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Two new species of *Kapateira* Young from Costa Rica (Auchenorrhyncha: Cicadellidae: Cicadellinae)

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Abstract

The genus *Kapateira* was described by Young (1977), who included one species from Colombia but noted that the genus also occurs in Panama, Venezuela, Eucador, and Bolivia. In this paper two new species are decribed, *K. peruana* from Peru and *K. coffea* from Costa Rica. The latter species is associated with coffee and citrus, and information is provided on its biology. DAS-ELISA tests for the bacterium, *Xylella fastidiosa*, yielded numerous positive results, suggesting that *K. coffea* is a potential vector of diseases such as coffee leaf scorch and citrus variegation chlorosis.

Key words: Hemiptera, Auchenorrhyncha, leafhopper, taxonomy, biology, *Xylella fastidiosa*, coffee

Introduction

The genus *Kapateira* was established by Young (1977), who included one species, *K. rosipennis* (Osborn). Despite the possible role of *Kapateira* species as vectors of plant diseases, there has been no further taxonomic work on this genus. Species of Cicadellinae, the subfamily to which *Kapateira* belongs, are among the most important vectors of *Xylella fastidiosa*, a bacterium that invades the xylem of various crop plants. Examples of diseases caused by this bacterium in Costa Rica include coffee leaf scorch on *Coffea arabica* (Rubiaceae), which was detected in the country in 2001 (Rodríguez et al., 2001); and citrus variegation chlorosis on *Citrus* (Rutaceae), which was detected in 2005 (Aguilar et al., 2005). An inventory of potential disease vectors in these crops has shown that one of

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the most commonly collected cicadellines is a new species of *Kapateira*. The purpose of this paper is to describe this new species, as well as another new species from Peru, and to provide preliminary information on its biology and potential status as a vector of *Xylella*. We show that the new Costa Rican species of *Kapeteira* is capable of completing its life cycle on coffee and that a substantial number of individuals harbor *Xylella fastidiosa*. The evidence thus suggests that species of *Kapeteira* may be economically important pests in the Neotropics.

Material and methods

The specimens from Costa Rica were collected with a suction pump and yellow sticky traps in Desamparados (San José), Carrizal (Alajuela) and Grecia (Alajuela). The specimens from Peru were borrowed from the California Academy of Sciences, San Francisco. Oman's (1949) method of preparing leafhopper genitalia was followed, except that the abdomen was placed separately in 10% potassium hydroxide overnight at room temperature instead of being heated. The following day the genitalia were washed for five minutes in water.

Depositories: CAS—California Academy of Sciences, San Francisco, USA. INBio—Instituto Nacional de Biodiversidad, Santo Domingo, Heredia, Costa Rica. BMNH—The Natural History Museum, London, UK. UCR—University of Costa Rica, San Pedro, San José, Costa Rica.

Tests for the presence of *Xylella fastidiosa* in the body of the insect were carried out with a double antibody sandwich enzyme-linked immunosorbent assay (DAS-ELISA). The specimens for this test were collected in San José Province, in Curridabat, Desamparados and San Cristobal Sur de Desamparados, 72, 16 y 32 individuals respectively. Each sample consisted of two individuals which were macerated in 200 µl general extraction buffer, following the protocol of Converse and Martin (1990).

The study of the life cycle was carried out in the Cellular and Molecular Biology Research Center of the University of Costa Rica between March and October, 2004. Breeding of *K. coffea* was initiated from adults collected in Desamparados and Curridabat. The adults were introduced into a growth chamber (Percival, model E-305) set at 23 ºC and a photoperiod of 12 hours. Three pairs of adults were removed from the growth chambers and placed on coffee saplings covered with a transparent plastic cylinder 12 cm in diameter and 24 cm high, with openings on the sides and top covered with a fine mesh screen. In total, 10 nymphs were obtained, which were transferred to individual plants on which observations of the life cycle were carried out.

Genus *Kapateira* Young

Type Species. *Oncometopia rosipennis* Osborn (1926b:172).

