Scientific Note: *Ficus benjamina* L. (Moraceae): a new exotic food plant for the *Eucereon sylvius* group (Lepidoptera: Erebidae) in Alagoas, Brazil

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Abstract: Despite a rich diversity of native Brazilian *Ficus* spp. (Moraceae) in the Amazon and the Atlantic forests, there are numerous non-native *Ficus* species that are raised or grown in public and private gardens that are consumed by phytophagous insects as host plants. These exotic plants can contribute to the persistence of native insect communities which are adapting to intensely modified environments. This study reports the exotic tree *Ficus benjamina* L. as the first host plant record for larvae of tiger moths of the *Eucereon sylvius* (Stoll, 1790) group.

Key words: food plant, immature stages, life history.

INTRODUCTION

The plant genus *Ficus* Linnaeus is one of 40 genera in the family Moraceae, and it is distributed mainly in tropical and subtropical regions of the world and is used extensively as medicinal plants by indigenous people (Rhaman & Khanom, 2013). There are about 850 species of woody trees, shrubs, and vines within the genus. In some countries, like Uganda, plants may be used for multiple purposes, including traditional medicine, fruits as fresh or dried food, and leaves as fodder for domestic animals (Ipulet, 2007). Despite the abundance of native Brazilian *Ficus* species in the Amazon and the Atlantic forests, several non-native *Ficus* species, such as *Ficus pumila* L. (creeping fig or climbing fig), *Ficus benjamina* L. (weeping fig or benjamin fig), *Ficus elastica* Roxb. (Indian rubber fig), and *Ficus retusa* L., are raised or grown in public and private gardens.

The native entomofauna associated with *Ficus* species is highly diverse. Misfud *et al.* (2012) found 39 arthropod species on different *Ficus* trees in the Maltese Islands. The phytophagous insect community includes mainly leaf-chewing insects (e.g., Orthoptera, Coleoptera and Lepidoptera) and sap-sucking insects (e.g., Thysanoptera, Auchenorrhyncha: scales and mealy bugs) (Williams, 2010; Misfud *et al*., 2012). Among them, the lepidopteran larvae which use *Ficus* as their host plant spend most of their immature stage development on and utilise *Ficus* trees as their main source of food. Records of new host plant associations and geographic range extensions remain important in the study of insect ecology, including Lepidoptera (Donahue, 1993). Knowledge of these associations in urban environments (intra- and peri-urban) may have biological and economic importance because certain plants, even non-native plants, can contribute to the preservation of native insects in response to anthropogenic habitat alteration and climate change.

This paper describes the first record of a Neotropical tiger moth species of the *Eucereon sylvius* (Stoll,1790) group (Erebidae: Arctiinae) on an exotic *Ficus* species in the intra-urban area of Maceió (Alagoas, Brazil), close to remnants of Atlantic Forest belonging to the Pernambuco Endemism Center (CEPE, Centro de Endemismo Pernambuco) (Pontes *et al.*, 2007; Nemésio & Santos-Junior, 2014).

MATERIALS AND METHODS

On 31 May 2019, the first author found one egg on the adaxial surface of a terminal leaf of *Ficus* sp. in Feitosa District (9°37'48"S, 35°43'36"W), an urban area located in the municipality of Maceió, Alagoas, in northeastern Brazil. The leaf containing the egg was taken to the Insect Bioecology Laboratory (LABIN, Laboratório de Bioecologia de Insetos), Campus A. C. Simões of Federal University of Alagoas (UFAL, Universidade Federal de Alagoas), for further examination under stereomicroscope before being placed in a capped container (100 mL) over a piece of humid paper towel covering the base. The container was labeled (to record the date of eclosion, ecdysis, feeding records, pupation, and adult emergence) and kept at a temperature ranging daily from 23.3°C to 25.5°C and relative humidity of 61.2% to 76.8%.

