

**NEW RECORDS OF THE ALIEN INVASIVE TROPICAL TENT-WEB SPIDER,  
*CYRTOPHORA CITRICOLA* (FORSSKÅL, 1775) (ARANEIDAE) IN CENTRAL CUBA**Tomás M. RODRÍGUEZ-CABRERA<sup>1✉</sup> and Rolando TERUEL<sup>2</sup>

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**ABSTRACT.** The tropical tent-web spider, *Cyrtophora citricola* (Forskål, 1775) (Araneidae), is an invasive alien species in the New World. It was first reported in eastern Cuba in 2003. Since then, it has colonized most part of the country in less than two decades. However, some areas have remained free of this species. Herein we present the first records of this species for Villa Clara Province and other localities in central Cuba. Also, we discuss its current status at some previously reported localities in eastern Cuba.

**KEYWORDS:** Exotic species, information gaps, new records, range expansion, West Indies.

**RESUMEN:** NUEVOS REGISTROS DE LA ARAÑA PARDA DEL MEDITERRÁNEO, *CYRTOPHORA CITRICOLA* (FORSSKÅL, 1775) (ARANEIDAE) EN CUBA CENTRAL. La araña parda del Mediterráneo, *Cyrtophora citricola* (Forskål, 1775) (Araneidae), es una especie exótica invasora en el Nuevo Mundo. Se reportó por primera vez para el oriente de Cuba en 2003 y en menos de dos décadas ha colonizado la mayor parte del país. Sin embargo, algunas áreas han permanecido libres de esta araña. En este trabajo se presenta el primer registro de esta especie para la provincia de Villa Clara y otras localidades de Cuba central. Además, hacemos algunas observaciones sobre su situación actual en algunas localidades previamente reportadas del oriente cubano.

**PALABRAS CLAVE:** Especie exótica, expansión de la distribución, Las Antillas, nuevos registros, vacíos de información

The invasive tent-web spider, *Cyrtophora citricola* (Forskål, 1775) (Araneidae), is native to Africa, the Circum-Mediterranean region, and the Near East (Rypstra, 1979; Levi, 1997; Teruel *et al.*, 2014). Under favorable conditions, this gregarious orb-weaver may form large colonies of several hundred individuals of both sexes and different age-classes (Blanke, 1972; Lubin, 1974; Rypstra, 1979; Leborgne *et al.*, 1998; Mestre and Lubin, 2011; Johannesen *et al.*, 2012). The compound webs of this spider may cover the entire foliage of shrubs and trees, power poles, and fence posts (Alayón *et al.*, 2001; Sánchez-Ruiz and Teruel, 2006; Martín-Castejón and Sánchez-Ruiz, 2010; Teruel *et al.*, 2014). Multiple observations suggest possible deleterious effects on the supporting plants when dense populations of this spider have become established, including leaf loss, terminal twig dieback, and even plant death (Cárdenas-Murillo *et al.*, 1997; Levi, 1997; Alayón *et al.*, 2001, 2017; Alayón, 2003; Starr, 2005; Edwards, 2006). Extensive web cover by *C. citricola* might restrict air circulation, causing a rise in temperature. As debris accumulates in these vast spider webs, sunlight becomes less available, potentially affecting photosynthesis and causing desiccation of leaves, young branches, and fruits (Cárdenas-Murillo *et al.*, 1997; Edwards, 2006).

First records of *C. citricola* in the Americas date back to 1996 in Colombia (Levi, 1997). In Cuba, the species was reported for the first time in 2003 in the eastern region of the country (Alayón, 2003). In less than two decades, *C. citricola* has colonized most parts of the country (Sánchez-Ruiz and Teruel, 2006; Sánchez-Ruiz, 2012; Barba-Díaz *et al.*, 2014; Teruel *et al.*, 2014; Díaz-Álvarez *et al.*, 2017; Pérez-Silva and García-Lahera, 2017; Rodríguez-Cabrera *et al.*, 2018). For reasons not yet

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understood, there are certain areas of the Cuban archipelago that have remained free of this spider, such as western Cuba and some provinces in central Cuba (Fig. 1). Here, we report for the first time the occurrence of *C. citricola* in Villa Clara Province and other localities of the Guamuhaaya massif. We also discuss the current status of this spider at previously reported localities in eastern Cuba.

