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## KARYOTYPES OF A DOZEN ANT SPECIES FROM THE SOUTHWESTERN U.S.A. (HYMENOPTERA: FORMICIDAE)

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**SUMMARY** — The karyotypes of ten species of ants belonging to two different subfamilies (Ecitoninae and Myrmicinae) are reported for the first time. Previously published karyotypes of a species of Myrmicinae and one species of a third subfamily (Dolichoderinae) are confirmed. The diploid number of 36 for *Neivamyrmex texanus* is the first report for the subfamily Ecitoninae. The diploid number reported for *Veromessor andrei* ( $2n=40$ ) is the first published karyotype of this genus. The other karyotypes are from members of *Pheidole* ( $2n=18$  and  $20$ ), *Solenopsis* ( $2n=32$ ), *Leptothorax* ( $2n=26, 27$ ), *Tetramorium* ( $2n=26$ ), and *Tapinoma* ( $2n=16$ ).

### INTRODUCTION

Almost 500 species of ants have been karyotyped (see BUSCHINGER *et al.* 1980; GOÑI *et al.* 1983; HAUSCHTECK-JUNGEN and JUNGEN 1983; IMAI, BARONI URBANI *et al.* 1984; IMAI, BROWN *et al.* 1984; COKENDOLPHER and FRANCKE 1985; TJAN *et al.* 1986; and citations therein), but few of these species are native to western North America. In an effort to provide new data for the systematic study of North American ants, we karyotyped 10 previously unexamined species and confirmed reports on two others. The first karyotypes from the subfamily Ecitoninae and the xerophilous Nearctic Myrmicinae genus *Veromessor* were obtained during this study.

### MATERIALS AND METHODS

Prepupal ants were collected directly from the mounds in the spring, summer, and fall of 1984 and 1985. Specific collection data are given in Table 1.

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TABLE 1 — Collection localities and museum catalogue number of ants used in this study (TTUno. = ant catalogue number, The Museum, Texas Tech University).

U.S.A.	Locality	TTUno.
Arizona:	Ruby Road, Sycamore Canyon, Santa Cruz County	6720
Arizona:	Miller Canyon, Huachuca Mountains, Cochise County	6704, 6797
Arizona:	Barfoot Park, Chiracahua Mountains, Cochise County	6942
California:	8 km E. Glenville, Kern County	6783, 6785
Texas:	1.6 km N. Tulsita, Bee County	6992
Texas:	Sam Houston National Forest, Walker County	6994
Texas:	17 km S. Alice, Jim Wells County	6987
Texas:	21 km S. Alice, Jim Wells County	6989
Texas:	37 km S. Tilden, McMullen County	6981, 6991
Texas:	Lubbock, Lubbock County	6982, 6990
Texas:	Post, Garza County	6976

The method of IMAI *et al.* (1977) was followed with minor modifications. Pharate pupae were selected when available and injected with a 0.01% aqueous colchicine solution 18 to 24 hours before dissection following COKENDOLPHER and BROWN (1985). Larvae were occasionally held at room temperature until the pharate pupal stage was reached. After injection with colchicine, the ants were incubated in toweling saturated with 0.01% aqueous colchicine for ca. 24 hours. The brains of the pupae were then removed and placed in a depression slide filled with a hypotonic solution of 1% aqueous sodium citrate for 20 minutes at room temperature. A single brain was then transferred with a Pasteur pipet to a microscope slide and the excess hypotonic solution was drained off. Several drops of fixative 1 (3: 1 glacial acetic acid: absolute ethyl alcohol) were applied and drained away. Two additional drops of fixative were then added and after 10 seconds the brain was minced using extremely fine teasing needles. Two drops of fixative 2 (1: 1 glacial acetic acid: absolute ethyl alcohol) were added and after 30 seconds the fluid was drained away. Several drops of fixative 3 (glacial acetic acid) were applied and after 10 seconds the slide was drained again and set aside to dry overnight. The next day the cells were stained for 10 minutes with 1: 20 Giemsa stain: buffer (COKENDOLPHER and BROWN 1985). The taxa studied and the number of replications of this procedure are presented in Table 2.

The methods of IMAI, BARONI URBANI *et al.* (1984) were followed in the description of chromosome morphologies. In that system, chromosomes are grouped into categories:  $\bar{A}$  (acrocentric in a broad sense, which includes traditional T and A) and M (metacentric in broad sense, which includes traditional M; SM and ST).

