

SOCIOBIOLOGY

Vol. 9, No. 2, 1984

A Revision of the genus *Paratrechina* (Hymenoptera: Formicidae) of the Continental United States

To AntBase.org
Jan. 2008

by
James C. Trager



TABLE OF CONTENTS

Chapter	Page
I Introduction.....	51
II Nomenclatural History and Affinities.....	53
III Methods, Measurements and Abbreviations.....	55
IV Synonymy of the Subgenera of <i>Paratrechina</i>	57
V Generic Description.....	59
Worker.....	59
Queen.....	61
Male.....	62
VI Identification of <i>Paratrechina</i> of the United States.....	63
Preface to Keys.....	63
Key to Workers.....	65
Key to Males.....	68
VII Format of Species Descriptions.....	71
VIII <i>Vividula</i> Complex.....	75
Diagnosis of Complex.....	75
<i>Paratrechina vividula</i>	75
<i>Paratrechina terricola</i>	81
IX <i>Parvula</i> Complex.....	88
Diagnosis of Complex.....	88
<i>Paratrechina concinna</i> , New Species.....	88
<i>Paratrechina faisonensis</i>	93
<i>Paratrechina flavipes</i>	97
<i>Paratrechina parvula</i>	104
<i>Paratrechina wojciki</i> , New Species.....	108
<i>Paratrechina austroccidua</i> , New Species.....	113

X	Arenivaga Complex	119
	Diagnosis of Complex.....	119
	<i>Paratrechina arenivaga</i>	119
	<i>Paratrechina phantasma</i> , New Species	124
XI	Bruesii Complex.....	129
XII	Hystrix Complex.....	134
XIII	Guatemalensis Complex	139
XIV	Fulva Complex	143
	Diagnosis of Complex.....	143
	<i>Paratrechina pubens</i>	143
XV	Bourbonica Complex.....	147
XVI	Longicornis Complex.....	153
	References	160

Location of distribution maps: Fig. 49, p. 87; Fig. 50, p. 103;
Fig. 51, p. 117; Fig. 52, p. 128

I dedicate this study to the memory of Dr. William F. Buren, who first suggested the subject and gave me the initial nudging necessary to get it underway. It is my hope that this will constitute a suitable tribute to his contributions to ant taxonomy.

ABOUT THE COVER:

Workers and males of *Paratrechina vividula* gather about a drop of honey water on a laboratory bench in Gainesville, Florida. This species is a common inhabitant of landscaped areas, fallow fields and buildings in the southern U.S. The population of sexuals is at its peak in early summer, when males may be recruited to rich food sources, but apparently do not feed directly. Great variation in sclerotization, melanization and vestiture of the worker population in *Paratrechina* colonies (only minimally visible in this photograph) has lead to taxonomic difficulties which are addressed in this publication. Note the abrupt curvature near the base of the male funiculus (more specifically antennal segment IV), characteristic of *P. vividula* and its sister species *terricola*.

A Revision of the genus *Paratrechina* (Hymenoptera: Formicidae) of the Continental United States^{1, 2}

by
James C. Trager³

ABSTRACT

The taxonomy of the ant genus *Paratrechina* in the continental United States is revised. The identity of previously published taxa is determined, and the workers and males are redescribed. The workers and males of the new species *P. concinna*, *P. phantasma* and *P. wojciki* from the Southeast and *P. austroccidua* and *P. hystrix* from the Southwest are described. *P. fulva pubens*, *P. melanderi arenivaga* and *P. arenivaga faisonensis* are raised to full species. *P. parvula grandula* is transferred to *Conomyrma*. The establishment of *P. flavipes* of temperate eastern Asia, in Pennsylvania and New York, and of *P. guatemalensis* of the Caribbean region, in southern Florida, is reported for the first time. The synonymy of *P. kincaidi* with *P. vividula* and the sibling species relationship of *vividula* to *P. terricola* are discussed, as are the reasons for resurrecting Buckley's name *terricola* for the species described by Wheeler as *melanderi*. Biological and distributional data for each species are also presented. Keys are given for the workers and males of all species.

CHAPTER I INTRODUCTION

Paratrechina is a common though often inconspicuous element of the ant faunas of almost all continental areas habitable by ants. Native species are lacking or nearly so from Europe (Brown, 1973) and colder temperate, Mediterranean climate and desert regions of other continents. The genus is most diverse in tropical Asia and Australia, which together have the greatest number of species groups, including one-third of the

¹Florida Agricultural Experiment Station Journal Series No. 5710.

²Extracted from a dissertation presented to the Graduate School of the University of Florida in partial fulfillment of the requirements for the Degree of Doctor of Philosophy.

³Department of Entomology and Nematology, University of Florida, Gainesville, Florida 32611.

described forms (Emery, 1925). Based on my acquaintance with the New World forms, I estimate that perhaps three-fourths of the true number of species has been described. For the Old World tropics, the proportion may be much smaller.

A number of species have been transported by shipping activity to localities well beyond their places of origin. Some of these species have attained at least minor pest status through their invasion of nurseries, greenhouses, laboratories, insectaries, homes, and other buildings (Smith, 1965). Foremost among such species in the New World are *longicornis*, *vididula*, *bourbonica*, and members of the *fulva* group. Other species have been transported by man and become established in new localities, but the taxonomy of the genus is so poorly known at present that it would be impossible to state with certainty which species are involved. Wilson and Taylor (1967) discussed the taxonomic difficulties in *Paratrechina* with special reference to Polynesia.

This study is the first attempt to monograph *Paratrechina* and constitutes Part I of a worldwide revision. I expect that this will lend a degree of clarity to a group for which the taxonomy "looks very much like a hopeless muddle" (Creighton, 1950). Apart from the purely academic interest in unravelling the taxonomic tangle of this difficult genus, it is hoped that the keys and descriptions will provide nursery and quarantine inspectors and other applied entomologists a means to readily identify the species of this frequently encountered genus.

In the next chapter, I review the nomenclatural history of *Paratrechina* and discuss what is known about its relationships to other ant genera. In the third chapter, I describe the methods and equipment used in examining the specimens studied and give a complete listing of abbreviations used in the text. In Chapter IV, I synonymize the subgenera of *Paratrechina* and give my reasons for doing so. In Chapter V, I describe the workers, males, and queens of *Paratrechina* at the generic level. Chapter VI contains a list of the U.S. species of *Paratrechina* and those introduced to the region, as well as their authors and known synonyms. Also in Chapter VI are keys to workers and males of these species. Chapter VII establishes the format of the treatment of each species and includes my reasons for the use of the term "complex" for groups of related species. The remainder of the chapters contain the descriptions of the species of each complex. A brief diagnosis of the complex treated is at the beginning of each of these chapters.

CHAPTER II NOMENCLATURAL HISTORY AND AFFINITIES

The name *Paratrechina* was first used in the combination *P. currens* Motschulsky (1863). The species name was not used for over sixty years, until Emery (1925) published his treatise on the formicine genera. In the interim, the great majority of species known today were described and were assigned to *Prenolepis* Mayr (1862), as was *Formica longicornis* Latreille (1802), the senior synonym of Motschulsky's species.

In 1906, Emery published a note in which he erected the subgenera *Prenolepis* s.s., *Euprenolepis*, and *Nylanderia*. *Nylanderia* was construed to contain all of what are now called *Paratrechina* that were known at that time. *Euprenolepis* is not in the scope of this paper. *Prenolepis* and *Nylanderia* are further discussed presently.

Prenolepis s.s. was distinguished by Emery in that all castes lack erect pilosity on the scapes and tibiae and instead possess long, dense, oblique (i.e., subdecumbent) pubescence on these segments. In workers, the mesothorax is extremely constricted, such that it is less than half as broad as the pronotum in dorsal view. The pronotum and propodeum are broad and globular, yielding in *Prenolepis* workers a "dumbbell-shaped" mesosoma. Later, Emery (1925) separated *Prenolepis* s. s. as a full genus and added to its distinguishing features the placement of the eyes posterior to the middle of the head and the possession of cerci by the males. In North America, at least, the short scape of the males of *Prenolepis* (about equal to or less than length of head) and the length of the females (10 or more mm) further distinguish it from our species of *Paratrechina*.

In 1925, Emery established the genus *Paratrechina* with *Paratrechina* and *Nylanderia* as subgenera, containing *longicornis* and the remainder of the species, respectively. Wheeler (1936) elevated *Nylanderia* to generic level. Though Donisthorpe (1943) and Kempf (1972) followed this arrangement in major taxonomic publications, most other authors have used Emery's (1925) arrangement. Donisthorpe (1947) proposed a third subgenus, *Paraparatrechina*, to include his New Guinean species *pallida*. Brown (1973) and Snelling (1981) listed *Nylanderia* as a synonym of *Paratrechina* without discussion. The validity of the subgenera is discussed in Chapter IV.

Paratrechina is said to be most closely related to *Prenolepis*, *Pseudolasius*, *Lasius* and *Formica* (Wilson, 1975)—to the last two certainly more distantly than to the first. Unfortunately, our knowledge of *Pseudolasius* is insufficient to state the degree of relatedness to *Paratrechina*. Future investigation should be directed toward reconstruction of the phylogeny of these apparently related genera and the rest of the Formicinae.

The relationship of *Paratrechina* and *Prenolepis* is clear. Together they form a monophyletic group. The larvae of these genera share a plump, dolichoderoid appearance, indistinct segmentation, lack of a "neck," and relatively few and short head hairs (G. C. and J. Wheeler, 1953). These last authors place the two genera in Forel's tribe Prenolepidini. (The larvae of

Brachymyrmex appear related to the tribe Prenolepidini, but other characters suggest differently and the larval similarities may be due to convergence.) Both prenolepidine genera have nude pupae, an unusual trait in Formicinae. In addition, the workers show similar reduced sculpture and restricted patterns of thoracic pilosity (and often of pubescence). The single-toothed male mandibles and 5- or 6-toothed female mandibles of the two are virtually indistinguishable, as is the structure of their proventriculi (Eisner, 1957). Workers of both groups have a reduced mesothorax, a trait much further developed in *Prenolepis*. Finally, both groups contain, with well-known exceptions, mostly smallish, soil or litter-dwelling inhabitants of more or less undisturbed mesic areas. All known species in this pair of genera can readily be placed in one genus or the other.

CHAPTER III METHODS, MEASUREMENTS AND ABBREVIATIONS

About one-third of the specimens studied were collected by myself in Florida, primarily in the vicinity of Gainesville and at Archbold Biological Station in Highlands County. The remainder of the specimens were obtained by loan or gift from the collections listed below, thanks to the cooperation of the individuals listed beside each collection (Table 1).

Table 1. Reference collections of *Paratrechina*, abbreviations for the collections used in the text, and individuals responsible for the loan or gift of specimens.

AMNH	American Museum of Natural History	M. Favreau
BMNH	British Museum (Natural History)	B. Bolton
CAF	Private Collection	A. Francoeur
CAS	California Academy of Sciences	W. Pulawski
FEM	Frost Entomological Museum	K. Kim
FSCA	Florida State Collection of Arthropods	E. Nickerson
HM	Helsingfors Zoological Museum	O. Biström
GJW	Private Collection	G. & J. Wheeler
JCT	Private Collection	J. Trager
JFL	Private Collection	J. Lynch
LACM	Natural History Museum of Los Angeles County	R. Snelling
MCZ	Harvard Museum of Comparative Zoology	A. Newton
MHNG	Muséum d' Histoire Naturelle, Geneva	C. Besuchet
NCSU	North Carolina State University	C. Parron
PSW	Private Collection	P. Ward
REG	Private Collection	R. Gregg
RJL	Private Collection	R. Lavigne
RMC	Private Collection	R. Chew
RWK	Private Collection	R. Klein
SBSK (MDB)	State Biological Survey of Kansas and Private Collection	M. DuBois
TPN	Private Collection	T. Nuhn
TTU	Texas Tech University	O. Francke
USNM	United States National Museum	D. Smith
UARK	University of Arkansas	C. Carlton
USDA (DPW)	USDA Fire Ant Project Collection and Private Collection	D. Wojcik
WFB	Private Collection	W. Buren
WMK	Private Collection	W. McKay

Point-mounted specimens were measured at 50X with an ocular micrometer. A computer program was used to convert the measurements from micrometer units to the nearest 0.01 mm equivalent, to calculate indices of relationship between the length of certain body parts and to calculate summary statistics. Only summarized, rounded-off, data are

presented in the text, but the full raw data set has been reproduced in Appendix A of Trager (1984). All measurements are reported in mm. Measurements and counts taken were as follows:

TL—HL + WL + GL (See below)

HL—Head length in full face view from a line perpendicular to sagittal axis and tangent to the posteriormost parts of the rear border to such a line tangent to the anteriormost parts of the clypeal border

HW—Maximum width of head (including eyes) in full face view

EL—Maximum diameter of compound eye

SL—Length of scape (chord if curved) from base (exclusive of basal radicle) to its terminus

PW—Maximum width of pronotum

WL—Weber's length of thorax, from anterior edge of pronotum (exclusive of anterior flange) to posterior corner of metapleuron)

MCL—Length (chord if curved) of largest pronotal macrochaeta

FL—Length of fore femur

GL—Length of gaster in dorsal view (exclusive of cone of acidopore in worker or of genitalia in males)

SM—Number of standing barbulate macrochaetae on scape

PM—Number of barbulate macrochaetae on pronotum to one side of sagittal plane

MM—Number of barbulate macrochaetae on mesonotum to one side of sagittal plane

$$CI = \frac{HW \times 100}{HL}$$

$$OI = \frac{EL \times 100}{HL}$$

$$SI = \frac{SL \times 100}{HL}$$

$$FI = \frac{FL \times 100}{HL}$$

Illustrations were prepared with the aid of a Nikon SMZ10 stereo dissecting microscope with drawing tube attachment. All are diagrammatic and are modelled on more than one specimen; proportions and macrochaetal counts were drawn at or near their mean values for the species. The pubescence patterns indicate on the head drawings are actual setal maps of the middorsal portion of the head of a specimen chosen for its "typical" pubescence.

Slide preparations of genitalia prepared by Dr. Arnold Van Pelt, loaned by USNM, were consulted in preparation of the drawings of the genitalia of *faisonensis* and *arenivaga*. The drawings of the genitalia of *guatemalensis* and *phantasma* are based on my own dissections but were positioned as though based on slide mounts.

CHAPTER IV
SYNONYMY OF THE SUBGENERA OF *PARATRECHINA*

As has been shown by Wilson (1955) and Snelling (1976), subgenera may be useful taxonomic tools when they represent clearcut phyletic trends comprising major monophyletic groupings of species within a genus. It seems clear to me that the named subgenera of *Paratrechina* do not live up to this criterion. Indeed, some of the species groups described in 1925 by Emery such as his *caledonica* group, and *microps* and its relatives in the Caribbean region come closer to meeting it, but it would be premature to describe subgenera for such groups without a better knowledge of the world fauna.

I have studied workers of *longicornis*, *pallida* and *cisipa* to determine the their relationship and to determine the validity of the subgenera. *Longicornis* and *pallida* are the sole members of the subgenera *Paratrechina* and *Paraparatrechina*, respectively, and *cisipa* is a member of *Nylanderia* which purportedly has some resemblance to *longicornis* (Smith and Lavigne, 1973). *Longicornis* is an unusual member of the genus in many respects, including its large eyes, great elongation of the scapes and tibiae, reduction of pilosity, unusual microsculpture (see Fig.

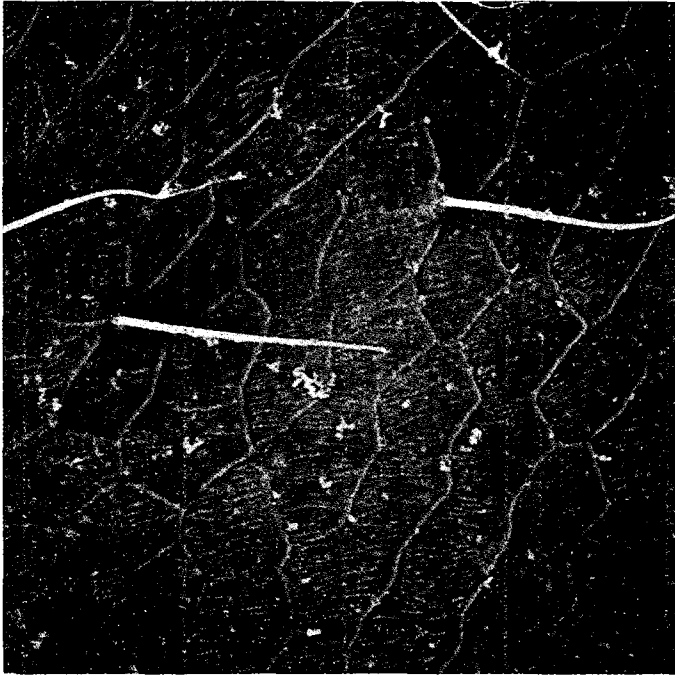


Fig. 1. Cephalic microsculpture of *longicornis* worker.

1 and description) and unique biology. *Pallida* appears related to *longicornis*. *Pallida*, too, has 5-tooth mandibles, long scapes and tibiae and even longer maxillary palps, further reduced pilosity (except that there are two pairs of macrochaetae on the propodeum not found on *longicornis*), fine very short pubescence, and slight bluish reflections. The thorax of the two species is of virtually identical conformation. The single type specimen of *pallida* available to me could not be subjected to study in the SEM to determine microsculptural details, but the macroscopic appearance of the integument and the thick, blunt appearance of the macrochaetae are similar to those of *longicornis*.

Smith and Lavigne (1973) described *cisipa* from Puerto Rico, noting that its elongated, flattened thorax and long legs and scapes resembled those of *longicornis* but that its 6-toothed mandibles and bristly scapes forced them to place *cisipa* in *Nylanderia*. In fact, *cisipa*, while not related to *longicornis*, is not close to any other member of *Paratrechina* either. Some *cisipa* workers I have seen (RJL, RWK), including one in the type colony, have 5-toothed mandibles. The bristles on the scapes and tibiae are not the usual barbulate macrochaetae but are in fact thickened, oblique pubescence very much like that of *Prenolepis*. Interestingly, the eyes of *cisipa* are placed further back on the head than usual for a *Paratrechina* (but not as far back as in *Prenolepis*), and the mesothorax is quite constricted. On the other hand, the lack of cerci on the male and the pattern of thoracic pilosity on the worker of *cisipa* are typical of *Paratrechina*. The microsculpture and nature of the barbulation of the macrochaetae are as found in "*Nylanderia*", but this species cannot otherwise be too closely linked to that grouping of species.

Thus, *longicornis* and *pallida* appear to form a real species-group but hardly constitute a major phyletic trend. *Nylanderia* is a paraphyletic group including all the remaining diversity within the genus, including some species-groups at least as removed phenetically from the mainstream of the genus as are *longicornis* and *pallida*. I, therefore, consider the subgenera *Parapatrechina* and *Nylanderia* synonymous with *Paratrechina* and recommend that the names no longer be used. The only feasible alternative is a more restricted *Nylanderia* and the erection of several new subgenera, but this must await further study.

CHAPTER V
GENERIC DESCRIPTION

The males and workers of *Paratrechina* have been characterized by M. R. Smith (1943, 1947, 1965). Some important points from his diagnoses are included below. In addition, characters not discussed by him and a description of the female are included.

Worker

Small, TL 1.5-3.5 mm (4 mm in one Australian form). Antenna 12-segmented arising from a fossa placed close to but not confluent with rear border of clypeus; scape longer than head, usually with two to four rows of subdecumbent to erect barbulate macrochaetae (as in Fig. 2) (lacking in *parvula*, *opaca*, *longicornis*, etc.); funiculus filiform to very weakly clavate, segments longer than broad, terminal one almost twice as long as the others. Eye typically well-developed, about one/fifth or more as long as head (much smaller in subterranean *microps* group of Caribbean region, *caledonica*, etc.). Ocelli usually indistinct, or absent; often only median ocellus is visible. Mandible striate 6- or 5-toothed; typical dentition as in

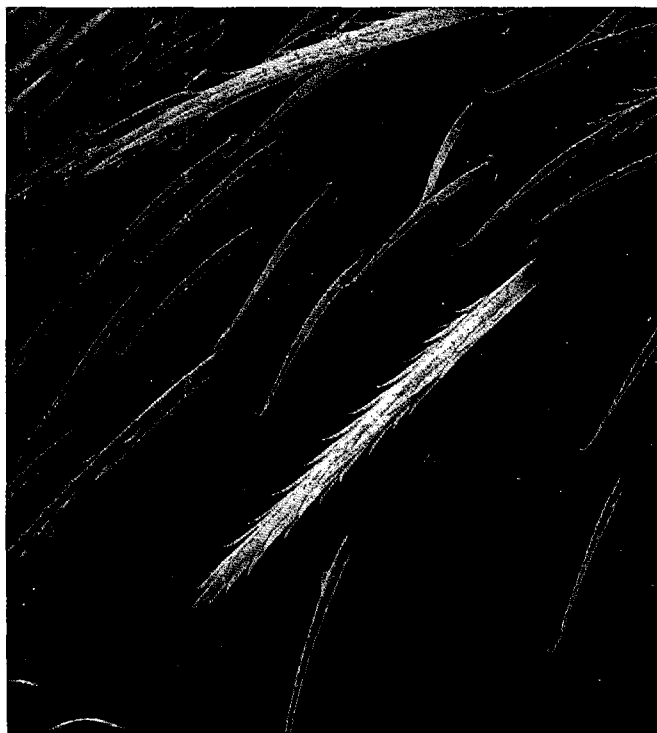


Fig. 2. Cephalic macrochaeta of *faisonensis* male.

vividula (Fig. 4) (Smith, 1939, was in error in stating that *myops* had four mandibular teeth.) Palpal formula 6, 4; palpal segments most often subequal in length. Clypeus bears 6-20 slender, barbed macrochaetae of varying lengths and a smoothly rounded median longitudinal angle. Clypeus emarginate or evenly rounded anteriorly; in side view with a declinate anterior face. Frontal carinae very short, extending little beyond antennal fossae, thus, the frontal area often indicated only by its possession of four longitudinal rows of regularly spaced thick, barbulate macrochaetae (the inner two, often, and the outer rows, occasionally, reduced to a pair or so of bristles); the rows extending back through the ocellar area to the rear border. Sides of head in full face view nearly parallel, or more often, rounded and weakly convergent anteriorly; rarely broader before than behind the eyes. Sides of head with macrochaetae shorter than those on preocellar area, subdecumbent and often greatly reduced in number. Posterior border straight or rounded, often weakly emarginate medially, with somewhat longer, more curved, erect pilosity than on sides. Venter of head with fine flexuous pilosity similar to that on clypeus, or none.

Pronotum convex or subangular. Mesonotum usually nearly flat in profile, the latter with a very short anterior and posterior face in many species such that the flat dorsal surface is slightly raised above pronotum, at least anteriorly. Mesonotum somewhat reduced, about 1/2 to 3/5 as broad as pronotum seen from above. Metanotum a narrow band usually in a distinct furrow, bordered laterally by mesothoracic spiracles which are nearly dorsal in position and orientation of their openings. Pronotum and mesonotum each with two pairs of large macrochaetae like those on head (Fig. 2) and usually one or more (rarely up to 16) pairs of smaller macrochaetae on pronotum and usually one or 2 (up to 8) such ancillary pairs on mesonotum.

Propodeum weakly angular with a short, low, dorsal face, or convex and of varying height relative to thoracic dorsum. Propodeum without pilosity except in *caledonica* group, and in *glabra*, *dugasi* (Emery, 1925), *microps*, *hystrix* and *pallida*. Some *caledonica*-group species may have only one pair of macrochaetae on mesonotum. Petiole cuneate with crest varying from sharp to truncate or rounded in profile; in dorsal view, crest flat, angular or convex, only rarely notched in workers (e.g., *sakurae*). Petiole glabrous or with one or a few short erect macrochaetae on the crest.

Gaster ovate, acuminate terminally, relatively voluminous, with more or less abundant flexuous pilosity with less barbs per macrochaetae (Fig. 3) than on those of thorax. Anterior face of gastral tergite 1 impressed and overhanging petiole, concealing it partially from dorsal view. Border of impression distinctly angular. Acidopore conspicuous and conical, with a distinct corona.

Pubescence typically dense on the head and appendages, shorter and more dilute or lacking on much of thorax and gaster, the patterns of vestiture forming important diagnostic characters of some species or species-groups.

Sculpture usually limited to shallow pubigerous foveolation on head, delicate shagreening on gaster, and honeycomb-like reticulation on



Fig. 3. Abdominal macrochaeta and sculpture of *faisonensis* male.

terminal segments. Some species in *caledonica* group are heavily punctate, opaque forms which contrast strongly with the typical shining appearance (when not obscured by pubescence) of other *Paratrechina*.

Queen

In general, fitting the worker description but differing as follows. TL 4-7 mm, scape relatively shorter and with less pilosity than in conspecific workers. Eye a little larger to much larger in subterranean forms, 1/4 or more HL. Ocelli fully developed.

Thorax of normal alate formicine type. Pronotum and other dorsal surfaces invested with barbulate macrochaetae like those found on workers but not in so regular an array.

Propodeum with relatively shorter dorsal face than in worker. Petiole typically broader, sharper in profile, and often with at least a weak median notch.

Gaster much more massive and more thoroughly hiding petiole in its impressed anterior face.

Pubescence longer, thicker and more dense, usually covering entire body, except petiole and rear face of propodeum.

Male

With the important generic characters noted for females, i.e., barbate pilosity; the impressed first gastric tergite and antennal scapes longer than head. In overall size, approximating that of conspecific worker.

Mandibles well-developed, though smaller and less heavily sclerotized than in workers; with a single apical tooth and occasionally a small adjacent cleft, and one or more inconspicuous subapical denticles. Antennal scapes with fewer macrochaetae than conspecific workers or queens. Antennae 13-segmented, with conformation of segments generally resembling that of female castes.

Petiole of same conformation as in workers but broader and more blunt, sometimes notched like that of queen.

External genitalia prominent, varying greatly between species-groups and interspecifically and, thus, useful in taxonomy. Cerci (as in *Prenolepis*) lacking.

Pubescence distributed as in queens, but in length and density more like that of workers. Thoracic pilosity usually limited to mesometanotum, rarely more generally distributed; typically sparse and decumbent on gastral dorsum, but like that of workers in structure (Fig. 3).

CHAPTER VI
IDENTIFICATION OF *PARATRECHINA* OF THE UNITED STATES**Preface to Keys**

In this chapter, I provide what will undoubtedly be the most frequently read portion of this study; the keys for identification of the workers and males of *Paratrechina* in the United States. Also included is a taxonomic synopsis of the species included in the keys and formally treated in the later chapters (see Table 2).

The key contains a number of species which occur outside of the United States but in many cases cannot be used to identify them outside of this country. There are many *Paratrechina* species not treated in this revision, which makes the use of these keys futile outside of the geographic region for which they are designed.

The characters which separate *Paratrechina* species are more subtle than those used to separate species in some other insect groups. One will not find here the simple, one-feature alternatives of older keys to *Paratrechina*. My keys assume the user has possession of a stereo dissecting microscope fitted with a calibrated ocular micrometer and of a calculator to expedite the calculation of indices. The reader is urged to read carefully the definitions of the measurements in Chapter III and the following remarks before attempting to use the keys.

Certain difficulties were encountered in taking some of the measurements, and the following comments may help the user of the keys in selecting the appropriate alternative at a given couplet (and in reading the descriptions).

The posteroventral portion of the head is excised and, thus, in certain positions obscures the front of the pronotum making it difficult or impossible to measure WL from the side. In such cases, WL was taken from a dorsal view. As a check, the measurement was taken on a number of specimens in which WL was visible from both views. The two measurements never differed by more than 0.01 mm and usually by no more than 0.005 mm.

Macrochaeta counts proved to have certain unforeseen pitfalls. Only barbate setae of the sort shown in Figs. 2 and 3 were counted. These were usually discerned by their greater length and diameter and their different color (usually darker than pubescence and body color), but in some species the macrochaetae are nearly the color of the substrate and are rather short. Compounding the problem in such cases is that there may occur simple setae of nearly the same macroscopic appearance. Through observation at high magnification and checking back at lower power, I learned to discriminate these setal types. The discrimination turned out to have a slightly different "Gestalt" for each of the "difficult" species. In addition, the macrochaetae are all visible only at certain angles of viewing and illumination or where SM is large, only by rotating the scape. Though this particular count is undoubtedly the one for which the most errors were made, I feel confident that the high end of the ranges reported are close to correct. The count recorded was the highest

Table 2. Synopsis of taxonomy and authorship of U.S. *Paratrechina*.

Vividula Complex

- vividula* (Nylander)
- =*kincaidi* (Wheeler) New Synonymy
- terricola* (Buckley) stat. n.
- =*melanderi* (Wheeler) New Synonymy

Parvula Complex

- concinna* sp. n.
- faisonensis* (Forel) stat. n.
- flavipes* (F. Smith)
- parvula* (Mayr)
- wojciki* sp. n.
- austroccidua* sp. n.

Arenivaga Complex

- arenivaga* (Wheeler) stat. n.
- phantasma* sp. n.

Bruesii Complex

- bruesii* (Wheeler)

Hystrix Complex

- hystrix* sp. n.

Complex Guatemalensis

- guatemalensis* (Forel)

Complex Fulva

- pubens* (Forel) stat. n.

Complex Bourbonica

- bourbonica* (Forel)

Complex Longicornis

- longicornis* (Latreille)

Excluded from *Paratrechina*

- parvula grandula* (Forel)
- =becomes *Conomyrma grandula* (Forel) comb. n.

repeatable one from among either of the two scapes resulting in an inherent bias against low counts, whether natural or due to damage. The scapes of a single specimen often differed in SM, even on fresh, undamaged specimens.

PM and MM also proved to be asymmetrical in many specimens. Always present (or at least indicated by a socket) were the 8 largest hairs (the "major thoracic macrochaetae"), but the number of ancillaries might be different on each side. The highest repeatable count of hairs and/or unmistakable hair-sockets was the one recorded. On occasion, smaller barbate setae resembled pubescence, but I learned to discriminate these as above. The discrimination was much easier on pale species with dark macrochaetae, and more counting errors were certainly made on more dark species.

I refer loosely to the middle tagma of ants as the thorax which is the current usage by many hymenopterists for the homologous body region of ants and other Hymenoptera. In practice, there is little need to refer specifically to the thorax and propodeum collectively, for which more

accurate terms would be alitrunk or mesosoma.

Pilosity refers to the large, standing, barbulate setae (macrochaetae) characteristic of this group (though by no means exclusive to it). The unbarbed macrochaetae on the parameres of males are also referred to as pilosity. Simple, appressed to subdecumbent setae of small diameter are referred to as *pubescence*. Otherwise terminology used here is that which has become standard in recent revisions of formicine genera (Wilson, 1955; Wing, 1968; Bolton, 1973; Snelling, 1976).

