



Scientific Note

Mimetic Assemblages of Lycidlike Cerambycidae (Insecta: Coleoptera) from Southeastern Brazil.

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Abstract. The mimetic relationships between cerambycid (mimics) and lycid beetles (models) are investigated in two forests of Southeastern Brazil. Eight lycidlike species of Cerambycidae were detected. The co-occurrence of the taxa and the greatest abundance of lycids through the time are evidences of the Batesian mimicry in Cerambycidae.

Key Words: aposematism, color patterns, Lycidae, mimicry, Neotropical beetles.

Resumo. Assembléia mimética de Cerambycidae licidomorfos (Insecta: Coleoptera) do sudeste do Brasil. A existência de relações miméticas entre besouros Cerambycidae (mímicos) e Lycidae (modelos) é verificada em duas florestas do sudeste do Brasil. Foram detectadas oito espécies de Cerambycidae com o mesmo padrão de coloração de espécies de Lycidae. A co-ocorrência dos táxons e a maior abundância de lícideos ao longo do tempo evidenciam o mimetismo batesiano em Cerambycidae.

Palavras-chave: aposematismo, besouros neotropicais, Lycidae, mimetismo, padrão de coloração.

The mimicry theory is pointed out as one of the best post-Darwinian applications of the natural selection concept (FISHER, 1930; RETTENMEYER, 1970). It is widespread among the animals, being common among arthropods. The main types of mimicry, *viz.* Batesian and Müllerian, discuss that to be mimicked, the model must have some kind of unprofitability, like sting or bad taste, among others unpleasant characteristics, combined with some warning signal, as color, behavior and/or sounds (*e.g.* RUXTON *et al.*, 2004). These characteristics will be recognized by predators that learned to avoid the model. Thus, the Batesian mimic, an edible animal, will have some degree of protection against experienced predators

by mimicking the model (WICKLER, 1968; RETTENMEYER, 1970; VANE-WRIGHT, 1980; ROBINSON, 1981).

The Lycidae, or net-winged beetles, are very noxious to predators and occurs worldwide, so they are pointed as models to potential mimics that belong to various insect taxa, as other beetles, wasps, bugs, moths and even flies (WALLACE, 1889; POULTON, 1890; 1909; MARSHALL & POULTON, 1902; SHELFORD, 1902; GUENTER, 1931; DARLINGTON, 1938; COSTA LIMA, 1953; LINSLEY, 1961; CARPENTER & FORD, 1933 *apud* LINSLEY *et al.*, 1961; EISNER *et al.*, 1962; SELANDER *et al.*, 1963; MOORE & BROWN, 1981). Despite their abundance in the tropical forests there is very few information about mimetic complexes involving Lycidae in Brazil.

The cerambycids, or longicorn beetles, may be considered good Batesian mimics, because they are palatable and very close resemble many other unpalatable insects, like ants, wasps and other beetles, including among them, the net-winged beetles of Lycidae family (LINSLEY, 1959, but see also HARRIS, 1978; DEL-CLARO, 1991). The resemblance between lycids and longicorns has been reported since early of nineteenth century (see GERMAR, 1824 *apud* LINSLEY, 1961), but readily after the seminal paper on mimicry from BATES (1862), many works suggesting mimetic resemblance between these groups appeared, indicating the occurrence of this kind of mimicry in all zoogeographic regions (WALLACE, 1867; BELT, 1874; MARSHALL & POULTON, 1902; SHELFORD, 1902; 1916; MELZER, 1931; DARLINGTON, 1938; CHOPARD, 1949; COSTA LIMA, 1953; LINSLEY, 1959; 1961; LINSLEY *et al.*, 1961; EISNER *et al.*, 1962; SELANDER *et al.*, 1963; EMMEL, 1965; MOORE & BROWN, 1989; MARTINS & GALILEO, 1991a; 1991b; 1992; TORRES, 2000; MONNÉ & MONNÉ, 2004; GALILEO & MARTINS, 2006; MARTINS & NAPP, 2006). In fact, individuals of species from many tribes in Cerambycidae have great similarity with lycids, what suggests various independent appearance of this adaptation in cerambycids (LINSLEY, 1961). Some species posses direct interaction with the net-winged beetles, living gregariously and eventually feeding on them, inducing EISNER *et al.* (1962) to propose that these cerambycids could sequestrate the chemical defenses from its models. However, recently EISNER *et al.* (2008) showed that there is not effective sequestration of chemical substances by the longicorns. According to some authors, some cerambycids can release defensive substances, therefore these species can be considered Müllerian mimics of lycids (LINSLEY, 1961; MOORE & BROWN, 1989; see also ALLISON *et al.*, 2004 for a review).

