Tenuirostritermes cinereus (Buckley), a Nasutitermitine Termite from South Central Texas (Isoptera: Termitidae)

by
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INTRODUCTION

The largest and most specialized subfamily of the Isoptera, the Nasutitermitinae, consists of at least 550 species (Emerson 1955). Many members of this group are known for their morphologically distinct soldier caste which bears a bulbous head tapering to a frontal projection (nasus) used to spray attackers with a defensive secretion (Deligne et al. 1981). Although the Nasutitermitinae are primarily pantropically distributed, a few species flourish in temperate climates. In the continental United States, *Tenuirostritermes tenuirostris* (Desneux) and *T. cinereus* (Buckley) are the only well documented nasutiform termites. While studies have been conducted on the swarming (Light and Weesner 1948), biology (Weesner 1953), colony development (Light and Weesner 1955), foraging method (Nutting 1970), and defensive mechanisms (Nutting et al. 1974) of *T. tenuirostris*, only brief and incidental reference has been made to the biology and morphology of *T. cinereus* (Swartz 1896, Desneux 1905, Banks and Snyder 1920, Weesner 1965 and 1970, including the original description by Buckley 1862). We herein provide additional information concerning its distribution; a diagnostic description of soldiers, workers, and alates; and observations of the open-air behavior of *T. cinereus*.

GEOGRAPHICAL DISTRIBUTION

Only 9 species of Nasutitermitinae are known from the Nearctic and neighboring Mexican Neotropical regions. Of these, 5 are neotropical members of the tropicopolitan genus *Nasutitermes* Dudley of which *N. nigriceps* (Haldeman) has been collected as far north as the Mexican state of Sinaloa (Weesner 1970). The remainder comprise members of the genus *Tenuirostritermes* Holmgren including *T. tenuirostris*, *T. cinereus*, *T. briciae* (Snyder), and *T. incisus* (Snyder) (Snyder 1922, Nutting 1970). According to

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Emerson (1955), *Tenuirostritermes* radiated from its Central American origin and is the only genus of Nasutitermitinae with Nearctic members. *T. tenuirostris* occurs northward from central Mexico into southeastern Arizona (Banks and Snyder 1920) and far-western Texas (Desneux 1905), while *T. cinereus* has limited distribution centered in south central Texas (Fig. 1). There are no reports of these two species occurring sympatrically.

Collection data for *T. cinereus* have previously been reported by Banks and Snyder (1920) and Weesner (1970). Recent collection records from Texas have been compiled by H. N. Howell, Jr. (pers. comm.) as follows: foraging workers and soldiers—Vance, Real Co., May 15, 1981 (J. W. Stewert); Uvalde, Uvalde Co., Nov. 24, 1981 (J. W. Stewert); Junction, Kimble Co., Sept. 25, 1980 (R. P. Johnson); Texas A & M Univ. Research Ranch, Maverick Co., Sept. 9, 1980, from the crop of a male scaled quail (L. Campbell); alates collected while swarming—San Antonio, Bexar Co., Sept. 12, 1980 (Presley), Sept. 8, 1978 (A. Mazzella), and Oct. 7, 1981 (M. Krapp); Uvalde, Uvalde Co., Sept. 15, 1981 (R. Nowell).

