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A new host record for *Euphoria* spp. Burmeister (Coleoptera: Melolonthidae: Cetoniinae) in Oaxaca, Mexico: *Tagetes patula* (Asteraceae)

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Tagetes patula Linnaeus (Asteraceae), popularly known as dwarf marigold or French marigold, is an annual plant, native to North America and widely disseminated throughout the world. The genus *Euphoria* Burmeister (Coleoptera: Scarabaeidae: Cetoniinae) includes 59 species, with Mexico having the greatest biodiversity (40 species). These species are distributed from southern Canada down to northern Argentina, although the highest specific richness is found from the southern U.S. to Guatemala in very diverse environments, principally above 1,000 masl. There is little documented information about the life cycle, feeding habits, and phenology of the 59 species of these Cetoniinae, and what is published on this insect is often imprecise (Orozco 2012). It is commonly known that larvae are found in soils with high levels of organic matter or sandy soils, under dry manure, and mounds of ant detritus (Deloya 1988). Little is known about the rhizophagous feeding habits of the larval stage of this insect, and only the dark-flower scarab *Euphoria sepulcralis* (F.) (Coleoptera: Cetoniidae) has been reported with this feeding habit (Buss 2004). The adults of the insect usually feed on liquid exudates (extrafloral nectaries) and tender parts of plants, and manure. The feeding habits of this insect on plant flowers is not extensively documented. The plants with large or abundant aerial parts are preferred as hosts by adults of the genus *Euphoria*, usually plants in the family Asteraceae. These plants provide glucose exudates (extrafloral nectaries) for the feeding of these beetles (Orozco 2012).

The specimens were collected manually in a *T. patula* culture area in the experimental campus of the Universidad Tecnologica de la Sierra Sur de Oaxaca, located in the municipality of Villa Sola de Vega in Oaxaca State, Mexico (16.5116°N, 96.9794°W, 1,440 masl, Fig. 1) from 5 to 8 Oct 2017. This plant is known in the region as Flor de San Miguelito, and occurs widely in relict pine-oak forest, agave, and maize crops, and in the presence of xeric scrubs. These specimens were identified as *Euphoria biguttata* (Gory & Percheron) (a single specimen) and *Euphoria subtomentosa* (Gory & Percheron) (47 specimens) (both Coleoptera: Cetoniidae). They were identified by using the key in Orozco (2012). The specimens were deposited in the collection of Ph.D. J. Hernández-Cruz in the Laboratory of Entomology of the Universidad Tecnologica de la Sierra Sur de Oaxaca.

Tagetes patula is documented for the first time as a host of these beetles. *Euphoria biguttata* has been observed on *Helianthus* spp. and *Tithonia tubiformis* (Jacq.) (both Asteraceae) (Orozco 2012). Morón et al (1997) documented adults feeding on flowers of *Mimosa* sp. and *Calliandra* sp. Benth. (both Fabaceae) in the following localities from Oaxaca State, Mexico: Huajuapan de León, Santiago Cacaloxtepec, Santiago Chazumba (Mixteca Region), and San Pedro Totolapan (Central Valleys Region) at altitudes above 1,000 masl.

The adults of *E. subtomentosa* also have been observed in flowers of the family Asteraceae: *Bidens odorata* Cav., *Dyssodia pinnata* (Cav.) B. L. Rob., and *Helianthus annuus* L. (Orozco 2012), although they also have been collected in detritus of *Atta mexicana* (Smith) (Hymenoptera: Formicidae) (Deloya 1988). The localities where this species has been recorded in Oaxaca State are: Huajuapan de León, San Francisco Huapanapan, Asunción Nochixtlán, Santiago Cacaloxtepec, Santiago Chazumba (Mixteca Region), Monte Albán, Oaxaca-Centro, San Pablo Villa de Mitla, San Sebastián Tutla (Central Valleys Region), and San Juan Bautista Cuicatlán (Cañada Region).

Orozco (2012) mentioned that *E. sepulcralis* is associated as an insect-host of 59 plant families, including the genus *Tagetes* spp., but the species *E. biguttata* and *E. subtomentosa*, reported here, are the only species of this insect genus that have been found feeding in flowers *T. patula* (Fig. 2).

The genus *Tagetes* has many biological properties that affect organisms, including fungi (Romagnoli et al. 2005), bacteria (Dasgupta et al. 2012), nematodes (Macedo et al. 2012), and insects (Faizi et al. 2011). A large number of studies have reported the biocidal properties of extracts obtained from different species of *Tagetes.* This plant genus contains secondary metabolites (in greater quantity in the aerial parts) that function as toxins, repellents, or growth regulators (Díaz-Cedillo & Serrato-Cruz 2011) against some insect pests. Phytochemical studies with flowers of *T. patula* identified terpenes (Prakash et al. 2012), alkaloids (Faizi & Naz 2002), thiophenes (Szarka et al. 2006), and flavonoids (Guinot et al. 2008) responsible for a variety of biocide properties (Massera et al. 1998).