Key to Workers

- 1a. Species of eastern U.S. and Great Plains, including plains and woodlands of east Texas 2
- 1b. Species of Southwest including west Texas mountains and deserts 14
- 2a. Scapes and legs unusually long (SI > 165, FI > 115); weakly shining black or gray with bluish reflections; with sparse, short, barely visible pubescence; near human dwellings, Gulf Coast states, urban areas, sporadic elsewhere *longicornis*
- 2b. Scapes and legs of usual proportions (SI < 130, FI < 105); colored variously but never with bluish reflections; shiny, or if dull, this due to dense pubescence; habitat various 3
- 3a. Yellow to pale whitish; nests in sandy soil or dunes with entrances surrounded by conspicuous crater of subsoil in clearings between vegetation 14
- 3b. Uniformly dark-colored or bicolored; nests inconspicuous; in more mesic microhabitats under moss, rocks, logs, in litter; or near man-made structures (*parvula* may have crater nests in sandy areas but is never uniformly yellow) 5
- 4a. Yellow with gaster infuscated posteriorly; thoracic pilosity flexuous and dark brown (notably darker than body color); scapes with 5-17 (usually 7-12) macrochaetae and suberect pubescence; New Jersey, Florida, Gulf Coast, sandhills of Midwest *arenivaga*
- 4b. Yellow or whitish with gaster, at most, only slightly darker, thoracic pilosity nearly straight, nearly the same color or only slightly darker than body color; scapes with 0-4 (usually 1-3) standing macrochaetae and short, appressed pubescence (Florida scrub and dunes) *phantasma*
- 5a. Scapes with not more than 4 standing macrochaetae 6
- 5b. Scapes with at least 4 (usually 7 or more) standing macrochaetae 7

- 6a. Typically bicolored, with thorax yellowish to reddish-brown, head and gaster darker; middle and hind coxae pale, much lighter than fore coxae or rest of legs; scapes with 1-4 suberect macrochaetae; in full face view eyes reaching sides of head or failing to do so by 1 or 2 facet-widths; small (HL usually 0.51-0.57); (Florida) *wojciki*
- 6b. Body typically uniform dark brown (at most weakly bicolored); appendages somewhat lighter or even yellowish, but middle and hind coxae only rarely contrastingly paler than fore coxae; scapes always lacking standing barbulate macrochaetae; in full face view outer edge of eyes failing to reach sides of head by about 1/4 their width; larger (HL usually ≥ 0.60) (eastern U.S.) *parvula*
- 7a. Thorax and gaster mostly covered with pubescence or lacking it only on pleura and disk of pronotum; dull 8
- 7b. Thorax and gaster with greatly reduced pubescence; shiny 10
- 8a. Body light reddish-brown with slender flexuous light brown pilosity (Fig. 33) *pubens*
- 8b. Body dull brown to nearly black or if faded, pilosity shorter, stouter, straighter, and dark (Figs. 31 and 34) 9
- 9a. Uniform dark brown or black, thoracic macrochaetae thick, often nearly straight, relatively short and abundant (PM 5-15); entire body pubescent; large (HL usually 0.70-0.81); Florida, disturbed habitats, mangrove islands; occasional along Gulf Coast, in greenhouses, etc., elsewhere *bourbonica*
- 9b. Yellowish-brown to dark brown with middle and hind coxae distinctly lighter; thoracic macrochaetae more slender, weakly flexuous and tapering, longer (at least relatively) and less abundant (PM 3-7); disk and sometimes sides of pronotum and pleura glabrous and shining; smaller (HL usually 0.56-0.66); Homestead, Florida. *guatemalensis*
- 10a. Uniform dark brown with appendages somewhat lighter; propodeum with a dense row of longitudinally aligned pubescence along anterior edge; mesonotum and front of pronotum with at least some dilute pubescence; head with shallow pubigerous puncta and dense pubescence which is mostly aligned with long axis of head; marshes, ditches, damp pastures, swamp edges; in rotten wood, cow dung or tussocks; Florida, Alabama, Georgia, Carolinas *concinna*
- 10b. Middle and hind coxae and/or thorax and legs lighter than gaster and head; pubescence very sparse or absent from promesonotum and often from propodeum; head smooth and shining or irregularly and weakly punctuate beneath pubescence;

- cephalic pubescence may be very dilute with some setae markedly not parallel to long axis of head; not typically inhabiting marshes or poorly-drained pastures..... 11
- 11a. Cephalic pubescence dilute; preoccipital area with most spaces between setae as wide as length of setae or wider, anterior 1/2 of head (except, perhaps, frons) lacking pubescence..... 12
- 11b. Cephalic pubescence denser; preoccipital area with more spaces between setae no wider than length of setae, usually less..... 13
- 12a. Eye about 1/4 HL or slightly larger (OI usually 24-47) inhabiting old fields, cultivated areas, gardens, disturbed habitats across southern half of U.S. or greenhouses, etc., further north; also in native scrub vegetation in southern Texas, New Mexico, northern Mexico *vividula*
- 12b. Eye smaller (OI 20-24), under stones, moss clumps or bark in forest openings and other open or disturbed habitats in Texas and Plains states, and at lower elevations in Southwest mountains, Arkansas and Tennessee..... *terricola*
- NOTE: The workers of *terricola* and *vividula* cannot always be reliably separated on morphological grounds. See male key for separatory characters. See also descriptions of these two species.
- 13a. Thorax, legs, antennae yellow; head averaging broader (CI usually 85-90) and with rounded sides (Fig. 16); wooded areas, Pittsburg, Philadelphia, Long Island..... *flavipes*
- 13b. Uniform brown or with slightly lighter head and thorax; middle and hind coxae usually markedly lighter than fore coxae; head narrower (CI usually 83-87) and less convex-sided (Fig. 15); mesic woodlands, southeastern U.S., north along the Atlantic coastal plain to southern New Jersey..... *faisonensis*
- 14a. Scapes and legs very long and thin (SI > 165, FI > 115), Gulf Coast, sporadic elsewhere..... *longicornis*
- 14b. Scapes and legs of more usual length (SI < 130, FI < 105)... 15
- 15a. Cephalic pubescence dense, partially obscuring the sheen of the integument beneath; the pubescence arising from fine puncta, weak bluish reflections often present on head and pronotum; pronotum angular, with short, steep anterior face and longer, flattened or concave dorsal face (Fig. 17); mid-elevation woodlands, mountains of Southwest, Mexico..... *austroccidua*
- 15b. Cephalic pubescence very short, dilute or absent, the integument strongly shining and easily seen between the setae; pronotum convex in profile, or if angular only weakly so and otherwise not fitting above description..... 16

- 16a. $SM < 10$, $PM < 7$, $HL < 0.65$ *terricola* or *vividula*, see couplet 12
- 16b. $SM > 13$, $PM > 7$, $HL > 0.65$ 17
- 17a. Brown to dark brown, or if partly yellowish then with notably darker pleura, propodeum and gaster; SM 13-19, PM 7-11; desert washes and riparian woodlands, Mexico and southern parts of adjacent Texas, New Mexico and Arizona *bruesii*
- 17b. Uniform yellow to yellowish brown with abundant black pilosity; SM 21-29; PM usually 12-16; deserts of east-central California, Nevada and Utah *hystrix*

Key to Males

- 1a. Parameres broad at apex, subrectangular or diamantiform (Figs. 42 and 43) 2
- 1b. Parameres conspicuously tapering toward apex, triangular or digitiform (Fig. 39-41, 44) 3
- 2a. Scapes long (SI 168-174), 3/5 or more of their length protruding beyond posterior margin of head and completely lacking standing macrochaetae; apical margin of parameres entire (Fig. 42); urban areas, sporadic elsewhere *longicornis*
- 2b. Scapes shorter (SI 128-135) a little over 1/2 of their length protruding beyond posterior margin of head, bearing 7-10 suberect macrochaetae; apical border of parameres emarginate (Fig. 43); Florida, disturbed habitats mangrove islands, occasional in greenhouses, etc., elsewhere *bourbonica*
- 3a. Scapes with 0-1 standing macrochaetae; parameres relatively short, subtriangular (Fig. 48); eastern U.S. 4
- 3b. Scapes with 4 or more standing macrochaetae; or if with less, then either a western species (see lug 14b), or an eastern one with elongate, triangular parameres and with prominent volsellar cuspides (Fig. 47) 6
- 4a. Digiti straight, lying close to aedeagus 5
- 4b. In posterior view digiti curved laterad distally (Fig. 48); scrubland and dunes of Florida *phantasma*
- 5a. Small ($TL < 1.9$); usually with 1-2 standing macrochaetae on scape; middle hind coxae distinctly paler than fore coxae; peninsular Florida *wojciki*
- 5b. Larger ($TL > 1.9$); scape lacking standing macrochaetae, middle and hind coxae usually same color as fore coxae; Midwest and eastern U.S. (except south Florida) *parvula*
- 6a. Parameres elongate, triangular, cuspides long and prominent, reaching to about 3/4 or more of the length of the aedeagus; sandy areas, Midwest, Gulf and East Coast states *arenivaga*

- 6b. Parameres variously formed; cuspides not reaching to 3/4 the length of the aedeagus, smaller and not prominent 7
- 7a. Antennal segment IV crooked or curved (Fig. 6); aedeagus in side view relatively slender and tapering but spatulate (Figs. 7 and 8) 8
- 7b. Antennal segment IV straight, aedeagus in side view tapering to a point, which may be rounded but is never spatulate..... 9
- 8a. Parameres viewed from the side tapering, triangular, rounded truncate to subacuminate, viewed from behind distinctly curved mesad, aedeagus in the form of a weakly spatulate narrow triangle which is notably shorter than the parameres (Fig. 8); southern half of U.S., disturbed areas, in greenhouses further north *vividula*
- 8b. Parameres viewed from the side tapering rapidly over their basal 1/2, then digitiform over the distal 1/2, from behind only weakly curved mesad, or straight; aedeagus with distal portion drawn out into a thin blade with a broadened up-curved terminus, extending well beyond parameres (Fig. 7); Arizona, New Mexico, Texas, Louisiana, Arkansas, Tennessee, Central Plains states *terricola*
- 9a. Dark species with at least gaster nearly black, head and thorax piceous brown or darker, and appendages dark brown; larger spp. (HL > 0.60) 10
- 9b. Lighter in color; or if nearly black, then with brownish-yellow antennae and legs, or pale middle and hind coxae, and overall size is smaller (HL < 0.57) 11
- 10a. Propodeum and gaster elongate (Fig. 39); scapes usually with 7-10 macrochaetae; parameres strongly tapering basally, then slender and digitiform over most of their length, notably longer than volsellae and aedeagus but not concealing the latter entirely in side view; Mexican border region, south to Hidalgo, Nayarit, also Baja California Sur..... *bruesii*
- 10b. Body of more usual conformation, gaster short (Fig. 41); scapes with 5-7 macrochaetae, parameres triangular, as long or a little longer than volsellae and aedeagus and concealing the latter in side view; Florida, Georgia, Carolinas *concinna*
- 11a. Seen from behind, digiti straight and lying parallel to aedeagus..... 12
- 11b. Seen from behind, digiti notably curved laterad distally (Fig. 46); Homestead, Florida (also Antilles, Central and Northern South America, Cocos Islands) *guatemalensis*
- 12a. Scapes with 6 or more (usually 8-10) standing macrochaetae 10
- 12b. Scapes with 6 or less (usually 1-5) standing macrochaetae ... 14

- 13a. Body densely pubescent; pale reddish-brown; eye large (OI > 40); parameres with more than 30 long blondish macrochaetae forming a dense fringe (Fig. 44); Miami, Florida, in greenhouses further north (also Antilles) *pubens*
- 13b. Body nearly free of pubescence; shiny yellowish-brown; eye smaller (OI < 32); parameres with about 15 brown, slender macrochaetae of varying lengths which do *not* form a dense fringe (Fig. 40) *hystrix*
- 14a. Scapes with 4-7 standing macrochaetae; eastern states 15
- 14b. Scapes with 2-3 standing macrochaetae; Southwest and Mexican mountains *austroccidua*
- 15a. Uniform dark brown to nearly black or less often gaster slightly darker than the blackish-yellow thorax and head; appendages yellowish-brown; wooded areas near Philadelphia and Pittsburg, Pennsylvania, and Long Island, ~~also D.C. area, Cleveland OH~~ *flavipes*
- 15b. Thorax and usually the head notably lighter brown than the dark brown gaster; middle and hind coxae pale relative to fore coxae and remainder of leg segments; woodlands of southeastern U.S. north to New Jersey pine barrens. *faisonensis*

CHAPTER VII FORMAT OF TAXONOMIC TREATMENT OF THE SPECIES

In the following chapters, I describe the 11 Nearctic *Paratrechina* species and the five introduced into the region. I have seen a few series I cannot place, in every case consisting of only a few workers. Thus, it has been possible for me to identify virtually all Nearctic *Paratrechina* material in good condition as belonging to one of the 16 species treated or, at the very worst, into one of the species complexes (see below). Only workers and males are formally described. A diagnosis of the queen follows that of the conspecific male. The queens of most of the native eastern species are best distinguished by association with workers or males.

It has become increasingly common in ant systematics to describe holotypes individually, followed by a section on variation, as is standard in taxonomic works on non-social insects. This procedure is followed here although I believe members of a caste from a single colony are essentially equivalent as name-bearers for ant species in view of their close genetic relationship and obvious conspecificity. There is no known case of a mixed colony of ants comprised of species which are anything less than clearly distinct from each other. On the other hand, it often happens that not all syntypes of earlier authors are concolonial nor even conspecific. I have designated and described lectotype workers (and allolectotype males wherever possible) for species described by earlier authors. Holotypes and allotypes of the 5 species described as new are in every case progeny of a single queen to the best of my ability to determine so. Males and workers of the 5 new species have been deposited at MCZ, AMNH, USNM, LACM and FSCA.

It has been stated repeatedly that the male genitalia offer the best characters for separation of *Paratrechina* species (Creighton, 1950; and included references), and indeed, they are useful. The generally accepted corollary to this is that *Paratrechina* workers are barely or not at all distinguishable. In fact, within species complexes, some of our species are quite similar to the structure of the male genitalia while the workers are readily distinguished. The males of these species are best distinguished by non-genitalic characters.

All but 2 of our native species form a rather homogeneous group. On a world-wide basis, they appear to belong to the *vividula* group of Emery (1925). This group includes all native eastern U.S. species and 2 western species, plus a number of tropical forms not treated here. Also in the group are the introduced *flavipes* and a few other Asian forms. The workers of these species share reduced thoracic and abdominal pubescence (but, except in the *Vividula* Complex itself, fully pubescent heads); reduced thoracic pilosity; somewhat shortened legs and scapes with reduced pilosity; and fairly uniform size in the medium range for the genus. The external male genital apparatus typically includes isoceles-triangular parameres which are curved mesad and relatively simple constructed volsellae approximating the structure of those of *faisonensis* (Fig. 45).

Since only a small part of *Paratrechina* is treated here, no attempt was

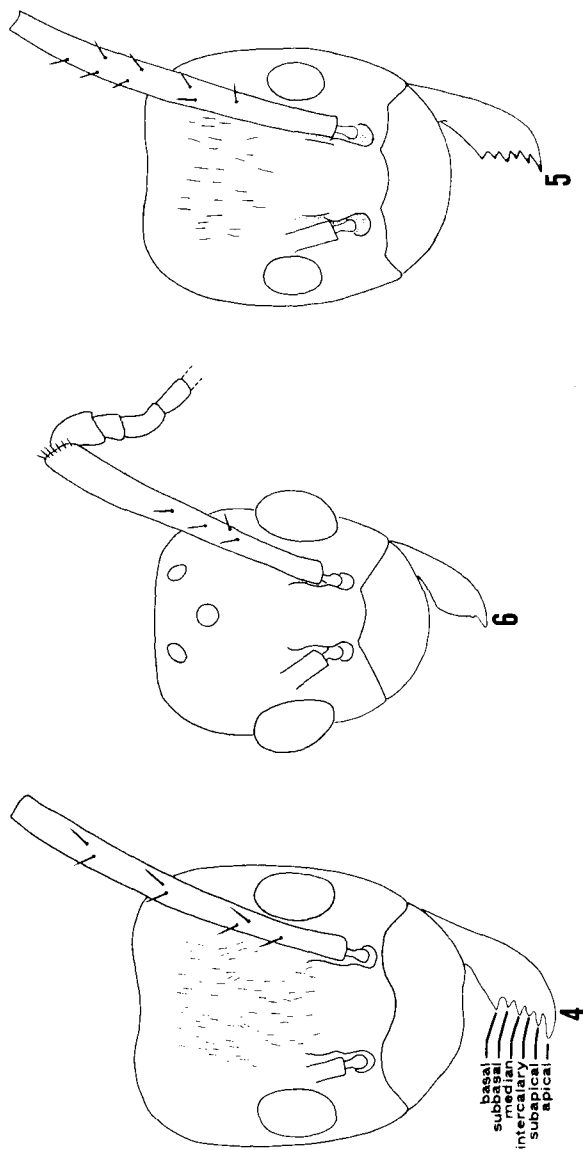


Fig. 4. Head of *vividula* worker, dorsal view.

Fig. 5. Head of *terricola* worker, dorsal view.

Fig. 6. Head of *terricola* male, dorsal view.

made to reconstruct a phylogeny for the species. Even a thorough knowledge of the all extant species would most likely yield only an approximation of the events leading to the present taxonomic structure of the genus, in view of the extinctions that have undoubtedly occurred.

All species are grouped in complexes containing groups of what I believe are ecological or geographical cognate species. The names of the complexes are simply the names of their oldest described species. Note that the term "complex" is used here to avoid confusion with the "species groups" of Emery (1925) which are larger and more heterogeneous assemblages within the genus.

Only when I have seen specimens studied by a previous author of where his description is sufficiently thorough to make certain the identification have I included any reference to a *Paratrechina* species in the synonymies presented here. Such a conservative approach undoubtedly will result in omissions but is necessitated by the following consideration: (1) Certain taxa, especially *vividula* and *fulva* have been used as catch-alls for new forms which may not even be closely related and (2) later authors have rarely bothered to study types or reliably type-compared material in making identifications. Under such circumstances, synonymies based purely on nomenclatural similarity, without reference to specimens, were considered unreliable.

I have dispensed with the usual practice of listing the collection data of all specimens studied. Instead, I have listed states from which specimens studied originated in the sections on specimens examined, have described the preferred altitudes and habitats based on my collecting experience and information gleaned from labels and the literature in the sections on natural history, and have provided range maps. A short description of the known distribution is the last item in the treatment of each species. In my opinion, these present as much of the truly useful information as a complete listing of localities but in a far more readily assimilable form. Those wishing to collect *Paratrechina* would do better to find them in previously uncollected localities than to duplicate past efforts.

The descriptions follow a format that is standard in systematic literature on ants. Except where otherwise indicated, the descriptions of the head refer to it in full face view, as in the figures. Descriptions of the thorax, on the other hand, refer to it in lateral view. Descriptions of the male genitalia, in general, refer to them as they appear, intact, on the preserved specimen. The vestiture of *vividula* is described in greatest detail; vestiture of other species is briefly described in as much as it differs from that of *vividula*.

Measurements of the type specimens are presented in the following order: TL, HL HW, SL EL, PW, MCL, WL, FL, GL, SM, PM, MM, CI, OI, SI and FL. These are listed at the start of each worker description. All measurements, counts, and indices taken are likewise listed at the start of the description of the type male, but note that PW, MCL, FL, PM and MM were not recorded for the males. In the sections on variation and in composite descriptions, the ranges of all measurements are reported at the head of the section. A complete listing of the measurements and summary

statistics, are on file in the library of the University of Florida (Trager, 1984).

The section on natural history of the species is necessarily rather short. There is little published on any of these species, including the tramps, and the observations reported are primarily my own, made mostly in Florida. The term "disturbed" has been used to characterize habitats of some species. Mild or light disturbance includes grazing activity, human foot traffic, or selective clearing of vegetation. Heavy disturbance refers to more thorough clearing of vegetation, tilling of soil, construction of buildings, and temporary flooding. It is my hope that this revision will help other investigators to more thoroughly characterize the lifeways of *Paratrechina* species.

CHAPTER VIII VIVIDULA COMPLEX

Diagnosis of Complex

Worker weakly bicolored, very shiny; cephalic pubescence sparse, limited mostly to rear 1/2 of head; scape pilosity usually subdecumbent to suberect, sometimes inconspicuous, SM usually 7 or 8. Nests in open, often disturbed habitats, under stones, logs, trash, moss clumps, etc.

Male shiny except thoracic dorsum; antennal segment IV distinctly bent or curved; parameres triangular; digitus boomerang-shaped; cuspis short; aedeagal lobes triangular with a spatulate or otherwise broadened tip.

Paratrechina vividula

(Figs. 4, 8, 10; Map-Fig. 49)

Formica vividula Nylander, 1846, Acta Soc. Fenn. 2: 900. Type loc., Botanical Garden, Helsingfors, Finland.

Tapinoma vividula (sic): F. Smith, 1858, Cat. Hym. Brit. Mus. 6: 56 (in part ?)

Prenolepis vividula: Mayr, 1861, Europ. Formicid., p. 52.

Prenolepis kincaidi Wheeler, 1906, Bull. Amer. Mus. Nat. Hist. 22: 350. Fig. 1, ♀, ♀, ♂. NEW SYNONOMY. Type loc., Bermuda.

Prenolepis vividula: Emery, 1906, Am. Soc. Ent. Belg. 50: 130-134. Figs. 1-4, ♀, ♀, ♂; Emery, 1910, Deutsch Ent. Z., p. 131. Figs. 6, 7, ♀, ♀, ♂.

Paratrechina vividula: Emery, 1925, Gen. Insectorum, Fasc. 183: 223, Creighton, 1950, Bull. Mus. Comp. Zool. Harvard 104: 409 (in part).

Diagnosis

Worker. TL usually 2.0-2.5, OI usually 24-27. A Southern species of disturbed habitats. Weakly bicolored; head and gaster yellowish-brown to piceous, thorax and appendages yellow to dark reddish-brown. Head subquadrate, sides weakly convex, subparallel. Cephalic pubescence, mostly limited to rear half of head and often rather varied in length and spacing.

Male. TL about 1.9-2.25, OI usually 38-40. Body color dingy yellow to dark brown, thorax usually lighter. Antennal segment IV curved or bent. Parameres, viewed from the rear, strongly curved mesad. Aedeagus as short or shorter than parameres, spatulate, hyaline.

Queen. Not readily distinguishable from those of *terricola*, *faisonensis* or *concinna*. In contrast to the latter two species, often bicolored as in worker. Normally has larger eyes than queen of *terricola*.

Description

Allolectotype worker. TL 2.15, HL 0.62, HW 0.53, SL 0.71, EL 0.15, PW 0.38, MCL 0.16, WL 0.77, FL 0.57, GL 0.77, SM 8, PM 4, MM 4, CI 85, OI 25, SI 115, FI 92.

In full face view, clypeus arcuate and entire. Dorsum of clypeus with sides meeting in a rounded, median angle. Head, exclusive of clypeus, subquadrate, the apparent squareness accentuated by the anterior $3/4$ of the sides being virtually parallel except where they curve inward to meet the mandibular insertions. Eyes in full face view appearing about $1/4$ as long as distance from mandibular insertions to rear border, though in fact their greatest diameter is longer. Distance between front of eye and mandibular insertion slightly greater than EL, eyes separated from sides of head by less than $1/3$ eye width. Scapes curved over basal $1/4$ of their length and over short distal section, otherwise nearly straight. Scapes of about average length for *vividula* group. No ocelli visible.

Pronotum in profile weakly angular; the anterior and dorsal faces flat, the dorsal a little longer than the anterior. Promesonotal suture clearly visible, through barely impressed. Mesonotum flat-topped with short anterior and posterior faces rising steeply to meet the dorsal face in rounded angles, the posterior face a little longer and steeper than the anterior. In profile, the propodeum nearly evenly rounded, its highest point distinctly lower than that of pronotum, the angle between its anterior and descending faces weakly obtuse. Legs of about average length for *vividula* group.

Petiole sharp-crested, cuneate in profile. In dorsal view, with straight sides weakly divergent dorsad; crest comprised of two nearly straight sides meeting in a blunt angle.

Clypeus with 12 forward-projecting macrochaetae, those closer to the front and center as long as clypeus in dorsal view, and with a few appressed hairs just to the sides of the median range. Front half of head with a few macrochaetae, those on frons somewhat shorter than longest clypeal macrochaetae and those on infraocular region much shorter and subdecumbent. Rear half of head with longer more abundant macrochaetae and pubescence composed of 4 or 5 dozen unevenly spaced appressed simple hairs of varying length. Scape macrochaetae suberect, less than half as long as greatest width of scape and of the same color as the scape; most easily seen in posterolateral view. The eight major thoracic macrochaetae weakly curved; the remaining ones half or less as long and straight. Forelegs with 3-6 macrochaetae on flexor surfaces of femora and tibiae and 1-2 on extensor surfaces. Middle and hindlegs with the reverse pattern: several hairs on extensor surfaces and 1 or 2 on flexors. Propodeum with a narrow patch of longitudinally oriented pubescence, along its front edge. Gaster with sparse, very fine, appressed hairs and the usual complement of macrochaetae.

Smooth and shining from head to first gastral tergite. Weakly shagreened posterior to this.

Head and gaster light yellowish-brown. Thorax, brownish-yellow. Mandibles light brownish-yellow with dark reddish-brown teeth. Legs and scapes yellow.

Lectotype male. TL 1.89, HL 0.52, HW 0.48, SL 0.59, EL 0.19, WL 0.81, GL 0.57, SM 4, CI 94, OI 37, SI 114.

Mandibles without subapical denticles in this specimen. Clypeus, in dorsal view with a very shallow median emargination and median raised

portion narrower than in worker, evenly rounded, subumbonate. Sides of head weakly convex, convergent anteriad, meeting the rear border through slightly obtuse rounded corners. Posteriormost portions of weakly convex rear border lie approximately behind inner border of eyes. Eyes convex, apparently about $1/3$ as long as head. Median and lateral ocelli separated by about 2X their diameter. Scapes slenderer than worker's. Antennal segment IV bent as in Fig. 6.

Petiolar crest more blunt than worker's. Petiole broader than worker's in posterior view.

Parameres about 2X as long as broad in side view, nearly triangular, but slightly recurved over distal $1/3$ of their length. In rear view, parameres sickle-shaped, curving mesad distally. Digitus shaped like a short boomerang, i.e., narrow throughout, bent downward at the middle through a broadly obtuse angle and tapering gently to a rounded terminus. Cuspides of the usual shape for *vididula* group, i.e., like an inverted bowl of a round spoon. Aedeagal lobes shorter than parameres, slender, triangular, weakly spatulate and splayed (as is normal in preserved males of this species).

Vestiture as in worker but cephalic pubescence more abundant and evenly distributed over rear half of head and on frons. Scapes less pubescent than worker's and with a row of 3, plus 1 offset, macrochaetae; these suberect, short and pale, inconspicuous as in worker. Parameres with about 25 simple, decurved, yellow macrochaetae on their outer surface.

Head, thorax, front of gaster and appendages uniform yellowish-brown. Gaster increasingly darkening brown from middle of first gastral tergite posteriad. Genitalia yellowish-brown, except aedeagal lobes, which are yellowish-hyaline.

Variation

Workers. TL 1.90-2.64, HL 0.55-0.69, HW 0.44-0.61, SL 0.61-0.77, EL 0.13-0.17, PW 0.32-0.44, MCL 0.12-0.19, WL 0.66-0.90, FL 0.46-0.62, GL 0.56-1.17, SM 6-9, PM 3-7, MM 2-5, CI 80-91, OI 21-27, SI 105-118, FI 83-93, ($n=58$).

The clypeus may have a shallow concave or flat median emargination in dorsal view. The sides of the head are usually subparallel (in eastern specimens) or are weakly convex (especially in material from Texas westward). OI is almost always greater than 24, but two series from separate localities in the Guadalupe Mountains, Texas, have unusually small eyes. These may represent a hybrid swarm of *vididula* $\times$ *terricola* or simply are aberrant. Mean OI for the species, including six specimens from Guadalupe Mountains is 25. The rear face of petiole in lateral view is often convex or subangular, rather than straight as in type, and the crest may be rounded or with a flat top and sloping sides in rear view.

The pilosity of the scapes is often longer (almost equal to width of scape) and brown, thus, much more conspicuous than in type; this is especially true in Gulf Coast and Florida material. The latter specimens have more abundant cephalic pubescence distributed further forward, especially on frons, and may have some long sparse appressed hairs on the pronotum

and mesonotum. Specimens from Arizona and California typically have the cephalic pubescence short, very fine and more evenly spaced but still limited to rear portion of head.

Western material is generally colored about as type, and most eastern material is darker. However, I have seen series from Arizona and Mississippi which are nearly uniform very dark brown, thus, recognizable only by head shape, eye size, and pattern of pubescence.

The types and one additional series of *kincaidi* from Jamaica, here synonymized with *vididula*, have color and vestiture like that of peninsular Florida specimens. European greenhouse material tends to look more like *vididula* from Texas or Northern Mexico. It should be recalled that Emery (1906) suggested Mexico as the provenience of *vididula*.

Males. TL 1.89-2.25, HL 0.46-0.55, HW 0.45-0.52, SL 0.54-0.62, EL 0.18-0.21, WL 0.69-0.85, GL 0.57-0.98, SM 4-6, CI 91-98, OI 33-42, SI 107-119, (n=11).

The mandibles of the males of *vididula* vary from unidentate to having an apical tooth, a small cleft, than a subapical denticle or two. The crook in antennal segment IV is sometimes manifest only as an even curve. Very few specimens lack the splaying of the aedeagal lobes typical of preserved males in this species. Most specimens are significantly darker than the type ranging from a dingy yellow to a dark reddish-brown, often with the thorax somewhat lighter.

Material Studied

The type material (HM) was collected in a greenhouse; Helsinki, Finland; 2-25/X/1845. Included are the lectotype, allolectotype, three paralectotype workers and a paralectotype queen (minus gaster). I have deposited conspecific material from Texas and Florida at HM. In addition, I have studied many hundreds of specimens from across the southern U.S. and Europe. The material was loaned or donated from LACM, USNM, TPN, DPW, and TTU. JCT contains Florida material. European material and types of *kincaidi* (here synonymized with *vididula*) are at MCZ. The material from TTU was particularly valuable (in addition to the suggestions of Emery, 1906), in helping me make a correct guess about the identity of *vididula* even before I saw the types, because of the large number and size of the series, many of them containing associated males. TTU also contained a similar large amount of *terricola*, thus helping to preserve the latter from being synonymized, as was my initial inclination.

Discussion

This species is very closely related to *terricola*; isolated workers cannot always be assigned to one or the other species with certainty. The larger OI and more straight-sided head will suffice to separate the great majority of *vididula* workers. The ranges of the two species are different (Fig. 49). I collected one series of *concinna*, normally uniform dark brown, which I mistook in the field for *vididula* because they were bicolored. The specimens were in all other characters typical *concinna*. Males of *vididula* are distinguished from *terricola* by genital characters as described above. Most of the *vididula* material I have seen in collections has been identified

as "*melanderi*," while most of the material identified as *vividula* previous to this study does not belong to *vividula* (see discussion of *faisonensis*). I believe this is due to the long standing dogma stated in Creighton's key (1950, p. 404), "erect hairs on the antennal scapes [are] abundant and occurring on the sides as well as the front of the scape" in *vividula*. In fact, the macrochaetae on the scape are almost always limited to two rows on the anterodorsal part of the scape comprised of 3 or 4 hairs each. The macrochaetae themselves are often inconspicuous, giving the casual observer the impression that there are fewer of them than, in fact, occur. It should be noted that the scape pilosity of *terricola* is of the same character as that of *vividula* and cannot be used as a separatory feature for the two species.

The type series of *kincaidi* (MCZ) unfortunately lacks the male that originally belonged to it, and he could not be found in the unit tray in which the series had been stored by MCZ staff who searched for it upon my request. Nevertheless, it seems unquestionable to me, based on the features of the workers and queens in the series and upon Wheeler's (1906) description and figure of the genitalia of male *kincaidi*, that *kincaidi* can be none other than a synonym of *vividula*.

Natural History

Under conditions of sufficient warmth, alates may be present at any time of year and may fly any warm day when humidity is high. In most of the range in the U.S., flights are restricted to the months May-October. Females are occasionally attracted to lights at this time of year, though flights, from the little available evidence, occur during the day. I observed a group of six males patrolling a fence post at 1300 hr in Lake Placid, Florida, in January, and I have alates of both sexes collected from the surface of a pool in a Juniper-oak woodland in Texas on 7 September (PSW).

This ant is characteristic of open, usually rather disturbed habitats including beaches, parks and other landscaped areas, crop fields, fallow fields, vacant lots, parking lots, etc. Nuhn and Wright (1979) reported finding *vividula* (as *Paratrechina* sp.) in fields and other open, disturbed habitats in North Carolina. It commonly establishes colonies in plant pots or mulch piles and is transported in these materials to greenhouses and nurseries far from the areas where it survives outside. It has apparently been established as a greenhouse ant in Europe for nearly 150 years. This ant occurs in less disturbed rangeland and other open habitat in Texas and Mexico, where it overlaps with and may occur in a mosaic distribution with its sibling species, *terricola*.

Distribution

Vividula is probably native to Texas and western Mexico, but is now found coast to coast in the southern tier of the US, and in Bermuda. In California it extends northward in the central valley to Chico, and in the east it is found outdoors at Raleigh, North Carolina. The northernmost plains-state record is from Liberal, Kansas. All more northerly US records

and European records are from indoors. I have recently seen three series from Chile.

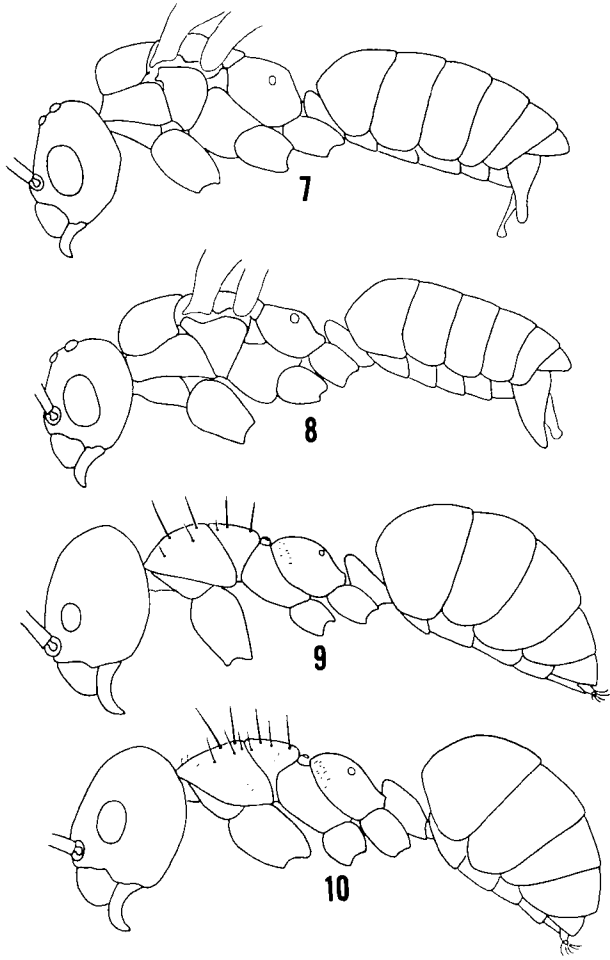


Fig. 7. Male *terricola*, lateral view.

Fig. 8. Male *vividula*, lateral view.

Fig. 9. Worker of *terricola*, lateral view.

Fig. 10. Worker of *vividula*, lateral view.

Paratrechina terricola
(Figs. 5, 6, 7; Map-Fig. 49)

Formica (Tapinoma) terricola Buckley, 1966, Proc. Ent. Soc. Phila. 6: 168. ♀, ♀, ♂. Type loc., Austin, TX.

Prenolepis melanderi Wheeler, 1903, Psyche 10: 104. Fig. 8, ♀, ♀, ♂. NEW SYNONYMY. Type loc., New Braunfels, TX (designated by Creighton, 1950).

Prenolepis (Nylanderia) vividula melanderi: Emery, 1906, Ann. Ent. Soc. Belg. 50: 132. Fig. 5, ♂, Emery, 1925, Gen. Insectorum, Fasc. 183: 223.

Paratrechina (Nylanderia) melanderi: Creighton, 1950, Bull. Mus. Comp. Zool. 104: 407; G. C. and J. Wheeler, 1953, Ann. Ent. Soc. Amer. 46: 144. P1. II, Figs. 16-20, larva.

Diagnosis

Worker. TL usually 1.9-2.4 (southern part of range), 2.2-2.7 (north), OI 20-24. A *vividula*-like species of open habitats and disturbed areas of northern Mexico, Arizona and Louisiana, north to Illinois and South Dakota and in the foothills of the Smoky Mountains. Particularly abundant in Texas. Yellowish-brown with darker head and gaster (more common south) to piceous with yellowish-brown appendages (more common north). Cephalic pubescence very sparse, head shiny. Eye small.

Male. TL 2.1-2.4, OI usually 35-37. Piceous brown to nearly black. Eye relatively small (compared to *vividula*). Parameres only weakly curved mesad. Distal portion of digitus about 2X as broad as that of aedeagus. Aedeagus longer than parameres, curved upward distally. Crook in antennal segment IV conspicuous.

Queen. Averages smaller and smaller-eyed than *vividula*, often not distinguishable.

Description

Alloneotype worker. TL 1.98, HL 0.61, HW 0.52, SL 0.68, EL 0.13, PW 0.36, MCL 0.16, WL 0.77, FL 0.54, GL 0.61, SM 8, PM 4, MM 3, CI 86, OI 22, SI 112, FI 88.

Clypeus lentiform; anterior clypeal border arcuate with a faint, narrow median concavity; rear border less strongly arched than front border, also with a small median concave emargination. Sides of head weakly convex along most of their length and slightly convergent anteriorly. Rear border of head rounded with a shallow median notch a little wider than the distance between the frontal carinae. Head of about average breadth for the species. Eyes smaller than in *vividula*, approximately their rear 1/5 overlapping the midpoint of the postmandibular head length; separated from sides of head about 1/2X eye width and from mandibular insertions by about 1 1/3X EL. Scapes weakly curved near the ends, straight over most of their length; of about the mean relative length for the species.

Pronotum broadly angular, the somewhat shorter anterior face flat and the dorsal face weakly convex. Mesonotum flat on top, sloped downward to the rear, its short anterior face meeting pronotal dorsum face at about the same angle as that between 2 faces of the pronotum. The posterior

mesonotal face shorter and much steeper than the anterior mesonotal face. Propodeum low and arched, its highest point only about as high as the rear edge of the mesonotal dorsum. Legs of about average length for the species.

Rear face of petiole obscured by anterior face of gaster, but petiole apparently cuneate with a blunt rounded crest and flat front face in profile. From above, petiolar crest is flat across the middle with rounded corners, and the sides are straight and weakly divergent dorsad.

Cephalic vestiture resembling that of small *vividula* workers but sparser than in most individuals of the latter species. Cephalic pilosity is rather short, weakly curved, and sparse, especially on the sides of the head. Cephalic pubescence sparse, widely spaced, the spaces between the hairs wider than the length of the hairs in most cases. The appressed hairs themselves are longer than those of other U.S. species (Fig. 5). Thoracic macrochaetae about half as long as the greatest width of the scape, of the same color as the scape, protruding above the finer subdecumbent pubescence which covers the scape. Ancillary thoracic macrochaetae about half as long as the shortest major macrochaetae and of the same dark brown color (pronotum) or somewhat lighter (mesonotum). Gaster covered with thick, dark brown rearward-curved macrochaetae of about even length and spacing throughout; and with some very sparse, long pubescence.

Body very shiny and smooth, except gaster which has some very fine almost undetectable (at 40X) shagreening.

Head piceous brown becoming a little lighter on the sides and clypeus. Scapes and mandibles brownish-yellow, the latter with dark brown teeth. Thorax, except mesonotum, colored like sides of head, mesonotum lighter and yellower. Legs brownish-yellow with the middle and hind coxae paler. Gaster piceous brown.

Neotype male. TL 2.27, HL 0.53, HW 0.48, SL 0.59, EL 0.18, WL 0.74, GL 1.01, SM 6, CI 92, OI 35, SI 112.

Mandible with an apical tooth, a sharp subapical denticle and a crenulate masticatory border. Anterior border of clypeus arcuate, rear border, with straight sides and a narrow median concave emargination. Sides of head convex from posterior corners to just before the eyes, straight from there to mandibular insertions. Head narrower than that of *vividula*. Rear border of head less convex than sides, about as broad as the distance between the mandibular insertions. Eyes apparently only about 1/3X HL (in fact a little longer) but strongly convex, protruding well beyond sides of head. Ocelli not large but fairly close set, median and laterals separated by about 2X their width. Scape weakly sigmoid, a little shorter than average for the species. Antennal segment IV longer than adjacent segments and distinctly bent at the middle.

Petiole cuneate with a blunt rounded crest, thicker than that of worker. In dorsal view, the crest is flat across the top and about twice as wide as that of the worker with straight sides weakly divergent dorsad; the anterior face is concave.

