FINAL REPORT

HABITAT USE BY THE GOLDEN MOUSE

(*Ochrotomys nuttalli*)

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Objectives

1) to compare microhabitats of golden mouse ground and arboreal nests to control sites without nests

2) to determine nest use of individual mice, including whether arboreal nests are in close proximity to related ground nests

3) to determine use of home range relative to arboreal and ground nest locations.

Summary of Results

To ascertain the nesting habits of golden mice, 19 individuals were radiocollared and their nests located. Significant variables associated with both ground and arboreal nest placement were distance to nearest vines and density of understory 0.0-0.5 m high 1 m from the nest. Depth of leaf litter, distance to nearest undergrowth, dbh of the nearest tree, and the number of woody stems within a 3-m radius of the nest also were significant predictors of ground nest placement. Density of understory 1.6-

2.0 m high at a 3-m radius, and number of herbaceous stems also were significant predictors of arboreal nest placement. No difference existed in distances between nests used by the same individual, regardless of nest type used. Females used more arboreal nests than males, whereas males used more ground nests. Only males exclusively used ground nests; both males and females used arboreal nests. We found no pattern in nest placement within home ranges. Home range size of individuals did not vary significantly with sex, season, or number of nests used. Golden mice may be less of a "habitat specialist" than previously thought. Disturbance and management for early successional or invasive plant species may enhance habitat for golden mice.

Introduction

Although common throughout the southeastern United States (Linzey and Packard 1977), golden mice (*Ochrotomys nuttalli*) in Illinois are at the northern periphery of their range and are considered threatened in the state (Herkert 1992).

Golden mice prefer thick, thorny undergrowth with honeysuckle (*Lonicera* spp.), greenbrier (*Smilax* spp.), brier (*Schrankia* spp.), and rhododendron (*Rhododendron* spp.) being common. Principal food items in Illinois include seeds from poison ivy (*Toxicodendron radicans*), blackberry (*Rubus spp.*), bedstraw (*Trifolium spp.*), acorns and other mast and seeds (Blus 1966). Packer and Layne (1991) suggested that because *Ochrotomys* forage on the ground more than other small mammal species, ground litter and dense understory cover are important.

Golden mice construct globular arboreal nests that are located at heights ranging from near ground level to >10 m, but most occur between 1.5 and 4.5 m above the ground (Barbour 1942; Blus 1966; Frank and Layne 1992; Linzey and Packard 1977; McCarley 1958; Packard and Garner 1964). Nests are often constructed among greenbrier, honeysuckle, sumac (*Rhus* spp.), and grapevines (*Vitis* spp.; Feldhamer and Paine 1987; Goodpaster and Hoffmeister 1954;

Linzey 1968; Packer and Layne 1991; Wagner et al. 2000). Barbour (1942) suggested that 2 types of arboreal nests exist, one for shelter and the other for rearing young. Blus (1966) found "shelter" nests among large fallen pine trees and "young rearing" nests among small trees and greenbrier.

Use of ground nests by golden mice was suggested after Goodpaster and Hoffmeister (1954) found only empty arboreal nests during summer. McCarley (1958) supported this suggestion after observing no arboreal nests in eastern Texas. Cory (1912), Strecker and Williams (1929), Barbour (1942), Eads and Brown (1953), and Blus (1966) noted golden mouse nests beneath piles of logs or at the base of bushes. Easterla (1968) provided the first detailed description of a ground nest. This nest was located in atypical golden mouse habitat, specifically, a wooded area without thick understory.

Although many studies have been conducted regarding the ecology and nesting behavior of golden mice (Dietz and Barrett 1992; Goodpaster and Hoffmeister 1954; Linzey 1968; Packard and Garner 1964), little information is available on nest site selection of this species, especially for ground nests. To contribute to our knowledge of nest site selection by golden mice, we 1) compared microhabitats of golden mouse ground and arboreal nests to control sites without nests; 2) determined nest use of individual mice, including whether arboreal nests are in close proximity to related ground nests; and 3) determined use of home range relative to arboreal and ground nest locations.