After hatching the larva was fed on fresh leaves of the host plant, which was replenished every two days in the early larval instars, and once a day at the last instar. The container was cleaned daily with 70% ethanol. During the fifth instar, the larva was transferred to a larger container, a so-called bernadete-cage (Lima & Carvalho, 2017), where it stopped feeding (prepupa)

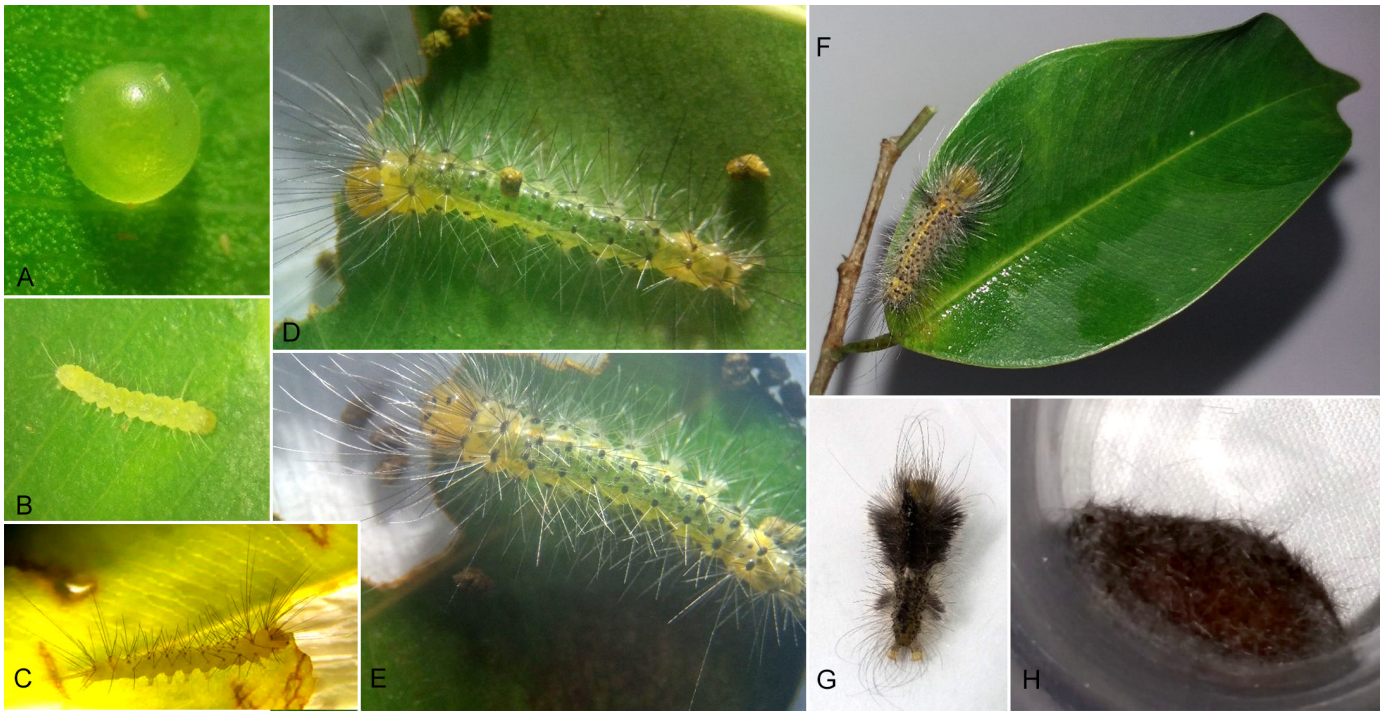

Figure 1: Immature stages of a species of the *Eucereon sylvius* (Stoll, 1790) group (Lepidoptera: Erebidae: Arctiinae) on *Ficus benjamina* L. (Moraceae) leaves: **A.** Egg laid on the adaxial surface of a terminal leaf; **B.** First instar larva; **C.** Second instar; **D.** Third instar; **E.** Fourth instar; **F.** Fifth instar on adaxial surface; **G.** Sixth instar; **H.** Cocoon surrounded by larval exuvial bristles fixed on the inner surface of the upper side of the bernadete-cage (Lima & Carvalho, 2017).

and then pupated. Larval development was recorded with a Leica EZ4 Stereo-Microscope. Immediately after eclosion and sclerotization of the integument, the adult was frozen, before being pinned and deposited at the LABIN Entomological Collection. Exsiccated tissue from the host plant was deposited in the MAC Herbarium of the Environment Institute of Alagoas (IMA, Instituto do Meio Ambiente do Estado de Alagoas).

