Within-tree distribution of seven insect pests of soursop (*Annona muricata*) in Honduras[1]

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Abstract. The within-tree distributions of seven insect pests of soursop, ~~*Annona muricata*~~ L., were determined during a 1-year period at four localities in Honduras. Five foliage and stem feeders, *Corythucha gossypii* (F.), *Calloconophora caliginosa* (Walker), *Membracis mexicana* (Guerin), *Parasaissetia nigra* (Nietner) and *Saissetia oleae* Olivier, and two fruit/seed borers, *Bephratelloides cubensis* (Ashmead) and *Cerconota anonella* (Sepp), were studied. Infestations by *C. gossypii*, *C. caliginosa*, *M. mexicana* and the fruit/seed borers were greatest in the middle third of the tree canopy. Densities of *P. nigra* and *S. oleae* were highest in the middle and bottom sections. Infestations by *P. nigra* were greater on the southern half of trees, whereas infestations by *C. anonella* were greater on the northern half.

Key words: Spatial distribution, foliage pests, stem pests, fruit borers, seed borers, sampling.

Resumen: Se determinó la distribución de siete plagas insectiles en la copa de árboles de guanábana, *Annona muricata* L., durante un año en cuatro localidades en Honduras. Se estudiaron cinco especies, *Corythucha gossypii* (F.), *Calloconophora caliginosa* (Walker), *Membracis mexicana* (Guerin), *Parasaissetia nigra* (Nietner) y *Saissetia oleae* Olivier, que atacan el follaje y los tallos, y dos especies, *Bephratelloides cubensis* (Ashmead) y *Cerconota anonella* (Sepp), que son barrenadores del fruto y semilla. Las infestaciones por *C. gossypii*, *C. caliginosa*, *M. mexicana* y los barrenadores fueron mayores en el tercio medio de la copa del árbol. Las densidades de *P. nigra* and *S. oleae* fueron mayores en las secciones media y baja. Las infestaciones por *P. nigra* fueron mayores en la mitad del sur de árboles, mientras que las infestaciones por *C. anonella* fueron mayores en la mitad norte.

Palabras claves: distribución espacial, plagas del follaje, plagas del tallo, barrenadores de los frutos, barrenadores de las semillas, muestreo.

INTRODUCTION

The genus *Annona* of the family Annonaceae has approximately 110 species. The principally cultivated species are *A. muricata* L. (soursop, guanábana), *A. reticulata* L. (bullock's heart, corazón de buey), *A. squamosa* L. (sugar apple, ata), *A. cherimola* Mill (anona, chirimoya) and *A. diversifolia* Safford (ilama), whose centers of origin and domestication are in the Neotropics (León, 1968).

Restrictions to the production of *Annona* spp. include the lack of improved varieties and hybrids and the deficiency of knowledge concerning insect pest and disease problems. Although pest inventories of *Annona* spp. have been conducted (Peña *et al.*, 1984; Vidal, 1982; Domínguez, 1980; Marín, 1973; Granadino and Cave 1994), very few studies have examined insect-induced crop loss or pest ecology. In Mexico, Vidal (1982) reported 70% crop loss resulting from insect damage, which included damage by fungi infecting the trees as a result of insect injury. Nadel and Peña (1991) examined the temporal occurrence of oviposition and emergence of the fruit-infesting *Bephratelloides cubensis* (Ashmead) (Hymenoptera; Eurytomidae).

The present study was conducted to investigate the within-tree distribution of seven key insect pests of *A. muricata* to permit the design of more accurate sampling procedures and improve control of them.

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MATERIALS AND METHODS

The study was conducted in the localities of Galeras (elevation 1000 m) in the department of El Paraíso, and San Francisco (elevation 800 m), El Zamorano (elevation 825 m) and Tatumbla (elevation 1100 m) in the department of Francisco Morazán, Honduras. Orchards in Galeras and Tatumbla were located in the foothills above the Yegüare Valley, whereas orchards in San Francisco and Zamorano were located on the floor of the valley. The orchard in Galeras was seven years old and consisted of six trees; mango, avocado and papaya trees surrounded the orchard during the study. The orchard in San Francisco was 15 years old and had 32 trees; surrounding vegetation consisted of star grass (*Cynodon nlemfuensis* Vanderyst) and mango trees. The orchard in Zamorano was 18 years old and numbered 40 trees; neighboring vegetation was mainly citrus and coffee under *Inga*. The orchard in Tatumbla was 10 years old, had four trees and was surrounded by cabbage. None of the four orchards was irrigated, thus receiving their water from rainfall only. In each locality two mature trees 3-4 m high were marked and each tree was examined at intervals of approximately 30 days, from January to December 1991. The selected trees were not sprayed with pesticides during the study.