Materials and Methods

Study area.--The study area was located within Jackson County, Illinois (37°81'N; 89°40'W). Sites were located between November 1998 and January 1999 when leaves were absent and arboreal nests were easily seen. Areas selected for this study were those used in past studies of golden mice (Feldhamer and Maycroft 1992; Feldhamer and Paine 1987; Wagner et al. 2000) including Southern Illinois University at Carbondale's Touch of Nature Environmental Center and Giant City State Park (16 and 20 km south of Carbondale, Illinois, respectively). Dominant plant species included persimmon (*Diospyros virginiana*), honey locust (*Gleditsia triacanthos*), black locust (*Robinia pseudoacacia*), eastern red cedar (*Juniperus virginiana*), autumn olive (*Elaeagnus umbellae*), oaks (*Quercus* spp.), hickories (*Carya* spp.), poison ivy, and grape. Herbaceous species included greenbrier, honeysuckle, and wild rose (*Rosa* spp.). Nests were located on either side of a frequently traveled gravel road that bisected both study areas.

Collection of golden mice.--Sherman live traps baited with sunflower seeds and dried corn were used to collect golden mice between January 1999 and June 2000. Traps were not arranged in a standardized grid pattern but were placed in proximity to observed arboreal nests and in nearby areas of dense vines and understory. Cotton was placed inside each trap when nighttime temperatures were below 10°C. Mice were classified by sex, age class (juvenile or adult), mass, and pelage color (Layne 1960; Linzey and Linzey 1967). Mice were removed from the field and weighed, and radiocollars were attached within 48 hours of capture. Animal handling complied with American Society of Mammalogists methods (Animal Care and Use Committee 1998).

Radiotelemetry and location of nests.--A bat transmitter, modified with a collar (0.45 g, LB-2; Holohil Systems Ltd., Ontario, Canada; total mass with collar 2.0 g), or a small mammal radio transmitter (1.5 g, SOM 2012 MVS, Wildlife Materials, Inc., Carbondale, Illinois) was attached around the neck of adult golden mice. Only adults were used in an effort to keep transmitter mass

<10% of body mass. Bat transmitters had an effective range of approximately 1.5 km and battery life of 10 days; small mammal transmitters had an effective range of approximately 1 km and battery life of 21 days.

Radiocollared mice were released during the afternoon where captured. Following release, at least 12 h elapsed before mice were relocated using standard radiotelemetry techniques (Springer 1979). A 3-element folding Yagi antenna and a TRX-1000S receiver (Wildlife Materials, Inc., Carbondale, Illinois) were used to locate each individual. When first relocated, all mice were in a nest; presence of a mouse was confirmed by visual observation of each arboreal or ground nest location.

We determined locations of subjects by triangulation after 2100 h, after establishing that mice did not emerge from their nests until then and returned approximately 1 to 2 h before sunrise. This activity pattern was consistent throughout the year. Points easy to locate on digital orthophotoquads (DOQs) were used as telemetry stations. Location estimates were made at 45-min intervals to reduce autocorrelation between consecutive bearings (Swihart and Slade 1985a, 1985b). After at least 72 h of collecting telemetry data, traps were reset to recapture the mouse and remove the transmitter collar. Mass of each individual was measured again after collar removal. A significant difference in mass, calculated by the Wilcoxon matched-pairs signed-ranks test (Siegel 1956), was used to ascertain if the collar was inhibiting movement or effective foraging behavior.

Analysis of home range.--Universal Transverse Mercator (UTM) coordinates of telemetry stations were obtained using DOQs. LOCATEII (Nams 1990) was used to plot locations of individual golden mice. Error polygon areas were not recorded because they were too small to draw using LOCATEII. Nighttime temperatures during telemetry were grouped as <10°C or >16°C. The Home Range Extension (Rogers and Carr 1998) to ArcView™ (Environmental Systems Research Institute, Redlands, California) was used to determine if home range area was affected by time of day, season (leaf-on: mid March through mid November, or leaf-off: mid November through mid March), sex, temperature, nest location(s) within the home range, or percent overlap of home range area among individuals. A sensitivity analysis, using bootstrapping of home range area versus number of estimated locations, was completed using Animal Movement Analysis (Hooge et al. 1999) to test for adequate sample size of estimated locations for each individual. Between 20 and

45 locations were used to estimate home ranges of 19 individual golden mice.

Nest location within a home range.--The 100% Minimum Convex Polygon (MCP; Mohr 1947) and 99% Adaptive Kernel Polygon Methods (Worton 1989) were used to calculate area of home ranges and ensure inclusion of peripheral nest locations. Isopleths were drawn at 10% intervals to determine activity cores and their relationship to nests used. Activity cores were defined arbitrarily as areas within 50% isopleths. Linear distance (m) between nests was measured for mice that used >1 nest, and differences between sex and season regarding home range area, and number of nests used also were analyzed using analysis of variance (ANOVA; Tabachnick and Fidell 1989). Individual mice were considered independent regardless of whether they shared a nest.

