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CONFIRMATION OF BLACK MANGROVE [*AVICENNIA GERMINANS* (L.) L.] AS A LARVAL HOST FOR *JUNONIA GENOVEVA* (CRAMER) (NYMPHALIDAE: NYMPHALINAE) FROM SONORA, MEXICO

Additional key words: feeding behavior; larval rearing; mangrove buckeye

Mangrove estuaries in northwestern Mexico, including the states of Baja California Sur, Sonora, Sinaloa, Nayarit and Jalisco (Aburto-Oropeza et al. 2008), are inhabited by a species in the genus *Junonia* (Nymphalidae: Nymphalinae) listed as *J. evarete* (Cramer) by Brown et al. (1992) and referred to as an intermediate between *J. evarete zonalis* C. Felder & R. Felder and *J. coenia* Hübner by Haferník (1982). Recent morphological (Neild 2008; Calhoun 2010) and molecular (Kodandaramaiah & Wahlberg 2007; E. Pfeiler et al., unpublished) studies support the assignment of the mangrove-associated buckeye to the taxon *J. genoveva* (Cramer), an assignment which is followed here. Ongoing research on *Junonia* in the Caribbean region, however, suggests that the taxonomy of the mangrove-associated buckeye is more complex than previously thought, probably consisting of more than one species, and that the name used here may ultimately require revision (C. Brévignon, personal communication).

Plant species typically found in mangrove forests in northwestern Mexico include Black mangrove, *Avicennia germinans* (L.) L. (Acanthaceae), Red mangrove, *Rhizophora mangle* L. (Rhizophoraceae), White mangrove, *Laguncularia racemosa* (L.) Gaertn. f. (Combretaceae) and Sweet mangrove, *Tricerna phyllanthoides* (Benth.) Lundell (Celastraceae). Although *J. genoveva* has long been known to be associated with the coastal mangrove ecosystem in northwestern Mexico (Haferník 1982), the larval host plant(s) has remained uncertain. Tilden (1971) suggested the genus *Phyla* (= *Lippia*) (Verbenaceae) as a larval host, a genus also used by larvae of the closely related *J. coenia* in California, USA (Shapiro & Biggs 2010). The genus *Stemodia* (Scrophulariaceae) was listed as probable larval host (in addition to *Phyla*) by Brown et al. (1992). Both Haferník (1982) and Brown et al. (1992) commented on the close association of *J. genoveva* with the mangrove habitat, but mangroves were not mentioned in either reference as a potential larval host. In the Caribbean region, however, the use of *A. germinans* as a larval host plant has been well documented (Turner & Parnell 1985; Elster et al. 1999; Brévignon 2009).

Given the ecological association of *J. genoveva* with

mangrove habitat in northwestern Mexico, it was of interest to determine whether *A. germinans* could be used by larvae of *J. genoveva* in this region as well. After much searching, five first and second instar larvae of what appeared to be *Junonia* were found feeding on *A. germinans* at Estero del Soldado (27°57'35"N, 110°59'00" W), a small hypersaline lagoon (negative estuary) located on the Gulf of California between Guaymas and San Carlos, Sonora Mexico (Fig. 1). Larvae were collected between 11–22 October 2010 and were provided with fresh leaves of *A. germinans* every 2–4 days until pupation. Wild-caught adults were taken mainly between 21 July–5 November 2010 at Estero del Soldado and at San Carlos. A population of *J. genoveva* also was found at a very small mangrove estuary (El Esterito) in San Carlos, 8 km W of Estero del Soldado.

The five larvae fed on *A. germinans* leaves for approximately 21 days and successfully developed to the last instar and pupated (Fig. 2). One of the five pupae died; the remaining four produced adults (2 males and 2 females) 7–10 days after pupation. One adult female and one adult male were taken as vouchers (Fig. 3); the other two individuals were released. Maculation and coloration of both reared (Figs. 2–3) and wild-caught adults from Estero del Soldado were similar to individuals of *J. genoveva* figured from coastal regions of Baja California Sur (Brown et al. 1992) and San Blas, Nayarit (Warren et al. 2010; as *J. evarete* NW Mexican segregate).

