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New leafhopper species of *Jikradia* from Mesoamerica with new records, revised key to species, distribution, origin, and checklist (Hemiptera: Cicadellidae: Coelidiinae: Teruliini)

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Abstract: The following four new species of leafhoppers are described and illustrated: *Jikradia dentata* n. sp. and *J. trispinata* n. sp. from Guatemala, *J. variabilis* n. sp. from Belize, and *J. exilis* n. sp. from Costa Rica. *Jikradia basipendula* Nielson and *J. krameri* Nielson are new records for Guatemala. Belize is a new record for the genus. A record of the first introduction of the genus in the Old World is reviewed. A revised key to the known species is provided with a review of its possible origin. A checklist of all known species is also given. Rev. Biol. Trop. 62 (4): 1375-1383. Epub 2014 December 01.

Key words: leafhoppers, taxonomy, new species, new records, checklist, Guatemala, Belize, Costa Rica, Italy.

The genus *Jikradia* was described by Nielson (1979) in a revision of the tribe Teruliini, followed by the description of one new species by Nielson (1989) and a subsequent review with descriptions of four new species by Godoy and Nielson (1998). Twenty-two species are presently known, including four new species described herein. A new introduction of *Jikradia olitoria* (Say) in the Old World (Italy) was first discovered and identified by Dr. Francesco Poggi and confirmed by Dr. Herbert Nickel, University of Göttingen, Göttingen, Germany (personal communications, 12 August 2013-22 October 2013). Specimens from Italy were donated by Dr. Poggi to the senior author who subsequently confirmed the identifications.

Jikradia is one of only two genera in the tribe Teruliini, subfamily Coelidiinae that occupies both the New and Old World. The other genus is *Biadorus* recorded from Brazil and

Ivory Coast in West Africa. *Jikradia* is broadly distributed in the Neotropical and Nearctic regions from the Galapagos Islands Northward into Canada. Guatemala has the richest fauna in Mesoamerica and may represent the center of its origin. A discussion of the taxonomic limitations of the genus is covered in Nielson (1979) and in Godoy and Nielson (1998).

In this paper we describe four new species, two from Guatemala, one from Costa Rica and one from Belize, which is also a new distribution record for the genus. Four taxa formerly designated as subspecies in Nielson (1979) are elevated to species rank. *Jikradia infula* Nielson, not included in the Godoy and Nielson (1998) paper is added herein. A revised key to species is provided. A checklist of all known species and their distribution is given. The possible origin of the group is also reviewed.

MATERIALS AND METHODS

Specimens from Guatemala were collected by Richard Zack and borrowed from the Florida State Collection of Arthropods, Gainesville, FL. Paul Freytag provided specimens from Costa Rica and Belize. Specimens from Italy were provided by Dr. Francesco Poggi and are in M. W. Nielson's personal collection (MWN). The Guatemalan types are deposited in the Universidad del Valle de Guatemala, Guatemala City (UVG). The types from Costa Rica and Belize are deposited in the Museo de Zoología, San José, Costa Rica (MZUCR) and the United States Natural History Museum, Washington, D.C. (NMNH), respectively. Additional specimens are deposited in the M. T. James Entomological Collection at Washington State University (WSUC).

RESULTS

Jikradia dentata

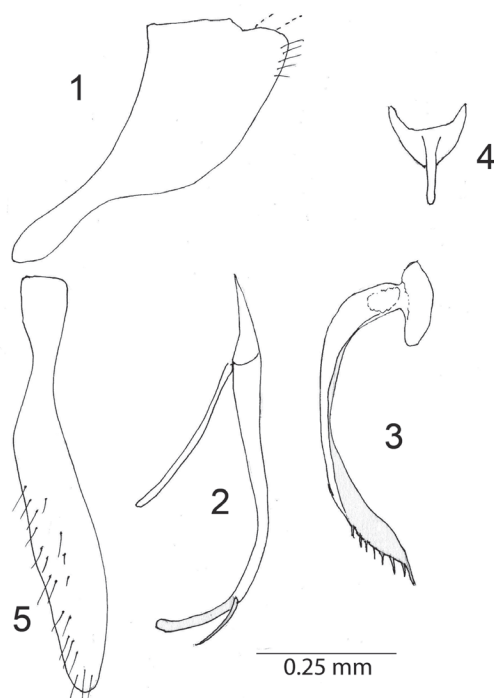
Nielson and Zack, n. sp.

