ENTOMOTROPICA
https://sventomologia.org/entomotropica/
http://saber.ucv.ve/ojs/index.php/rev_ento
Año 2025, Vol. 40: 43-46

ISSN 2443-437X
(electrónico)

Article

Seasonal and annual variation in the abundance of *Tiphia wasps* (Hymenoptera: Tiphiidae) in Panama

urn:lsid:zoobank.org:pub:6139DBF8-38CD-4DAC-97FD-82E31F0315D2

Roberto A. Cambra[1], Yostin J. Añino[1,2*], John Pickering[3], Donald M. Windsor[4], Emilio Romero[5], Lynn S. Kimsey[6]

[1]Universidad de Panamá, Facultad Ciencias Naturales, Exactas y Tecnología, Museo de Invertebrados G. B. Fairchild, República de Panamá. [2]Estación Científica Coiba (COIBA AIP), Clayton, Panamá. [3]Fundación Polistes, 133 Washington St., Belmont, MA 02478, EE. UU. [4]Smithsonian Tropical Research Institute, Balboa, Ancón, Panamá. [5]Universidad de Panamá, Facultad Ciencias Naturales, Exactas y Tecnología, Departamento de Fisiología y Comportamiento Animal, República de Panamá. [6]Bohart Museum of Entomology, University of California, Davis, CA, U.S.A. E-mails: cambramiup60@gmail.com, yostin0660@gmail.com, pick@discoverlife.org, windsordm@gmail.com, emilioromero2011@gmail.com, lskimsey@ucdavis.edu*

Abstract

We present the first records on seasonal and annual variation in the abundance of *Tiphia* wasps in the understory of a Neotropical Forest based on catches from 10 Malaise traps monitored weekly on Barro Colorado Island, Panama over three years (2003-2005). A total of 396 specimens of Tiphiidae were collected (351 males and 45 females), 201 individuals from year one, 65 from year two and 130 from the final year. Eight species were identified in the total catch, with the two most numerous species, *Tiphia pacozo* Allen, 1964 and *T. panamaensis* Allen, 1964 contributing with 311 and 35 specimens, respectively. *Tiphia* were most abundant in collections made during October and November 2003-2005, with an additional peak of abundance occurring in July 2005. We conclude that *Tiphia* display strong seasonal variations in abundance, with peaks occurring during the rainy season.

Additional keywords: Aculeate wasps, Neotropical, Seasonal timing, Taxonomy, Tiphioidea

Resumen

Presentamos los primeros registros sobre la variación estacional y anual en la abundancia de avispas *Tiphia* en el sotobosque de un bosque neotropical, basados en capturas con 10 trampas Malaise monitoreadas semanalmente en la Isla Barro Colorado, Panamá, durante tres años (2003-2005). Se colectó un total de 396 especímenes de Tiphiidae (351 machos y 45 hembras), 201 individuos del primer año, 65 del segundo año y 130 del último año. Se identificaron ocho especies en la captura total, siendo las dos especies más numerosas, *Tiphia pacozo* Allen, 1964 y *T. panamaensis* Allen, 1964, las que contribuyeron con 311 y 35 especímenes, respectivamente. Las *Tiphia* fueron más abundantes en las recolecciones realizadas durante octubre y noviembre de 2003-2005, con un pico adicional de abundancia en julio de 2005. Concluimos que las *Tiphia* muestran fuertes variaciones estacionales en abundancia, con picos que ocurren durante la temporada de lluvias.