Genitalia distinctive, even from those of closely related *vividula*. In side view, paramere is about twice as long as its basal breadth, but it tapers quickly in the basal 1/3 of its length and is digitiform over the distal 2/3. In

posterior view, digitiform portion of parameres only slightly curved mesad (strongly so in *vividula*). Cuspis curved mesad to overlie the digitus in posterior view and is a little larger and more prominent than in *vividula*, *faisonensis*, etc. but much shorter and less prominent than in *arenivaga*. Digitus not decurved as in *vividula* but with basal edge straight. Distal portion of digitus about 2X as broad as narrowest portion of aedeagus; the former subtriangular with angles rounded. Outer face of digitus convex. Aedeagus distinctly longer than parameres; the lobes closely appressed (not splayed, as in *vividula*); conspicuously broadened dorsad and truncate distally, resembling a miniature inverted tomahawk (Fig. 7).

Pilosity finer than worker's, brown to dark brown, of approximately equal spacing and length over entire dorsal surface, except on anterior half of gaster. Pilosity virtually lacking on sides of head and of thorax. Parameres with more than 20 yellowish, weakly decurved hairs. Pubescence on head sparse not obscuring sheen of integument. Pubescence of thoracic dorsum denser.

Sculpture much as on workers, but shagreening on gaster consisting of larger, more conspicuous integumental plates.

Eyes grey. Body and appendages uniform piceous, except articulations and tarsi of legs and post-mandibular mouthparts, all of which are light yellowish-brown.

Variation

Worker. TL 1.87-3.03, HL 0.54-0.73, HW 0.44-0.63, SL 0.58-0.84, EL 0.11-0.16, PW 0.30-0.44, MCL 0.12-0.19, WL 0.65-0.93, FL 0.45-0.67, GL 0.61-1.37, SM 5-10, PM 3-6, MM 2-4, CI 80-92, OI 20-24, SI 106-118, FI 83-93, (n=42).

This species is sympatric (or more precisely, mosaically parapatric) with *arenivaga* and *parvula* in the western half of the latter two species' ranges. Interestingly, *terricola* exhibits the same tendency as these other species in having larger overall body size and a broader head in the northern and eastern parts of its range. TL of Arizona specimens averages about 1.9, that of Texas and Oklahoma specimens about 2.2, that of Kansas and South Dakota specimens about 2.4, and that of Tennessee specimens almost 2.6. CI of specimens from southern states ranges 80-87, while CI of Kansas and South Dakota specimens ranges 84-92. Correlated with size trends is a greater degree of investiture of northern material. Four of the five workers with SM 10 and five of the eight workers with SM 9 are from northern states, as are all individuals with PM>5 and MM>3. Greater density of cephalic pubescence is normal on larger specimens wherever they occur. Specimens from Arkansas (UARK), predictably, span the gap between the large, hairy, Tennessee material and the smaller, nearly glabrous Texas material.

Male. TL 2.12-2.40, HL 0.49-0.59, HW 0.46-0.54, SL 0.57-0.69, EL 0.17-0.21, WL 0.73-0.93, GL 0.85-1.05, SM 4-6, CI 90-94, OI 31-37, SI 110-117, (n=9).

These numbers describe fairly well the metric variation of *terricola* males. Most males have CI 35-37. The two specimens with CI 31 and 33 are unusually small-eyed. I have seen no *terricola* males from Arizona but

would expect them to have small eyes as do workers from that area.

The paramere is generally narrower and straighter (i.e., more digitiform) than in *vividula* males. While it is always less curved, the shape may closely resemble the weakly recurved triangular form of the *vividula* parameres. The aedeagus of *terricola* males is normally considerably longer than the parameres, and the lobes of the aedeagus are closely approximated in preserved material. In side view, in the intact animals, the aedeagus normally projects below the parameres. Occasionally, especially in Tennessee material, the aedeagus more closely resembles that of *vividula* in being shorter than the parameres and having its halves splayed and projecting above the parameres. In such cases, the structure of the volsella is that typical of *terricola*, and the specimens have in each case belonged to series in which other males have the aedeagal structure more typical of *terricola*.

Material Studied

The neotype male and alloneotype worker were designated from a nest series (TTU) labeled Texas, Real Co. 12 mi NE Leakey. Among small rocks. 19 Mar 1970. O. Francke et al. #3725. The pins bearing the neotype and alloneotype are deposited at LACM, and the remaining three pins from the series are deposited at MCZ. Other series, containing at least males and workers, from nearby Texas localities (all from TTU) are deposited at these and the other usual depositories.

Material from North Dakota and Oklahoma was from GJW. Kansas material was from JCT and SBSK. A large amount of Texas material and smaller samples from other states is at LACM and USNM. Wheeler's types of *melanderi* (here synonymized with *terricola*) are at MCZ and AMNH. A large sample of workers from Arkansas (UARK) seems to fill in the middle portion of the size and hairiness clines between Texas and Tennessee and upper midwestern specimens.

Discussion

The resurrection of Buckley's (1866) name *terricola* for the ant which has been known for 80 years as *melanderi* is based on several considerations. The first is that despite an adequate description and fine drawings accompanying Wheeler's (1903) description, the name *melanderi* has been applied recklessly to almost every native species of nearctic *Paratrechina*. Most references to "*melanderi*" in the literature apply either to other species or to a mix of species which may or may not include the *melanderi* of Wheeler's description. In its modern usage, the name has become at worst meaningless and at best highly ambiguous. Of course, this is true for many names in this genus and would not alone constitute sufficient reason for bringing into use a name of apparently uncertain identity in place of *melanderi*.

Another problem concerning *melanderi* is Creighton's designation of New Braunfels, Texas, as its type locality. Among the syntypes of *melanderi* at AMNH are seven workers and parts of two others from New Braunfels, but no males. MCZ contains no syntype material from New Braunfels. The only male in the entire syntype series, as presently

construed, is a rubbed, headless male from Austin.

The importance of the lack of suitable male specimens among the *melanderi* syntypes becomes clear when we consider that *vididula* and *terricola* are separable with certainty only in the males. It is for this reason that I have designated males as lectotype and neotype, respectively, for these two species.

There is considerable overlap in the phenology of workers of *terricola* and *vididula*, so much so that lacking associated males, worker specimens often cannot be identified. The differences in the males, contained in the descriptions and in Figs. 7 and 8, need no elaboration. What follows is a list of hints for identifying workers of these two species in the absence of males. The list is, of course, based on the assumption that all other possibilities besides *terricola* or *vididula* have been eliminated.

1. Specimens collected outdoors from north of the Mason-Dixon line, from undisturbed or moderately disturbed habitats are almost certainly *terricola*. Specimens collected in Gulf or Atlantic coast states east of Louisiana are almost certainly *vididula*.

2. In Mexico and Arizona, *terricola* averages about 2.0 mm in length while *vididula* from the same area averages a little larger, about 2.25 mm.

3. Specimens with OI 24 or less are usually *terricola*. Workers with OI 25 or more are certainly *vididula*.

4. Specimens with very sparse cephalic pubescence are usually *terricola*, although small *vididula* specimens may have the pubescence on the head quite dilute. Specimens with denser (though very fine) pubescence on the rear portion of the head are probably *vididula*.

Finally, we consider Buckley's description itself and enumerate the reasons why it must concern the ant Wheeler redescribed as *melanderi*.

1. The name *Formica (Tapinoma) terricola*—Creighton (1950, p. 24) points out that Buckley was strongly influenced by the British hymenopterist Frederick Smith. Smith referred species of *Paratrechina* to *Tapinoma* (e.g., *flavipes*). It is possible that Buckley would have used the name in the same way.

2. The size of the castes—The size reported for the queen is certainly too large for a *Paratrechina* (6.86 mm). The sizes for the worker and male (2.0 mm) are appropriate. (Buckley gave the queen measurement as 0.27 inch which may be a misprint for 0.17 inch which equals about 4.32 mm, approximately the size of a *Paratrechina* queen).

3. Coloration—The color of the queen is described as piceous, and the males are said to be "like the female." The worker is described as dark brown above, lighter below and on the petiole and legs. Fully sclerotized Texas material of this species fits these descriptions.

4. Head shape—The head of the queen is described as "small, triangular," i.e., strongly convergent anteriad. The worker's head is said to be "little wider than the thorax." While the latter is an understatement of the true width, it does suggest that he observed the relative narrowness of the head of many workers from Texas.

5. Vestiture—The queen is described as "thickly sprinkled with short grey hairs," probably referring to her dense pubescence. No such pubescence is mentioned for workers or males, as is appropriate.

6. Venation—Buckley says the wings have one marginal and two submarginal cells (i.e., a submarginal and a median cell) and that the discoidal cells are obsolete—as in *Paratrechina*.

7. Petiole—In Buckley's words, "pedicle short, inserted in the base of the abdomen . . . inclined forward, wedge-shaped." This describes the petiole of *Paratrechina* perfectly.

8. Ecology—*Terricola* is described as "very active" (i.e., fast-moving) "with shallow nests in soil. Winged males and females captured in March" and as "rare," which reflects the great difficulty in encountering nests except in early spring. Among ants that could fit the rest of Buckley's description only *Paratrechina* has alates in the nest in March. The color is inappropriate for *arenivaga*, the locality is inappropriate for *bruesii*, and the alate season is inappropriate for *vividula*. *Melanderi* is the only suitable Texas *Paratrechina* for the description. Even Wheeler (1903) mentioned that his species might be the same as Buckley's, then dismissed the name without any attempt to ascertain the identity of the ant Buckley had described.

Any one or a few of these points, except perhaps number 8, would leave us in doubt, but considered together, I believe they describe, however poorly, Wheeler's *melanderi* which must, therefore, be relegated to synonymy. It is probable that Buckley's *Formica picea* (1866, p. 163) is in fact a description of *terricola* minors or other unusually small workers. Lacking sufficient evidence, I do not include *picea* in the synonymy. While I realize that resurrecting *terricola* from the ranks of Buckley's numerous *nomina dubia* constitutes a virtual myrmecological apostasy, I trust that the evidence presented shows this to be the best course for eliminating confusion and stabilizing the taxonomy of the nearctic *Paratrechina*.

Natural History

Alates of *terricola* overwinter in the nest and, as indicated in both Buckley's and Wheeler's descriptions, are commonly found in March in Texas. Texas alate records range from January through April. A Kansas record is from April, and I collected a colony with male pupae from Lawrence, Kansas, on 2 August. Series from Tennessee and Missouri with alates are dated March and April, respectively. Collections of alates in May from Tennessee and Arkansas are both from mountainous areas.

Mitchell and Pierce (1912) reported "large numbers of winged forms were collected running, flying and mating, March 2, 1909." This description recalls to me my observation of a mating swarm of *vividula* in which males ran about on the substrate, periodically flying up then quickly circling back into the swarm and running about on the substrate with wings vibrating.

Buckley (1866), Wheeler (1903), Mitchell and Pierce (1912) and Van Pelt (1983) state that this species nests in soil, usually beneath a stone, log or cow dung. Records from the TTU collection indicate they are found in most soil types, except very sandy soils, and in vegetation varying from open disturbed areas and pasture to mesquite and post-oak woodland and occasionally in denser more mesic woods. Specimens from South Dakota (GJW) were from *Juniper*—*Rhus trilobata*—*Chrysothamnus* wood-

land. Kansas collections are from woodland edges and openings, pastures and meadows.

Distribution

Terricola is most abundant in Texas and adjacent states west of the Mississippi River, and eastern Mexico. Collections from Tennessee, northern Illinois, southwestern South Dakota, southeastern Arizona and Mexico City probably are near the extremities of the range of this species.

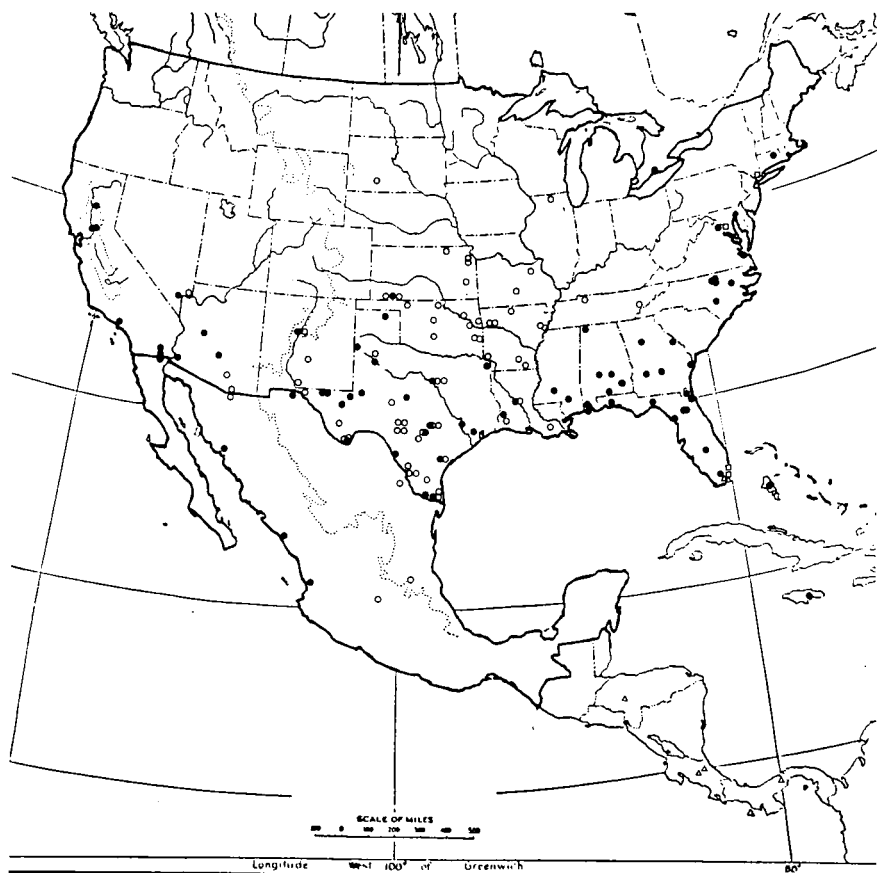


Fig. 49. Distribution in North America of *vividula* (●), *terricola* (○), *guatemalensis* (▲) and *pubens* (□).

CHAPTER IX PARVULA COMPLEX

Diagnosis of Complex

Worker brown or bicolored, shiny; head with dense pubescence, this arising from very fine to rather conspicuous punctae; scape pilosity reduced in some species, suberect to erect. Nests in a variety of undisturbed or lightly disturbed, moist habitats in leaf litter, rotten wood, clumping plants or in soil.

Male shiny, but thoracic and cephalic dorsum usually dulled by pubescence; parameres triangular, digitus boomerang-shaped; cuspis short; aedeagus triangular, acuminate.

***Paratrechina concinna*, New Species**

(Figs. 11, 14, 38; Map-Fig. 50)

Diagnosis

Worker. TL usually 2.3-2.9, CI usually 84-89, OI 24-28. A species found from Florida to North Carolina, usually found in marshes, wet grasslands and pastures, and swamp edges. Uniform brown or with thorax and legs slightly lighter than gaster and head. Scapes and middle and hind coxae brown (never tan or whitish). Overall size large among native eastern U.S. species. Cephalic pubescence arising from small foveolae giving punctate appearance. Pubescence of pronotum and propodeum usually conspicuous, that on front of pronotum subdecumbent.

Male. TL 2.25-2.5, OI usually 34-37. Closely resembling *faisonensis* but darker in color, has larger body and eyes and a broader head with cephalic sculpture as in workers.

Queen. Resembles *vividula* and *faisonensis*. Differs in having uniform dark color, cephalic punctuation, and slightly larger size.

Description

Holotype worker. TL 2.72, HL 0.72, HW 0.65, SL 0.81, EL 0.19, PW 0.46, MCL 0.20, WL 0.91, FL 0.65, GL 1.09, SM 12, PM 7, MM 4, CI 90, OI 27, SI 113, FI 90.

In full face view, clypeus lentiform, anterior border arcuate with a shallow concave emargination across the middle 1/4; rear border also arcuate. Dorsum of clypeus with sides meeting in a rounded median angle. Sides of head rounded, convergent anteriorly; widest just behind the eyes. Rear border of head straight with rounded corners; the corners about as far apart as the width of the clypeus. Head subquadrate, broader than usual for the species (CI 90 versus mean CI 86 for the species). Eyes longer and somewhat broader than in *faisonensis*, slightly more convex. Eyes separated from sides of head by less than 1/3 their width; from mandibular insertions by slightly over 1X EL. Scapes a little shorter than average for the species, which has SI slightly but probably insignificantly longer than average for *vividula* group. Scape very slightly but evenly

curved over its entire length, distal portion tapering giving the illusion of greater curvature. Small round markings at the positions of the ocelli probably represent vestiges of those organs.

Pronotal profile evenly curved, somewhat more convex than in *faisonensis*. Anterior face of mesonotum rising from promesonotal suture to dorsal face through about a 50% slope; posterior mesonotal declivity steeper and longer than usual in the *faisonensis*; mesonotal dorsum slightly sloped to the rear. Propodeum low and evenly rounded, only a little higher in profile than metathoracic spiracles, the angle between its anterior and declivous faces slightly obtuse.

Petiole sharp-crested, cuneate in profile; in dorsal view broader and with more rounded sides and crest than *faisonensis*.

Cephalic pilosity as in *faisonensis*. Cephalic pubescence very dense, reminiscent of queens of other species, and neatly aligned, giving a combed appearance. Thoracic macrochaetae conspicuous like those of *faisonensis*. Thorax appears quite bristly because the macrochaetae are less curved than those of *faisonensis*, and the eight major hairs are subtended by ancillary hairs about 3/4X as long and these in turn (on the pronotum) by smaller hairs about 1/2 length of the latter. In other species the ancillary hairs are relatively shorter, thus less conspicuous. Pubescence of thorax is diagnostic: subdecumbent and unusually abundant (for the *vididula* group) on the anterior portion of the pronotum, scattered appressed hairs on the metanotum and metapleuron, and abundant suppressed hairs on the anterior portion of the propodeum. Gaster with a few appressed hairs, unlike *faisonensis*. Petiole with two small macrochaetae on the crest.

Thorax and gaster strongly shining, the former very smooth, the latter delicately shagreened. Head and appendages punctate, feebly shining, the sheen reduced by the denser pubescence which arises from tiny foveolae.

Uniform castaneous brown with only the articulations of the appendages and the blade of the mandibles a little lighter.

Allotype male. TL 2.46, HL 0.65, HW 0.61, SL 0.73, EL 0.22, WL 0.97, GL 0.85, SM 6, CI 94, OI 34, SI 112.

Head large compared to all other males in *vididula* group. Head shape, including that of clypeus, strikingly like that of worker. Though CI indicates head is proportionately wider than worker, this is because the head width is taken across the eyes which are much larger than workers' and protrude beyond the sides of the head. Head is, in fact, a little narrower than workers' minus the eyes. Mandibles strongly sclerotized, dark colored with an apical tooth, cleft and subapical denticle, the denticle larger than in any specimen of *vididula* having it. Scape a little shorter and with fewer macrochaetae than workers but pilose for a *vididula*-group species. Eyes larger and more prominent than *faisonensis*. Median ocellus notably larger than laterals.

Upper portion of rear face of petiole concave. Petiole otherwise as in worker but broader. Gaster contracted, shorter than thorax. Genitalia closely resembling those of *faisonensis* but with cuspis a little more convex and all structures generally heavier and darker colored.

Vestiture as in workers with the usual differences. Parameres with decurved pilosity as in *faisonensis* but this less abundant, about 20 hairs.

Not as shiny as workers, due to occurrence of pubigerous punctation on thoracic dorsum and coxae. Gaster also appearing somewhat roughened, this due to a slightly coarser version of the usual shagreening.

Darker in color than all other *vividula* group species, except *flavipes*, from which *concinna* differs by larger size and having dark colored appendages. Head, thorax, and appendages dark brown, gaster piceous.

Variation

Worker. TL 2.13-3.10, HL 0.61-0.76, HW 0.52-0.65, SL 0.71-0.85, EL 0.15-0.20, PW 0.37-0.49, MCL 0.16-0.20, WL 0.77-0.93, FL 0.57-0.71, GL 0.65-1.41, SM 7-16, PM 4-8, MM 2-6, CI 83-90, OI 24-28, SI 110-125, FI 88-97, (n=41).

This species seems to be quite uniform in general appearance throughout its range. The head shape is somewhat variable as indicated by the large range of CI. This seems to have no relationship to overall size, as even large workers may have heads in the narrow end of the range. The abundance and degree of appression of the pronotal pubescence, which occasionally consists of only a few appressed hairs is also somewhat variable. The macrochaetae on the petiolar crest vary from 0-2. The color of the thorax is not uncommonly a little lighter and yellower than that of the head and gaster. This is probably the normal condition of young workers.

Male. TL 2.24-2.46, HL 0.59-0.67, HW 0.55-0.63, SL 0.67-0.74, EL 0.20-0.24, WL 0.87-1.01, GL 0.69-0.85, SM 5-7, CI 92-97, OI 33-38, SI 108-117, (n=8).

The large size, dark color, distinctly short gaster and worker-like aspect of the head of *concinna* males show little variation in the specimens from Florida and North Carolina I have seen. Most have the ocelli more equal in size than those of type.

Material Studied

Holotype and allotype and a large series of paratypes, including queens, were collected 15 April 1980, 1.5 miles ESE of Gainesville, Florida, under a plant pot on a damp lawn at the edge of a sweetgum swamp. Holotype and allotype are deposited at FSCA. Paratypes are deposited in the usual depositories.

Most of the material studied was collected by myself in Alachua County and Highlands County, Florida. A number of collections made by Van Pelt (1956, 1958) are stored at FSCA. Additional small series were found in LACM, USNM, AMHN, DPW (USDA) and TPN, these from Florida, Georgia, and North Carolina.

Discussion

The name *concinna* (Latin—neat, orderly) refers to the neatly aligned appearance of the cephalic pubescence.

This species falls into Creighton's concept of *vividula*, but I do not believe he ever saw it and, thus, have not included his *vividula* treatment in the synonymy. There are only a few specimens of *concinna* in the major

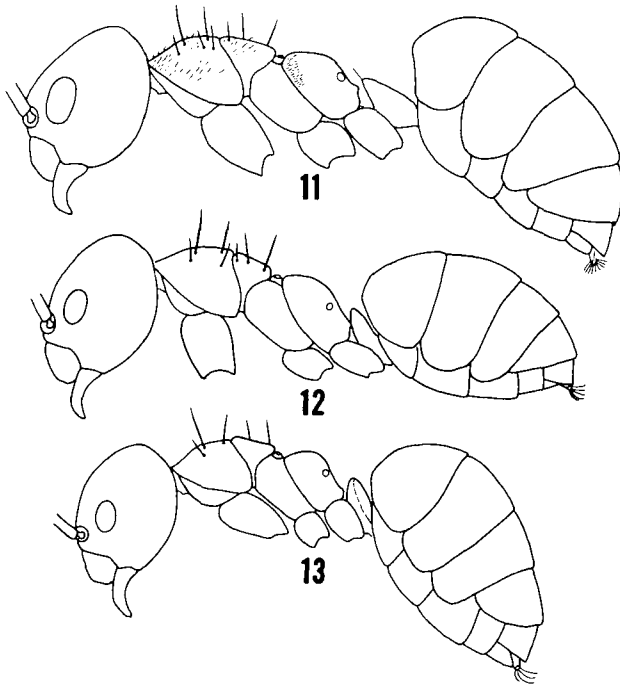


Fig. 11. Worker of *concinna*, lateral view.

Fig. 12. Worker of *faisonensis*, lateral view.

Fig. 13. Worker of *flavipes*, lateral view.

collections due to its preference for habitats rarely collected by ant hunters. My collection contains many more *concinna* than all other collections together except FSCA, which reflects both the poor representation of Florida ants in these collections and the unlikelihood of collectors entering marshy areas to find ants.

Concinna could be confused in the field with *vividula*, *faisonensis* or *bourbonica*. *Faisonensis* lacks thoracic pubescence and is smaller, while *bourbonica* is more uniformly covered with dense grey pubescence and is larger. Large, dark specimens of *vividula* can be recognized by their smooth heads, less abundant cephalic and thoracic pubescence and lower SM.

Based on the overall similarity of the workers and of the genitalia of the males, I believe *concinna* is most closely related to *faisonensis*.

Natural History

Like *vividula*, this ant may, under appropriate conditions, produce alates at any time of year. I have records of alates and alate pupae in nest series

from south Florida in December (Highlands County) and May (Dade County), and I have alates from North Carolina collected in April and September. In the Gainesville, Florida, area, these ants seem not to raise alates during the cool months; the peak rearing of sexual brood occurs March-July.

I believe, based on the collections of Van Pelt (FSCA) and myself in relatively pristine habitats, that *concinna* was originally a species of marshy areas and of openings in flatwoods and swamp. In such habitats, it nests in grass tussocks and in pieces of rotten wood that have fallen from nearby wooded areas. Today, it probably is more readily found in pastures and lawns of high water-table areas and along ditches and drainage canals where it nests in tussocks, cow dung and discarded wood. I found one colony at a laboratory complex in Gainesville, nesting in leaf litter beneath shrubbery. *Vividula* is abundant at this site, which is adjacent to a low pasture. A collection from "xeric mixed woods" in Seminole County, Georgia (LACM), is unusual and possibly is inadequately labelled. It seems likely that a swale or body of water was near the site of collection but not mentioned on the label.

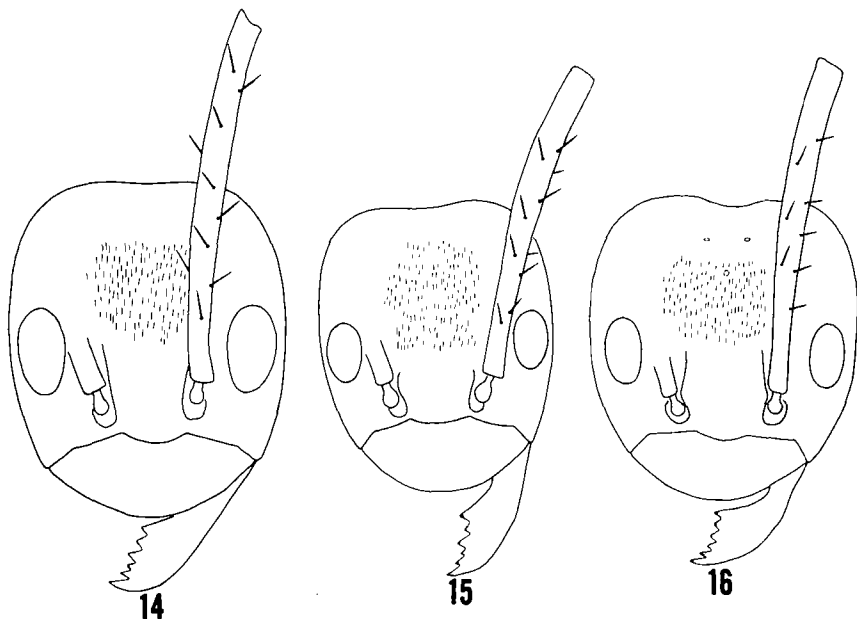


Fig. 14. Head of *concinna* worker, dorsal view.

Fig. 15. Head of *faisonensis* worker, dorsal view.

Fig. 16. Head of *flavipes* worker, dorsal view.

Distribution

Concinna is found throughout Florida, and has also been collected in Alabama and in Georgia and North Carolina, near the Atlantic coast.

Paratrechina faisonensis

(Figs. 1, 2, 12, 15, 42; Map-Fig. 50)

Prenolepis arenivaga var. *faisonensis* Forel, 1922. Rev. Suisse Zool. 30: 98. ♀. Type loc. Faison, NC.

Paratrechina vividula: Creighton, 1950. Bull. Mus. Comp. Zool. Harvard 104: 408 (in part?); Nuhn and Wright, 1979, Amer. Mid. Nat. 102: 353-362; Thompson et al., 1979, Psyche 86: 321-325.

Paratrechina melanderi: Lynch, Balinsky and Vail, 1980, Ecol. Ent. 5: 353-371; Lynch, 1981, Oikos 37: 183-198.

Diagnosis

Worker. TL usually 2.0-2.5, CI usually 83-87, OI usually 20-23. A deciduous woodland species of the southeast U.S. north to the New Jersey Pine Barrens. Brown with tan to whitish middle and hind coxae. Head narrow, CI usually 83-87. Eye small, weakly convex. Cephalic pubescence dense, partly obscuring sheen of head. Erect macrochaetae on scape conspicuous, almost as long as width of scape. Thorax and propodeum normally completely lacking pubescence, very shiny. SM 8-13.

Male. TL usually 2.0-2.25, OI usually 31-33. Color as in worker. Head narrow due to small, weakly convex eyes. CI usually around 90 (94+ in sympatric species). Scape macrochaetae conspicuous, SM 4-7.

Queen. Small eyes, light coxae and very shiny integument of head and thorax (visible even through dense pubescence when specimens are clean) distinguish this species from *vividula*, *concinna* and *arenivaga*.

Description

Lectotype worker. TL 2.10, HL 0.59, HW 0.48, SL 0.69, EL 0.13, PW 0.35, MCL 0.16, WL 0.71, FL 0.53, GL 0.81, SM 9, PM 3, MM 2, CI 83, OI 22, SI 117, FI 90.

In full face view, clypeus subtrapezoidal, anterior border truncate, its straight portion about half as wide as its sinuate rear border. Sides of head rounded, slightly convergent anteriorly, widest just behind eyes. Middle half of rear border of head nearly straight except for narrow median concavity. Head, exclusive of clypeus, longer than broad, narrower than head of related species. Eyes small, weakly convex separated from the sides by more than 1/2X the eye width and separated from mandibular insertions by about 1 1/2X EL. Scapes a little longer than average for the species, evenly and very slightly curved for about the basal 85% of their length, a little more strongly curved distally. No ocelli visible.

Pronotal profile an even, very weakly convex upward slope toward the rear. Promesonotal suture feebly impressed. Mesonotal profile almost flat, parallel to long axis of thorax and lacking an anterior face, thus yielding a hemiparabolic profile together with the pronotum.

Posterior portion of mesonotal profile bearing a small setigerous swelling, followed by a posterior declivity. Propodeum partly crushed on the left side but in profile from the right appears evenly rounded like that of *vividula*. The angle between its base and its rearmost portion near the petiole weakly obtuse. Legs of usual length for *vividula* group.

Petiole partly imbedded in glue, appears cuneate, but more rounded at the top than in *vividula*. In posterior view, crest is an even curve.

Cephalic pilosity as in *vividula*; the pubescence fine, more densely and more uniformly distributed over entire head but difficult to see in this callow specimen. Scape macrochaetae brown, suberect, a little longer and stouter than those of *vividula* and quite visible. Thoracic macrochaetae dark brown, gently and evenly curved mesad. Pilosity of gaster and legs just as in *vividula*. Thorax and abdomen lacking appressed pubescence.

Head and thorax shiny (in the former case even through the pubescence). Gaster delicately shagreened.

Head and gaster light brown, thorax, legs and scapes a shade lighter, middle and hind coxae very pale yellow.

Variation

Worker. TL 1.83-3.00, HL 0.53-0.69, HW 0.44-0.61, SL 0.63-0.80, EL 0.12-0.16, PW 0.29-0.44, MCL 0.14-0.20, WL 0.65-0.89, FL 0.47-0.65, GL 0.57-1.49, SM 8-13, PM 2-6, MM 2-5, CI 81-90, OI 20-24, SI 112-119, FI 87-97, (n=40).

TL is typically less than 2.5; the 3.0 specimen's length largely due to its very distended gaster. CI is usually less than 87; only one specimen had CI 90.

The clypeal shape described in lectotype is common, but the anterior border may range from arcuate and virtually entire to having two straight sides with a narrow concave emargination. The eyes of some specimens are larger and more convex, approximating the condition of related species (see discussion). A vestigial median ocellus is rarely present. The rear border of the head of larger specimens in full face view usually has a broader emargination than the type (and most other smaller specimens), yielding a weakly subcordate appearance. The widest portion of head is directly across eyes in many larger specimens. The promesonotal profile is usually hemiparabolic as described in type, but often the parabola is broken by a short, steep anterior mesonotal face. Rarely, the pronotum is very obtusely subangular. The sides of the petiole appear to diverge a little more toward the crest than in *vividula* (the latter feature not visible in lectotype).

Pilosity is often a little more abundant than on the type, particularly on the clypeus and promesonotum. In the latter case, the eight major macrochaetae are 2X or more as long as the six or eight adjacent ancillary hairs, and a few still shorter hairs may be present. Some large specimens may have a small amount of pubescence along the anterior edge of the propodeum, or rarely on the anteromedian portion of the pronotum.

The color of fully sclerotized individuals varies from nearly uniform dark brown to dark yellowish-brown. The middle and hind coxae are less contrastingly pale in the lighter specimens. Occasionally, the thorax and, less often, the head are a little lighter than the gaster. The color described for the type is typical of callows. Many darker specimens have some faint bluish reflections on the pronotum.

Description and Variation

Male. (Composite description, no males in syntype series. Two males from my collection have been deposited at MHNG. I have not formally designated them as alloparatypes, since they are not from the type locality.)

TL 1.96-2.24, HL 0.52-0.57, HW 0.46-0.51, SL 0.61-0.65, EL 0.16-0.18, WL 0.73-0.83, GL 0.65-0.93, SM 4-7, CI 87-92, OI 31-35, SI 113-123, (n=8).

Anterior border of clypeus arcuate, often with a shallow median concavity or truncation. Rear border of clypeus more arcuate than worker's, yielding a lenticular general form to the clypeus in full face view. Median portion of clypeus rounded, subumbonate. In full face view, rear border of head straight with rounded corners. Mandibles with smooth masticatory border, apical tooth often only indistinctly set off from this border. Eyes smaller and less convex than any other sympatric *Paratrechina* in full face view. Eyes less than 1/3 the length of the head, and in some specimens, barely protruding beyond the sides of the head. Head narrower than in sympatric species.

Petiole shaped as in worker but broader. Genitalia (Fig. 45) have the form that I consider most generalized among nearctic species. Parameres in side view triangular, about 2X as long as broad. In rear view, parameres weakly curved mesad over their distal half. Volsella weakly sclerotized, of simple structure; the digitus resembling the boomerang shape of that of *vidula* but shorter, less strongly bent and less tapered distally; cuspis thumb-like in appearance and not convex in dorsal aspect, appearing more truncate than rounded distally. Aedeagus resembling paramere in shape but narrower at the base and less tapering, less sclerotized and slightly decurved near the tip (Fig. 45 does not show this clearly because it is a more dorsal view). In rear view, the aedeagal lobes are normally closely appressed in preserved specimens and are about equal in length to the parameres.

Vestiture, color and sculpture almost like those of the workers with the usual difference in the vestiture of the scapes and thorax. In colonies with fully sclerotized workers at the lighter end of the color range, the males tend to be lighter, as well. Parameres with about 25 decurved brown hairs, like those of *vidula*, except for their darker color.

Material Studied

Syntype material (MHNG) consists of nine workers on three pins collected in a forest at Faison, North Carolina, on 24 July 1922, by Forel. The topmost specimen on the pin with Forel's red "Typus" label is the lectotype. The letter B is written on the point upon which this specimen is mounted. One specimen on the middle point of another of the pins is a worker of *Lasius flavus*. The syntype series is hereby restricted, with appropriate pertinent labeling, to the eight *faisonensis* workers. The specimens are callows and probably minims, so I have deposited two pins containing a male and two workers each from Florida at MHNG for reference of later students of *Paratrechina*.

Also studied were series from Mississippi, Alabama, Florida, Georgia, North Carolina, Virginia, Maryland and New Jersey. Most of the material is at LACM, TPN, JCT and MCZ. The Robert E. Gregg collection, cursorily examined in August 1982, contains numerous samples of *faisonensis* from Great Smoky Mountains National Park and from near Memphis, Tennessee, and one from Arkansas. One silt-encrusted series at UARK is probably *faisonensis*.

