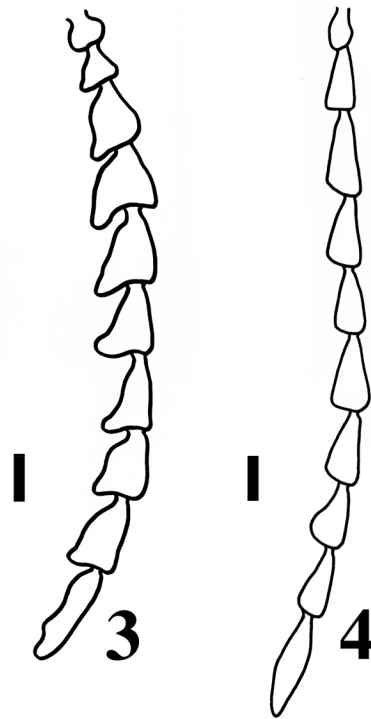


Figures 1–2. Adult dorsal habitus of: 1) *Carlota coigue*, holotype, male. 2) *Candanius gracillimus*, paralectotype, male. Scale line = 1 mm.

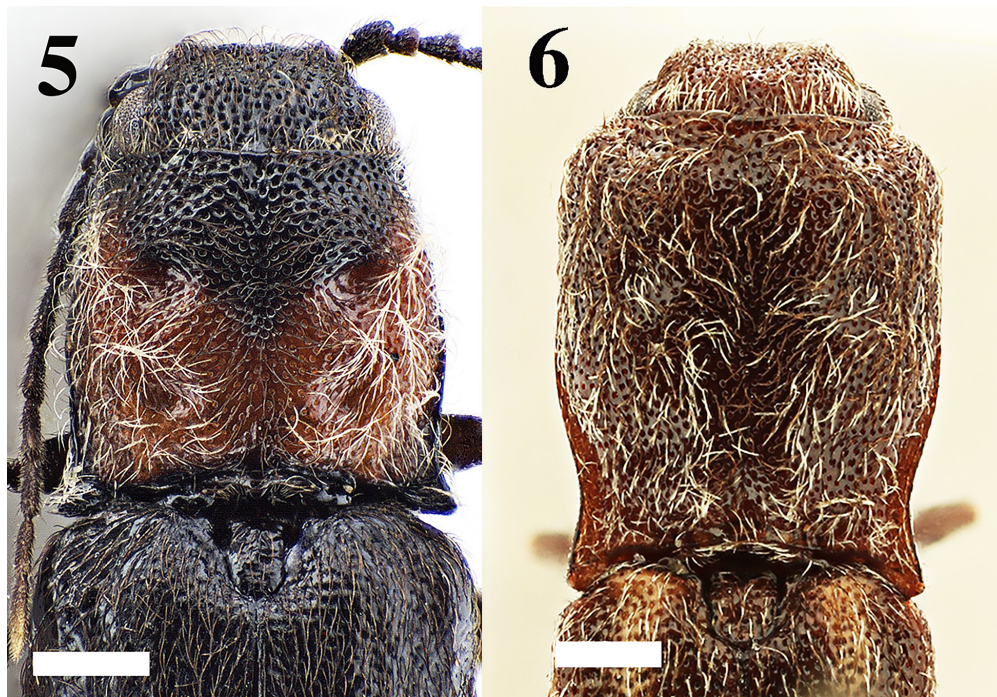
Male. EMEC10006000 [JEB]; CHILE prov. Ñuble/ Shangri-lá, 1490 mt 36°52'34"S 71°28'3"W, 7dic 2008. Fogging Lenga (*Nothofagus pumilio*). leg J. E. Barriga-Tuñon. Colección. JE Barriga-Tuñon. Chile 122722. PARATYPE *Carlota coigue* E. Arias-Bohart 2013. Female. EMEC10006001 [JEB]; CHILE- ÑUBLE Shangri-lá. 6-11-12, 1998. col. J. Mondaca. PARATYPE *Carlota coigue* E. Arias-Bohart 2013. Male. EMEC10006002. [MNNC].