Fig. 1, Fig. 2, Fig. 3, Fig. 4 and Fig. 5.

Length: Male 7.05mm; female 8.15-8.30mm.

External morphology: moderately large, slightly robust species. General color deep brown to black with light brown head and translucent costa on forewing. Face light brown, eyes dark brown.

Male genitalia: Pygofer in lateral view narrow in basal 1/3, rectangulate in distal 2/3, tuft of macrosetae on upper caudoventral margin, small digitate lobe apically (Fig. 1); aedeagus in lateral view with single, subapical process, arising from ventral margin, gonopore not evident (Fig. 2); style in lateral view with apophysis distinctively dentate on inner lateral margin from middle to apex (Fig. 3); connective Y-shaped, arms about equal in length of stem, membrane present in basal half (Fig. 4); dorsal connective very long, narrow (Fig. 2) subgenital plate constricted subbasally, setaceous in distal 1/5 (Fig. 5).



Figs. 1-5. *Jikradia dentata*, n. sp. (1) male pygofer, lateral view; (2) aedeagus and dorsal connective, lateral view; (3) style, lateral view; (4) connective, caudodorsal view; (5) subgenital plate, ventral view.

Female: Seventh sternite about twice as long as penultimate sternite, its posterior margin sinuate.

Material examined: Holotype male. GUATEMALA: Zacapa Dept., Marble Quarry rd. at San Lorenzo, NE of Teculután, 19 July 2007, N15°04.856' W89°40.086', 1880m, R. S. Zack collector (UVG). Four female specimens, same data as holotype (UVG, WSUC).

Etymology: The name of the species is descriptive of the dentate, inner lateral margin of the stylar apophysis. The name is based on the Latin root "denta" meaning toothed with consonant "t" and feminine suffix "a."

Remarks: This species is nearest to *J. serrata* Nielson but can be distinguished easily from it and all other known species by the distinctive dentate style (Fig. 3).

Jikradia trispinata

Nielson and Zack, n. sp.

Fig. 6, Fig. 7, Fig. 8, Fig. 9 and Fig. 10.

Length: Male 6.59mm; female unknown.

External morphology: Moderately large, slightly robust species. General color black, head including face tannish, forewing with costa translucent.

Male genitalia: Pygofer in lateral view very narrow in basal 1/3, subquadrate in distal 2/3, caudal margin rounded, few macrosetae apically (Fig. 6); aedeagus in lateral view very short, shorter than style, with 3 very long setae arising near middle of shaft on lateral side, gonopore not evident (Fig. 7); style in lateral view very long, apophysis very narrow throughout (Fig. 8); connective Y-shaped, membrane large, nearly triangulate, stem short, expanded

distally (Fig. 9); dorsal connective very long, narrow (Fig. 7); subgenital plate long, very narrow in basal 2/5, broad throughout in distal 3/5, setaceous in distal 3/5 (Fig. 10).

Material examined: Holotype male, GUATEMALA: Dept. El Progreso, Sierra de las Minas, nr Pinlano, road between old “fca la Trinidad/fea la Tomenta – la Cabañas”, 15°07'22"N 89°04'69"W, 2199 m. 15-17-V-2010, moist oak forest, light trap, Paul Skelly, G. Steck, and B. Sutton (UVG).

Etymology: The name of the species is descriptive of the 3 microsetae on the shaft of the aedeagus. The name is based on a combination of the Latin prefix “tri” meaning three and the root “spina” meaning spine with consonant “t” and feminine suffix “a.”

Remarks: This species, with three microsetae on the aedeagal shaft is nearest to *J. bispinosa* Nielson, which has two microsetae on the aedeagal shaft.