Discussion

Forel's (1922) description of *faisonensis*, though scant, clearly points out the features by which even the small, crumpled and poorly mounted specimens which served as his syntype series may be readily distinguished from *arenivaga*. The *faisonensis* types resemble *arenivaga* in vestiture, thoracic shape and (because they are callows) color but have smaller, flatter eyes and a darker gaster and were collected in a forest. Creighton (1950) synonymized Forel's variety without even seeing the types. As we shall see, his concept of *arenivaga* was so confused (see discussion of *arenivaga*) that even seeing Forel's types might not have prevented him from sinking *faisonensis*. I believe he would have considered them representatives of his supposed intermediates between *arenivaga* and "*melanderi*" (i.e., *terricola*) though he stated the intermediates he saw came from Alabama. In fact, the rather large pale *faisonensis* material from Florence, Alabama, in his collection (LACM) may be what he had in mind when he discussed these "intermediates." By not considering some of the subtler but no less important characters elucidated in this study, which separate these three species, it is easy to see why he made such a determination of paler *faisonensis* material. I gather from his discussion of the characters separating "*melanderi*" and "*vividula*" (p. 408) that most of what Creighton called *vividula* was in fact fully sclerotized material of *faisonensis*. Thus, Creighton synonymized *faisonensis* because he believed the material rightly belonging to it to be *vividula*, while true *vividula* specimens were considered to be "*melanderi*" (*terricola*) in most cases. Now we can see why he so vehemently defended the distinctiveness of *terricola* and *vividula* in the face of Emery's (1906) having made "*melanderi*" a race of *vividula*. Suffice it here to point out that Emery's decision was based on having seen and illustrated authentic type material of both species.

This species closely resembles *parvula* in the field but may be easily distinguished by the macrochaetae on the scape, light coxae, and its preference for shaded habitats. Males of *parvula* and *faisonensis* may be separated by the same characters. Colonies of *concinna* are normally found in open areas such as moist pastures or marshy areas, and the workers are larger and have relatively larger eyes, small puncta from which the cephalic pubescence arises, dark brown middle and hind coxae and conspicuous pubescence on the thorax. Males of *concinna* have most of the same differences and, like the workers, average significantly larger than those of *faisonensis*.

Natural History

In Florida, alates are reared from the end of August through December. Flights of *faisonensis* occur in March at the southern end of its range and from the end of April through May in the northern part of its range. Alate females appear to gain weight during the cool season and have large, heavy gasters during the mating season.

Virtually all records of *faisonensis* with accompanying habitat data make reference to deciduous or mixed woodland, often with the modifiers moist or mesic. Lynch et al. (1980), Lynch (1981), and Nuhn and Wright (1979) contain details on some aspects of this species' ecology and corroborate the observation that this is a woodland species. The colony queen generally lives in a rotting branch or tree root beneath leaf litter, while colony fragments comprised mostly of partially sclerotized nurse workers and later-instar larvae and pupae are commonly found near the surface of the leaf litter or under bark of a rotting log. Such colony fragments are commonly encountered by collectors. They were called intermediates between the "yellow form" (i.e., *arenivaga*) and the "dark form" (i.e., fully sclerotized *faisonensis*, *concinna*, *parvula* or *wojciki*) by Van Pelt (1947). Later Van Pelt (1956, 1958) recognized *arenivaga* as a separate species and referred all dark species of the area studied to *P. parvula*. I have examined his material at FSCA and find that the majority of it is *faisonensis*, and most of the series are accompanied by labels indicating they originated in "mesic hammock," Floridian for moist broadleaf or mixed forest.

Lynch et al. (1980) found *faisonensis* to be a codominant ant in hardwood forest in Maryland, where it coexists with *Prenolepis imparis* and *Aphaenogaster rudis*, and is distinguished ecologically by differences in seasonality, food preference and handling, and foraging and recruitment strategies. In Florida, I have collected it in mixed pine-hardwood forests with the same codominants and in shadier flood plain forests where *Lasius alienus* and *Formica pallidefulva* were virtually the only other ants.

Thompson et al. (1979) reported on the possible association of this species (reported as *vividula*) with the cixiid homopteran, *Oliarus vicarius* (Walker).

Distribution

Faisonensis is abundant in every state east of the Mississippi River and south of the Mason-Dixon line. It is also known from several collections in Arkansas, and extends north of the Mason-Dixon line near the Atlantic seaboard to southern New Jersey. This species is rare or absent in southern Florida.

Paratrechina flavipes

(Figs. 13, 16; Map-Fig. 50)

Tapinoma flavipes F. Smith, 1874, Trans. Ent. Soc. Lond., P. 404. ♀, ♀. Type loc., Hyogo, Japan.

Prenolepis flavipes: Wheeler, 1906, Bull. Amer. Mus. Nat. Hist. 22: 321. Fig. 1, ♀, ♀, ♂.

Paratrechina flavipes: Emery, 1910, Deutsch. Ent. Z., p. 132. Figs. 8-9, ♀, ♀, ♂; Emery, 1925, Gen. Insectorum Fasc. 183: 220.

Diagnosis

Worker. TL usually 2.0-2.25, CI usually 86-90, OI 21-25. A temperate Asian deciduous woodland species, introduced on Long Island and in southern Pennsylvania. Head yellowish-brown, darker on top, broad with convex sides and rear border covered with fine dense pubescence. Mandible with subbasal tooth almost as, or indeed as large as median and basal teeth. Thorax yellow to yellowish-brown, arched in profile with relatively few yellowish-brown macrochaetae. Propodeum almost as high in profile as mesonotum. Gaster brown or with tergite 1 yellow and posterior tergites banded yellow and brown. Legs short, FI < 90.

Male. TL 1.95-2.2, OI 34-36. Uniform dark brown to nearly black with blackish-yellow or brownish-yellow appendages. Rear border of head usually convex in full face view. Ocelli small, $2\frac{1}{2}$ -3X their width between the median and laterals.

Queen. Very close to *faisonensis* in appearance, but mandible with basal and subbasal teeth subequal in size.

Description

Lectotype worker. TL 2.09, HL 0.56, HW 0.48, SL 0.61, EL 0.12, PW 0.33, MCL 0.14, WL 0.65, FL 0.46, GL 0.89, SM 5, PM 3, MM 2, CI 87, OI 22, SI 109, FI 84.

Clypeus sublentiform, its anterior border with arcuate sides, the middle third truncate and slightly concave. Dorsum of clypeus convex with only a trace of the median angle near the front edge. Sides of head rounded, slightly convergent toward the front, more convex than other species in *vividula* group. Head broadest across the rear half of the eyes. Rear border convex except for a narrow, median concavity. Bulging aspect of sides of head and convexity of rear border gives an unusually broad look to the head for a worker of this small size. Mandible with subbasal tooth notably larger than intercalary, almost as large as basal. Eyes small, closer to the sides of the head than in *faisonensis*, separated from them by less than $\frac{1}{2}$ X eye width. Eyes separated from mandibular insertions by about $1\frac{1}{4}$ EL, their rear edge lying anterior to the midpoint of distance from the rear border to the mandibular insertions. Ocelli indistinct, small, but all three visible from posterodorsal view. Scape shorter than usual for *vividula* group, reminiscent of the condition in *parvula*.

Pronotal profile more convex than *faisonensis*. Metanotal profile sloping to the rear, slightly concave, with a short, steep anterior face and slightly steeper rear face about 2X as long as the anterior. Propodeum evenly rounded, the angle between its anterior and declivous faces about 90°, giving it a more arched appearance than other *vividula* group species. Legs relatively short.

Petiole cuneate, formed like that of *faisonensis* in side view but flat across the top in rear view.

Cephalic and thoracic pilosity mostly rubbed off of the left side of the

specimen, that remaining on the right side is a little less abundant, lighter in color and shorter than that found in *faisonensis*. The anterior macrochaeta on the metanotum about 1/2 as long as the posterior pronotal macrochaeta. Cephalic pubescence shorter, finer, and denser than in *faisonensis*, thinning a little toward the front. Pubescence on scapes long, subdecumbent and partially obscuring the macrochaetae, some of which have perhaps fallen off (see variation). Thorax and gaster without pubescence. Gastral pilosity relatively short, light-colored and sparse.

Specimen shining throughout, duller on head where obscured by pubescence. Even the gastral shagreening is finer than usual in the group.

Eyes grey. Head yellowish-brown, a little darker on top. Gaster banded, the first tergite testaceous yellow; the posterior tergites with their front edge the same light color and their rear 2/3 brown as the head. Thorax of same color as light portions of gaster. Appendages somewhat yellower.

Variation

Worker. TL 1.71-2.81, HL 0.51-0.67, HW 0.41-0.61, SL 0.54-0.73, EL 0.11-0.16, PW 0.29-0.41, MCL 0.13-0.17, WL 0.57-0.82, FL 0.42-0.58, GL 0.63-1.33, SM (5) 7-12, PM 2-4, MM 2-4, CI 82-94, OI 21-25, SI 105-116, FI 80-92, (n=45).

Thirty-seven of the *flavipes* workers measured had CI 86 or greater. Not surprisingly, the 8 with narrower heads were at the low end of the TL range. Most specimens have vestiges of all 3 ocelli. The rounded aspect and fine dense yellow pubescence of the head are virtually invariable. Clypeus, unlike the type, sometimes retains the subangular interface between the sloping sides. All specimens other than the type have SM 7 or greater, and it seems likely that the type has lost some of the macrochaetae. The pubescence on scape usually is not so long or erect as in type.

The pronotum is always high in profile but occasionally is somewhat angular rather than evenly convex. The mesonotal profile sometimes lacks the anterior face and/or is flat, both of which enhance the high arched appearance of the promesonotum. The propodeum at its highest point varies from notably lower than the mesonotum to about the same height, with most specimens tending toward the higher propodeum and having approximately a right angle between its base and its rear face between the metapleural glands. The petiolar crest varies from flat to convex in dorsal view.

On some specimens, a few very fine, yellow, appressed hairs are detectable on the anterior edge of the propodeum and/or some short erect hairs on the petiole. Some fine pubescence may occur on the sides of the gastral tergites. The promesonotum generally has only the 8 major macrochaetae conspicuous, and even these are yellowish and shorter and finer than in other species. The anterior mesonotal macrochaetae are sometimes longer than in the type, up to 3/4X the length of the posterior ones. The ancillary macrochaetae, when present, are typically 1/3X or less as long as the major hairs.

Japanese specimens of *flavipes* from Fukuoka, graciously collected for

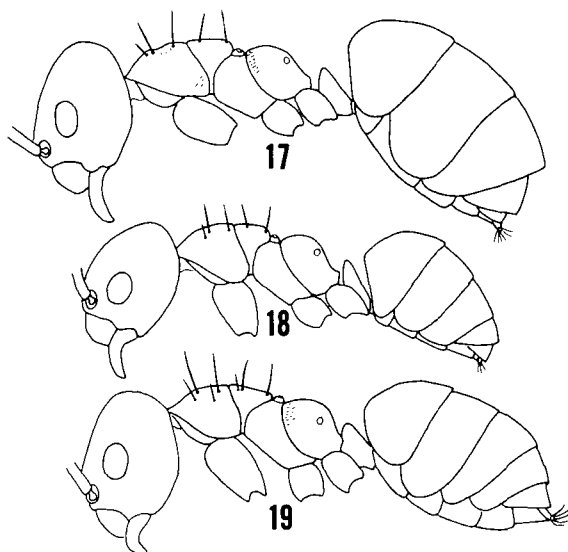


Fig. 17. Worker of *austroccidua*, lateral view.

Fig. 18. Worker of *wojciki*, lateral view.

Fig. 19. Worker of *parvula*, lateral view.

me by Dr. Masaki Kondoh, are darker colored than American specimens. On the other hand, specimens kindly donated by Dr. Masao Kubota, collected on Taiwan, closely resemble the American specimens in color. This may indicate that the American population originated in Taiwan or adjacent mainland. These specimens and another series from Japan (in MCZ) are quite uniform in size; e.g., HL 0.57-0.62 in all but one specimen, WL 0.69-0.73 ($n=20$). By contrast, a series of eight workers from Pittsburg have ranges for the same measurements HL 0.51-0.63, WL 0.57-0.82! Ranges nearly as broad occur in specimens collected in Philadelphia in 1939 (FEM) and 1964 (MCZ).

Male. (Composite description—no male in syntype series.)

TL 1.96-2.20, HL 0.48-0.53, HW 0.44-0.48, SL 0.54-0.58, EL 0.17-0.18, WL 0.72-0.79, GL 0.75-0.89, SM 4-6, CI 92-100, OI 34-36, SI 110-115, ($n=9$).

Clypeus lentiform, anterior border more arcuate than posterior, with a conspicuous concave or subangular notch across about the middle 1/4 of clypeal width. Sides of head convex; rear corners strongly rounded off; rear border slightly convex or nearly straight across, lying directly behind the inner borders of the eyes; i.e., rear border comparatively narrower between the corners than in other species, emphasizing convexity of sides of head. Mandibles edentulous or with a short apical tooth, in either case having one or two very short, blunt denticles. Eyes more convex than

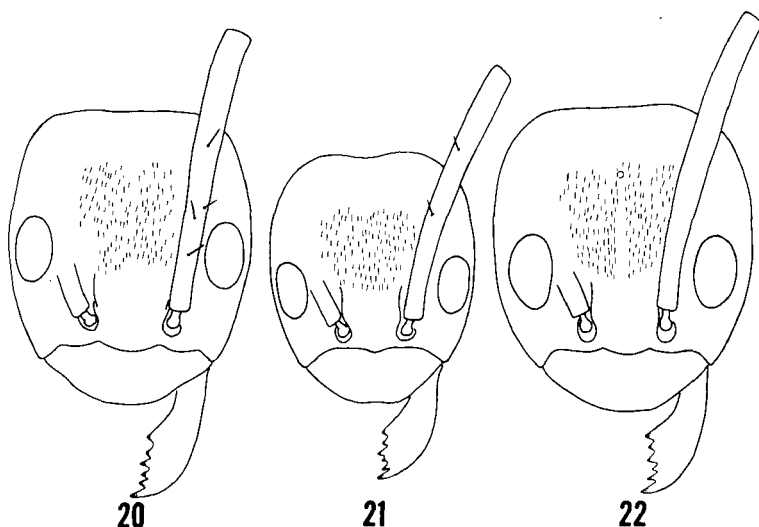


Fig. 20. Head of *austroccidua* worker, dorsal view.

Fig. 21. Head of *wojciki* worker, dorsal view.

Fig. 22. Head of *parvula* worker, dorsal view.

in *faisonensis* apparently occupying about the middle $1/3$ of standard HL. Ocelli small, medians separated from laterals by $2\frac{1}{2}$ - $3\times$ their width.

Petiole as in workers, through a little broader.

Genitalia close in form to those of *faisonensis* (Fig. 45) and *concinna*, but parameres shorter, only about $1\frac{1}{2}\times$ as long as broad and with a slightly concave rear border in side view. Cuspidal terminus a little smaller and more convex than in *faisonensis* but more readily visible because the convexity faces more dorsad and is very shiny; in side view, it often may be seen barely protruding above the paramere. Aedeagus as long or slightly longer than parameres, in the latter case protruding a bit beyond them as seen from dorsal view. Pilosity obscures this in side view.

Pilosity comprised of yellowish-brown macrochaetae over the entire body, shorter and less abundant on the first gastral tergite than behind. Pubescence a little longer than worker's, except on scapes where it is sparser and shorter. A few scattered appressed hairs may be found on the lateral portions of the gastral tergites. Parameres with about 15-20 of the usual sort of long decurved simple macrochaetae.

Very dark brown to nearly black. (Occasional specimens are bicolored, a dark version of the worker coloration.) Appendages light to dark brownish- or blackish-yellow.

Sculpture almost nonexistent—very shiny with faint gastral shagreening.

Material Studied

The lectotype (BMNH) is a single worker mounted on a card labeled "*T. flavipes* Sm. Hiogo/syntype." (Locality probably Hyogo Prefecture,

Japan.) A queen labeled "*Tapinoma flavipes* Smith, Type/syntype" on a second pin, accompanies the worker. Also studied were specimens from Pittsburg has ranges for the same measurements HL 0.51-0.63, WL Japanese and Taiwanese series mentioned above (JCT). Specimens from the Asian collections have been donated to BMNH and FEM in addition to the usual depositories.

Discussion

The presence of *flavipes* on Long Island and in the vicinity of Pittsburg and Philadelphia (in the latter since at least the late 1930s) suggests that the species entered the country with potted plants materials or logs for growing mushrooms brought in by immigrants from Japan or China early in this century. This is another tribute to the success of this genus in sending immigrant species to many parts of the world. Based on their color (see variation) I believe the American population originated in China. Its success in forests near cities at the periphery or just beyond the periphery of the range of *faisonensis* also suggests it may be found in woodlands further from these cities and eventually may be found in sympatry with *faisonensis*.

I believe that *flavipes* is the temperate Asian cognate of *faisonensis*. They both prefer moist deciduous forests and have small eyes, nearly the same range of SM, similarly distributed cephalic pubescence, virtual lack of thoracic pubescence, and polished appearance. The statistical difference in CI, while significant, obscures a broad range of overlap. Indeed, narrow-headed, dark *flavipes* so closely resembles broad-headed, bicolored *faisonensis* that I, at one point, thought *flavipes* might be a northern variant of *faisonensis*. The shorter scapes and legs, arched appearance of the thorax and propodeum, and the more intense yellow chroma of *flavipes* will serve to separate them. I originally placed *flavipes* in a "Faisonensis Complex" along with *faisonensis* and *concinna*, based on ecological features and scape pilosity. It is significant that in *flavipes* SI and FI and the proportion WL/HL are closer to those of *parvula*, *austroccidua* and *wojciki*. Also, our only other native form which regularly has 3 visible ocelli is *austroccidua*. Perhaps *flavipes* represents something closer to the common ancestor of both groups of species. For this reason, I have placed the 6 species together in the Parvula Complex.

The resemblance in color of *vividula* material, which might be found in the area where *flavipes* occurs, should cause a little confusion as the habitat preference of the 2 species are so different; likewise for *arenivaga*.

Natural History

Fully sclerotized, well-fattened alate queens and abundant males have been collected in May in Pennsylvania and in April in Fukuoka. The Taiwan series contains a callow male and is dated 8 August. I presume *flavipes* alates pass the winter in the nest as do *faisonensis*.

The preference for either primary or old secondary hardwood or mixed forest or forest remnants is apparently characteristic of both the Japanese and American populations. Dr. Kondoh (personal communication) states that he considers "*flavipes*" from open habitats in Japan a different

species.

It may be that *faisonensis* has prevented the spread of *flavipes* further south, where the latter could very likely thrive, as it occurs in warm temperate forests in Japan and China. In this light, it is interesting to note that *wojciki* expands into moist shaded habitats from its usual more xeric habitats in south Florida where *faisonensis* is uncommon. It appears that the abundant native woodland species *faisonensis* has a strong competitive edge over related species in its preferred habitat.

Distribution

Flavipes is a temperate east Asian species known in the US from the following localities: PA, Allegheny and Philadelphia Co.'s; NY, Long Island (no county listed).

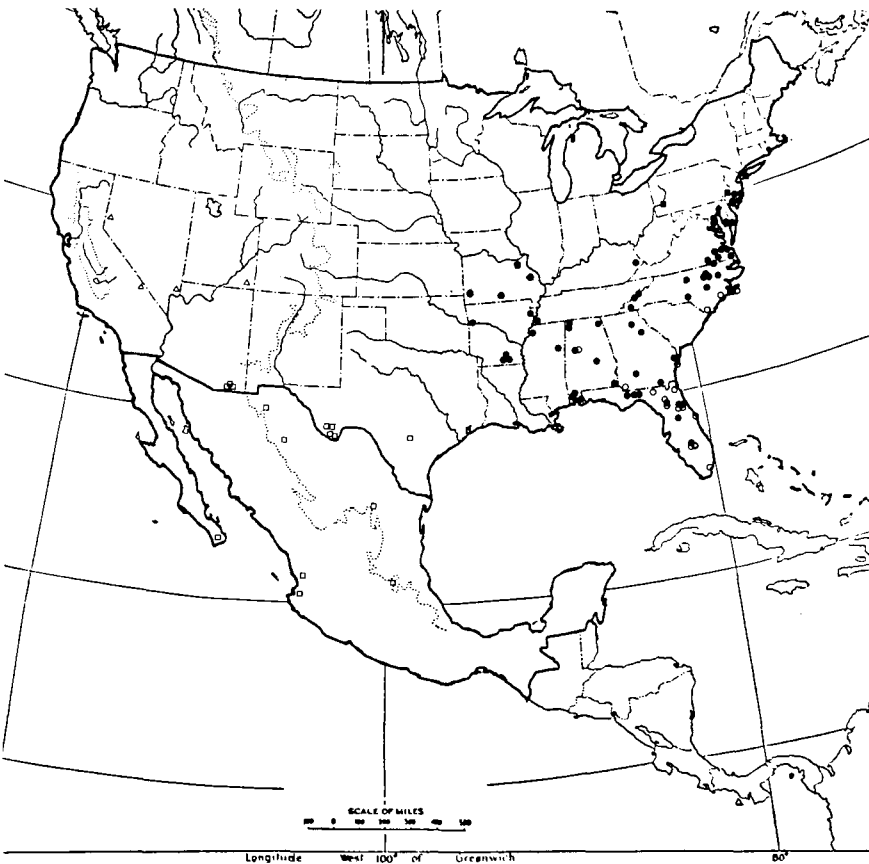


Fig. 50. Distribution in North America of *concinna* (○), *faisonensis* (●), *flavipes* (■), *hystrix* (Δ) and *bruesii* (□).

Paratrechina parvula
(Figs. 19, 22; Map-Fig. 51)

Prenolepis parvula Mayr, 1870, Vehr. Zool. Bot. Ges. Wien. 20: 948. ♀, ♀, ♂; Emery, 1893, Zool. Jahrb. Syst. 7: 636. Pl. 22, Fig. 23, ♂; Wheeler, 1905, Bull. Amer. Mus. Nat. Hist. 21: 390. Fig. 2, ♂. Type loc., United States (New York?).

Prenolepis vividula parvula: Forel, 1884, Bull. Soc. Vaud. Sci. Nat. 20: 348.

Paratrechina (Nylanderia) parvula: Emery, 1925, Gen. Insectorum, Fasc. 183: 222; Buren, 1944, Iowa State College J. of Science 18: 295; M. R. Smith, 1947, Amer. Mid. Nat. 21: 390. Pl. 20, Fig. 76, ♀; Creighton, 1950, Bull. Mus. Comp. Zool. 104: 409 (in part?).

Not *Prenolepis parvula* var. *grandula* (Forel, 1923, Rev. Suisse Zool. 30:98. ♀) See Table 2.

Diagnosis

Worker. TL usually 1.85-2.25, OI usually 23-27. Probably found in every U.S. state from North Dakota to Texas eastward and in Ontario, usually in open habitats on sandy or loamy soils. Uniform dark brown to brown to piceous (lighter, Oklahoma and Texas). Scapes short, SI usually 105-110, completely lacking standing macrochaetae.

Male. TL usually 1.9-2.25, OI 34-36. Uniform dark brown (including middle and hind coxae). Scapes without standing pilosity.

Queen. Uniform dark brown. Scapes short, without standing pilosity. In Florida, larger and broader-headed than *wojciki*, which usually has SM 1-2.

Description

Lectotype worker. TL 1.86, HL 0.56, HW 0.47, SL 0.60, EL 0.13, PW 0.34, MCL 0.14, WL 0.66, FL 0.47, GL 0.65, SM 0, PM 4, MM 3, CI 85, OI 23, SI 107, FI 85.

Clypeus lentiform; anterior clypeal border arcuate, entire though somewhat flattened medially; the rear border arcuate with a narrow concave median emargination. Clypeal dorsum with median angle rounded, a little sharper than in *vividula* but not carinate. Sides of head weakly convex, broadest just behind the eyes. Posterior corners of head lie behind inside margins of eyes and enclose the shallowly concave rear border. Head notably longer than broad. Eyes separated from mandibular insertion by a little over 1X EL and from sides of head by about 3/5X eye width. Rear border of eyes lies right at the midpoint of the postclypeal length of the head. Scapes short, gently curved over the basal and distal thirds of their length, straight in the middle. Ocelli lacking.

Pronotum in lateral view convex. Mesonotum flat-topped and sloping to the rear with short anterior and posterior faces more gently sloped and meeting the dorsum in more broadly rounded angles than in *vividula*. Propodeum smooth and rounded, its highest point about as high as that of pronotum. Legs shorter than in *vividula* or *faisonensis*.

Petiole cuneate in side view, with a very flat front face, convex rear face

and a narrow but blunt crest. In rear view, crest is concave and meets the straight sides through smooth round corners.

Cephalic pilosity about as abundant as *vididula* but shorter, flexuous. Scapes completely lack standing macrochaetae. On this specimen, one or two suberect hairs on each scape resemble short macrochaetae, but these proved at 200X to lack barbulation and, in any case, are inconspicuous. Cephalic pubescence moderately dense and uniformly distributed on dorsal surface. Some of the thoracic pilosity broken or lost on this specimen. PM and MM reported above are estimated based on hair sockets, etc. Thoracic macrochaetae curved, longer and thicker than those on head, the ancillary hairs over 1/2X the length of the 8 major hairs. Major macrochaetae of pronotum distinctly larger than those of mesonotum. Gastral pilosity as long as, but more slender than, major thoracic hairs. Pilosity dark brown. Thorax, propodeum, and gaster free of pubescence. Scapes and legs with the usual dense pubescence, that on the scapes varying from fully appressed to suberect.

Generally shiny; with even the pubescence of the head obscuring the sheen only partially.

Uniform dark brown with appendages a little lighter and yellowish.

Variation

Worker. TL 1.78-2.68, HL 0.55-0.66, HW 0.44-0.59, SL 0.57-0.71, EL 0.12-0.16, PW 0.33-0.43, MCL 0.13-0.20, WL 0.64-0.81, FL 0.46-0.58, GL 0.55-1.21, SM 0, PM 2-6, MM 2-4, CI 79-91, OI 21-27, SI 100-115, FI 81-90, (n=52).

This widespread species shows considerable variation. As in *arenivaga*, there is a tendency for specimens from the northwestern part of the range to be larger and more pilose, but any combination of size and pilosity can be found virtually anywhere in the range. Specimens from Iowa (WFB) are particularly large and broad-headed. The placement of the eyes with the rear margin at the midway point of the postclypeal head length is almost universal. The eyes extend a trifle posterior to this in some specimens with large OI. The distance between the sides of the head and the outer margins of the head varies from about 1/4 to 1/2X the apparent width of the eye in full face view, again varying somewhat with eye size. The pronotal profile is broadly angular in many specimens. Many specimens have pubescence on the propodeum. The general aspect of the thorax in profile is short and arched as in *flavipes*. Mean WL/HL in *parvula* is 1.18 (cf. 1.20 in *flavipes*, 1.24 in *vididula*).

Color is surprisingly constant in this species. Uniform dark brown body and somewhat lighter, yellowish appendages are the rule. Typically, the middle and hind coxae are as dark as the fore coxa, though sometimes they are lighter as in *faisonensis* or *wojciki*. Many fully sclerotized Georgia and Gulf Coast state specimens are very dark piceous brown. In these dark individuals, even the appendages are dark brown but appear lighter due to the pubescence. In Texas and Oklahoma, this species appears smaller than usual and is bicolored with yellowish thorax and yellowish-brown head and gaster.

Male. (Composite description—no syntype males studied though they probably exist in the Mayr collection at Vienna.)

TL 1.86-2.24, HL 0.51-0.57, HW 0.46-0.56, SL 0.54-0.63, EL 0.17-0.20, WL 0.69-0.85, GL 0.61-0.93, SM 0, CI 91-98, OI 34-36, SI 104-115, (n=11).

Clypeus sublentiform; anterior border arcuate with median 1/4 to 1/3 ranging from flat to concave or even notched; rear border evenly arcuate except for shallow concavity at the anterior edge of the frons. Sides of head convex and distinctly convergent in front of eyes, subparallel behind the eyes or at least less strongly convergent than in front. Head widest across the middle of the eyes. Posterior corners of head lie directly behind anterior corners or are a little further apart. Rear border of head ranging from slightly concave, especially on broader-headed specimens, to straight or weakly convex. Eyes appear to occupy about 1/3 of the postclypeal head length, with the rear 1/4 or less of the eye extended beyond midpoint. Eyes placed relatively centrally on the face, protruding only slightly or not at all beyond the greatest width of the head except in the most narrow-headed specimens. Scapes without erect barbate macrochaetae, though an occasional specimen has a thick suberect simple seta as in the lectotype worker. Mandibles with a short equilateral or short isosceles triangular tooth and in most specimens a broad, lobose subapical denticle.

Petiole very much like worker's, with a narrow but blunt crest which is flat or slightly concave from dorsal view.

Genitalia resembling those of *flavipes* or a foreshortened version of those of *faisonensis*. Parameres subtriangular, with concave rear border in side view; curved mesad in rear view. Base of volsella meets rear edge in a rounded-off right angle in side view. Rear edge of volsella vertical; cuspis arises at about 150° angle to rear edge. This is best seen in slide preparations or in side view on the specimen by chipping off one paramere. Aedeagus subtriangular, with a somewhat concave ventral edge and slightly deflected tip.

Cephalic and abdominal pilosity shorter, finer, less erect and less abundant than in workers; that on thoracic dorsum similar to that of head. Pilosity on parameres comprised of about 20 decurved yellow hairs. Cephalic pubescence fine, dense and light brown as in worker; that on thoracic dorsum similar. Appendages with usual dense pubescence; gaster lacks it entirely.

Shining deep brown throughout. Often head and thorax are a little lighter than gaster. Appendages may be lighter than body, though not as conspicuously so as in workers. One group of three males from Wood County, Texas, is light yellowish-brown, as are the workers that accompany them (see Discussion).

Material Studied

The lectotype is one of two workers on a card (the lectotype indicated by a small arrow) labeled Verein St. Coll. G. Mayr/*Pr. parvula* G. Mayr Type/Brit. Mus. 1922-501/Syntype. By inference from Mayr's description, I assume the collection was taken in New York state. There are at least a

few series of *parvula* in almost every lot of *Paratrechina* material loaned to me for this study, coming from North Dakota south to Texas and eastward including the southern tip of Ontario (CAF). I lack records from Minnesota and Wisconsin, some New England states, Ohio, Kentucky, and Alabama. Careful collecting in these states will very likely produce records of *parvula* in the future.

Discussion

Of the nearctic *Paratrechina*, only *parvula* occurs in the northern tier of states and in Ontario under natural conditions. There is little chance for confusing it with any other species outside of Florida. In the Gainesville, Florida, area, it is collected only occasionally and is largely replaced by the tiny, related form *wojciki*. To the south of Gainesville, it has never been collected, to my knowledge. In the zone of overlap of these two species (northern peninsular Florida), *parvula* is usually easily recognized by its larger size, dark color, greater distance of the eyes from the sides of the head, more rounded sides of the head, and barely or not at all excised rear border of the head. It also tends to have the pronotal pilosity much longer than the mesonotal rather than subequal to it as in *wojciki*.

Creighton's (1950, p. 409) comments on color variation in *parvula* seem to be based on his belief that any *Paratrechina* (other than *longicornis*) without standing macrochaetae on the scapes is *parvula*. However, this condition is found in workers of *phantasma* and *wojciki* as part of their normal variation. Furthermore, the inconspicuous nature of the scape macrochaetae of some *arenivaga*, *melanderi*, and *vididula* workers has caused some investigators to overlook them and call individuals of these species *parvula*.

In the field, *parvula* is indistinguishable from *faisonensis* except by its prevailing but not absolute preference for more open habitats and by its slightly darker coloration. It also resembles the dark colored *melanderi* variants found in Tennessee and Arkansas, which occur in open areas. In both of these cases, only microscopic inspection will allow certain identification.

TTU series I have identified as *parvula* from Wood and Cherokee counties, Texas (about half way between Shreveport and Dallas), are rather small, bicolored and dolichocephalic for *parvula*. The workers, in fact, are much more like the Floridian *wojciki* in appearance. The males in the Wood County series, however, are metrically and morphologically clearly *parvula*, except for their unusual pale coloration.

Forel's (1922) *Paratrechina parvula* var. *grandula* does not belong in *Paratrechina*. The types closely resemble an inconspicuous dark colored *Conomyrma* of glades in woodlands of sandy soils in southeastern U.S. The name *grandula* thus becomes available to the next reviser of *Conomyrma*.

Natural History

I have little personal experience with this northern species. The following account is based largely on information from Cole (1940) and from a summary of unpublished observations on *parvula* provided by Dr. Mary Talbott (*in litt.*).

Alates are reared in July and August in Michigan. Based on the few southern collections I have made, the alates are reared about a month later in Florida and Georgia. As in most of our native species, the sexuals overwinter in the nest and are frequently found near the surface on the warm days of early spring, i.e., late March and April in Tennessee, May in Michigan and Iowa. I have one collection of a winged queen and male, collected separately on low vegetation in western Alachua County, Florida, on March 14, 1984. A newly mated queen was collected under cow dung the same day, and she had reared out her first workers by the first week in May. Flights have not been observed elsewhere but must occur from late March to early May since alates are never found in the nests from mid-May to early July.

Nests are usually found in open areas, often with trees nearby, such as forest edges and openings. In northern Florida, *parvula* is limited to open woodlands and old fields on loamy soils overlying limestone. The nests may be under cover-objects such as stones and logs. When these are unavailable, burrows in open soil are usually cryptic but may be rendered more conspicuous by a small crater of soil around the entrance. Cole found a few nests in stumps and logs in deep woods in Tennessee, but lacking specimens, I am forced to wonder if these were not *faisonensis*. Curiously, I could find no material of *parvula* in Cole's collection at LACM, though he stated it to be one of the most common ants in the Great Smoky Mountains National Park. The nest consists primarily of small chambers near the surface, but burrows may extend 30 cm into the soil.

This ant has been collected from as high as 1425 m elevation in the Smoky Mountains, but most collections are from well below 600 m.

Distribution

Parvula is the most widespread and abundant species of eastern US east of the 100th meridian. No specimens were seen from Maine, Wisconsin or Minnesota, but collections from North Dakota, northern Illinois, Michigan and northern Massachusetts indicate *parvula* may occur in all the northern tier of states in eastern US. This species does not occur in peninsular Florida south of Alachua Co.

***Paratrechina wojciki*, New Species**

(Figs. 18, 21; Map-Fig. 51)

Paratrechina (Nylanderia) bruesi (sic): Creighton, 1950, Bull. Mus. Comp. Zool. 104:406 (in part).

Diagnosis

Worker. TL usually 1.7-2.2, OI usually 23-25. A very small Florida and eastern Gulf Coast species usually of open woodlands. Bicolored, head and gaster brown, thorax yellowish. Middle and hind coxae pale. Scapes short, SI usually 102-108; SM 1-4 (rarely 0). Head narrow, CI usually 85 or less; sides of head subparallel; rear border with distinct median notch. Eyes lie close to sides of head.

Male. TL usually less than 1.9, OI 33-38. Resembles small *parvula* in color and morphology but usually with SM 1-2 and SI 100-109. Middle and hind coxae pale.

Queen. Resembles small *parvula* but with PM 1-2.

Description

Holotype worker. TL 1.87, HL 0.53, HL 0.43, SL 0.58, EL 0.12, PW 0.32, MCL 0.13, WL 0.63, FL 0.44, GL 0.72, SM 4, PM 3, MM 2, CI 83, OI 23, SI 110, FI 85.

Anterior border of clypeus arcuate except for the flattened middle 1/5; rear border of clypeus nearly straight behind the median raised portion of the clypeus, curved forward lateral to this. Sides of head weakly convex and subparallel. Rear corners of head notably closer together than inner border of eyes and delimiting a broad, shallow notch across slightly more than the middle 1/3 of the rear edge of the head. Head narrow, subrectangular. Eyes small, their rear margin lying slightly anterior to the midpoint of the postclypeal head length. Eyes close to sides of head, their lateral margins separated from sides of head by about 1/4X their width and separated from the mandibular insertions by about 1/4X their length. No ocelli present. Scapes near the upper end of the range of relative length for this species but short compared to species outside of the *Parvula* Complex.