## RESULTS AND DISCUSSION

The results of the karyological survey are summarized in Table 2. The detailed descriptions of the karyotypes are as follows:

TABLE 2 — Analyzed karyotypes from brains of ants inhabiting the western U.S.A.

Taxon	Locality: TTUno. (see Table 1)	Chrom. no. (n) 2n	No. of individuals observed	No. of cells with modal chrom. no.	Figs.
Subfamily Ecitoninae					
Tribe Ecitonini					
<i>Neivamyrmex texanus</i>	6992	36	8♀	22	1a
Subfamily Myrmicinae					
Tribe Pheidolini					
<i>Aphaenogaster lamellidens</i>	6994	38	1♀	3	—
<i>Veromessor andrei</i>	6783	40	1♀	6	—
	6985	40	7♀	33	1b
<i>Pheidole desertorum</i>	6981	20	6♀	35	2a
<i>Pheidole byatti</i>	6990	20	3♀	23	2b
<i>Pheidole porcula</i>	6987	20	5♀	25	2c
<i>Pheidole sitarches campestris</i>	6982	18	4♀	43	2d
<i>Pheidole tepicana</i>	6989	18	8♀	38	2e
	6991	18	1♀	4	—
<i>Solenopsis xyloni</i>	6976	32	6♀	8	—
	6720	(16) 32	2♂, 2♀	11, 13	3a
Tribe Leptothoracini					
<i>Leptothorax rugatulus</i>	6797	26, 27	2♀	27 = 17 26 = 10	3b —
Tribe Tetramoriini					
<i>Tetramorium spinosum</i>	6704	(13) 26	1♂, 6♀	1, 11	3c
Subfamily Dolichoderinae					
Tribe Tapinomini					
<i>Tapinoma sessile</i>	6942	16	1♀	7	—

### 1. Subfamily Ecitoninae.

This group comprises the New World army ants. Old World army ants are considered by some to be members of a separate subfamily, Dorylinae (WHEELER and WHEELER 1985). Karyological reports on members of the Dorylinae are few (HUNG *et al.* 1972; IMAI, BARONI URBANI *et al.* 1984; IMAI, BROWN *et al.* 1984). The three reported species have  $2n = 22$ ,  $24$  ( $2K = 2\dot{A} + 22M$ ), and  $30$ . One species of New World army ant, *Neivamyrmex texanus*, was examined during the present study. The ants were collected in southeastern Texas (Tables 1, 2) and represent the first ecitonines to be karyotyped. The diploid karyotype (Fig. 1a) is  $2K = 36M$ .

### 2. Subfamily Myrmicinae.

Myrmicinae is cosmopolitan and is the largest ant subfamily. Members of four tribes were examined during this study.

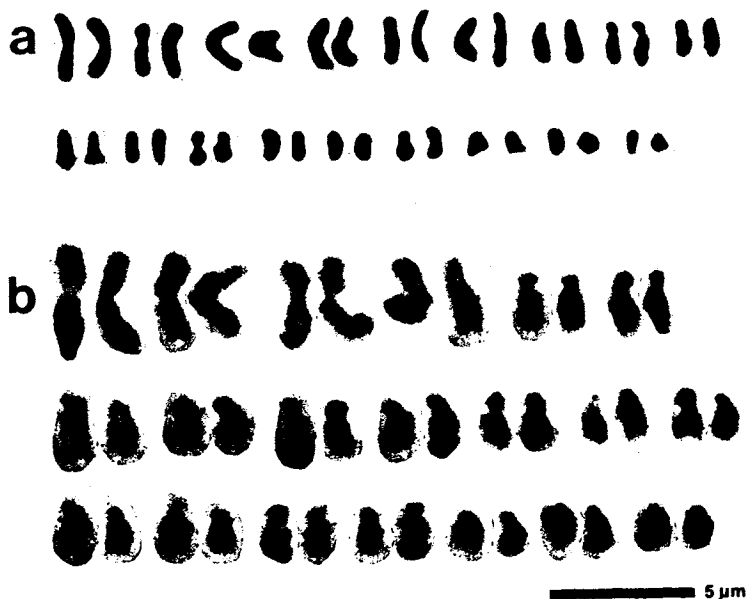


Fig. 1. — Karyotypes of an ecitonine (a) and a myrmicine (b) ant species. (a) *Neivamyrmex texanus* ( $2n=36$ ) and (b) *Veromessor andrei* ( $2n=40$ ).