Jikradia variabilis

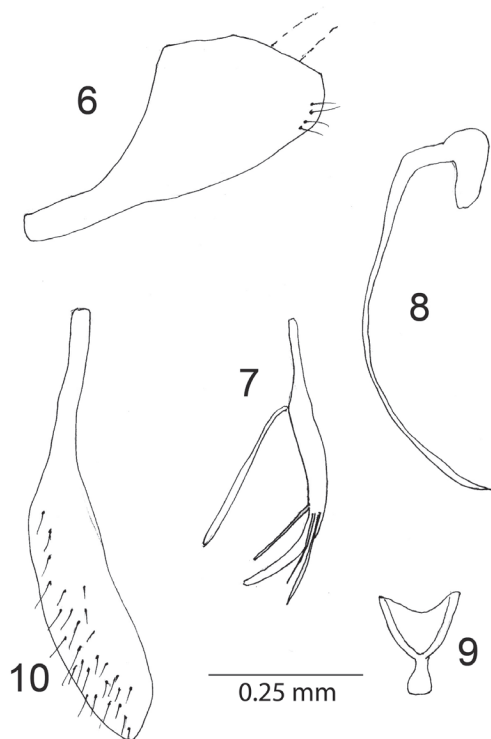
Nielson and Nickel, n. sp.

Fig. 11, Fig. 12, Fig. 13, Fig. 14 and Fig. 15

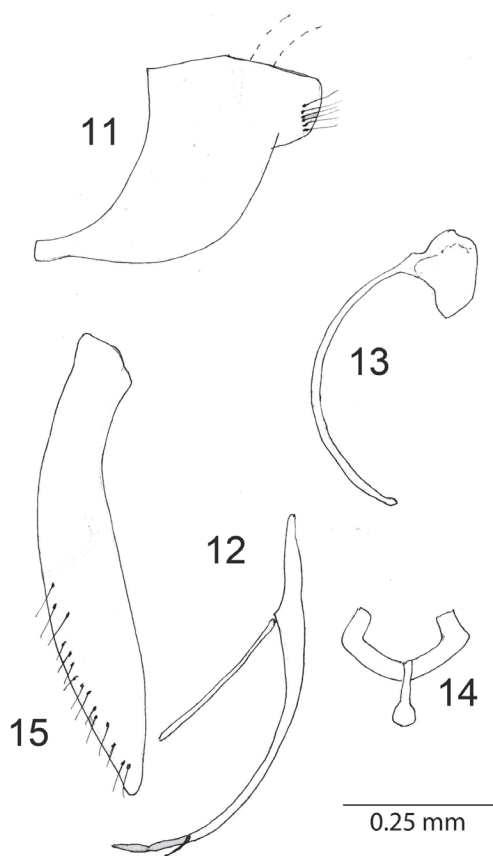
Length: Male 6.20-6.50mm; female 7.75mm.

External morphology: Moderately large, robust species. General color black in males, dark brown in females; head tannish in males, light brown in females; face light yellow in males, light brown in females; forewing with small irregular, light brown spot near middle of costa, color pattern variable in female.

Male genitalia: Pygofer in lateral view subrectangulate, caudal margin subtruncate, few microsetae apically (Fig. 11); aedeagus in lateral view very long, longer than style, shaft tapered apically, sharply pointed apically, with single short subapical microseta, gonopore not evident (Fig. 12), microsetae sometimes absent or broken off; style in lateral view broadly curved, base large, apophysis long, very narrow throughout (Fig. 13); connective Y shaped, arms of uniform width, angled subdistally, stem moderately long, apex bulbous (Fig. 14) dorsal connective very long, narrow (Fig. 12);



Figs. 6-10. *Jikradia trispinata*, n. sp. (6) male pygofer, lateral view; (7) aedeagus and dorsal connective, lateral view; (8) style, lateral view; (9) connective, caudodorsal view; (10) subgenital plate, ventral view.