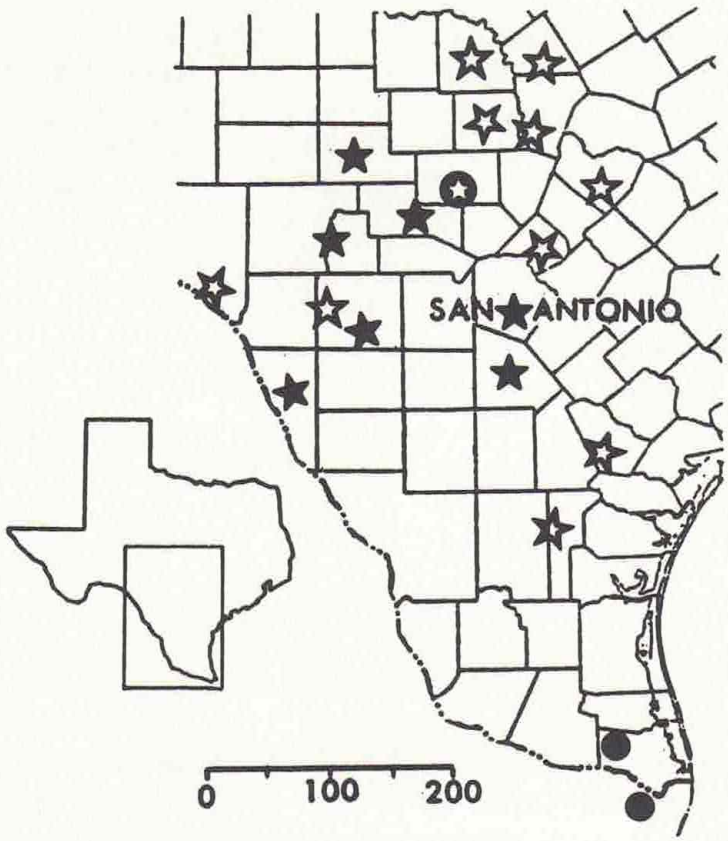

Fig. 1. South central Texas showing collection localities of *Tenuirostritermes cinereus*. Banks and Snyder 1920 (outlined stars); H. N. Howell, Jr., Texas A&M University (solid stars); Weesner 1970 (solid circles); and this study (encircled star). Some localites confirmed by more than one author. Scale in km.

Kerrville, Kerr Co., Sept. 26, 1980 (Hill Country Pest Control); Atascosa Co., Sept. 8, 1978 (J. W. Stewert); Medina Co., Sept. 30, 1980 (E. Holland). A compilation of collection localities is given in Fig. 1.

OPEN-AIR BEHAVIOR

Behavioral observations of *T. cinereus* were made at a residential subdivision in Fredericksburg, Gillespie Co., Texas (Fig. 1; 98° 52.2′ W and 30° 16.4′ N, 550 m, ann. precipitation 76 cm, mean ann. R.H. 52%, mean ann. temperature 19°C.). Termites were observed foraging on sparsely vegetated ground, heavily sodded lawn, and on soil beneath oak and mesquite canopies.

Small conspicuous surface mounds constructed of coarsely fitted spheriod particles of soil were evidence of underlying exit holes (*ca.* 5 mm. diam). Often several arcades (*ca.* 1.5 cm wide × 1.0 cm high), which usually served as runways for commuting foragers, radiated up to 20 cm from the central mound. Sometimes foragers circumvented arcade entrances or entered arcadeless mounds *via* an opening near the mound base (Fig. 2). During construction, nasutes positioned themselves along the periphery of unfinished mound or arcade canopies while workers completed the enclosures. The mounds varied considerably in size, attaining a height of 6 cm but more commonly *ca.* 2 cm. Efforts to locate nests below the surface structures by excavating the soil were unsuccessful as only narrow galleries were intersected to a depth of 30 cm.

Surface structures of *T. cinereus* were plentiful on the 0.4 ha study site and throughout Fredericksburg. *Gnathamitermes tubiformans* (Buckley), a prevalent subterranean termite in this area, was easily recognized by the thin soil sheeting constructed by workers to cover the same types of cellulosic litter harvested by *T. cinereus*. Even though termite workings were sometimes side-by-side, only once was a *G. tubiformans* worker collected from a vacant *T. cinereus* exit hole. Food for these surface foraging termites was abundant and did not appear to be a growth limiting factor for either species. Some *Reticulitermes* sp. workers were also unearthed in the *T. cinereus* study site.

One apparent function of *T. cinereus* surface structures was as protective staging shelters where workers and soldiers congregated prior to foraging expeditions. When rain destroyed the mounds, they were reconstructed before foraging was initiated. Additional soil exits were periodically opened presumably to exploit new food collection sites. Mound building was observed as early as 1800 hrs. CDT in June. Termites could be taken inside structures or exit galleries during all but the warmest and sunniest midday periods.

Crepuscular foraging marked the initial or terminal segments of prolonged nocturnal activity. Foraging was observed as late as 800 hrs. CDT and as early as 1900 hrs. CDT in one day (6/26/81, cloudy morning and partly cloudy evening after a brief rain at 1800 hrs. CDT). Only direct

sunlight deterred foraging during crepuscular hours.

