Annals of the V Symposium on the Biology of Gall Inducing Arthropods

August 9-14, 2009

Serra Do Cipó, Minas Gerais, Brazil

Index

ORAL PRESENTATION

MONDAY - AUGUST 10, 2009

SECTION 1: SPATIAL ECOLOGY AND BIODIVERSITY

LARGE VARIATIONS OVER LARGE SCALES: SPATIAL DISTRIBUTION OF GALLS ON A SCRUB OAK SPECIES

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Several studies have attempted to understand patterns of animal and plant species distribution at the landscape scale. In this study, we examined the community structure of gall-formers occurring in the scrub oak *Quercus myrtifolia* by sampling the complete distributional range of this plant species and examining gall richness and abundance over its whole distribution. Gall richness and abundance as well as plant quality effects were evaluated for 40 sites in Florida, covering 17,000 km^2 and the whole distribution of the plant. Spatially structured models were used to determine the effects of spatial location on community structure and on the bottom-up effects examined (tannin concentration, foliar nitrogen and soil nitrogen). A total of 24 gall species was found in all sites combined. Coastal and inland sites did not differ in gall richness (mean richness coastal sites: 8.9±0.77; mean richness inland sites: 8.3±0.75), but gall abundance was significantly higher in coastal compared to inland sites ($F_{1,38}$=4.88, P=0.033). Sites did not differ in tannin concentration, the amounts of foliar nitrogen or nitrogen in the soil (all P>0.05) indicating that these bottom-up factors do not explain the local spatial structure found for the gall-former community. Correlograms constructed for the richness and abundance data indicated no spatial structure for gall-formers over the range. Our results suggest that spatial location could not be used as a predictor of gall community structure and other abiotic and biotic factors might be more important in determining the number of gall species in a host plant at the landscape scale. (FAPEMIG/CNPq)

KEY WORDS: spatial location, gall richness, gall abundance, myrtle oak, plant quality.

AUSTRALIAN GALL-FORMING CECIDOMYIIDAE – DIVERSITY, HOST TRENDS AND ECOLOGY. NEW PERSPECTIVES FROM A LITTLE KNOWN FAUNA

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The Australian flora and fauna has evolved in relative isolation since the separation of Gondwana around 167 million years ago. High levels of endemism and species richness characterize the Australian biota which often displays strong regional patterns in the distribution of biodiversity. Until recently, Australian Cecidomyiidae has received limited attention from a range of disciplines. Recent emphasis on the collection and description of gall-forming Cecidomyiidae allow the formation of continental perspectives on distribution, taxonomic composition, host relations, and modes of feeding. Despite a rich and diverse flora, Australian gall-forming Cecidomyiidae are relatively depauperate and show no clear patterns of association with major modern day plant families and genera. Australia's largest plant genus *Acacia* supports a rich fauna, but *Eucalyptus* with an equally diverse flora, supports relatively few gall-forming Cecidomyiidae. The patterns of distribution and taxonomic affinities of the Australian gall-forming Cecidomyiidae and the ecological factors that may have shaped the Australian midge fauna are discussed.

KEY WORDS: Australia, Cecidomyiidae, gall-forming, midges, diversity.

POPULATION DECLINE OF PSEUDASPHONDYLIA NEOLITSEAE (DIPTERA: CECIDOMYIIDAE) ON MIYAKE ISLAND, JAPAN, DUE TO VOLCANIC ERUPTIONS OF MOUNT OYAMA AND ASYNCHRONY WITH HOST PLANT PHENOLOGY, POSSIBLY RELATED TO GLOBAL WARMING

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Pseudasphondylia neolitseae induces leaf galls on *Neolitsea sericea* (Lauraceae). An earlier study reported that almost all host trees were galled by *P. neolitseae* in high elevation sites (>250m asl.), whereas no trees were galled in low elevation sites of Miyake Island, Japan in the late 1970's. In 2000, Mount Oyama on Miyake erupted and vegetative areas were damaged, particularly in high elevation sites. In addition to the volcanic activities, recent global warming may have influenced the population dynamics of *P. neolitseae* because a asynchrony between host phenology and short-lived herbivores might affect their survival rate. To examine the influences of volcanic activities and global warming on *P. neolitseae* population, we surveyed in 2009 the distribution pattern, density, and survival rate of *P. neolitseae* and the host budburst phenology. No trees were galled by *P. neolitseae* in low elevation sites, and only 1.9% of trees were galled in high elevation sites. Although many galls were found in the late 1970's at the southern sides of Mount Oyama, *N. sericea* and *P. neolitseae* in these sides have become extinct by 2009 due to volcanic activities. In high elevation sites, most host buds were already extended beyond the length suitable for oviposition of *P. neolitseae* before adult emergence in 2009. This asynchrony is possibly related to global warming and restricts habitats of *P. neolitseae* to hosts with late budburst phenology. A hymenopteran ectoparasitoid (*Bracon tamabae*) heavily attacked the gall midge, and the parasitism probably has caused the decline of *P. neolitseae* population on Miyake.

KEY WORDS: Plant–herbivore interaction, parasitoid, phenology, population density, volcanic island.

METACOMMUNITY DYNAMICS OF GALLERS AND LEAF MINERS ON OAK

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Metacommunity theory predicts that local communities are shaped by the interplay between local dynamics and regional processes. In this presentation, I will focus on the relative importance of different factors in structuring a specialist insect community on the pedunculate oak (*Quercus robur*) in Finland. We first experimentally assessed the relative strength of local factors, including direct competition for resources, indirect competition mediated by the host plant, apparent competition mediated by parasitoids, and the effect of host plant genotype and local adaptation. Further, using potted oak trees distributed in the field, we quantified the dispersal ability of each herbivore species. We then combined our experimental results with observational data from our long-term survey of the herbivore community on the island of Wattkast. On this island, all oak trees have been mapped (n=1868) and are patchily distributed, allowing for a spatially explicit analysis of the insect community dynamics. Based on our observational and experimental data, we fitted a spatially explicit metacommunity model, which points at a major role for landscape context in structuring a community of gallers and leaf miners in a natural setting.

KEY WORDS: metacommunity, spatial connectivity, local dynamics, host plant genotype, dispersal

INVASIVE WASP GONE WILD? - ORIGIN AND DISPERSERSION OF ERYTHRINA EULOPHID WASP QUADRASTICHUS ERYTHRINAE BASED ON GENETIC DIFFERENTIATION

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A recently emerged invasive wasp, *Quadrastichus erythrinae* (Hymenoptera: Eulophidae), has brought great disaster to the *Erythrina* trees in tropical and subtropical Pacific basin since its discovery at Mauritius and Réunion in year 2000. The wasp form galls on the leaves and young shoots which caused severe damages and eventually killed the tree. Various degrees of damages and different symptoms have been observed in different host species. Besides, the spread seems to be chronically and spatially progressive from the west of Indian Ocean islands toward east to pacific islands. While African origin of the pest has been presumed and recent discovery of other three *Qudrastichus* species and the survey of various host susceptibility reinforced the assumption, test of this “Out of Africa” hypothesis is necessary. We analyzed 16 populations of *Q*. *erythrinae* from various locations across its range, west from South Africa and east to Hawaii. Both mitochondrial genes (12S ribosomal RNA and cytochrome oxidase I) and the nuclear sequence of intergenic spacer 2 were analyzed. While many haplotypes existed in Africa, little variation was found among the samples from other regions. The homogeneity of the genetic composition suggests that the pests from the countries outside Africa came from the same monomorphic genotype which quickly and widely spread to other areas. “Out of Africa” hypothesis is supported and the possible origin of this widely spread invasive pest is discussed.

KEY WORDS: invasive insect, *Quadrastichus erythrinae*, *Erythrina*, dispersal, phylogeography

DOES THE GLOBAL WARMING EXPAND THE HOME RANGE OF AN INVASIVE GALLING WASP (QUADRASTICHUS ERYTHRINAE)?