Mimetic cerambycids, as other mimic taxa, suffers some external morphological modifications that resemble more the models than the related taxa (WALLACE, 1889). According to LINSLEY (1961), the lycidlike Cerambycidae usually show: (1) aposematic coloration, as lycids have – two or more color patterns can be mimicked; (2) a flattening of the body –even subcilindrical cerambycids can also mimic lycids; (3) expansion or flaring of the elytra wich are often fringed – some lycids are not so flattened, allowing that non-flattened mimics occurs; (4) development of elytral ridges and reticulations – it is more common only the elytral ridges; (5) abbreviation of the antennae or reduction of the outer antennal segments, in length or diameter or both; (6) serration of the antennae or tufting of the basal segments to seem serrate; (7) prolongation of the head and mouth parts. These features can vary in mimics, being combined or not, according to the characteristics of the models (see the plates in MARTINS & GALILEO, 1991a; 1991b; 1992).

Thus, many cerambycids are suggested, based on museum collections, to mimic the lycids, but this can only be confirmed with systematic field collections and experiments (LINSLEY 1961), showing that models and mimics share potential predators, often occurring in the same place, but sometimes with distinct seasonalities. In southern Brazil, TORRES (2000), found *Batus hirticornis* (Gyllenhal) and *Sparna platyptera* Bates as lycid mimic cerambycids in the field. Here we present the first field data supporting the mimetic relationships between lycids and cerambycids that co-occur spatially and temporally in two sites in southeastern Brazil

The field work was done from January to December/2007, in two Conservation Units in the

São Paulo state, southeastern Brazil: 1-) Estação Ecológica de Ribeirão Preto, (Mata Santa Tereza) – hereafter MST, Ribeirão Preto city, northeast of São Paulo state. This Conservation Unity has ca. 154 ha, characterized as Atlantic Forest remnant, with semideciduous mesophytic vegetation (KOTCHETKOFF-HENRIQUES, 2003). The collections were done in field trips of a whole day, covering 4,5 km, each 15 days. 2-) Reserva Biológica Serra do Japi, hereafter JAPI, Jundáí city, southeastern of São Paulo state. This Conservation Unit has ca. 2.071 ha, consisted in great majority by semideciduous mesophytic vegetation (CARDOSO-LEITE *et al.*, 2005). Collections were performed in field trips of a whole day, covering 7 km, 3 days monthly.

All collections were done from January to December/2007 by one person, with insect net, walking through the trails in the vegetation from 9:00 am to 17:00. Cerambycids presenting lycidlike color patterns (with yellow/black or black/yellow/black patterns - Figs. 1-4) and similar behavior to the lycids (*e.g.* remaining on the leaves surface), were collected, as well as the models.

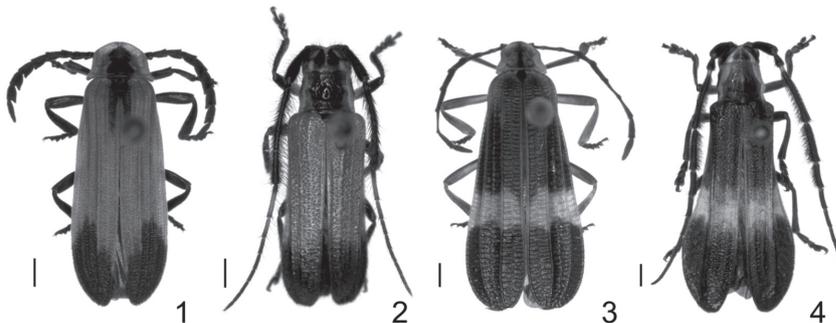
We found a total of 8 species of lycidlike cerambycids in the two localities, most of them belonging to Lamiinae subfamily, being 7 individuals belonging to 4 species from MST: *Cuicirama smithii*

(Bates), *Icimauna ciliaris* (Klug), *Malacoscyclus cirratus* (Germar) and *Lycidola amicta* (Klug); and 61 individuals belonging to 6 species from JAPI: *Batus hirticornis*, *Icimauna ciliaris*, *Malacoscyclus cirratus*, *Malacoscyclus gonostigma* Bates, *Mallosoma zonatum* (Sahlberg) and *Ucai nascimentoi* Galileo & Martins.