Seven key pests were studied: nymphs and adults of the cotton lace bug, *Corythucha gossypii* (F.) (Heteroptera; Tingidae), *Calloconophora caliginosa* (Walker), *Membracis mexicana* (Guerin) (Homoptera; Membracidae), and adults of the nigra scale, *Parasaissetia nigra* (Nietner), the black scale, *Saissetia oleae* Olivier, (Homoptera; Coccidae), *B. cubensis* and *Cerconota anonella* (Sepp) (Lepidoptera; Oecophoridae). The first five pests are foliage and/or stem feeders. The larva of *B. cubensis* develops in the seed within the fruit, whereas the larva of *C. anonella* bores through the pulp, then attacks the seed. To evaluate the population of foliage and stem feeders and their pattern of distribution, all individuals were counted throughout the tree canopy, which was divided into two cardinal points, north and south, and three tree canopy sectios, top third, middle third and bottom third, for a total of six sections. Each pest was noted as to the section in which it was found.

The 1-year study was divided into three four-month periods, representing three distinct tree stages. The period from April-July (tree stage 1) includes bud formation, flowering and fruiting. The period from August-November (tree stage 2) includes senescence when the last fruits are produced and there is no more vegetative budding or reproduction. December-March (tree stage 3) is the dormancy stage where the majority of leaves are lost and bud production is severely reduced and concentrated in the middle third of the tree canopy.

For fruit/seed pests, two mature fruits were taken from each canopy section of the two trees in July since this is the time when trees have more fruits per tree and is just before the emergence period of the seed borers. Each fruit was placed on dry sterilized sand in a 15-cm flower pot and then covered by the top 26 cm of the transparent section of a 2-liter soda bottle with two 6 × 6 cm windows cut out and covered with cotton organdy for ventilation. The mouth of the bottle cage was plugged with cotton. Fruits were observed for pest emergence until they reached advanced stages of rot.

The data were statistically analyzed using a random block factorial design with two factors: number of individuals in each tree section and number of individuals at each tree stage. For the factors or the interactions of these that showed significant differences, a separation of means was performed using Duncan's multiple range test ($\alpha<0.05$). Foliage and stem pest density data were transformed for analysis using the equation

$$D_t = \sqrt{(D+1)} \qquad [1]$$

where D= density and D_t= transformed density.

RESULTS AND DISCUSSIONS

Significant differences in foliage and stem pest population numbers were found between the four localities. Therefore, means of pest numbers per tree stage within each tree section were analyzed separately for each locality.

Numbers of *C. gossypii* were similar during all three tree stages. The highest infestations occurred in the middle section of the tree canopy (Table 1). Occasionally this pest was equally abundant in the bottom section when preferred feeding and oviposition sites (i.e. underside of older leaves) were abundant. The bottom two-thirds of the tree canopy also provides greater protection from direct sunlight and rain impact and reduced leaf agitation by wind. There were no significant differences between the north and south halves of trees for the top and bottom sections. Differences in number of individuals between the north and south halves of trees for the middle section were inconsistent. At Galeras, there were significantly more *C. gossypii* in the north half during all tree stages. During stage 1 at El Zamorano, more than twice as many individuals were found on the north side than on the south side. However, during stages 2 and 3 significantly more individuals were found on the south side than on the north side. At Tatumbla, only during stage 2 was there a significant difference in density between tree halves; more *C. gossypii* were on the north half. No significant differences were detected at anytime at San Francisco.

Populations of *C. caliginosa* were greatest during tree stages 1 and 2, which is the time when preferred feeding and oviposition sites (buds, flowers and fruits) are more abundant. Both nymphs and adults showed a high preference for concentrating in the middle section of the tree canopy in all three tree stages (Table 2). This section usually has more buds, flowers and fruits; buds are especially preferred for oviposition. Pest densities in the top section of the tree were also possibly limited by greater direct rain impact and more direct sun exposure. The bottom south section had higher populations than the bottom north, which may have been due to more intensive sunlight in the southern half of the tree, which resulted in the greater production of more feeding and oviposition sites and more leaves which provided more shading and rain protection.

