SOLENOPSIS ENIGMATICA, A NEW SPECIES OF INQUILINE ANT FROM THE ISLAND OF DOMINICA, WEST INDIES (HYMENOPTERA: FORMICIDAE)

MARK DEYRUP[1] AND ZACHARY A. PRUSAK[2]
[1]Archbold Biological Station, P.O. Box 2057, Lake Placid, FL 33862
E-mail: mdeyrup@archbold-station.org

[2]The Nature Conservancy, 222 South Westmonte Drive, Suite 300,Altamonte Springs, FL 32714
E-mail: zprusak@tnc.org

ABSTRACT

A new species of ant, *Solenopsis enigmatica*, is described from 2 dealate queens and 3 workers collected from nests of *Pheidole antillana* Forel in rainforest on the island of Dominica, West Indies. The queen of *S. enigmatica* is similar to that of another inquiline, *S. phoretica* Davis and Deyrup, known only from 1 queen collected in Florida. The 2 species differ in mandibular dentition and other ways. Worker *S. enigmatica* do not closely resemble those of other known species. They lack clypeal carinae, have short antennal scapes, and have long, coarse hairs arising from conspicuous punctures. The presence of workers suggests that *S. enigmatica* might be a temporary nest parasite, but many questions remain about the relationship of this species to its host.

Key Words: parasitic ant, parasitic *Solenopsis*, parasitic fire ant, insects of Dominica

RESUMEN

Una nueva especie de hormiga, *Solenopsis enigmatica*, es descrita de 2 reinas sin alas y 3 trabajadores recolectados en nidos de *Pheidole antillana* Forel en un bosque pluvial en la isla de Dominica. La reina de *S. enigmatica* es similar a otra hormiga inquilina, *S. phoretica* Davis y Deyrup, conocida solamente por 1 reina recolectada en la Florida. Las 2 especies se diferencia por los dientes de la mandibula y en otros caracteres. Los trabajadores de *S. enigmatica* no se parecen a las otras especies conocidas. Ellos carecen de la carinae del clipeo, tienen el segmento del escapo de la antena mas corto y tienen setas largas y gruesas saliendo de punteaduras conspicuas. La presencia de los trabajadores sugiere que *S. enigmatica* puede ser un parásito temporaneo del nido, pero quedan muchas preguntas sobre la relacion entre esta especie y su hospedero.

Solenopsis is a moderately large genus with over 180 described species (Bolton 1995) and a large but unknown number of undescribed species. Most *Solenopsis* species are small, cryptic and poorly known, ecologically unrelated to the small number of large, open-foraging, notorious species such as *S. invicta* Buren, *S. geminata* (Fabricius) and *S. saevissima* (F. Smith). Some small subterranean species live next to nests of other ants and prey on the larvae of their neighbors (Hölldobler & Wilson 1990). A few South American *Solenopsis* species are workerless parasites, whose peculiar morphology caused them to be placed in the genera *Labauchena* or *Paranamyrmex* until Ettershank (1966) synonymized those genera with *Solenopsis*. Recently, a new species of *Solenopsis*, *S. phoretica*, was described, based on a single dealate queen found clinging to the petiole of a queen of *Pheidole dentata* Mayr (Davis & Deyrup 2006). It is suspected that this queen represents a parasitic species, considering the situation of the specimen and certain morphological features. At the time of the description of *S. phoretica*, this species did not appear to be closely related to the known parasitic *Solenopsis*, or any other known species of *Solenopsis* (Davis & Deyrup 2006). Soon after the description of *S. phoretica* was published, another species of inquiline *Solenopsis* was discovered on the island of Dominica in the West Indies. This species appears to be closely related to *S. phoretica*, and is described below.

Character states defining *Solenopsis* are provided by Ettershank (1966), or can be derived from the keys in Bolton's guide to ant genera (1994). Members of the genus can usually be recognized by the following combination of character states: 2-segmented petiole; 2-segmented antennal club; propodeum lacking spines or angles; petiolar node well developed; head and body shining, sculpture restricted to setigerous punctures and localized striae; clypeus longitudinally carinate, with a median, apical marginal seta. The clypeal features are lacking in *S. phoretica* and the species described below.

We have designated a dealate queen as the holotype because of the apparent close relationship between this species and *S. phoretica*. Diagnosis of the new species must be by reference to charac-

ter states of queen *S. phoretica*, as workers of that species are unknown.

