

Track Analysis of the Species of *Lampetis* (*Spinthoptera*) Casey, 1909 (Coleoptera: Buprestidae) in North America, Central America, and the West Indies

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ABSTRACT.—Based on the comparison of 29 individual tracks, distributional patterns of species of *Lampetis* (*Spinthoptera*) in North and Central America, and the West Indies were analyzed by a track analysis. Fifteen generalized tracks and six nodes were found. Three generalized tracks were found in the Nearctic region, six in the Mexican transition zone, and eight in the Neotropical region (two in the Antillean dominion and six in the Mesoamerican dominion). Nodes were located in the Mexican transition zone (Sierra Madre del Sur and Transmexican Volcanic Belt biogeographic provinces) and the Neotropical region (Mexican Gulf and Mexican Pacific Coast biogeographic provinces). Two nodes were located in the Isthmus of Tehuantepec, which represents a key area to the understanding of the biotic evolution of Mesoamerica.

KEYWORDS.—Biogeography, evolution, Neotropics, Mexican transition zone, Isthmus of Tehuantepec.

INTRODUCTION

The genus *Lampetis* Dejean, 1833 is one of the most speciose genera in the subtribe *Dicercina* Bellamy, 2003, with approximately 251 species widely distributed in the Afrotropical, Tropical and Temperate Australian, Nearctic, Neotropical, Oriental, and Palaearctic regions. According to Kurosawa (1993), all New World species belong to the subgenus *Spinthoptera* Casey, 1909. Corona (in press) has recently recognized 31 species in North America, Central America and the West Indies: 12 are endemic to Mexico, four to Central America, five are shared between Mexico and Central America, four are shared between Mexico and the United States, and six are endemic to the West Indies. Based on this wide distribution in the Nearctic and Neotropical regions, as well as the Mexican transition zone (*sensu* Morrone 2004a), it seems that distributional patterns of the species of *Lampetis* (*Spinthoptera*) may help elucidate some aspects of the biotic evolution of this area.

Our objective is to analyze the geographical distribution of the North and Central American, and West Indian species of *Lampetis* (*Spinthoptera*) applying a track analysis, to contribute to the knowledge of their biotic diversification.

MATERIALS AND METHODS

We obtained 555 records from labels of 2433 specimens of *Lampetis* (*Spinthoptera*) borrowed from 44 collections. Two species were excluded from the analysis, because they are not well collected or have few localities (one or two): *L. lesnei* (Kerremans, 1910) and *L. christophi* (Théry, 1923) (1 and 4 specimens respectively).

The track analysis consists of plotting localities of different taxa on maps, and connecting them together with lines termed "individual tracks". When different individual tracks are superimposed, the resulting summary lines are considered "generalized" or "standard tracks", which indicate the preexistence of ancestral biotas subsequently fragmented by tectonic and/or climatic changes. If two or more generalized tracks intersect in a given area, they determine a node, which indicates that different ancestral biotic and geological frag-

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ments interrelate in space/time (Morrone and Crisci 1995; Craw et al. 1999; Morrone 2004b). Localities, individual and generalized tracks, and nodes were represented on maps using ArcView 3.2 (ESRI 1998). Localities were connected according to their geographical proximity. When two or more individual tracks coincided, generalized tracks were delimited. Nodes were drawn where two or more generalized tracks intersected.

The areas used in this study correspond to the following regions, subregions, dominions, and biogeographic provinces (Morrone 2001a,b, 2004a; Morrone and Márquez 2003):

Neotropical region

Caribbean subregion

Mesoamerican dominion

Mexican Gulf province: coast of the Mexican Gulf, in eastern Mexico, Belize, and northern Guatemala.

Mexican Pacific Coast province: western Mexico, in the Pacific coast of the states of Sinaloa, Nayarit, Colima, Jalisco, Michoacán, Guerrero, Oaxaca, and Chiapas.

Western Panamanian Isthmus province: western Central America, from Costa Rica to western Panama.

Antillean dominion

Cuba province: Island of Cuba.