Diagnosis. Male 6.7–10.6 mm, female 6.5–7.4 mm. Color dull yellowish. Anterior portion of the pronotum and the scutellum dull yellow, with the disk of the pronotum and the forewing tan to purplish. Some species with black pronotal spots. Head moderately produced, crown with or without a concavity across ocelli, surface without sculpturing or setae. Thorax with pronotal width less than transocular width of head, lateral margins parallel or slightly convergent anteriorly, dorsopleural carinae complete, posterior margin concave; scutellum not transversely rugose. Forewing with membrane including all or almost all apical cells, extending proximally along costal margin or not, with three closed anteapical cells, middle anteapical cell the longest, texture coriaceous with or without weak transverse rugae. Hind femoral setal formula 2:1:1, first tarsomere slightly longer than combined length of distal tarsomeres and with two parallel asymmetrical rows of small setae on plantar surface. Male genitalia: Pygofer moderately produced, posterior margin varying from regularly convex to slightly produced posterodorsally and slightly angular, with numerous macrosetae on posterior half of disk, occasionally with interspersed microsetae, pygofer processes absent. Subgenital plate narrowly triangular, variable in their posterior extent compared with apex of pygofer, with uniseriate macrosetae. Style extending posteriorly beyond apex of connective,without preapical lobe. Connective occurring as a transverse bar, or short and Y-shaped. Aedeagus symmetrical, usually with paired processes occurring basally or at apex of shaft, with or without additional processes. Paraphyses usually absent.

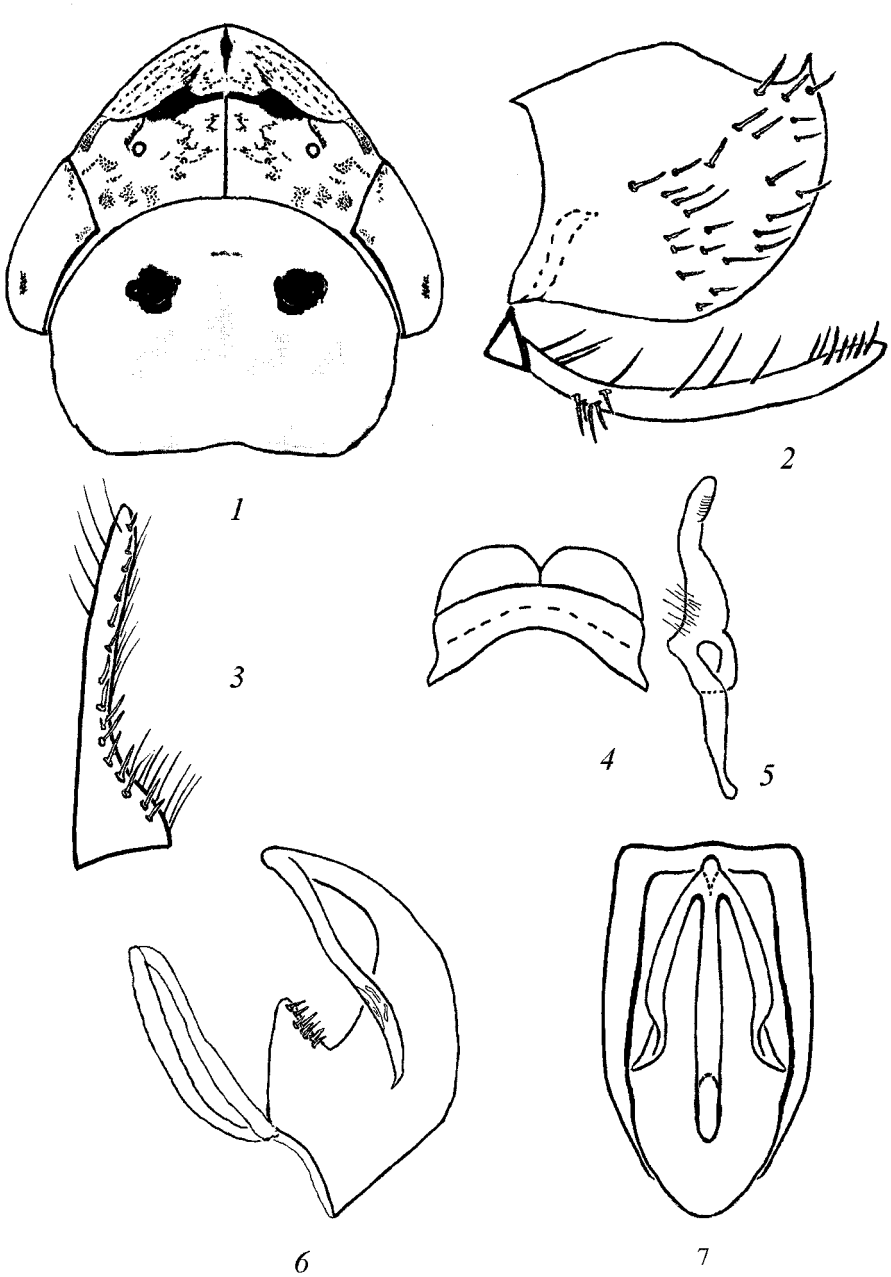
***Kapateira coffea*, Godoy, sp. nov. (Figs. 1–13)**