The central models were mainly from *Plateros* genus, Erotini tribe, however, many other Lycinae genera also play this role (see NASCIMENTO, 2009). While in JAPI, the mimics represented ca. 1/3 of sample, in MST the cerambycids represented less than 1/10 of sample. The highest abundance of cerambycids occurred in October-November, when the abundance of models decreased (Fig. 5).

In some cases, cerambycids can gain protection by joining to lycid aggregations, but it is not essentially necessary to have some kind of protections against predators (LINSLEY, 1961; EISNER *et al.*, 1962), in fact we never observed such aggregations or other kind of interaction between these models and mimics in field conditions.

The greater abundance of lycidlike cerambycids found in JAPI in relation to MST can be associated to the size of the preserved area, since JAPI is almost fourteen times greater in size than MST, and MST presents more environmental disturbance, we



Figures 1-4. (1, 3: models-Lycidae; 2, 4: mimics-Cerambycidae). 1. *Plateros* sp., 2. *Malacoscyclus cirratus*, 3. *Calopteron* sp., 4. *Lycidola amicta*. Scales 1 mm.

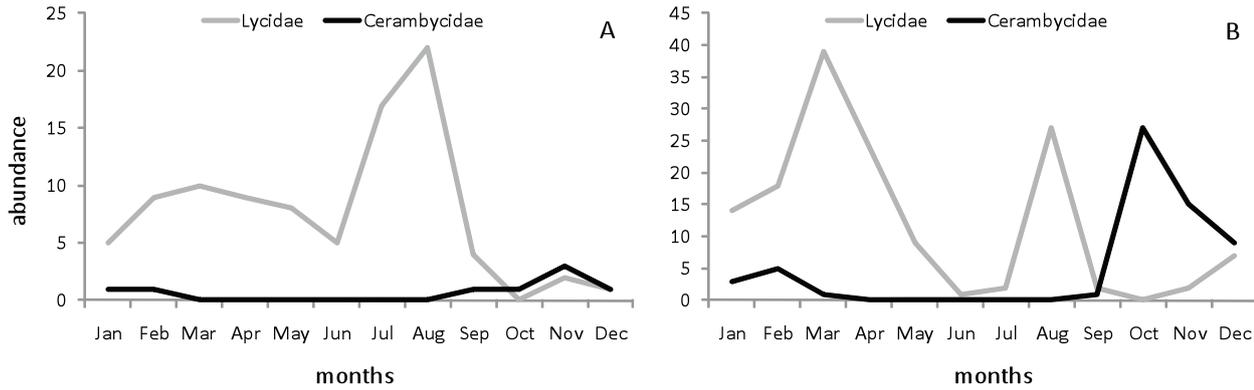


Figure 5. Abundance in number of individuals of models (gray line) and mimics (black line) through the year of 2007 in Mata Santa Tereza (A) and Serra do Japi (B).

can correlate the size of the sites to abundance. However, the species *Cuicirama smithii*, found previously only in Amazonian region, is registered to MST, therefore for the first time in São Paulo State. Other two species of lycid mimics, *Cuicirama fasciata* (Bates) *Tyrinthia nigroapicata* Galileo & Martins were also found in MST in other years.

Due to similar color pattern and behavior, as just as occur to *Adesmus colligatus* (Redtenbacher) and *Homophoeta octoguttata* (Fabricius) at Serra do Japi (DEL-CLARO 1991), we suppose that the cerambycids also mimic other distasteful taxa in these localities, as *Spathoptera albilatera* Audinet-Serville and *Cuiciuna iuati* Galileo & Martins, putative mimics of lampyrids, and *Adesmus hemispilus* (Germar), putative mimic of *Chauliognathus fallax* Germar (Cantharidae).

Generally it has been stated that the cerambycids are batesian mimics, but they often try to defend themselves using their mandibles, so it can be considered a kind of natural defense. According to the taxa found in the two sites, including the discovery of a new genus (GALILEO & MARTINS, 2009a) and a new species (GALILEO & MARTINS, 2009b) in

the two studied localities, show great potential to discover more assemblages of cerambycid mimics, involving other insect taxa, including mainly other Coleoptera and wasps, evaluating the interactions between the taxa and the dynamics of the mimicry phenomenon.