On February 17 and 27, 2020, we found several webs of *C. citricola* around the municipal dump of Placetas town ( $22^{\circ}16'47''\text{N}$ ,  $-79^{\circ}40'25''\text{W}$ ; 200

m a.s.l.; Placetas Municipality; Fig. 1) and along “Callejón de los Tubos” dirt road near La Ceja village (central point:  $22^{\circ}12'45''\text{N}$ ,  $-79^{\circ}42'35''\text{W}$ ; 150 m a.s.l.; Villa Clara Province; Fig. 1). The dominant vegetation in these two areas encompasses anthropogenic savanna with isolated shrubs and trees. The webs were on invasive thorny shrubs (*Vachellia farnesiana* [L.] Wight and Arn. and *Dichrostachys cinerea* [L.] Wight and Arn., Mimosaceae) and fence poles alongside a road and a path. We observed several spiders of different age classes and egg-sacs in the webs. These two localities represent the first records of *C. citricola* for Villa Clara Province. We found *C. citricola* in seven additional localities within protected areas, all located in the Guamuhaaya massif in central Cuba (Fig. 1), including:

1. Meteorological radar station at Pico San Juan Ecological Reserve ( $21^{\circ}59'20''\text{N}$ ,  $-80^{\circ}08'48''\text{W}$ ; 1,110 m a.s.l.), Cumanayagua Municipality, Cienfuegos Province. On December 5, 2019, we found a single web on an *Agave* plant at the beginning of the staircase to the meteorological radar station, at the base of a rocky cliff by a road. We did not examine the web thoroughly for spiders, but it seemed intact and had an egg sac in its center. The montane rainforest is the dominant vegetation in the area. This record constitutes the highest-elevation siting for this spider in central Cuba. It occurs at a similar altitude than the absolute highest ever reported in the Cuban archipelago (1,214 m a.s.l. in La Gran Piedra, Santiago de Cuba) (Teruel *et al.*, 2014).

2. Head of trail to Salto El Rocío at Charco Azul Abajo ( $21^{\circ}57'40''\text{N}$ ,  $-80^{\circ}03'50''\text{W}$ ; 550 m a.s.l.), Parque Guanayara, Topes de Collantes Protected Landscape, Cumanayagua Municipality, Cienfuegos Province. On December 3, 2019, we found three active webs, each with adult and juvenile spiders plus egg sacs, on the barbwire fence with live posts, bordering a dirty road. The area's dominant vegetation is anthropogenic, including coffee plantations with shadow tree species and patches of open pasture, located about 200 meters of the primary semi-deciduous forest in a karst outcrop at the Charco Azul riverbanks.

3. La Gallega Restaurant at Parque Guanayara ( $21^{\circ}57'42''\text{N}$ ,  $-80^{\circ}02'36''\text{W}$ ; 390 m a.s.l.), Topes de Collantes Protected Landscape, Cumanayagua Municipality, Cienfuegos Province. On December 2 and 5, 2019, we found many active webs, each containing adult and juvenile spiders plus egg sacs, on almost each of the ornamental bushes of the

