

*POLYPEDILUM NUBIFER*, A CHIRONOMID MIDGE (DIPTERA: CHIRONOMIDAE) NEW TO FLORIDA THAT HAS NUISANCE POTENTIAL

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In 2001, Everglades National Park (ENP), United States Department of the Interior, initiated a biomonitoring program incorporating fish and invertebrate sampling to monitor water quality entering the Park, and to detect exotic species. Midges (Diptera: Chironomidae and Ceratopogonidae) were sampled by collecting their floating pupal exuviae according to standard United States Environmental Protection Agency (USEPA) protocols (Ferrington et al. 1991). Sam-

ples collected in early Oct 2002 from two recently constructed 242-hectare and 324-hectare detention ponds along the eastern boundary of ENP (Ponds 332C and 332D, Fig. 1) yielded large numbers of pupal exuviae, larval exuviae, and spent adults of *Polypedilum nubifer* (Skuse). Additional pupal exuviae and adults were collected near these ponds in shallow solution depressions within ENP. This is the first record of *P. nubifer* in Pan-America, and is particularly noteworthy con-

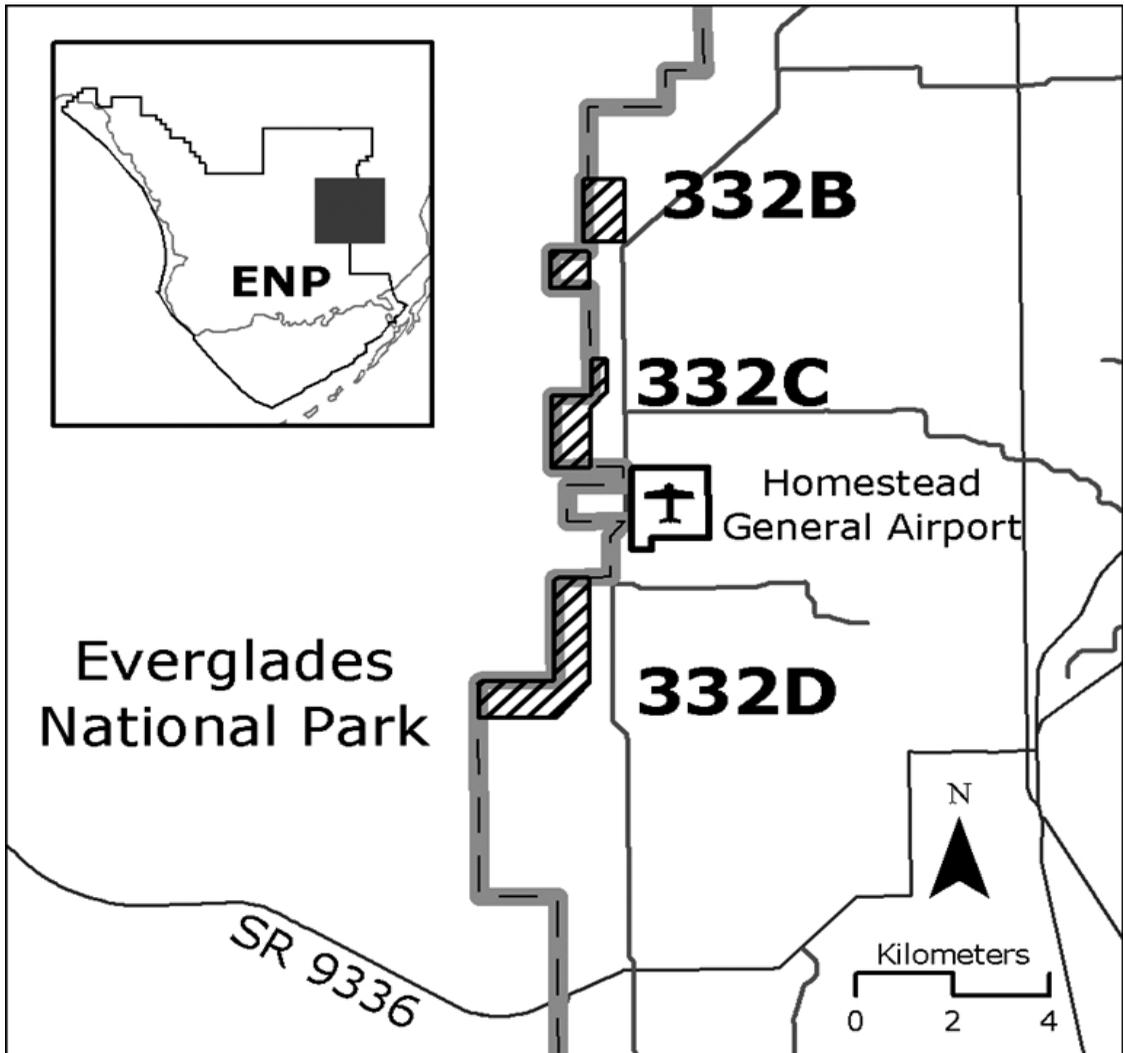


Fig. 1. Locations of detention ponds 332c and 332d along the eastern boundary of Everglades National Park.

