KLINCKOWSTROEMIA MULTISETILLOSA ROSARIO & HUNTER (ACARINA: TRIGYNASPIDA: KLINCKOWSTROEMIIDAE) ASSOCIATED WITH THREE SPECIES OF *PROCULUS* KUWERT (COLEOPTERA: PASSALIDAE)

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ABSTRACT

Klinckowstroemia multisetillosa Rosario & Hunter was known to be asociated with *Proculus mniszechi* Kaup in Guatemala. We have found *K. multisetillosa* associated with allopatric populations of *P. burmeisteri* Kuwert and *P. opacipennis* (Thompson). *K. multisetillosa* is now known from 4 regions of Guatemala and 1 of Honduras. At present, there appears to be no gene flow between these 5 areas. Only 1 species of *Proculus* is known from each region. Since this genus is flightless, the distribution of mites among these "geografic islands" could be explained in 2 ways: the first implies a possible wide spread ancient distribution and the second implies the distribution of such mites by phoresy on other passalid species that fly.
Key Words: Acarina, Klinckowstroemiidae, Passalidae, distribution, Guatemala.

RESUMEN

Klinckowstroemia multisetillosa Rosario & Hunter se conocía asociada a *Proculus mniszechi* Kaup en Guatemala. Hemos encontrado *K. multisetillosa* asociada a poblaciones alopátricas de *P. burmeisteri* Kuwert y *P. opacipennis* (Thompson). *K. multisetillosa* se conoce de 4 regiones de Guatemala y 1 de Honduras. En el presente, parece que no hay flujo genético entre esas 5 áreas. Sólo una especie de *Proculus* es conocida de cada una de las áreas mencionadas. Puesto que este género no vuela, la distribución de ácaros entre estas "islas geográficas" puede ser explicada en 2 formas: la primera implica una amplia y antigua distribución y la segunda implica la distribución de los ácaros por foresia en otras especies de pasálidos que vuelan.
Palabras Clave: Acarina, Klinckowstroemiidae, Passalidae, distribución, Guatemala.

INTRODUCTION

Fourteen species of the mite family Klinckowstroemiidae Trägårdh are associated with at least 14 genera of passalid beetles (bess beetles) from Surinam, Mexico, Costa Rica and Guatemala (Rosario and Hunter, 1988).

The exact ecological and trophic relationships between beetle and mite are unknown. *Klinckowstroemia* has recently been studied taxonomically by Rosario and Hunter (1988).

This paper treats biogeographical and ecological associations between *K. multisetillosa* and 3 species of the passalid genus *Proculus*: *P. burmeisteri, P. mniszechi* and *P. opacipennis*. These mite associations with *P. burmeisteri* and *P. opacipennis* are first reported here. *Proculus* shows an extraordinary wing reduction (the greatest in the Passalidae) that is associated with its restricted distribution in the tropical mountains of southern Mexico and Central America. These mountain systems have been centers of diversification (Reyes-Castillo, 1970). *Proculus* is associated with cloud and very humid forests, showing the Mesoamerican Montane distributional pattern (Halffter and Reyes-Castillo, 1976).

METHODS

The mites were obtained directly from passalid beetles that were collected in logs in the following sites: Cerro San Gil, Izabal; La Unión, Zacapa; Sierra de Las Minas, Izabal and Purulhá, Baja Verapaz, all in Guatemala and El Portillo mountain, Ocotepeque, Honduras. Mixing of beetle species were carefully avoided to prevent any possible transference of mites. Mites were identified using keys of Rosario & Hunter (1988) and identifications were confirmed by P. Hunter. The mites were mounted on slides using Hoyers as a fixative.

The specimens of *K. multisetillosa* are deposited in the Universidad del Valle Arthropod Collection and the University of Georgia Mite Collection.

RESULTS

K. multisetillosa (Fig. 1) was found associated with 3 allopatric species of *Proculus* in 5 areas, each isolated from one another (Fig. 1). The life zone of Purulhá, based on the Holdridge system, is a Lower Montane Rain Forest (De la Cruz, 1984). The specimens of *P. mniszechi* were found in a *Liquidambar styraciflua* L. log in a mixed forest of *Quercus* spp., *Pinus* spp., and *L. styraciflua* at 1500m in the Sierra de las Minas system.

Specimens of *K. multisetillosa* from Purulhá, Baja Verapaz, constitute topotypes of this species. A small area of cloud forest exists above La Unión, Zacapa Department, between 1160-1550m altitude. This forest is not indicated on the Life Zone map of the area (De la Cruz, 1984). It is separated by low, dry valleys from other mountains in the Sierra del Merendón which runs along the Honduras-Guatemala border. Here we found an isolated population of *P. mniszechi* that were collected in an oak (*Quercus* sp.) log (Castañeda, pers. comm.).