Home range overlap.–Area of overlap for each pair of mice was calculated using MCP. Results were compared within and among sexes and seasons using ANOVA. A Pearson correlation was used to determine whether a relationship existed between area of home range and percentage of home range overlap (Tabachnick and Fidell 1989).

Analysis of microhabitat variables.--Sample locations (NESTYPE) were grouped into 3 categories: ground nest, arboreal nest, or control (random) location with no nest. Eighteen independent habitat variables were selected and modified from past studies (Drickamer 1990; Dueser and Shugart 1978; Feldhamer and Maycroft 1992; Feldhamer and Paine 1987; Linzey and Packard 1977; Maser and Trappe 1984; Nudds 1977; Seagle 1985; Smith and Mannan 1994; Wagner et al. 2000), and were measured for nest and control sites. Variables measured were: average depth of ground litter (LITSOIL); distance (m) to nearest downed log >5 cm in diameter (LOGDIS); nearest understory tree (DISUNDER); nearest overstory tree (DISOVER); nearest vine suitable for climbing (VINDIS); nearest undergrowth stem (DISUNGRW); dbh (cm) of nearest tree (DMTREE); horizontal cover at distance of 1 m (DEN11, 0-0.5 m height; DEN12, 0.6-1.0 m height; DEN13, 1.1-1.5 m height; DEN14, 1.6-2.0 m height) and 3 m (DEN31, 0-0.5 m height; DEN32, 0.6-1.0 m height; DEN33, 1.1-1.5 m height; DEN34, 1.6-2.0 m height) from the nest; total number of woody stems within 3 m of the nest (WOOD360); and estimated number of herbaceous stems within 3 m of the nest (HERB360). A control site was established within a paced 50-m distance from each arboreal or ground nest, in a random direction within the same vegetation type. If 50 paces in a random direction did not result in the same vegetation type, the process was repeated.

Microhabitat data were tested for seasonal variation and intercorrelation between variables. Stepwise forward logistic regression was applied at varying confidence intervals until the best-fit model was achieved (Cody and Smith 1997). Two logistic regression models were tested for significant differences in independent variables between presence of nest (ground or arboreal) or absence of nest (control). Distance to nearest downed log (LOGDIS) was not used in regression analysis because only 1 of 10 ground nests was within 15 m of a fallen log >5 cm in diameter. Canopy cover (CI) was eliminated because of seasonal variation. Pairs of horizontal cover measurements were correlated with each other ($R > 0.7$), so one of each pair was arbitrarily selected and eliminated. Statistical significance was considered to be $P < 0.05$, except for logistic regression when $P < 0.20$ was used.

Results

Home range.--Nineteen golden mice were captured and radiocollared in 7,650 trap nights. We observed no significant change in mass of mice between radiocollar attachment and removal (Wilcoxon matched-pairs signed-ranks test; $T = 16$, $P > 0.05$). Occupied ground and arboreal nests were easily located using radiotelemetry. Bearing error averaged ±2°, however distance between the observer and subject was always <250 m. Therefore, bearing error was likely insignificant (Schmutz and White 1990).

Average MCP for females (n = 9) was 0.37 ha ± 0.29 *SD* (range 0.1-0.75 ha), and for males (n = 10) 0.53 ± 0.33 ha (range 0.31-1.33 ha). Average Kernel estimate for females was 1.1 ± 0.56 ha (range 0.33-1.9 ha), and for males 1.3 ± 0.86 ha (range 0.66-2.82 ha). Home range size did not differ between sexes (MCP $F = 1.52$, $d.f. = 1, 17$, $P = 0.23$; Kernel $F = 0.88$, $d.f. = 1, 17$, $P = 0.36$). There also was no difference in home range size within sex between leaf-on and leaf-off seasons (females: MCP $F = 1.61$, $d.f. = 1, 8$, $P = 0.25$; Kernel $F = 5.25$, $d.f. = 1, 8$, $P = 0.06$; males: MCP $F = 0.98$, $d.f. = 1, 9$, $P = 0.35$; Kernel $F = 0.00$, $d.f. = 1, 9$, $P = 0.97$). Seasons coincided with temperature categories (e.g., leaf-on = >16°C; leaf-off <10°C). Therefore, home range data were pooled for further analyses.