Pronotum in profile angular, with a straight anterior face and a distinctly longer convex dorsal face. In lateral view, mesonotal convexity contiguous and equal in curvature to that of pronotum. Mesonotum with a short rear dorsal face flat and about 1/2X as long as convex rear face. Legs short, as in *parvula*.

Petiole in side view cuneate with convex posterior face and blunt, rounded crest. Viewed from behind, petiole has straight sides only slightly divergent dorsa and a smooth rounded crest.

Cephalic and gastral pilosity about as abundant as in *parvula* and, as in that species, rather short and somewhat curved. Left scape with 4 barbulate macrochaetae; right one with 3, but these short, decumbent to subdecumbent and the same color as the scape, thus difficult to discern; most easily seen in anterior view. Thoracic pilosity sparse and only weakly curved, the pronotal ancillary hairs very short and pale. Pilosity on body is brown; on the legs a little darker. Fine yellowish-brown pubescence covers dorsal surface of head. Finer yellow pubescence covers appendages. Thorax and gaster lack pubescence.

Pubescence of head obscures the shining integument beneath. Thorax and gaster smooth and shiny, with fine shagreening on the gaster obscuring the sheen only slightly.

Head yellowish-brown, darker on top. Mesopleuron and propodeum same color as sides of head; pronotum and mesonotum are brownish-yellow. Gaster as dark as top of head. Appendages as light as promesonotum, with middle and hind coxae even paler.

Allotype male. TL 1.86, HL 0.48, HW 0.45, SL 0.51, EL 0.17, WL 0.65, GL 0.73, SM 1, CI 94, OI 35, SI 104.

Clypeus nearly perfectly lentiform, its anterior and posterior edges equally arcuate and both with a shallow median concave emargination. Sides of head convex, tapering more quickly in front of the widest part of the head (across the eyes) than it does behind, as in *parvula*. Middle 1/2 of rear border of head straight; meeting sides of head in rounded corners which lie almost directly behind the anterior corners. Eyes separated from mandibular insertions by about 2/3X their length; protruding beyond sides of head a little more than in *parvula* males. Ocelli smaller than typical for the species; the median and laterals separated by about 2 1/2X their width. Mandible only partly visible, but apical tooth and part of blunt subapical denticle (as in *parvula*) can be seen.

Petiole shaped as in worker in lateral view. In dorsal view, it is much broader but has straight sides and a smooth rounded crest, as in the worker.

Genitalia resembling a small version of those of *parvula* with the following differences. Parameres with shorter less abundant pilosity; less curved, their inner (rear) border less concave, nearly straight. Volsella with base and outer rear edge meeting in a rounded obtuse angle; posterior edge of cuspis (in lateral view) is a mere continuation of rear edge of volsella, as in *faisonensis* (Fig. 45).

Pilosity as in worker, with the usual greater abundance on the thoracic dorsum and reduction on the anterior dorsum of the gaster. Macrochaetae on scape short and inconspicuous as in worker. Pilosity on parameres appears a little shorter than in other species, even for this small ant, and not abundant, 15-17 hairs per paramere. Cephalic pubescence a little sparser than in worker. Pubescence occurring elsewhere only on mesonotum and appendages.

A very shiny ant with even the gaster lacking visible shagreening.

Eyes grey. Body uniform castaneous brown, femora and fore coxae same color. Scapes, tibiotarsi and middle and hind coxae light brownish-yellow.

Variation

Worker. TL 1.48-2.29, HL 0.48-0.58, HW 0.40-0.48, SL 0.53-0.62, EL 0.11-0.14, PW 0.30-0.36, MCL 0.12-0.15, WL 0.59-0.71, FL 0.40-0.48, GL 0.40-1.01, SM 0-4, PM 2-4, MM 2-4, CI 78-87, OI 22-26, SI 100-112, FI 80-88, (n=44).

This species is normally less than 2 mm long. The specimens with greater lengths in the range have the gaster distended. The head is narrower than in any other of our native species, with CI exceeding 85 in only a few specimens. The broader-headed specimens tend to have the eyes separated from the sides of their heads by a little over 1/4X eye width, while most specimens have the eyes closer to the sides, even almost reaching them. SI exceeds 108 in only 2 of the specimens measured. SM usually 1-4, but macrochaetae are completely lacking on one specimen. In the northern part of the range, the macrochaetae tend to number one or 2 and are shorter, decumbent and the color of the scape, thus, difficult to see. Towards the South, the macrochaetae more often number 2 to 4 and are longer, darker and more erect. However, variation in scape pilosity is

not strictly geographical. Propodeal profile usually an even convexity.

Color varies from almost uniformly dark brown with the thorax and appendages only slightly lighter and with pale middle and hind coxae (i.e., the *faisonensis* pattern) to very light yellowish with the head and gaster only slightly darker (i.e., a little darker than *arenivaga*). The most common coloration in fully sclerotized workers is a brown head and gaster, brownish-yellow thorax and appendages and pale yellowish middle and hind coxae.

Male. TL 1.67-1.93, HL 0.45-0.48, HW 0.42-0.46, SL 0.48-0.53, EL 0.16-0.19, WL 0.61-0.73, GL 0.54-0.79, SM 0-2, CI 91-98, OI 33-38, SI 100-109, (n=7).

Metric variation in male *wojciki* needs little explanation beyond the figures given above. However, additional material checked since the above measurements were taken indicates the SM=0 is relatively uncommon and that SM 1-2 is the rule. Ocelli usually larger than in type, median and laterals separated by only 2X their width. The length of the parameres variable from about 1X to around 1 1/2X their basal width.

Coloration of fully mature individuals ranges from castaneous as in the type to nearly black but always with pale middle and hind coxae.

Material Studied

The types come from a collection donated by DPW labeled Florida, Franklin Co. 3 mi. N. Alligator Pt. Oak-pine litter berleseates. 22 Mar. 1975. G. B. Marshall/75-223. The entire series includes 3 queens, 4 males, and 11 workers. The holotype and allotype are deposited at FSCA, and the remainder will be split between MCZ and USNM. FSCA contains the collections of Van Pelt (1956). Series containing males and workers from all over Florida were also studied, and some of these will be distributed to the usual depositories. One large series of workers from Citronelle, Alabama, collected by Creighton (LACM) is the only extra-Floridian sample I have seen (but see Discussion).

Discussion

This species is named for Dr. Daniel P. Wojcik, who contributed the types and who has, through providing access to his literature files and collecting specimens for me, substantially aided this study. The name *wojciki* is the genitive case of Dr. Wojcik's name and should be pronounced /wo'jik i/ in English (symbols as in *American Heritage Dictionary*). In the unlikely event of transfer to a genus of neuter or masculine gender, the name is invariant in form.

Most material of this species loaned to me has arrived identified as *bruesii* due to Creighton's use of the character of short scapes as a definitive feature of *bruesii*. Suffice it to say here that the possibility of confusing *bruesii*, a larger-than-average Southwestern and Mexican species with *wojciki*, a tiny Floridian species, is remote.

The scapes of *wojciki* are quite short, much shorter than those of *bruesii* and statistically a little shorter than those of *parvula* or *austroccidua*, *wojciki*'s closet relatives. This, in addition to its low SM, yellowish thorax and even paler middle and hind coxae, combine with its small size to make

this a distinctive ant.

I have 2 series from northern Florida; a large one from DPW and a smaller one from LACM—which fall into the *wojciki* size range and coloration but which differ as follows from typical *wojciki*: pilosity on the scapes and thorax a little longer, that on scapes more abundant (SM 4-7); propodeum with pubescence along the anterior edge; eyes small; sides of head more convex so CI is a little larger. Three males associated with the larger series have unusually small eyes, abundant scape pilosity (SM 3-5) and are bicolored, with the head, thorax, and legs light brown, the middle and hind coxae pale, and the gaster dark brown. Whether these represent part of the normal variation of *wojciki*, a sibling species deserving description or products of hybridization (say, with *faisonensis*) cannot be determined with certainty at this point. The hybridization hypothesis is unlikely in view of the concordance of males (haploids) with the workers (diploids) in the apparently intermediate characteristics. I suspect that these hairy-scaped, small-eyed, broad-headed series are simply aberrant *wojciki*, since similarly atypical individuals or series are sometimes seen in other *Paratrechina* species. The DPW specimens have been placed with other *wojciki* series in FSCA with determination labels as follows: *Paratrechina* prob. *wojciki*. Det. J. C. Trager, 1984.

Natural History

As in most Florida *Paratrechina*, *wojciki* sexuals are produced in the early fall months, overwinter in the nest, and fly in the early spring. I have two separate collections of microgynes from nests which also reared normal-sized queens. Interestingly, microgynes have been captured in flight traps in late fall at Archbold Biological Station in Highlands County, Florida, by Dr. Mark A. Deyrup (personal communication) with whom I have collaborated in studying ants at the station for nearly 2 years. The microgynes are intermediate between workers and queens in color and proportions. It is unlikely that microgynes ever found colonies since no male *wojciki* fly at this unusual time.

This ant has very broad habitat preferences and nests in a wide variety of situations including submerged rotting wood or litter in depressions the most xeric scrub, grass clumps in temporary ponds and flatwoods, and beneath stones in marl-based pinelands of the Everglades region. In north Florida, it seems, based on my collecting experience and Van Pelt's records, to be limited to sandhills and flatwoods. In south Florida, where *faisonensis* is uncommon, *wojciki* expands into mesic woodlands and bayheads.

Wojciki is attracted to baits such as tunafish. When the bait is discovered by larger, more aggressive species such as *Solenopsis geminata*, *Pheidole dentata* or *P. morrisi*, *wojciki* workers sneak in between these species and fill their gasters with the oil. They do not appear to cut up such baits unless recruited in large numbers and free of competition.

Distribution

Wojciki is found throughout Florida where it largely replaces *parvula*. A collection from Citronelle, Alabama is the only extra-Floridian sample, but

it would not surprise me if future collecting reveals *wojciki* occurs in sandy-soil, post-oak and turkey-oak communities in other Gulf-coast states where *parvula* is rare.

***Paratrechina austroccidua*, New Species**

(Figs. 17, 20; Map-Fig. 51)

Diagnosis

Worker. TL usually 2.0-2.75, OI usually 21-25. Found in woodlands at 1400-2400 m (probably higher in Mexico) in mountains of southwest and subtropical Mexico. Gestalt is *parvula*-like, but SM 2-9. Yellowish-brown to deep castaneous (less often, bicolored), often with bluish reflections on head and thorax. Head with dense pubescence (not found on workers of other southwestern species). Dorsal face of pronotum flat or with a transverse concavity.

Male. TL about 2.0-2.5, OI 36-37. Colored as worker. Mandible with a sharp subapical denticle and blunt denticles along entire masticatory border. Genitalia resembles those of *parvula*; parameres not long and slender (cf. *bruesii*); aedeagus not longer than parameres and spatulate and upturned distally (cf. *terricola*).

Queen. Virtually indistinguishable from *melanderi*. Sides of head probably more convex. Found at higher altitudes in more shaded habitat.

Holotype worker. TL 2.26, HL 0.63, HW 0.53, SL 0.69, EL 0.14, PW 0.38, MCL 0.16, WL 0.73, GL 0.91, FL 0.55, SM 4, PM 3, MM 3, CI 84, OI 23, SI 110, FI 87.

Anterior border of clypeus evenly arcuate with a narrow median concavity; rear border undulating and less strongly arched. Dorsum of clypeus with a smooth rounded median angle. Sides of head weakly convex. Head broadest about $1/2X$ EL behind the eye. Head of about average width for the species. Cephalic rear border with rounded corners which lie almost directly behind anterior corners, nearly flat across middle $1/2$ with a faint median concavity. Eyes of about average length for species, separated from sides of head by about $1/3X$ eye width, and from mandibular insertions by a little over EL. All 3 ocelli present, though indistinct. Scapes rather thick and gently curved throughout their length. Scapes relatively short, as in *parvula*, protruding beyond posterior corners of head by only about $2/5X$ SL.

Pronotum angular in side view, with a slightly concave anterior face and a longer, nearly flat dorsal face bearing a shallow transverse furrow between the anterior macrochaetae. Mesonotal dorsum weakly convex, approximately parallel to long axis of thorax, and higher than the pronotum. Anterior and posterior faces of mesonotum meeting the dorsal face through very rounded corners, as in *parvula*; the posterior face over $2X$ as long as the anterior face. Propodeum low, evenly convex in profile, with all but its short anterior portion sloping to the rear and its highest point only about as high as the anterior angle of the pronotum. Legs long relative to *parvula*, but short compared to other species.

Petiole in profile sharp-crested with 2 short erect hairs on the crest and

with a convex rear face. In posterior view, it is about 1 1/2X as broad at the top as at the base, and the crest is smooth and weakly convex.

Head and appendages densely pubescent. Pubescence apparently lacking elsewhere, except for scattered appressed hairs on pronotum, anterior edge of propodeum and gaster. Scape macrochaetae short, suberect and about the color of the scapes, most easily seen in anterodorsal view.

PM 3, MM 3; these the most common values in this species. Dorsum of head with fine pubigerous punctae, which obscure the sheen. Sides of small head and remainder of body very shiny.

Specimen is deep castaneous brown with lighter yellowish-brown appendages. Cephalic dorsum and sides of thorax with faint bluish reflections.

Allotype male. TL 2.55, HL 0.57, HW 0.55, SL 0.63, EL 0.20, WL 0.89, GL 1.09, SM 2, CI 96, OI 36, SI 111.

Clypeus lentiform, with short front and rear borders about equally arched; the front border flat across the middle 1/3, the rear border with only a faint, narrow prefrontal concavity. Median angle of clypeus, as in worker, a trifle sharper than that of *parvula*. Sides of head convex; head broadest at the middle. Rear border of head about as convex as sides; set off from them by rounded corners which lie almost directly behind inner border of the eyes. Eyes rather elongate and relatively weakly convex, protruding only a little beyond sides of head in full face view. Median ocellus separated from the laterals by about 2 1/2X their width. Scapes a little longer than in *parvula* but shorter than in *faisonensis*; and weakly sigmoid as in most *Paratrechina* males. Mandible with the usual apical tooth, a sharp subapical denticle, a median diastema and 2 blunt subbasal denticles.

Petiole in profile has sharp crest and short erect hairs as in the worker. In posterior view, crest is weakly concave and broader than worker's.

Parameres (one removed) are isosceles-triangular, about 1 1/2X as long as broad, with rounded tips and slightly concave rear edge. Parameres weakly curved mesad and longer than volsella and aedeagus. Digitus has the short 3/4-of-a-boomerang shape of *parvula*, *faisonensis*, etc. and cuspis arises at about 145° angle to the vertical rear edge of the volsellar base. In side view, the base of the volsella has its ventral and rear edge meeting in a rounded right angle, as in *parvula*. Aedeagus triangular with concave ventral edge and decurved tip.

Distribution of vestiture much as in *parvula*, except that scapes and petiolar crest bear suberect macrochaetae, and gaster has a few widely spaced fine appressed hairs.

Sculpture consists of fine pubigerous punctation on head, thoracic dorsum and delicate gastral shagreening.

Eyes grey. Specimen is teneral but not structurally distorted. Entire body is greyish-yellow with the gaster and cephalic dorsum a littler darker. Fully colored specimens probably approximate the coloration of the worker.

Variation

Worker. TL 1.94-3.04, HL 0.56-0.69, HW 0.45-0.60, SL 0.60-0.75, EL 0.12-0.17, PW 0.33-0.44, MCL 0.12-0.18, WL 0.65-0.85, FL 0.47-0.61, GL 0.69-1.56, SM 2-9, PM 2-5, MM 2-4, CI 79-89, OI 19-27, SI 100-120, FI 81-95, (n=64).

The montane woodlands that are home to *austroccidua* exist as isolated bands ringing mountain ranges throughout the species' geographic range. Therefore, it comes as no surprise that this species exhibits considerable variation. Specimens from the periphery of the range of *austroccidua* (Utah, Hidalgo) are smaller than those from the central portion of the range (southern Arizona, Texas, Nuevo León). Those from Texas and northern Mexico tend to have larger, more distended gasters. Specimens from Chihuahua and Arizona have larger eyes, OI 23-27, while those from Texas and eastern Mexico have small eyes, with OI usually 21-24 (19 in one specimen). Specimens from northern Mexico, Texas, and Utah are dark reddish-brown, while those from Arizona are lighter yellowish-brown, and the Hidalgo specimens have a dark gaster, lighter head and still lighter, more yellow thorax. Specimens from most areas have the middle and hind coxae paler than the fore coxae, but Texas and Nuevo Leon specimens are variable, even within nest series in this trait. Head shape is variable, and larger specimens from Texas and Nuevo León have heads with strongly convex sides and deeply emarginate rear borders. In my opinion, these non-concordant variations have no taxonomic significance.

Head shape is variable, and larger specimens from Texas and Nuevo León have heads with strongly convex sides and deeply emarginate rear borders.

Most specimens of all series have the characteristic thoracic shape, with the angular pronotum transversely furrowed between the anterior macrochaetae. Occasional specimens have the furrow indistinct or absent, but the angularity and flatness of the dorsal surface of the pronotum remain. The petiole may be less sharply crested than usual, but its possession of one or 2 short erect hairs is the rule. The cephalic punctation varies from conspicuous to rather fine, but the blue reflections between the punctae and on the sides of the thorax can be seen, at least faintly, on any clean specimen.

Male. TL 2.07-2.55, HL 0.53-0.57, HW 0.48-0.55, SL 0.56-0.64, EL 0.19-0.21, WL 0.70-0.89, GL 0.71-1.09, SM 2-3, CI 91-96, OI 36-37, SI 106-113, (n=4).

The four males of *austroccidua* I have seen belong to 3 nest series, and it is doubtful that I would have recognized them as belonging to the same species had I not had the associated workers. In certain characters, they are strikingly uniform. All but the allotype have SM 3, and OI is 36-37 in all 4 specimens. The structure of the genitalia is essentially identical in the 4 males I have seen. The coloration of the specimens is essentially like that of the workers with which they are associated. The type and its brother are callows, but they are matched in their uniform greyish-yellow coloration by callow workers in the series. The specimen from Hidalgo is smaller than the rest, has much shorter scapes (106 versus 111-113), and lacks the

denticles on the mandibular border. The masticatory border is, however, faintly crenulate on this specimen. Further statements on the variation in *austrorcidua* males must await more specimens.

Material Studied

The two pins containing the holotype and allotype and four paratype workers are deposited at LACM. They are labeled TEX: Boot Springs, Chisos Mts. 2040 m. 26. vii. 1979 P. Ward #3771/under stone, mesic oak-maple forest. The remaining three pins, containing eight workers and one male paratype are deposited at MCZ. The Hidalgo specimens are stored at MCZ, the Utah specimens and a series in alcohol from the Chisos Mountains at USNM. Material from Arizona is at LACM, including a male and a queen. Material from Chihuahua was donated by WMK, and the types plus material from Nuevo León by PSA. Most of this material will be placed in the usual depositories.

Discussion

The name of this ant refers to its geographic distribution in the United States (Lat. *auster*—south, plus *occiduus*—western). *Austrorcidua* is an adjective and must be appropriately declined in the event of a transfer to a genus of masculine or neuter gender.

Paratrechina austrorcidua, once known, is unlikely to be confused with any other species. The unique pronotal profile, petiole with short erect hairs on a sharp crest, densely pubescent head with the pubescence arising from punctae, and the blue reflections of the head and thorax can be found on most workers of any series, though one or two of the characters may be indistinct on some individuals.

That it has remained unrecognized up to this time is due to the paucity of collections, in part, since general collectors have tended to overlook or ignore *Paratrechina*, especially in the West, in favor of more "glamorous" genera. In addition, whenever *austrorcidua* has been collected, it has been assumed to be *melanderi* (relatively small size and sparse pilosity), *bruesii* (relatively short scapes) or *parvula* (general habitus, dark color, inconspicuousness of scape pilosity). It is a fairly common species which shows up in any serious collecting effort from within its range (e.g., Eastlake-Chew and Chew, 1980; Van Pelt, 1983). With human population growth and the inevitable increase in collecting activity that accompanies it in the areas where *austrorcidua* lives, it will undoubtedly become known as a characteristic Southwestern and Mexican *Paratrechina*.

Natural History

The timing of alate production and flights seems to correspond to the usual nearctic pattern. The callow males in the type series were collected in late July and alates from Arizona (at LACM) in September. I collected an alate queen in late May in the Chiricahua Mountains. That no other queens and no males were present in that nest may be due to their having flown already. The male from Hidalgo is dated 25 July.

Austrorcidua is a species of mesic habitats at 1400-2400 m altitude. The types were collected in mesic oak-maple forest; specimens from

Nuevo León were from mesic oak-pine gully, and specimens I collected in the Chiricahuas were in a pine forest on a north-facing slope. Van Pelt (1983) reports *austroccidua* (as *P.* probably *melanderi*) being abundant in "high forest" and canyons in the Chisos Mountains. Eastlake-Chew and Chew (1980), on the other hand, found this species lacking on the north slope of a 1855 m hill in southeastern Arizona but collected it (along with *melanderi* and *bruesii*) at honey-bait transects on slopes facing the other cardinal directions. It is not clear whether the 3 species were segregated according to slope preference from the Chews's specimens loaned to me or from their published account (*op. cit.*).

Distribution

Costa Rica teste Ant Webb—Costa Rica

Austroccidua is a Mexican mountain species. In the US, it is known from the following localities: AZ, Cochise Co.; TX, Brewster Co.; UT, Provo (probably Provo, no other locality information on label). The Utah record is unusual as are the specimens, which only tentatively belong to *austroccidua*.

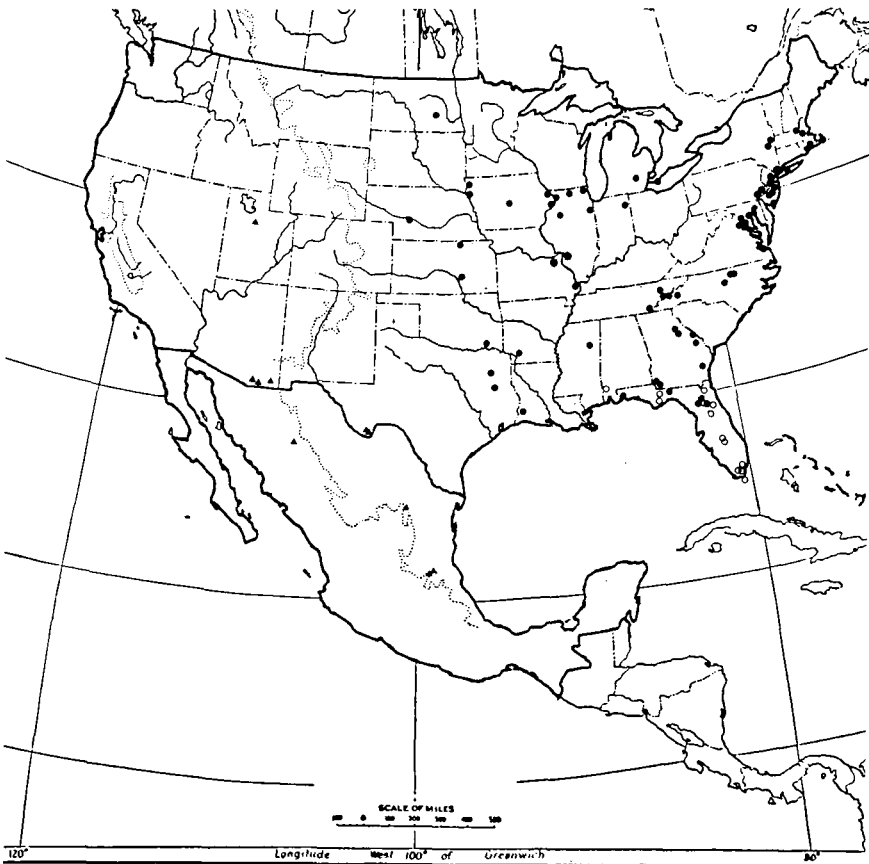


Fig. 51. Distribution in North America of *parvula* (●), *wojciki* (○) and *austroccidua* (▲).

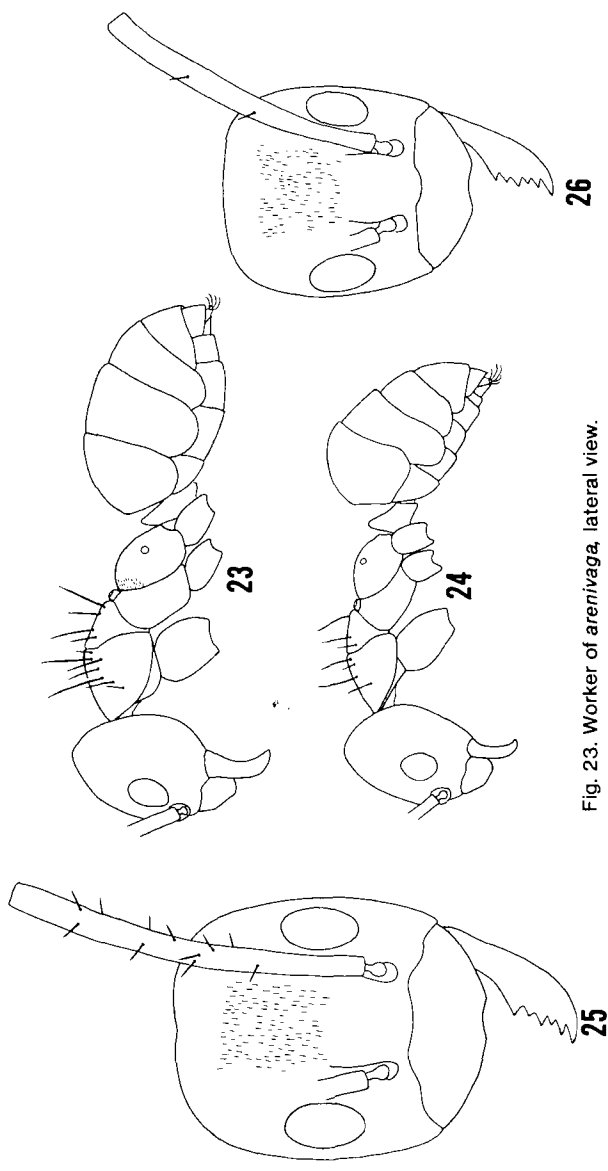


Fig. 23. Worker of *arenivaga*, lateral view.

Fig. 24. Worker of *phantasma*, lateral view.

Fig. 25. Head of *arenivaga* worker, dorsal view.

Fig. 26. Head of *phantasma* worker, dorsal view.

CHAPTER X ARENIVAGA COMPLEX

Diagnosis of Complex

Worker yellow or whitish, shiny; cephalic pubescence dense but fine and pale; scape pilosity subdecumbent to suberect, sometimes inconspicuous. Nests deep vertical tunnels with lateral branches in well-drained sand.

Male shiny except thoracic dorsum; parameres triangular; digitus boomerang-shaped but more elongate than in *Parvula* Complex; cuspis nearly as long as digitus; aedeagus triangular, acuminate.

Paratrechina arenivaga

(Figs. 23, 25, 47; Map-Fig. 52)

Prenolepis arenivaga Wheeler, 1905, Bull. Amer. Mus. Nat. Hist. 21: 391. Fig. 3, ♀, ♂. Type loc., Lakehurst, N.J.

Paratrechina (*Nylanderia*) *arenivaga*: Emery, 1925, Gen. Insectorum, Fasc. 183: 221; Buren, 1944, Iowa State Coll. J. of Science 18: 295; Van Pelt, 1958, Amer. Midl. Nat. 59: 50.

Paratrechina (*Nylanderia*) *melanderi arenivaga*: Creighton, 1950, Bull. Mus. Comp. Zool. 104: 408.

Formica perminuta Buckley, 1866, Proc. Ent. Soc. Phila. 6: 162. ♀ (questionable synonymy). Type loc., central Texas.

Diagnosis

Worker. TL 2.0-2.25 (Gulf and East Coasts), 2.2-2.7 (Midwest), OI 25-28 (East), 24-27 (West). A widely distributed nocturnal eastern and mid-western species which makes crater nests in sand. Yellow with large black eyes and slightly infuscate gastral apex. Head densely pubescent, thorax usually lacking pubescence but bearing relatively long and abundant brown flexuous macrochaetae—mean PM 6, mean MM 4, PM 4-9, MM 2-7. Smells acrid when crushed (*phantasma* smells sweet).

Male. TL 1.9-2.4 (larger specimens from North and Midwest), OI usually 35-39. Uniform brown with yellowish legs and scapes. Genitalia distinctive (Fig. 47). Parameres elongate with slender distal portion curved mesad. Cuspides very large and prominent, reaching at least 2/3X, often more than 3/4X length of aedeagus.

Queen. Uniform brownish-yellow to yellowish-brown with large black eyes and broad head. Most likely to be confused with *phantasma* but has macrochaetae on scape (SM 3 or more; body deeper yellow or brownish) in *arenivaga*.

Description

Lectotype worker. TL 2.17, HL 0.64, HW 0.56, SL 0.73, EL 0.16, PW

0.40, MCL 0.20, WL 0.81, FL 0.59, GL 0.73, SM 8, PM 6, MM 3, CI 88, OI 25, SI 114, FI 92.

Clypeus has an arcuate front border with a narrow median concavity; rear border undulating but not arcuate. Sides of dorsal face of clypeus meet in a rounded median angle. Anterior 1/2 of sides of head nearly straight and slightly convergent; rear half somewhat more rounded, especially posteriorly. Rear border of head a shallow concavity across the middle 1/3 of HW between the rounded corners. Head about as broad as in *flavipes*, but eyes larger. Eyes separated from mandibular insertions by slightly more than their length and from sides of head by about 3/5 their width. Scapes of about the usual length for *vividula* group, with about 1/2 their length extending beyond posterior corners of head; gently curved. Ocelli lacking. Mandibles with a single large apical tooth and masticatory border which meets inner edge of tooth in an even curve.

Promesonotal profile a nearly even convexity, broken only by a shallow impression formed by the portions of the pro- and mesonotum adjacent to the promesonotal suture. Angle between dorsum and rear face of mesonotum more rounded and obtuse than other *vividula* group species. Propodeum low, with dorsal face nearly flat and meeting posterior face in a very rounded yet detectable obtuse angle. Propodeum appears a little longer than in other species. Legs a little longer than usual for *vividula* group, though a little shorter than average for this species.

Petiolear profile cuneate with a blunt, rounded crest. In dorsal view, flat across the top with a shallow median impression.

Cephalic vestiture distributed very much as in *faisonensis*, pilosity longer and lighter in color, and pubescence a little denser and yellow. Scape macrochaetae short, oblique and pale; best seen against a pale background from posterior view. Thoracic macrochaetae long (cf. MCL of *arenivaga* and *faisonensis*), dark brown and flexuous. Pubescence completely lacking on thorax and propodeum. Macrochaetae on legs a little longer and more abundant than usual in *vividula* group, and a few are present on the lateral as well as flexor and extensor surfaces. Gaster without pubescence but with numerous flexuous macrochaetae.

Head and appendages dulled by pubescence, thorax and gaster very shiny.

Eyes black; head light brownish-yellow; thorax and front 1/2 of gaster clear yellow; rear 1/2 of gaster a little darker than head.

Allolectotype male. TL 2.41, HL 0.55, HW 0.53, SL 0.61, EL 0.21, WL 0.86, GL 1.01, SM 3, CI 96, OI 39, SI 111.

Clypeus like a flattened hexagon in dorsal view; the anterior border truncate across the middle 1/3 of the clypeal width; the rear border truncate across the portion anterior to the frontal carinae. Head narrower and differently shaped from that of worker. Sides convex, equally broad at mandibular insertions and at posterior corners. Head broadest across the middle of the sides of the head. Rear border of head more convex than the sides and meeting them in rounded but abruptly angular (about 100°) corners. Eyes large, convex, occupying about 40% of the sides of the head and about equidistant from mandibular insertions and posterior corner (notably further from rearmost part of convex rear border). Ocelli as in

vividula, median and laterals separated by about 2X their width. Mandibles with a large sclerotized apical tooth and a smooth straight masticatory border.

Petiole a little shorter but not much broader than in workers, in contrast to most other species.

Genitalia prominent and distinctive (Fig. 47). Parameres tapering and slightly recurved in side view, as in *vividula* but longer and less strongly curved mesad in rear view. Volsellar lobes very elongate; the digitus boomerang-shaped (but longer and more slender than the shorter, broader boomerang-shape of males in the *Parvula* Complex); but this more easily seen in other specimens due to the way the lectoallotype is mounted; the convex cuspidal terminus about 2X the size of that of other species and only a little shorter than the digitus; the opposing surfaces of volsellar lobes papillose (again, more readily seen in other specimens or cleared and mounted preparations). Aedeagal lobes triangular with weakly decurved tips.

Body with relatively long, abundant, weakly flexuous golden brown pilosity. Pilosity of parameres yellow, comprised of about 25 decurved hairs per paramere. Pubescence of head and thorax appressed, shiny and yellow. Pubescence of legs and scapes subdecumbent, partially obscuring the relatively short yellow pilosity. Gastral pubescence limited to sparse appressed hairs.

Head and thorax slightly dulled by pubescence, gaster with the usual shagreening.

Eyes black. Body, scapes, legs and parameres yellowish-brown. Middle and hind coxae and volsella pale yellow, aedeagus hyaline.

Variation

Worker. TL 1.92-2.75, HL 0.56-0.71, HW 0.47-0.65, SL 0.64-0.85, EL 0.14-0.19, PW 0.33-0.44, MCL 0.16-0.21, WL 0.69-0.91, FL 0.49-0.68, GL 0.57-1.29, SM 5-17, PM 4-9, MM 2-7, CI 79-92, OI 23-28, SI 110-127, FL 88-102, (n=61).

It will come as little surprise that this species, with its wide distribution but rather specific habitat requirements, exhibits considerable variation. The ranges of SI and FI are skewed toward the high end due to a Florida series of 4 workers and one worker from Louisiana with unusually long appendages. SI exclusive of these 5 individuals' ranges 110-119 and FI 88-95. Series from peninsular Florida tend to be overall smaller than specimens from the Midwest. Specimens from Texas and New Jersey are approximately intermediate in body size. Western specimens have more pilosity on the scapes; SM 8-17 in Louisiana, Texas and Midwestern material versus SM 5-10 in Florida and New Jersey material. Western specimens have broader heads CI 88-96 (versus 81-90 in the East). Specimens from Louisiana and Iowa have shorter lighter-colored thoracic pilosity, while Texas specimens have somewhat less dense cephalic pubescence. Iowa material and one of the Louisiana series studied have small eyes, in these 2 series OI 23-25 in all specimens, while in all other series the majority of workers have OI greater than 25. The usual color of *arenivaga* is clear yellow with a slightly deeper yellow head and infuscated

gastral apex, but a series from northern Florida and 2 from Illinois are much more brownish than usual.

Male. TL 1.87-2.41, HL 0.49-0.58, HW 0.46-0.54, SL 0.54-0.62, EL 0.18-0.21, WL 0.73-0.86, GL 0.65-1.05, SM 0-13, CI 91-100, OI 32-41, SI 107-116 (n=9).

Males of *arenivaga* show variation parallel to that found in the workers. They are generally larger in the West, but the type from New Jersey is the largest of the specimens measured overall, though it falls slightly short of this in a few measurements. One clear trend is that Western specimens have hairy scapes; SM 6-13 for Illinois and Texas specimens, 3-4 in New Jersey, 0-2 in Florida. Illinois specimens have the genitalia less elongate but retaining the distinctive form and have the appropriate habitat preference and associated workers.

Material Studied

Lectotype and lectoallotype from a series of 5 workers and 4 males (3 badly mutilated) on cards on a single pin with an unnumbered AMNH cotype label, collected by W.M. Wheeler, 24-26 September 1904 at Lakehurst, New Jersey. Labels written directly on the cards indicate the selected specimens. Another pin with 2 males and 2 workers (MCZ) with the same collection date has been labeled paralectotype. Though all syntype material with the same date should technically be so designated, I do not have the entire series available to do so at this time. One pin included in the *arenivaga* syntype series at MCZ contains specimens of *parvula* and has been so labeled. Additional material studied includes material from Louisiana and Iowa (WFB), Illinois and Kansas (MBD, SBSK), Texas and Mississippi (USNM), New Jersey, Alabama, and Nebraska (LACM). A large amount of Florida material is contained in JCT, and there are a few series in other collections.