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Species invasion were becoming more frequent as a result of intensifying intercontinental transportations. However, global climate change could worsen the situation. Global warming is likely to allow range expansion of invasive species from tropics, such as a newly invasive galling wasp - *Quadrastichus erythrinae*, which forms galls and causes severe damages on coral trees (*Erythrina* spp.) and was first described in 2004. It quickly expanded and caused massive host mortalities in affected areas. In this study, we used a niche modelling method to predict range changes of *Q. erythrinae* under the double pre-industrial CO_2 concentration scenario. Changes on the species' range size were calculated and influences of environmental factors were compared. Our result suggests that annual rainfall is the most influential factor to the distribution of *Q. erythrinae*. Models indicated an overall invasion risk of *Q. erythrinae* for tropical and subtropical areas and a trend of polarward expansion under the climate change scenario. Furthermore, its distribution would possibly ascend along altitudes and penetrate into mountain areas, such as Himalayas and central Borneo. Our results suggest risks associated with invasive *Q. erythrinae* will likely become more intensive under further climate change impacts, not only for areas where *Q. erythrinae* had been reported but also for regions where it has opportunities to establish populations.

KEY WORDS: global climate change, species distribution model, niche modelling, demography, spatial structure.

DIVERSITY OF GALL-INDUCING INSECTS IN THE TROPICAL DRY FORESTS (CAATINGA) OF PERNAMBUCO

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The Caatinga, a Brazilian seasonally dry tropical forest, is the fourth largest and the only exclusive ecosystem in Brazil. Despite its great biological importance, the Caatinga is known for a lack of studies in the most diverse fields of the science. This research was carried out along seven months in seven private areas (cities of Alagoinha, Custódia, Pombos, Bodocó, Serrita, Pesqueira, Salgueiro and Parnamirim), in Vale do Catimbau National Park, in the ecological station of Universidade Federal Rural de Pernambuco and in one ecological station of Instituto Agronômico de Pernambuco. In each site, two researchers sampled galling insect richness for three hours. All plant organs were investigated and each gall and host plants found were collected, packed in plastic bags, and then taken to a laboratory for photographic registration and description of the external morphology. Host plants were classified into morphospecies in the field, and later at the species level in the in the Herbarium UFPE following APG II classification. We recorded 64 different types of galls collected primarily from leaves and stems of 48 species of host plants belonging to 17 families and 31 genera. The most common gall morphological types were spheroid and discoid, glabrous, predominantly green and with one chamber, while the main gall inducing taxon was the Cecidomyiidae (Diptera). This is the first study on galling insect richness done in the Caatinga and constitutes a unique data set that reinforce the need to survey tropical dry forests to better comprehend gall-forming insect distribution patterns.

KEYWORDS: Cecidomyiidae, host plants, insect galls, insect herbivore, species richness.

Acknowledgments We thank the support provided by DCR-FACEPE/CNPq (DCR-0087-2.05/06, APQ-0008-2.05/07)

ARTHROPOD GALL DIVERSITY IN THE SOUTHERN REGION OF THE ATLANTIC FOREST, BRAZIL

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Vegetation within a biome can change dramatically due to differences in environmental conditions; galling arthropods are expected to strongly respond to this. Human interference can also affect diversity depending on kind and amount of disturbance. We describe galling arthropod diversity patterns in two vegetation types within the Atlantic Forest biome, a biodiversity hotspot. In southern Brazil, this biome has distinct phytophisiognomies, as Araucaria forest (AF) at higher altitudes and subtropical rainforest (SR) at intermediate ones. Two close by preserved sites represent vegetation types (AF: São Francisco de Paula town, SR: Barra do Ouro town, Rio Grande do Sul state) with 6 trails each, covering 3 levels of human disturbance (low to high). Trails were repeatedly traversed searching for galls during 1h30min across one year. The number of galled plant individuals was used as an abundance measure. Diversity was compared for gall species richness, abundance and equitability, tested with MANOVA. Both vegetation type and disturbance were significant factors for species richness and equitability. AF was richer in galls than SR, unexpectedly, since the former is colder and a slightly less diverse vegetation type. Higher human disturbance lead to lower galling richness, as expected. Gall assemblages in SR had higher equitabilities (less dominance by a species) than AF, but no differences appeared for disturbance – disagreeing with the usual view. Gall diversity is commonly found to differ between vegetation types, even nearby ones, but human disturbance on native vegetation is of clear importance for galling diversity studies, although rarely addressed.

KEYWORDS: vegetation, disturbance, species richness, abundance, equitability.

TUESDAY - AUGUST 11, 2009

SECTION 1: SPATIAL ECOLOGY AND BIODIVERSITY

EXTINCTIONS OF MONOPHAGOUS INSECTS ON BIODIVERSITY HOTSPOTS.

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Biodiversity hotspots are decreasing in area due to habitat loss, threatening the existence of a large number of plants and vertebrates. In this study, it is recognized that monophagous insects, such as galling insects, can be expected to be particularly susceptible to habitat loss since in order to survive they depend on the existence of a single host plant. Here, I estimated the number of monophages that live in 34 biodiversity hotspots and the number committed to extinction because of habitat loss. Such estimates were based on species–host area equations, parameterized with data from the literature and interviews with botanical experts. I calculated that 213,830 to 547,500 monophagous species are committed to extinction in biodiversity hotspots because of the reduction of the geographic range size of their endemic hosts. To face such mass extinction of insect herbivores, one must expand the coverage of the network of protected areas and improve the richness of native plants on private lands.

KEY WORDS: biodiversity hotspots, extinction, habitat loss, monophages, insects.

UNTANGLING THE DRIVERS OF GALLING SPECIES DISTRIBUTION PATTERNS: THE IMPORTANCE OF THE SUPER HOSTS

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One of the most famous ecological patterns is the relationship between species richness and altitude. Species richness along altitudinal gradients patterns has been already described but few efforts were done on the development of general theories to explain this subject. Galling species richness is higher at intermediate latitudes on warm habitats with sclerophyllous vegetation, under water or nutrient stresses. Along altitudinal gradients, galling species richness was explained by environmental harshness habitat. My aim was to explore the relationships between galling species richness and latitude, altitude, and host plant species. Through the Espinhaço Range, six regions were selected. There were 10 sample areas in each region, with a total of sixty points of collection through an altitudinal gradient of 1.172m of extension. In each site, 100 shrubs, 1.000 plants in each region, in a total amount of 6.000 plants were collected. To answers question two statistical approaches are used in model selection, tests of significant correlations based on linear and multiple regression analyses, and an information theoretic approach (Akaike`s information criterion). We found 241 gall morphotypes on 142 host plant species belonging to 29 families. The plant family (genera) which supported the higher number of galls was Asteraceae (*Baccharis, Vernonia*) and Malpighiaceae (*Byrsonima*). Galling species richness was not influenced by latitude and altitude, but was positively correlated to host plant species. However, no correlation was found between the number of galls and the host plant density or taxonomy composition plant within an area. Our data corroborate previous studies on the relation between galling species richness and host plant species. In this study, *Baccharis,* and other Asteraceae genera supported the highest level of galling-insect richness in rupestrian fields. These 'super-host plants' would drive galling species richness along altitudinal gradients, independently to other factors. (FAPEMIG/CNPq)

KEY WORDS: Host plants, insect galls, insect herbivore, rupestrian fields, species richness. (Financial support -FAPEMIG CRA 2893/98)

