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Source: Florida Entomologist, 87(1) : 37-40

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/0015-4040(2004)087[0037:NBOZAH]2.0.CO;2

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NESTING BIOLOGY OF *ZETA ARGILLACEUM* (HYMENOPTERA: VESPIDAE: EUMENINAE) IN SOUTHERN FLORIDA, U.S.

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ABSTRACT

Zeta argillaceum (L.), a common neotropical wasp, is established in Florida. The characteristic mud potter-like nests are easily recognized. They prey on geometrid caterpillars. Their nests are reused by various arthropods, forming an ecological web similar to that of other mud dauber wasps. Prey, inquilines, parasites, and scavengers found inside the nests are presented.

Key Words: *Pachodynerus erynnis*, *Pachodynerus nasidens*, *Anthrax* sp., *Melittobia australica*, *Anthrenus* sp., *Macrosiagon* sp., *Chalybion californicum*

RESUMEN

Zeta argillaceum (L.) es una avispa neotropical muy común y está establecida en Florida. Ellas construyen nidos de barro en forma de vasija, fáciles de reconocer. Sus hospedadores son larvas de geométridos. Sus nidos son reutilizados por varios artrópodos y forman una red ecológica similar al de otras avispas constructoras de nidos de barro. Se presentan en este trabajo los hospedadores, inquilinos, parásitos y carroñeros encontrados dentro de los nidos.

Translation provided by author.

Zeta is a small neotropical eumenine wasp genus with 4 species that range from Mexico to Argentina and also Trinidad, in the West Indies (Bertoni 1934; Bodkin 1917; Callan 1954; Carpenter 1986b, 2002; Carpenter & Garcete-Barrett 2002; Giordani Soika 1975; Martorell & Escalona S. 1939; Rocha 1981a, b). *Zeta argillaceum* (L.) (Fig. 1) is probably one of the commonest potter wasps in South America. It is well adapted to urban environments; it is easy to find its distinctive mud nest attached to house walls (Garcete-Barrett, pers. comm.). The nests can be also found in sheltered spots under bridges, electric poles and eaves (Bodkin 1917; Chavez 1985; Rocha 1981b) and can be easily transported on ships, thereby expanding its distribution (Bertoni 1934). The mud cell normally appears uniformly colored, but if not it is often due to subsequent closures of the original emergence hole by inquilines or opportunistic "renter" species (Bertoni 1911).

Recently introduced into the Southern United States (Menke & Stange 1986; Stange 1987), *Z. argillaceum* appears to be expanding its range. Like mud daubers in the genera *Trypoxylon* and *Sceliphron*, *Z. argillaceum* nests harbor not only its offspring but also numerous other arthropods, including scavengers, parasites and predators, and their nests could be used to teach ecological interactions (Matthews 1997).

Menke & Stange (1986) summarized the nesting biology of *Z. argillaceum*. They relied heavily on Taffe (1979) who studied the biology of *Zeta canaliculatum* (=*Z. argillaceum*) in Trinidad. A similar approach was used to study *Z. argillacea* (=*Z. argillaceum*) in Brazil (Rocha & Raw 1982). In many aspects the general biology resembled that of the related *Z. abdominale* (Drury) (in some cases using its synonym *Eumenes colona* Saussure) studied in Jamaica by Freeman & Taffe (1974), Taffe & Ittyieipe (1976), and Taffe (1978, 1979, 1983). Detailed accounts of the inquilines and parasites of *Z. argillaceum* in Brazil and in

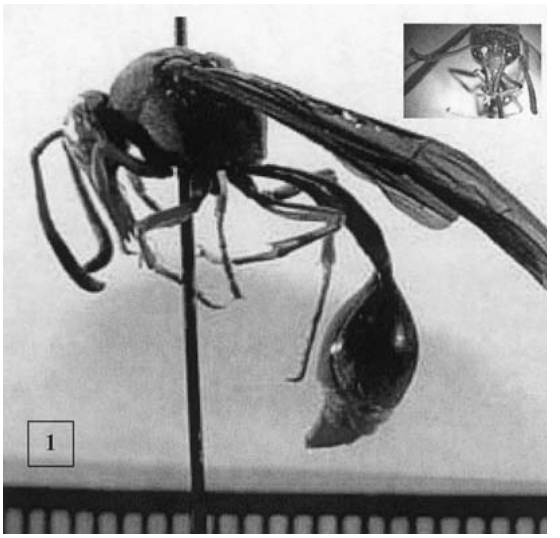


Fig. 1. *Zeta argillaceum* female, lateral view. Ruler marking are in mm. Inset is portrait of head, frontal view.