RESULTS AND DISCUSSION

The plant species was identified as *Ficus benjamina* L. (Moraceae) (MAC 65224) (syn.: *Ficus comosa* Roxb.; *F. nitida* Thunb.; *F. nuda* (Miq.) Miq. (Lorenzo-Cáceres, 2016)), an exotic species originally from Asia, northern Australia and Pacific islands, which is grown in urban and private gardens as well as indoors (Lorenzo-Cáceres, 2016). Although one of the most common plants in Brazilian urban areas, this plant causes serious problems when planted in the vicinity of buildings as it damages sidewalks and waterways and sewage pipes, due to the aggressiveness of its root system (Rocha *et al*., 2004; Castro *et al*., 2012). Despite these significant problems, Reschke *et al.* (2007) found that chemical compounds extracted from *F. benjamina* have high antibacterial activity, while another study showed some extracted compounds from the leaves have high antiviral activity (Yarmolinsky *et al.*, 2012).

The yellowish egg (Fig.1A) turned dark before larval hatching. The postembryonic stages (larval + pupal) lasted 42 days, with six larval instars: first, second and the fourth (L1, L2, L4) four days each (Figs. 1B, 1C, 1E); the third and the last instar (L3, L6) seven days each (Figs. 1D, 1G); fifth (L5), five days (Fig. 1F); and an 11-day pupal stage (Fig. 1H) protected by a cocoon. The adult moth was identified as a member of the *Eucereon sylvius* (Stoll, 1790) group (Erebidae: Arctiinae) (Fig. 2) based on the external features described and illustrated by Stoll (1790) in the original description. However, one reviewer of this paper (pers. comm.) noted that the *Eucereon sylvius* group is a species complex that contains at least seven species, of which two are presently undescribed. The type locality of *sylvius* (Suriname) lies almost 3,000 km from Alagoas, while in southeastern Brazil there are two species, *E. chalcodon* Druce,

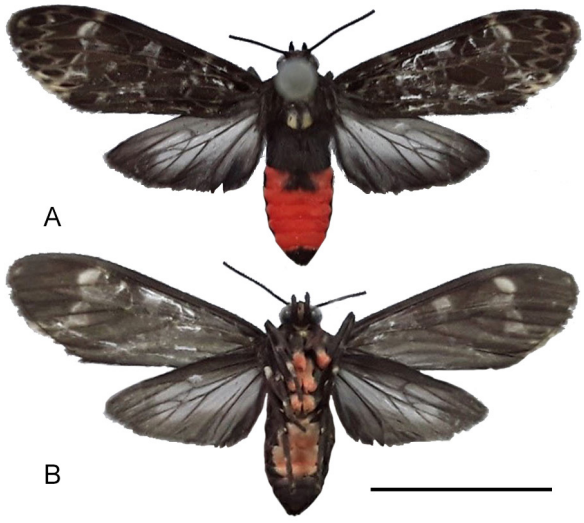

Figure 2: Adult female of *Eucereon sylvius* (Stoll, 1790) group (Lepidoptera: Erebidae: Arctiinae). Scale bar 1 cm, wingspan: 3.3 cm: **A.** Dorsal view; **B.** Ventral view.

1893, and one undescribed species. *Eucereon chalcodon* can be easily identified based on its very distinct habitus, but the undescribed species seems very similar to our reared specimen (reviewer, pers. comm.). As a result, further resolution of the specific identification of our reared specimen is not possible at this time.

The genus *Eucereon* Hübner, 1819 includes over 70 known species and several undescribed ones from Neotropics (e.g., Janzen & Hallwachs, 2009). *Eucereon sylvius* has already been reported feeding on leaves of many species of *Ficus* during its larval stages (Travassos, 1959; Robinson *et al.*, 2010), but feeding on an exotic *Ficus* such as *F. benjamina* has not been reported for the species complex. *Eucereon sylvius* occurs in three major Brazilian biomes: Amazon Rainforest, Atlantic Forest and Cerrado (Fig. 3). Among them, Atlantic Forest and Cerrado represent two of the world's 25 biodiversity hotspots (Myers *et al.*, 2000). According to Travassos (1959), *Eucereon sylvius* (potentially including multiple similar species) occurs from the Guianas to Paraná, Brazil. In Brazil, the species complex is known from Acre, Amazonas, Bahia, Goiás, Mato Grosso, Minas Gerais, Pará, Paraná, Rio de Janeiro and São Paulo (Zerny, 1931; Travassos, 1959; Ferro & Diniz, 2007; Teston & Correa, 2015; Moreno *et al.*, 2015 Nascimento *et al.*, 2016; Teston *et al.*, 2019). Therefore, our record is the first for Alagoas, Brazil (Fig. 3).