Densities of *M. mexicana* were similar during all three tree stages. Although this species prefers to feed on buds, flowers, young fruits and fresh stems, its equal prevalence in tree stage 3 indicates that reduced numbers of oviposition and feeding sites do not significantly affect populations or that during this stage the insect can sustain its populations on less-preferred older stems. Nymphs and adults exhibited a greater preference for feeding in the middle section of trees (Table 3). The greater concentration of feeding and oviposition sites and more protection from direct sunlight and rain in the middle third of the tree canopy explain this pest's greater abundance in this part of the tree. Young fruits heavily infested with nymphs become deformed, fail to reach full potential size or drop prematurely from the tree. There were no consistently significant differences between the north and south halves of trees.

Numbers of *P. nigra* were similar during all three tree stages. Infestations were greater in the bottom and middle sections (Table 4). The preferred feeding sites of this soft scale are the undersides of fully developed leaves and the surfaces of fruits, both of which are more abundant in the lower two-thirds of the tree canopy. In the bottom section, populations were consistently greater in the south half of trees, which is the more wind-protected side.

Table 1. Mean ± SD of *Corythuca gossypii* per soursop tree (*Annona muricata*) for three phenological tree stages from January to December of 1991 in Galeras (GA), San Francisco (SF), Tatumbla (TA) and El Zamorano (EZ) in Honduras.

	Tree stage 1				Tree stage 2				Tree stage 3			
Section	GA	SF	TA	EZ	GA	SF	TA	EZ	GA	SF	TA	EZ
Top												
North	5.0± 0.0bc	6.5± 2.1c	2.5±0.7b	1.0±1.4bc	1.0± 1.4b	0.5± 0.7c	1.5±0.7b	9.0± 0.0c	3.0±4.2b	17.5± 6.4c	0.0±0.0b	7.0± 1.4c
South	1.0± 1.4c	3.0± 0.0c	0.0±0.0c	1.0±0.0b	3.0± 2.8b	0.5± 0.7c	0.5±0.7b	2.0± 1.4c	2.5±3.5b	9.5± 6.4c	0.0±0.0b	1.5± 0.7c
Middle												
North	28.5±10.6a	66.5± 4.9a	8.5±7.8a	12.5±9.2a	48.0±14.1a	21.0±12.7ab	12.5±3.5a	26.0± 7.1b	32.0±5.7a	29.0± 2.8bc	9.0±4.2a	53.5±14.8b
South	11.0± 4.2bc	51.0± 7.1ab	8.5±2.1a	5.0±1.4b	13.5± 0.7b	33.0± 9.9a	5.0±2.8b	46.0±15.6a	10.0±0.0b	49.5±14.8ab	10.5±6.4a	88.5± 6.4a
Bottom												
North	11.5± 4.9b	16.0± 5.7c	2.5±0.7b	8.0±1.4a	12.5± 4.9b	4.0± 1.4bc	0.0±0.0b	2.0± 1.4c	15.5±7.8ab	29.0±15.6bc	0.0+0.0b	12.5± 0.7c
South	15.0± 7.1b	46.5±12.0b	1.5±0.7b	8.0±7.1a	18.5± 6.4b	15.5± 2.1abc	5.0±2.8b	5.5± 3.5c	27.0±8.5a	64.0± 5.7a	1.0±1.4b	41.0±11.3b

Numbers in the same column with different letters are significantly different (P(0.05, Duncan's multiple range test)

Table 2. Mean ± SD number of *Calloconophora caliginosa* per soursop tree (*Annona muricata*) section for three phenological tree stages from January to December of 1991 in Galeras (GA), San Francisco (SF), Tatumbla (TA) and El Zamorano (EZ) in Honduras.