***Candanius gracillimus* (Candèze 1889: 103)**

IRScNB Virtual Collection: Label 1/7 Coll. R.I.Sc.N.B. Chile, Quillota ex coll Fairmaire Label 2/7 Anius gracillimus Cd. Det E. Candèze Label 3/7 n.sp. Gracillimus Cdz., Chili Fairm. Label 4/7 G.n. Gracillimus Cdz. Label 5/7 Collection Candèze Label 6/7 Syntype Label 7/7 sec. von Hayek 1973, recl. of Agrypninae p.86, Candanius; IRScNB Virtual Collection: Label 1/6 Coll. R.I.Sc.N.B. Chile, ex coll Fairmaire Label 2/6 Anius gracillimus Cd. Det E. Candèze Label 3/6 Anius gracillimus Cand. Fleutiaux det 1908? Label 4/6 Collection Candèze Label 5/6 Syntype Label 6/6 sec. von Hayek 1973, recl. of Agrypninae p.86, Candanius; IRScNB Virtual Collection: Label 1/7 Coll. R.I.Sc.N.B. Chile, ex coll Fairmaire Label 2/7 Anius gracillimus Cd. Det E. Candèze Label 3/7 Anius gracillimus Cand. Fleutiaux det 1908? Label 4/7 Collection Candèze Label 5/7 Syntype Label 6/7 female Label 7/7 sec. von Hayek 1973, recl. of Agrypninae p.86, Candanius. Colchagua Aconcagua. 7-11-1977 FMNH.



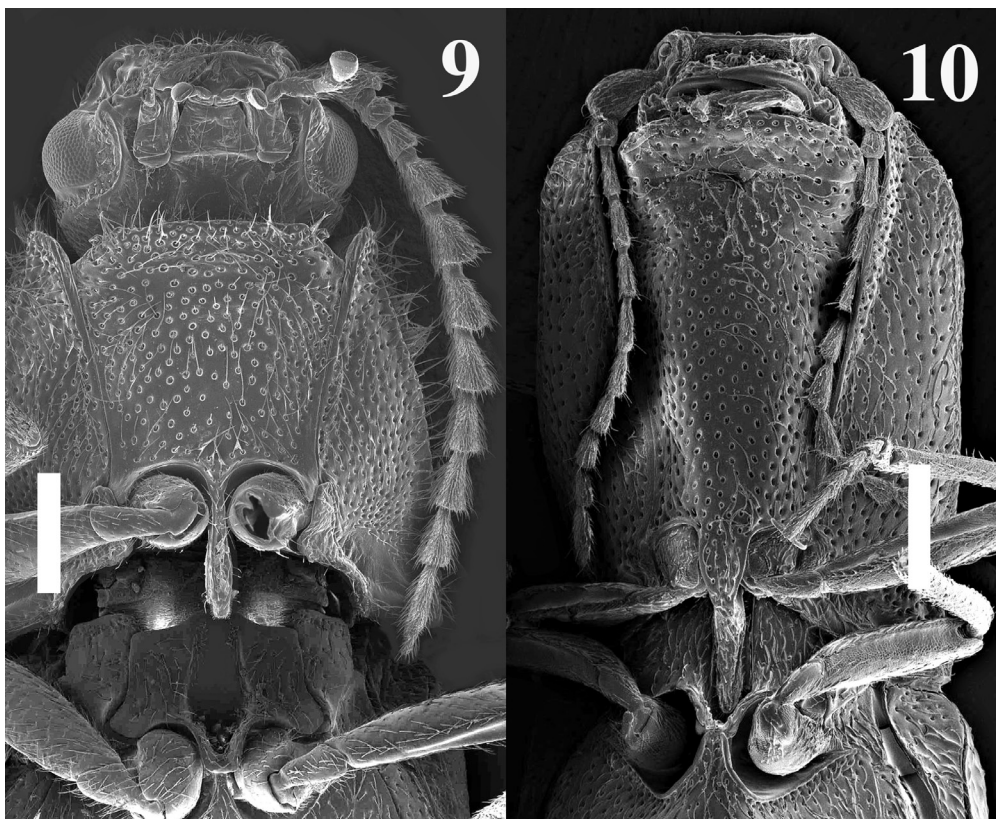
Figures 3–4. Antenna of: 3) *Carlota coigue*. 4) *Candanius gracillimus*. Scale line = 0.2 mm.