*Tribe Pheidolini*: Three genera were available for analysis and two of these include species which have been reported in earlier publications. The genus *Aphaenogaster* contains many species that are found worldwide. Sixteen species have thus far been karyotyped (IMAI, BARONI URBANI *et al.* 1984; IMAI, BROWN *et al.* 1984; HAUSCHTECK-JUNGEN and JUNGEN 1983). Haploid numbers range from  $n=10-11$  to  $n=15-23$ . CROZIER (1977) reported  $2n=38$  for *Aphaenogaster lamellidens* from Georgia, U.S.A. Our observations on three cells from a single female collected in Texas also reveal  $2n=38$  (Tables 1, 2).

The xerophilous ant, *Veromessor andrei*, is the first species of the genus to be investigated karyologically. The diploid karyotype (Fig. 1b) is  $2K=40M$ . The ants were collected in California (Tables 1, 2).

The cosmopolitan genus *Pheidole* is one of the largest ant genera and over 70 species of this genus have been karyotyped previously. Of these, karyotypes

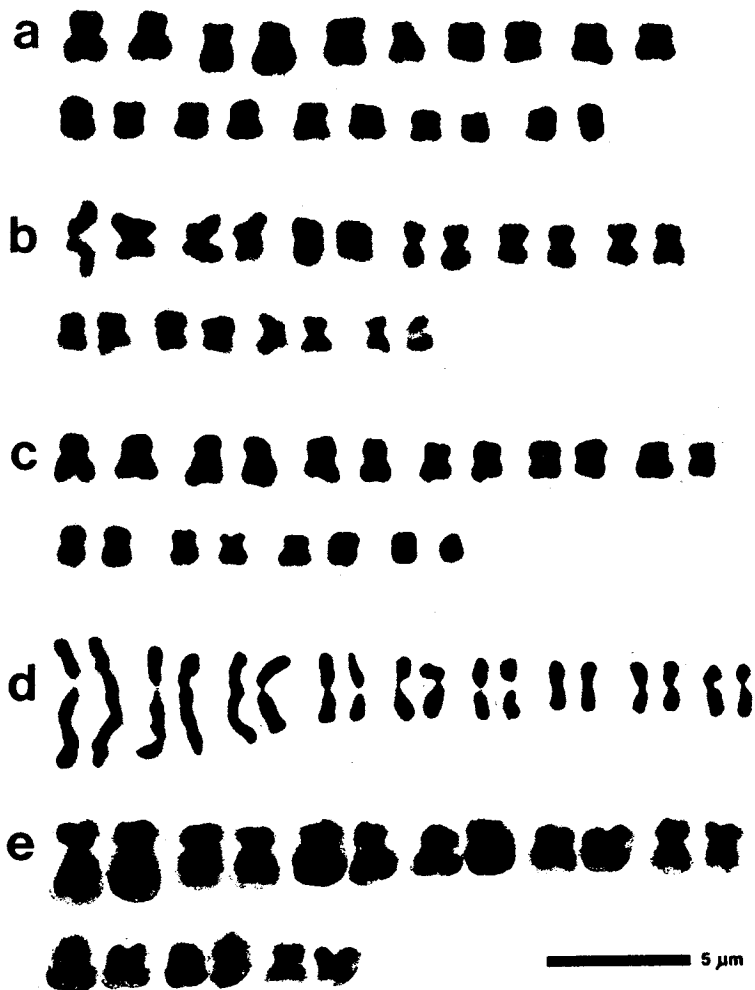


Fig. 2. — Karyotypes of myrmicine ant species. (a) *Pheidole desertorum* ( $2n=20$ ), *Pheidole hyatti* ( $2n=20$ ), (c) *Pheidole porcula* ( $2n=20$ ), (d) *Pheidole sitarches campestris* ( $2n=18$ ), and (e) *Pheidole tepicana* ( $2n=18$ ).

range from  $n=6$  to  $n=19$ , with the majority being  $n=9$  or  $n=10$  (CROZIER 1975; IMAI *et al.* 1977; GOÑI *et al.* 1983; IMAI, BARONI URBANI *et al.* 1984; IMAI, BROWN *et al.* 1984). In the present study, five species of *Pheidole* collected in Texas were examined (Tables 1, 2). The diploid karyotypes of *P. desertorum*, *P. hyatti*, and *P. porcula* are all similar,  $2K=20M$  (Figs. 2a-c). In some *Pheidole* spp., heteromorphic chromosomes comprise the largest pair, but homomorphics only were observed in the present study. *Pheidole sitarches campestris* and *P. tepicana* are  $2K=18M$  (Figs. 2d-f). The two longest pairs of chromosomes of *P. sitarches campestris* are ST; whereas all other chromosomes of the five *Pheidole* spp. studied are conventional M and SM.