We report evidence of an organism (Insecta: Coleoptera: Melolonthidae) with potential to be an insect pest by feeding on

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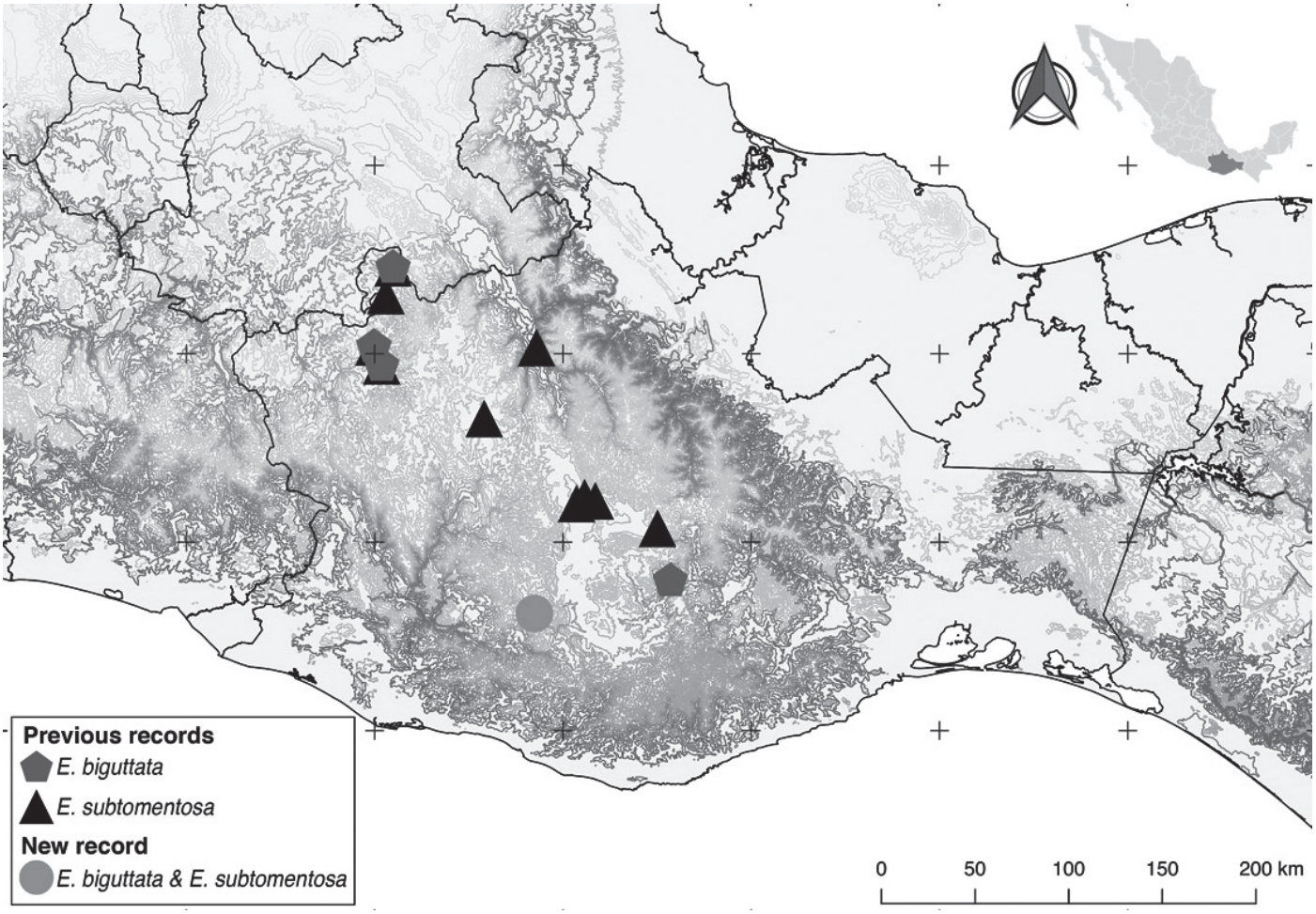


Fig. 1. Map of the state of Oaxaca, Mexico, showing the locations of collection records of *Euphoria subtomentosa* and *Euphoria biguttata*.

a plant with insecticidal properties, suggesting that beetles of the genus *Euphoria* may have developed resistance to the secondary metabolites produced by *Tagetes* spp.

Plant secondary metabolites have multiple functions throughout the plant life cycle, affecting the interaction of plants with their environment, including the relationship of plants with pollinators, herbivores, and predators of herbivores (Dixon 2001). Resistance to antagonist organisms in plants has been identified as one of the major defense functions, but a large diversity of abiotic and biotic environmental factors are found to significantly affect the production of plant secondary metabolites, factors that could affect its function as toxins, and interfere with insect host search patterns (Kessler 2015).

After consulting the literature, we concluded that this is the first time that *E. biguttata* and *E. subtomentosa* were reported to feed on flowers of *Tagetes patula* (Asteraceae). Additionally, this is the first time the species were observed in Sola de Vega, Oaxaca State, Mexico.

