A New Phytotelm Plant, Crinum moorei (Asparagales: Amaryllidaceae), for the Americas and Its Mosquito Inhabitant (Diptera: Culicidae) in Ecuador

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A NEW PHYTOTELM PLANT, *CRINUM MOOREI* (ASPARAGALES: AMARYLLIDACEAE), FOR THE AMERICAS AND ITS MOSQUITO INHABITANT (DIPTERA: CULICIDAE) IN ECUADOR

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Phytotelmata are water-impounding structures formed by non-aquatic plants, such as modified leaves (*Heliconia*), leaf axils (Bromeliaceae and Araceae), flowers (Marantaceae), perforated internodes (bamboo), stem holes or depressions, rot-holes in tree trunks or branches (tree-holes), open fruits (cacao pods and coconuts) and fallen leaves (spathes of palms and Musaceae). The word was coined by Varga (1928) and derived from Greek words: *phyton* (plant) and *telma* (pool) and has been adopted into English (Maguire 1971; Fish 1983). The singular in English is phytotelma (or phytotelm), and plural is phytotelmata (or phytotelms). The term has been adopted in Spanish as fitotelma/fitotelmata.

A short review of the biota and community structure of taxa with phytotelmata was made by Maguire (1971), followed by comprehensive book with contributed chapters (Frank & Lounibos 1983). The non-taxonomic group of taxa with phytotelmata is represented by members of at least 29 plant families (Fish 1983), mostly monocotyledons, but some dicotyledons can form treeholes. In the Neotropics, the most important phytotelmata are Apiaceae, Araceae, Bromeliaceae, Poaceae, Heliconiaceae, Marantaceae, Musaceae, Sarraceniaceae, Strelitziaceae and Zingiberaceae, including an uncompiled and probably long list of plant families providing fruits or fallen leaves. There are no lists of plant families that form tree-holes. An extensive bibliography of the biota inhabiting bromeliad leaf axils (Frank 1996) has been updated frequently since then.

Immature mosquitoes (Diptera: Culicidae) are well represented among the inhabitants of phytotelmata, and they include some important disease vectors. Some mosquitoes show a species-specific association with phytotelmata species (e.g., Maguire 1971; Fish 1983; Frank 1983; Navarro et al. 1995), representing an ideal system for biogeographical analyses (Navarro et al. 2007) and altitudinal analyses (Navarro et al. 2010).

In a survey for mosquito vectors biodiversity in Ecuador, we collected in a locality 90 km from Quito, at San Miguel de los Bancos at N 0° 01' 25.37" W 78° 53' 42.74" and 1,180 m in Pichincha Province. This locality is in the southern part of the ecological corridor of the Andes Chocó, in the northwest of the Ecuadorian Andes cordillera. The average annual temperature is 24 °C (13-32 °C), 86% RH, and 14 rainy days/month (INAMHI 2009) in an evergreen mountain forest with primary forest relicts.

We found several mosquito species associated with the following phytotelmata: fallen leaves of "platanillo" (*Musa velutina* H. Wendl. et Drude [Musaceae]), axils of "camacho" (*Xanthosoma sagittifolium* (L.) Schott [Araceae]), inflorescences of "bijao" (*Calathea lutea* (Aubl.) Schult. [Marantaceae]), axils of "guaycundo" (*Mezobromelia capituligera* (Griseb.) J.R. Grant [Bromeliaceae]), internodes of a bamboo (*Guadua angustifolia* Kunth [Poaceae]), bracts of *Heliconia* aff. *bihai* (L.) L. (Heliconiaceae), and also in the axils of the main subject of this paper, *Crinum moorei* Hook. f. (Amaryllidaceae).

Crinum moorei (Figs. 1 and 2) is a native of South Africa and is found in the South African eastern seaboard coastal forest from the northern Eastern Cape in the south to northern KwaZulu-Natal. It grows well in large colonies in light shade at higher altitudes if protected from frost. This plant was introduced in the continent, growing in botanical gardens in the Americas, and probably is spread by commercial sales and by gardeners exchanging plants. The name *Crinum* is derived from the Greek *krinon*: lily (Verdoorn 1961).

The common names are: Natal lily, Moore's crinum (English); boslelie, Natal-lelie (Afrikaans); Umnduze (Zulu); crino, lirio, lirio del Orinoco (Spanish). It is one of the larger members of the worldwide tropical to temperate ornamental family Amaryllidaceae. The family includes the European narcissi and daffodils.