Foraging initiation was observed twice at dusk from different mounds in which workers and soldiers had congregated earlier that afternoon. A pseudopod-like rank of nasutes first exited the mound and gradually radiated in a seemingly random path followed by more soldiers as the exploratory column expanded. Workers then began filing into the area settled by the soldiers. When workers encountered food, it was harvested and carried back along developing trails. Nasutes did not assist in food gathering. Soon, a main trail of workers, flanked by nasutes, emanated from the mound (Fig. 2). Several side trails often branched from the quickly moving main traffic line. Advancing soldiers continually established more distant foraging territories which were exploited by foraging workers. Dry weathered grass was the only natural food source collected, however, instant oatmeal flakes sprinkled near trails were also harvested. Although many ants including *Pogonomyrmex*, *Tetramorium*, and *Diromyrmex* species and *Solenopsis invicta* wandered directly adjacent to soldier occupied termite foraging boundaries, ants were not observed penetrating nasute lines. The ants preyed upon swarming termite alates and experimentally provided termite workers. Soldiers comprised 53% (718 nasutes; 633 workers) and 48% (197 nasutes; 209 workers) of the termites collected from two complete foraging parties.

Foraging parties demonstrated a coordinated retreat behavior. Physical disturbance of grass or soil, even footsteps, in their proximity produced a rapid retreat of workers accompanied by part of the soldier force followed by the remainder of nasutes. Escaping termites followed existing foraging trails back to their subterranean passage. The concatenated reaction caused by a local disturbance suggests a rapid chemical alarm system.

Previous collection data and present observations verify that alates of *T. cinereus* swarm at night during or after substantial late-summer, early-fall rain. Alates collected in Fredericksburg on September 7, 1980, swarmed between 2200 hrs. and midnight CDT during a soaking rain of 11 cm. On September 19, 1982, *T. cinereus* swarmed between 2000 and 2200 hrs. after *ca.* 1.5 cm of rainfall that afternoon. In both cases alates were collected on the ground below a porch light to which they were attracted. In 1980, 32 of 56 and in 1982, 15 of 20 of the alates collected were males (Fig. 8, 9 and Weesner 1969).

Description and measurements of *T. cinereus* were determined from specimens collected in Fredericksburg, Texas. Soldiers and workers were taken from foraging parties on July 1, 1981 and alates were collected during swarming on September 19, 1982. Specimens of *T. tenuirostris* were provided by W. L. Nutting who collected soldiers and workers in Guerrero, Mexico (Nutting 1970) and alates in Jalisco, Mexico. Measure-

Fig. 2. Typical crepuscular foray of a *T. cinereus* foraging party emerging from a surface mound to a food collection site (adapted from photograph). Nasutes solid; workers outlined.

ments follow those used by Snyder (1922).

Soldier (Fig. 3–5)—Head dark-brown grading to light brown at tip of nasus and lower ventral regions surrounding antennal sockets, mandibles, and clypeus. Several large blackish bristles occur on dorsal surface of nasus and vertex. Antennae pale brown, 12-segmented, and coarsely pubescent.

Scape stouter but as long as first flagellar segment; pedicel about half the length of adjacent segments. Thoracic nota, abdominal tergites, and legs lighter than head color. Sternites nearly colorless and transparent and more pubescent distad. Head and body of *T. cinereus* is smaller, but nearly identical in form to *T. tenuirostris*. Head of *T. tenuirostris* is light reddish brown but body color likened to *T. cinereus*. The 12-segmented antennae of *T. cinereus* is a diagnostic character of mature soldiers in this species, the nasutes of the other three species having 13-segmented antennae (Banks and Snyder 1920, Snyder 1922).