Type material: Holotype: male, **COSTA RICA: San José:** Desamparados, 1200m, 5-I-2001, C.M. Rodríguez (CAS). Paratypes: 13 males and 6 females, same data as holotype; 4 male and 7 female, same data except 19-I-2000; 1 female, same data except 8-II-2000; 2 males and 3 females, same data except 15-II-2000; 4 males and 7 females, same data except 21-XII-2000; 2 females same data except 8-II-2001; 4 males and 3 females, same data except 12-II-2001; 2 females, same data except 8-III-2001; 1 male and 2 females, same data except 19-III-2001; 1 male and 3 females, same data except 28-III-2001; 1 male and 2 females, same data except 6-IV-2001; 2 females, same data except 21-XII-2001; 1 male and 3 females, same data except 29-X-2001 (CAS, INBio, BMNH, UCR).

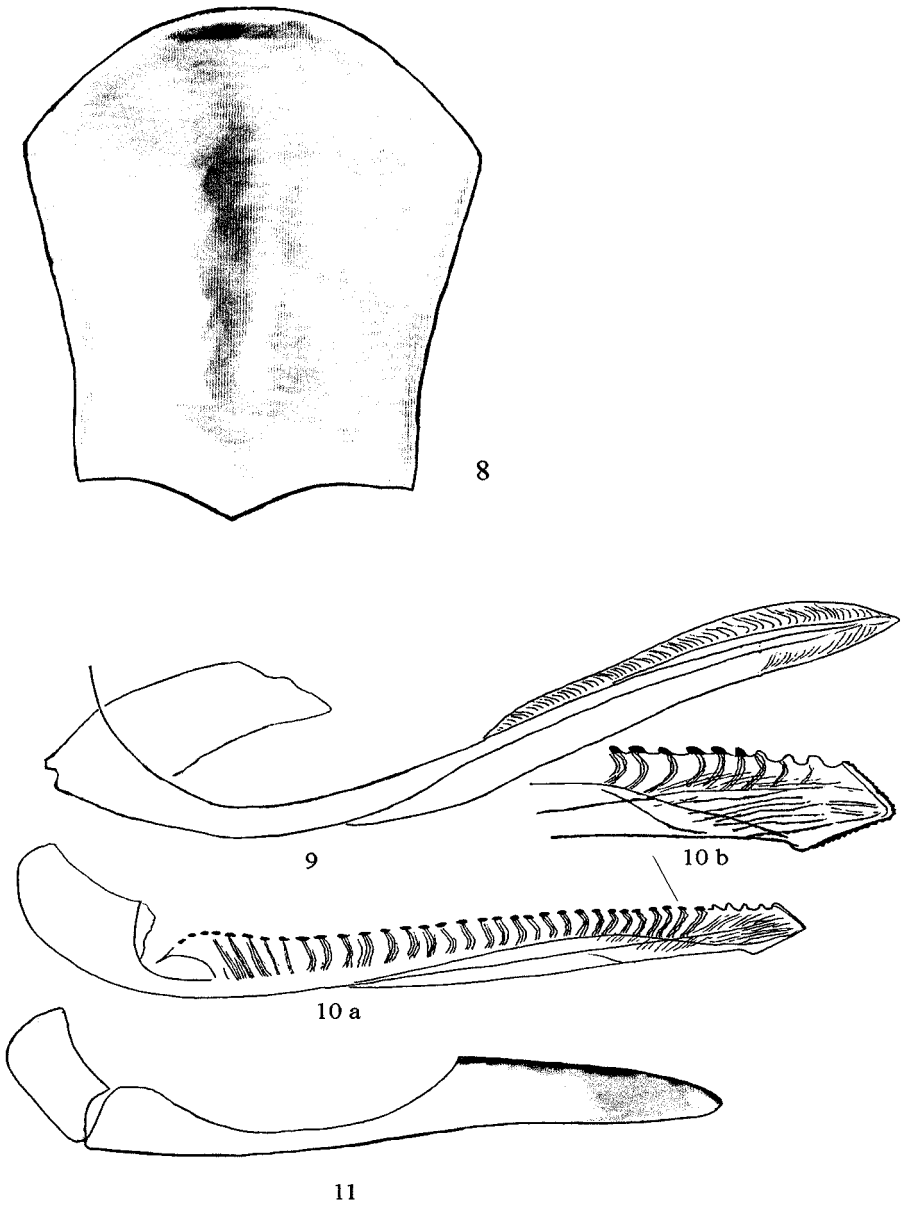
Description. Length of male 6.7–7.2 mm, female 6.5–7.4 mm. General color mustard yellow, with black spots or lines on the dorsum of head; pronotum with two spots (Fig. 1).