Hispaniola province: Island of Hispaniola (Dominican Republic and Haiti).

Nearctic region

Mexican Plateau province: central Mexico, in the states of Chihuahua, Coahuila, Durango, Zacatecas, San Luis Potosí, Guanajuato, and parts of Nuevo León and Sonora, and New Mexico (U.S.A).

Tamaulipas province: basically includes the coastal areas in the northern part of the Mexican Gulf.

Mexican Transition zone

Sierra Madre Occidental province: western Mexico, in the states of Chihuahua, Durango, Zacatecas, Sonora, Sinaloa, Nayarit, and Jalisco, above 1,000 m altitude.

Sierra Madre Oriental province: eastern Mexico, in the states of San Luis Potosí, Coahuila, Hidalgo, Nuevo León, Vera-

cruz, Puebla, and Querétaro, above 1,500 m altitude.

Transmexican Volcanic Belt province: central Mexico, in the states of Guanajuato, México, Distrito Federal, Jalisco, Michoacán, Puebla, Oaxaca, Tlaxcala, and Veracruz.

Balsas Basin province: central Mexico, in the states of Guerrero, México, Jalisco, Michoacán, Morelos, Oaxaca, and Puebla, below 2,000 m altitude, situated between the Transmexican Volcanic Belt and the Sierra Madre del Sur provinces.

Sierra Madre del Sur province: south central Mexico, from southern Michoacán to Guerrero, Oaxaca, and part of Puebla, above 1,000 m altitude.

RESULTS

Individual tracks were drawn for the following species (number of specimens in parentheses): *Lampetis aurata* (Saunders, 1871) (67), *L. aurifera* (Olivier, 1790) (71), *L. auropunctata* (Kerremans, 1893) (66), *L. bahamica* (Fisher, 1925) (71), *L. chalconota* (Waterhouse, 1882) (89), *L. chiapaneca* Corona, 2004 (23), *L. cortesi* (Laporte and Gory, 1837) (92), *L. cupreopunctata* (Schaeffer, 1905) (61), *L. dilaticollis* (Waterhouse, 1882) (102), *L. drummondi* (Laporte and Gory, 1836) (786), *L. geniculata* (Waterhouse, 1889) (94), *L. granulifera* (Laporte and Gory, 1837) (87), *L. guildini* (Laporte and Gory, 1836) (21), *L. hirtomaculata* (Herbst, 1801) (36), *L. mexicana* Théry, 1923 (8), *L. monilis* (Chevrolat, 1834) (122), *L. obscura* Thomson, 1879 (61), *L. simplex* (Waterhouse, 1882) (36), *L. srdinkoana* (Obenberger, 1924) (9), *L. straba* (Chevrolat, 1867) (10), *L. torquata* (Dalman, 1823) (110), *L. webbii* (LeConte, 1858) (303), and seven new species (103).

Based on their comparison, we obtained 15 generalized tracks (Fig. 1, Table 1). Three are found in the Nearctic region, six in the Mexican transition zone, and eight in the Neotropical region. Two of the latter are found in the Antillean dominion and six in the Mesoamerican dominion (Morrone 2001a, b, 2004a; Morrone and Márquez 2003).