BEYOND SCLEROPHYLLY: HOST RELIABILITY AND GALL SURVIVORSHIP

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Several studies have shown that leaf sclerophylly is a major mechanism driving galling species distribution. However, the correlation between leaf hardness and galls may not represent cause-effect, as sclerophylly may itself be related to other causes. Our general hypothesis is that environmental stress, in addition to promoting schlerophylly and creating enemy free spaces, suppresses three important host plant defenses against endophagous insects: (i) *hypersensitivity reaction;* (ii) *damage induced leaf abscission;* (iii) *fast leaf turnover*. The basic assumption is that plants growing in harsh environments, having more costly leaves (in face of the old dilemma of growth vs. defense) would be compelled towards the maintenance of their leaves at the expense of tolerating galling herbivores. Various studies support the contention that leaf lifespan is longer in plants growing under lower nutrient and water availability. Since galling larvae cannot move from one host to another they depend on the temporal stability of their host leaves to complete development. Thus, galls would show higher incidence in such costly long-lasting leaves, which are the most reliable for larvae development. Deciduous and semi-deciduous plants have longer leaf life spans, as leaves are simultaneously produced at the beginning of the growing season without later production. By the other hand, evergreen species have shorter leaf lifespan, shedding and producing leaves continuously in time. Besides faster leaf turnover, such strategy allows for selective abscission in response to attack. Thus, we expected to find more galls in deciduous and semi-deciduous trees than in evergreens. We performed a bibliographic review of leaf ecological traits for galling host trees from three different Brazilian ecosystems: Atlantic Rainforest, Cerrado and Seasonally Dry Forest. Out of 44 host trees revised, 21 were deciduous, 20 semi-deciduous and only 3 were evergreen (Atlantic Rainforest: 8 deciduous, 3 semi-deciduous, 1 evergreen; Cerrado: 8 deciduous, 5 semi-deciduous, 2 evergreen; Dry Forest: 5 deciduous, 12 semi-deciduous). The Jaccard index indicated only 2.32% of similarity of host species between vegetation formations. The results support our general hypothesis that galls present higher incidence where they can safely

develop without the risk of leaf abscission, tissue necrosis or attack by natural enemies, in a scenario marked by strong environmental stresses. (FAPEMIG/CNPq)

KEY WORDS: Insect galls, hypersensitivity, abscission, leaf lifespan, deciduous plants

DIVERSITY OF GALL-INDUCING INSECTS IN THE ATLANTIC FORESTS OF PERNAMBUCO, NORTHEASTERN BRAZIL

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Despite the great biological importance of Atlantic Forest of northeast Brazil, ecological studies on insects in this ecosystem located up north of the São Francisco River are scarce. This research was conducted along seven months in six different fragments of Atlantic Forest of Pernambuco state, Brazil: Reserva Ecológica de Saltinho, Parque Dois Irmãos, Reserva Ecológica de Carnijó, Reserva de Dois Lagos, Refúgio Ecológico Charles Darwin and Engenho Monjolo, and reports for the first time the richness of galling insects of Pernambuco's Atlantic forest. In each site, two researchers sampled galling insect richness for three hours. All plant organs were investigated and each gall and host plants found were collected, packed in plastic bags, and then taken to a laboratory for photographic registration and description of the external morphology. Host plants were classified into morphospecies in the field, and later at the species level in the in the Herbarium UFPE following APG II classification. We found 136 morphologically distinct types of insect galls in the Atlantic forests of Pernambuco. These galls were found in 79 species of host plants from 35 families and 53 genera**.** The most representative host families were: Myrtaceae, Polygonaceae and Melastomataceae. The most common gall morphological types were globoid and elliptical, predominantly green and with one chamber, and on the leaves. The main gall inducing taxon was the Cecidomyiidae (Diptera). This study represents the first contribution on the knowledge about galling insects guild distribution and diversity in the Atlantic forest of northeast Brazil.

Keywords: insect galls, species richness, Cecidomyiidae, insect herbivory, host plants.

Acknowledgments We thank the support provided by DCR-FACEPE/CNPq (DCR-0087-2.05/06, APQ-0008-2.05/07)

COMPARATIVE LIFE HISTORY AND ECOLOGY OF GALL-INDUCING AND FREE-FEEDING INSECTS IN TEMPERATE AND TROPICAL LATITUDES

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The Phylogenetic Constraints Hypothesis argues that plesiomorphic traits in lineages influence the ecology of species. Focus is on the body plan of females and how they lay their eggs. Females with ovipositors adapted for ovipositing into plant tissues evolved with coordinated behaviors which enable exact placement of eggs on or in plant resources, which maximizes larval survival: a strong female ovipositional preference and larval performance correlation evolves. Usually vigorously-growing plant tissues are favorable for oviposition supporting the Plant Vigor Hypothesis. Some free-feeding insect herbivores and most gall-inducing species fit this pattern, which is observed in temperate and tropical latitudes. Examples are provided in which distribution, abundance, and population dynamics are influenced by these close and specialized plant-herbivore relationships. High quality resources are limiting, and populations are usually at low density and in high quality patches on the landscape. Latent populations and patchy distributions result. In contrast, many free-feeding insect herbivores illustrate little or no female ovipositional preference and larval performance linkage. Some have no ovipositor, such as moths, and others oviposit into soil, such as short-horned grasshoppers, and are therefore unable to evaluate host-plant quality relevant to the immature insects' requirements. When females are unselective, immatures evolve to be generalist feeders, making the carrying capacity of the environment high, with eruptive dynamics possible, which cause serious damage to vegetation. This scenario is evident in temperate and tropical latitudes.

KEY WORDS: female body plan, latent and eruptive species, phylogenetic constraints hypothesis, plant vigor hypothesis, temperate and tropical comparisons.

SECTION 2: HOST RELATIONSHIP AND TRI-TROPHIC INTERACTION

QUANTITATIVE ANALYSIS OF PLANT HORMONES RELATED TO GALL INDUCTION BY CICADULINA BIPUNCTATA (HOMOPTERA: CICADELLIDAE) ON MAIZE.

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The maize orange leafhopper *Cicadulina bipunctata* (Homoptera: Cicadelidae) is a serious pest of forage maize in Kyushu, Japan. The leafhopper induces galls on various plants of Poaceae, which are characterized by stunted growth and severe swelling of leaf veins. Previous studies suggest that some chemicals injected by the leafhopper affect at the leaf primordia and galls are induced only on the leaves that have extended during the feeding. To clarify the mechanism underlying gall induction by the leafhopper, we performed high-throughput and comprehensive plant hormone analyses using LC-ESI-MS/MS. Galled maize leaves contained higher contents abscisic acid (ABA) and *trans*-Zeatin (tZ) and lower contents of gibberellic acid (GA_1 and GA_4) than ungalled maize leaves. Leafhopper treatment significantly increased ABA and tZ contents and decreased GA_1 and GA_4 contents in extending leaves. After the removal of leafhoppers, contents of tZ and gibberellic acid in extending leaves soon became similar to the control values. ABA content was gradually decreased after the removal of leafhoppers. These results suggest that ABA, tZ, and gibberellic acid are related to gall induction by *C. bipunctata* on maize.

KEY WORDS: gall induction, maize, the maize orange leafhopper, plant hormone, Poaceae

GALL-INDUCING INSECTS AND THEIR HOST PLANTS IN PERNAMBUCO'S ECOSYSTEMS, NORTHEASTERN BRAZIL

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Gall-inducing insects are very rich in species around the word. Despite its great biological importance of ecosystems of northeast Brazil, there are exceedingly few ecological studies on insects in these ecosystems located north of the River São Francisco.We report on the richness of galling insects of caatinga, altitudinal wet forests "brejos de altitude"and Atlantic forests of Pernambuco in an attempt to broaden our knowledge of Northeastern and Brazilian galling species diversity. In each site, galling insect richness were sampled by two people following the methodology of random walking three hours in each area. All plant organs were investigated, and each gall and host plants found were collected. The galls were characterized by: host plant species, number of types of galls by host plant, type of host tissue attacked, shape of galls, color of galls, presence or absence of pubescence, and number of chambers in the gall, occurrence on the galled organ: isolated or grouped/coaslescent. We observed many galls naturally damaged, or without the presence of the inductor or with inductor parasited. We found 64 morphologically distinct types of insect galls in the caatinga. These galls were found in 48 species of host plants from 17 families and 31 genera. In the Atlantic forests 136 insect galls were found in 79 species of host plants from 35 families and 53 genera. Eighty types of insect galls were found on 49 species of host plants belonging to 28 families and 35 genera, in the altitudinal wet forests.