Figs. 11-15. *Jikradia variabilis*, n. sp. (11) male pygofer, lateral view; (12) aedeagus and dorsal connective, lateral view; (13) style lateral view; (14) connective, caudodorsal view; (15) subgenital plate, ventral view.

subgenital plate long, slightly curved, slightly tapered apically, setose on outer lateral margin in distal 2/5 (Fig. 15).

Female: Seventh sternite large, about twice as long as penultimate sternite, caudal margin sinuate.

Material examined: Holotype male, BELIZE, Cayo district, near Teakettle Bank, Pooks Hill, N1709.257N 8851.094W, 279ft., 7-VII- 2003, Charles R. Bartlett (NMNH). Additional specimens, four males, same data as holotype except two specimens collected 6-VII-2003 (NMNH, MWN), two females same data as holotype except collected 3-VII-2003 and 5-VII-2003 (NMNH).

Etymology: The name of the species denotes variation in the number of setae on the aedeagal shaft, which varies from zero to one. The name is based in the Latin root “varius” meaning change and “bilis” for combined adjective and feminine ending.

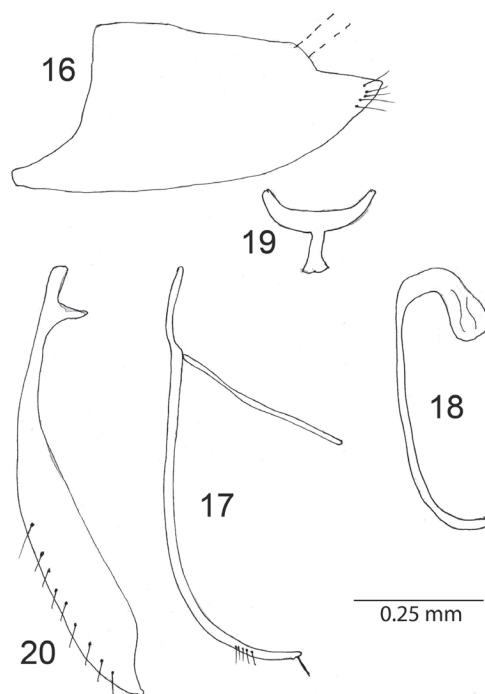
Jikradia exilis

Nielson and Poggi, n. sp.

Fig. 16, Fig. 17, Fig. 18, Fig. 19 and Fig. 20

Length: Male 4.34 mm, female unknown.

External morphology: Small, slender species. General color black with markings on forewings; head black, crown black bordered with yellow on lateral margins; eyes black; forewings black, costa with narrow, yellow stripe on outer margin, joined to yellow spot subapically, appendix with yellow border, small yellow spot at apex of clavus; face yellow with



Figs. 16-20. *Jikradia exilis*, n. sp. (16) male pygofer, lateral view; (17) aedeagus and dorsal connective, lateral view; (18) style, lateral view; (19) connective, caudodorsal view; (20) subgenital plate, ventral view.

two longitudinal black stripes from apex of clypeus to apex of clypellus.

Male genitalia: Pygofer in lateral view more or less rectangular, its caudal margin slightly tapered, apex with few microsetae (Fig. 16); aedeagus very long, nearly twice as long as style, very narrow throughout from base to apex, small narrow spine subapically, tuft of 4-5 microsetae subapically, gonopore subapical (Fig. 17); style with long narrow apophysis, nearly recurved apically (Fig. 18); connective Y-shaped, arms broad, broadly curved, membrane absent, stem moderately long and robust (Fig. 19); dorsal connective very long and narrow (Fig. 17); subgenital plate long, constricted along basal 1/5, with subbasal lobe on inner lateral margin, row of microsetae on apical half of inner lateral margin (Fig. 20).

Material examined: Holotype male, COSTA RICA, Rincón, Osa Pen., 100ft. VIII-II-1966, S. L. Wood (MZUCR).

Etymology: The name of this species is descriptive of the very narrow aedeagal shaft. The name is based in the Latin root “exili” meaning thin and the suffix “s” for feminine gender.