Solenopsis enigmatica, Deyrup and Prusak
new species

Diagnosis of Dealate Female (Fig. 1). Distinguished from most other *Solenopsis* by the form of the mandibles, which are falcate, with the teeth not in an oblique series, as normal in species of *Solenopsis*; the basal angle is strongly developed and weakly bidentate, the concave inner margin with a low, median double tooth; *S. phoretica* lacks this median double tooth.

Description of Holotype Dealate Female. Features visible in lateral view, described from left side. Measurements in mm. Total length (length of head excluding mandibles + length of mesosoma + length of petiole + length of postpetiole + length of gaster): 3.92; head length: 0.60; head width at rear margins of eyes in frontal view: 0.62; length of mesosoma: 1.20; length of petiole: 0.37; length of postpetiole: 0.20; length of gaster: 1.55. Color: yellowish brown, ocellar triangle dark brown, appendages yellow. Head: smooth, shining, sparsely covered with setigerous punctures separated by 2-8 times the width of a puncture in frontal area, 2-4 times the width of a puncture on sides, setae suberect, directed posteriorly in frontal area, elsewhere directed anteriorly; ocelli not enlarged, each ocellus about the width of antennal scape near base; malar distance about half (4/7) length of eye; mandibles elongate, a little less than half the length of the head at midline; mandible with basal angle strongly developed, bidentate; inner margin of mandible strongly concave distal to basal angle, with a low, median, marginal double tooth, the proximal cusp blunt but conspicuous, the distal cusp reduced to a low ridge; clypeus declivitous, concave, without carinae, with 4 subapical elongate setae; antennae 10-segmented, scapes reaching outer corner of head in frontal view, antennal club 2-segmented, club about as long as remainder of funiculus. Mesosoma: smooth and shining, with sparse setigerous punctures on pronotum and near margins of mesonotum, mesopleura, sides of propodeum; katepisternum with sparse setigerous punctures; disc of mesonotum and declivity of propodeum not punctate; propodeum evenly declivitous in lateral view; legs smooth, shining, with sparse, strong, semidecumbent, curved, distally directed hairs; hind basitarsus longer than hind tibia; a dense, coarse, ventral brush of hairs on distal half of front basitarsus. Petiole: peduncle short, less than 0.25 length of base of petiole in lateral view; node of petiole in lateral view triangular, apex broadly and smoothly rounded, in posterior view semicir-