KEY WORDS: insect galls, species richness, Cecidomyiidae, insect herbivory, host plants.

Acknowledgments: We thank the support provided by DCR-FACEPE/CNPq (DCR-0087-2.05/06, APQ-0008-2.05/07).

FOREST INSECT GALLS DENSITY DISTRIBUTION: CANOPY AND UNDERSTOREY COMPARISONS FOR PANAMA AND AUTRALIA.

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IBISCA project has developed a protocol for comparative analyses of vegetation and herbivory distribution between forest canopy and understorey. Gall-forming insects reach highest diversity on sclerophyllous vegetation, thus the upper canopies may represent a suitable habitat for gall-forming insects. At the San Lorenzo Protected Area, Panama, we estimated free-feeding herbivory and gall densities within five sites in 2003 and 2004, by surveying leaves in vertical and horizontal transects (canopy and understorey pin-transects). A second study was developed in the National Park of Lemington, Queensland, Australia, in 2006 and 2007, in a high altitude montane forest. Along an altitudinal gradient, four independent canopy pin-transects and one understorey pin-transect were sampled at 300, 700, 900, and 1100 metres. All same measurements were taken. In Panamá and Australia, leaf sclerophylly increased significantly with sampling height, while free-feeding herbivory decreased inversely. In Panamá, the number of live galls collected in the canopy was 13-16 times higher than in the understorey, a pattern consistent across sites and years. In contrast, both total and alive galls increased with canopy height for the Australian forest, while leaf-chewing decreased significantly, despite seasonal variation. Altitude had little effect on herbivory distribution. The probability of gall survivorship increased with increasing leaf sclerophylly as death by fungi, parasitoids or accidental chewing were greater in the understorey. The present work supports the existence of a global positive effect of sclerophylly on gall establishment and survivorship in the upper canopy of tropical forests, along with a decrease of other herbivory types in this habitat.

KEY WORDS: arthropods, canopy, gall density, leaf herbivory, hypothesis of harsh environment, IBISCA, sclerophyllous habitats, vertical distribution.

EVIDENCE OF COMPETITION AMONG GALLING INSECTS ON *CARYOCAR BRASILIENSE* LEAVES

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Caryocar brasiliense Camb. (Caryocaraceae) is one of the most common and important plant species in the dry and harsh semi arid vegetation of Brazil, called cerrado. It is host to a large number of insect like as galling insect herbivore. We recorded the four galls spatial distribution within *C. brasiliense* trees, in general, in three areas. More *Eurytoma* galls (Hymenoptera: Eurytomidae) were found on the eastern tree slope, followed the southern and northern slopes in pasture 2. Spherical galls were found on the northern followed the eastern slopes while fewer spherical galls were found on the foliage in the southern and western slopes in pasture 1. However, in the pasture 2, the lower spherical galls was observed on the norther than other slopes. More discoid galls were found on the eastern followed the northern while fewer galls were found on the foliage in the southern in savanna. However, in the pasture 1, the lower discoid galls were observed on the easter slope. More vein galls were found on the northern tree slope, followed the western, eastern and southern slopes in pasture 2. More *Eurytoma* galls were found on the leaves in the interior of the tree crown than at the border on all categories of leaf area taken by the galls. Leaf positions 3 and 4 supported 66.7% of all *Eurytoma* galls sampled. More spherical galls were found in the leaf 1 (30.5%) than leaf position 4 (20.8% of all galls sampled). More discoid galls were found on the leaves in the interior of the tree crown than at the border, principally in the leaf position 3 in savanna. Leaf positions 3 and 4 supported 83.6% of all galls sampled. On the other hand, this insect changed its behaviour, attacking more the second leaf and, in this case, leaf positions 3 and 4 supported 32.8% of all galls sampled. More vein galls were found on the leaves in the interior of the tree crown than at the border, principally in the leaf position 3. Leaf positions 3 and 4 supported 61.2% of all galls sampled. At the leaf level, more *Eurytoma* galls were found on the median region compared to the distal or proximal in pasture 2. The average number of spherical galls did not differ statistically among the longitudinal

region on leaflet of *C. Brasiliense.* More discoid galls were found on the median region compared to the distal and proximal longitudinal regions on leaflet in savanna and in pasture 1. More vein galls were found on the distal and median region compared to the proximal longitudinal regions on leaflet. Leaf colonization by *Eurytoma* sp. may initiate at the leaf margin but after colonization reaches 50% the central portion starts to be colonized. The spherical gall insect preferred colonized the leaf margin than the central portion or near mid vein on transversal regions on a leaflet. The discoid gall insect preferred colonized the central portion than the border portion or near mid vein on transversal regions on a leaflet in the pasture 1. In the savanna, followed the same trend, but perhaps due to greater population, the discoid galls have spread more evenly by the leaf of the tree. This gall insect preferred colonized the central portion than the leaf margin or near mid vein on transversal regions on a leaflet. Why did the others gall show different behaviors in the savanna and pasture? Perhaps the answer is to avoid competition with the major galling insect on *C. brasiliense* leaves, the *Eurytoma* sp.. Furthermore, the *C. Brasiliense* trees more attacked by *Eurytoma* sp. Almost are not colonized by other galls and we have observed one *C. brasiliense* tree stronger attacked by spherical galls which is not detected *Eurytoma* sp., and this tree being visited by us for four years. Maybe there is a chemical or visual marker for that a specie of gall dominate a particular ecological niche (i.e. part of leaf, branch or even a tree). Other possibility is the genetic differences among *C. brasiliense* plants that can be responsible for this process or even chemical or morphological differentiation in different parts of a leaf or leaf position that occupies a branch or leaf´s exposure to the sun/wind, and their relationship with other arthropods (i.e. natural enemies). Only more detailed field studies would solve these questions.

KEY WORDS: Cerrado, insect distribution, *Eurytoma* sp. Pequi, ecological niche

THURSDAY - AUGUST 13, 2009

SECTION 3: GENETICS AND MOLECULAR BIOLOGY

PHYLOGENY AND EVOLUTION

NOT EVERYTHING IS CRYPTIC: A COMPARISON OF FOOD WEBS BASED ON MORPHOLOGICAL AND MOLECULAR SPECIES CHARACTERS

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Quantitative food webs offer detailed information about the structure of a community, by describing not only the identity and abundance of species present, but also the abundance of their interactions. One of the most commonly used targets for studies of quantitative food webs consists of endophytic herbivores and their parasitoids. Over the past 15 years, researchers have described the structure of some tens of such communities. Yet, the presence of cryptic species, i.e. species which cannot be identified using morphological characters alone, offer a potential challenge to food web studies. In our study, we examine a community of leaf-miners and gall wasps, and their parasitoids in a temperate region of northern Europe. To identify cryptic species, we sequenced a sample of nearly all parasitoid species present for mitochondrial region COI and nuclear region ITS2. Among 33 morphologically resolved parasitoid species, we detected three cryptic taxa. Each of these cases offered a different scenario: within the first species, the cryptic taxa seemed specialized to host phenology, within the second, the cryptic taxa occurred in different areas, whereas in the third species, the cryptic taxa seemed randomly distributed. Nevertheless, the detection of these cryptic taxa had little impact on overall food web structure. Hence, in this particular web, the application of molecular tools did not change our view of how the community was structured. Whether or not the same will prove true for other systems remains to be seen.