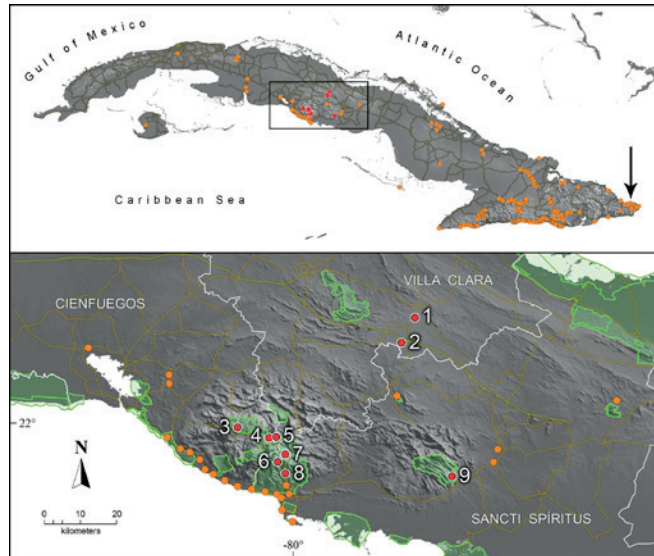


FIGURE 1. Distribution of *Cyrtophora citricola* in the Cuban archipelago (above), including previous records (orange dots) and new records (red dots); arrow indicates visited localities in eastern Cuba. Map of central Cuba (below) highlighting the new records, including 1) municipal dump of Placetas Town; 2) Callejón de los Tubos dirt road, near La Ceja; 3) Pico San Juan; 4) Charco Azul Abajo; 5) La Gallega restaurant; 6) Codina Estate; 7) Kurhotel, Topes de Collantes; 8) Mirador del Caribe restaurant; and 9) Jarico Field Station, Lomas de Banao Ecological Reserve. Green outlines represent protected areas.

FIGURA 1. Distribución de *Cyrtophora citricola* en el archipiélago cubano (arriba), incluyendo los registros previos (puntos naranjas) y los nuevos (puntos rojos); la flecha indica las localidades visitadas en la región oriental. Mapa de Cuba central (abajo) destacando los nuevos registros: 1) basurero municipal del pueblo de Placetas; 2) ‘Callejón de los Tubos’, cerca de La Ceja; 3) Pico San Juan; 4) Charco Azul Abajo; 5) restaurante ‘La Gallega’; 6) hacienda ‘Codina’; 7) Kurhotel, Topes de Collantes; 8) restaurante ‘Mirador del Caribe’; y 4) Jarico, Reserva Ecológica ‘Lomas de Banao’. Los contornos verdes representan las áreas protegidas.



restaurant garden, mostly Rosebush (*Rosa* sp., Rosaceae) and China Rose (*Hibiscus rosa-sinensis* L., Malvaceae). Similarly to the previous locality, coffee plantations with shadow tree species and patches of open pastures were dominant in this area. The site is only 2 km (air distance) east of the previous locality, in the same bank of the Charco Azul river.

4. Trail to El Altar cave at Codina Estate (21°53'52"N, -80°02'27"W; 770 m a.s.l.), Topes de Collantes Protected Landscape, Trinidad Municipality, Sancti Spíritus Province. On December 1, 2019, we found a single inactive web on an orange tree (*Citrus x aurantium* L., Rutaceae) bordering the trail. The web was old, dirty and abandoned, with two long-hatched egg sacs. The dominant vegetation in the area is mostly anthropogenic, including mixed secondary pine forest and broadleaf forest, with open pasture patches.

5. Kurhotel building at Topes de Collantes Protected Landscape (21°55'00"N, -80°01'10"W; 800 m a.s.l.), Trinidad Municipality, Sancti Spíritus Province. On December 2, 2019, we found a single inactive web on the base of a satellite dish on top of the hotel roof. The web was old, abandoned and partially destroyed, with one old egg sac. Tall trees such as *Eucalyptus* sp. and *Pinus* sp. surround the hotel. The site is 3 km (air distance) northeast of the previous locality.

6. Mirador del Caribe restaurant at Topes de Collantes Protected Landscape (21°51'52"N, -80°01'12"W; 550 m a.s.l.), Trinidad Municipality, Sancti Spíritus Province. On November 11, 2019, we found several webs on a prickly pear cactus (*Opuntia ficus-indica* [L.] Mill., 1768). We observed several spiders of different age classes and egg-sacs in the webs. The dominant vegetation in the area is mostly anthropogenic, composed of secondary shrubs and ornamental plants around the building, surrounded by secondary forest and broadleaf evergreen forest.