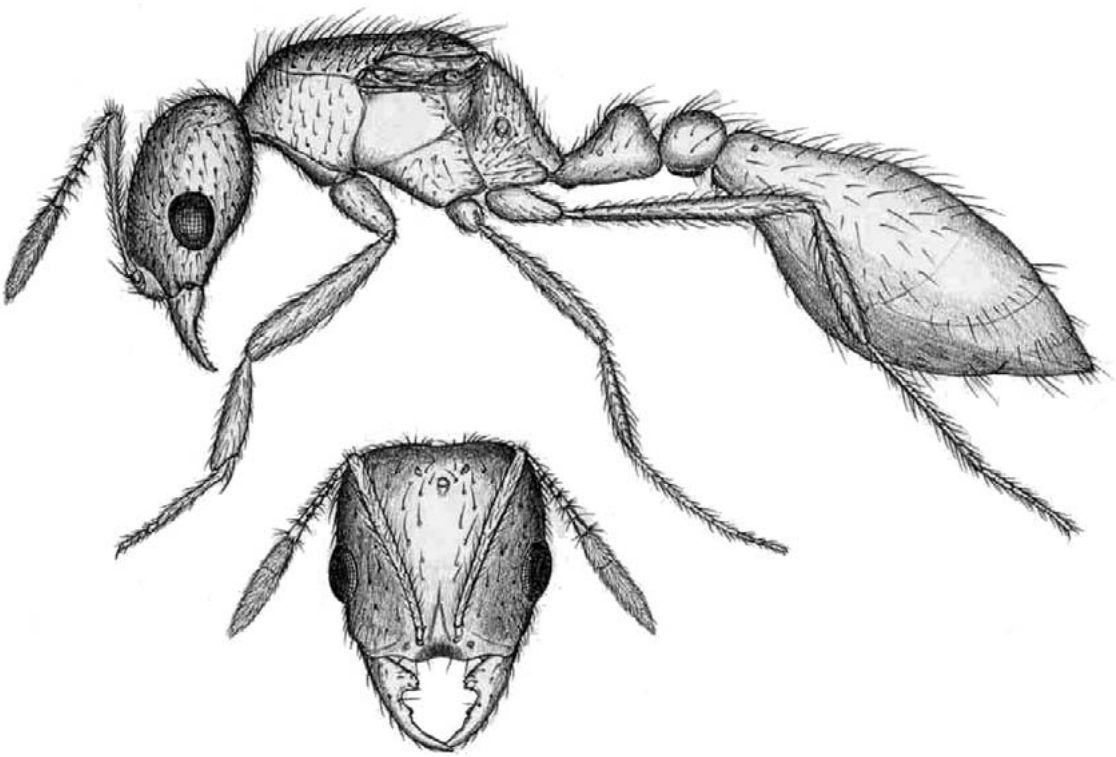

Fig. 1. *Solenopsis enigmatica*, dealate female reproductive, length of specimen 3.92 mm.

cular; ventral process narrowly expanded, with a small ventral projection that is like a low ridge rather than a tooth. Postpetiole: low and rounded above in lateral view, in posterior view about 1.5 times as wide as long. Gaster: in dorsal view first tergite with prominent, rounded anterior corners, projecting forward from midline; first gastral tergite and sternite each with a broad, median, basal concavity; first tergite with sparse, long, suberect, posteriorly-directed, hairs that are generally distributed; tergites 2-4 smooth, each with an irregular row of large, suberect, subapical hairs.

Type Locality and Associated Information. Collecting data on labels (3) of holotype: DOMINICA, W.I., Pont Casse, 30 April 2006, M., N., L. Deyrup; Trail to Trois Pitons, in nest of *Pheidole antillana* in rotten log; rainforest near base of trail, N15°22.80', W61°20.46'.

Diagnosis of Worker (Fig. 2). Distinguished from other *Solenopsis* workers by clypeal morphology: clypeus lacking carinae, in lateral view rounded and strongly declivitous. Pale yellow, antennal scapes short, in frontal view failing to reach occipital margin of head by a distance about equal to the combined length of the first 4 segments of the funicle. If *S. phoretica* produces workers, they might be similar to those of *enigmatica*, so this diagnosis may not be definitive.

Description of Paratype Worker. Measurements in mm. Total length (length of head excluding mandibles + length of mesosoma + length of petiole + length of postpetiole + length of gaster): 2.27; head length: 0.50; head width at rear margins of eyes in frontal view: 0.45; length of mesosoma: 0.60; length of petiole: 0.20; length of postpetiole: 0.12; length of gaster: 1.55. Color: pale yellow, eyes black. Head: smooth, shining, with scattered setigerous punctures, including a series of 4 large, posteriorly-directed, suberect, slightly convergent setae on each side of frontal area, and several small, decumbent, convergent setae on each side of frontal area; eye composed of a single, large, dark facet; mandibles unlike those of queen, more typical of workers of other small *Solenopsis* species: apical tooth long and sharp, remaining 3 teeth small, sharp, in a strongly oblique series, with a long, toothless proximal inner margin; clypeus without carinae, convex in lateral view, with four subapical elongate setae and a long median apical seta; antennae 10-segmented, scapes in frontal view failing to reach occipital margin by a distance about equal to the first 4 segments of the funicle; antennal club 2-segmented. Mesosoma smooth, shining, pronotum with 3 large, semierect, posteriorly-directed setae on each side, and 1 smaller, semierect, anteriorly-directed seta on each side at posterior margin of pronotum; propodeal spiracle large, as in Fig. 2; legs smooth, shining, with sparse, strong, semidecumbent, distally-directed hairs; hind basitarsus about the