	Tree stage 1				Tree stage 2				Tree stage 3			
Section	GA	SF	TA	EZ	GA	SF	TA	EZ	GA	SF	TA	EZ
Top												
North	10.5 ±10.6c	0.5 ± 0.7c	0.0 ±0.0c	4.5 ±2.1b	1.0 ± 1.4b	4.5 ±6.4b	3.5 ±0.7b	3.0 ±2.8b	1.5 ± 0.7b	16.0 ±18.4c	0.5 ±0.7c	1.0±1.4b
South	4.5 ± 0.7c	0.0 ± 0.0c	0.5 ±0.7c	0.0 ±0.0c	2.5 ± 3.5b	3.5 ±4.9b	1.0 ±0.0b	3.0 ±1.4b	3.0 ± 1.4ab	2.0 ± 2.8c	0.0 ±0.0c	0.0±0.0b
Middle												
North	51.0 ± 8.5ab	34.0 ± 0.0a	10.0 ±5.7a	15.0 ±9.9a	48.0 ± 4.2a	16.5 ±4.9a	18.5 ±2.1a	6.0 ±2.8b	9.5 ± 4.9a	51.0 ± 2.8b	6.0 ±4.2a	6.0±2.8a
South	72.0 ± 8.5a	45.5 ± 3.5a	11.5 ±9.2a	16.0 ±7.1a	31.5 ±31.8ab	17.5 ±2.1a	18.5 ±3.5a	19.0 ±5.7a	10.5 ±10.6a	87.5 ±10.6a	5.5 ±6.4a	5.0±1.4a
Bottom												
North	3.5 ± 2.1c	19.5 ±27.6b	5.0 ±1.4b	2.5 ±3.5b	2.5 ± 0.7b	7.5 ±0.7b	2.5 ±0.7b	5.0 ±1.4b	3.0 ± 1.4ab	3.0 ± 0.0c	0.5 ±0.7c	0.0±0.0b
South	31.5 ±30.4bc	24.5 ±24.7b	12.5 ±0.7a	10.0 ±0.0a	19.0 ± 1.4ab	16.5 ±0.7a	4.5 ±3.5b	8.5 ±3.5b	9.5 ±13.4a	25.0 ± 7.1c	3.5 ±2.1b	0.0±0.0b

Numbers in the same column with different letters are significantly different (P<0.05, Duncan's multiple range test)

Table 3. Mean ± SD number of *Membracis mexicana* per soursop tree (*Annona muricata*) section for three phenological tree stages from January to December of 1991 in Galeras (GA), San Francisco (SF), Tatumbla (TA) and El Zamorano (EZ) in Honduras.

	Tree stage 1				Tree stage 2				Tree stage 3			
Section	GA	SF	TA	EZ	GA	SF	TA	EZ	GA	SF	TA	EZ
Top												
North	2.0 ±2.8b	1.0 ±0.0c	4.5 ±0.7ab	0.5 ±0.7d	1.5 ±2.1c	2.0 ±0.0b	2.0 ±2.8b	1.5 ±0.7cd	3.0 ±2.8b	1.5 ±2.1b	0.5 ±0.7a	3.0 ± 2.8b
South	0.0 ±0.0b	0.0 ±0.0c	0.5 ±0.7c	0.0 ±0.0d	0.5 ±0.7c	1.0 ±0.0c	1.0 ±1.4b	0.5 ±0.7d	2.5 ±0.7b	0.0 ±0.0c	0.0 ±0.0c	4.0 ± 2.8b
Middle												
North	12.5 ±2.1a	17.0 ±4.2a	3.5 ±2.1b	16.5 ±2.1a	8.0 ±5.7a	13.5 ±6.4a	8.5 ±2.1a	20.0 ±2.8a	8.5 ±4.9a	17.0 ±5.7a	1.0 ±2.1b	57.0 ±22.6a
South	8.5 ±12.0a	14.5 ±9.2ab	10.5 ±4.9a	10.5 ±0.7b	7.0 ±8.5a	9.5 ±3.5a	11.5 ±4.9a	12.0 ±5.7ab	12.0 ±2.8a	13.5 ±4.9a	3.5 ±0.7a	48.0 ± 9.2a
Bottom												
North	2.0 ±0.0c	2.5 ±0.7c	0.0 ±0.0b	4.5 ±2.1c	5.5 ±4.9a	9.0 ±2.8a	0.5 ±0.7b	6.5 ±6.4bcd	1.5 ±0.7b	4.0 ±2.8b	1.0 ±2.1b	33.5 ± 9.2ab
South	5.0 ±0.0a	6.0 ±1.4bc	2.5 ±0.7a	3.0 ±2.8cd	3.5 ±0.7b	7.0 ±7.1a	3.5 ±4.9b	10.0 ±0.0bc	4.5 ±2.1b	10.5 ±9.2a	0.0 ±2.8c	28.0 ±18.4b

Numbers in the same column with different letters are significantly different (P<0.05, Duncan's multiple range test).