Male genitalia: pygofer with ventral posterior margin rounded, posteriorly produced into short spine on dorsal posterior margin (Fig. 2). Subgenital plate narrowly triangular, extending posteriorly beyond apex of pygofer, with uniseriate macrosetae (Figs. 2, 3).

Style extending posteriorly beyond apex of connective, without preapical lobe (Fig. 5). Connective short, Y-shaped (Fig. 4). Aedeagus symmetrical in lateral view with a paired elongate apical processes projecting distally, gonopore located apically, atrium with spine, basal apodemes greatly elongate (Figs. 6, 7).

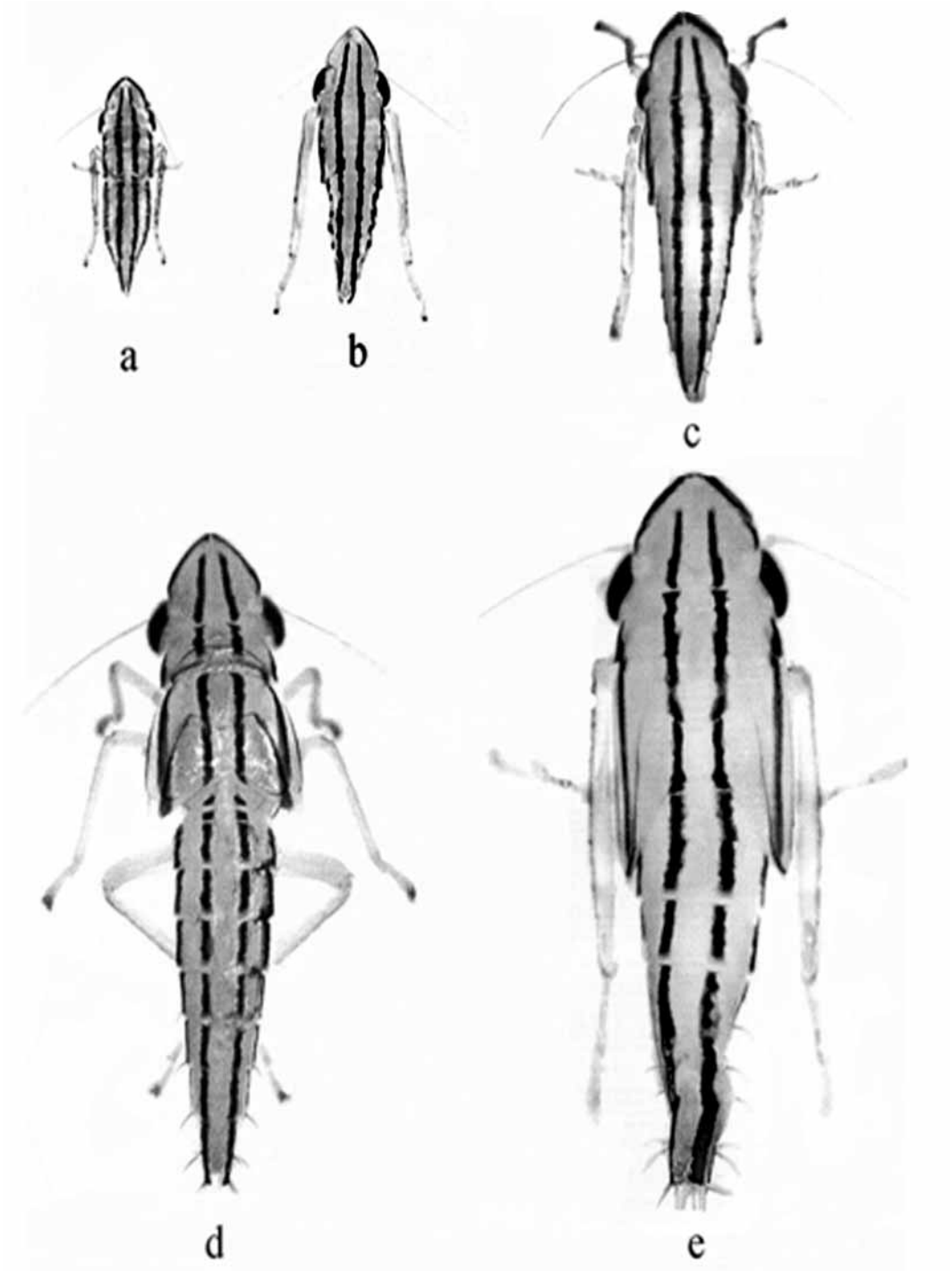


FIGURES 1–7. *Kapateira coffea*, Godoy sp. nov. (holotype). 1. Anterior dorsum, dorsal view; 2. Pygofer, subgenital plate and valve, lateral view; 3. Subgenital plate, ventral view; 4. Connective dorsal view; 5. Style, dorsal view; 6. Aedeagus, lateral view; 7. Aedeagus, ventral view.



FIGURES 8–11. *Kapateira coffea*, Godoy sp. nov. 8. Female abdominal sternum VII, dorsal view; 9. Ovipositor, first valvula, lateral view; 10a. Ovipositor, second valvula, lateral view; 10b. Apex of ovipositor, second valvula, lateral view; 11. Ovipositor, third valvula, lateral view.

Female sternum VII with ventral surface convex, posterior margin pointed at apex and concave on both sides (Fig. 8). First and second valvulae elongate, slightly wider subapically, tapered to apex. First valvula in lateral aspect wider in apical half and slightly curved, with strigate sculpture on dorsal and apical margins (Fig. 9). Second valvula in lateral aspect with dorsal teeth, individual teeth rounded and slightly elevated (Fig. 10 a–b). Third valvula shorter, narrowed apically to rounded point (Fig. 11).



FIGURES 12 a–e. The five instars of *Kapateira coffea*, Godoy sp. nov.

Nymphs (Figs. 12 a–e). Color yellowish, with four distinct longitudinal brown to black stripes. Head large, as long as basal width, crown with anterior portion brown to