CONCLUSIONS

Our captive rearing study that successfully resulted in an adult supports the feasibility of the exotic plant *F. benjamina* as a host plant for *Eucereon sylvius* in urban environments. Despite work on the higher classification of tiger moths (e.g., Kristensen *et al.*, 2007; Zahiri *et al.*, 2012; Pinheiro & Duarte, 2013; Mitter *et al.*,2016), our understanding of their life cycle and biology is still unfortunately in its infancy. We need to understand not only the life cycle of the moth and how it is affected by host plant quality and by weather, but also how the host plant is affected by weather and by the moth (Sören, 2001). Moreover, the genus *Eucereon* requires taxonomic revision and biogeographical study to clarify species diversity and distributions. The host plants of species such as those of the genus *Eucereon* that are native to the Atlantic Forest Pernambuco Endemism Center, are believed to be one of the most important limiting resources that shape adaptive life histories.

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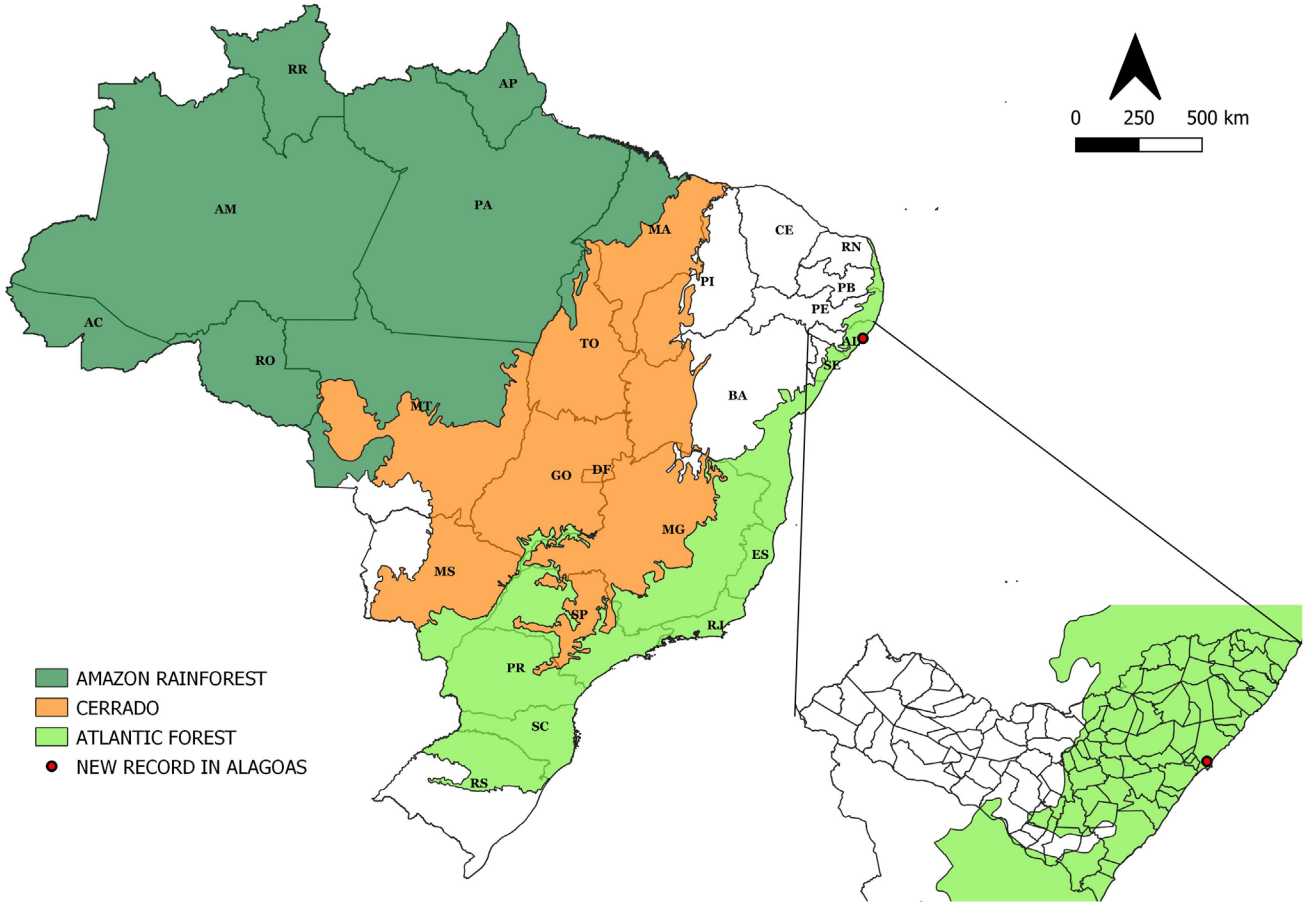