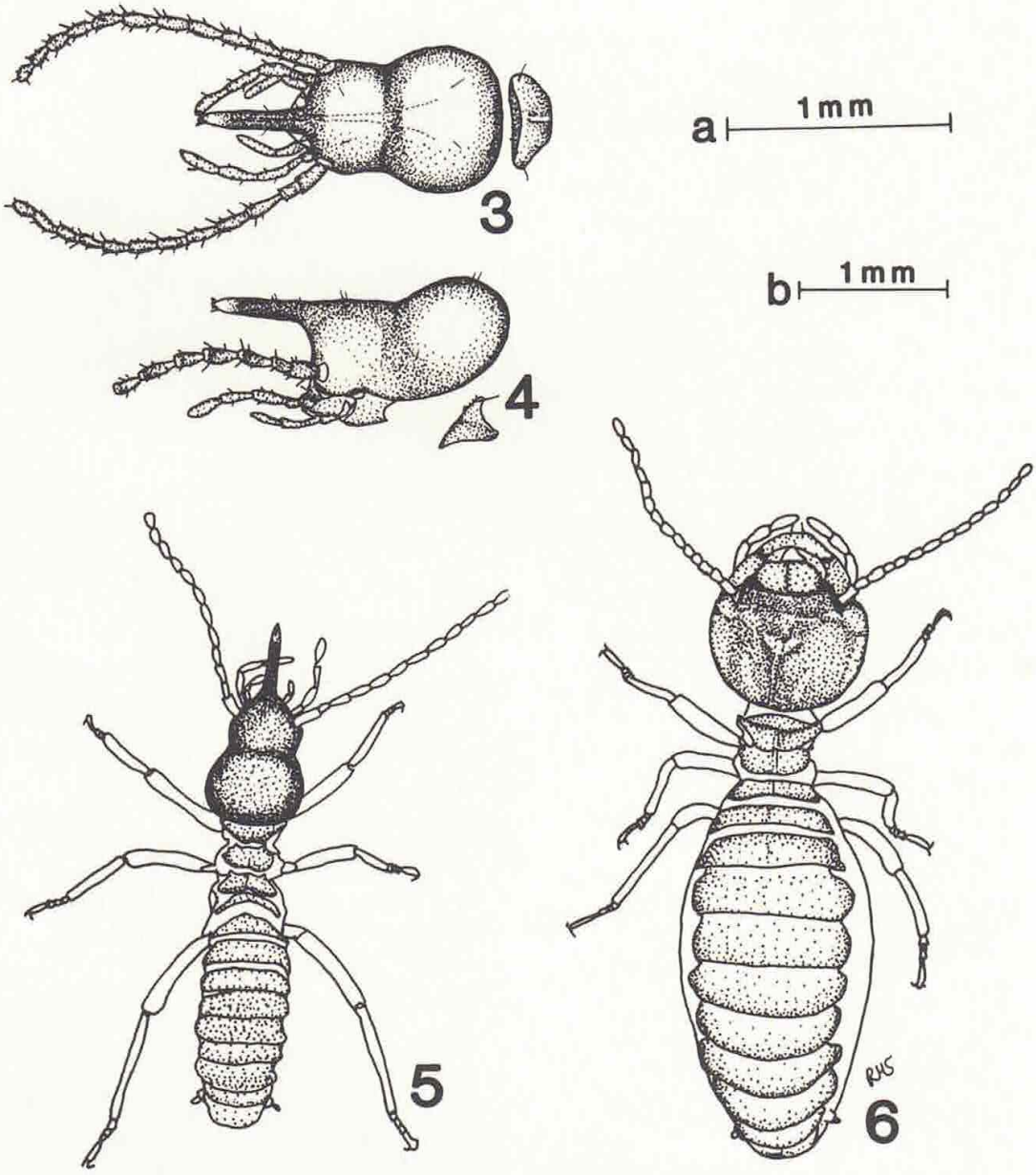

Fig. 3–6. Neuter castes of *Tenuirostritermes cinereus*; 3 and 4, dorsal and lateral left aspects, respectively, of nasute head and pronotum; 5, dorsal aspect of nasute; 6, dorsal aspect of worker. Scale a Fig. 3–4; scale b Fig. 5–6.

Measurement (N=25)	Range (mm)	Mean	S.D.
Total length	3.02–3.44	3.27	0.111
Head length with nasus	1.28–1.38	1.34	0.033
Head length minus nasus	0.82–0.92	0.87	0.023
Nasus length	0.44–0.51	0.47	0.018
Abdomen + thorax length	1.94–2.23	2.08	0.083
Pronotum length	0.15–0.19	0.16	0.013
Hind tibia length	0.87–0.95	0.93	0.020
Head width	0.59–0.67	0.63	0.024
Pronotum width	0.38–0.42	0.39	0.012

Alate (Fig. 7–10)—Overall pigmentation yellowish compared to other castes. Head with fine yellow hairs on anterodorsal surface with vertex yellowish brown to brown. Fontanelle delineated by pale Y-shaped region at the intersection of the coronal and frontal sutures. Post-clypeus swollen and somewhat lighter than frons. Compound eye black and slightly ovoid. Unpigmented ocellus about two-fifths diameter of, and less than its diameter from compound eye. Yellowish brown antennae 15-segmented with stout scape and thinner first flagellar segment about twice as long as pedicel. Abdominal tergites fainter than notum. Sternites 2–6 each with two rounded brown patches on lateral fourth about half as long as sternite. Wing pigmented yellowish brown along and below radius; twisted near ends when dry. Distal branches of media and cubitus variable.