Home range overlap.--Home range overlap with at least 1 other golden mouse existed for 18 of 19 individuals. Nine individual home ranges overlapped with only 1 other golden mouse: a male-female pair that shared nests every day during observation; a male-female pair that never shared nests; a male-male pair that overlapped only with each other but never shared nests; and a male that overlapped with 2 females, none of which shared nests. Home ranges of 9 mice overlapped almost completely. Nest sharing occurred among the 5 females within this group; no nest sharing occurred between males and females or among the 4 males.

Area of home range overlap did not differ between sexes (F = 1.04, $d.f.$ = 1, 17, P = 0.51). Average female-female home range overlap (n = 5) was 0.19 ± 0.20 ha (range 0.02-0.64 ha). Average male-female home range overlap (n = 7) was 0.18 ± 0.03 ha (range 0.01-0.33 ha). Average female-male home range overlap (n = 9) was 0.20 ± 0.15 ha (range 0.01-0.31 ha). Average male-male (n = 6) home range overlap was 0.08 ± 0.02 ha (range 0.01-0.15 ha).

Percent overlap also did not differ between seasons (F = 0.85, $d.f.$ = 1, P = 0.37). Average overlap during the leaf-on season was 0.18 ± 0.20 ha (range 0.01-0.64 ha). Average overlap during the leaf-off season also was 0.18 ± 0.10 ha (range 0.12-0.33 ha). Total number of nests used was not related to area overlap of home range based on linear regression (r = 0.20, *d.f.* = 17, P = 0.41).

Nests used by the same individual.--For the 19 radiocollared golden mice, 10 ground nests and 21 arboreal nests were located, many of which were used by >1 mouse. Five individuals used only ground nests, 9 individuals used only arboreal nests, and 5 mice used a combination of ground and arboreal nests (Table 1). Because no seasonal difference existed in nest type used (arboreal: χ^2 = 0.07, *d.f.* = 1, P = 0.95; ground: χ^2 = 0.03, *d.f.* = 1, P = 0.97), nest data were pooled to include both seasons.

Nest use varied among individual golden mice (Table 1). Females used significantly more nests (X = 2.4; range 1 - 5) than males (X = 1.3; range 1 - 2; F = 6.36, *d.f.* = 1, 17, P = 0.02). Number of each nest type used also differed. Females used more arboreal nests than males (F = 11.87, *d.f.* = 1, 17, P = 0.003), whereas males used more ground nests (F = 6.45, *d.f.* = 1, 17, P = 0.02). Only males used ≥1 ground nests but no arboreal nests.

Three males and 6 females used arboreal nests exclusively (Table 1). One arboreal nest used by a golden mouse for 2 days, likely built by a squirrel (*Sciurus* spp.), was composed of sticks much larger than a mouse could carry. Distance between arboreal nests used by this mouse ranged from 2.3 to 63.7 m. For individuals using 1 arboreal nest only, nest height ranged from 0.8 to 3.7 m above ground. For individuals using 2 arboreal nests only, average nest height ranged from 1.2 to 1.8 m above ground. Only females (n = 4) occupied >2 arboreal nests. Two individuals used the same 3 arboreal nests, which were 1.4 m above ground. One female occupied 4 different arboreal nests, at an average of 2.2 m above the ground (Table 1).

Home range size and total number of nests used by an individual were not related (MCP $r = 0.10$, $d.f. = 17$, $P = 0.68$; Kernel $r = 0.20$, $d.f. = 17$, $P = 0.41$), neither was home range size versus number of arboreal nests used (MCP $r = 0.30$, $d.f. = 17$, $P = 0.22$; Kernel $r = 0.20$, $d.f. = 17$, $P = 0.41$) nor home range size versus number of ground nests used (MCP $r = 0.35$, $d.f. = 17$, $P = 0.14$; Kernel $r = 0.05$, $d.f. = 17$, $P = 0.82$). Both nest types were similarly distributed within home ranges with no clumping (Kolmogorov-Smirnov test: ground nests $D = 0.21$, $d.f. = 9$, $P > 0.05$; arboreal nests $D = 0.178$, $d.f. = 20$, $P > 0.5$).

Microhabitat variables.-- Twelve independent habitat variables were used in logistic regression (Table 2). For predicting location of both ground and arboreal nests, selection of the best-fit models occurred at $\alpha = 0.2$. Two independent variables were significant for both ground and arboreal nest site selection (Table 2). Mean distance to vines was less than control sites. Mean density of undergrowth up to 0.5 m high was greater than control sites. For ground nest sites, there was a positive relationship with total number of woody stems, and negative relationships with depth of ground litter, distance to nearest undergrowth, and dbh of nearest tree compared to control sites (Table 2). The concordance value was 100%. Arboreal nests were negatively associated with number of herbaceous stems and positively related to density of undergrowth from 1.6 to 2.0 m high relative to control sites. The concordance value was 93.7%.

