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FRUIT FLIES (DIPTERA: TEPHRITIDAE) ASSOCIATED WITH UMBU (*SPONDIAS TUBEROSA*) IN THE SEMIARID REGION OF BAHIA, BRAZIL

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Umbu, *Spondias tuberosa* Arr. Cam. (Anacardiaceae), is a xerophytic tree species endemic to the northeastern Brazilian semiarid region in the states of Piauí, Paraíba, Pernambuco, Bahia, and in the northern part of Minas Gerais (Silva et al. 2004). It occurs in the Caatinga biome, which is characterized by a semiarid climate and a mosaic of vegetation types varying from dry thorn forest to open shrubby vegetation (Costa et al. 2007). Deforestation has recently increased in Caatinga as a result of an expanding human population and the demand for timber and land for cattle ranching (Coimbra-Filho & Câmara 1996). Few studies have focused on the contribution of Caatinga's biota to biodiversity in Brazil (Leal et al. 2005), and it is considered one of the least known biomes in Brazil regarding terrestrial host-dependent invertebrates (Lewinsohn et al. 2005).

The umbu tree is important from an economic and social standpoint to many populations in Brazil's northeast due to its edible fruit and high tolerance to drought. Rural communities in the semiarid region can increase their income through selective extraction of umbu fruit, especially during the prolonged drought periods (Cavalcanti et al. 2006; Santos 1999). The fruit is a round, ovoid, or oblong drupe, 2-3.5 cm long and weighs 10-20 g. The fruit has a thin skin, a large seed, and high content of moisture, ascorbic acid, and iron. The pulp has a very distinct flavor and aroma and its consumption has been increasing in recent years in several regions in northeastern Brazil, not only for the fresh market but also for the processing industry (Narain et al. 1992; Santos 1999).

Inventories carried out at a regional level in the states of Maranhão (Oliveira et al. 2000) and Rio Grande do Norte (Araujo et al. 2005) indicated that there were fruit flies associated with umbu fruit. A paucity of studies on possible fruit flies in Bahia prompted the current consideration of which fruit fly species and parasitoids might be associated with umbu fruit in the semiarid region of Bahia.

Umbu fruit were collected in southwestern Bahia. Our study site was a 3-ha area on a 10-ha farm located in Manoel Vitorino, Bahia, at 290 m above sea level (14°21'S, 40°11'W). Climate is semiarid, which corresponds to the BSh climatic

type of Köppen, with an annual average temperature of approximately 28°C with little variation. Annual average rainfall usually totals less than 800 mm and is concentrated from Jan through Mar (Rodrigues 2005). The farm hosts native umbu trees at an average density of about 30 trees per hectare. The phenology of 30 umbu trees was verified through monthly observations in 2005 in 3 study parcels of 1 ha each at 200 m spacing. Three distinct periods were identified: vegetative rest from Apr through Aug, flowering from Sep through Nov, and fruiting from Dec through Mar. We collected 770 ripe or ripening umbu fruit, 410 from the canopies and 360 that had fallen on the ground, totaling 10.68 kg in Jan 2006, Jan, Nov and Dec 2007, and Jan 2008. The collected fruits were counted, weighed, placed in individual plastic containers with a layer of vermiculite, and covered with voile cloth until larvae emerged and pupated. Puparia were removed weekly. All puparia obtained were placed in 30-mL plastic containers with a layer of vermiculite at the bottom and covered with voile cloth until adults emerged. Voucher specimens were deposited at the Laboratório de Entomologia, UESC, Ilhéus, Bahia, Brazil.

Altogether, 328 fruits (42.6%) were infested by tephritid larvae, corresponding to an infestation rate of 0.65 ± 0.93 (SD) puparia/fruit and 47 puparia/kg. The number of puparia per fruit ranged from 1 to 4. We obtained 502 puparia from the infested fruit, from which 361 adults emerged, representing a pupal viability of 71.2%. All adults reared were *Anastrepha obliqua* (Macquart) (183 females and 178 males). No specimens of *Ceratitis capitata* (Wied.) were recovered. A single braconid specimen was recovered, *Doryctobracon areolatus* (Szépligeti) (Hymenoptera: Braconidae, Opiinae) representing a parasitism rate of 0.2%.

Fruit damage due to infestation by *A. obliqua* is high in the region according to our results and according to local growers. Farmers generally lack the means and knowledge to apply any management and control strategies, including insecticides. Moreover, farms in the region where umbu is native and abundant are dedicated primarily to rearing goats. Most fruit are harvested while still unripe, thus probably before most larvae have crawled from the fruit. Although the umbu fruit

season is short, potential hosts such as *Mangifera indica*, *Spondias purpurea*, and *Malpighia puniceifolia*, a few of which are scattered in backyards, may contribute to the maintenance of a population of *A. obliqua* in the region. Previous studies on umbu fruit in Brazil recorded infestation by *A. obliqua* and *C. capitata* in the state of Rio Grande do Norte (Araujo et al. 2005) and by *A. zenildae* in the state of Maranhão (Oliveira et al. 2000). Prior to this study, only a low infestation of umbu fruit by tephritids in Irecê, in the semiarid region of Bahia (11°18'S, 41°52'W) was reported (2 puparia reared from 80 fruit collected) (Cova & Bittencourt 2003). However, no adults were obtained, which precluded associations of tephritid species and umbu fruit. Infestation of umbu fruit by *A. obliqua* (0.3 puparia per fruit) was recorded in the state of Rio Grande do Norte (Araujo et al. 2005).

The only parasitoid found in this survey, *D. areolatus*, is widespread in Brazil and has been reported in other regions in the state of Bahia (Carvalho 2005; Souza-Filho et al. 2007). Previous studies found low parasitism levels (ranging from 3.8 to 4.9%) by *D. areolatus* in Brazil, including the semiarid region of the state of Minas Gerais (Alvarenga et al. 2000). To our knowledge, this is the first report of the association among *D. areolatus*, *A. obliqua*, and *S. tuberosa*.

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SUMMARY

The occurrence of *Anastrepha obliqua* (Diptera: Tephritidae) infesting umbu fruit (*Spondias tuberosa*) is reported in the semiarid region of Bahia, Brazil, for the first time. A high infestation rate of 0.65 ± 0.93 (SD) puparia/fruit and 47 puparia/kg was observed. Number of puparia per fruit ranged from 1 to 4.

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