*Tribe Solenopsidini*: A single species of this tribe was examined during this study. Eight species of *Solenopsis* have previously been studied karyologically (CROZIER 1975; IMAI, BARONI URBANI *et al.* 1984; GLANCEY *et al.* 1976; GOÑI *et al.* 1983). Three species of the subgenus *Diplorhoptrum* and five species of the subgenus *Solenopsis* have been previously karyotyped. The diploid numbers found in these groups are 22 and 32, respectively. Larvae of the southern fire ant, *Solenopsis (Solenopsis) xyloni*, were collected in west central Texas and southern Arizona (Tables 1, 2). Eleven karyotypes from two Arizona males revealed  $n=16$  and workers from both localities had  $2n=32$ . A diploid karyotype,  $2K=28M+4A$ , is presented in Fig. 3a. The present observations confirm  $2n=32$  for the subgenus *Solenopsis*. Although the predominance of M to SM chromosomes in the karyotypes of *S. xyloni* suggests a closer affinity to *S. aurea*, *S. invicta*, and *S. saevissima* than to *S. germinata* and *S. richteri*; contradicting information (occurrence of hybrids, morphological, biogeographic and bionomic evidence) is available. *Solenopsis invicta* is one of the few Hymenoptera reported to have both haploid and diploid males (ROSS and FLETCHER 1985, 1986).

*Tribe Leptothoracini*: A single species of the genus *Leptothorax* was examined during the present study. Previously, 17 species of *Leptothorax* had been investigated cytologically (IMAI 1974; CROZIER 1975; BUSCHINGER *et al.* 1980; BUSCHINGER 1982; HAUSCHTECK-JUNGEN and JUNGEN 1983; FRANCOEUR 1986). [Note «*Leptothorax*» *provancheri* which was reported on by BUSCHINGER *et al.* (1980) is now placed in *Formicoxenus* (see FRANCOEUR *et al.* 1985)]. Reported *Leptothorax* haploid numbers are  $n=9, 11-13$ , and  $15-18$ . B-chromosomes were reported for the Japanese species *L. spinosior* (IMAI 1974).

The genus *Leptothorax* is currently recognized as consisting of several subgenera. The species examined here is placed in the subgenus *Myrafant*. The observed karyotypes of *L. (Myrafant) rugatulus* from Arizona reveal a chromosome polymorphism of  $2n=26, 27$  (Tables 1, 2). From observations of numerous spreads, the longest pair of chromosomes is clearly heteromorphic. In the  $2n=27$  spreads, a medium sized SM is unpaired. These unpaired chromosomes were observed in somatic cells of both worker females examined. Of the nine