7. Jarico Field Station at Lomas de Banao' Ecological Reserve (21°51'27"N, -79°34'30"W; 240 m a.s.l.), Sancti Spíritus Municipality, Sancti Spíritus Province. On June 5, 2019, we found spider webs on exotic *Agave* plants and native trees (*Podocarpus angustifolius* Griseb., Podocarpaceae, and *Lysiloma sabicu* Benth., Fabaceae). The webs were small and with only a few individuals and egg sacs (Fig. 2). The dominant vegetation in the area is a mosaic of secondary forest and broadleaf evergreen forest.

In Cuba, *C. citricola* seems to proliferate best in sites below 400 m a.s.l., particularly with xeric

vegetation associated with coastal and subcoastal areas (e.g., Sánchez-Ruiz and Teruel, 2006; Teruel *et al.*, 2014). However, although less common, it also may inhabit humid and cold montane ecosystems at much higher elevations such as Pico San Juan (1,140 m a.s.l., present record) and La Gran Piedra (1,200–1,214 m a.s.l., Teruel *et al.*, 2014). Five of the seven new localities reported here for the Guamuhaia massif are above 500 m a.s.l. and constitute the highest elevations at which *C. citricola* occurs in central Cuba. Mountain ranges of Cuba typically exhibit higher mean annual precipitations and lower temperatures when compared to surrounding lowland areas (Borhidi, 1991). Teruel *et al.* (2014) stated that under such conditions (i.e., high altitude and humidity, and dense forest cover), *C. citricola* colonization seems not as successful as in lowlands. Also, according to Teruel *et al.* (2014), this colonization appears to be restricted to open areas such as paths, human buildings, and their surroundings.

Our findings in the Guamuhaia massif are consistent with observations of Teruel *et al.* (2014). Notably, the first sighting at Lomas de Banao Ecological Reserve was in early June 2019, and we did not detect any noticeable increase in the webs' size nor the occupied substrates/area during further visits in mid-July and early November of the same year. Contrarily, Sánchez-Ruiz and

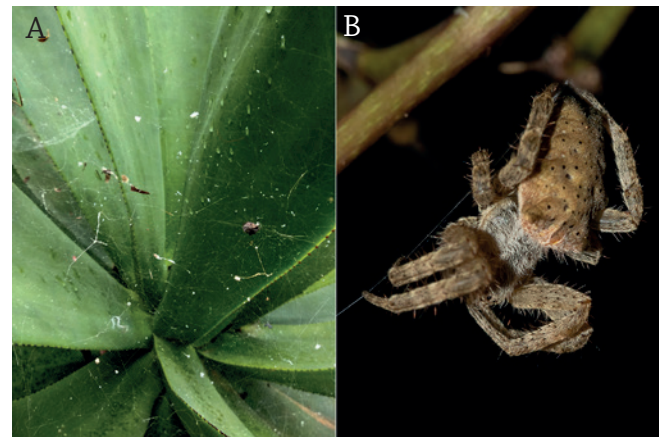


FIGURE 2. Web of *Cyrtophora citricola* at Jarico, “Lomas de Banao” Ecological Reserve, Sancti Spíritus province: A) on an *Agave* plant with and B) detail of an adult female on a native tree (*Lysiloma sabicu*). Photo: Aslam I. Castellón (B).

FIGURA 2. Tela de *Cyrtophora citricola* en Jarico, Reserva Ecológica “Lomas de Banao”, provincia de Sancti Spíritus: A) sobre una planta de *Agave* y B) detalle de una hembra adulta sobre un árbol nativo (*Lysiloma sabicu*). Fotografía: Aslam I. Castellón (B).

Teruel (2006) recorded *C. citricola* as very abundant along roadsides from 1,200–1,400 m a.s.l., on the Central Range of the Dominican Republic.