Palabras clave: Avispas aculeadas, Neotropical, tiempo estacional, Taxonomía, Tiphioidea

Introduction

Little is known about the seasonal flight activity and annual abundance of tiphiid wasps, parasitoids principally on the larvae of scarab beetles (Davis 1919, Box 1925, Krombein 1948, Rivers et al. 1979, Poprawski 1994, Rogers and Potter 2004, Kimsey 2006, Calderón-Arroyo 2018). Ramoutar and Legrand (2007) determined the distribution and seasonal timing of *Tiphia vernalis* (Rohwer, 1924) in Connecticut, U.S.A. However, we are unaware of similar studies on the flight activity of Tiphiidae in the Neotropical region. Nevertheless, in Panama, Barro Colorado Island, studies on variation in abundance of scoliid (Añino et al. 2020a) and mutillid wasps (Cambra et al. 2018, Añino et al. 2020b, Cambra et al. 2021) have been carried out, helping to understand

Recibido: 21-V-2025, Revisado: 26-VI-2025, Aceptado: 9-VII-2025

CAMBRA RA, AÑIÑO YJ, PICKERING J, WINDSOR DM, ROMERO E, KIMSEY LS. 2025. Seasonal and annual variation in the abundance of *Tiphia* wasps (Hymenoptera: Tiphiidae) in Panama. ENTOMOTROPICA, 40:43-46.

on line Octubre-2025

how the number of individuals of a species changes over space and time, and the factors that influence these changes. These researches are crucial for understanding ecological dynamics, biodiversity patterns, and the effects of environmental change in this region.

Tiphia Fabricius, 1775 (Hymenoptera: Tiphioidea) is a cosmopolitan genus in the family Tiphiidae with more than 500 species (Hanima et al. 2024), of which about 95 species are Neotropical (Han et al. 2023). Allen (1964) described seven species of *Tiphia* from Barro Colorado Island, Panama. Other records for Panama were given by Allen (1965, 1971, 1972).

Due to the importance of *Tiphia* wasps as biological control agents of pest beetle larvae and given the scarcity of information about their biology, we present new information about variation in flight seasonality and annual abundance of this ecologically important taxon.

Materials and Methods

We follow the classification of Pilgrim et al. (2008), which includes Tiphiidae + Sierolomorphidae in the superfamily Tiphioidea. Flight seasonality data come from the field station of the Smithsonian Tropical Research Institute (STRI) on Barro Colorado Island (BCI), 09°0917" N, 79°50' 53" W., Republic of Panama. The seasonal timing of *Tiphia* was studied by sampling specimens from ten Malaise traps (Townes modified) separated from each other by approximately 50 to 100 m, installed at ground level in the old forest by the Smithsonian Environmental Studies Program (see Richards and Windsor 2007). The samples were collected weekly, from January 2003 to December 2005. For other information of the study area, see Windsor (1990) and Cambra et al. (2018). Specimens examined in this study were identified by RAC, according to the descriptions in Allen (1964) and key of *Tiphia* species of western North America (Allen 1971). All specimens mentioned below are deposited in the Museo de Invertebrados Graham Bell Fairchild, Universidad de Panamá, Panamá (MIUP).

Results and Discussion

During the three continuous sampling years (2003−2005) in BCI, 396 specimens of *Tiphia* (351 males and 45 females) were collected (Table 1). Specimens in eight species were separated and identified. The most abundant species was *Tiphia pacozo* Allen, 1964, with 311 specimens (78,5%). *Tiphia* was most abundant during October and November 2003−2005, but another peak of abundance was observed in July 2005 (Figure 1).

In the Nearctic region, Ramoutar and Legrand (2007) determined the month of May as the seasonal peak for *Tiphia vernalis* (Rohwer, 1924) in four localities