Figure 1

Map of the northern Central America nucleus, showing collecting sites (numbers) and altitudinal zonation: 1) Cerro San Gil, Izabal, Guatemala; 2) Purulhá, Baja Verapaz, Guatemala; 3) La Unión, Zacapa, Guatemala; 4) Río Zarco, Izabal, Guatemala; 5) El Portillo, Ocotepeque, Honduras. Altitude is given in meters above the sea level. The white area ranges from 0m to 500m. Areas with vertical bars range from 500m to 1,000m. The black area ranges from 1,000 m to 2,000 m. Areas with horizontal bars are above 2,000 m. The dotted areas represent bodies of water.

The Sierra de las Minas is separated from the mountain above La Unión for approximately 50km by the Motagua River valley. The floor of the valley is approximately 200m above the sea level in the area of Zacapa and contains Subtropical Dry Forest and Subtropical Thorn Scrub (De la Cruz, 1984).

P. opacipennis also occurs in 2 separated mountain systems, the eastern Sierra de Las Minas and Cerro San Gil, both in Izabal Department. The Life Zone of the former collecting site is Subtropical Cool Wet Forest, the later is Tropical Wet Forest (De la Cruz, 1984). Some of the *P. opacipennis* we studied were collected in a *Castilloa elastica* forest, with a few *Cedrela* sp., *Cecropia* sp., and *Chamaedoria* sp. above Zarco River, a cloud forest with lowland tropical influence at 1480m (E. Cano, pers. comm.). Others were collected on Cerro San Gil between 950 and 1000m (H. Castañeda, pers. comm.) in a forest with many lowland rainforest plants such as *Pithecolobium* sp., *Heliconia* sp., *Sterculia* sp., *Calophyllum brasiliense* var. *rekoi* Standl., *Clusia rosea* Jacq., *Ceiba pentandra* (L.) Gaertn., and *Tamarindus indica* L. (possibly introduced) (E. Pöll, pers. comm.).

At present, aproximately 45 km of lowlands dedicated to agriculture and cattle activities separate the two systems and constitute an anthropogenic barrier for the dispersion of the flightless passalid in any direction from Cerro San Gil.

P. burmeisteri is known with exactness from only one place, El Portillo, Honduras. Specimens were collected in a cloud forest located at 1810m. El Portillo is isolated from all mountain to the north, south and west by deep, dry valleys.

Specimens of a few other passalid species such as *Verres corticicola* (Truqui), *Ogyges cakchiqueli* Schuster & Reyes-Castillo, *O. crassulus* (Casey) from the same and different areas of Guatemala and Honduras have been checked for mites without having found *K. multisetillosa*.

DISCUSSION

K. multisetillosa was first found with *P. mniszechi* (Rosario & Hunter, 1988) from Purulhá. Since then we have found this mite associated with 4 more isolated populations of *Proculus*. Though the genus *Klinckowstroemia* is known from other passalid species in Guatemala, *K. multisetillosa* is known only from *Proculus*.

How can we explain the presence of the same species of mite in different allopatric populations of *Proculus*?. One hypothesis is that the mites may have been phoretic on flying species of passalids that could more easily communicate among these 5 areas. Nevertheless, the barriers between each of these areas, except perhaps those between Cerro San Gil-Sierra de las Minas (Izabal) and Purulhá (the westernmost extension of the Sierra de las Minas, in Baja Verapaz), seem to be extensive enough to limit even flying passalids. Also, no evidence exists yet that *K. multisetillosa* is associated with other passalids.

The fact that *K. multisetillosa* occurs on 3 species of *Proculus* may mean that it was present on the common ancestor of these species. If so, then speciation has been less rapid in the mites than in the passalids. A third possibility is that *K. multisetillosa* originated on a given species of *Proculus* which at one time became sympatric with one or more other species to which the mites then passed. Later, the *Proculus* became allopatric again. This latter scenario doesn't seem highly probable; it would imply for each case of sympatry the local total extinction of one of the other 2 species of *Proculus*. We suspect that the second hipothesis is the most likely. It will be interesting to see if other *Proculus* species even more isolated from these 5 populations also have *K. multisetillosa*, especially *P. beckeri* Zang of Chiapas, *P. goryi* Melly of the Guatemalan volcanoes, and possible *Proculus* populations in Costa Rica and Colombia. These data, along with phylogenetic analyses of both mites and passalids should provide insights with respect to climatic history and migrations in Mesoamerica.

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