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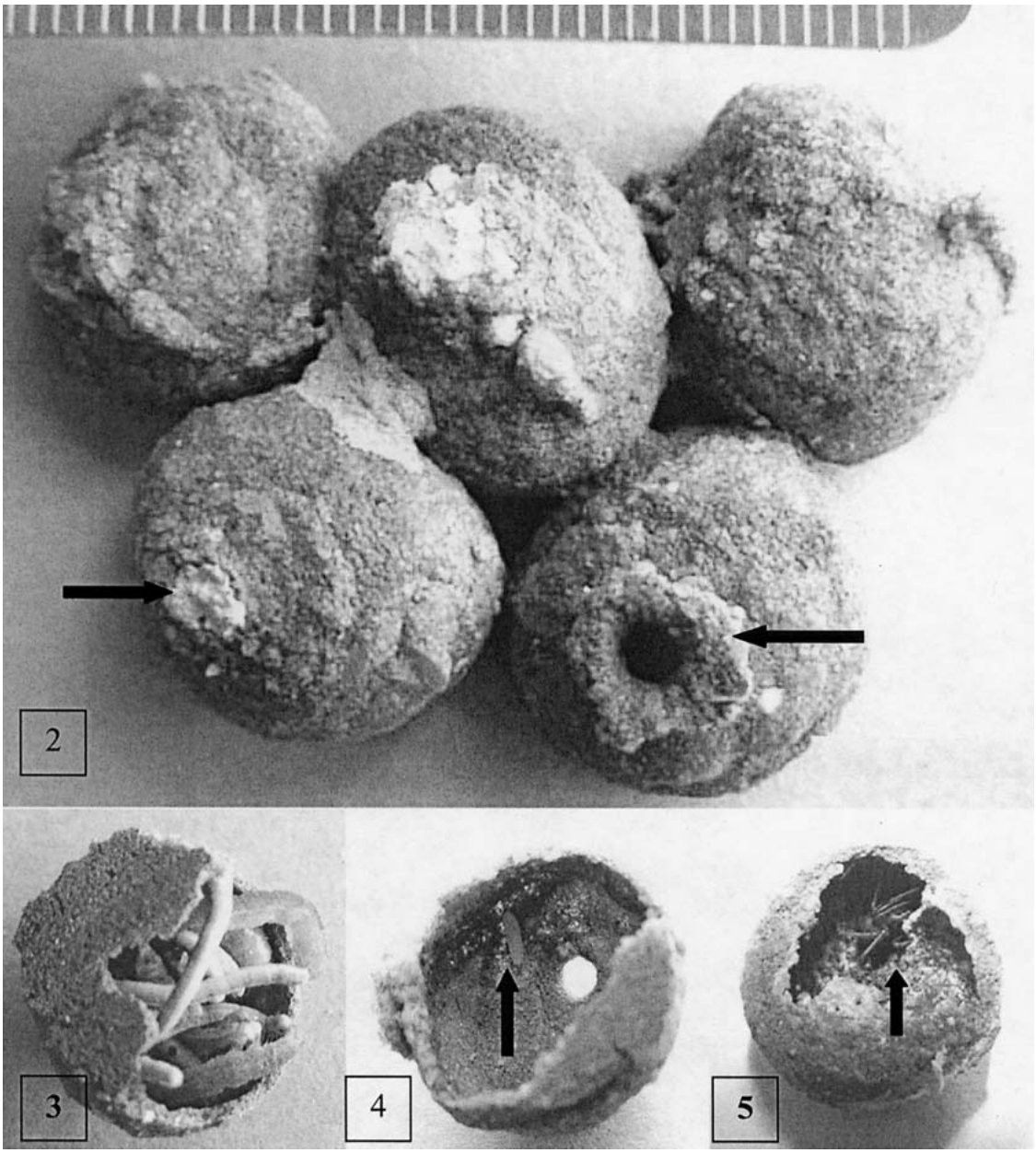
Venezuela are given by Bruch (1904), Rocha (1981a, 1981b), Rocha & Raw (1982) and Chávez (1985). Here we present the first biological data for this species from North America, and demonstrate that it is well established in southern Florida.