The youngest larvae of *J. genoveva* fed by scraping the upper epidermis of leaves, whereas later instars were chewers. Larvae preferred the younger, fresher tree leaves, although they were originally collected in the wild from older leaves ~1 m above the water. This feeding behavior differs from that reported in Colombia where larvae of *Junonia* (listed as *J. evarete*) were never found more than a few centimeters from the water feeding on propagules, young seedlings and pneumatophores of *A. germinans*, but not on the mature tree leaves (Elster et al. 1999). Larvae collected in Jamaica also prefer feeding on the cotyledons of young seedlings of *A. germinans* (Turner & Parnell 1985). The close association between the distribution of *A. germinans* and *J. genoveva* in northwestern Mexico

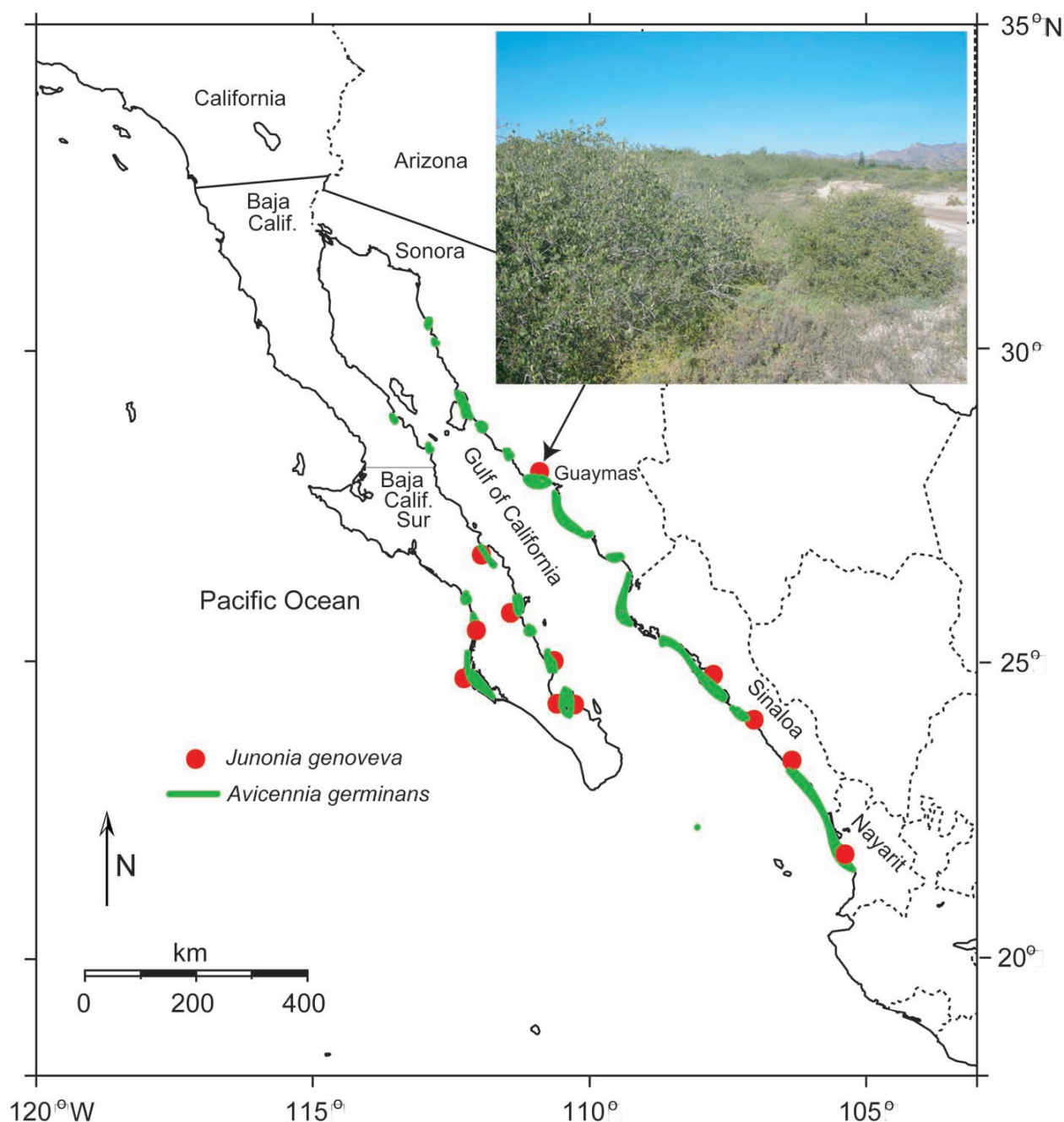


FIG. 1. Map of northwestern Mexico showing location of the study site at Estero del Soldado near Guaymas, Sonora, Mexico, in addition to collection and observation records for *Junonia genoveva* and Black mangrove (*Avicennia germinans*) for this region. Records were compiled from data given in Hafernik (1982), Brown et al. (1992), Turner et al. (1995), Aburto-Oropeza et al. (2008), Warren et al. (2010), and collection data provided by K. Hansen, R. Wells and J. A. Scott (personal communication). Inset shows landward (north) side of Estero del Soldado looking west. Plants in the foreground are *Avicennia germinans* (at left) and *Tricerma phyllanthoides* (at right). Trees in the distance are principally *A. germinans*, together with *Laguncularia racemosa* and a few small *Rhizophora mangle*. All larvae were found in the foreground area on *A. germinans*; adults of *J. genoveva* typically "patrolled" the dirt road and disturbed area seen at far right.

FIG. 3. (opposite page; bottom image) Reared *Junonia genoveva* from Estero del Soldado. Male (top; voucher no. CIAD 10-B37; eclosed 9 Nov. 2010); Female (bottom; CIAD 10-B38; eclosed 20 Nov. 2010). Ventral view is shown in images on the right.