KEY WORDS: bar-coding, cryptic species, parasitoids, herbivore community, food web

EPIGENETICS, METHYLATION AND GALL FORMATION OF *PISTACIA* TREES

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The gall-forming aphids (Homoptera: Fordinae) form characteristic galls on the leaves of *Pistacia* (Anacardiaceae) host plant. Different aphid species induce remarkably different types of galls. The mechanism by which the aphids manipulate their plant host to form the gall is not yet clear. The phenomenon may involve aphid control over gene expression patterns of the plant. We have tested the possibility that the aphids induce epigenetic changes of their host tissues. Epigenetic molecular regulation alters temporal and spatial patterns of gene expression through silencing or activation of parts of the genome by modifications of the DNA without changing the sequence of the gene. Methylation of the cytosine residue of DNA is one of the major mechanisms of epigenetic inheritance. We used an amplified fragment length polymorphism (AFLP)-derived technique for identifying methylated sites in the genome of the *Pistacia* trees induced by the aphids. We tested variability in methylation patterns of the leaves of *Pistacia palestina* trees parasitize by three different Fordinae galling-aphids species. *P. palestina* harbours a compound leaf with several leaflets. We compared the methylation patterns of un-parasitize leaves, un-affected leaflet of parasitize leaves, and leaflets affected by aphids, and found different profiles of methylation among the three types of leaflets. Our results indicate that gall formation of Fordinae aphids indeed involve epigenetic modifications of *P. palestina* host leaves.

KEY WORDS: Fordinae galling-aphids, gall formation, epigenetics, methylation.

REVISITING THE PHYLOGEOGRAPHY OF EUROSTA SOLIDAGINIS: HOST RACES AND SUBSPECIES

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Patterns of molecular variation within and among populations can help place events like speciation in their ecological, historical, and geographic context. We (Brown et al. 1995) previously described the phylogeography of *Eurosta solidaginis* host races in central and eastern North America, based on variation in mtDNA sequences. That study suggested the recent origin of the *Solidago gigantea* host race from eastern populations of the ancestral *Solidago altissima* host race: the latter exhibited a phylogeographic break between two haplotype lineages, E(ast) and W(est), while all *Solidago gigantea* individuals -- regardless of geographic origin -- carried the E haplotype. Here I present new genetic data from across the geographic range of *E. solidaginis*, including populations of the western North American subspecies *E. s. fascipennis*, which differs in wing pattern from the eastern subspecies *E.s. solidaginis*. mtDNA sequence variation indicates the presence of three haplotype lineages of approximately equal age, divided into populations west of the Rockies, in the Great Plains (the W haplotype lineage), and in eastern North America (the E lineage). The recent origin of the *S. gigantea* host race is confirmed, but subspecies boundaries are not congruent with those of the haplotype lineages. In addition, I present an analysis of variation at nuclear AFLP loci, which suggests divergence among host races and subspecies despite gene flow between them. Finally, I discuss the ongoing development of nuclear microsatellite markers, which should provide better tools for fine scale studies of gene flow among host races and subspecies.

KEY WORDS: molecular phylogeography, gene flow, speciation, host shifts

PATTERNS OF TISSUE DIFFERENTIATION OF VARIOUS GALLS INDUCED BY *DAPHNEPHILA* SPP. ON *MACHILUS* LEAVES.

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In Taiwan, many *Daphnephila* spp. (Cecidomyiidae) form galls at vegetative leaves, buds and branches of *Machilus* (Lauraceae) which is a widely distributed dominant plant species in the lowland forest. Dipteran galls have been typed into two groups based on the structure and presence of fungi. The rudimentary gall is the typical one which galler feeds on nutritive tissue while the ambrosia gall has fungi lined inside and the nutritive tissue is reported missing. Galls of *Daphnephila* belong to ambrosia galls but reveal atypical pattern which have both fungi and nutritive tissue present. Fungal flora associate with various galls were analyzed. Investigation of gall tissues by paraffin sectioning across various gall types of *Daphnephila* on different hosts suggests that there are three main types of gall differentiation. Galls on *M*. *thunbergii* reveal that both fungi and nutritive tissue present through all the developmental stages of galls. Our observation supports the hypothesis that fungal mycelium is essential to larval feeding. The possible evolution of gall tissue diversity is discussed.

KEY WORDS: *Daphnephila*, *Machilus*, nutrition, gall tissue, fungi.

EVOLUTION OF GALLMAKING DURING THE RADIATION OF THE ENDEMIC HAWAIIAN TEPHRITID FLIES

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The endemic fauna of tephritid flies of the Hawaiian archipelago provide an excellent system to evaluate the evolution of gallmaking from other modes of feeding. The 25 described endemic species of Hawaiian tephritids (Tephritinae: Tephritini) have been distributed taxonomically among the endemic genus *Phaeogramma* Grimshaw (2 spp.), the cosmopolitan genus *Trupanea* Schrank (21 spp.), and *Neotephritis* Hendel (2 spp.). All feed as larvae on plant tissues, either within capitula (seedheads), shoot-tip meristems, or stem galls. Hosts are Asteraceae species of the endemic Hawaiian silversword alliance (*Dubautia, Wilkesia,* and *Argyroxiphium*), and endemic *Bidens*, *Lipochaeta,* and *Artemisia* spp. Here, I present a phylogenetic reconstruction of the relationships among these taxa and several new species (discovered through rearing from host plants) based on sequence variation from both mtDNA and the nuclear gene EF1α. The analysis supports a single ancestor for all the endemic taxa. Gallmaking has evolved at least twice during the radiation, and has been followed by speciation between allopatric populations on different islands. Shifts to gallmaking are also associated with significant morphological evolution, primarily in body size and in patterns of melanization of adults.

KEYWORDS: molecular phylogeny, evolution of feeding mode, adaptive radiation, speciation, host shifts

FRIDAY - AUGUST 14, 2009

SECTION 4: NATURAL HISTORY AND BIOLOGY

CURRENT AND NOVEL ISSUES

HOST RELATIONSHIP

LIFE HISTORY STUDIES WITH MORPHOLOGICAL EXAMINATIONS AND SPECIES STATUS CONFIRMATION OF A NEW GALL MIDGE (DIPTERA: CECIDOMYIIDAE) ON *CYCLOBALANOPSIS GLAUCA* (FAGACEAE) FROM TAIWAN

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Insect gall flora has been extensively surveyed in Taiwan, but the biology and taxonomy of gall-inducing insects are poorly known. We studied a common but unknown species of gall midge, which induce spindle-shaped gall on the lower surface of leaves of *Cyclobalanopsis glauca* (Fagaceae). From January 2007 to May 2008, four populations of the midge galls in four counties (Taipei, Hsinchu, Taichung, and Nantou) were sampled to establish life history and biological data. The gall midge is univoltine. Emergence of adults and the first instars coincided with the shooting of hosts in March. Second instars prolonged up to eight months and then turned into third instars. Third instars overwintered inside their galls and remaining on the leaves of their hosts. Pupation and eclosion occurred in the following March. Adults emerged through precut holes and lack of holes indicates death of the residing larvae. Four taxa of parasitoids of larval stage were found, including 3 endoparasitoids (Torymidae, Eulophidae, Platygastridae) and an unknown ectoparasitoid. Rate of parasitism, mainly by endoprasitoids, maximized in March 2008. Morphological examination of adults suggests that they belong to *Dasineura*. However, its life history differs from most known species of *Dasineura* and we speculate that it may belong to a new genus. Nevertheless, *Dasineura* is a catchall genus and no records of spindle-shaped midge galls have been reported on the host before. The midge is tentatively treated as a new species *Dasineura glaucae* sp. nov. Its taxonomic status and the genus boundary require further revision.