Table 4. Mean ± SD number of *Parasaissetia nigra* per soursop tree (*Annona muricata*) section for three phenological tree stages from January to December of 1991 in Galeras (GA), San Francisco (SF), Tatumbla (TA) and El Zamorano (EZ) in Honduras.

	Tree stage 1				Tree stage 2				Tree stage 3			
Section	GA	SF	TA	EZ	GA	SF	TA	EZ	GA	SF	TA	EZ
Top												
North	2.5 ±0.7bc	0.5 ±0.7c	0.5 ±0.7b	1.0 ±0.0c	1.5 ±0.7bc	1.0 ±0.0b	1.0 ±1.4b	2.0 ±1.4c	1.5 ±0.7d	1.5 ±2.1c	0.0 ±0.0c	0.5 ±0.7c
South	0.5 ±0.7c	1.0 ±0.0b	0.5 ±0.7b	0.5 ±0.7c	0.5 ±0.7c	1.0 ±1.4b	0.5 ±0.7b	1.0 ±0.0c	2.5 ±0.7d	0.0 ±0.0d	0.0 ±0.0c	1.0 ±1.4c
Middle												
North	18.5 ±0.7a	9.5 ±4.9a	5.0 ±4.2a	15.0 ±2.8a	8.5 ±0.7a	7.0 ±1.4a	7.5 ±4.9a	11.0 ±5.7ab	14.0 ±4.2a	8.0 ±5.7a	3.0 ±1.4ab	16.0 ±11.3a
South	17.5 ±0.7a	7.0 ±5.7a	2.0 ±0.0a	10.0 ±2.8b	7.0 ±4.2a	4.5 ±0.7a	5.5 ±0.7a	14.0 ±2.8a	7.5 ±0.7bc	6.0 ±4.2a	5.0 ±7.1a	14.0 ±5.7a
Bottom												
North	3.5 ±0.7bc	5.0 ±4.2ab	2.0 ±1.4b	4.0 ±1.4c	2.0 ±1.4b	7.5 ±7.8a	0.5 ±0.7b	5.5 ±0.7bc	4.5 ±0.7cd	3.5 ±0.7b	1.0 ±0.0b	2.0 ±1.4c
South	5.0 ±2.8b	12.5 ±3.5a	6.0 ±1.4a	17.0 ±1.4a	6.5 ±3.5a	10.5 ±3.5a	7.5 ±2.1a	6.5 ±0.7abc	10.5 ±3.5ab	11.5 ±7.8a	3.5 ±0.7ab	6.0 ±0.0b

Numbers in the same column with different letters are significantly different (P<0.05, Duncan's multiple range test)

Table 5. Mean ± SD number of *Saissetia oleae* per soursop tree (*Annona muricata*) section for three phenological tree stages from January to December of 1991 in Galeras (GA), San Francisco (SF), Tatumbla (TA) and El Zamorano (EZ) in Honduras.

	Tree stage 1				Tree stage 2				Tree stage 3			
Section	GA	SF	TA	EZ	GA	SF	TA	EZ	GA	SF	TA	EZ
Top												
North	0.5 ±0.7a	3.0 ±0.0bc	1.0 ±1.4c	3.0 ±2.8b	0.0 ±0.0b	2.5 ±0.7a	2.5 ±0.7b	2.5 ±2.1c	0.0 ±0.0c	2.0 ±1.4b	1.0 ±1.4b	3.0 ±0.0cd
South	0.0 ±0.0b	0.5 ±0.7c	0.0 ±0.0c	1.0 ±1.4b	0.0 ±0.0b	1.5 ±0.7b	2.0 ±1.4b	2.0 ±1.4c	0.0 ±0.0c	1.0 ±1.4b	0.5 ±0.7b	2.0 ±0.0d
Middle												
North	3.0 ±0.0a	4.0 ±1.4bc	3.0 ±1.4bc	7.5 ±3.5a	1.0 ±0.0a	4.5 ±0.7a	9.0 ±1.4a	10.5 ±4.9a	4.0 ±0.0a	7.0 ±4.2a	6.0 ±0.0a	5.5 ±2.1bcd
South	1.5 ±2.1a	9.5 ±2.1a	7.0 ±1.4a	1.5 ±0.7b	1.0 ±0.0a	3.0 ±2.8a	2.5 ±2.1b	5.5 ±0.7a	0.0 ±0.0c	7.5 ±0.7a	1.0 ±1.4b	7.0 ±1.4ab
Bottom												
North	2.0 ±0.0a	2.5 ±2.1bc	2.0 ±0.0bc	6.5 ±2.1a	0.5 ±0.7ab	3.5 ±0.7a	1.0 ±0.0b	4.0 ±1.4b	3.0 ±1.4ab	4.5 ±0.7ab	6.0 ±2.8a	6.5 ±2.1abc
South	1.0 ±0.0a	5.5 ±2.1ab	5.0 ±1.4ab	8.5 ±3.5a	1.0 ±0.0a	2.0 ±0.0a	3.5 ±0.7b	6.0 ±1.4b	2.0 ±0.0b	8.0 ±5.7a	4.5 ±0.7ab	9.5 ±0.7a