FIG. 2. Developmental stages of *Junonia genoveva* from Estero del Soldado. (A) last instar larva feeding on its host plant *Avicennia germinans*; (B) head and thoracic region of last instar larva; (C) pupa attached to underside of a leaf of *A. germinans* (salt deposits are visible on leaf); (D) recently-eclosed female being released.



(Fig. 1) suggests that *A. germinans* is the principal host throughout the region. But because of the low numbers of larvae found it was not possible to test for possible alternative hosts. There is evidence, however, suggesting that larvae of *Avicennia*-feeding *Junonia* in the Caribbean region are host specific (Turner & Parnell 1985; Elster et al. 1999).

Peak flight activity of *J. genoveva* at Estero del Soldado occurred from late August through November in agreement with the findings of Brown et al. (1992) in Baja California Sur. Adults showed a preference for bare ground adjacent to the mangroves (Fig. 1). Adults of a large and dark buckeye, recognized as the subspecies *J. evarete nigrosuffusa* W. Barnes & McDunnough by Pelham (2008), were also found in the Guaymas/San Carlos region, but this subspecies was never observed flying together with *J. genoveva* in the immediate vicinity of the mangroves at Estero del Soldado. Both taxa, however, were observed flying on the beach ~1 km W of Estero del Soldado, and feeding together on Desert broom *Baccharis sarothroides* A. Gray (Asteraceae) at San Carlos and on ornamental *Lantana* (Verbenaceae) at a residential complex adjacent to Estero del Soldado. Most observations of *J. e. nigrosuffusa*, however, were inland from the immediate coast. Thus, the two taxa, although occurring sympatrically, appear to be largely ecologically isolated, similar to the findings in Baja California Sur (Brown et al. 1992).

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