sidering its capacity to reach nuisance population levels in Asia and Australia (Ali 1995; Cranston & Martin 1989; Sasa & Sublette 1980; Traylor et al. 1994; Wang 2000) and its potential for causing similar problems in Florida.

Adults of *P. nubifer* can be distinguished from other congeners by the distinctive spotting pattern on the wings and the characteristic configuration of the male hypopygium (Sasa & Sublette 1980). Pupae possess an unusually large, uneven, multiple-toothed anal comb, extensive shagreen on tergites II-VI, and short, pointed cephalic tubercles (Cranston 2000; Sasa & Sublette 1980). The alternating Lauterborn organs on the larval antenna are unique for the genus.

*Polypedilum nubifer* is a common, eurytopic midge in tropical and subtropical waters in the Afrotropical, Palaearctic, Oriental, and Australasian regions. Populations can become extremely abundant in warm, shallow, eutrophic waters subject to seasonal drying (Cranston 2000). Consequently, emerged adults from many artificial or altered habitats such as rice fields, eel ponds, drainage channels, canals, and treatment ponds, often pose a considerable nuisance to people living nearby (Sasa & Sublette 1980; Wang 2000). The larvae are also considered a major pest of rice fields in China, damaging the roots and leaves of rice seedlings (Wang 2000). Presumably introduced into Hawaii during World War II, mass emergences of *P. nubifer* have become a serious problem to residents near Kealia Pond National Wildlife Refuge in Maui (M. B. Berg, Dept. of Biology, Loyola Univ. of Chicago, personal communication).

Introductions of non-native chironomid midges through air or sea transport are probably common, but instances of their occurrence are difficult to ascertain with confidence because many species are widely distributed, and our understanding of regional midge faunas and the distributions of species is generally poor. The most plausible cases of human-mediated midge introductions involve the appearance of large, pestiferous populations of previously uncollected species in a region where the midge fauna has been fairly well studied (Spies 2000). Our observations of large populations of *P. nubifer* from Florida, a state whose chironomid fauna has been relatively well documented (Epler 1995, 2001), lead us to suspect that it is a recent arrival to south Florida. Other extraneous species in the Nearctic include *Goeldichironomus amazonicus* (Fittkau) in Florida and southern California (Wirth 1979; Sublette & Mulla 1991), and *Chironomus strenzkei* Fittkau in southern California (Sublette & Mulla 2000). Both species are thought to be recent introductions from the Neotropics, joining other suspected earlier Neotropical migrants such as *Chironomus anonymus* Williston (Wülker et al. 1989), and *Chironomus calligraphus* Goeldi (Sublette & Mulla 2000), that have flourished in eu-

rythermal, eutrophic, and usually human-engineered aquatic habitats in the southern Nearctic (Spies et al. 2002).

The artificial ponds where *P. nubifer* was collected, called detention ponds 332C and 332D, are 2 of a series of shallow infiltration basins constructed by the U.S. Army Corps of Engineers in 2001 and 2002 for maintaining suitable water levels for breeding populations of the endangered Cape Sable Seaside Sparrow (*Ammodramus maritimus mirabilis*) in eastern ENP. Water from the L-31N canal, which transects agricultural areas in southern Miami-Dade County, is periodically pumped into these shallow basins to a depth of approximately 1.0 m and allowed to percolate through the porous limestone bedrock. The resulting locally-elevated water table reduces the flux of groundwater eastward out of ENP. The successive cycles of flooding with water from the L-31N canal, and subsequent drydowns, concentrate nutrients in these basins during their operation period. Soil samples collected at the time of midge sampling showed total phosphorus levels (EPA 3050 method) in detention pond soils ranged from 581 ppm in 332B to 1579 ppm in 332C, whereas soils from neighboring marshes in ENP had total phosphorus concentrations from 221-288 ppm. At drydown, elevated water temperatures and solute concentrations, and accumulation of fine organic and inorganic sediments may provide ideal conditions for warm-adapted species with broad ecological requirements and environmental tolerances to thrive. The fauna of both detention ponds (Table 1) were dominated by potentially pestiferous taxa such as *Apedilum elachistum* Townes, *A. subcinctum* Townes, and *P. nubifer* (Table 13.1 in Ali 1995). Collections of pupal exuviae in primarily open-water habitats do not allow one to estimate the magnitude of emergence on an areal basis. However, windrows of exuviae were evident along leeward shorelines, and 10 dips with a 3-quart pot within a bed of floating macrophytes in Pond 332C yielded an estimated 24,000 chironomid pupal exuviae, 76.4% of which were *P. nubifer*. A similar sample from Pond 332D had an estimated 23,000 pupal exuviae, of which 1.6% were *P. nubifer*. Samples (about 2 m<sup>2</sup> surface area) from vegetated solution depressions located 50 m, 250 m, and 3 km to the west of Pond 332C yielded 6, 1, and 0 pupal exuviae of *P. nubifer*, respectively.