Generalized track 1: western Arizona,

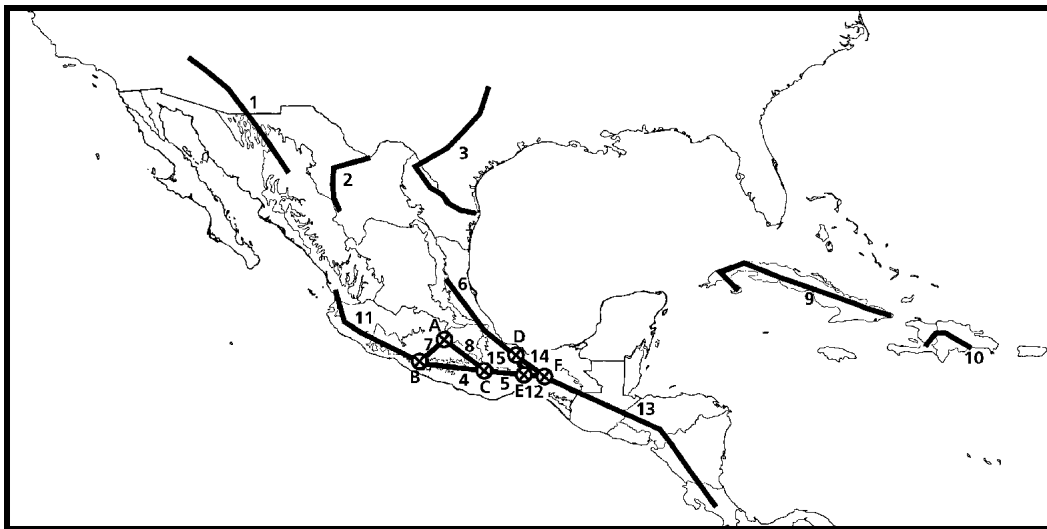


FIG. 1. Generalized tracks and nodes found in the analysis of 29 species of *Lampetis*.

TABLE 1. Generalized tracks arranged in regions and dominions, with the species defining them, and nodes interception.

Regions	Dominions	Generalized tracks	Species	Nodes
Nearctic	Continental	2	<i>L. dilaticollis</i> and <i>L. webbii</i>	–
	Nearctic	3	<i>L. cupreopunctata</i> and <i>L. drummondi</i>	–
Mexican transition zone		1	<i>L. auropunctata</i> , <i>L. drummondi</i> , and <i>L. webbii</i>	–
		4	<i>L. chalconota</i> and <i>L. cortesi</i>	B and C
Neotropical		5	<i>L. chalconota</i> , <i>L. cortesi</i> , and <i>L. obscura</i>	C and E
		6	<i>L. cortesi</i> , <i>L. cupreopunctata</i> , <i>L. granulifera</i> , <i>L. monilis</i> , <i>L. simplex</i> , and <i>L. obscura</i>	D
		7	<i>L. chalconota</i> and <i>L. sp. C</i>	A and B
		8	<i>L. dilaticollis</i> and <i>L. sp. D</i>	A and C
		9	<i>L. straba</i> and <i>L. torquata</i>	–
	Antillean	10	<i>L. aurata</i> and <i>L. aurifera</i>	–
		Mesoamerican	6	<i>L. cortesi</i> , <i>L. cupreopunctata</i> , <i>L. granulifera</i> , <i>L. monilis</i> , <i>L. simplex</i> , and <i>L. obscura</i>
	11		<i>L. auropunctata</i> , <i>L. sp. A</i> , <i>L. sp. B</i> , <i>L. cortesi</i> , and <i>L. sp. C</i>	B
	12		<i>L. chalconota</i> , <i>L. granulifera</i> , <i>L. monilis</i> , and <i>L. obscura</i>	E and F
	13		<i>L. chalconota</i> , <i>L. chiapaneca</i> , <i>L. geniculata</i> , <i>L. monilis</i> , <i>L. simplex</i> , <i>L. srdinkoana</i> , <i>L. sp. E</i> , and <i>L. sp. F</i>	F
		14	<i>L. monilis</i> and <i>L. simplex</i>	D and F
	15	<i>L. cortesi</i> and <i>L. granulifera</i>	D and E	

USA to southwestern Chihuahua, Mexico. Mexican transition zone (Sierra Madre Occidental biogeographic province).

Generalized track 2: northeastern Chi-

huahua to northern Durango. Nearctic region (Mexican Plateau biogeographic province).

Generalized track 3: northeastern Texas,

USA to northeastern Tamaulipas, Mexico. Nearctic region (Tamaulipas biogeographic province).

Generalized track 4: northern Guerrero to northern Oaxaca. Mexican transition zone (Sierra Madre del Sur biogeographic province).

Generalized track 5: central Oaxaca. Mexican transition zone (Sierra Madre del Sur biogeographic province).