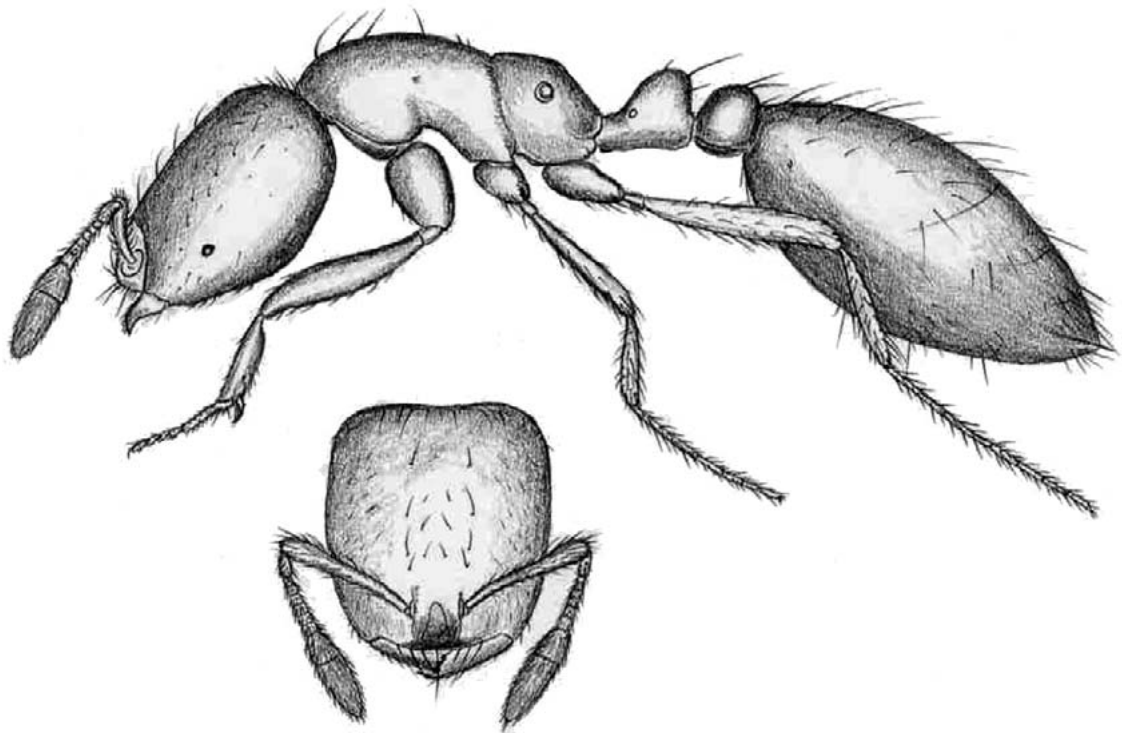

Fig. 2. *Solenopsis enigmatica*, worker, length of specimen 2.27 mm.

length of hind tibia. Petiole: apex of node in posterior view somewhat flattened; node with two long, posteriorly-directed setae on each side near apex; ventral process a low, triangular tooth, somewhat rounded apically. Postpetiole: low and rounded above in lateral view; in dorsal view 5/7 as long as wide. Gaster: first tergite with sparse, long, suberect, posteriorly-directed hairs that are generally distributed; tergites 2-4 smooth each with an irregular row of large, suberect, subapical hairs; sting slightly extruded.

Type locality and associated information as in holotype female.

Additional Paratype Material. Two workers, one a pharate adult in pupal skin, associated with the holotype female. One dealate queen: collecting data as on labels: DOMINICA, W.I., Cochrane, west of Morne Macaque, 29 April 2006. Z. Prusak. Middleham Falls Trail, in nest of *Pheidole antillana* in rotten log. 15°20.852'N, 61°20.698'W.

All specimens were collected in Dominica rain forest habitat as defined by Lack et al. (1998), with evergreen shrubs, canopy trees and abundant epiphytes.

Holotype and other type material to be deposited in the Museum of Comparative Zoology, Harvard University, Cambridge, MA.

Etymology: from *aenigma* (Latin), meaning "mystery," referring to the many unknown aspects of the natural history of this unusual *Solenopsis*.

Discussion

There is a striking resemblance between the queens of *enigmatica* and *phoretica* (Fig. 1, Fig. 3). With only one specimen of *phoretica* and two of *enigmatica*, little can be said about the variation in either species. It seems unlikely, however, that these specimens represent a single, widespread, variable species. The differences in mandibular structure are probably functionally significant, considering that the specimen of *phoretica* was found with her mandibles locked around the petiolar peduncle of the host queen. Inquiline ants tend to be host-specific, exploiting a single host, or a few very closely related hosts (Hölldobler & Wilson 1990). *Pheidole antillana* Forel is in the *tristis* species group of *Pheidole*, *dentata* in the *fallax* group, and the two species are not closely related (Wilson 2003). It also seems more likely that these specimens represent 2 rare, localized species, rather than a widely distributed species that has never been found anywhere but Florida and Dominica.