KEY WORDS: *Cyclobalanopsis glauca*, gall midge, biology, life history, *Dasineura glaucae*

RELATIONSHIPS AMONG PLANT GENETICS, PHYTOCHEMISTRY AND HERBIVORY PATTERNS IN *QUERCUS CASTANEA* ACROSS A FRAGMENTED LANDSCAPE: IMPORTANCE OF INSECT BIOINDICATORS

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Habitat fragmentation is often defined as a process during which “a large expanse of habitat is transformed into a number of smaller patches of smaller total area, isolated from each other by a matrix of habitats unlike the original. Habitat fragmentation has large, consistently negative effects on biodiversity and may affect biotic interactions altering the composition and structure of insect herbivores, reducing the number of specialist and large-bodied species as result of reduction and isolation of habitats. However, few studies have evaluated the effects on host plant genetic variation on the community structure of insects way plant traits. In this study, we determine the influence of plant genetics of *Quercus castanea* on plant traits (chemical compounds) and community traits such as herbivory patterns by different insect guilds in fragmented forests of the Cuitzeo basin, Mexico. We found higher frequency and amount of area removed by folivores, leaf miners and gallers in fragments than in continuous forests, indicating that these insect guilds could be potential bioindicators of conservation stage of temperate forests. Habitat fragmentation affects plant chemical composition increasing plant defense and decreasing nutritional quality of host plants in fragments. We found that plant genetic similitude does not depend of forest fragmentation. Similar plant genotypes presented similar chemical compounds concentration independently of

habitat fragmentation. Herbivory patterns were associated with habitat fragmentation, similar amount of leaf are removed by folivores per plant was associated to habitat fragmentation. We found that plants with similar genotypes have similar chemical composition, that in turn, have similar herbivoría levels independently of habitat fragmentation, indicating potential relationships between plant genetic variation, plant and community traits in *Q. castanea*.

KEY WORDS: Habitat fragmentation, insect guild, *Quercus castanea*, plant genetic variation, plant chemical compounds.

GALL MORPHOTYPES: RESPONSES TO ALTERATIONS IN HOST PLANT CELL FATES

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Gall morphotypes, with their peculiar sizes and shapes, are commonly used in inventories of gall species richness especially in Neotropical region where the taxonomy of gall inducing fauna is poorly known. Plant cells react do galling stimuli in such a specific mode that in each morphotype the patterns of cell division and differentiation are repetitive. Nevertheless, galls have not been used for studying plant cell fates in relation to the establishment of the peculiar shapes and the immense variability of gall morphotypes. It should be inferred that gall inducing agents should generate one or more cecidogenetic fields in which auxin flux is redirected in relation to the pattern of the host organ. Auxin flux suffers the influence of phenolics location, which can be easily demonstrated by histochemical methods. Due to auxin-phenolics balance within gall tissues, changes in cell polarity and axiality occur, gradients of cellular hypertrophy and tissue hyperplasia are generated, and each gall morphotype differentiates. Investigating the ontogenesis of several galls in a superhost of galling herbivores, *Copaifera langsdorffi*, some patterns have emerged. For instance, spherical galls, common either in leaves or stems, have aleatorious planes of cell divisions, and homogeneous expansion constrained by the differentiation of a zone of lignified cells. During gall development, accumulation of phenolics seems to be related to cell responses, whereas the morphogenetical patterns are repetitive, but spatially displaced. In distinct gall morphotypes, observed in *C. langsdorffiiI, Lonchocarpus muehlbergianus, Aspidosperma australe*, and *A. spruceanum* morphogenetical cell fates seem to superpose so as to generate the final morphotypes.

KEY WORDS: cell fates, *Copaifera langsdorffii*, morphotypes, morphogenesis

GALLISPHERE – THE HEADSPACE SURROUNDING THE GALL: CHARACTERIZATION AND PUTATIVE FUNCTION.

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Gall-formers manipulate and exploit the development, anatomy, morphology, physiology and chemistry of their host plants. Inside the galls, the inducing insects benefit from an improved nutrient supply and defense from natural enemies due to high levels of secondary metabolites. The insects may even control the composition of metabolites among different gall parts. Conspicuousness by color, size or shape is a common gall trait and thus galls are often easy to detect in the canopy. This conspicuousness may serve as a signal for potential natural enemies or herbivores (such as leaf chewers), indicating that the gall is well defended and not palatable. Volatiles emitted by the galls may be part of this signaling complex. We have studied the chemical components of the large, red coral-shaped galls induced by the aphids *Slavum wertheimae* on *Pistacia atlantica* trees. In a replicated field experiment, volatile organic compounds (VOC) were sampled from the headspaces of intact and artificially damaged galls, leaves and fruits, using Super Q-filters attached to portable air pumps. The emitted VOC were analyzed by GC-MS. In addition, total tannin concentrations were determined by a radial diffusion assay. We found that 1. Compared with leaves and fruits, gall tissue contained higher concentrations of tannins and VOC. 2. Galls emitted more monoterpenes compared to fruits and especially to leaves. 3. Artificial damage increased the amounts of monoterpenes emitted to the gall headspace by two-fold. We show here for the first time that galls create a 'Gallisphere' – headspace which is particularly rich in monoterpenes that should emphasize its conspicuity in the canopy. The adaptive value of the 'gallisphere' may be explained by the aposematic gall hypothesis: galls, well-protected by secondary chemicals in the tissue, employ warning signals (shape, color and scent) to deter potential enemies.

KEY WORDS: aposematism, conspicuous galls, gall scent, signal

LEAF HOLES CAUSED BY PLANT HYPERSENSITIVITY MIMICS HERBIVORE DAMAGE

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The measurement of damage caused by herbivores can be confounded with the drop off necrotic spots due to hypersensitive reactions. The negative impacts of sessile herbivores on host plants are minimized by hypersensitive reactions that results in the death of the attacked tissue. We report a phenomenon that remarkably resembles damage caused by free feeding insect herbivores, but instead represents reaction spots against endophytic herbivores and/or pathogens. Although the leaves of *Tapirira guianensis* (Anacardiaceae) appear highly damaged by chewing herbivores, the removed leaf area represents the abscission of plant reaction against by gall-inducing insects. The area lost from *T. guianensis* leaves due to the hypersensitive reactions was almost five fold greater than the area lost by free-feeding herbivores in 2004 ($p<0.0001$) and two times greater in 2005 ($p<0.0001$). The herbivory mimetic phenomenon is widespread in plant species and we expect a change in the view that gall-inducing insects inflict low damage on their host plants. We argue for caution when evaluating herbivory rates in the field and highlight the need to calibrate the evaluations done in previous studies which may have overestimated herbivory damage. (FAPEMIG/CNPq)

KEY WORDS: plant resistance, induced defense, herbivory, gall impact, Amazon.

THE EVOLUTION OF TRITROPHIC INTERACTIONS INVOLVING GALL-FORMING INSECTS

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We have been studying the complex tritrophic interaction involving goldenrod, *Solidago altissima*, the galler *Eurosta solidaginis*, a parasitoid *Eurytoma gigantea*, an inquiline beetle, *Mordellistena convicta*, and two avian predators Downy Woodpeckers, *Picoides pubescens,* and Black-capped Chickadees, *Parus atricapillus.* The host plant and each of these natural enemies exerts different types of selection on *E. solidaginis* gall morphology, and this selection varies geographically. Some of the interactions are strongly coevolved such as gall size and the ovipositor length of *E. gigantea*, while others are highly asymmetrical such as gall size and local adaptation in *M. convicta*. Many of the strongest evolutionary forces are indirect: an example is that birds exert strong selection on the parasitoids and inquilines through their selection on gall morphology. Low bird densities may permit positive feedback cycles with increasing inquiline densities selecting for increasing gall size, but high bird densities may stop this cycle. The two bird species also differ in the selection that they exert on gall morphology altering the evolution of all other species in the interaction. Gall morphology is also strongly influenced by local variation in the goldenrod and the abiotic environment. Local variation in the abiotic environment has effects that move upward through the trophic levels creating a tritrophic geographic mosaic of coevolution. Evolution in geographically variable multi-trophic level interactions is important in the creation and preservation of biodiversity, and the interaction of gallers with other species offer excellent model systems in which to study these interactions.