Generalized track 6: southern San Luis Potosí to southeastern Veracruz. Mesoamerican dominion (Mexican Gulf biogeographic province) and Mexican transition zone (Sierra Madre Oriental biogeographic province).

Generalized track 7: central Guerrero to northern Morelos. Mexican transition zone (Transmexican Volcanic Belt, Balsas Basin, and Sierra Madre del Sur biogeographic provinces).

Generalized track 8: northern Morelos to western Oaxaca. Mexican transition zone (Transmexican Volcanic Belt, Balsas Basin, and Sierra Madre del Sur biogeographic provinces).

Generalized track 9: Cuba and Isla de la Juventud. Antillean dominion (Cuba province).

Generalized track 10: Dominican Republic and Haiti. Antillean dominion (Hispaniola province).

Generalized track 11: southern Nayarit to northern Guerrero. Mesoamerican dominion (Mexican Pacific Coast biogeographic province) and Mexican transition zone (Transmexican Volcanic Belt, Balsas Basin, and Sierra Madre del Sur biogeographic provinces).

Generalized track 12: Isthmus of Tehuantepec to Central Chiapas. Mesoamerican dominion (Mexican Pacific Coast biogeographic province).

Generalized track 13: Central Chiapas, Mexico to Costa Rica. Mesoamerican dominion (Mexican Pacific Coast and Western Panamanian Isthmus biogeographic province).

Generalized track 14: southeastern Veracruz to Central Chiapas. Mesoamerican dominion (Mexican Gulf and Mexican Pacific Coast biogeographic provinces).

Generalized track 15: southeastern Vera-

cruz to southern Oaxaca. Mesoamerican dominion (Mexican Gulf and Mexican Pacific Coast biogeographic provinces).

We found six nodes in the areas where these generalized tracks overlapped: three are located in the Mexican transition zone and three in the Neotropical region (Fig. 1, Table 1):

Node A: northern Morelos. Mexican transition zone (Transmexican Volcanic Belt biogeographic province).

Node B: northwestern Guerrero. Mexican transition zone (Sierra Madre del Sur biogeographic province).

Node C: northwestern Oaxaca Mexican transition zone (Sierra Madre del Sur biogeographic province).

Node D: southeastern Veracruz. Mesoamerican dominion (Mexican Gulf biogeographic province).

Node E: eastern Oaxaca. Mesoamerican dominion (Mexican Pacific Coast biogeographic province).

Node F: central Chiapas. Mesoamerican dominion (Mexican Pacific Coast biogeographic province).

DISCUSSION

Generalized track 13 is similar to the Northern and Southern Mesoamerican generalized tracks from Márquez and Morrone (2003) and Abrahamovich et al. (2004). Generalized track 7 is similar to generalized track 28 from Morrone and Gutiérrez (in press), which includes the Transmexican Volcanic Belt, Balsas Basin, and Sierra Madre del Sur biogeographic provinces.

Fifty percent of the nodes are in the Mexican transition zone (Sierra Madre del Sur and Transmexican Volcanic Belt biogeographic provinces) and the remaining are in the Mesoamerican dominion (Mexican Gulf and Mexican Pacific Coast biogeographic province) of the Caribbean subregion. Node B is similar to node 25 from Morrone and Gutiérrez (unpubl.) and node A is similar to node 3 from Escalante et al. (2004).

Three nodes (D, E, and F) are located in the area of the Isthmus of Tehuantepec, where a node was also found by previous

analyses (Morrone and Márquez 2001; Márquez and Morrone 2003; Abrahamovich et al. 2004). These results corroborate Halffter's (2003) hypothesis, which highlighted the relevance of the Isthmus of Tehuantepec. For that coincidence we consider the Isthmus of Tehuantepec as a boundary between biotic components within the Caribbean subregion. Ruggiero and Ezcurra (2003) and Morrone (2004a) recently discussed the evolutionary relevance of these areas, which are characterized by biotic interactions more than representing static lines. In spite of being classified in the Neotropical region, the Caribbean subregion exhibits such interactions and complexities, as indicated in the previous analyses.

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