T. tenuirostris alates are nearly identical in size and morphology to those of *T. cinereus*, however, they differ in that their pronota are punctuated by a dark-brown border, especially along the anterior margin. *T. tenuirostris* has a brown band extending medially on the meso- and metanotum which is about half the width of the nota. *T. tenuirostris* is more pigmented on its dorsal abdominal surface and has larger and darker brown patches on its sternites which are nearly as long as each sternite.

Measurement (N = 20; 15 male, 5 female)	Range (mm)	Mean	S.D.
Total length	18.35–20.53	19.56	0.593
Length minus wings	8.76–10.94	9.88	0.626
Head length to labrum terminus	1.80– 2.06	1.90	0.061
Pronotum length	0.93– 1.01	0.96	0.028
Hind tibia length	1.80– 2.03	1.93	0.062
Anterior wing length	16.47–18.27	17.37	0.558
Anterior wing width	4.33– 5.07	4.70	0.195
Anterior scale length	0.84– 1.00	0.93	0.047
Head width at eyes	1.59– 1.74	1.66	0.048
Eye diameter (maximum)	0.39– 0.46	0.41	0.019
Pronotum width	1.49– 1.65	1.57	0.049

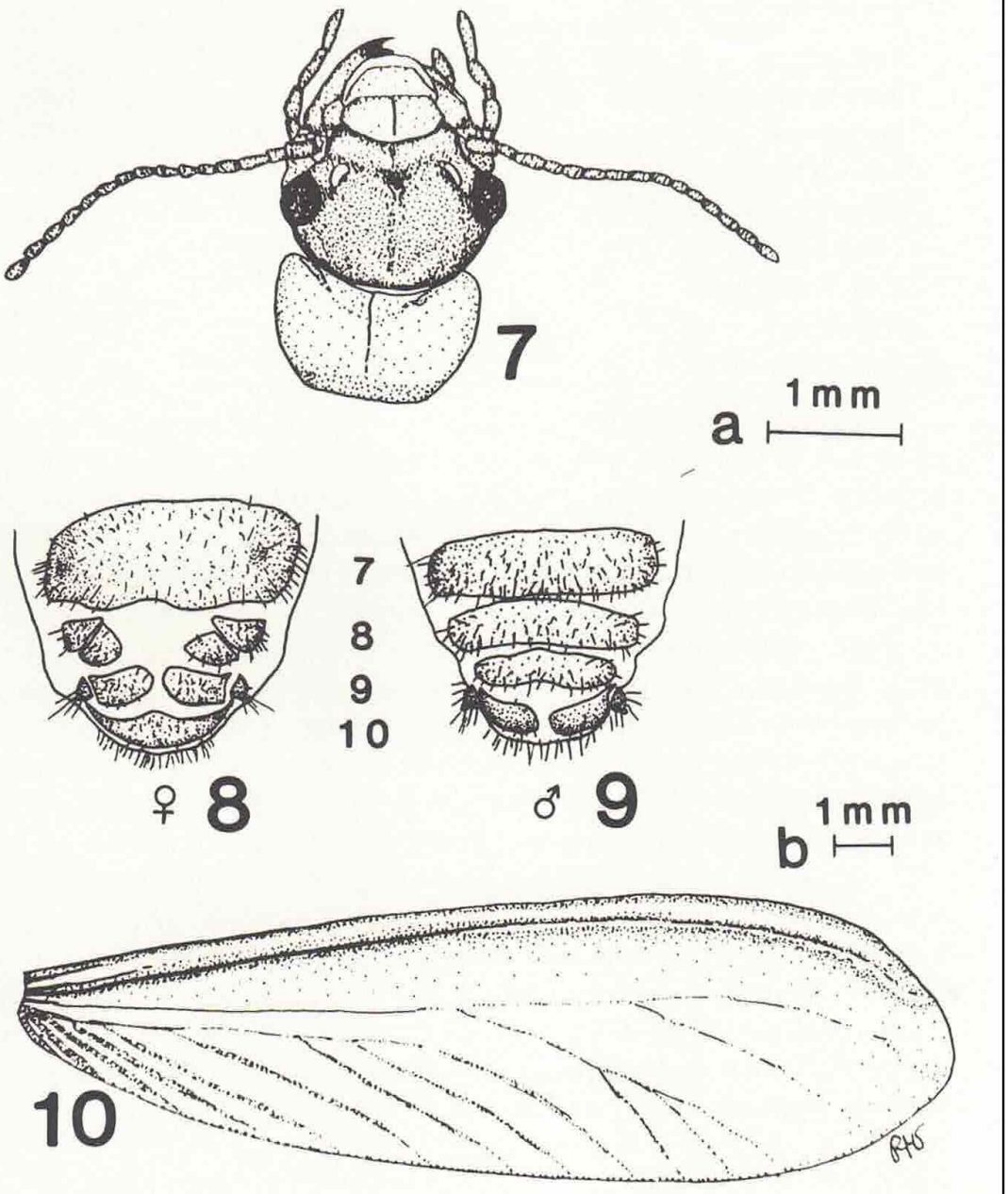

Fig. 7–10. Alate of *Tenuirostritermes cinereus*. 7, dorsal aspect of head and pronotum; 8–9, ventral aspects of female and male abdomen, respectively, beginning with the seventh sternite (see Weesner, 1969); 10, dorsal aspect of right forewing. Scale a Fig. 7–9; scale b Fig. 10.

Worker (Fig. 6)—Vertex of head brown grading to light-brown ventrally; sutures pale. Antennae 14-segmented, pale-brown, with shortened pedicel and second flagellar segments. Ventral surface nearly unpigmented except head and coxal regions. Notum and abdominal tergites equally lighter than head, but darker brown than *T. tenuirostris*. Body smaller than *T. tenuirostris*, but difference not as great as that between soldiers.

Measurement (N = 25)	Range (mm)	Mean	S.D.
Total length	3.88–4.23	4.07	0.115
Abdomen + thorax length	2.80–3.09	2.93	0.107
Head length	1.27–1.40	1.36	0.031
Head width	1.01–1.11	1.06	0.020
Hind tibia length	0.99–1.10	1.03	0.028

DISCUSSION

Many of the habits and behaviors of *T. cinereus* coincide with those reported for *T. tenuirostris* such as swarming (Light and Weesner 1948, Weesner 1953), close association with *Gnathamitermes* spp. (Weesner 1953), retreat behavior (Nutting et al. 1974), open-air foraging (Nutting 1970), and preforaging congregation and foraging behavior (Nutting et al. 1974). However, some dissimilarities are