Discussion

Creighton's (1950) evaluation of *arenivaga* as a subspecies of "*melanderi*" (*terricola*) has already been mentioned in the discussion of *faisonensis*, but some additional points can be made here. A sizable series of *arenivaga* from Lakehurst, New Jersey, in the Creighton collection (LACM) contains males whose genitalia have been particularly dissected, so it is evident that he had familiarity with the species in the field and that he had studied the genitalia. Thus, it is difficult for me to understand how he could state that the genitalia of the Lakehurst specimens are "much more like Wheeler's figure of *melanderi* than his figure of *arenivaga*" (p. 408). What remains of the genitalia of these specimens is typical *arenivaga* genital apparatus, differing from Wheeler's (1905, p. 392) figure only in that the papillae on the rami of the volsellae are rather inconspicuous. Creighton's statements concerning the form of the volsellae on these specimens are erroneous and could only have followed mislabeling of slides or some other such error. Creighton (p. 403) had high regard for zoogeographical analysis as a possible solution to taxonomic difficulties in *Paratrechina*, but he apparently did not consider that analysis of habitat preference

would be important. The very strict preference of *arenivaga* for making crater nests in sand is a diagnostic feature Creighton overlooked. The fact that *terricola* nests in finer textured soils, normally under a stone, log or other object, distinguishes it readily for *arenivaga* where their ranges overlap, even without microscopic examination.

Darker-colored series of *arenivaga* such as those mentioned above are not likely to be confused with any other species due to their habitat preference. In the absence of such information, dark *arenivaga* might be confused with *faisonensis*, *terricola* or *vividula*. Larger eyes will distinguish it from the first 2, denser cephalic pubescence from the latter 2, and the long, slightly more abundant thoracic pilosity from all 3 other species. In Florida, *arenivaga* might be confused with *phantasma*. Means of distinguishing those species are given in the description and discussion of *phantasma*.

I have opted against resurrecting Buckley's name *perminuta* though it must have applied to *arenivaga*, if indeed to any *Paratrechina*. Buckley's description leaves too few clues for me to comfortably use his name.

Natural History

Arenivaga appears, like most of our native species, to rear sexuals in the late summer and fall, which fly the next spring. I have often collected alates near the nest entrance on sunny days in December and January in Florida. Apparently, they fly before April in Florida, for I have never collected them from April to October. Further north they fly in May. I have series collected in Hartley County, Texas (from TTU), which had alates remaining in the nest on 8-9 May. This becomes less surprising when one takes into account that that part of Texas experiences the same number of frostfree days in an average year as does Lakehurst, New Jersey (Visher, 1954).

Wheeler's name *arenivaga* is very appropriate, for this species nests almost exclusively in highly drained sands of low nutrient content with well-spaced vegetation. The only exception to this that I know of is Buren's collection (now in JCT) of *arenivaga* from the loess bluffs along the Missouri River in Iowa. These bluffs are more closely analogous in soil characteristics and ant fauna to sandy areas much further south than to those of the surrounding heavier soils.

Arenivaga seems to need relatively undisturbed samples of its preferred habitat to survive. Paradoxically, it often inhabits the more disturbed or harsh areas within these habitats, such as areas swept by fire, fire lanes, footpaths, primitive road-beds, dune blowouts, and openings between vegetation subject to high temperature fluctuations. It does not usually tolerate conversion to pasture or other such modifications. Nest entrances are surrounded by a small crater of sand, usually of a color different from that of the surface or immediate subsurface, indicating that the nests may be quite deep. Unfortunately, I have never succeeded in following one in the crumbly sand in which they occur more than a two or three dm down.

In the scrublands of Florida, colonies are usually polydomous, and individuals collected from an opening in vegetation or group of adjacent openings may be placed together with ensuing aggression. However,

more than one colony may inhabit large clearings, and members from these will fight, even when from adjacent entrances within 1 m of each other. The "territory" of a single colony may have as many as 20 entrances ranging from a few centimeters to over a meter apart. Where the two species overlap, *phantasma*, which has nearly similar habitat preference and nesting habits, has its territories interspersed with those of *arenivaga*.

I have often collected this species (as well as *phantasma* and *wojciki*) with cixiid homopterans in their nests. Apparently, the homopterans are associated with the roots of the palmetto, *Serenoa repens*. The details of the interactions are not known.

Mealybugs (Homoptera: Pseudococcidae) are often associated with roots of *Serenoa* and other plants in the scrub and probably provide food (honeydew) for *P. arenivaga*, but they are much more commonly tended by *Brachymyrmex* and small *Solenopsis* in these areas. *Arenivaga* workers bring in insect carcasses (often cooperating in the effort) which presumably form their main protein source. Unfortunately, their strictly nocturnal foraging habits, small size and pale color make it most difficult to observe them in the field. In the lab, colonies grow in size, though slowly, producing full-sized workers on a diet of honey-water and fresh-killed insects (cockroaches, caterpillars, and houseflies).

Van Pelt (1956, 1958) has given a careful account of his observations on *arenivaga* in Florida. See Discussion of ecology of *phantasma* for comparison of these two closely related species.

Distribution

Arenivaga is spottily distributed but locally abundant in areas with highly drained, sandy soils in eastern US from New Jersey to Nebraska south to Florida and eastern Texas. This species appears to be absent from the Appalachian region.

***Paratrechina phantasma*, New Species**

(Figs. 24, 26, 48; Map-Fig. 52)

Diagnosis

Worker. TL usually 1.8-2.2, OI 25-27. A small, pale, nocturnal Florida-peninsula species of xeric sandy habitats. Very pale whitish to light yellow, with pilosity of approximately the same color. Very slight or no infuscation on gaster. SM 1-4, PM 4-5, MM usually 3. Smells sweet when crushed.

Male. TL usually around 2.0, OI usually 37-40. Uniform brown or with gaster darker, appendages lighter than body, middle and hind coxae pale. SM always 0. Genitalia distinctive (Fig. 48). Parameres short, weakly deflected, subtriangular with concave rear border. Volsellae with terminus of digitus curved laterad, cuspis less prominent than in *arenivaga*. Aedeagus reaching or protruding a little beyond parameres.

Queen. Looks very much like *arenivaga* but with SM 1-2, paler in color, and larger than Florida *arenivaga* queens. Some *phantasma* queens have a small supernumerary tooth either between the basal and subbasal

mandibular teeth or arising from a common base with the subbasal tooth. One paratype has such a tooth between the median and subbasal teeth.

Description

Holotype worker. TL 1.92, HL 0.57, HW 0.48, SL 0.66, EL 0.15, PW 0.34, MCL 0.16, WL 0.71, FL 0.55, GL 0.65, SM 1, PM 5, MM 3, CI 85, OI 27, SI 116, FI 96.

Anterior border of clypeus with very weakly convex sides and a narrow median concavity; rear border shaped like a baseless trapezoid with a median concave emargination. Clypeus with the usual broadly rounded median angle. Sides of head weakly convex, subparallel; apparently convergent toward the rear because posterior corners are positioned behind inner borders of eyes, i.e., much closer together than mandibular insertions. Rear border of head straight, narrow due to proximity of corners, about $1/3 \times HW$, the latter is greatest across the middle of the eyes. Head subrectangular. Eyes large, convex and close to sides of head, separated from sides of head by less than $1/4 \times$ their width and from mandibular insertions by a little over their length. Scares of about median length for the species, slightly curved near base, straight beyond.

Pronotal profile weakly convex. Mesonotal profile flat, sloping to the rear, its anterior slightly raised above rear portion of pronotum. Propodeum low and angular, the weakly convex dorsal face meeting the flat rear face in about a 120° rounded angle. Legs rather long and slender.

Petiole cuneate with a moderately sharp crest and convex rear face in lateral view. In posterior view, crest rounded.

Vestiture very much like that of *arenivaga*; the macrochaetae flexuous and relatively long over the entire body. Petiole with 2 small macrochaetae. Pilosity very pale whitish, not at all darker than body color; in fact, lighter than color of gaster; pilosity substantially less abundant on scape and slightly less abundant on thorax than in *arenivaga*. Pubescence on head very pale but fairly dense; that on scapes and anteriomedian portion of pronotum subdecumbent.

No detectable sculpture other than the usual gastral shagreening.

Eyes dark grey. Body pale whitish yellow, gaster a little darker, but this apparently due to color of contents and not to infuscation of the tergites. Mandibular teeth red, rather than the usual dark brown or black.

In the field, this species has a distinctive sweet odor when crushed (type not sampled for this character).

Allotype male. TL 1.94, HL 0.53, HW 0.53, SL 0.60, EL 0.20, WL 0.79, GL 0.63, SM 0, CI 100, OI 38, SI 113.

Anterior clypeal border with weakly arcuate sides and straight median truncation across the middle $1/3$ of its width; rear border roughly bell-curve shaped with a median concave emargination at the top of the curve. Clypeal sides meet in a broadly rounded median angle. Head with sides more convex than in worker. Mandibular insertions closer together and lying directly anterior to posterior corners of head. Rear border about as convex as sides but a little less broad than they are long. Eyes large, bulging, making head seem broader (see CI). Ocelli a little smaller than in *arenivaga*, the median and laterals separated by about $2 \frac{1}{4} \times$ their width.

Mandible with a short apical tooth whose inner border curves without interruption into the straight masticatory edge.

Petiole a little broader and blunter than in worker.

Genitalia rather like a foreshortened version of those of *arenivaga* (cf. Figs. 47 and 48). Parameres tapering and recurved in side view but are only about as long as they are broad at the base. In posterior view the parameres conceal more of the inner genital appendages because of their greater relative width than in *arenivaga* and are somewhat curved mesad as in *arenivaga*. The volsellae have digiti with straight-line length a little longer than that of aedeagus but curved laterad near their terminus and, thus, do not protrude. This formation of the digiti, common in the *fulva* group, is unique to this species in the *vividula* group (in North America, at least). Cuspides, as in *arenivaga*, about 3/4X as long as digiti, papillose on their tip (as is the opposing portion of the digiti). Aedeagus triangular with a rounded tip not decurved.

Body with pale yellow pilosity, relatively shorter than in *arenivaga*, but flexuous. Parameres with about 20 decurved yellowish macrochaetae. Gaster less pilose than worker's, especially toward the front, and with long but widely scattered appressed pubescence on the rear half. Pubescence of scapes short and subdecumbent.

Eyes grey. Thoracic dorsum and appendages dulled by pubescence. Sides of the thorax and legs brown. Scapes brownish-yellow. Middle and hind coxae pale tan. Gaster piceous brown.

Variation

Worker. TL 1.78-2.26, HL 0.57-0.61, HW 0.46-0.55, SL 0.65-0.73, EL 0.14-0.16, PW 0.32-0.38, MCL 0.16-0.18, WL 0.69-0.77, FL 0.52-0.59, GL 0.53-0.89, SM 0-4, PM 4-6, MM 2-4, CI 80-90, OI 25-27, SI 113-121, FI 91-100, (n=37).

Aside from minor variations in size and proportions, there is little notable variation among the workers of *phantasma*.

A series from Gainesville, Florida, is deeper yellow than south Florida specimens, thus, closely resembling *arenivaga* from the same locality. The normal range of CI appears to be 83-90. The two specimens with narrower heads may have undergone shriveling upon desiccation.

Male. TL 1.92-2.13, HL 0.48-0.53, HW 0.48-0.53, SL 0.54-0.60, EL 0.17-0.20, WL 0.73-0.83, GL 0.63-0.81, SM 0, CI 94-100, OI 35-40, SI 108-113, (n=8).

The males of *phantasma* are quite uniform in size, setation, and structure of the genitalia. The main variation in body is in color which ranges from uniform brown to having head and thorax light brown with the gaster piceous, and all intermediate conditions.

Material Studied

Holotype and allotype, deposited in FSCA, were collected at Archbold Biological Station, 12 December 1982, in *Quercus inopina* scrub by myself. Other than a small collection from the same locality by T. C. Schnierla in 1943 (USNM), all material of this species known to me is in JCT or in the ant collection of Archbold Biological Station where I have

been collaborating with Dr. Mark Deyrup on an ecological and distributional study of the ants of the Station. In addition to collections from the Station, JCT contains a large series from Gainesville, Florida, and a smaller one from Jupiter, northeast Palm Beach County, Florida (WFB). Gifts of this material from JCT will be placed in the usual depositories.

Discussion

This pale *Paratrechina* well deserves the name *phantasma* (Latinized Greek meaning ghost or phantom). The name is a noun in apposition and, thus, invariant in the unlikely event of change in placement to a genus of masculine or neuter gender.

Only *arenivaga* resembles in any way closely this small, delicate pale yellow species of Florida's xeric sandy scrub and dune vegetation. Even the darker yellow specimens from the Gainesville area may be recognized in the field by crushing one or a few workers, which yield a sweet, to me rather rose-like odor, quite unlike the acrid odor of *arenivaga*. Under microscopic examination, the pale color of the pilosity and the paucity of bristles on the scapes will separate *phantasma* from the dark-haired, bristly-scaped *arenivaga*. However, the scape macrochaetae of Florida *arenivaga* are often rather short and inconspicuous, so one must search carefully for them in attempting to identify specimens of the *Arenivaga* complex from Florida.

The males are easily separated from *arenivaga* and all other native species by their distinctive genitalia, especially the outward curvature of the digiti.

Faded workers of another small Florida species, *wojciki*, with similar chaetotaxy of the scapes may be confused with *phantasma*, but *wojciki* has the 8 major thoracic macrochaetae short, subequal in size to each other and less abundant than in *phantasma*, and always has at least a trace of infuscation on the head. (For other characters, see description of *wojciki*.)

Phantasma seems likely to have arisen from a population of *arenivaga* during a warmer era when higher sea levels isolated parts of south central Florida. The two species seem to be coexisting without exchange of genes today, despite their very similar ecologies providing ample opportunity for this. However, Florida workers of *arenivaga* are more similar in metric and meristic characters to *phantasma* than are *arenivaga* from other areas, so the two species do not exhibit character displacement in at least this set of traits. Cole (1968) notes similar situations in the myrmicine genus *Pogonomyrmex*. In the case of *phantasma* and *arenivaga*, the situation seems best explained by a mechanism comparable to centrifugal speciation (Brown, 1957).

Natural History

The ecology of *phantasma* so closely matches that of sympatric *arenivaga* that it is a wonder to me that they manage to coexist. Alates are produced October through December and fly in late winter. Colonies are polydomous, and nest entrances are marked by craters of subsoil. The nests often contain cixiid homopterans like those in the nests of *arenivaga*.

Phantasma workers forage at night all year long, even at temperatures below 15°C in winter months, as do those of *arenivaga*. The only slight, but perhaps important, ecological difference between the two species is that *phantasma* is limited to more xeric, fire-swept, scrub vegetation, while *arenivaga* can exist in later successional, more shaded stages of the vegetation and near the edges of temporary ponds where the sand may be quite damp.

Distribution

Phantasma is probably endemic to the central ridge of Florida, having only recently spread to the coastal dunes. This species abounds in Highlands Co., Florida and has been collected once each in Alachua Co. and Palm Beach Co.



Fig. 52. Distribution in North America of *arenivaga* (●), *phantasma* (○) and *bourbonica* (□).

CHAPTER XI
BRUESII COMPLEX**Diagnosis of Complex**

Worker usually larger than sympatric forms; brown and shining gaster often appears massive; cephalic pubescence sparse, thoracic pubescence lacking or with a little on the sides in larger individuals; scape pilosity suberect to erect, usually conspicuous and abundant, SM >10. Nests under stones or wood, often near stream beds in lowlands and foothills of Chihuahuan desert area.

Male large, with long cylindrical gaster; parameres slender, digitiform; digitus and aedeagus essentially as in *Parvula* Complex.

Paratrechina bruesii

(Figs. 27, 29, 39; Map-Fig. 50)

Prenolepis bruesii Wheeler, 1903, Psyche 10: 106. Worker, female, male. Type loc., Fresno Canyon, Presidio Co., TX.

Paratrechina (*Nylanderia*) *bruesi* (sic): Creighton, 1950, Bull. Mus. Comp. Zool. 104: 406; in part.

Prenolepis anthracina var. *nodifera*: Pergande, 1895. Proc. Calif. Acad. Sciences 5: 860. ♀, ♂. Not Mayr, 1870, Sitzber. Akad. Wiss. Wein 61: 338.

Prenolepis (*Nylanderia*) *mexicana*: Wheeler, 1914, J. N. Y. Ent. Soc. 22: 55.

Diagnosis

Worker. TL usually 2.5-3.0, OI usually 20-22. Large, dark brown Mexican and border-region species of riparian habitats in scrub desert and desert grasslands at 750-1800 m. SM 13-19, PM usually 7-11. Scape thick, appearing even thicker due to subdecumbent pubescence, but not notably shorter than in other species as reported elsewhere (Creighton, 1950; Wheeler, 1903)—mean SI of Texas *bruesii* about 112, or about the same as that of *vividula*.

Male. TL 2.6-3.3, OI usually 35-36. Elongate, black, form vaguely reminiscent of *Formica* males, especially the long cylindrical gaster. Head narrow, CI 88-92. Scapes long, SI usually 125+, pilose, SM 7-10. Parameres slender, digitiform, much longer than volsella and aedeagus. Wings dusky.

Queen. Large, dusky brown, with dusky wings. SM 9 or more.

Description

Lectotype worker. TL 2.51, HL 0.73, HW 0.61, SL 0.81, EL 0.15, PW 0.43, MCL 0.22, WL 0.89, FL 0.63, GL 0.89, SM 13, PM 10, MM 4, CI 83, OI 21, SI 111, FI 86.

Anterior border of clypeus arcuate, flattened across the middle portion lying directly anterior to the frons; rear border scalloped and much less

arched. Sides of head subparallel from an imaginary line across the rear edge of the antennal fossae to one about 1/2 way between the rear border of the eyes and the posterior corners of the head. Rear border of head convex except for a distinct notch behind the frons. Eyes small, separated from sides of head by about 1/2X eye width and from the mandibular insertions by about 2X EL. Scapes slender at the base, thickening to about 2X their basal diameter at their thickest portion, nearly straight out to thickest point, slightly curved beyond. SI about average for Texas material.

Pronotum in profile smoothly convex. Mesonotum flat; its anterior edge raised only slightly above rear edge of pronotum, its rear face meeting the dorsal face through a rounded, strongly obtuse angle (about 155°). Propodeum evenly arched, its highest point about as high as pronotum. Legs short for this species about comparable to those of *parvula* in length (normally somewhat longer).

Petiole scale-like, quite different from cuneate form of species considered thus far. Anterior face convex; rear face less convex, becoming concave near the sharp crest which bears a few small erect hairs. From above, the petiolar crest is weakly rounded.

Pilosity long and abundant over entire body. Numerous shorter bristles occur on the cheeks. Scape macrochaetae notably longer than greatest width of scape, partially obscured by subdecumbent pubescence which is not as long but quite abundant. The 8 major thoracic macrochaetae dark brown with large barbules detectable even at 40X; the ancillary hairs 1/2X or less the length of the major hairs and of much finer diameter. Gaster with abundant, long, curved, noticeably barbate macrochaetae. Pubescence dense, subdecumbent on scapes; short and appressed on legs, apparently non-existent on body.

Entire body shiny but lacking the highly polished appearance of the sympatric *austroccidua*.

This specimen, probably not fully sclerotized, has grey eyes and is yellowish-brown on the top of the head and on the gaster, a little lighter elsewhere. Gasterless specimen on the point beneath the lectotype is uniform brown.

Allolectotype male. TL 2.92, HL 0.62, HW 0.57, SL 0.78, EL 0.22, WL 1.01, GL 1.29, SM 8, CI 92, OI 36, SI 126.

Clypeus lentiform, its front and rear borders about equally arcuate and with shallow median concavities. Sides of head straight, subparallel, anterior to eyes, curving inward behind the eyes to meet the posterior corners. Posterior corners of head lie behind inner margin of eyes and delimit the straight rear border. Eyes large, convex, protrude well beyond sides of head. Though CI is about the same as *faisonensis* and *melanderi*, this specimen, in fact, has a narrower head than either of these species—the CI being due to the strongly protruding eyes. Lateral ocelli smaller than median, separated from it by about 2X the greatest width of the latter. Scapes long and with shorter, less conspicuous macrochaetae than in worker.

Petiole viewed from the side with a thick, blunt, smooth top, but apparently flat front and rear faces. Viewed from above, front and rear

faces are concave in the middorsal area, petiole very broad with rounded sides. Crest bears some short curved hairs.

Genitalia distinctive. Parameres slender (Fig. 39), digitiform, weakly curved mesad and considerably longer than volsellae or aedeagus. In side view, convex aedeagal dorsum may be seen above paramere, and deflected tip of aedeagus protrudes below paramere. Base of volsella may also be seen protruding beneath basal portion of paramere. Ventral and rear edge of volsellar base meet in a weakly obtuse angle in side view, the angle not rounded off but sharp and distinct.

Pilosity dark brown, finer and much less abundant than on worker, especially sparse (but coarsely barbulate) on gaster. Appendages, head and mesometathorax with fine, light-colored pubescence. Gaster with sparse appressed hair. Parameres with long curved yellowish-brown pilosity.

Body shiny, a little duller where pubescence occurs. Gaster lightly shagreened with individual cuticular plates larger than in other nearctic species.

Eyes black. Body uniform castaneous brown. Specimen is faded, since Wheeler (1903) described it as black.

Variation

Worker. TL 2.34-3.37, HL 0.61-0.84, HW 0.53-0.73, SL 0.69-0.97, EL 0.12-0.18, PW 0.36-0.56, MCL 0.16-0.24, WL 0.77-1.07, FL 0.55-0.79, GL 0.89-1.52, SM 13-19, PM 6-13, MM 3-8, CI 81-90, OI 17-25, SI 107-119, FI 86-99, (n=31).

Head shape may be quite variable in this species, especially with respect to breadth and convexity of the sides. I have 2 small series from Arizona (not measured) in which the smaller workers of the series have narrow, straight-sided heads and the larger ones have the heads quite broad and convex-sided. One of these large workers has CI obviously higher than the upper value of 90 reported above and is reminiscent of the major workers of *Pseudolasius*. A straight to weakly-convex-sided head of moderate breadth (CI around 85) is characteristic of the great majority of *bruesii* workers. The petiole of the type is atypical in having a sharp crest, as most workers have a blunt, rounded crest in side view. The gaster of *bruesii* workers is usually quite voluminous, and only rarely is it a little longer than the thorax as is shown in Fig. 27. Comparison of the ranges of WL and GL above should give some indication of this.

The vestiture varies considerably, but it can safely be said that within the U.S. this ant has notably more pilosity on the scapes and thorax than any sympatric form (unless *bruesii* should be found to be sympatric with *hystrix* in the future). The pilosity of the scapes is often not as long as in the type, and in such cases, the scape pubescence is usually shorter and less erect. The larger ancillary macrochaetae of the thorax are often up to 3/4X as long as the major macrochaetae. There is usually some sparse pubescence on the head and gaster, and not uncommonly, especially in larger workers, there is decumbent to suberect pubescence on the front and sides of the pronotum, the mesometapleural area, and the propodeum.

The only notable geographic variation in *bruesii* is that Arizona specimens have longer scapes (mean SI about 115.5) than specimens from Mexico and Texas (mean SI about 111.7).

Male. TL 2.61-3.28, HL 0.61-0.69, HW 0.54-0.63, SL 0.73-0.89, EL 0.19-0.24, WL 0.95-1.09, GL 1.05-1.54, SM 7-10, CI 87.5-92, OI 32-36, SI 120-131, (n=8).

The major obvious variation in *bruesii* males is in gaster length. This may be geographically determined since individuals of a series of 8 males from Nayarit, Mexico (only 2 measured), appear to have shorter gasters than the males from the U.S. Scape length is at the high end of the range in males from Arizona, as in workers.

The angle formed in side view by the meeting of the basal and rear edges of the volsella ranges from about 85° to 120°, or so. The left and right parameres of the type are quite different in this respect. Most specimens have the angle nearly a right angle with the rear edge slightly concave to very slightly convex and the lower edge straight to slightly convex.

Material Studied

The lectotype and lectallotype are mounted on the middle and upper points of a single pin at AMNH labeled: Fresno Canyon, Presidio Co., Tex., Dec. 19, '01/Wm. M. Wheeler Collection/Cotype No. (no number) AMNH. Two other pins containing 2 queens, 2 males and a worker, at AMNH; plus a pin with one member of each caste (male gasterless), at MCZ; comprise the rest of the syntype series in the U.S. A series of 3 workers and a male from Fresno Canyon at USNM appears not to belong to the syntype series, based on the handwriting on the label. USNM contains most of the Mexican material studied. A large series from Arizona in the Creighton collection (LACM) contains good representation of all castes. Most other material studied is duplicate material donated to me from TTU.

Discussion

The name *bruesii* or the misspelling *bruesi* (Creighton, 1950; Emery, 1925) has been so widely misapplied that perhaps all references to it, aside from the original description, do not, in fact, concern *bruesii*. Aside from the type material and perhaps one other series, all material loaned to me belonging to this species was either unidentified or misidentified. On the other hand, most of the material labeled *bruesii* has been *wojciki*, *terricola* or *austroccidua*.

As mentioned above, *bruesii* is a large species, the largest among our species. Most of the misidentifications of *bruesii* can be traced to Creighton's (1950) key which states that *bruesi* (sic) has "scapes surpassing the occipital margin by not more than one-third their length." This was contrasted with "scapes surpassing the occipital margin by only a little less than half their length." It is, in fact, the latter description which better fits *bruesii* (and all other native U.S. species except *wojciki*, *parvula* and *austroccidua*). I believe it was Creighton's misconception that *bruesii* is an eastern U.S. species that blinded him to its real identity, even though he had seen genuine *bruesii* material (his Plate 51 is *bruesii*, as can be

seen from the form of the male). This species is, in fact, primarily Mexican and extends its range into southern Texas, Arizona and probably New Mexico. Pergande's collections from Baja California identified as the neotropical species *nodifera* (USNM) are unmistakably *bruesii*, as they were called by Emery (1925). Curiously, Wheeler (1914) failed to recognize his own species, *bruesii*, when he saw specimens collected by Mann in Mexico (USNM) some years after the original description.

Natural History

The collections I have studied indicate that *bruesii* rears alates during summer and fall. Collection with fully sclerotized alates date from April in Arizona and early August in Texas. The types were collected in December. I have callow males from 1670 m in Arizona collected in September. Unfortunately, Pergande's Mexican material is not dated. Apparently, the alates remain in the nest through the cool months and fly at the onset of hot weather (or late spring rains?).

Bruesii is a riparian species of the warm deserts of Mexico and far southern U.S. It is found up to 1800 m elevation in the desert grasslands and even in juniper-oak or juniper-cottonwood woodlands. At lower elevations, it is found in Chihuahuan type desert. The vegetation of the Mexican localities where Pergande collected this species is subtropical thorn forest. All nest series which include nesting information indicate the nests were under stones near streambeds or in desert washes.

Distribution

Bruesii is primarily a species of desert and foothill Mexico. I have seen numerous US samples from the following Mexican border areas: AZ, Cochise Co., TX, Presidio and Brewster Co.'s

CHAPTER XII
HYSTRIX COMPLEX**Diagnosis of Complex**

Worker larger than those of Parvula Complex; light brownish-yellow, shiny; pubescence virtually lacking over entire body; pilosity stout, black, abundant on dorsum, legs, scapes, SM usually > 20 . Nests deep in soil (perhaps entirely hypogaedic).

Male larger than those of Parvula Complex; dark brown, shiny; virtually free of pubescence on body; $SM > 15$; genitalia like those of Parvula Complex.

***Paratrechina hystrix*, New Species**

(Figs. 28, 30, 40; Map-Fig. 50)

Paratrechina species B Snelling and George, 1979, California Desert Ants, p. 200. Figs. 228-229, ♀. (Unpub. rep. to Bur. Land Management)

Diagnosis

Worker. TL usually 2.5-2.9, OI 19-23. A distinctive, probably hypogaedic species of the sagebrush and creosote deserts of eastern California, Nevada, and Utah. Yellow to light yellowish-brown with abundant dark brown pilosity and almost no pubescence on body and legs. SM 17-29, PM 9-17.

Male. TL about 2.3-2.7, OI 28-32. Dark yellowish-brown. Eyes small. Scapes long, SI 134-137. Pilosity abundant, SM 15-21.

Queen. Yellow with brownish-yellow head. Pilosity brown, abundant, shorter and less erect than on workers. Grooved, yellow median carina on clypeus distinctive.

Description

Holotype worker. TL 2.47, HL 0.70, HW 0.61, SL 0.94, EL 0.15, PW 0.44, MCL 0.20, WL 0.97, FL 0.72, GL 0.81, SM 21, PM 16, MM 8, CI 87, OI 22, SI 135, FI 103.

Clypeus sublentiform, anterior border more strongly arched than posterior border, and truncate; the rear border a nearly perfect arch except for a narrow median concave emargination. Clypeus with a weak, medially grooved, median carina. Sides of head convex, widest in front of the eyes, weakly convergent posteriad. Posterior corners of head lie approximately behind inner borders of eyes and delimit the broadly, shallowly notched rear border. Head longer than broad, relatively wide for this species. Eyes small, placed far back, near the middle of the sides of the head; separated from sides of head by about $1/2X$ eye width, and from mandibular insertions by a little less than $2X$ EL. Ocelli lacking. Scapes long, even for this species, bent at about $1/3X$ their length from the base.

Pronotum broadly and very weakly angular, the anterior and the slightly longer dorsal face flat, connected by a subtle rounded angle. Promesonotal suture feebly impressed, the front edge of the mesonotum virtually confluent with the rear edge of the pronotum. Mesonotal dorsum very

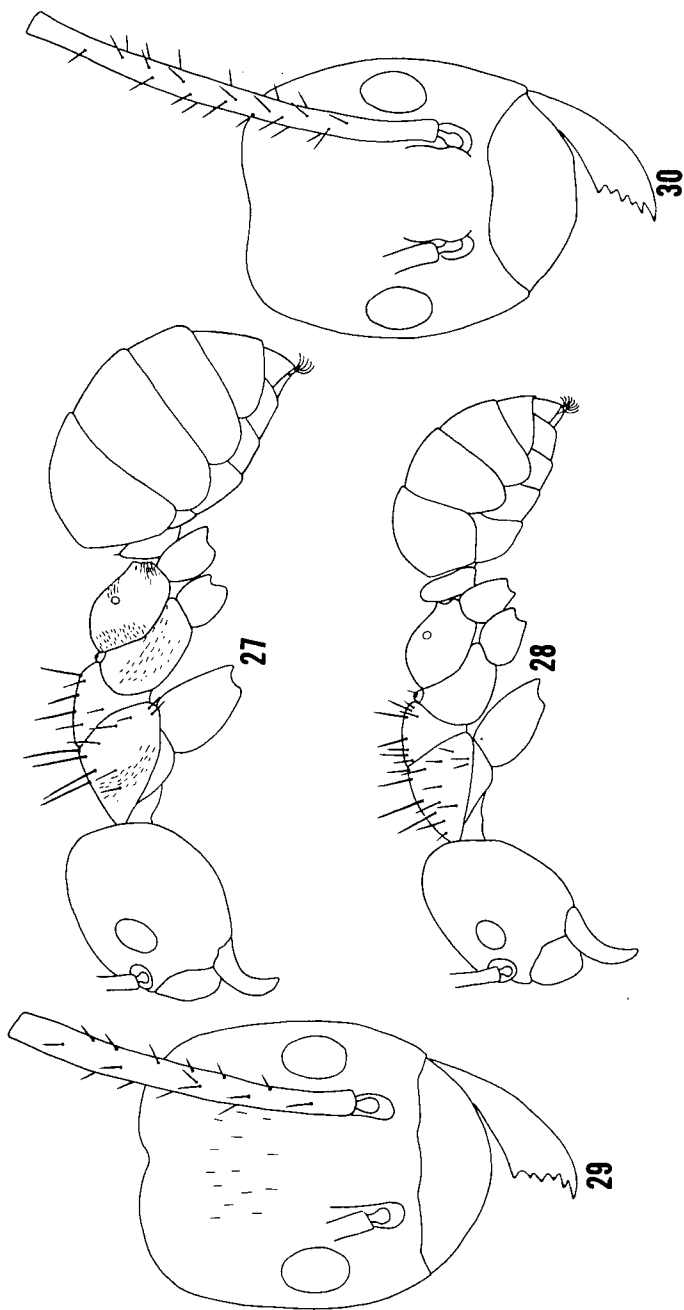


Fig. 27. Worker of *bruesii*, lateral view.

Fig. 28. Worker of *hystrix*, lateral view.

Fig. 29. Head of *bruesii* worker, dorsal view.

Fig. 30. Head of *hystrix* worker, dorsal view.

weakly convex and weakly sloped to the rear relative to the long axis of the thorax. Rear face of mesonotum meets dorsal in about a 130° angle, is relatively long among U.S. species, and gives rise to several barbate macrochaetae. Propodeum high and arched, its highest point about as high as that of pronotum; the angle between the dorsal and posterior faces about 90° . Legs a little longer than other U.S. species.

Petiole stout, squamose in side view, with straight, nearly parallel front and rear faces and a blunt convex crest. Viewed from above, the petiole is straight-sided with rounded corners and flat across the crest.

Vestiture distinctive among North American *Paratrechina*. Straight to weakly curved, dark brown pilosity abundant on head and thorax, gaster and appendages; SM 21 is near the low end of the range for this species. Pilosity on scapes lighter and shorter than on legs. Even propodeum has a small barbed macrochaeta on each side positioned behind the metathoracic spiracles. Pubescence sparse, limited to a few subdecumbent yellow setae on scapes, femora, tibiae and propodeum, a few erect setae on the anterior pronotum, and a small patch of appressed hairs near the eye.

Head and thorax shiny, gaster and femora a little less so due to fine indistinct shagreening. Scapes and tibiae weakly shining.

Yellow with head and posterior half of gaster a little darker. Mandibles brownish-yellow with castaneous edges and teeth. Dark brown pilosity very conspicuous due to its abundance and contrast with the yellow body and limbs.

Allotype male. TL 2.64, HL 0.62, HW 0.56, SL 0.84, EL 0.19, WL 0.97, GL 1.05, SM 19, CI 90, OI 31, SI 136.

Mandible with a well-sclerotized apical tooth and straight, edentulous masticatory border. Anterior clypeal border arcuate with a deep but narrow median concavity which itself has a narrow median tooth. Rear border shaped as a bell-curve with the top excised by the median concavity; the median arch of the curve conspicuously more strongly arcuate than the front border. Sides of head convergent anteriorly, concave in front of the eyes, convex behind. Posterior corners lie behind the mandibular insertions and delimit the convex rear border. Eyes small, notably less than $1/3X$ HL, but strongly convex and protruding distinctly beyond sides of head. Ocelli close-set, median and laterals separated by about $1\ 1/2X$ their width. Scapes long, weakly curved, lacking the weakly signoid curvature of many other *Paratrechina* males.

Petiole blunt and squamose in side view, as in worker; the crest convex. Viewed from above crest flat across the top. Petiole broader and heavier than worker's.

Parameres triangular in side view, about $2X$ as long as their basal breadth; curved mesad in rear view. Volsellar basal edge almost perpendicular to rear edge. Cuspis stout, thumb-like; projecting dorsoposteriad as in *bruesii* or *austrocidua*. Digitus blunt, broader than cuspis and weakly deflected. Aedeagal lobes triangular in side view, with weakly convex dorsal edge, in posterior view thickened and slightly divergent distally.

Pilosity long, dark brown and abundant over most of body, including on gastral dorsum unlike males of most other nearctic species. Even pronotum, propodeum and petiole bear a few short macrochaetae. Pubescence sparser on scapes but more abundant on legs than in worker. Pubescence virtually lacking on body; appendages pubescent. Parameres with 15-18 slightly sinuate decurved macrochaetae.