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REFERENCES

- ALLISON, J.D.; BORDEN, J.H. & SEYBOLD, S.J. 2004. A review of the chemical ecology of the Cerambycidae (Coleoptera). **Chemoecology** **24**: 123-150.
- BATES, H.W. 1862. Contributions to an insect fauna of the Amazon Valley. Lepidoptera: Heliconidae. **Transactions of the Linnean Society of London** **23**: 495-566.

- BELT, T. 1874. **The naturalist in Nicaragua**. London, John Murray, 403p.
- CARDOSO-LEITE, E.; PAGANI, M.I.; MONTEIRO, R. & HAMBURGER, D.S. 2005. Ecologia da paisagem: mapeamento da vegetação da Reserva Biológica da Serra da Japi, Jundiá, SP, Brasil. **Acta Botanica Brasilica** **19**: 233-243.
- CHOPARD, L. 1949. **Le mimétisme**. Paris, Payot, 335p.
- COSTA LIMA, A.M. 1953. **Insetos do Brasil. Coleópteros**. Rio de Janeiro, Escola Nacional de Agronomia. V. 8, 323 p.
- DARLINGTON, P.J. 1938. Experiments on mimicry in Cuba with suggestions for future study. **Transactions of the Royal Entomological Society of London** **87**: 681-695.
- DEL-CLARO, K. 1991. Aspects of mimicry between two tropical beetles in South-Eastern Brazil. **Journal of Tropical Ecology** **7**: 407-410.
- EISNER, T.; KAFATOS, F.C. & LINSLEY, E.G. 1962. Lycid predation by mimetic adult Cerambycidae (Coleoptera). **Evolution** **16**: 316-324.
- EISNER, T.; SCHROEDER, F.C.; SNYDER, N., GRANT, J.B.; ANESHANSLEY, D.J.; UTTERBACK, D.; MEINWALD, J. & EISNER, M. 2008. Defensive chemistry of lycid beetles and of mimetic cerambycid beetles that feed on them. **Chemoecology** **18**: 109-119.
- EMMEL, T.C. 1965. A new mimetic assemblage of lycid and cerambycid beetles in central Chiapas. **The Southwestern Naturalist** **10**: 14-16.
- FISHER, R.A. 1930. **The genetical theory of natural selection**. Oxford, Clarendon Press, 272 p.
- GALILEO, M.H.M. & MARTINS, U.R. 2006. Novos Hemilophini (Coleoptera, Cerambycidae, Lamiinae) da Coleção F.T. Hovore, Santa Clarita, California. **Revista Brasileira de Zoologia** **23**: 789-791.
- GALILEO, M.H.M. & MARTINS, U.R. 2009a. *Ucai*, um novo gênero de Anacolini (Coleoptera, Cerambycidae, Prioninae) do Brasil. **Papéis Avulsos de Zoologia (São Paulo)** **49**: 93-95.
- GALILEO, M.H.M. & MARTINS, U.R. 2009b. Novas espécies de Hemilophini (Coleoptera, Cerambycidae, Lamiinae) da América do Sul. **Les Cahiers Magellanes, Andrésy** **97**: 1-10.
- GUENTHER, K. 1931. **A Naturalist in Brazil**. Boston & New York, Houghton Mifflin Company, 400 p.
- HARRIS, A.C. 1978. Mimicry by a longhorn beetle, *Neocalliprason elegans* (Coleoptera: Cerambycidae), of its parasitoid, *Xanthocryptus novozealandicus* (Hymenoptera: Ichneumonidae). **New Zealand Entomologist** **6**: 406-408.
- KOTCHETKOFF-HENRIQUES, O. 2003. **Caracterização da vegetação natural em Ribeirão Preto, SP – Bases para conservação**. PhD thesis. Universidade de São Paulo – Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Ribeirão Preto. 221 p.
- LINSLEY, E.G. 1959. Ecology of Cerambycidae. **Annual Review of Entomology** **4**: 99-139.
- LINSLEY, E.G. 1961. Lycidlike Cerambycidae (Coleoptera). **Annals of Entomological Society of America** **54**: 628-635.
- LINSLEY, E.G.; EISNER, T. & KLOTS, A.B. 1961. Mimetic assemblage of sibling species of lycid beetles. **Evolution** **15**: 15-29.
- MARTINS, U.R. & GALILEO, M.H.M. 1991a. Subdivisão do gênero *Lycidola* Thomson, 1864 (Coleoptera, Cerambycidae, Lamiinae, Hemilophini). **Revista Brasileira de Entomologia** **35**: 553-565.
- MARTINS, U.R. & GALILEO, M.H.M. 1991b. Os gêneros *Lycaneptia* Thomson, 1868 e *Lycomimus* Melzer, 1931