Discussion

Nest site selection.--Benefits of ground nests may include less energy required to build, protection from predators with possible escape tunnels providing additional safety, and moderation of temperature in winter and summer (Frank and Layne 1992; Klein and Layne 1978; Wagner et al. 2000). Protection from predators also may accrue from arboreal nests located among a tangle of vines (Wagner et al. 2000) as well as cooler conditions during the summer.

We expected that concealment of ground nests would be important and result in positive relationships with number of herbaceous stems and amount of ground litter, which did not occur. Many ground nests were located in areas of older growth forest containing sparse understory. The lack of undergrowth and sparse leaf litter suggests that other variables are important, such as existing holes in the ground or reduced underground obstruction. Indeed, telemetry suggested that mice were moving about underground while we were searching for ground nest entrances. Tunnels extending from a ground nest, as observed in past studies (Easterla 1968; Packer and Layne 1991), may provide additional protection from predators. Perhaps concealment is not as important as proximity to escape routes, and may explain why mean number of woody stems within 3 m of ground nest sites was greater than expected.

Arboreal nests are often found within a colony (Blus 1966; Goodpaster and Hoffmeister 1954; Ivey 1949; McCarley 1958) with up to 8 golden mice using a nest (Dietz and Barrett 1992; Linzey and Packard 1977; Packer and Layne 1991). Sexual composition of occupants varies seasonally. Frank and Layne (1992) found male-male pairs only during the winter and male-female pairs throughout the year. However, pairings were uncommon in their study (<10% of all nesting mice observed), possibly because of overall higher ambient temperatures in Florida or uncertainty about mice that were not radio-tagged. Bohall-Wood and Layne (1986) suggested that male golden mice leave the nest after mating with female occupants.

Year-round occupation of arboreal nests by golden mice has been observed near both northern (Blus 1966) and southern (Frank and Layne 1992) boundaries of their range. Although new nests are constructed each year, consecutive generations may use the same nests year after year (Goodpaster and Hoffmeister 1954; Packard and Garner 1964) as long as they remain concealed within vegetation (Blus 1966).

Wagner et al. (2000) suggested that presence of vines, quantity of woody vegetation, density of vegetative cover, and distance to understory trees are important in selection of arboreal nest sites. In our study, mean distance from arboreal nests to nearest climbing vine was much less than for control sites. Vines may serve as escape routes if a nest is disturbed, and as protection from predators (Wagner et al. 2000). Density of herbaceous stems near arboreal nests also was less than control sites, whereas horizontal cover from 0.0-0.5 m and from 1.6-2.0 m was greater than control sites. Many of the nests were conspicuously placed; however some were well concealed within vegetation. A greater number of herbaceous stems does not necessarily mean that nests are better concealed. For example, grass and honeysuckle runners may not be high or dense enough to provide sufficient cover.

Just as arboreal nests may serve different functions (Barbour 1942; Blus 1966), ground nests may serve different purposes than arboreal nests. Different microhabitat variables were associated with site selection for each type of nest. Nest type used was the same seasonally suggesting that climatic conditions did not affect nest switching by mice. Females used significantly more nests than males, which was expected if females have multiple litters per breeding season. Arboreal nests are better for protecting young (Handley 1948; Holway 1991; Ivey 1949; McCarley 1958; Packard and Garner 1964; Packer and Layne 1991; Wagner et al. 2000), and females in our study used significantly more arboreal nests than males. It also is possible that non-captured females were within arboreal nests occupied by radiocollared males. Only 1 male-female pair shared a ground nest. Males were captured close to female nests but never observed within these nests during daytime. Females shared arboreal nests with each other, but also were solitary nesters during both breeding and nonbreeding seasons. Only males used ground nests exclusively.

Blus (1966) reported 13.1 m as the average distance between arboreal nests used simultaneously by different individuals. We found no significant difference in distance between nests of any type used at different times by the same individual or simultaneously by different individuals. Ground nests were not always in close proximity to arboreal nests or always related to an arboreal nest. Likewise, we found no pattern of locations of either nest type within home ranges. Nests were located on the periphery as well as within core activity areas. Likely, variables other than distance to activity areas are important in determining nest locations within home range and the type of nest chosen for use on a particular day.