Materials and Methods

Seventy-three cells of *Zeta argillaceum* were collected from the roofs of two beach shelters at Hutchinson Boulevard, Martin County, Florida on 28 July 2003. Cells were dissected and contents recorded. Live material was reared under laboratory conditions (25°C, 70% RH) and identified. Voucher specimens were deposited in the entomological collection of the Georgia Museum of Natural History, Athens, Georgia.

Results and Discussion

Nests of *Zeta argillaceum* consist of rounded, pot-like cells (Fig. 2). Nest clusters contained up



Figs. 2-5. 2, Five-celled nest of *Zeta argillaceum*. Left arrow indicates plug sealing entrance to cell. Right arrow shows open entrance of a cell. Ruler marking are in mm. 3, Caterpillar prey stocked in cell of *Z. argillaceum*. 4, Egg (arrow) attached with a silk thread to the cell wall; egg is 3 mm long. 5, unidentified spider using cell as shelter.

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to 15 cells. Most contained 4-7 cells, but isolated single cell nests were also found. Most nests in our sample were old and many had been reused, suggesting that the site had been occupied for some time. Taffe (1979) found that *Z. argillaceum* had 6 generations per year in Trinidad, each requiring about 60 days. In subtropical Florida it is probable that the species can have up to 4-5 generations, leading us to infer that the site had been used for at least a year.

Cells measured 14-18 mm in diameter (Fig. 2) and about 9-13 mm height. Eleven cells were recently made, and contained paralyzed but responsive caterpillars representing two unidentified species of Geometridae. Larvae of this lepidopteran family are reported as common prey of *Z. argillaceum* elsewhere (Callan 1954; Rocha 1981a). One cell (Fig. 3) contained 19 geometrid caterpillars (15 of one species) and a newly hatched wasp larva. The wasp's egg (Fig. 4) is suspended in the empty cell.

Many of the remaining cells (52 of 62) were reused by other arthropods. This rate of reuse was higher than previously found in Brazil (42.75%) and Trinidad (42.72%), where the wasp is very common (Rocha 1981b; Taffe 1979). It appears that *Z. argillaceum* builds a new nest each time, as there are no reports of it re-using old nests. Table 1 lists the arthropods found in the cells of *Z. argillaceum*. Two other Eumeninae, *Pachodynerus nasidens* (Latreille) and *P. erynnis* (Lepeletier) were found reusing *Z. argillaceum* cells. *Pachodynerus nasidens*, the most widespread species in the genus and distributed from the U.S. to Argentina, but not in Chile, and also in the Antilles (Carpenter 1986a; Willink & Roig-Alsina 1998), use the cells by dividing them in two by adding a wall in the middle, so from each *Z. argillaceum* cell 2 *P. nasidens* wasps will emerge. These wasps reused 24 *Z. argillaceum* cells. In Brazil, *P. nasidens* also are recorded to build two cells inside of reused cells of *Z. argillaceum* (Rocha 1981a, b). *Pachodynerus erynnis*, the only red-marked *Pachodynerus* in the U.S. (J. M. Carpenter, pers. comm.), and restricted to the southeast (Carpenter 1986a; Willink & Roig-Alsina 1998), use the cells unmodified so that only one individual of this species emerges per *Z. argillaceum* cell. Apparently only two *Z. argillaceum* cells in our sample were reused by *P. erynnis*. However, two other *Z. argillaceum* cells contained dead and mummified larvae of Noctuidae, which could have been prey of that wasp, as found by Krombein (1967). The sphecid *Chalybion californicum* (Saussure) also reused *Z. argillaceum* cells (one wasp found in a cell). Taffe (1979) reported cells of *Z. argillaceum* being reused in Trinidad by *Trypoxylon* sp. and *Amobia* sp. The later was probably a parasite of *Trypoxylon*. Rocha (1981a, b) found that *Trypoxylon* sp. and *Pachodynerus nasidens* were the most common inquilines in old nests of *Z. argillaceum* in Brazil.