Remarks: From *J. galapagoensis* to which it is nearest, *J. exilis* can be easily distinguished by the very long narrow aedeagus and the single row of setae on the outer lateral margin of the subgenital plate. The subapical aedeagal process is a spine in *J. exilis* whereas in *J. galapagoensis*, it is a seta. Also, *J. exilis* has two black stripes in the face, characters lacking in *J. galapagoensis*.

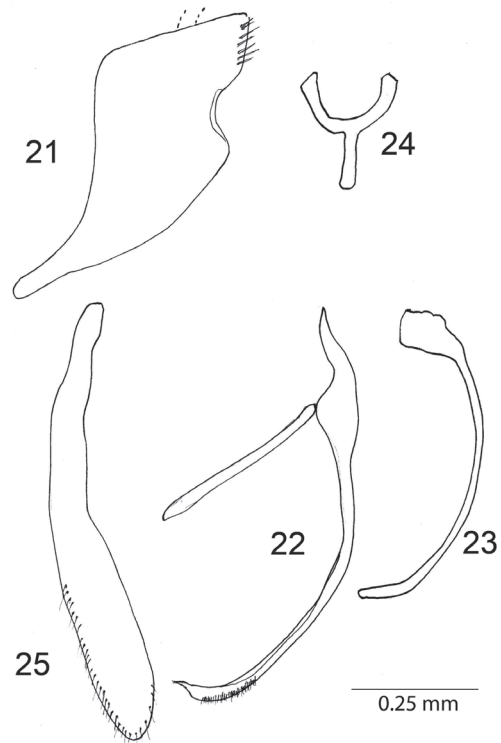
Jikradia olitoria (Say) (reinstated)

Jassus olitorius Say, 1830:310

Coelidia olitoria (Say); Metcalf, 1964:64

Jikradia olitoria olitoria (Say); Nielson, 1979: 92

Jikradia olitoria (Say) is the most widespread species. The latest taxonomic treatment and previous distribution of this species are covered in Nielson (1979). Comparison of the adult general habitus and male genitalia features between the Italian and American



Figs. 21-25. *Jikradia olitoria* (Say), from Italy (21) male pygofer, lateral view; (22) aedeagus and dorsal connective, lateral view; (23) style, lateral view; (24) connective, caudodorsal view; (25) subgenital plate, ventral view.

populations are shown in Plate 2 and Fig. 21, Fig. 22, Fig. 23, Fig. 24, Fig. 25, Fig. 26, Fig. 27, Fig. 28, Fig. 29 and Fig. 30, respectively. These differences are not considered significant to justify separate species. Specimens from Italy were collected in Lombardia, Maresso (LC), 350m., 1.viii. 2013, at light, 350m.; 5.ix.2 013 on *Populus tremula* L., 350 m.; 14.ix.2013 on *Salix alba* L. by Francesco Poggi. The earliest record appears to be 2010. Specimens from United States were collected in St. Joseph, Buchanan Co, Missouri, on 18. vii. 1987 on unidentified shrubs and trees by M. W. Nielson.

Reinstated and new status species

- Jikradia melanota* (Spångberg) [**reinstated**]
Jassus melanotus Spångberg, 1878:19
Coelidia melanota (Spångberg); Oman, 1949:55
Coelidia melanota (Spångberg); Metcalf, 1964:60
Coelidia melanota melanota (Spångberg); Nielson, 1979:86
- Jikradia galapagoensis* (Osborn) [**reinstated**]
Coelidia galapagoensis (Osborn); Metcalf, 1964:52
Jikradia melanota galapagoensis (Osborn); Nielson, 1979:88
- Jikradia bahamensis* Nielson [**new status**]
Jikradia melanota bahamensis Nielson, 1979:90
- Jikradia costaricensis* Nielson [**new status**]
Jikradia melanota costaricensis Nielson, 1979:91
- Jikradia olitoria* (Say) [**reinstated**]
Jassus olitorius Say, 1830:310
Coelidia olitoria (Say); Metcalf, 1964:64
Jikradia olitoria olitoria (Say); Nielson, 1979:92
- Jikradia floridana* (Lawson) [**reinstated**]
Jassus floridanus Lawson, 1927:171
Coelidia floridana (Lawson); Oman, 1949:55
Jikradia olitoria floridana (Lawson); Nielson, 1979:95