KEYWORDS: Geographic mosaic of coevolution, tritrophic interaction, bottom-up, parasitoid, inquiline, birds

THE GALLING ERIOPHYID MITE, VASATES ACERISCRUMENA, AND ITS IMPACT ON MATURE SUGAR MAPLE CANOPIES IN A NORTHERN TEMPERATE FOREST

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Diminutive gall-forming mites (Acari; Eriophyoidae) are common herbivores that have evolved intimate and complex associations with their hosts, yet we know little about their role in forest canopies or their impacts on trees. The maple spindle gall mite, *Vasates aceriscrumena*, is a common mite forming leaf galls on sugar maple (*Acer saccharum*) forests in eastern North America. Here, we document details of its life cycle, interaction with an as yet undescribed, predaceous, gall-invading tarsonemid species, and its impact on leaf-level physiology in canopies of mature sugar maple. Gall mites are found most frequently in the upper canopies of mature trees with an average of five galls per leaf in infected leaves. *V. aceriscrumena* follows a univoltine life cycle similar to other galling eriophyid mites. Additionally, galls formed by this species are frequently 'invaded' by a tarsonemid mite (species unknown), the larvae of which appear to feed on *V. aceriscrumena* eggs. *In situ* experiments showed significant reductions in photosynthesis and instantaneous water use efficiency in galled leaves (even at low levels of <1 gall/leaf) compared to nearby ungalled leaves of mature trees, but such differences did not exist between galled and ungalled leaves of understorey maple saplings implying large ontogenetic differences in host tolerance to mite galling.

KEYWORDS: Eriophyoidae, mite galling, Tarsonemidae, host tolerance, *Acer saccharum*, canopy physiology

HOST RELATIONSHIPS OF GALL-INDUCING INSECTS IN COSTA RICA

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To date we have found more than a thousand species of gall-inducing insects in Costa Rica, the vast majority of which are undescribed. At least 70% of these are Cecidomyiidae, a family that is associated with an extremely wide range of plants (including six families of ferns), although certain plant taxa harbor an above-average number of species. Gall-inducing Tephritidae are mostly associated with Asteraceae and some of these are among the few gall inducers found at very high altitudes (> 3000 m); however, a few occur on other plants (e.g. Buddlejaceae and Verbenaceae). Cynipidae are restricted to *Quercus* (Fagaceae), unlike temperate regions, and at least some oaks harbor high numbers of cynipid species, like temperate regions. Gall-inducing Braconidae are associated with Araceae, Fabaceae (Mimosoideae), Melastomataceae, Moraceae (*Ficus*), and Rubiaceae, and are one of the most overlooked groups of gall-inducing insects since many of the galls are hidden inside fruits. Species in a dozen families of Lepidoptera induce galls on plants in nearly twenty families and one of the most diverse groups of gall-inducing moths is Momphidae, most of which are associated with Melastomataceae. The principal group of gall-inducing beetles is Curculionidae, which have been found on eight plant families. Among hemimetabolous insects, the most species-rich group is Psylloidea, which induce galls on about twenty families of dicotyledons (e.g. Anacardiaceae, Araliaceae, Fabaceae, Lauraceae, Moraceae). There are relatively few species of gall-inducing Thysanoptera and Coccoidea. Overall, Fabaceae, Melastomataceae, Moraceae, and Myrtaceae appear to harbor the widest range of gall-inducing insect taxa.

KEY WORDS: Costa Rica, gall-inducing insects, host plants.

POSTER PRESENTATION

Section: ***Spatial Ecology and Biodiversity***

ARTHROPOD GALL DIVERSITY IN THE PAMPA BIOME, SOUTHERN BRAZIL: FOREST EDGES AND RIPARIAN FORESTS COMPARED.

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Forest edges are usually abrupt transitions between distinct environments. Because galling arthropod assemblages strictly depend on vegetation type and composition, their diversity in forest edges and forest interiors might change appreciably. Here I characterise galling arthropod diversity patterns on riparian forests of the Southern Hills region of the Pampa biome, south Brazil. This region has gently rolling hills with vast grasslands but also dense, low subtropical forests on valleys. Three sites were sampled: two near Canguçu town, one near Caçapava do Sul town, Rio Grande do Sul State. Each site had 2 trails, one bordering a riparian forest from the grassland side and one inside the forest 10 m from the edge. Trails were crossed five times across one year; searching for galls during 1h30min comprised a sampling unit. The number of galled plant individuals was used to measure abundance. Diversity between environments was compared for gall species richness, abundance and evenness, tested with MANOVA. Overall 139 gall morphotypes were found. Only species richness was significantly different between forest edges and interiors: the latter were richer. This could be attributed to a richer flora within forests, but since sampling is easier on forest edges this could have balanced the effect of plant richness. Also, plant growth could be expected to be higher on edges because of improved light intensity, but an associated potential increase in plant resources overall or to particular plants do not appear to lead to higher abundance or abundance inequality among galling species (evenness), respectively.

KEY WORDS: vegetation, species richness, abundance, equitability.

Section: ***Spatial Ecology and Biodiversity***

PARASITOID COMMUNITY CENTERED UPON GALL MIDGES (DIPTERA: CECIDOMYIIDAE) ASSOCIATED WITH EVERGREEN TREES ON VOLCANIC ISLANDS

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Island biota has many differences from that of mainland. The Izu Islands consist of volcanic islands located south of Honshu, Japan, extending for about 230 km from north to south, and have unique biota of insects, terrestrial reptiles and plants. We surveyed these areas in 2009. Among different islands and mainland (the Izu Peninsula), we compared structures of parasitoid community associated with *Pseudasphondylia neolitseae* inducing leaf galls on *Neolitsea sericea* (Lauraceae), *Asteralobia sasakii* inducing bud galls on *Ilex crenata* (Aquifoliaceae), and several other gall midges (Diptera: Cecidomyiidae). Two hymenopteran ectoparasitoids, *Bracon tamabae* (Braconidae) and an eulophid, and one endoparasitoid, *Gastrancistrus* sp. (Pteromalidae), attack *P. neolitseae* in the mainland and on northern islands closely located to the mainland, while only *B. tamabae* was found to attack *P. neolitseae* on Miyake and Hachijo Islands, which are apart from the mainland. Morphological studies and molecular analysis revealed that *B. tamabae* attacks both *P. neolitseae* and *A. sasakii*. There were no geographical variations and host races in mitochondrial DNA haplotypes of *B. tamabae* distributed in the mainland and islands surveyed except for Hachijo Island, where only an endemic haplotype was found. On *P. neolitseae*, the relative abundance of *B. tamabae* to the eulophid was gradually decreased from southern to northern localities. *A. sasakii* was attacked by at least four parasitoid species in the mainland and on northern islands, but only by *B. tamabae* on Hachijo Island. Based on the results, we discuss biogeographical aspects of parasitoid community centered upon gall midges on these islands.

KEY WORDS: Biogeography, gall midge, molecular phylogeny, parasitoid, volcanic islands.

Section: *Spatial Ecology and Biodiversity*

PATTERNS OF GALL RICHNESS IN SHRUBS OF ALTITUDINAL FIELDS FROM SERRA DA MANTIQUEIRA-BRAZIL

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The discovery of broad biodiversity patterns has stimulated the generation of many theories in ecology. Galling insects are considered excellent ecological models for hypothesis testing. The aim of this study was to test the 1) “Altitudinal gradient” hypothesis, which predicts that galling insects richness decreases with altitude, 2) "S plant richness hypothesis" which predicts that galling insect richness increases with the plant richness and 3) "plant density hypothesis", which predicts that galling insect richness increases with plant density. Samplings were carried out in altitudinal fields of three regions of Serra da Mantiqueira 1) atitudinal fields of Brigadeiro State Park, in Araponga – MG; 2) Caparaó National Park, in Alto Caparaó-MG, and 3) Rupestrian fields of Ibitipoca State Park, in Conceição do Ibitipoca-MG. We found 83 species of gall-inducing insects in 15 families, 27 genera and 42 species of plants. The richness of galling insects in the region of the Ibitipoca State Park was 31, for the Brigadeiro State Park was 39 and 15 in the Caparao National Park. The only corroborated hypotheses were the altitudinal gradient (R^2 = 0.54, F = 914, P = 0.015, and y = (2.7420036-0.0005478x) and the plant richness hypothesis (R^2 = 0.53, F = 536, P = 0.028, y = e (1.19730-0.05305x). This study supports the hypothesis that stressful environments have higher richness of galling insects. (FAPEMIG/CNPq)

KEY WORDS: herbivory, altitude, plant richness, plant density, richness hypothesis.