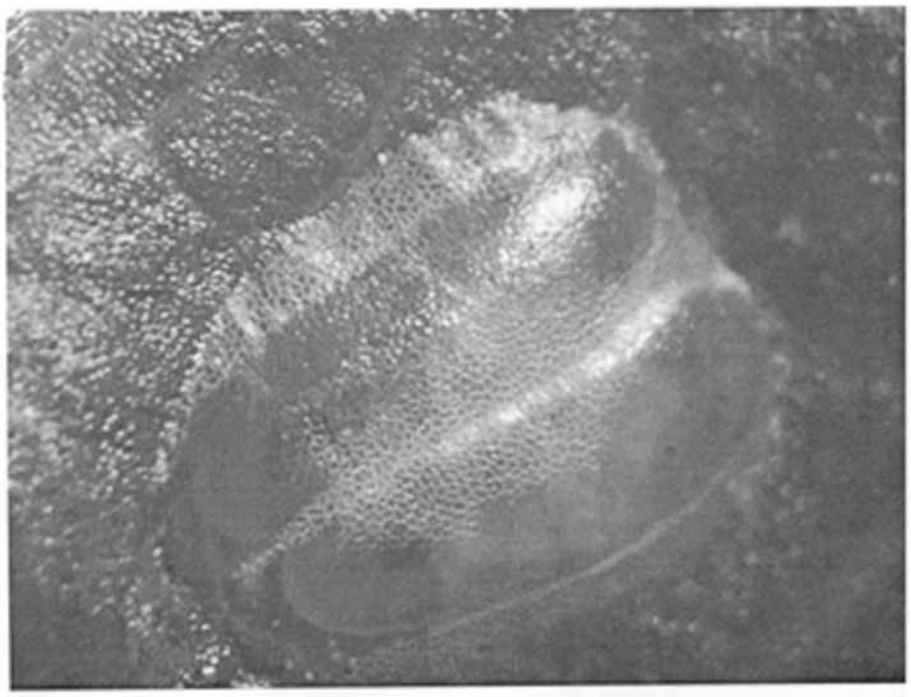
black; clypeus broad with two longitudinal stripes. Abdominal tergites VI to VIII each with short setae on posterior lateral margins, usually more setae on tergite IX. There are five instars, each resembling the other except for size and the developing wings as shown in Fig. 12e. The developing wings, in the form of wing pads, become more pronounced in the third, fourth and fifth instars. In these same instars the tibiae have a brown line between setal rows I and II. The nymphs vary from 1.6 to 1.8 mm in length in the first instar, to 6 mm in the fifth instar.

Distribution. Known only from Costa Rica.

Diagnosis. *Kapateira coffea* is similar to *K. rosipennis* but the pygofer has the ventral margin rounded and it is produced into a short spine. Moreover, the aedeagus has paired processes, which is very distinct from the aedeagus of *K. rosipennis*.

Etymology. The specific name refers to the host plant *Coffea arabica.*

Biology. The eggs (Fig. 13) are generally laid in pairs, rarely individually, the two eggs together and in the same position. They are covered with a transparent mucilaginous secretion and are inserted just under the surface of the epidermis, on both the underside and the upperside of the leaf, occasionally on young, nonwoody stems. Each egg is about 2 mm long and yellow. They are fairly difficult to find even with a hand lens, but can be recognized as small, bean-shaped blisters (Fig. 13). The red eye of the developing nymph can be recognized shortly before it hatches. The egg stage lasts about 7 days (n = 10).



FIGURES 13. Eggs of *Kapateira coffea*, Godoy sp. nov.

Immediately after eclosion the nymphs began feeding, generally on the underside of young leaves. The average duration of the first stadium was 11 days (n=10). Nymphs observed in the process of molting in the laboratory (n=10), were always located on the undersides of mature leaves on the lower part of the plant. The average duration of the second, third, and fourth stadia was 5 (n=9), 4.5 (n=8), and 9.5 days (n=8), during which time feeding behavior remained the same, except that the fourth and fifth instars began feeding for greater lengths of time on nonwoody stems. The average duration of the fifth stadium was 11 days (n=6). Of the ten total individuals under observation in the laboratory, one died during the second stadium, one in the third, and two died during the fourth stadium.

The adult stage, which lasted about 37.5 days (n=6), fed on both young and mature leaves. Adults also fed on young stems, on which they remained for most of the day. A total of 120 individuals were tested with DAS-ELISA, and of these 43 were positive for *Xylella fastidiosa*. This suggests that *K. coffea* is a potential vector of plant diseases caused by this bacterium, although further tests are needed to determine its actual role in disease transmission. In North America *X. fastidiosa* has a diverse host range encompassing over 30 families of monocotyledonous and dicotyledonous plants (Purcell and Hopkins, 1996). In Costa Rica this bacterium causes coffee leaf scorch and citrus variegated chlorosis, although the latter seems to occur primarily when citrus is planted in coffee plantations (Rodríguez, et al. 2001; Aguilar et al. 2005).

Kapateira peruana, Godoy, sp. nov. (Figs. 14–18)

Type material. Holotype: male, **PERU**, Monson Valley, Tingo Maria, XII-9-1954, E. Schlinger and E. S. Ross (CAS).