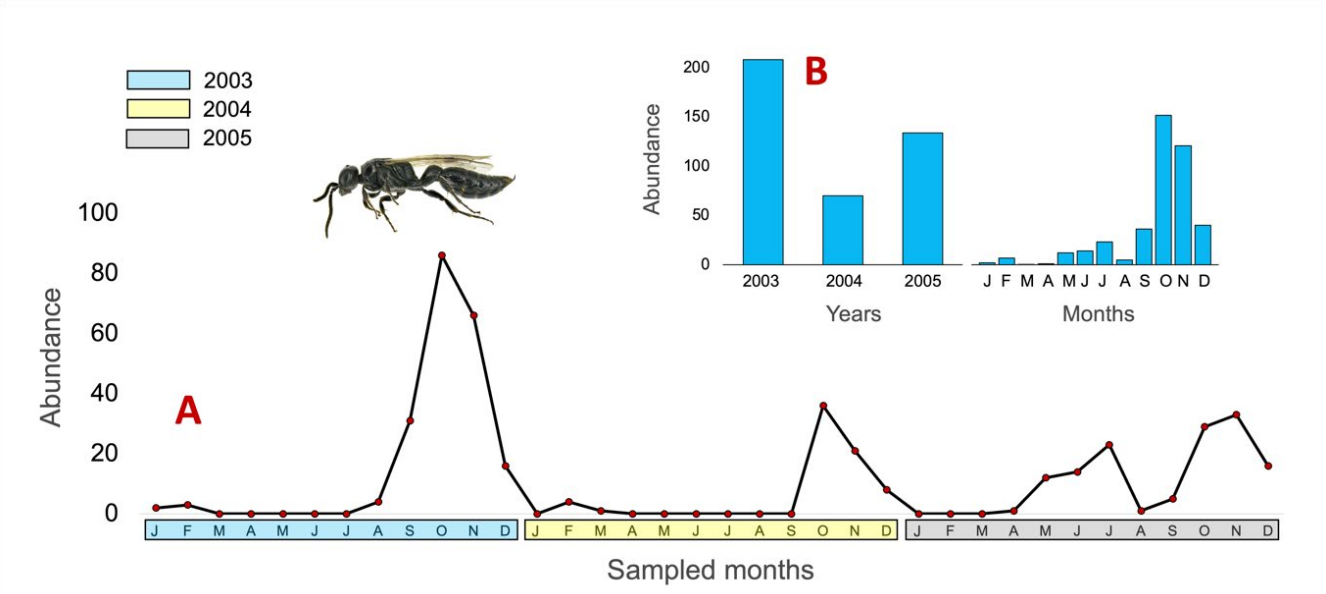

Figure 1. A. Total *Tiphia* specimens captured by month (2003-2005). **B.** Total *Tiphia* specimens captured by year (2003-2005).

Table 1. Species of *Tiphia* from BCI (2003-2005).

ESPECIE	females	males	Total
Tiphia panamaensis Allen, 1964	35	0	35
Tiphia vierecki Allen, 1964	1	0	1
Tiphia atrata Allen, 1964	7	0	7
Tiphia barcola Allen, 1964	2	0	2
Tiphia mallochi Allen, 1964	0	1	1
Tiphia pacozo Allen, 1964	0	311	311
Tiphia rettenmeyeri Allen, 1964	0	37	37
Tiphia veracruzae Allen, 1965	0	2	2
Total	45	351	396

of Connecticut. The seasonal peaks of *Tiphia* wasps in tropical forests are probably related to the greater availability of scarab beetle hosts in particular months of the year. Similar patterns in annual abundance are also found in other families of aculeate wasps present on BCI (Añino et al. 2020 a, b). Comparing the abundance of *Tiphia* with Scoliidae (Añino et al. 2020a) from BCI, we find that both families of wasps are more abundant during the rainy season, but tiphiids are more abundant in October-November (late wet season) and Scoliidae in June (early wet season). Studies on flight seasonality in Mutillidae from BCI (Cambra et al. 2018, Añino et al. 2020b, Cambra et al. 2021), show greater abundance during the dry season in the months of March and April. The smaller catch of *Tiphia* females (11,4%) relative to that of males (88,6%) on BCI may be a product of sampling methodology. Female *Tiphia* wasps probably spend much of their time in and on the ground searching for larval hosts. This may suggest why they are seldom collected by Malaise traps. However, males spend more time flying, mainly in search of females, thereby increasing chances of capture in Malaise traps. Añino et al. (2020a) give this explanation for *Scolia guttata* Burmester, 1853 as observed over two continuous sampling years (2005-2006) with Malaise traps on BCI, 95,1% males and 4,9% females.