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Summary

A total of 48 specimens of *Euphoria* (Coleoptera: Cetoniinae) were collected, represented by a single specimen of *E. biguttata*, and 47 specimens *E. subtomentosa*. We report for the first time these two beetles (Melolonthidae) feeding on flowers of *Tagetes patula* (Asteraceae). Additionally, this is the first time the species were observed in Sola de Vega, Oaxaca State, Mexico.

Key Words: Insect host feeding; Asteraceae

Sumario

Un total de 48 especímenes fueron colectados lo que representa a dos especies del género *Euphoria* (Coleoptera: Cetoniinae), un solo espécimen pertenece a la especie *E. biguttata*, mientras que 47 muestras se registran para *E. subtomentosa*. Reportamos por primera vez a estos dos escarabajos (Melolonthidae) alimentándose sobre las flores de *Tagetes patula* (Asteraceae). Adicionalmente, esta es la primera observación de estos insectos en el municipio de Sola de Vega del estado de Oaxaca, México.

Palabras Clave: Alimentación por hospedero; Asteraceae

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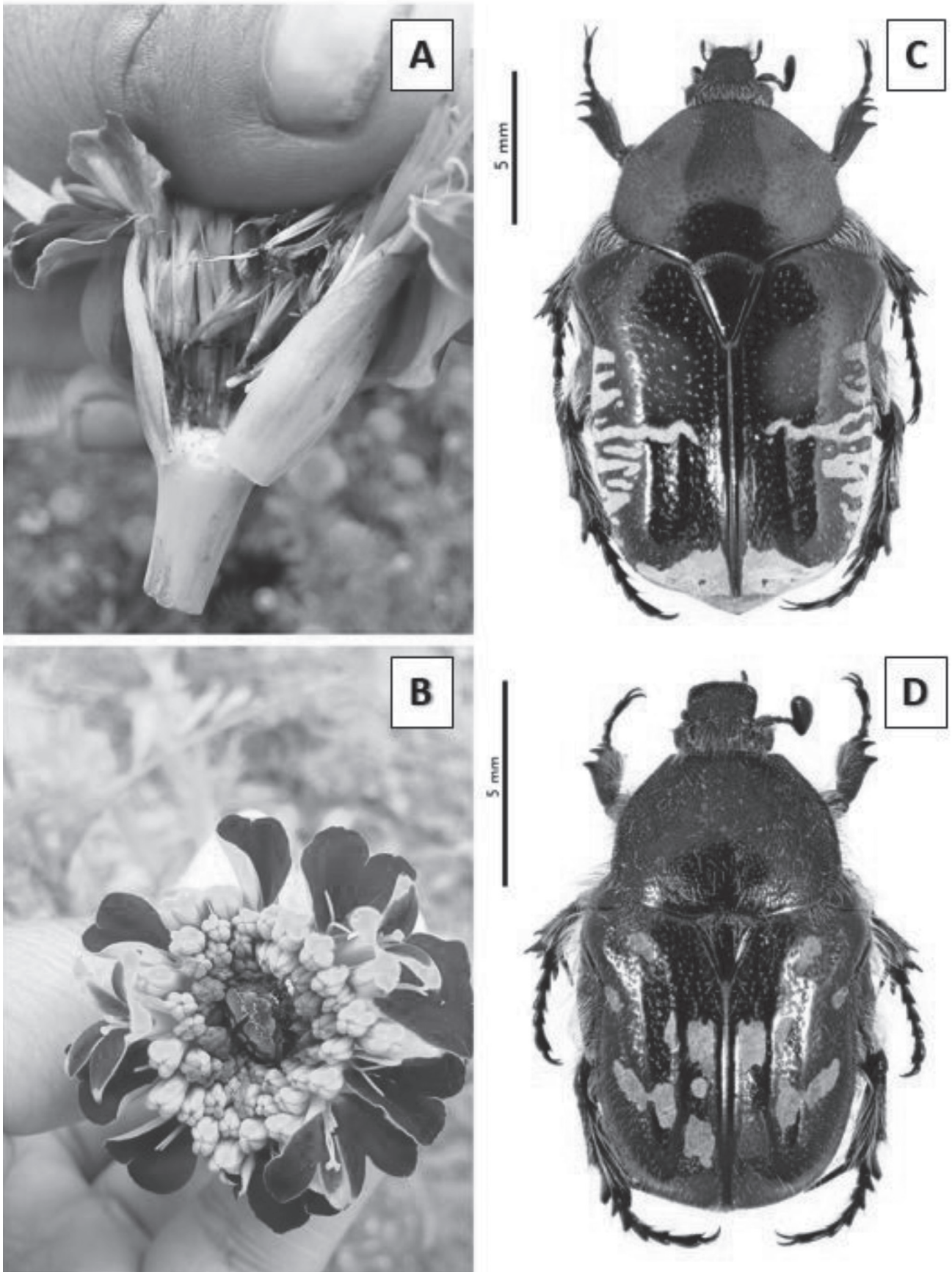


Fig. 2. Photographs of *Euphoria* specimens and blossoms: A, B = *Tagetes patula* flowers; C = *Euphoria biguttata* dorsal view; D = *Euphoria subtomentosa* dorsal view.

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