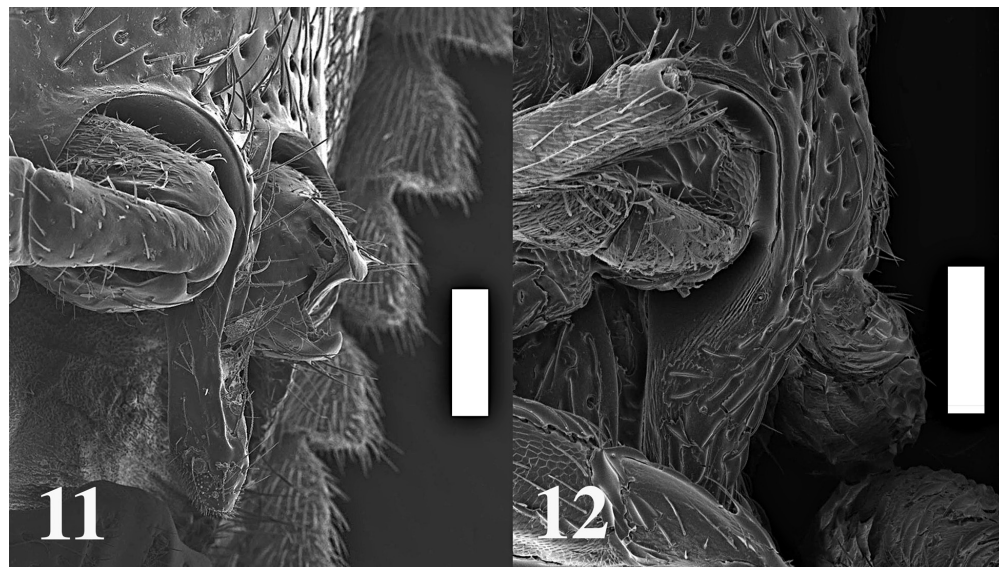
Figures 5–6. Head and pronotum dorsal of: 5) *Carlota coigue*. 6) *Candanius gracillimus*, paralectotype, female. Scale line = 0.5 mm.



Figures 7–8. Head and prosternum ventral of: 7) *Carlota coigue*. 8) *Candanius* sp. Scale line = 0.5 mm.



Figures 9–10. Scanning electron micrograph of ventral view of head, prosternum and mesoventral cavity. 9) *Carlota coigue*. 10) *Candanius* sp. Scale line = 0.5 mm.



Figures 11–12. Scanning electron micrograph of lateral view of prosternal spine. **11)** *Carlota coigue*. **12)** *Candanius* sp. Scale line = 0.2 mm.

Field Chicago *Anius gracillimus*. [FMNH] male; Colchagua Aconcagua. 27-XI-1974 Coll M. Donoso. FMNH 1986. L. Peña Coll. Acc.# 17-422. FMNH. Field Chicago *Anius gracillimus*. [FMNH] male; (2 Specimens) Santiago Maipu Luz negra. 10-X-1966. R. H. Gonzalez Collector. *Anius gracillimus* [ETA]; CHILE. Limarí Prov, Fray Jorge NP, camino Corcobedo Neblinero 565 m Malaise trap, 7/24. Nov 2003. Leg. ME Erwin FR Parker. 30°38'82"S 71°41'04"W Male. [ETA].

***Candanius* sp.**

Chile Melipilla. Carena (CtaBarriga). 30-X-2001. Leg. J. Mondaca E. *Candanius* sp. [ETA]; Chile Curacaví. Central Carena. 8-X-2003. Leg. J. Mondaca E. *Candanius* sp. Male. [ETA].

Discussion

Up to now the tribe Agrypnini Candèze (1857) has included 25 genera worldwide (Kundrata et al. 2019). Five of these genera are represented in Chile: *Acrocryptus* Candèze, *Dilobitarsus* Latreille, *Lacon* Laporte, *Candanius* Hayek and *Carlota* Arias-Bohart. *Carlota* was recently synonymized with *Candanius* by Pineda (2019), based on superficial similarities. However, the genus *Carlota* differs from *Candanius* by the following generic characters (contrasting characters for *Candanius* in parentheses): antennomere 2 subcircular, antennomeres 3–10 serrate and each antennomere with stout shape like a tea-cup, Fig. 3 (antennomere 2 ovoid-elongate, antennomeres 3–10 serrate, Fig. 4); prothorax subquadrate with four distinct subcircular depressions, Fig. 5; (prothorax longer than wide, in some species with apparent set of 2 light linear depressions, Fig. 6 female); antennal grooves incipient, shallow and very short, Fig. 7, 9; (antennal grooves deeply grooved, groove length varies among *Candanius* species, Fig. 8, 10); prosternal process strongly narrowed between procoxae, straight and somewhat inclined, Fig. 7, 9, 11; (prosternal process not narrowed between procoxae, strongly bent dorsally, Fig. 8, 10, 12); mesoventral process not lobate, pointed, Fig. 7, 9 (mesoventral process lobate or excavate, Fig. 8, 10).

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Patrick Grootaert for access to the Candèze collection. Jerome Constant for assisting with specimens. Adam Ślipiński, Alfred F. Newton, Rosser W. Garrison and Ladislav Bocak, for editorial comments and suggestions. The Fulbright Commission of Educational Exchange, Brussels, Belgium, the National Science Foundation DEB 435413 to E. T. Arias and K. W. Will.

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