Past studies of average home range area of golden mice report ranges between 0.07 and 0.23 ha (Dunaway 1955; Linzey 1968; McCarley 1958; Shadowen 1963) with no difference between the sexes. McCarley (1958) further suggested that considerable overlap of home range exists between individuals, which may be attributed to the gregarious nature of golden mice (Howell 1954). Lack of differences between male and female home range size, percentage overlap, or seasonal differences in our study are consistent with these observations. The extensiveness of home range overlap supports suggestions of Dunaway (1955) and Linzey and Packard (1977) that golden mice are not territorial. Within home ranges of individuals that overlapped other mice, however, each mouse appeared to concentrate its activity use within its own partitioned area within the area of overlap. Similar results were reported by Dunaway (1955).

Management Implications

Individual golden mice often encompassed many different habitats within their home range. Parts of our study area were fragmented islands of "typical" golden mouse habitat of wooded areas with dense, thorny undergrowth and climbing vines. Several mice ventured for short distances into areas of different habitats such as grassy fields with a sparse canopy of eastern red cedars.

Several individuals, both males and females, regularly crossed a dirt road within the study area.

Dueser and Hallett (1980:293) considered the golden mouse a "strongly competitive habitat specialist." However, our findings and past studies in southern Illinois (Andrews 1963; Blus 1966) observed golden mice within a variety of habitats. We suggest that golden mice may be less habitat-specific than commonly believed. However, relationships between habitat used by golden mice and individual reproductive success within peripheral habitats awaits further investigation.

Golden mice in our study were common among early to mid-successional stages. Disturbance may enhance golden mouse habitat. Although Shadowen (1963) reported reduced home range size immediately after a controlled burn, disturbance may ultimately increase early successional seed-producing species important to golden mouse ecology.

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TABLE 1.—Number of arboreal and ground nests used, and distances between nests, for 19 golden mice (*Ochrotomys nuttalli*) in Jackson County, Illinois.

Mouse number	# arboreal nests used	# ground nests used	Horizontal distance (m) between nests
Males			
3	0	1	-
8	0	1	-
14	0	1	-
13	0	2	20.4
18	0	2	30.0
17	1	0	-
15	2	0	8.3
16	2	0	4.8
4	1	1	90.0
11	1	1	18.0
Females			
2	1	0	-
6	2	0	63.7
7	2	0	3.5
9	3	0	2.3 - 30.5
19	3	0	2.3 - 30.5
10	4	0	7.5 - 61.0
5	1	1	68.6
12	1	1	18.0
1	4	1	2.1 - 22.4

TABLE 2.—Mean ± SE of microhabitat variables (see text for definitions) used in logistic analyses to compare golden mouse ground and arboreal nest sites with control locations.

	Ground nest		Arboreal nest		Control sites	
Variable Name	n	x ± SE	n	x ± SE	n	x ± SE
LITSOIL[a]	10	3.5 ± 0.62	21	3.8 ± 0.38	12	5.5 ± 0.99
DISUNDER	10	450.4 ± 107.4	21	436.2 ± 71.5	12	333.4 ± 73.0
DISOVER	10	115.3 ± 33.3	21	226.9 ± 57.4	12	165.7 ± 29.5
VINDIS[a,b]	10	42.0 ± 36.3	21	11.4 ± 9.5	12	71.2 ± 19.3
DISUNGRW[a]	10	5.3 ± 3.7	21	3.6 ± 1.8	12	7.5 ± 5.0
DMTREE[a]	10	14.5 ± 3.8	21	28.3 ± 9.8	12	29.4 ± 11.5
DEN11[a,b]	10	17.8 ± 3.0	21	26.1 ± 2.8	12	10.6 ± 2.3
DEN14	10	13.9 ± 3.2	21	21.7 ± 13.6	12	10.1 ± 2.4
DEN31	10	37.9 ± 10.4	21	46.0 ± 4.2	12	22.9 ± 14.5
DEN34[b]	10	26.9 ± 6.4	21	36.2 ± 18.9	12	17.0 ± 13.9
WOOD360[a]	10	17.1 ± 4.9	21	16.7 ± 3.3	12	9.8 ± 3.0
HERB360[b]	10	316.0 ± 38.7	21	336.2 ± 26.6	12	357.3 ± 24.2

a/ Significant ($\alpha < 0.2$) in logistic regression analysis of ground nest vs. control sites
b/ Significant ($\alpha < 0.2$) in logistic regression analysis of arboreal nest vs. control sites