Figure 3: Three biomes where the *Eucereon sylvius* (Stoll, 1790) group (Lepidoptera: Erebidae: Arctiinae) occurs in Brazil and the new distributional record reported here in Alagoas. Brazilian states acronyms follow the official Brazilian list (https://atendimento.tecnospeed.com.br/hc/pt-br/articles/360021494734-Tabela-de-C%C3%B3digo-de-UF-do-IBGE).

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LITERATURE CITED

Castro, A. L., Bertoldo, L., Vale, M. 2012. Análise do paisagismo arbóreo urbano em malhas viárias dos bairros Vila Valença e Vila Margarida situados no município de São Vicente. *Revista Ceciliana* 4(2): 1-8.

Donahue, J. P. 1993. Six species of tiger moths (Arctiidae: Lithosiinae: Ctenuchinae) new to the United States fauna, with notes on their nomenclature and distribution in middle America. *Journal of the Lepidopterists' Society* 43(3): 199-210.

Ferro, V. G., Diniz, I. R. 2007. Composição de espécies de Arctiidae (Insecta: Lepidoptera) em áreas de Cerrado. *Revista Brasileira de Zoologia* 24(3): 635-646.

Ipulet, P. 2007. Uses of genus *Ficus* in Buganda region, central Uganda. *African Journal of Ecology* 45(3): 44-47.

Janzen, D. H., Hallwachs, W. 2009: *Dynamic database for an inventory of the macrocaterpillar fauna*, *and its food plants and parasitoids*, *of Area de Conservacion Guanacaste (ACG)*, *northwestern Costa Rica (nn-SRNP-nnnnn voucher codes)*. http://janzen.sas.upenn.edu (accessed March 2021).

Kristensen, N. P., Scoble, M. J., Karsholt, O. 2007. Lepidoptera phylogeny and systematics: the state of inventorying moth and butterfly diversity. *Zootaxa* 1668(1): 699-747.

Lima, I. M. M., Carvalho, M. B. 2017. Garrafas pet como alternativa para a confecção de recipientes para criação de insetos em laboratório. *Ciência Agrícola* 15(1): 79-86.

Lorenzo-Cáceres, J. M. S. 2016. *Ficus benjamina* L. Mant. Pl. 129 (1767). www.arbolesornamentales.es (accessed December 2020).

Mifsud, D., Falzon, A., Malumphy, C., Lillo, E., Porcelli, F., Vovlas, N. 2012. On some arthropods associated with *Ficus* species (Moraceae) in the Maltese islands. *Bulletin of the Entomological Society of Malta* 5: 5-34.

Mitter, C., Davis, D. R., Cummings, M. P. 2016. Phylogeny and Evolution of Lepidoptera. *Annual Review of Entomology* 31: 24-46.

Moreno, C., Magalhães, F. C., Rezende, L. H. G., Neves, K., Ferro, V. G. 2015. Riqueza e composição de Arctiinae (Lepidoptera: Erebidae) em cincos Unidades de Conservação do Cerrado. *Iheringia*, *Série Zoológica* 105(3): 297-306.

Myers, N., Mittermeier, R. A., Mittermeier, C. G., Fonseca, G. A. B., Kent, J. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403: 853-858.

Nascimento, M. S., Ferro, V. G., Monteiro, R. F. 2016. Arctiinae (Lepidoptera: Erebidae) in the State of Rio de Janeiro, Brazil. *Biota Neotropica* 16(2): 1-22.