Borhidi (1991) stated that in the mountain ranges of Cuba, there is a vertical gradient of decreasing temperature and increasing relative humidity of approximately 0.5°C and 1.8% per 100 m elevation, respectively. This vertical gradient of temperature drops significantly at what he called “the condensation belt,” which encompasses heights ranging from 800 to 1,600 m a.s.l. This change in climatic conditions associated with an increase in elevation directly affects the vegetation physiognomy and the distribution of several plant and animal species (Borhidi, 1991; Rodríguez-Cabrera and Teruel, 2014). The distribution of *C. citricola* in Cuba and its absence or scarcity in the mountain ranges, particularly at the highest elevations, might be related to these sharp differences in climatic conditions.

The primary dispersal mechanism of *C. citricola* seems to be ballooning (Rodríguez-Cabrera *et al.*, 2018, and references therein). However, these authors commented on the possibility that it may use vehicles as an additional dispersal mechanism, based on the abundance of this species on power and telephone lines and fences along roadsides (e.g., Sánchez-Ruiz and Teruel, 2006; Teruel *et al.*, 2014). The distribution of *C. citricola* in Cuba seems to follow the line of roads and paths, always associated with human presence (Teruel *et al.*, 2014). These spatial features are common to the two protected areas assessed in this study, especially Lomas de Banao Ecological Reserve and Topes de Collantes Protected Landscape. Besides their montane location, these two protected areas are highly visited touristic destinations. Quite frequently, vehicles stop and pass through these areas, mostly coming from places where *C. citricola* have been previously reported, such as Cienfuegos, Trinidad and Sancti Spiritus cities (Teruel *et al.*, 2014; Pérez-Silva and García-Lahera, 2017; Rodríguez-Cabrera *et al.*, 2018).

During the years following the arrival of *C. citricola* to eastern Cuba, the species became exceedingly abundant in many areas, including the northern coast of Baracoa and Maisí municipalities in Guantánamo Province (Sánchez-Ruiz and Teruel, 2006; Teruel *et al.*, 2014). When we visited this region in 2012–2015, we found the species to be very abundant along power lines (Fig. 3) and living fences made of the Euphorbiaceae Cande-

labra Spurge *Euphorbia lactea* Haw. (Teruel *et al.*, 2014). During more recent trips (2018–2019), we were unable to detect any web on the power lines along the road from Baracoa to Boca de Yumurí. However, webs on living fences at many villages and town remained in place and active. Two powerful Category 5 hurricanes with winds >250 km/h and coastal flooding >200 m inland stroke this area between 2015 and 2018. Hurricane Matthew hit in early October 2016, and Hurricane Irma hit in mid-September 2017 (e.g., Fonseca-Rivero *et al.*, 2018; Hidalgo-Mayo *et al.*, 2019; Perigó *et al.*, 2020). The impact of these hurricanes is the most probable cause of the apparent disappearance of *C. citricola* from the highest and more weather-vulnerable sites such as power lines and poles.

The range of impacts of this invasive spider to the native Cuban biota is still unknown. In eastern Cuba, reports describe potential damage to citrus plantations by *C. citricola* (F. Simon *in* Martín-Castejón and Sánchez-Ruiz, 2010). Pérez-Silva and García-Lahera (2017) reported signs of desiccation in several supporting plant species in Sancti Spiritus Province, especially citrus. Sánchez-Ruiz and Teruel (2006) found a carcass of a passerine bird (*Vireo* sp.) on a web of *C. citricola* in Punta de Piedra, Pílon, Granma Province. However, these authors could not prove if the bird died of sunstroke, dehydration, or starvation as a consequence of having been trapped on the web or just died from another cause and ended up on the web.



FIGURE 3. Webs of *Cyrtophora citricola* near Boca de Yumurí, Baracoa, Guantánamo province, in November 2012: A) power poles entirely covered by spider webs and B) detail of the web.

FIGURA 3. Telas de *Cyrtophora citricola* cerca de Boca de Yumurí, Baracoa, provincia de Guantánamo, en noviembre de 2012: A) postes de electricidad completamente cubiertos por telarañas y B) detalle de la tela.