Checklist of species of *Jikradia*

- Jikradia bahamensis* Nielson (Bahama Islands)
Jikradia basipendula Nielson (Costa Rica, Guatemala (**new record**), Mexico)
Jikradia bispinosa Nielson (Guatemala, Mexico)
Jikradia cornicula Nielson (Guatemala, Mexico)
Jikradia costaricensis Godoy & Nielson (Costa Rica, El Salvador, Honduras, Panama)
Jikradia dentata n. sp. (Guatemala)
Jikradia exilis n. sp. (Costa Rica)
Jikradia galapagoensis Nielson (Galapagos Islands)
Jikradia infula Nielson (Mexico)
Jikradia krameri Nielson (Guatemala (**new record**), Honduras)
Jikradia lizanoi Godoy & Nielson (Costa Rica)
Jikradia longa Godoy & Nielson (Costa Rica)
Jikradia floridana (Lawson) (United States)
Jikradia galapagoensis (Osborn) (El Salvador, Galapagos Islands, Guatemala, Mexico, Nicaragua, Panama)
Jikradia melanota (Spångberg) (Bahama Islands, Bermuda, Cuba, United States)
Jikradia mexicana Godoy & Nielson (Mexico)
Jikradia olitoria (Say) (Canada, Italy (**new record**) United States)
Jikradia serrata Nielson (El Salvador, Guatemala, Honduras, Panama)
Jikradia trispinata n. sp. (Costa Rica)
Jikradia uniseta Nielson (Guatemala, Honduras, Mexico)
Jikradia variabilis n. sp. (Belize (**new record**))
Jikradia zurquiensis Godoy & Nielson (Costa Rica)

Key to species of *Jikradia*

1. Aedeagus with subapical to apical process, subapical processes setate, apex spinate 2
- Aedeagus without subapical to apical setate processes, apex spinate or not. 19
2. Style in lateral view with serrations or smooth on inner, lateral margin of apophysis 3
- Style in lateral view with distinctive spines on inner lateral margins of apophysis (Fig. 3). *dentata* n. sp.
3. Aedeagus with 1 or 3 very long subapical processes, without adjacent processes basad of subapical processes 4
- Aedeagus with 1 long subapical process more than 4 times longer than adjacent processes or with group of short, subapical processes, none of which is more than 3 times longer than adjacent processes 8
4. Aedeagus with 1 long subapical process 5
- Aedeagus with 3 long subapical processes. *trispinata* n.sp.