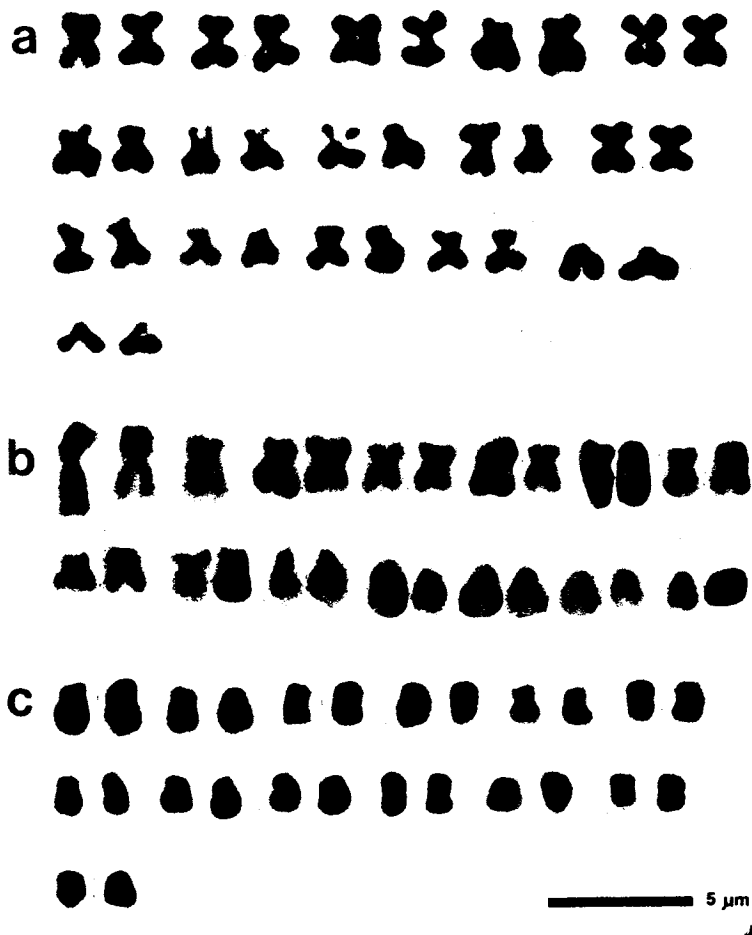


Fig. 3. — Karyotypes of myrmicine ant species. (a) *Solenopsis xyloni* ( $2n = 32$ ), (b) *Leptothonax rugatulus* ( $2n = 27$ ), suspected B-chromosome polymorphism, (c) *Tetramorium spinosum* ( $2n = 26$ ).



species previously reported on from the subgenus *Myrajan* (*L. congruus*, *L. spinosior*, *L. longispinosus*, *L. interruptus*, *L. tuberum*, *L. schauami*, *L. nylanderi*, *L. unifasciatus* and *L. corticalis*), the diploid numbers are 18, 22, 24 and 24 plus B-chromosomes. The  $2n = 26$ , 27 of *L. rugatulus* is thus the highest known for the subgenus. In *L. spinosior*, 1-12 B-chromosomes were observed primarily in male germ cells. They were always small M, with the appearance of isochromosomes, and were clearly distinguishable from A-chromosomes:  $K = 11\bar{M} + 1\bar{A}$ . In *L. rugatulus*,  $2K = 18\bar{M} + 8\bar{A}$  with an additional  $\bar{M}$  appearing in many plates (Fig. 3b).

André FRANCOEUR (pers. comm.) has informed us that he also karyotyped *L. rugatulus*. His specimens were from Boulder, Colorado, U.S.A. From two worker prepupae and five male pupae, counts were obtained that were essentially identical to ours. In all cases with  $2n = 27$  or  $n = 14$ , the odd or extra chromosome was SM.

*Tribe Tetramorini*: A single species, *Tetramorium spinosum*, of the tribe was examined during this study.

Members of the genus *Tetramorium* have been moved back and forth to *Xiphomyrmex*, until BOLTON (1976) synonymized the two genera. Our samples of *Tetramorium spinosum* were collected from the Huachuca Mountains in southern Arizona (Tables 1, 2). The karyotype (Fig. 3c) is  $2K = 26\bar{M}$ . A single karyotyped male revealed one cell countable as  $n = 13$ . Until now, 16 identified and seven unidentified species of *Tetramorium* [some were reported in combination with *Triglyphothrix* now considered a junior synonym of *Tetramorium* (BOLTON 1985)] have been karyotyped (CROZIER 1975; IMAI, BARONI URBANI *et al.* 1984; IMAI, BROWN *et al.* 1984; IMAI *et al.* 1985; TJAN *et al.* 1986). The identified species karyotyped are divided into eight species groups. The species reported on herein belongs to the *tortuosum* group. IMAI, BROWN *et al.* (1984) reported on the Malaysian *T. eleates*, the only other species karyotyped from this group. The karyotypes of *T. eleates* reveal  $2n = 28$ . Other reported karyotypes for species of *Tetramorium* range from  $2n = 14$  to  $2n = 36$ .

### 3. Subfamily Dolichoderinae.

Only a single species of the Tribe Tapinomini was examined in the present study. Until now, six species of *Tapinoma* have been karyotyped (CROZIER 1970; HAUSCHTECK-JUNGEN and JUNGEN 1983; IMAI, BARONI URBANI *et al.* 1984). The diploid numbers range from  $2K = 8\bar{M}$ ,  $14\bar{M}$  or  $16\bar{M}$  with  $2\bar{A}$  each, to  $2K = 16\bar{M}$ . Two *Tapinoma* species, *T. sessile* from the U.S.A. and *T. erraticum* from Switzerland, have  $2n = 16$ . Both species have  $2K = 14\bar{M} + 2\bar{A}$  populations, and CROZIER (1970) reported a  $2K = 16\bar{M}$  for *T. sessile*. Both samples of *T. sessile* were collected in the state of New York. Examination of

seven cells from a single worker female collected in Arizona revealed  $2K = 14\dot{M} + 2\dot{A}$  (Tables 1, 2). Our karyotypes were essentially identical to those published by CROZIER (1970: Fig. 1B).

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