The large bulb of *C. moorei* rests just under the surface of the soil but has an elongate neck, which protrudes a further 200-300 mm above ground. The long, flat, dark green leaves (up to 1 m long; about 200 mm wide), emerge in a rosette from the neck which also produces a long flowering stalk in summer of 1.2 m or more, topped by 5-10 large, open, white to pale pink flowers (Govaerts 1999)

Other Amaryllidaceae reported as phytotelmata are: *Crinum asiaticum* L. (Japan); *C. giganteum* Andr. (Sudan); *C. hybridum* Hort. (Java); *Crinum* sp. (Tanzania) and *Hymenocallis ma-*

Fig. 1. Patch of *Crinum moorei* plants with a close-up of its flower at the bottom left corner.

cleana Nichols (Java) (Fish 1983; Kitching 2000). *Crinum moorei* is the first report of this family as phytotelmata in the Americas, and the mosquito that inhabits it in the Americas has adapted to it, but evolved in other plants.

A closely related plant in New Zealand, *Collospermum hastatus* (Colenso) Skottsb. (Liliaceae) has been reported as a phytotelm with a native mosquito *Culex asteliae* Belkin and the non-native mosquito *Aedes (Finlaya) notoscriptus* Skuse as inhabitants of its axils (Dumbleton 1968; Derraik 2004, 2005)

C. moorei has two records in Ecuador, Azuay Province, plants cultivated in a garden, at 2,320 m at Cuenca, recorded in Missouri Botanical Garden (collection number 11737), and in Los Rios Province, rio Palenque, Quevedo - Santo Domingo at 220 m (collection number 13559) (Jørgensen & León-Yánes 1999).

The larvae and pupae were collected in more than 50 *C. moorei* plants (Nov 2012, Jan-Feb 2013), a scant 3-10 ml of clean rainfall water in the axils. The species was identified in 4th instar and adult females and males as *Wyeomyia (Dendromyia) complosa* (Dyar) (Diptera: Culicidae) *sensu* Motta & Lourenço de Oliveira (2000).

The subgenus *Dendromyia* includes six species: *Wy. luteoventralis* Theobald, *Wy. ypsipola* Dyar, *Wy. jocosa* (Dyar & Knab), *Wy testei* Senevet & Abonnenc, *Wy trifurcata* Clastrier and *Wy complosa*. Even though *Wy. complosa* is less typical of *Dendromyia* because of differences in the maxilla and siphon of the larva, it still shares the group characters of *Dendromyia* (Motta & Lourenço de Oliveira 2000).

Most *Dendromyia* develop in *Heliconia* and Marantaceae although *Wy. ypsipola* and *Wy. jocosa* also develop in Araceae. *Wy complosa* has been collected in "sororoca" (*Phenakospermum guyannense* (Rich.) Endl. [Strelitziaceae]) in forest in Belém, State of Pará, Brazil (Motta & Lourenço de Oliveira 2000) and also in *Heliconia* and Araceae (Dieffenbachia sp.) (Heinemann & Belkin 1977, 1978 a,b). *Wy. complosa* has been reported from Panamá (type locality), French Guiana, Costa Rica, Guyana, Trinidad, Colombia, Brazil, Venezuela and Ecuador (Guimarães 1997). In Ecuador, *Wy. complosa* has been collected from Los Rios, Quevedo, SW of Pichilingue and Cañar, Cochancay, 86 km E of Guayaquil, 280 m (Heinemann & Belkin 1979) both in leaf axils of a terrestrial aroid (*Montrichardia*) and leaf axils of *Heliconia*.

Fig. 2. Close-up view of a *Crinum moorei* axil filled with water, providing a phytotelm.

Crinum moorei is a new phytotelmata record for this species and perhaps is a normal development site for mosquitoes in Ecuador. However, little is known about the ecology and bionomics of this species. In the same location, the *Xanthosoma sagittifolium* plantation held immatures of another *Wyeomyia* species, so perhaps there is niche segregation.

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Summary

A new phytotelm plant for the Americas is recorded for San Miguel de los Bancos, Pichincha Province, Ecuador. In the leaf axils of *Crinum moorei* Hook. f. (Amaryllidaceae) were collected larvae and pupae of a common mosquito, *Wyeomyia (Dendromyia) complosa* (Dyar) (Diptera: Culicidae: Sabethini). This plant is a South African native, introduced into several countries, but never reported as a habitat for immature mosquitoes. We provide notes about its botanical and ecological characteristics, and also of the mosquito associated at this locality.

Key Words: leaf axils, Natal lily, *Wyeomyia (Dendromyia) complosa*

Resumen

Una nueva planta phytotelma para el continente Americano es registrada en San Miguel de los Bancos, Provincia de Pichincha, Ecuador. En las axilas de *Crinum moorei* Hook, f. (Amaryllidaceae) fueron colectadas larvas y pupas de la especie de mosquito *Wyeomyia* (*Dendromyia) complosa* (Dyar) (Diptera: Culicidae: Sabethini). Esta planta es nativa de Africa del Sur, y ha sido introducida en varios países, pero nunca había sido señalada como hábitat para las fases inmaduras de mosquitos. Se hacen comentarios botánicos acerca de la planta así como también del mosquito asociado en la localidad.

Palabras Clave: axilas de hojas, lirio, *Wyeomyia (Dendromyia) complosa*

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