| | | |
|-----|--|------------------------------------|
| 5. | Aedeagus with sharp apical spine. | 6 |
| - | Aedeagus without spine, apex bluntly rounded. | 7 |
| 6. | Connective with arms broad throughout, abruptly curved mesally in distal 1/3 (Fig. 14); pygofer in lateral view with truncate caudodorsal marking (Fig. 11) (in part) | <i>variabilis</i> n. sp. |
| - | Connective with arms tapered apically, gradually curved mesally throughout (Fig. 283; Nielson, 1979); pygofer in lateral view with slightly tapered caudorsal margin (Fig. 281; Nielson, 1979). | <i>uniseta</i> Nielson |
| 7. | Aedeagus in lateral view with base of process dentate, subapical process not extending beyond apex of aedeagal shaft (Fig. 298; Nielson, 1979) | <i>cornicula</i> Nielson |
| - | Aedeagus in lateral view with process without dentate base, subapical process extending considerably beyond apex of aedeagal shaft (Fig. 281; Nielson, 1979) | <i>basipendula</i> Nielson |
| 8. | Aedeagus with 1 long subapical process that is more than 4 times longer than adjacent processes. | 9 |
| - | Aedeagus with 1 long subapical process that is less than 3 times longer than adjacent processes. | 12 |
| 9. | Aedeagus with 1 long subapical process and 1 single short process basad of long process. | 10 |
| - | Aedeagus with 1 long subapical process and tuft of short processes basad of long processes. | 11 |
| 10. | Forewing with narrow flavous band along costa; aedeagus in ventral view with sharply pointed spine apically (Fig. 311; Nielson, 1979); connective with broad arms (Fig. 309; Nielson, 1979) | <i>krameri</i> Nielson |
| - | Forewing without narrow flavous band along costa; aedeagus in ventral view with abruptly pointed spine apically (Fig. 305; Nielson, 1979); connective with very narrow arms (Fig. 301; Nielson, 1979) | <i>bispinosa</i> Nielson |
| 11. | Subgenital plate with sparse macrosetae (Fig. 10; Godoy & Nielson, 1998); connective with long narrow arms (Fig. 8; Godoy & Nielson, 1998) | <i>longa</i> Godoy & Nielson |
| - | Subgenital plate with numerous macrosetae (Fig. 314; Nielson, 1979); connective with short robust arms (Fig. 313; Nielson, 1979). | <i>galapagoensis</i> Nielson |
| 12. | Aedeagus with row of subapical processes on one side of aedeagal shaft. | 13 |
| - | Aedeagus with few subapical processes on both sides of aedeagal shaft. | 18 |
| 13. | Aedeagus with continuous row of numerous, subapical to apical processes. | 14 |
| - | Aedeagus with row of 3-5 processes separated by space equal to length of row, single subapical or apical process. | 17 |
| 14. | Subgenital plate slightly tapered or rounded apically. | 15 |
| - | Subgenital plate triangulate apically (Fig. 320; Nielson, 1979); aedeagus with short row of subapical processes with a single longer apical process (Fig. 321 and Fig. 322; Nielson, 1979). | <i>bahamensis</i> Nielson |
| 15. | Aedeagus with long row of processes occupying about ¼ length of shaft. | 16 |
| - | Aedeagus with short row of processes occupying about 1/7 of length of shaft (Fig. 338; Nielson, 1979) <i>olitoria</i> (Say) | |
| 16. | Aedeagus in lateral view with long row of very short processes equal in length with 2 longer apical processes (Fig. 333 and Fig. 334; Nielson, 1979); subgenital plate rounded apically (Fig. 322; Nielson, 1979). | <i>costaricensis</i> Nielson |
| - | Aedeagus in lateral view with long row of processes unequal in length (Fig. 19; Nielson, 1989); subgenital plate tapered apically (Fig. 23; Nielson, 1989) | <i>infula</i> Nielson |
| 17. | Subgenital plate abruptly tapered apically (Fig. 17); connective with broad arms, apices abruptly curved distally (Fig. 19) | <i>exilis</i> n. sp. |
| - | Subgenital plate slightly tapered apically (Fig. 15; Godoy & Nielson, 1998); connective with narrow arms, apices not abruptly curved distally (Fig. 13; Godoy & Nielson, 1998) | <i>zurquiensis</i> Godoy & Nielson |
| 18. | Aedeagus with 2 distinct tufts of subapical processes, one on each side of shaft (Fig. 17A, Fig. 17B and Fig. 17C; Godoy & Nielson, 1998); pygofer in lateral view with few short caudodorsal processes (Fig. 16; Godoy & Nielson, 1989) | <i>lizanoi</i> Godoy & Nielson |
| - | Aedeagus with few scattered subapical processes (Fig. 327 and Fig. 328; Nielson, 1979); pygofer in lateral view with numerous caudodorsal processes (Fig. 324; Nielson, 1979) | <i>melanota</i> (Spångberg) |
| 19. | Style in lateral view with apophysis smooth on outer lateral margin. | 20 |
| - | Style in lateral view with apophysis serrated on outer lateral margin (Fig. 280; Nielson, 1979); aedeagal shaft broad throughout. | <i>serrata</i> Nielson |
| 20. | Aedeagus without apical spine (Fig. 12A); connective with broad arms, arms abruptly angled mesally in distal 1/3 (Fig. 14); subgenital plate with row of macrosetae on outer lateral margin (Fig. 15) (in part) | <i>variabilis</i> n. sp. |
| - | Aedeagus with apical spine (Fig. 2; Godoy & Nielson, 1989); connective with narrow arms, arms not abruptly angled mesally (Fig. 3; Godoy & Nielson, 1989); subgenital plate with macrosetae occupying much of distal 2/3 of surface (Fig. 5; Godoy & Nielson, 1989) | <i>mexicana</i> Godoy & Nielson |