Some of the mortality factors for *Z. argillaceum* and the opportunistic wasps were a bee fly (*Anthrax* sp., Diptera: Bombyliidae), the Australian wowbug (*Melittobia australica*, Hymenoptera: Eulophidae) and one individual of *Macrosiagon* sp. (Coleoptera: Rhipiphoridae), a known parasite of Eumeninae (Krombein 1967; Genaro 1996), that was found dead inside one old cell. *Melittobia australica* was found parasitising *Z. argillaceum* in two of the cells, and *P. nasidens* in 4 reused cells. Mold was consuming the prey caterpillars in one cell. Taffe (1979) also mentions mold attack, cuckoo wasps (Chrysididae), Ichneumonidae and especially *Melittobia* sp. (=*M. australica*) as the most important mortality factors in this potter wasp in Trinidad as well as in *Z. abdominale* in Jamaica. *Melittobia australica* was also found parasitising different Eumeninae in Venezuela including *Z. argillaceum* (Chávez 1985; González 1994; González & Terán 1996).

TABLE 1. CONTENTS OF 73 *ZETA ARGILLACEUM* NEST CELLS COLLECTED IN MARTIN CO., FLORIDA, U.S.

Order (Family)	Species	Habits	No. of Cells Used
Hymenoptera (Vespidae)	*Zeta argillaceum**	Maker	11
Hymenoptera (Vespidae)	*Pachodynerus erynnis*	Re-user	2 (+2)**
Hymenoptera (Vespidae)	*Pachodynerus nasidens*	Re-user	24
Hymenoptera (Sphecidae)	*Chalybion californicum*	Re-user	1
Hymenoptera (Eulophidae)	*Melittobia australica****	Parasite	6
Coleoptera (Rhipiphoridae)	*Macrosiagon* sp.	Parasite	1
Diptera (Bombyliidae)	*Anthrax* sp.	Parasite	1
Coleoptera (Dermestidae)	*Anthrenus* sp.	Scavenger	10
Psocoptera		Scavenger	1
Aranea		Using nests as shelter	4
Empty			10

*1 cell with a newly hatched wasp larva contained 19 prey larvae. Another cell had a recently laid wasp egg.
**2 specimens of *P. erynnis* were found in 2 cells. Two other cells had larvae of Noctuidae caterpillars, typical prey of *P. erynnis*.
***1 on *Z. argillaceum*, 5 on *P. nasidens*.

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At least two species of scavengers were also found. Ten of the *Z. argillaceum* cells contained carpet beetles (*Anthrenus* sp. Coleoptera: Dermestidae), while Psocoptera were found only in 1 old cell. Web remnants and live spiders were present in four old cells, which probably served as shelters (Fig. 5). Many other insects present in Florida are also potential users of *Z. argillaceum* nests, such as *Crematogaster* ants, that also have been found using old nest cells (Bodkin 1917).

Clearly the persistence of the mud pots of *Z. argillaceum* after the emergence of their original progeny provides a home for a diverse community of opportunists and nest associates. The composition of this community no doubt differs from location to location, but generally includes other cavity-nesting Hymenoptera and their parasites, scavengers and associates. In this small sample we found a community involving some 10 arthropod species. Thus, such nests are potentially useful for teaching ecological concepts as well as helping to maintain biological diversity in relatively urban environments by providing shelter and food to other species of arthropods.

Acknowledgments

We thank Bolívar Garcete-Barrett and James M. Carpenter for comments and providing relevant literature. J.M. Carpenter also kindly identified the *Pachodynerus* spp. The study was partially supported by NSF Grant 0088021, R.W. Matthews Principal Investigator.

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