Body shiny, appendages slightly dulled by pubescence.

Head dark yellowish-brown; thorax and gaster a little lighter. Coxae and petiole light brown. More recently mounted specimens (JCT) are deeper brown.

Variation

Worker. TL 2.35-2.94, HL 0.63-0.73, HW 0.53-0.63, SL 0.81-0.95, EL 0.13-0.16, PW 0.37-0.44, MCL 0.17-0.20, WL 0.80-0.98, FL 0.61-0.73, GL 0.77-1.25, SM 17-29, PM 9-18, MM 4-10, CI 81-88, OI 19-23, SI 119-135, FI 90-103, (n=18).

Specimens of *hystrix* from Nevada and Utah are smaller and have less thoracic pilosity, PM 9-13, MM 4-7. One Nevada specimen has a convex, rather than flat, petiolar crest, in dorsal view. One specimen in the type colony has relatively short appendages. Lacking this specimen, the ranges for SI and FI are 126-135 and 97-103, respectively. Color varies from yellow to yellowish-brown.

Male. TL 2.30-2.68, HL 0.58-0.63, HW 0.51-0.56, SL 0.76-0.85, EL 0.17-0.19, WL 0.85-1.00, GL 0.85-1.08, SM 15-21, CI 87-93, OI 28-32, SI 132-137, (n=9).

The known males of *hystrix* are all in the type series and are quite uniform in appearance.

Material Studied

The holotype and allotype are among a large series (LACM) of workers and males, and the colony queen, labeled CAL-316. Inyo Co. DVNM (i.e., Death Valley National Monument). Grapevine Ranger Station, 2100'. 4-III-1968. G. C. and J. Wheeler. The worker and male types are further labeled "HOLOTYPE *Paratrechina hystrix* Det. Trager, 1984" and "ALLOTYPE *Paratrechina hystrix* Det. Trager, 1984." Specimens from Washoe and Lincoln Counties, Nevada, and San Juan Country, Utah, are at LACM. Dr. G. C. Wheeler kindly gave me the remainder of the type series from his alcohol collection, including the colony queen. The queen will go to LACM, and the rest of the series to JCT and the usual depositories.

Discussion

The name *hystrix* (Greek—porcupine) refers to the abundant, tapering pilosity characteristic of this species. It is a noun in apposition and, thus, invariant in form.

There is little likelihood *hystrix* will be confused with any other nearctic species. The Utah specimens (LACM) were determined as *guatemalensis*, but the latter is strictly tropical, much smaller, more pubescent and less pilose. The Mexican cavernicole, *P. pearsei* has a superficial resemblance

to *hystrix* but has scapes and legs longer, scape pilosity more abundant, eyes smaller, and body covered with short dense whitish pubescence. Since completing this study, I have acquired a male of *pearsei*. This specimen, too, appears related to *hystrix*, with the same sorts of interspecific differences except the eyes are slightly larger than those of *hystrix* males.

Natural History

The type series was collected in March. In view of the locality, it seems most likely the males were reared in the warmer months of the preceding fall, as in other nearctic species.

The type colony was collected under adjacent large stones in an old wash (i.e., not the current channel) in creosote-bush desert. The locality is only a few kilometers from sites with sagebrush desert, the vegetation characteristic of the Nevada and Utah collection sites. From available information, the species' range straddles the transition areas between the warmer Mojavean and Arizonan deserts and the colder Great Basin desert. The species may be mostly hypogaeic, as the stones under which the types were collected were deeply imbedded in the soil, and the nest extended downward from under the deepest parts of the stones. This cryptic nesting habit and its occurrence in an area which has been poorly collected by myrmecologists have probably caused *hystrix* to remain unknown for so long.

Distribution

Hystrix is an upper Coloradan and Sonoran desert species known from 4 localities: CA, Inyo Co., NV; Washoe and Lincoln Co.'s; UT, San Juan Co.

CHAPTER XIII GUATEMALENSIS COMPLEX

Diagnosis of Complex

Yellowish-brown to dark brown, shiny, but this obscured by pubescence on dorsal surfaces of head, thorax, and gaster; pubescence dilute on sides; scape pilosity suberect to erect, conspicuous, SM usually 17-25; mandible slender, weakly curved, usually with small subbasal tooth. Nests in rotting wood, litter, or epiphytes in tropical woodlands.

Male smaller than worker and shinier; pubescence distributed as in worker but sparser. Parameres triangular, blunt-tipped, about as long as broad; digitus curved outward distally; cuspis short; aedeagus shaped about like parameres.

Paratrechina guatemalensis

(Figs. 34, 35, 46; Map-Fig. 49)

Prenolepis vividula var. *guatemalensis* Forel, 1884, Bull. Soc. Vaud. Sci. Nat. 20: 348. ♀, ♀; Forel, 1912, Mem. Soc. Ent. Belg. 29: 66. Type loc., Retaluleu, Guatemala.

Prenolepis guatemalensis Forel, 1893, Trans. Ent. Soc. Lond., p. 340; Wheeler, 1905, Bull. Amer. Mus. Nat. Hist. 21: 392. Fig. 4, ♂.

(All other citations only questionably refer to the true *guatemalensis*.)

Diagnosis

Worker. TL usually 2.0-2.5, OI 23-26. A neotropical species which nests in rotting wood or moist soil beneath logs or stones, typically in second growth; established at Homestead, Florida. Light brownish-yellow to castaneous brown with pale yellowish or whitish mid and hind coxae. Greyish or whitish pubescence dulls the dorsal surface. Head narrow, CI usually 77-83. Scapes long, SI 117-127; pilose, SM 17-25. Mandible slender, weakly curved; subbasal tooth, small, separated by a large gap from basal tooth.

Male. TL about 1.8-2.2, OI usually 36-38. Color as in worker, but thorax paler. Pubescence more dilute on gaster. Scapes long, SI usually 130-140. Parameres short, nearly equilateral-triangular. Digits with broad apex; curved laterad distally.

Queen. Very similar to other *fulva*-group species, but smaller with narrower head. Color, mandibular dentition as in workers.

Description

Lectotype worker. TL 2.43, HL 0.62, HW 0.49, SL 0.73, EL 0.15, PW 0.39, MCL 0.18, WL 0.77, FL 0.58, GL 1.05, SM 20, PM 7, MM 3, CI 80, OI 25, SI 118, FI 93.

Mandible as shown in Fig. 35; note small size and approximation of subbasal tooth to median tooth and large gap between basal and subbasal teeth. Clypeus subtrapezoidal; anterior border truncate, sides

slightly convex, median emargination slightly concave, shorter than sides. Posterior clypeal border sinuate and weakly convex in full face view. (Fig. 35 shows clypeus as it appears with head somewhat tilted forward.) Sides of head weakly convex, a little more strongly convergent in front of the eyes. Rear border of head straight (conspicuously concave in many other specimens), confluent with the sides through rounded corners. Head narrow. Eyes of about average length for the species; their posterior margin at about the midpoint of the postmandibular head length; their lateral margins separated from sides of head by about $1/3$ eye width; their anterior margin separated from mandibular insertion by only a little over EL. Ocelli lacking. Scapes near the low end of range of relative length for the species.

Pronotal profile with straight, relatively steeply sloped anterior face and a weakly convex dorsal face which are confluent through a gradually increasing curvature of the rear part of the anterior face. Anterior portion of mesonotum slightly higher than adjacent pronotal dorsum. Mesonotal dorsum slightly convex and only a little shorter than pronotum (may be shorter in other specimens but is always proportionately longer than in native species). Propodeum smoothly convex, the angle between its base and rearmost portion slightly obtuse. Highest point of propodeum about as high as that of pronotum. Legs, as scapes, near the low end of the range of relative length for this species; nevertheless, a little longer than those of most native species.

Petiole cuneate with a moderately sharp crest in profile. In dorsal view, petiole narrow, straight-sided with a convex crest.

Pilosity not abundant except on scapes, but conspicuous due to stoutness and dark color. Scape macrochaetae suberect and longer than greatest width of scape. The ancillary thoracic macrochaetae $1/3$ or less as long as the major macrochaetae and lighter in color. Pubescence covering top and sides of head, thorax and gaster; but is of fine diameter and very pale, thus difficult to see except at certain angles of viewing and illumination. Orientation of propodeal pubescence is dorsad rather than posteriad. This orientation of the propodeal pubescence is unique in U.S. species, though it is found in other members of the *Guatemalensis* Complex. Appendages with dense pubescence.

All pubescent surfaces dulled by irregular shagreening and pubigerous punctation. Other surfaces smooth and shining.

This specimen is pale, slightly brownish-yellow. The thorax is a little lighter than the head, gaster and legs. The trochanters and middle and hind coxae are very pale and completely lack any brownish tint. Pilosity is dark greyish-brown. The specimen is probably very faded, as it is much lighter than even the other syntypes.

Variation

Worker. TL 1.91-2.70, HL 0.56-0.64, HW 0.44-0.53, SL 0.69-0.78, EL 0.13-0.16, PW 0.32-0.40, MCL 0.14-0.19, WL 0.72-0.85, FL 0.51-0.64, GL 0.57-1.21, SM 17-24, PM 3-7, MM 2-3, CI 77-86, OI 23-26, SI 117-127, FI 91-100, (n=36).

Clypeal shape is rather variable in this species, ranging from that

reported from the type to a more rounded-off lentiform shape. The rear border is typically weakly arched or, in any case, less so than the front border. The rear cephalic border is often conspicuously emarginate, but this varies from worker, even within nest series. Petiole in profile may have a blunter crest than described, but this is the less common condition.

Color is particularly variable, ranging from the pale brownish-yellow of the lectotype to castaneous brown. Some specimens are bicolored with a brown gaster and lighter, yellower head and thorax. The middle and hind coxae are always notably lighter, though less so in pale specimens. On the paler specimens, the femora and tibiae are often darker than the body color. In a series of foraging workers collected in Florida at bait (RWK), the color ranges from light yellowish-brown to rich reddish-brown. The middle and hind coxae are nearly white in all specimens of this series, though they may be yellower or more tan in some individuals of other series.

Male. I have seen no males of this species from Florida, and there are none among the syntypes. The key is based on Central American specimens believed to be *guatemalensis* (see Discussion).

Material Studied

Syntypes of this species include 2 queens and 7 workers. All but one of the workers are at MHNG. The remaining worker (MCZ) is designated the lectotype. The specimens were collected some time shortly before 1884 by Stoll at Retaluleu, Guatemala. Florida material consists of workers in 3 series from Homestead, (GJW, RWK) and one series from Miami (FSCA). Types of *guatemalensis antillana*, *steinheili* and *steinheili minuta* (MHNG, USNM), specimens which are probably nidotypes of *guatemalensis itinerans* and *guatemalensis cocoensis* (USNM) and samples believed to be *guatemalensis* from various Central and South American localities (MCZ, JCT) and from Cocos Islands (LACM) were also studied.

Discussion

The treatment given here of this introduced species is less than satisfactory. The problems associated with separating *guatemalensis* and its relatives cannot be sorted out without careful revisionary work. Based on types and a small amount of other material, the taxonomic situation in this genus appears to break down as outlined below. It should be remembered that this is a preliminary scheme and not a formal proposal (see Table 3).

Features of the males seem to corroborate a four-species hypothesis. On the other hand, the genitalia (Fig. 46) on these forms are essentially identical in form and are similar to those of several other species which may belong outside this species complex. I believe that the forms *guatemalensis cocoensis* and *guatemalensis itinerans* will eventually have to be synonymized with *guatemalensis (sensu stricto)* and *minuta*, respectively. *Guatemalensis* appears to belong in the *fulva* group as stated by Forel (1893).

Guatemalensis in Florida is unlikely to be confused with any other species. Within its size range, it is the only highly pubescent form with SM 18 or more. Among the pubescent species, the pale coxae, paucity of

thoracic pilosity and smaller size are diagnostic.

A specimen in the Pergande collection (USNM) labeled *guatemalensis* from Phoenix, Arizona, is *vividula*, not "*melanderi*" as stated in Smith (1979).

Natural History

No information is available on seasonality of alate production and flight activity in *guatemalensis*. The few alates available are either undated or so scattered through the year that no pattern is evident. This species may produce alates throughout the year and fly whenever appropriate conditions are present, as in other tropical species.

The nests are often in rotting wood but may be found under stones or in litter. This species has been found in semiopen or secondarily wooded habitats and, apparently, is not a primary rain forest species. Accounts of "*guatemalensis*" in the literature are not reliable, in view of the taxonomic confusion prevalent with respect to *Paratrechina* in the tropics.

Distribution

Guatemalensis is a Central American species known to occur outdoors in the US only at Homestead and Miami, Florida.

Table 3. Selected characteristics of members of the Guatemalensis Complex of *Paratrechina*.

	HL	CI	OI	SI	SM	WLx100/HL	Size of Subbasal Tooth Relative to Basal and Median	Color	n
<u>guatemalensis</u>	0.58-0.63	77-83	23-26	118-125	18-23	103-108	small	yellowish-brown or darker, coxae variable pale to yellow	10
<u>steinheili</u>	0.65-0.69	81-87	25-28	123-131	19-26	104-113	small	dark brown, coxae pale	10
<u>minuta</u>	0.55-0.60	81-84	25-27	112-118	14-18	100-102	large	dark brown, coxae reddish	7
<u>antillana</u>	0.63-0.65	84-87	24-25	124-128	20-22	100-103	intermediate	yellowish-brown, coxae pale	2

CHAPTER XIV FULVA COMPLEX

Diagnosis of Complex

Worker large; reddish-brown; densely pubescent on thorax and gaster, a little less so on head, appearing dull; pilosity same color as body, abundant, SM usually 20-30. Nests in disturbed areas under trash, plant litter, abandoned termite or ant mounds, etc.

Male large; reddish-brown; SM usually > 15; genitalia similar to those in *Guatemalensis* Complex but a little more elongate, especially parameres, and digitus not curved in most species.

Paratrechina pubens

(Figs. 33, 36, 44; Map-Fig. 49)

Prenolepis fulva pubens Forel, 1893, Trans. Ent. Soc. Lond., p. 338, ♀, ♂, Type loc., St. Vincent, Antilles.

Prenolepis fulva pubens: Emery, 1893, Zool. Jahrb. Syst. 7: 636. Pl 22, Fig. 24, ♀, ♂.

Paratrechina (Nylanderia) fulva: Creighton, 1950, Bull. Mus. Comp. Zool. 104: 406.

Diagnosis

Worker. TL usually 2.75-3.0, OI 24-26. A large reddish-brown West Indian species established in the Miami, Florida, area. Occasionally in greenhouses further north. Scapes long, SI 116-125, bristly, SM usually 20-30. Head shiny, sparsely pubescent; subcordate. Thorax densely pubescent with long, abundant, light brown flexuous pilosity, PM 9-15.

Male. TL 2.6-3.2, OI 40-42. Uniform reddish-brown. Head shiny, sparsely pubescent. Scapes long, SI 141-145, bristly, SM usually 16-19. Unrubbed specimens have a dense fringe of long, sandy-blond hairs on the border of bluntly rounded, weakly recurved parameres.

Queen. Apparently not discernible from *fulva*. Easily recognized in U.S. fauna by large size and reddish-brown coloration.

Description and Variation

Worker. (Composite description—no types available.)

TL 2.55-3.10, HL 0.77-0.85, HW 0.65-0.77, SL 0.91-1.01, EL 0.18-0.21, PW 0.46-0.57, MCL 0.23-0.28, WL 0.97-1.09, FL 0.73-0.81, GL 0.80-1.71, SM 19-34, PM 9-15, MM 3-6, CI 84-92, OI 24-27, SI 116-125, FI 95-100, (n=35).

Mandibles robust, their outer margin strongly convex such that the angle between the basal and distal portions of the outer margin is only weakly obtuse (95-105° versus 110° or more in other species). Clypeus lentiform, front and rear borders about equally arcuate; median concavity of front border indistinct, that of rear border distinct but small. Head

subcordate, broadest behind the eyes; the convex sides strongly convergent anterior to the eyes and confluent with the rounded posterior lobes; the latter meeting in a distinct median notch. Eyes about $1/4 \times \text{HL}$, high on the face, separated from sides of head by over $1/2$ eye width and from mandibular insertion by about $1 \frac{1}{3} \times \text{EL}$. No trace of ocelli visible. Scapes long and bristly.

Pronotum weakly convex. Anterior portion of mesonotum with a short rounded anterior face; the mesonotal dorsum higher than adjacent pronotum. Mesonotal dorsum flat, sloping strongly to the rear. Propodeum rounded, low; its highest point about as high as the low rear portion of the mesonotal dorsum. Legs rather long; femora robust basally, tapering to a slender apex.

Petiole in profile chisel-shaped, the rear face appearing "beveled" near the top; the crest narrow but blunted by rounding or truncation. In dorsal view, petiole with concave or straight sides, the crest with convergent, weakly convex sides and a flat or weakly concave top.

Pilosity long, abundant, light reddish-brown. Scape macrochaetae suberect to erect, often longer than width of scape. Pilosity on all body surfaces and even on legs long, flexuous, and of relatively fine diameter. Pubescence on head sparse, not obscuring the shiny surface beneath. Remainder of body and appendages covered with dense yellowish pubescence; that on promesonotum decumbent or subdecumbent, that on propodeum, gaster and legs appressed.

Body surface smooth and shiny but this obscured by dense pubescence, except on head.

Body and appendages uniform light to dark ferruginous brown. Head may appear a little darker because of lesser reflectivity of the sparser pubescence.

Male. (Composite description—no types available.)

TL 2.64-3.16, HL 0.66-0.69, HW 0.63-0.67, SL 0.93-0.98, EL 0.26-0.28, WL 1.01-1.13, GL 0.97-1.37, SM (10) 16-19, CI 94-97, OI 40-42, SI 141-145, ($n=6$).

Outer border of mandible more strongly curved than in other species, less conspicuously so than in workers. Mandible with a sharp narrow apical tooth and three or more short blunt denticles on the masticatory border giving it a crenulate appearance. Clypeus subtrapezoidal; with a weakly arcuate front border; and rear border with straight sides and a shallowly concave median truncation. Sides of head largely obscured by eyes but are weakly convex and distinctly convergent anteriorly. Head widest at about the rear edge of the eyes. Posterior border weakly convex, delimited by indistinct corners which lie behind the inner border of the eyes or somewhat further apart. Scapes long, straight and more pilose than any sympatric form.

Petiole in profile cuneate to chisel-like, with a blunter, more rounded crest than in worker. In dorsal view, petiole is broader than worker's, with straight sides and an evenly convex crest.

Parameres in side view are broadly triangular as in *guatemalensis* but are very rounded off distally and may appear weakly recurved. The border of the parameres is clothed with a dense fringe of long, curved light brown

hairs in clean, unrubbed specimens. In rear view, the parameres have their outer surface convex and are weakly curved mesad. Volsellae and aedeagus very close in form to those of *guatemalensis* (Fig. 46) in structure, but the digiti are straight, not curved laterad.

Vestiture, sculpture and pilosity as in worker with the usual sexual differences.

Material Studied

A large series of *pubens* from Washington, D.C. in the Pergande collection (USNM) forms the basis for the major part of the above descriptions. These specimens are a part of the same collection which Emery (1893) studied when he said that greenhouse collections from eastern U.S. were conspecific with Forel's West Indian *pubens*. Also studied were series (WFB, FSCA) collected in Coral Gables and Miami, Florida, in the period 1953-1973 and series from Puerto Rico, Guadeloupe and Anguilla.

Discussion

This species was synonymized by Creighton (1950) on the basis of the "startling" similarity between workers of *pubens* from the U.S. and from Brazil. I have seen samples of *fulva* from Brazil, Argentina and Mexico (JCT, LACM) which may comprise more than one species, but all can be distinguished from *pubens* by the straight or at least less strongly emarginate rear border and denser pubescence and punctuation of the worker head; and the coarser and often shorter and darker thoracic pilosity. Males associated with these workers invariably have more elongate, tapering parameres with sparse pilosity of uneven length and orientation which in no way resembles the characteristic fringe of *pubens*. The cephalic pubescence of these males is denser than the characteristic of *pubens*. While thorough revision of *Fulva* Complex must await a later study, I feel the conclusion is inescapable based on present evidence that *pubens* is a separate species within this group which was probably originally endemic to the West Indies.

The Brownsville, Texas, specimens studied by Creighton are *fulva*, not *pubens*. Since no other *fulva*-group species have been collected in southern Texas since 1938, it is likely that no *Fulva* Complex species other than *pubens* is established in the U.S. *Pubens* in the USDA greenhouses in Washington, D.C. from which Pergande collected them have undoubtedly succumbed to pesticides and replacement by more modern structures.

Natural History

I have no direct experience with *pubens* in the field. The field notes of H. H. Smith (in Forel, 1893) indicate that the nesting habits of this ant are very much like those of *fulva* I have collected in South America. The colonies are large, with several hundred individuals, and are found under cover objects such as stones or logs. Smith states this species is limited to open land not far from the sea and may even be found on beaches above the surf line.

Distribution

Pubens is apparently an Antillean species, restricted outdoors in the US to the Miami, Florida area.

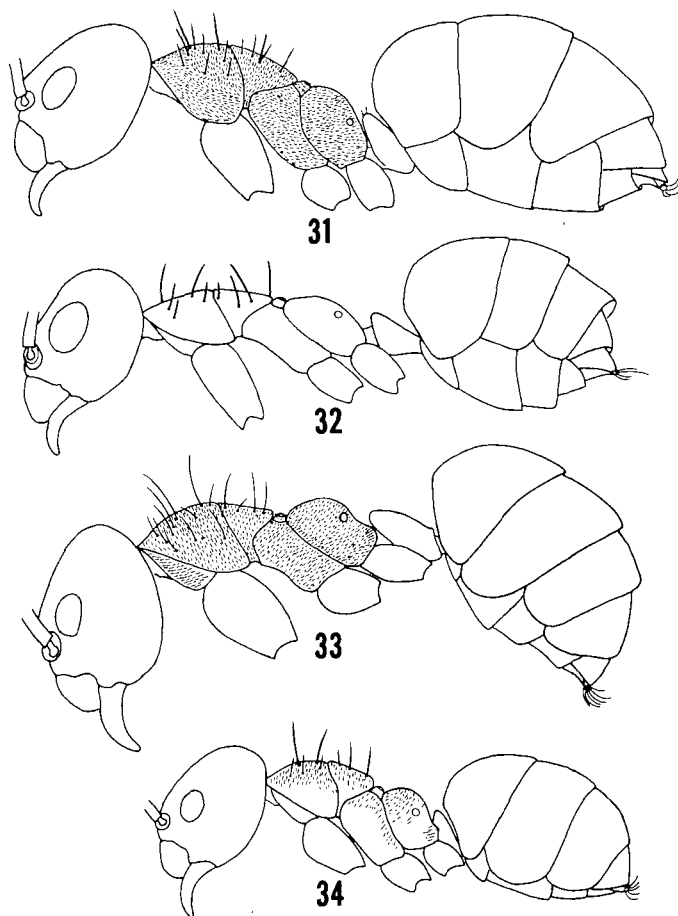


Fig. 31. Worker of *bourbonica*, lateral view.

Fig. 32. Worker of *longicornis*, lateral view.

Fig. 33. Worker of *pubens*, lateral view.

Fig. 34. Worker of *guatemalensis*, lateral view.

CHAPTER XV
BOURBONICA COMPLEX**Diagnosis of Complex**

Worker large; brown to black with greyish pubescence on all surfaces; pilosity stout, black, nearly straight, abundant, SM usually 28-34; eyes large, OI 26-30. Nests in disturbed habitats near buildings, in cultivated areas, etc.

Male grey with dense pubescence; scape pilose, SM 10-16; eyes large; parameres broad-margined, notched, very black and heavily sclerotized; volsellar rami heavily sclerotized, cuspis longer than the coarsely punctate digitus and closely approximated to paramere; aedeagus hyaline, ovate with decurved tip.

Paratrechina bourbonica
(Figs. 31, 37, 43; Map-Fig. 52)

Prenolepis nodifera bourbonica Forel, 1886, Ann. Soc. Ent. Belg. 30: 210. ♀, ♀, ♂. Type loc. St. Denis. Réunion.

Prenolepis bourbonica Forel, 1891, In Grandidier, Hist. Nat. Madagascar 20: 82. Fig. 2, ♀, ♀, ♂; Emery, 1914, Nova Caledonia Zool. 1: 422.

Paratrechina (Nylanderia) bourbonica: Emery, 1925, Gen. Insectorum, Fasc. 183: 219; Creighton, 1950, Bull. Mus. Comp. Zool. 104: 406; Wilson and Taylor, 1967, Pacific Ins. Monog. 14: 87-89.

Diagnosis

Worker. TL usually 2.6-3.2, OI 26-30. A large introduced species, especially abundant in disturbed habitats in southern Florida, also marshes and mangroves, Everglades National Park and Florida Keys. Dark brown to nearly black with dense grey pubescence. Pilosity stout and straight, black, abundant. SM 24-38, PM usually 7-12. Head punctate, broad, with large eyes.

Male. TL about 2.5-2.75, OI 44-48. Larger than any other dark colored male in Florida. Eyes very large, scapes long (SI 128-136) and pilose (SM 10-16). Parameres broad-margined, margin bilobate. Digitus heavily sclerotized, black and coarsely sculptured.

Queen. Large, finely punctate, charcoal-colored (brownier under magnification). SM > 20. Eyes very large.

Description

Lectotype worker. TL 2.90, HL 0.74, HW 0.67, SL 0.93, EL 0.21, PW 0.46, MCL 0.19, WL 1.01, FL 0.73, GL 1.15, SM 33, PM 9, MM 4, CI 90, OI 29, SI 126, FI 99.

Clypeus sublentiform; the anterior border a truncate arch with the middle half of its width flattened and, on this specimen, bearing a median concave emargination which is distinctly narrower than the least distance between the frontal carinae. Posterior clypeal border a sinuate curve,

more strongly arcuate than front border, and with a narrow median emargination. Sides of head convex, notably convergent anteriorly. Posterior corners behind and slightly laterad of the inner margins of the eyes, and delimit the weakly concave rear border. Head broader than most native U.S. species. Eyes larger than all other species except *longicornis*, separated from sides of head by less than $1/3X$ eye width, and from mandibular insertions by slightly over EL. Three ocelli present, though small. Scape of about average length for the species, longer than any native species.

Pronotum evenly convex. Mesonotum weakly convex, raised about adjacent edge of pronotum, but sloping to the rear; with short, indistinct front and rear faces. Propodeal profile a low, rounded angle; the angle between the base and the rear face obtuse, about 120° . The highest point of the propodeum about as high as the rear portion of the mesonotal dorsum. Thorax long, WL about $1.35X$ HL. This proportion 1.30 or less in native species.

Petiole chisel-like in profile; with a sharp crest, straight anterior face, and weakly convex rear face with upper third "beveled." From above, petiole relatively narrow with straight sides meeting the flattened top through rounded corners.

Pilosity abundant, relatively short and stout, straight or weakly curved and coarsely barbed. Scape pilosity conspicuous, a little shorter than maximum diameter of scape; dark brown. Thoracic pilosity blackish; the 8 major macrochaetae weakly curved, less than $2X$ as long as the straighter, next-largest ancillaries. Pilosity on legs and gaster blackish, subdecumbent to erect. Crest of petiole with a few short, erect hairs. All surfaces invested with greyish pubescence, except rear face of propodeum and petiole. Pubescence dense on all dorsal surfaces, sparser on the sides.

Head with fine, dense pubigerous punctation. Other surfaces strongly shining, though this obscured by pubescence.

Mandibles deep yellow with brown edges and teeth. Trochanters and tarsi brownish-yellow. Femorotibiae and antennae yellowish-brown. Body dark brown, but appears greyish unmagnified, due to dense pubescence.

Allolectotype male. TL 2.47, HL 0.58, HW 0.58, SL 0.74, EL 0.27, WL 0.97, GL 0.93, SM 15, CI 100, OI 46, SI 128. (This is the smallest *bourbonica* male among those studied. It is one of two syntype males in the Forel collection. The other has the genitalia removed and could not be used for description.)

Mandible with a large, blunt apical tooth which has a small denticle arising from the inner side of its base. Masticatory border concave, indistinctly crenulate. Clypeus sublentiform, the rear border more strongly arcuate than the front border; both with a median concave emargination, that on the front border wider. Sides of head straight and convergent in front of the eyes, convex behind. Posterior corners of head rounded, indistinct, notably further apart than anterior corners. Rear border of head convex. Head broad; even exclusive of eyes, it is less elongate than in other species. Eyes very large, easily filling more than half of the sides of the head. Ocelli large, the median and laterals separated by about $1\frac{1}{2}X$

the ocellar width. Scapes long and straight; over half of their length protruding beyond posterior corners of head.

Petiole chisel-like in profile with a blunt but relatively narrow crest; the beveled upper portion of the rear face concave. In dorsal view, the petiole is broader than the worker's and weakly concave across the top.

Genitalia distinctive within the U.S. fauna. Parameres and volsellae heavily sclerotized, aedeagus hyaline. Parameres wider than long; their outer face convex; the broad distal margin bilobate. Mesal lobe of the paramere conceals cuspis at most viewing angles on the intact specimen. Cuspis long; its outer face of the same length and convexity as the mesal lobe of the paramere; the two structures lie close together and must work as a functional unit in copulation. Digitus with weakly bilobate distal margin, coarsely punctate on its irregularly concave lateral surface, smoothly convex on its mesal surface. Aedeagus subovate; the distal portion of the ventral edge concave, giving rise to a deflected tip. Tips of aedeagal lobes curved outward as well as downward.

Cephalic pilosity like that of the worker's; that on thoracic dorsum short, bristly; that on gaster sparse, longer and of finer diameter. Scape pilosity abundant, shorter than width of scape, suberect. Gastral pilosity light brown; pilosity elsewhere blackish. Pubescence distributed as in worker but sparser, especially on the gaster.

Shinier on head than worker because pubescence and punctation from which it arises sparser and finer. Punctation dense on thoracic dorsum; barely noticeable on sides of gaster.

Uniform dark brown, except for lighter trochanters, middle and hind coxae and extremities of legs.

Variation

Worker. TL 2.26-3.25, HL 0.65-0.81, HW 0.55-0.79, SL 0.78-1.01, EL 0.18-0.24, PW 0.40-0.58, MCL 0.17-0.20, WL 0.83-1.14, FL 0.61-0.81, GL 0.79-1.45, SM 24-38, PM 5-15, MM 3-9, CI 84-98, OI 26-30, SI 120-130, FI 94-104, (n=39).

The anterior clypeal emargination of *bourbonica* workers varies from barely evident to quite distinct as in the type. Head width is quite variable for the species as a whole, but 33 of the specimens measured had CI in the range 88-92. The petiole in profile often lacks the beveling of the upper portion of the rear face and, thus, has a cuneate form and a blunter crest. Most Florida material has the appendages more uniformly dark than in the type, but the yellowish coloration of the appendages may be typical of populations in the Pacific region, as I have seen fresh material from Hawaii and Hong Kong with yellow feet.

Male. TL 2.47-2.77, HL 0.58-0.65, HW 0.58-0.65, SL 0.74-0.87, EL 0.27-0.29, WL 0.97-1.09, GL 0.89-1.13, SM 10-16, CI 100-102, OI 44-48, SI 128-136, (n=8).

As indicated above, the type male is the smallest of the *bourbonica* males measured. It is notably smaller than the emasculated specimen (presumably its brother) on the same pin. Petiole shape in the males has about the same variation as in the workers (see above). The rear edge of the digitus is straight rather than weakly emarginate in many specimens,

but even in these there may be the illusion of the bilobate condition due to the concavity of the digital lateral face.

Material Studied

The lectotype and allolectotype were chosen from among Forel's syntypes (MHNG) consisting of a pin each of queens, males and workers with red "Typus" labels and another with a single worker labeled "Cotypus." The original labels have been removed and refolded numerous times. I have deciphered them and written out new labels in permanent ink so that the originals can be better preserved by lack of handling. The new labels read as follows: *P. bourbonica* Forel. ♀, ♂, or ♂ (as appropriate) syntypes. St. Denis, Réunion. 30 Mai, 1886. Also studied were numerous Florida samples (JCT, FSCA, USDA and some in the major ant collections), several from islands in the Indian and Pacific Oceans (MCZ), and a series from Cuba (WFB).

Discussion

Creighton's (1950) treatment of *bourbonica* has been of no help to those encountering this insect since the publication of his monograph. Since he did not include *bourbonica* in his key, it has been almost uniformly misidentified as *fulva* by those attempting to use his key. There is no comfortable manner in which this species could be identified as *vividula* in Creighton's key, as he stated it would. A large, pubescent *Paratrechina* could only come out as *fulva*. Creighton's excuse for his treatment of *bourbonica* was that he believed the ant in question might be typical *bourbonica* rather than the subspecies *amia*, as was supposed by Wheeler (1932). I have not seen any type material of *amia*, but inspection of the *bourbonica* cotype at MCZ (#22959), which was available to Creighton at the time when he treated *Paratrechina*, leaves no doubt that our Florida population is typical *bourbonica*. (Forel's MHNG material from Réunion merely confirms this.) In other words, Creighton could have settled the issue with material available to him, and it is unfortunate that he did not do so, as this species is second only to *longicornis* in the frequency with which it is transported from place to place with plant materials.

The species was first noted in the U.S. by M.R. Smith (1930a, 1930b) and a little later by Wheeler (1932). Apparently, it was well-established in Florida already when these authors became aware of its presence.

Wilson and Taylor (1967) synonymized two of Forel's subspecies of *bourbonica*—*bengalensis* and *hawaiiensis*. I have not seen the types of these forms but regard the synonymies as premature for two reasons. First, Wilson and Taylor point out that they were not always able to distinguish *bourbonica* and *vaga*. I have examined some of their Polynesian and Melanesian "*vaga*" material and find that it contains some workers of *bourbonica* as well as those of at least two other distinct species, differing in vestiture and proportions, and only one (or perhaps none) of which can be true *vaga*. In view of their admitted lack of clarity as to the identity of these species, I believe the more prudent course would have been not to engage in any taxonomic decisions of this nature. Secondly, I have a large

series of ants from Taiwan which closely resembles *bourbonica*, but in my opinion is a related, but distinct species, separated in all castes by subtle but consistent differences in color, size, head width, pubescence and genitalic structure. It is just the latter sort of population to which a name such as *amia* or *bengalensis* may apply, for Forel was a very keen observer of the types of differences separating species in *Paratrechina* (though he often called them "varieties"). Without the careful revisionary work necessary to determine whether the varietal and subspecific names in question apply to truly distinct form, Wilson and Taylor's synonymies should not be accepted unquestioningly at this time.

Workers of *bourbonica* are larger-eyed, more pubescent and have more erect hairs on longer scapes than any of the native species with which they might be confused in the U.S. *Pubens* may always be distinguished from faded *bourbonica* specimens by its longer, finer and more flexuous thoracic pilosity, which is light brown. Furthermore, the head of *pubens* is much less pubescent and has a conspicuous median emargination of the rear border. (The difference in orientation of pronotal pubescence of *bourbonica* and *pubens*, shown in Figs. 30 and 31 is not significant. The pattern shown for *bourbonica* is the more common one for both species.) The male of *longicornis* may be easily distinguished from that of

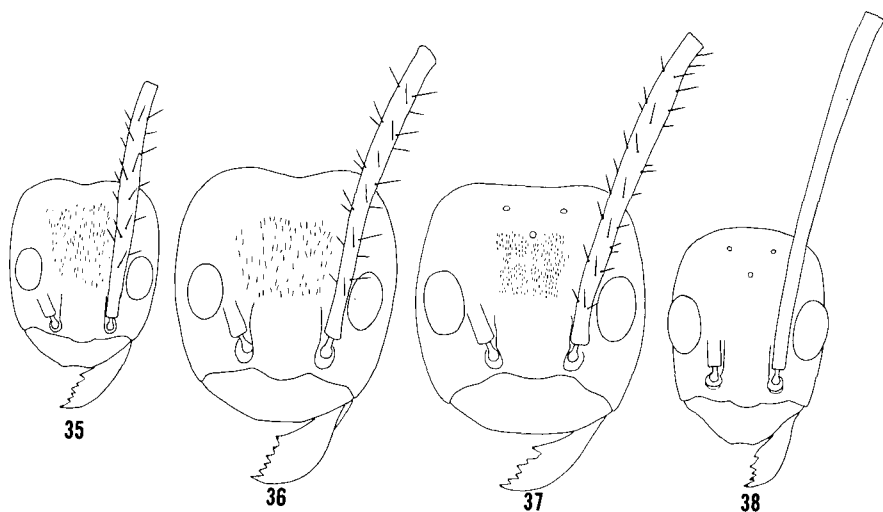


Fig. 35. Head of *guatemalensis* worker, dorsal view.