The observed populations of *P. nubifer* are in sparsely inhabited agricultural areas 5 miles west of the City of Homestead and currently not a nuisance problem. Collections of *P. nubifer* pupal exuviae in solution depressions in ENP indicate that this species is capable of surviving in Everglades marshes, but their low numbers in these depressions relative to those in the detention ponds suggest that there is a low likelihood that they will flourish and displace native species

TABLE 1. PERCENT RELATIVE ABUNDANCE OF CHIRONOMIDAE AND CERATOPOGONIDAE SPECIES IN PUPAL EXUVIAE SAMPLES FROM DETENTION PONDS 332C AND 332D ADJACENT TO EVERGLADES NATIONAL PARK ON 7 OCT 2002. X = RARE (<0.1%), — = ABSENT.

Taxon <sup>1</sup>	Pond 332C	Pond 332D
Chironomidae		
<i>Ablabesmyia rhamphe</i> grp. sp. B	X	4.7
<i>Coelotanypus</i> sp.	0.2	—
<i>Djalmabatista pulchra</i> (Johannsen)	3.7	0.1
<i>Labrundinia maculata</i> Roback	—	0.5
<i>Labrundinia neopilosella</i> Beck & Beck	—	0.1
<i>Nanocladius alternantherae</i> Dendy & Sublette	—	X
<i>Parakiefferiella coronata</i> (Edwards)	X	0.2
<i>Psectrocladius</i> sp.	—	X
<i>Pseudochironomus</i> cf. <i>articaudus</i> Sæther	0.1	0.1
<i>Apedilum elachistum</i> Townes	—	9.8
<i>Apedilum subcinctum</i> Townes	—	36.6
<i>Chironomus</i> sp. B	—	X
<i>Cladopelma forcipis</i> (Rempel)	—	0.4
<i>Cryptochironomus</i> cf. <i>ponderosus</i> (Sublette)	—	X
<i>Goeldichironomus amazonicus</i> (Fittkau)	X	0.4
<i>Parachironomus directus</i> Dendy & Sublette	—	0.1
<i>Polypedilum nubifer</i> (Skuse)	76.4	1.6
<i>Polypedilum simulans</i> Townes	—	X
<i>Cladotanytarsus</i> sp. C (= sp. A Epler)	—	0.9
<i>Paratanytarsus</i> sp. A	—	1.2
<i>Tanytarsus limneticus</i> Sublette	—	1.3
<i>Tanytarsus</i> sp. B (= sp. C Epler)	—	0.2
<i>Tanytarsus</i> sp. D (= sp. R Epler)	0.7	8.0
<i>Tanytarsus</i> sp. I	18.8	33.2
Ceratopogonidae		
<i>Dasyhelea</i> cf. <i>major</i> (Malloch)	X	0.4

<sup>1</sup>Letter designations for species are those of the first author and do not correspond to those of other authors except when noted in parentheses.

under the current high water quality conditions present in ENP. Samples collected in 2003, 2004, and 2005 from ENP marshes near 332C and 332D did not yield any *P. nubifer* pupal exuviae. However, continued monitoring of the midge fauna along the perimeter of ENP will be necessary to confirm the non-invasive status of this species. Considering the warm climate, and the variety of intermittent, enriched, and shallow-water habitats present in south Florida, the potential exists for *P. nubifer* to reach nuisance levels in urban or agricultural areas in the future.

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## SUMMARY

We document the first record of *Polypedilum nubifer* in Pan-America. This eurytopic species often reaches severe nuisance population sizes in Australia, Asia, and Hawaii in warm, shallow, eutrophic waters subject to drying. A large population was discovered in newly-constructed infiltration basins and neighboring marshes along the eastern boundary of Everglades National Park. Presently, this population appears minimally invasive to Park marshes and is far removed from urban areas. However, we anticipate this species could disperse and attain nuisance population sizes in suitable urban and agricultural habitats in south Florida.

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