- (Coleoptera, Cerambycidae, Lamiinae, Hemilophini). **Revista Brasileira de Entomologia** **35**: 587-591.
- MARTINS, U.R. & GALILEO, M.H.M. 1992. Gêneros de Hemilophini (Coleoptera, Cerambycidae, Lamiinae) relacionados com *Hemilophus* A.-Serville, 1835. **Revista Brasileira de Entomologia** **36**: 121-128.
- MARTINS, U.R. & NAPP, D.S. 2006. Notas sobre os gêneros *Deltosoma* e *Thelgetra* (Coleoptera, Cerambycidae, Pteroplatini). **Iheringia, Série Zoologia** **96**: 339-344.
- MARSHALL, G.A.K. & POULTON, E.B. 1902. Five years' observations and experiments (1896-1901) on the bionomics of South African insects, chiefly directed to the investigation of mimicry and warning colours. **Transactions of the Entomological Society of London** **1902**: 287-697.
- MELZER, J. 1931. Cerambycideos neotrópicos, principalmente do Brasil. **Revista de Entomologia** **1**: 1-15.
- MONNÉ, M.A. & MONNÉ, M.L. 2004. *Nothoprodontia*, um novo gênero de Trachyderini (Coleoptera, Cerambycidae, Cerambycinae). **Revista Brasileira de Entomologia** **48**: 239-241.
- MOORE, B.P. & BROWN, W.V. 1981. Identification of warning odour components, bitter principles and antifeedants in an aposematic beetle: *Metriorrhynchus rhipidius* (Coleoptera: Lycidae). **Insect Biochemistry** **11**: 493-499.
- NASCIMENTO, E.A. 2009. **Estudos do mimetismo em Lycidae (Insecta: Coleoptera)**. PhD thesis. Universidade de São Paulo – Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Ribeirão Preto, São Paulo. 172 p.
- POULTON, E.B. 1890. **The colours of animals: their meaning and use specially considered in the case of the insects**. London, Kegan Paul, Trench, Trubner and Co. Ltd., 337 p.
- POULTON, E.B. 1909. **Charles Darwin and the Origins of Species: Addresses, etc., in America and England in the year of the two anniversaries**. London, Longmans, Green and Co., 302 p.
- RETENMEYER, C.W. 1970. Insect mimicry. **Annual Review of Entomology** **15**: 43-74.
- ROBINSON, M.H. 1981. A stick is a stick and not worth eating: on the definition of mimicry. **Biological Journal of Linnean Society** **16**: 15-20.
- RUXTON, G.D.; SHERRATT, T.N. & SPEED, M.P. 2004. **Avoiding Attack: the evolutionary ecology of crypsis, warning signals and mimicry**. Oxford, Oxford University Press, 249 p.
- SELANDER, R.B.; MILLER, J.L. & MATHIEU, J.M. 1963. Mimetic associations of lycid and cerambycid beetles in Coahuila, Mexico. **Journal of Kansas Entomological Society** **36**: 45-52.
- SHELFORD, R.W.C. 1902. Observations on some mimetic insect and spiders from Borneo and Singapore. **Proceedings of the Zoological Society of London** **2**: 230-284.
- SHELFORD, R.W.C. 1916. **A Naturalist in Borneo**. London, T. Fisher Unwin Ltd., 331 p.
- TORRES, R.F. 2000. **Estudos de casos de mimetismo em insetos nos Mananciais da Serra, Piraquara, PR**. MSc thesis, Universidade Federal do Paraná, Curitiba, 59 p.
- VANE-WRIGHT, R.I. 1980. On the definition of mimicry. **Biological Journal of Linnean Society** **13**: 1-6.
- WALLACE, A.R. 1867. Mimicry and other protective resemblances among animals. **Westminster and Foreign Quarterly Review** **32**: 1-43
- WALLACE, A.R. 1889. **Darwinism – an exposition of the theory of natural selection with some of its**

applications. 2 ed. London, MacMillan and Co., 494 p.

WICKLER, W. 1968. **Mimicry in animals and plants.** London, Weidenfeld and Nicholson, 255 p.

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