The *S. phoretica-enigmatica* group is known from only 3 queens and a few associated workers, but all 3 were apparent inquilines in the nest of *Pheidole* species, and we are assuming that this is a normal association. It is rare for an inquiline ant to be so distantly related to its host, but there is a relevant example in *Oxyepoecus*, a genus related to *Solenopsis*, with hosts in both *Pheidole*

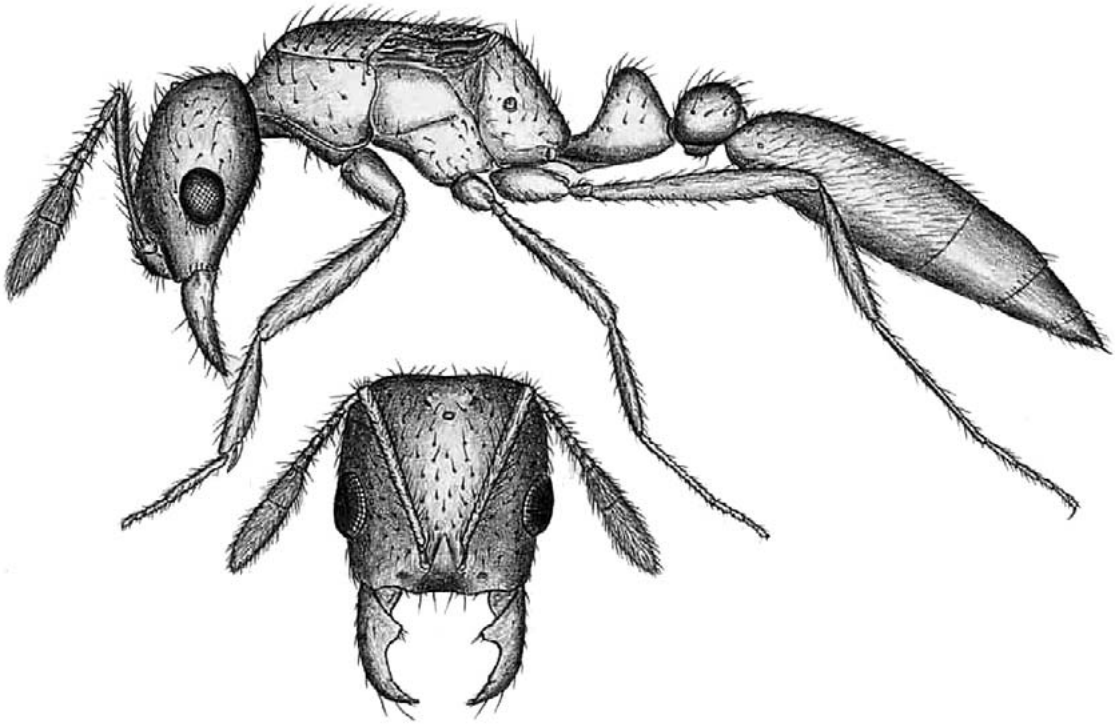

Fig. 3. *Solenopsis phoretica*, dealate female reproductive, length of specimen 3.03 mm.

and *Solenopsis* (Hölldobler & Wilson 1990). We are not suggesting that there is any reason to think that *phoretica* and *enigmatica* could be transferred to *Oxyepoecus*, or that they represent some sort of transition between *Solenopsis* and *Oxyepoecus*. Several species of small *Solenopsis* may live in nests adjacent to those of other ants, which they exploit in what one might call a peri-inquiline way (Hölldobler & Wilson 1990), and it could be that the *phoretica-enigmatica* lineage took such a relationship a few steps further.

The exact nature of the relationship between *S. enigmatica* and its host is unknown. It is reasonable to speculate that queen *enigmatica* spend some time in close association with the host queen, as *enigmatica* has the elongate mandibles and concave first gastral tergite found in *phoretica*. No queen *Pheidole* was found in either of the 2 colonies that contained *enigmatica*, but it is possible that the host queens were overlooked. The presence of 3 workers associated with 1 queen *enigmatica* is consistent with the hypothesis that *enigmatica* is a temporary nest parasite, but no mature colony has been found. Worker *enigmatica* are conspicuously larger than the other 3 species of yellow *Solenopsis* that we found on Dominica, and it is unlikely that we would have discarded a colony of *enigmatica*, mistaking it for one of the common little yellow *Solenopsis*. Parasitic ants in general are notoriously rare. The abundance of another parasitic *Solenopsis*, *S. daguerrei* (Santschi) has been studied by Calcaterra et al. (2000). With 4,131 potential host colonies examined, parasitization rates were 3.9%. If this degree of rarity is at all typical of parasitic *Solenopsis*, we were fortunate to find 2 parasitized colonies during the short time we were in Dominica.