Numbers in the same column with different letters are significantly different (P<0.05, Duncan's multiple range test).

Populations of *S. oleae* were also similar during all three tree stages. This pest was more abundant in the middle and bottom sections of trees (Table 5). An explanation for this skewed distribution could be the abundance of stems, the preferred settling sites of crawlers, in these sections. The lowest populations were in the top section probably because crawlers avoid direct sunlight and rain impact may wash them away. There were no consistent differences between the north and south halves of trees.

Among the fruit/seed borers, *B. cubensis* was the principal pest, with greater numbers emerging from fruits in the middle section without any significant difference between north and south halves (Table 6). More *C. anonella* emerged from fruits in the middle north section than any other section (Table 6). The greater emergence from fruits in the middle canopy section may be due to the adult females' ovipositional preferences in these fruits, owing to the greater abundance of flowers and fruits in this section which make it more attractive to the adults. Additionally, the fruits in the middle section have lower exposure to sunlight, wind and rain impact.

In general, *C. gossypii*, *C. caliginosa* and *M. mexicana* show a preference for feeding in the middle third of the tree, whereas *P. nigra* and *S. oleae* concentrate in the middle and lower thirds. Thus, in order to obtain a clearer picture of tree infestations by these pests and also more effective chemical control methods, it is recommended that samples be taken from and control be aimed at the middle section of the tree canopy for the first three pests and at the lower two-thirds of the tree for the scale insects. Only *C. gossypii* and *C. anonella* show a tendency for higher populations on the north half of trees, thus sampling and control of them might best be emphasized on the north side of trees. *P. nigra* shows a distinct preference in the bottom section, but not in the middle section, for inhabiting the south half of trees. Thus, sampling and control for this pest in the bottom third of the canopy should be emphasized on the south half. There are no consistent differences between the north and south halves of the canopy for the other three foliage and stem pests and *B. cubensis*. Therefore, sampling and control may be performed on any side without risk of encountering higher variability due to cardinal orientation.

All the foliage and stem pests are capable of maintaining populations during every tree stage. A higher population is expected in stage 1, as this stage provides the foliage and stem feeders with more food sources. However, pest behavior is never entirely predictable, since highly variable environmental phenomena play an important role in population dynamics.

The fruit/seed borers show a significantly greater tendency to attack fruits in the middle third of the tree canopy. For this reason, sampling methods should be directed toward sampling fruit in the middle of the tree. Also, control measures will have more impact if directed toward the middle third of the tree canopy.

Table 6. Mean ±SD number of *Bephratelloides cubensis* and *Cerconota anonella* emerging per *Annona muricata* fruit from six tree sections in July 1991.

Section	*B. cubensis*	*C. anonella*
Top north	5.5 ±0.6 b[1]	0.0 ±0.0 b
Top south	1.0 ±0.0 b	0.5 ±0.5 b
Middle north	29.5 ±1.4 a	2.5 ±0.0 a
Middle south	24.5 ±2.1 a	0.5 ±0.0 b
Bottom north	0.5 ±0.5 b	0.0 ±0.0 b
Bottom south	10.0 ±1.5 b	0.0 ±0.0 b

[1]Numbers in the same column with different letters are significantly different (P<0.05, Duncan's multiple range test).

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