A great variety of native insects conforms the diet of *C. citricola* in Cuba, as evidenced by the high number of carcasses found on the webs (Fig. 4). However, no formal studies on *C. citricola* feeding habits exist in the country. The scarcity of baseline studies of this species makes it very difficult to detect its possible impacts on the local biota, particularly on arthropods. Díaz-Álvarez *et al.* (2017) suggested applying the precautionary principle on *C. citricola* in Cuba. This principle states that scientific uncertainty on the existence of any damage to the environment must not be considered an impediment to take preventive actions (Vera, 1994; Kriebel *et al.*, 2001). Alayón *et al.*, 2017 developed a protocol to assess and monitor the established populations of *C. citricola* in Cuba. We recommend wildlife conservation authorities to prioritize the control of this species, especially in protected areas, to reduce its impacts on native Cuban species.

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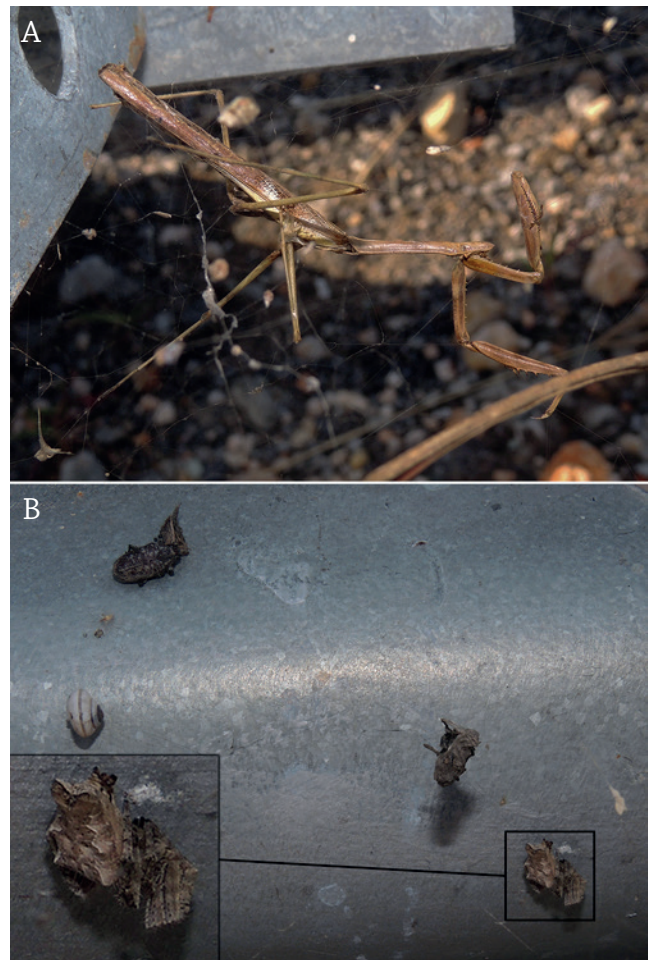


Figure 4. Examples of native insect carcasses found in webs of *Cyrtophora citricola* on the guardrails of the Damují river bridge, Cienfuegos province, Cuba: A) adult male *Stagmomantis domingensis* Palisot de Beauvois, 1805 (Mantodea: Mantidae) and B) unidentified insects (Lepidoptera: Noctuoidea; Coleoptera: Cerambycidae: Lamiinae); the inset shows a close up of the spider on the lower right corner consuming a moth.

FIGURA 4. Ejemplos de cadáveres de insectos nativos encontrados en telas de *Cyrtophora citricola* en las barreras de seguridad sobre el puente del río Damují, provincia de Cienfuegos, Cuba: A) macho adulto de *Stagmomantis domingensis* Palisot de Beauvois, 1805 y B) insectos no identificados (Lepidoptera: Noctuoidea; Coleoptera: Cerambycidae: Lamiinae); el recuadro muestra un acercamiento de la araña en la esquina inferior derecha consumiendo una polilla.

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