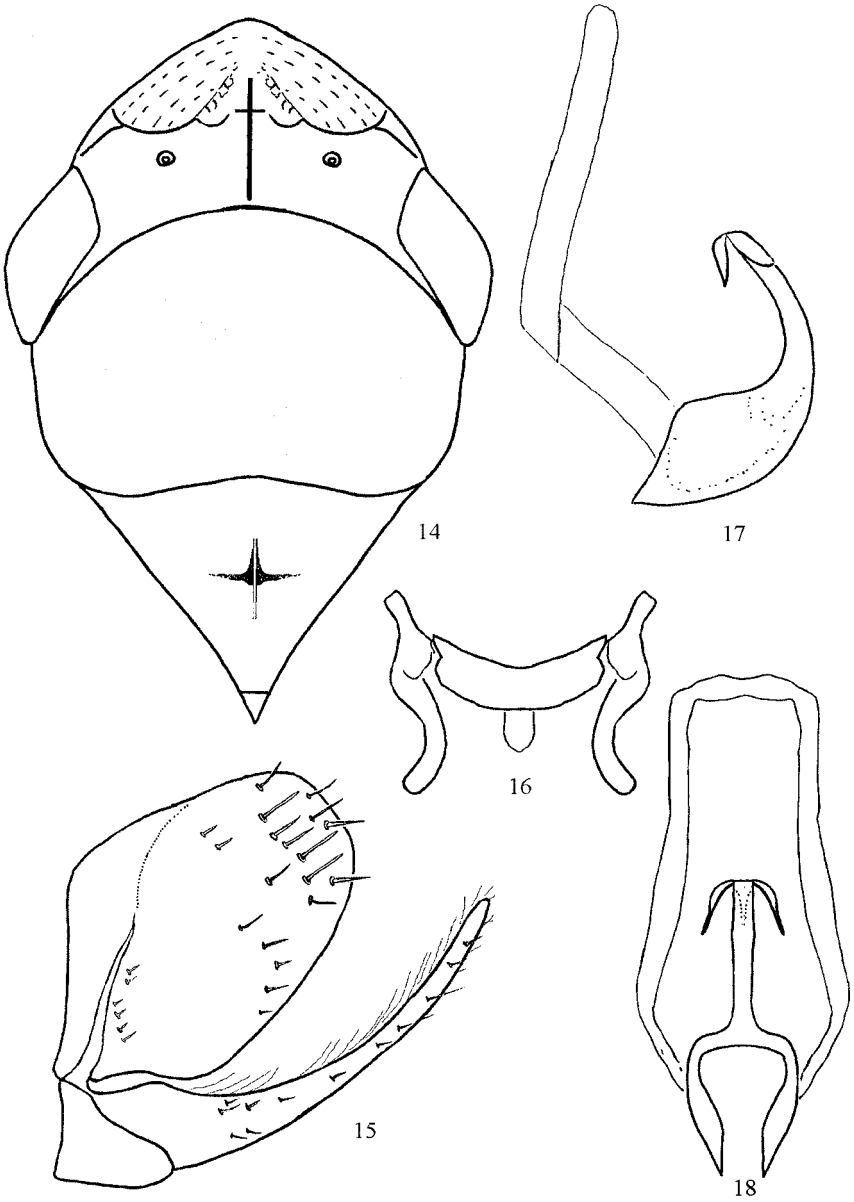
Description. Length of male 7.9 mm. Mustard yellow, with black spots or lines dorsally on head; pronotum with two spots. Scutellum mustard yellow, with black spots medially (Fig. 14).

Male genitalia: pygofer with ventral margin rounded and produced on dorsal posterior margin (Fig. 15). Plate narrowly triangular, extending posteriorly beyond apex of pygofer, with uniseriate macrosetae. Style extending posteriorly beyond connective. Connective broadly U-shaped (Fig. 16). Aedeagus symmetrical in lateral view with paired short apical processes projecting distally, gonopore apical, basal apodemes greatly elongate (Figs. 17–18).

Distribution. Known only from Peru.

Diagnosis. *Kapateira peruana* is similar to *K. rosipennis*, but the aedeagus has paired processes and is thus very distinct from that in *K. rosipennis*.

Etymology. Named for the country from which this species was collected.



FIGURES 14–18. *Kapateira peruana*, Godoy sp. nov. (holotype). 14. Anterior dorsum, dorsal view; 15. Pygofer, subgenital plate and valve, lateral view; 16. Style and connective, dorsal view; 17. Aedeagus, lateral view; 18. Aedeagus, ventral view.

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