Nemésio, A., Santos-Junior, J. E. 2014. Is the "Centro de Endemismo Pernambuco" a biodiversity hotspot for orchid bees? *Brazilian Journal of Biology* 74 (3):78-92.

Pinheiro, L. R., Duarte, M. 2013. Taxonomic notes on Ctenuchina, Euchromiina, and Phaegopterina (Lepidoptera, Erebidae, Arctiinae, Arctiini). *Florida Entomologist* 96(2): 351-359.

Pontes, A. R. M., Normande, I. C., Fernandes, A. C. A., Rosas Ribeiro, P. F., Soares, M. L. 2007. Fragmentation causes rarity in common marmosets in the Atlantic Forest of northeastern Brazil. *Biodiversity and Conservation* 16: 1175-1182.

Rahman, A. H. M., Khanom, A. 2013. A taxonomic and ethno-medicinal study of species from Moraceae (Mulberry) family in Bangladesh Flora. *Research in Plants Sciences* 1(3): 53-57.

Reschke, A., Marques, L. M., Mayworm, M. A. S. 2007. Atividade antibacteriana de Ficus benjamina L. (Moraceae). *Revista Brasileira de Plantas Medicinais* 9(2): 67-70.

Robinson, G. S., Ackery, P. R., Kitching, I. J., Beccaloni, G. W., Hernández, L. M. 2010: *HOSTS - A Database of the World's Lepidopteran Hostplants. Natural History Museum*, *London*. http://www.nhm.ac.uk/hosts (accessed March 2021).

Rocha, T., Leles, P. S. S., Oliveira Neto, S. N. 2004. Arborização de vias públicas em Nova Iguaçu, RJ: o caso dos bairros Rancho novo e centro. *Sociedade de Investigações Florestais* 28(4): 599-607.

Sören, N. 2001. Life history perspectives on pest insects: What's the use? *Austral Ecology* 26(5): 507-517.

Stoll, **C.** 1787-1791. *Aanhangsel van het Werk*, *De uitlandsche Kapellen: voorkomende in de drie Waereld-Deelen Asia*, *Africa en America*, *door den Heere Pieter Cramer*, *vervattende naauwkeurige afbeeldingen van surinaamsche rupsen en poppen; als mede van veele zeldzaame en nieuwe ontdekte uitlandische dag- en nagt-kapellen*. Amsteldam, Chez Nic. Th. Gravius. 384 pp.

Teston, J. A., Correa, C. V. 2015. The Arctiini (Lepidoptera: Erebidae: Arctiinae) fauna of Serra do Pardo National Park, Pará, Brazil. *Check List* 11(2): 1-9.

Teston, J. A., Abreu, D. S., Ferro, V. G. 2019. Arctiini Leach, [1815] (Lepidoptera: Erebidae: Arctiinae) of the Brazilian Amazon. III- Subtribe Ctenuchina Kirby, 1837. *Biota Neotropica* 19(2): 1-19.

Travassos, L. 1959. Contribuição ao conhecimento dos Arctiidae. XLII. Gênero *Eucereon* Hübner, 1819 (Lepidoptera, Heterocera). *Memórias do Instituto Oswaldo Cruz* 57(2): 171-190.

Williams, M. 2010. Annotated list of the scale insects of Guatemala. *Entomologia Hellenica* 19(2): 144-152.

Yarmolinsky, L., Huleihel, M., Zaccai, M., Ben-Shabat, S. 2012. Potent antiviral flavone glycosides from *Ficus benjamina* leaves. *Fitoterapia* 83: 362-367.

Zahiri, R., Holloway, J. D., Kitching, I. J., Lafontaine, D., Mutanen, M., Wahlberg, N. 2012. Molecular phylogenetics of Erebidae (Lepidoptera, Noctuoidea). *Systematic Entomology* 37: 102-124.

Zerny, H. 1931. Ergebnisse einer zoologischen sammelreise nach Brasilien, insbesondere in das Amazonasgebiet, ausgeführt von Dr. H. Zerny. VII. Teil. Lepidoptera III: Die Syntomiden des Staates Pará. *Annalen Des Naturhistorischen Museums in Wien* 45(1): 225-263.