A total of 38 *Tiphia* specimens, 35 females and 3 males, were collected during a short survey in Darien National Park (March 21 to April 4, 2000) using 50 yellow pan traps, placed at forest floor level. Seven Malaise traps installed at the same locality and time captured a total of only 3 females and 6 males. While these results are based on limited sampling, they do suggest that sampling methodology can have significant effects on the capture effectiveness for different sexes of *Tiphia* on the forest floor, with Malaise traps capturing significantly more males than females, and yellow pan traps capturing significantly more females than males. Therefore, it is possible that a peak abundance of females in BCI occurs during the dry season that is not shown in our study. Male *Tiphia* appear in low in abundance during the dry season as shown by data from BCI and Darien National Park.

Acknowledgment

The long-term malaise trap sampling project on BCI was initiated by JP (University of Georgia, USA) with funding from the "Environmental Sciences Program" of the Smithsonian Institution. We thank Vanessa Sanchez and Saturnino Martinez for weekly collections from traps and the initial sort and care of specimens. YA and ER thank the "Convocatoria de Movilidad Internacional" (Economic Subsidy Contract SENACYT-DDCCT No. 002-2025). This research is registered by Vicerrrectoría de Investigación y Postgrado, Universidad de Panamá as VIP-01-04-05-2024-06.

References

Allen HW. 1964. New species of *Tiphia* (Hymenoptera: Tiphiidae) from Panama. *Notulae Naturae*, 371: 1-6.

Allen HW. 1965. Tiphiinae (Hymenoptera; Tiphiidae) of Western North America. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 117: 45-115.

ALLEN HW. 1971. A monographic study of the genus *Tiphia* (Hymenoptera: Tiphiidae) of western North America. *Transactions of the American Entomological Society*, 97(2): 201-359.

ALLEN HW. 1972. A Monographic study of the subfamily Tiphiinae (Hymenoptera: Tiphiidae) of South America. *Smithsonian Contributions to Zoology*, 113: 1-76.

AÑINO YJ, CAMBRA RA, WINDSOR DM, ZUÑIGA R, QUINTERO D. 2020a. Review of *Scolia* (Hymenoptera: Scoliidae) from Central America, including seasonal flight activity in *Scolia guttata*. *Acta biológica Colombiana*, 25(2): 202-209. http://dx.doi.org/10.15446/abc.v25n2.77590

AÑINO YJ, CAMBRA RA, WINDSOR DM, WILLIAMS KA, BARTHOLOMAY PR, QUINTERO D, SÁNCHEZ V. 2020b. Seasonal and annual variation in the abundance of *Ephuta* Say (Hymenoptera: Mutillidae) in Panama. *Revista de Biología Tropical*, 68(2): 573-579.

BOX HE.1925. Porto Rican cane-grubs and their natural enemies, with suggestions for the control of lamellicorn larvae by means of wasp-parasites (Scoliidae). *The Journal of Agriculture of the University of Puerto Rico*, 9(4), 291-356. https://doi.org/10.46429/jaupr.v9i4.15086

CALDERÓN-ARROYO C. 2018. Caracterización de las especies de *Tiphia* (Hymenoptera: Tiphiidae) de Costa Rica y su papel como parasitoides de larvas de *Phyllophaga* spp. (Coleoptera: Scarabaeidae) en Zarcero, Alajuela. Undergraduate thesis, School of Agronomy, University of Costa Rica. 74 pp.

CAMBRA RA, WILLIAMS KA, QUINTERO D, WINDSOR DM, PICKERING J, SAAVEDRA D. 2018. *Dasymutilla* Ashmead (Hymenoptera: Mutillidae) from Panama: New species, sex associations and seasonal flight activity. *Insecta Mundi*, 0608:1-17.