notable. *T. tenuirostris* occurs in mountainous areas at elevations of 945–1830 m (Desneux 1905, Weesner 1953, Nutting 1970, and Nutting et al. 1974) while *T. cinereus* is found in flat or hilly terrain at lower elevation (0–660 m). Nests of *T. tenuirostris* reportedly occur beneath surface rocks (Weesner 1953, Nutting 1970, Nutting et al. 1974); such rocks were absent from our study site and nests of *T. cinereus* could not be located. *T. tenuirostris* harvests living vegetation in addition to dead matter (Snyder 1920, Nutting 1970), but we observed only detritivorous behavior by *T. cinereus*.

The success of open-air foraging by *T. cinereus* is in part attributable to efficient defense strategies. Their retreat behavior has likely evolved in response to vertebrate predation against which nasute chemical armament may be ineffectual. The high proportion of nasutes provide an impervious barrier which is seldom challenged by foraging ants. Ants appear to detect nasutes and avoid contact without being fired upon. Possibly the soldiers dispense chemical tocsins to mark the boundaries of the territory they guard and thus minimize confrontation with potential invertebrate predators sensitive to these cues.

Although soldiers of *T. cinereus* initiate foraging, the worker caste executes food recognition. Traniello (1981) found that nasutes of *Nasutitermes costalis* Holmgren initiate foraging, locate food, and recruit workers. Unlike *T. cinereus*, this Neotropical species feeds on decaying wood which, due to the nature of the resource, is exploited for extended periods. Food sites and foraging trails connecting with arboreal nests are covered by a sheeting canopy constructed by the *N. costalis* workers. In contrast, *T. cinereus* nasutes establish transitory foraging areas in close proximity to their subterranean exit holes where small and spacially diffuse bits of cellulosic detritus are likely to be encountered by workers.

Tenuirostritomes cinereus is an ideal candidate for further field and

laboratory studies of chemical and behavioral ecology, including defense mechanisms, communication, and foraging methods. Understanding of the defense system of this termite species may even provide practical solutions for management of pestiferous ants. Nevertheless, *T. cinereus* remains an unusual member of the Nearctic termite fauna.

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