Fig. 36. Head of *pubens* worker, dorsal view.

Fig. 37. Head of *bourbonica* worker, dorsal view.

Fig. 38. Head of *longicornis* worker, dorsal view.

bourbonica by its longer hairless scapes, though the general form of the body and genitalia of the two are quite similar.

Natural History

Bourbonica, like other tropical species, produces alates at any time of year. Alates are attracted on warm mornings, before sunrise, and following rains to blacklights. Mating has not been observed but may occur in the air previous to their coming to lights, as females trapped at lights rear workers after capture. Apparently, after mating, females are attracted to areas of high reflectivity such as walkways, buildings and bodies of water. Females captured near lights are very prone to desiccation, and die within a few hours unless provided with conditions near 100% relative humidity. At laboratory temperatures fluctuating between 25° and 30°C, a brood of 6-12 minims is reared out in just over four weeks.

Workers of *bourbonica* aggressively attack small insects and injured larger insects. The prey is carried or dragged to the nest in pieces. Group carrying is a much less concerted affair in *bourbonica* than in *longicornis*. Honeydew and other sweets are readily taken. In the field, *bourbonica* recruits over distances of five or more meters to rich food sources but is apparently unable to defend them from *Solenopsis invicta*. During cooler weather, *bourbonica* may seek food and shelter inside buildings.

Bourbonica also occurs in certain natural habitats. Simberloff and Wilson (1969, 1970) found *bourbonica* on mangrove islands off the Florida Keys and noted that it rapidly recolonized defaunated islands. Dr. Mark Deyrup of the Archbold Biological Station informs me (personal communication) that *bourbonica* is abundant along the intermittently flooded Coastal Prairie Trail in Everglades National Park. I have collected them in lakeside marshes near Leesburg (Lake County) and Sebring (Highlands County), Florida. All of these areas have in common frequent flooding and clumping vegetation, part of which normally remains above the high water mark, and an absence of other terrestrial ants of similar habits (except perhaps *concinna*). Wilson and Taylor (1967) report *bourbonica* from rain forest on Samoa.

Distribution

Bourbonica is a widespread tropical tramp species, established outdoors in the US in peninsular Florida from Gainesville south. I have also seen specimens from Mobile, Alabama which were probably collected outdoors.

CHAPTER XVI
LONGICORNIS COMPLEX

Diagnosis of Complex

Worker grey or black with bluish or purplish reflections, feebly shining; pubescence very sparse; pilosity sparse (absent on scapes); legs and scapes very long and slender. Nests in buildings, rubble, etc. near man-made structures.

Male greyish with long, slender scapes and legs and reduced pilosity as in worker; genitalia somewhat like in *Bourbonica* Complex, but parameres entire margined; digitus less coarsely sculptured; aedeagus not deflected.

Paratrechina longicornis

(Figs. 32, 38, 42)

Formica longicornis Latreille, 1802, Hist. Nat. Fourmis, p. 113. ♀. Type loc., Senegal, Africa.

Formica vagans Jerdon, 1851, Madras Jour. Lit. Sci. 17: 124. ♀.

Formica gracilescens Nylander, 1856, Ann. Sci. Ant. Zool. 5: 73. ♀.

Tapinoma gracilescens: F. Smith, 1858, Cat. Hym. Brit. Mus. 6: 56.

Paratrechina currens Motschulsky, 1863, Bull. Soc. Nat. Moscou 36: 14. ♀.

Prenolepis longicornis: Roger, 1863, Verz. Formicid., p. 10; Mayr, 1865, Reise Novara Formicid., p. 50. ♀; Mayr, 1867, Tijdschr. v. Ent. 10: 72. ♀, ♀; Andre, 1882, Spec. Hym. Europe 2: 203. ♀, ♀, ♂; Andre, 1891, Ann. Soc. Ent. Fr. 1: 60. ♂; Forel, 1894, Jour. Bombay Nat. Hist. Soc. 8: 406. ♀, ♂; Bingham, 1903, Fauna Brit. India Hym 2: 326. ♀, ♀, ♂; Arnold, 1922, Ann. S. African Mus. 14: 605. ♀, ♀, ♂.

Prenolepis (Nylanderia) longicornis: Emery, 1910, Deutsch. Ent. Zeitschr., p. 129. Figs. 2 and 3, ♀, ♀, ♂; Emery, 1914, Nova Caledonia Zool. 1: 422. ♀.

Paratrechina (Paratrechina) longicornis: Emery, 1925, Gen. Insectorum, Fasc. 183: 217. ♀; Creighton, 1950, Bull. Mus. Comp. Zool. 104: 404; Wilson and Taylor, 1967, Pacific Ins. Monog. 14: 87. Fig. 72, ♀.

Diagnosis

Worker. TL 2.3-2.9, OI 29-31. A fast-moving urban species of the tropics and subtropics worldwide. In U.S., most abundant in Florida and Gulf Coast States. Grey to black with bluish reflections and flattened, whitish thoracic pilosity. Scapes and legs slender and very long, SI about 170, FI about 120. Scapes lack erect hairs.

Male. TL 2.24-2.44, OI 39-44. Head and gaster dark brown; thorax and appendages lighter. Scapes long, SI about 175, without erect hairs. Pilosity sparse. Parameres broad at apex, *not* emarginate.

Queen. Scapes notably longer than head. Scapes and entire dorsal surface lack pilosity, except for a few macrochaetae on frons and clypeus. Eyes large, strongly convex.

Description and Variation

Worker. (Composite description—no types seen.)

TL 2.29-2.89, HL 0.64-0.71, HW 0.51-0.57, SL 1.07-1.19, EL 0.19-0.22, PW 0.36-0.41, MCL 0.14-0.18, WL 0.91-1.05, FL 0.77-0.87, GL 0.73-1.13, SM 0, PM 3-5, MM 2-5, CI 76-81, OI 29-31, SI 166-175, FI 118-126, (n=15).

Mandible 5-toothed, more elongate than in most species. Clypeus lentiform, the anterior border arcuate, entire or with a small median notch about as wide as median clypeal carina. Rear clypeal border less strongly arcuate, with a median concave emargination about as wide as the frons between the antennal fossae. Sides of clypeal dorsum convex; the median carina ranging from rounded and nearly obsolete to a distinct raised angle. Sides of head weakly convex; head broadest behind the eyes. Posterior corners of head indistinct, the sides grading into the convex rear border through smooth curves. Head narrow. Eyes large and convex, protruding beyond sides of head. Three whitish ocelli are small, but distinct. Scapes long and slender, about 2/3 of their length protruding beyond the rear border of the head.

Thorax elongate, depressed; WL about 1.5X HL. Promesonotum weakly convex; propodeum more strongly so; the upper surfaces of all three about on the same plane in side view. Metanotum high, only a little lower than adjacent mesonotum and propodeum. Legs elongate; fore coxae long and slender; the normally-proportioned (relative to other *Paratrechina*) middle and hind coxae appearing disproportionately robust by contrast.

Petiole, in side view cuneate, blunt-crested, with a broad base. In dorsal view, petiole slender from side to side; the sides weakly concave and only weakly divergent dorsad. Upper corners of petiole often with a small tubercle, or this lacking. Crest rounded to subtrapezoidal.

Pilosity whitish, apparently blunt, flattened, only weakly tapering on dorsal surfaces; slightly browner, finer and more tapering on coxae, venter of head and gaster. Pubescence very sparse, fine, not readily visible.

Most surfaces lightly shagreened. At very high magnification, each of the cuticular plates is marked with longitudinal microrugulae; yielding in macroscopic appearance a feebly shining surface with conspicuous bluish or purplish iridescence (Fig. 1).

Greyish-brown to piceous brown with appendages a little lighter.

Male. (Composite description)

TL 2.24-2.44, HL 0.55-0.57, HW 0.53-0.57, SL 0.95-0.97, EL 0.22-0.24, WL 0.92-1.01, GL 0.73-0.89, SM 0, CI 95-100, OI 39-44, SI 168-174, (n=8).

Mandible with a convex outer border, a larger but weakly sclerotized apical tooth with a broad base and a convex masticatory edge; apical tooth and masticatory border separated by a distinct cleft. Clypeus irregularly subhexagonal to subrhombiform; anterior border weakly arched and broadly truncate or truncate with straight sides; posterior border with nearly straight sides and a straight or weakly concave prefrontal portion. Sides of head in front of eyes straight, convergent anteriad. Posterior to eyes, sides of head confluent with convex rear border; yielding a hemispherical appearance to the rear half of the head,

in dorsal view. Head a little broader than worker's; but large convex eyes cause head to appear much wider. Ocelli large, median and laterals separated by only about 1 1/2X ocellar width. Scapes long, very slender, nearly straight throughout their length.

Petiole in lateral view broad-based, bluntly cuneate as in worker. In posterior view, sides of petiole straight, weakly divergent dorsad, meeting the flat dorsal edge through rounded corners. Petiole broader than worker's, but relatively narrow in comparison with that of other *Paratrechina* males.

At a glance, genitalia reminiscent of those of *bourbonica*, differing as follows. Parameres a little longer, entire-margined, nearly diamantiform in outline from side view. Cuspis only about half as long as digitus and not as closely associated mesal portion of parameres as in *bourbonica*. Digitus with coarse black tubercles on the lateral and dorsal surfaces. Digitus longer than aedeagus, distal half with a concave dorsal edge and convex ventral edge; slightly turned upward distally; tapering to a broadly rounded-off or truncate tip. Only the tip is visible in side view without removal of a paramere, but when thus exposed, digitus is bluntly falcate. In posterior view, digitus has a flat mesal side, except near the tip, which is curved laterad. Aedeagus ovate, the tip not deflected.

Pilosity relatively sparse; finer and browner than that of workers. Thoracic dorsum with 12 or less macrochaetae. Scapes lack pilosity; femora have only 1 or 2 hairs. Parameres with 15-20 of the usual sort of long decurved hairs. Pubescence very sparse on body. Appendages with short, dense pubescence.

Entire body shiny; the only detectable sculpture is faint gastral shagreening.

Head and gaster tan to sandy brown. Gaster, parameres and volsellae (except black tubercles) dark brown. Appendages a little lighter than head and thorax.

Material Studied

Most of the *longicornis* material seen in this study was collected by me in Florida. Specimens from Mexico and Brazil (CAF) proved to be remarkably similar to the Florida material.

Discussion

Longicornis is so distinctive that it is one of the few *Paratrechina* that is not consistently misidentified in collections. As indicated in Chapter IV, *longicornis* appears to be closely related to *pallida*, of New Guinea. *Pallida* is clearly distinct from *longicornis* in the pale yellow color of the worker, the smaller eyes, the longer maxillary palps, the propodeal pilosity and the abundant erect macrochaetae on the queen. The queen of *pallida* is furthermore colored a striking tiger-striped brown and yellow. The male of *pallida* has not been collected.

Natural History

Longicornis may raise sexuals at any time of year in warmer regions, but in the seasonal climate of Gainesville, Florida, alate production is

apparently limited to the warm, rainy months of May through September. From my observations, the nuptial flights of *longicornis* are abortive. On warm, humid evenings, large numbers of males gather outside nest entrances and may mill about excitedly. Workers patrol vegetation and other structures nearby. Periodically, a dealate queen emerges. I have not observed mating, but I believe it occurs in such gatherings about the nest entrance. Wings of queens are removed while they are still callow. I have never seen males fly or use their wings in any way.

Such an approach to reproduction partially explains the vast success of *longicornis* as a colonizer of urban areas throughout the tropics and subtropics. Perhaps no large city in the tropics is without this ant, and they are very successful in warm temperate towns from Florida to Texas, and even in New York City, inside buildings (Creighton, 1950).

Another contributing factor to the success of *longicornis* is its tolerance (preference?) for nesting sites with relatively low humidity, including crannies in walls, board and trash piles, palm thatching and dry litter. Wilson and Taylor (1967) report that *longicornis* penetrates rain forest in areas with depauperate native ant faunas. Interestingly, the related species *pallidus*, though a rain forest inhabitant, seems to select dry nest sites such as dry frass in a hollow tree or among fronds in palm litter (E.O. Wilson, personal communication).

In Gainesville, *longicornis* thrives at gasoline stations, convenience stores and sidewalk cafes, where they may be seen transporting crumbs and dead insects attracted to lights, etc. They apparently have a seasonal preference for a high-protein diet, and during the summer months may refuse honey or sugar baits. They are highly attracted to honeydew-producing homopterans in spring and fall, however. A large laboratory colony consumed far less honey and more dead insects than a similar-sized colony of *concinna*. Large prey items are carried in a highly concerted group action. I have occasionally observed large dead insects gliding slowly over the substrate, which turned out upon closer observation to be being transported by several dozen *longicornis* workers. H. H. Smith (in Forel, 1893) reports seeing a lizard transported in like manner.

Wheeler (1910, p. 156) reported observations by earlier authors of the association of *longicornis* with two species of myrmecophiles from India: *Myrmecophila acervorum* var. *flavocincta* (Orthoptera: Gryllidae) and *Coluocera maderae* (Coleoptera: Lathridiidae). I have a single collection record of a cricket which is very likely the above form, as it was black with a yellowish band across the thorax. It was found emigrating with a large swarm of *longicornis* which had been flooded out of its nest near a sprinkler head. Unfortunately, the cricket specimen was sacrificed for a study of the alimentary tracts of Gryllidae before I realized its significance.

Distribution

Longicornis is found in tropical cities world-wide, but in the US is restricted to Florida and the Gulf Coast region outdoors. In California it seems never to remain established for long.

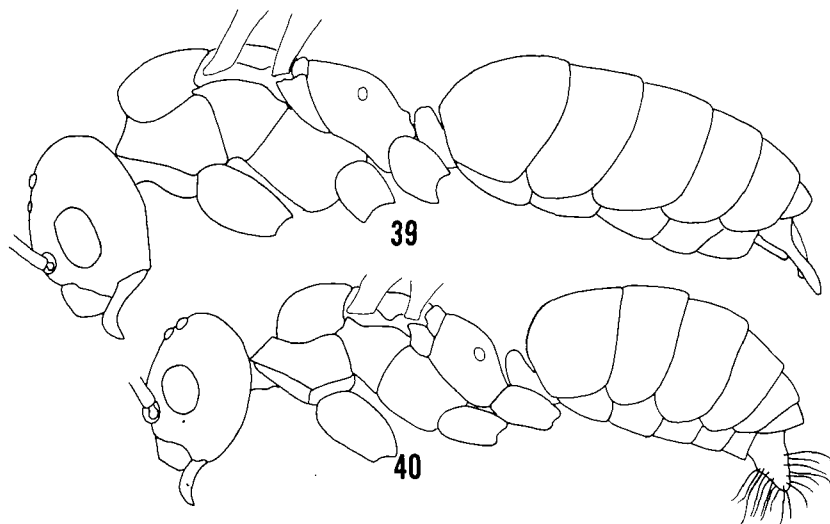


Fig. 39. Male of *bruesii*, lateral view.

Fig. 40. Male of *hystrix*, lateral view.

ACKNOWLEDGEMENTS

As in all such studies, this work could never have been brought to its present state without the aid of many people. Foremost among these is my wife, Kim, whose unfailing love and devotion and assistance with the minutiae of curation and preparation of the manuscript have been immensely important and are thoroughly appreciated. I give heartfelt thanks to the late Dr. William F. Buren and to Dr. Jerry L. Stimac for their many discussions with me on this study and related matters, for their friendship and encouragement, and not the least of all for arranging financial support during much of the course of the work. I wish to thank Dr. William L. Brown, Jr., and Mr. Roy R. Snelling for their indirect guidance through the example of their work in ant taxonomy for commenting on early drafts of the work, and for their careful review of the finished manuscript. Their suggestions, while occasionally not followed, were always appreciated.

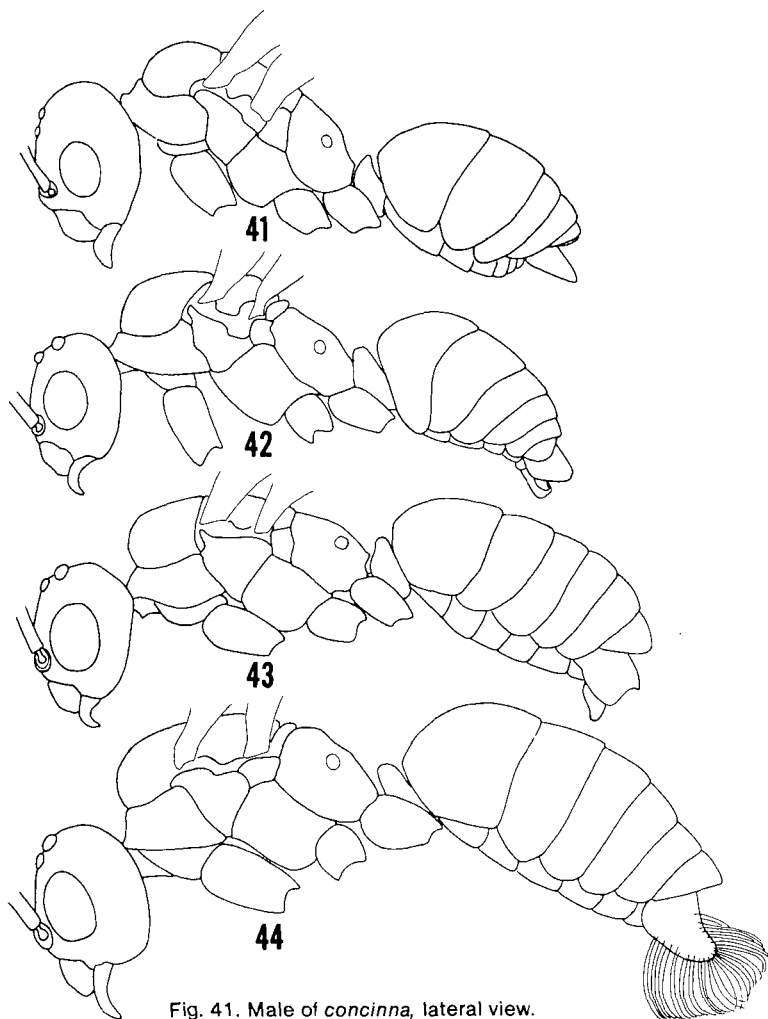


Fig. 41. Male of *concinna*, lateral view.

Fig. 42. Male of *longicornis*, lateral view.

Fig. 43. Male of *bourbonica*, lateral view.

Fig. 44. Male of *pubens*, lateral view.

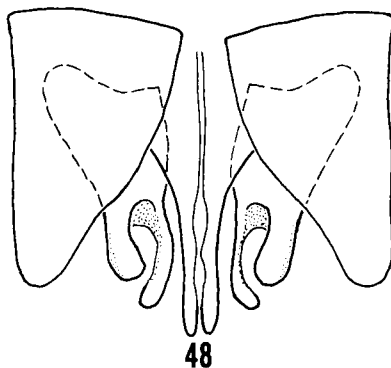
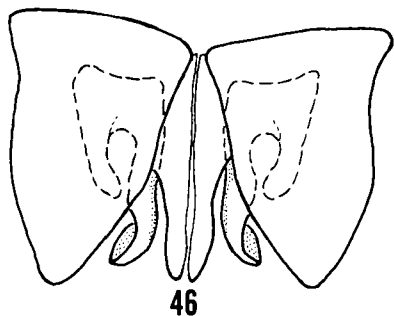
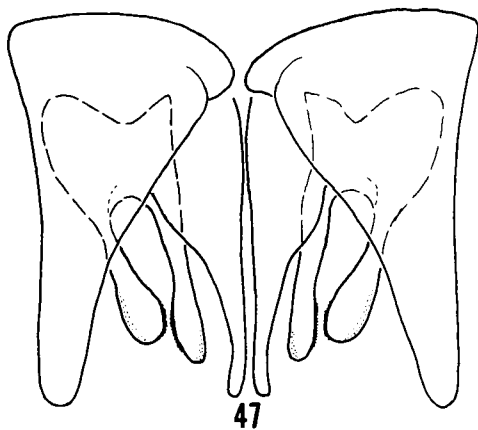
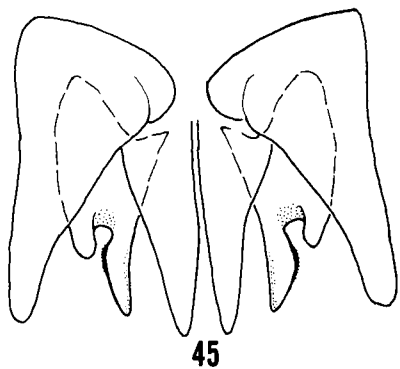


Fig. 45. Genitalia of *faisonensis* male, dorsal view, slide mounted.

Fig. 46. Genitalia of *guatemalensis* male, dorsal view.

Fig. 47. Genitalia of *arenivaga* male, dorsal view, slide mounted.

Fig. 48. Genitalia of *phantasma* male, dorsal view.

REFERENCES

- The American heritage dictionary of the English language. 1973. American Heritage Pub. Co., New York. 1550 pp.
- Bolton, B., 1973. The ant genus *Polyrhachis* F. Smith in the Ethiopian Region (Hymenoptera: Formicidae). Bull. Brit. Mus. Nat. Hist. 28: 283-369.
- Brown, W. L. Jr. 1957. Centrifugal speciation. Quart. Rev. Biol. 32: 247-277.
- _____. 1973. A comparison of the hylean and Congo-West African rain forest and faunas. In Meggers, B. J., E. A. Ayensu and D. Duckworth, eds. Tropical forest ecosystems in Africa and South America: a comparative review. Smithsonian Inst. Press, Washington, D.C. pp. 161-185.
- Buren, W. F. 1944. A list of Iowa ants. Iowa State Coll. J. Sci. 18: 277-312.
- Buckley, S. B. 1866. Descriptions of new species of North American Formicidae, Part I. Proc. Ent. Soc. Philad. 6: 152-171.
- Cole, A. C. 1940. A guide to the ants of the Great Smoky Mountains National Park, Tennessee. Amer. Midland Nat. 24: 1-88.
- _____. 1968. *Pogonomyrmex* harvester ants. Univ. Tennessee Press. 222 pp., 12 pls.
- Creighton, W. S. 1950. Ants of North America. Bull. Mus. Comp. Zool. 104: 1-585, pls. 1-57.
- Donisthorpe, H. 1943. A list of type-species of the genera and subgenera of the Formicidae. Ann. Mag. Nat. Hist. (11th series) 10: 649-720.
- _____. 1947. Some new ants from New Guinea. Ann. Mag. Nat. Hist. 14: 183-197.
- Eastlake-Chew, A. and R. M. Chew. 1980. Bodysize as a determinant of small-scale distribution of ants in evergreen woodland, southeastern Arizona. Insectes Soc. 27: 189-202.
- Eisner, T. 1957. A comparative study of the proventriculus of ants (Hymenoptera: Formicidae). Bull. Mus. Comp. Zool. 116: 439-490, pls. 1-25.
- Emery, C. 1893. Beiträge zur Kenntniss der Nordamerikanischen Ameisen-fauna. Zool. Jahrb. Syst. 7: 633-683.
- _____. 1906. Note sur *Prenolepis vividula* Nyl. et sur la classification des espèces du genre *Prenolepis*. Ann. Soc. Ent. Belg. 50: 130-134.
- _____. 1925. Genus *Paratrechina*. Genera Insectorum Fasc. 183: 216-226.
- Forel, A. 1893. Formicides de l'Antille St. Vincent, récoltees par Mons. H. H. Smith. Trans. Ent. Soc. London: 333-418.
- _____. 1922. Glanures myrmecologiques en 1922. Rév. Suisse Zool. 30: 87-102.
- Kempf, W. W. 1972. Catálogo abreviado das Formigas da Região Neotropical (Hymenoptera: Formicidae). Stud. Ent. (n.s.) 15: 1-344.
- Latreille, P. A. 1802. Histoire naturelle des Fourmis. N. P. Paris.
- Lynch, J. F. 1981. Seasonal, successional and vertical segregation in a Maryland ant community. Oikos 37: 183-198.
- Lynch, J. F., E. C. Balinsky and S. G. Vail. 1980. Foraging patterns in three sympatric forest ant species, *Prenolepis imparis*, *Paratrechina melanderi* and *Aphaenogaster rudis* (Hymenoptera: Formicidae). Ecol. Ent. 5: 353-371.
- Mayr, G. 1862. Myrmecologische Studien. Verh. Zool.-bot. Ges. Wien 12: 649-776.
- Mitchell, J. D. and W. D. Pierce. 1912. The ants of Victoria County, Texas. Proc. Ent. Soc. Washington 14: 67-76.
- Motschulsky, V. 1863. Essai d'un catalogue des insectes de l'île de Ceylan (Suite). Bull. Soc. Imp. Nat. Moscou 36: 1-153.
- Nuhn, T. P. and C. G. Wright. 1979. An ecological survey of ants (Hymenoptera: Formicidae) in a landscaped suburban habitat. Amer. Midl. Nat. 102: 353-362.

- Simberloff, D. S. and E. O. Wilson. 1969. Experimental zoogeography of islands. The colonization of empty islands. *Ecology* 50: 278-296.
- _____. 1970. Experimental zoo-geography of islands. A two-year record of colonization. *Ecology* 51: 934-937.
- Smith, D. R. 1979. Superfamily Formicoidea. In Krombein, K. V., P. D. Hunt, Jr., D. R. Smith and B. D. Durks, eds. *Hymenoptera in America north of Mexico*, Vol. II. Smithsonian Inst. Press, Washington, pp. 1323-1467.
- Smith, D. R. and Lavigne, R. J. 1973. Two new species of ants of the genera *Tapinoma* Foerster and *Paratrechina* Motschoulsky from Puerto Rico (Hymenoptera: Formicidae). *Proc. Ent. Soc. Washington* 75: 181-187.
- Smith, M. R. 1930a. A list of Florida ants. *Florida Ent.* 14: 1-6.
- _____. 1930b. Another imported ant. *Florida Ent.* 14: 23-24.
- _____. 1936. The ants of Puerto Rico. *J. Agr. Univ. Puerto Rico*. 20: 819-975.
- _____. 1943. A generic and subgeneric synopsis of the male ants of the United States. *Amer. Midl. Nat.* 30: 273-321.
- _____. 1947. A generic and subgeneric synopsis of the United States ants based on the workers (Hymenoptera: Formicidae). *Amer. Midl. Nat.* 37: 521-647.
- _____. 1965. House-infesting ants of the eastern United States. ARS-USDA Tech. Bull. No. 1326. 105 pp.
- Snelling, R. R. 1976. A revision of the honey ants, genus *Myrmecocystus* (Hymenoptera: Formicidae). *Nat. Hist. Mus. Los Angeles Co. Bull.* 24: 1-163.
- _____. 1981. Systematics of social Hymenoptera. In Hermann, H. R., ed. *Social insects*, Vol. II. Academic Press, New York, pp. 369-453.
- Thompson, C. R., J. C. Nickerson and F. W. Mead. 1979. Nymphal habitat of *Oliarus vicarius* (Homoptera: Cixidae) and possible association with *Aphaenogaster* and *Paratrechina* (Hymenoptera: Formicidae). *Psyche* 86: 321-325.
- Trager, J. C. 1984. A revision of the genus *Paratrechina* (Hymenoptera: Formicidae) of the Continental United States, Ph.D. dissertation University of Florida.
- Van Pelt, A. F. 1947. Ants of the Gainesville region, with special reference to ecology and taxonomy (Hymenoptera: Formicidae). M. S. Thesis, University of Florida, Gainesville, Florida.
- _____. 1956. The ecology of the ants of the Welaka Reserve, Florida (Hymenoptera: Formicidae). *Amer. Midl. Nat.* 56: 358-387.
- _____. 1958. The ecology of the ants of the Welaka Reserve, Florida (Hymenoptera: Formicidae). Part II. Annotated List. *Amer. Midl. Nat.* 59: 1-57.
- _____. 1983. Ants of the Chisos Mountains, Texas (Hymenoptera: Formicidae). *Southwestern Nat.* 28: 137-142.
- Visher, S. S. 1954. Climatic atlas of the United States. Harvard Univ. Press, Cambridge, 403 pp.
- Wheeler, G. C. and J. Wheeler. 1953. Ant larvae of the subfamily Formicinae. Part I and II. *Ann. Ent. Soc. Amer.* 46: 126-170 and 175-217.
- Wheeler, W. M. 1903. A deced of Texan Formicidae. *Psyche* 10: 93-111.
- _____. 1905. An annotated list of the ants of New Jersey. *Bull. Amer. Mus. Nat. Hist.* 21: 371-403.
- _____. 1906. The ants of the Bermudas. *Bull. Amer. Mus. Nat. Hist.* 22: 350-352.
- _____. 1910. Ants: their structure, development and behavior. Columbia Univ. Press, New York, 663 pp.
- _____. 1914. Ants collected by W. M. Mann in the state of Hidalgo, Mexico. *J. N. Y. Ent. Soc.* 22: 37-61.
- _____. 1932. A list of the ants of Florida with descriptions of new forms. *J. N. Y. Ent. Soc.* 40: 1-17.
- _____. 1936. Ants from Hispaniola and Mona Island. *Bull. Mus. Comp. Zool.* 80: 195-211.

- Wilson, E. O. 1955. A monographic revision of the ant genus *Lasius*. Bull. Mus. Comp. Zool. 113: 1-201.
- _____. 1975. Sociobiology. Harvard Univ. Press, Cambridge, 697 pp.
- _____. and R. W. Taylor. 1967 The ants of Polynesia (Hymenoptera: Formicidae). Pacific Insects Monogr. 14:1-109.
- Wing, M. W. 1968. Taxonomic revision of the nearctic genus *Acanthomyops* (Hymenoptera: Formicidae). Cornell Univ. Agr. Exp. Station Mem. 405. 173 pp.





SCIENTIFIC WRITING FOR GRADUATE STUDENTS

This manual is a "must" for those who would introduce courses of instruction in scientific writing into university graduate schools. The first nine chapters provide the essentials for "Writing a Journal Article," and the remaining five chapters cover "Related Topics" in scientific communication.

CONTENTS: 1. Clearing Away the Underbrush • 2. The Ground Plan • 3. The Master Plan • 4. The First Draft • 5. The First Revision: Structural Alterations • 6. Further Revision: Polishing the Style • 7. Editing Assignments • 8. The Final Steps • 9. Responding to the Editor • 10. Design of Tables and Figures • 11. Preparation for Writing the Doctoral Thesis • 12. Writing a Research Project Proposal • 13. Oral Presentation of a Scientific Paper • 14. Principles and Practices in Searching the Scientific Literature

Paperbound; ISBN: 0-914340-01-8; Published 1968, reprinted 1983;
Trim size: 6 × 9 inches; 190 pages

Regular Price: \$9.75 (10% discount on 10 or more copies delivered to one address)

CBE Member Discount Price: \$8.75 (single copy paid by personal check)

Terms of Sale: All sales final; no returns.

Prepayment required; U.S. currency drawn on a U.S. bank.

Price includes BOOK RATE postage.

For faster delivery--first class, air mail, or UPS available at additional charge (book weight, 11.5 oz).

Maryland residents, please add 5% sales tax.

COUNCIL OF BIOLOGY EDITORS, INC.
9650 Rockville Pike, Bethesda, MD 20814



CBE STYLE MANUAL **Fifth Edition**

**A guide for Authors, Editors, and Publishers in
the Biological Sciences**

Widely accepted and recommended as the
standard reference for journals and books in the
biological sciences

Special features of this newly updated and greatly expanded edition include:

- four new chapters;
- reorganization of the "Manuscript Preparation" section for easier reference;
- new conventions in the chapter on "Style in Special Fields";
- complete revision of the section on "Plant Sciences";
- cross-listing of "Abbreviations and Symbols";
- and much more . . .

CONTENTS: Ethical conduct in authorship and publication • Planning the communication • Writing the article • Prose style for scientific writing • References • Illustrative materials • Editorial review of manuscripts • Application of copyright law • Manuscript into print • Proof correction • Indexing • General style conventions • Style in special fields • Abbreviations and symbols • Word usage • Secondary services for literature searching • Useful references with annotations • Subject index

ISBN: 0-914340-04-2; clothbound; publication date: September 1983; trim size 6 x 9 inches; 324 pages

Regular Price: \$24.00 (10% discount on 10 or more copies delivered to one address)

CBE Member Price: \$21.50 (single copy paid by personal check)

Terms of Sale: All sales final; no returns.

Prepayment required; U.S. currency drawn on a U.S. bank.

Price includes BOOK RATE postage.

For faster delivery--first class, air mail, or UPS available at additional charge (book weight 1 lb 9 oz).

Maryland residents, please add 5% sales tax.

Mail your order with payment to:

COUNCIL OF BIOLOGY EDITORS, INC.
9650 Rockville Pike, Bethesda, MD 20814



ECONOMICS OF SCIENTIFIC JOURNALS

"This publication is an in-depth source for anyone who wants to learn about the inner workings of scientific journal publishing. Although it deals mostly with society, not-for-profit publishing, it provides the reader with the general philosophy and methods used by most commercial publishers as well."

--Society for Scholarly Publishing Letter

CONTENTS: Member Subscriptions • Single Issues and Back Volumes • Reprints • Advertising in Scholarly Journals • Page Charges • Journal Income: a Multipublisher's View • Editorial Operations • Copy Editing • Purchasing Typesetting Separately from Printing • Presswork, Binding, and Paper • Distribution and Postage • Subscription Fulfillment • Budgeting, Accounting, and Financial Planning • Marketing the Scientific Journal • Subject Index

Paperbound; ISBN: 0-914340-03-4; Publication date: December 1982;
Trim size: 6 x 9 inches; 106 pages

Regular Price: \$11.95 (10% discount on 10 or more copies delivered to one address)

CBE Member Discount Price: \$10.75 (single copy paid by personal check)

Terms of Sale: All sales final; no returns.

Prepayment required; U.S. currency drawn on a U.S. bank.

Price includes BOOK RATE postage.

For faster delivery--first class, air mail, or UPS available at additional charge (book weight 8.5 oz).

Maryland residents, please add 5% sales tax.

COUNCIL OF BIOLOGY EDITORS, INC.

9650 Rockville Pike, Bethesda, MD 20814

HUMAN SOCIOBIOLOGY

General Editors:

MARTIN DALY and MARGO WILSON

McMaster University

THE STATE UNIVERSITY OF NEW YORK PRESS has initiated a new series of books and monographs dealing with human sociobiology, the application of evolutionary theory to the study of human social behavior. Under the editorship of Martin Daly and Margo Wilson, SUNY Press is soliciting book-length manuscripts, singly or multiply authored. Manuscripts may be based upon empirical research, new interpretations of pre-existing data bases, or proceedings of conferences of topical interest. Selection of publishable manuscripts will be based on the quality of underlying scholarship, the significance of the issues addressed, and the clarity and style of the written text.

All books selected for this series will be published simultaneously in hardcover and paperback to facilitate potential course adoptions and to attract a more immediate wider general readership. Through membership in the Columbia University Press Sales Consortium and effective utilization of direct mail marketing, SUNY Press has access to a vast promotion and distribution network that reaches a complete range of national and international markets. In addition, SUNY Press offers rapid decision-making regarding manuscript acceptance and rapid publication.

All inquiries about the series and all manuscripts and book proposals should be submitted to Susan D. Suarez, Ph.D., the Editor of SUNY Press at the above address.