CAMBRA RA, QUEIROS CN, DE DEUS ALVES JP, WILLIAMS KA, BARTHOLOMAY PR, IANTAS J, NETHER MC, NISHIDA K, AÑINO YJ, SAAVEDRA D, TUNES-BUSCHINI ML. 2021. Description of the male of *Xystromutilla bucki* Suárez, 1960 (Hymenoptera, Mutillidae), including new information on the biology of the genus. *ZooKeys*, 1011: 73-84. https://doi.org/10.3897/zookeys.1011.60944

DAVIS JJ. 1919. Contributions to a knowledge of the natural enemies of *Phyllophaga*. *Illinois Natural History Survey Bulletin*, 13(5): 53-95. https://doi.org/10.21900/j.inhs.v13.329

FABRICIUS JC. 1775. Systema entomologiae, sistens insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus. Flensburgi et Lipsiae: Korte, 832 pp.

HAN Q, WANG HS, CHEN B, LI TJ. 2023. A taxonomic revision of the nominotypical subgenus *Tiphia* Fabricius, 1775 (Hymenoptera: Tiphiidae: Tiphiinae) from China, with three new species and a key to the Chinese species. *Zootaxa,* 5284(1): 1-43. https://doi.org/10.11646/zootaxa.5284.1.1

HANIMA RKP, GIRISH KUMAR P., HEGDE VD. 2024. Description of a new species of *Tiphia* Fabricius, 1775 (Hymenoptera: Tiphiidae: Tiphiinae) from Andhra Pradesh, India. *Journal of Insect Biodiversity and Systematics*, 10 (2): 321-326. https://doi.org/10.61186/jibs.10.2.321

KIMSEY L. 2006. 14.2. Familia Tiphiidae. Págs: 575-583. En: Hanson PE, Gauld ID, (eds.). Hymenoptera de la Región Neotropical. *Memoirs of the American Entomological Institute* 77: 1-994.

KROMBEIN KV. 1948. Liberation of Oriental scolioid wasps in the United States from 1920 to 1946. *Annals of the Entomological Society of America*, 41: 58-62.

PILGRIM EF, VON DOHLEN CD, PITTS JP. 2008. Molecular phylogenetics of Vespoidea indicate paraphyly of the superfamily and novel relationships of its component families and subfamilies. *Zoologica Scripta*, 37(5): 539-560. https://doi.org/10.1111/j.1463-6409.2008.00340.x

POPRAWSKI TJ. 1994. Insect parasites and predators of *Phyllophaga anxia* (LeConte) (Col., Scarabaeidae) in Quebec, Canada. *Journal of Applied Entomology*. https://doi.org/10.1111/j.1439-0418.1994.tb00701.x

RAMOUTAR D, LEGRAND A. 2007. Survey of *Tiphia vernalis* (Hymenoptera: Tiphiidae), a parasitoid wasp of *Popillia japonica* (Coleoptera: Scarabaeidae), in Connecticut. *Florida Entomologist*, 90(4): 780-782.

RICHARDS LA, WINDSOR DM. 2007. Seasonal variation of arthropod abundance in gaps and the understory of a lowland moist forest in Panama. *Journal of Tropical Ecology*, 23(2):169−176. https://doi.org/10.1017/S0266467406003907

RIVERS RL, MAYO ZB, HELMS TJ. 1979. Biology, behavior and description of *Tiphia berbereti* (Hymenoptera: Tiphiidae) a parasite of *Phyllophaga anxia* (Coleoptera: Scarabaeidae). *Journal of the Kansas Entomological Society*, 52: 362-372.

ROGERS ME, POTTER DA. 2004. Biology and conservation of *tiphia* wasps, parasitoids of turf-infesting white grubs. *Acta Horticulturae*, 661: 505-510. https://doi.org/10.17660/ActaHortic.2004.661.67

WINDSOR DM. 1990. Climate and moisture variability in a tropical forest: Long-term records from Barro Colorado Island, Panama. *Smithsonian Contributions to the Earth Sciences*, 29: 1-145.