It is highly unlikely that the *phoretica-enigmatica* lineage of *Solenopis* is confined to the island of Dominica and Alachua County in Florida. One possibility is that members of this group occur throughout the range of *Pheidole* in the New World, but have escaped notice because they are rare and host-specific. It is also possible that this group of inquilines can only succeed in communities in which a few species of *Pheidole* are especially abundant, with persistent and accessible colonies. This might favor the success of inquilines on islands with relatively low *Pheidole* diversity, and near the edges of the range of *Pheidole*. The relentless raiding of *Pheidole* nests by army ants in the humid Neotropics would seem to decrease the effective resource base for inquilines.

The potential host range for *S. enigmatica* on Dominica is probably limited. The species most similar to *P. antillana* is *P. laudatana* Wilson, a slightly smaller member of the *tristis* group that is common on Dominica, but not known from other islands. Both species are common in primary forest on Dominica. *Pheidole antillana* nests in rotten sticks and logs on the forest floor, while colonies of *laudatana* nest in clay soil and have a small nest opening. It seems probable that *antillana* is more vulnerable to inquilines than *laudatana*. If it turns out that *S. enigmatica* is a host-specific inquiline, it must have a restricted distribution, as *P. antillana* is known only from St. Vincent, Grenada and Dominica. We found *antillana* common in the extensive forest reserves on Dominica, but absent from disturbed areas. Other islands of the Lesser Antilles have less extensive forest reserves, in some cases only small fragments. It is too soon too speculate about the rarity of *S. enigmatica*, but its conservation status is one of several interesting questions pertaining to the species.

Acknowledgments

We thank Arlington James, Forest Officer from the Forestry, Wildlife and Parks Division of the Dominica Ministry of Agriculture and the Environment for providing research permits and for sharing his remarkable natural history expertise. We thank Nancy Osler, Managing Director of the Archbold Tropical Research and Education Center for her hospitality and for offering her invaluable logistical support during our expedition to Dominica. We thank James Wetterer, who supplied funds for the expedition under a grant from the National Science Foundation to survey the ants of the eastern Caribbean. We thank Nancy and Leif Deyrup for assisting in collecting ants throughout our stay in Dominica. We gratefully acknowledge the Government of Dominica for protecting and managing the amazing natural areas that serve as refuges for this species and thousands of other interesting animals.

Literature Cited

Bolton, B. 1994. Identification Guide to the Ant Genera of the World. Harvard University Press, Cambridge, MA. 222 pp.

Bolton, B. 1995. A New General Catalog of the Ants of the World. Harvard University Press, Cambridge, MA. 504 pp.

Calcaterra, L. A., J. A. Briano, and D. F. Williams. 2000. New host for the parasitic ant *Solenopsis daguerrei* (Hymenoptera: Formicidae) in Argentina. Florida Entomol. 83: 363-365.

Davis, L. R., and M. Deyrup. 2006. *Solenopsis phoretica*, a new species of apparently parasitic ant from Florida (Hymenoptera: Formicidae). Florida Entomol. 89: 141-143.

Ettershank, G. 1966. A generic revision of the world Myrmicinae related to *Solenopsis* and *Pheidologeton* (Hymenoptera: Formicidae). Australian J. Zool. 14: 73-171.

Hölldobler, B., and E. O. Wilson. 1990. The Ants. Harvard University Press, Cambridge, MA. 732 pp.

Lack, A. J., C. Whitfoord, P. G. H. Evans, and A. James. 1998. Dominica: Nature Island of the Caribbean. 5: Illustrated Flora. Ministry of Tourism, Dominica. 88 pp. + 76 pp. illustrations.

Wilson, E. O. 2003. *Pheidole* in the New World: a Dominant, Hyperdiverse Ant Genus. Harvard University Press, Cambridge, MA. 794 pp.