DISCUSSION

Previous to this paper, the genus *Jikradia* was known only in the New World from the Galapagos Islands (Ecuador) northward to Canada. Recent discovery of *Jikradia olitoria* (Say) from Italy reported by Francesco Poggi and Herbert Nickel extends the distribution to the Old World. Comparisons of the adult general habitus and male genitalia features among specimens from Italy and Missouri, U.S.A are shown in Plate 2 and Fig. 21, Fig. 22, Fig. 23, Fig. 24, Fig. 25, Fig. 26, Fig. 27, Fig. 28, Fig. 29 and Fig. 30, respectively. The Italian adults, on average, were about 2mm shorter than specimens from USA.

The origin of the genus appears to be Guatemala in Central America. Speciation and dispersal are believed to be multidirectional, South to the Galapagos Islands, Northeast to

United States and Canada, and from Southern United States to the Caribbean Islands. The Italian population of *Jikradia olitoria* (Say) was an introduction from the United States.

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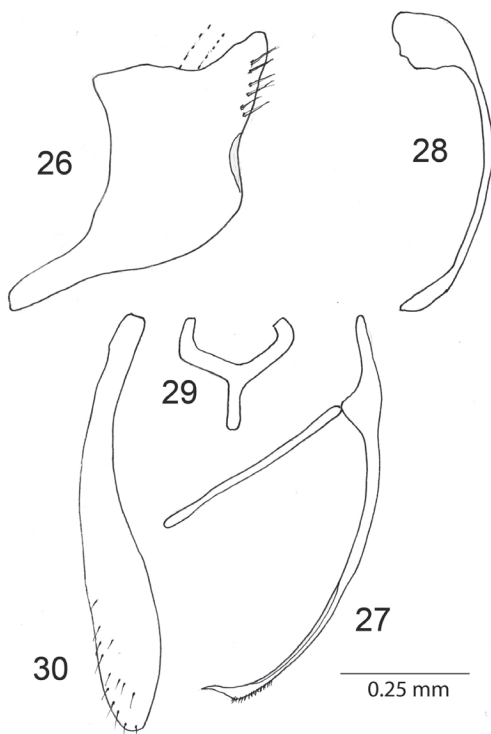
RESUMEN

Las siguientes cuatro nuevas especies de chicharritas son descritas e ilustradas: *Jikradia dentata* n. sp. y *J. trispinata* n. sp. de Guatemala, *J. variabilis* n. sp. de Belice, y *J. exilis* n. sp. de Costa Rica. *Jikradia basipendula* Nielson y *J. krameri* Nielson son nuevas especies reportadas para Guatemala. El género *Jikradia* es un nuevo registro para Belice. Un registro de la primera introducción del género en el Viejo Continente es revisado. Se presenta una clave revisada de las nuevas especies con una revisión de su posible origen. También se presenta una lista revisada de todas las especies conocidas.

Palabras clave: chicharritas, nuevas especies, nuevos registros, lista de verificación, taxonomía, Costa Rica, Belice, Guatemala, Italia.

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Figs. 26-30. *Jikradia olitoria* (Say) from U.S.A. (26) male pygofer, lateral view; (27) aedeagus and dorsal connective, lateral view; (28) style, lateral view; (29) connective, caudodorsal view; (30) subgenital plate, ventral view.

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