Section: ***Spatial Ecology and Biodiversity***

GALL INDUCING INSECTS IN SHRUBS OF ALTITUDINAL FIELDS FROM SERRA DA MANTIQUEIRA-BRAZIL

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The richness of galling insects is high in southeastern Brazil. However, there are still many areas to be studied. The aim of this study was to describe the richness of galling insects and their host plants in the Serra da Mantiqueira - Brazil. Samplings were carried out in altitudinal fields of three regions of Serra da Mantiqueira 1) altitudinal fields of Brigadeiro State Park, in Araponga - MG and 2) Caparaó National Park, in Alto Caparaó-MG and 3) Rupestrian fields of Ibitipoca State Park, in Conceição do Ibitipoca-MG. We found 83 species of gall-inducing insects in 15 families, 27 genera and in 42 host plant species. The richness of galling insects in the region of the Ibitipoca State Park was 31, for the Brigadeiro State Park was 39 and 15 in the Caparao National Park. The two families, Asteraceae (50,6%) and Melastomataceae (19,2%), exhibited the highest number of gall morphotypes. The family Cecydomiidae (Diptera) was the most frequent, accounting for 82% of insects sampled. The most attacked organ was the stem (48%), followed by leaves (37%). Only 12% of the galls described in this study were reported in previous studies, reinforcing the need to increase the sampling effort in order to better understand the richness and natural history of galling insects in Brazil. (FAPEMIG/CNPq)

KEY WORDS: biodiversity, biogeography, herbivory, host-plant, altitude.

Section: ***Spatial Ecology and Biodiversity***

GALL INDUCING ARTHROPODS FROM A SEASONALLY DRY TROPICAL FOREST IN SERRA DO CIPÓ, BRAZIL.

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High richness of galling arthropods can be identified in much of the southeastern Brazilian vegetation. Three fragments of a Seasonally Dry Tropical Forest (SDTF) located in the southern range of the Espinhaço Mountains were selected for this study, encompassing the first survey of galling organisms in this tropical vegetation. We found 92 distinct gall morphotypes on several organs of 51 host plant species belonging to 19 families. Cecidomyiidae (Diptera) was the most frequent gall-inducing family, responsible for the largest proportion of galls (77%) observed. Leaves were the most frequently galled organ (63%), while the most common gall morphotype was of a spherical shape (30%). Two plant species, *Baccharis dracunculifolia* (Asteraceae) and *Celtis brasiliensis* (Cannabaceae), exhibited the highest number of gall morphotypes, displaying an average of 5 gall morphotypes each. This is the first study of gall-inducing arthropods and their host plant species ever undertaken in a Brazilian SDTF ecosystem. Given the intense human pressure on SDTFs, the high richness of galling arthropods, and the implied floral host diversity found in this study we suggest the need for an increased effort to catalogue the corresponding flora and fauna, observe their intricate associations and further understand the implications of such rich diversity in these stressed and vulnerable ecosystems. (FAPEMIG/CNPq)

KEY WORDS: biodiversity, biogeography, host plant family, insect galls, herbivory, richness.

Section: Spatial Ecology and Biodiversity

PARASITOIDS AS BIOINDICATORS OF ENVIROMENTAL QUALITY

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We can define a bioindicator as a species or assembly of species that are characteristic of an area and that respond to impacts or environmental changes. In this study, two areas of a sandbank ecosystem ("restinga") in Maricá (Rio de Janeiro State, Brazil) were investigated, a low impacted and a greatly impacted one, where *Bruggmannia elongata* (Diptera, Cecidomyiidae) occurs. This midge induces leaf galls on *Guapira opposita* (Nyctaginaceae) and there is a parasitoids guild associated with it, composed of three families of Hymenoptera: Eulophidae, Eurytomidae and Platygastridae. The composition of this guild was practically the same in the two areas; however, the abundance of each species varied. Furthermore, one of the parasitoid species showed preference by plants longer than one meter in the impacted area. And two other species showed preference by the higher density of the gall midge. The test of indicator species (Dufrene and Legendre, 1997) was used for the analyses. Those parasitoids are oligophagous, attacking not only other galling species associated with *G. opposita*, but also other host plants in the protected area. Otherwise, in greatly impact area, a single galling species, *B. elongata,* occurs in association with *G. opposita* and no other host plant is present. This suggests that the richness of the galling species as well as the richness of the host plants can affect the contribution of the parasitoids guild in a differential way to the mortality of the inducers. Therefore, the parasitoids can be used as efficient bioindicators.

KEY WORDS: Bioindicator, parasitoid, gall midge, Cecidomyiidae, "Restinga".

Section: ***Host relationships***

GALLERS ON CONSTANT LEAF RESOURCES IN TROPICAL RAIN FOREST.

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Almost all research on galling insects has been done in highly seasonal environments. Adaptations to seasonality and phenology of host plants are considered to be very important for gallers. This is well documented in arctic, boreal, temperate, and tropical dry areas. We studied three galler species (a cecidomyid leaf galler, a psyllid leaf galler, and a cecidomyid leaf petiole galler) on *Neoboutonia macrocalyx* Pax (Euphorbiaceae) tree in a medium-altitude tropical rain forest in Kibale National Park, western Uganda. *N. macrocalyx* produces new leaves constantly throughout the year. Although the environment has two rainy and two dry (less rainy) seasons a year, moist and warm conditions of the forest are constant. We followed population densities of the three gallers by taking monthly samples for eight months in four different forest compartments. Although resources (= fresh new leaves) are available all the time for the gallers, their densities vary temporally, but less than those of miners, borers, or free-feeders. Galler densities are not correlated temporally with densities of miners, shoot borers, or free-feeding Lepidoptera larvae. Densities of different galler species are not correlated temporally. Densities of the same galler species do not correlate temporally among forest compartments. This means that densities of different galler species vary independently on relatively small spatial scales (1-5 km). Therefore, it seems that gallers on constant leaf resources are regulated by some factors operating on small spatial

scales. We emphasize parasitism as a main hypothesis creating this spatially variable density pattern on a small landscape scale.

KEY WORDS: bottom-up, top-down, small spatial scale, population dynamic, free feeders.

Section: ***Host relationships***

PHOTOSYNTHETIC EFFICENCY OF LEAF TISSUE OF *CLUSIA ARRUDAE* WITH AND WITHOUT CECIDOMYIIDAE GALLS

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Leaf galls induced by a still undescribed new species of Cecidomyiidae (Diptera) are frequent on leaves of *Clusia arrudae* Planchon & Tirana (Clusiaceae) in the rupestrian fields at 1400m a.s.l. in Serra do Cipó, Minas Gerais, Brazil. Galls were 7.1 ± 0.7 mm in diameter, one-chambered with one larva inside. The gall tissue is green and soft and can be seen from both sides of the leaf lamina. We assessed the photosynthetic capacity of the gall tissue and leaf tissue using chlorophyll fluorescence. Tissue temperature was 30℃ and ambient photosynthetic pho ton flux density (PPFD) c. 1000 µmol m^{-2} s^{-1}. At this PPFD, photosynthetic performance was similar for both galled and non-galled tissue. Comparison with light-dependence curves shows that this ambient PPFD was close to saturation for the healthy tissue but clearly below saturation for the galled tissue. However, this was not obtained in the light curves. Although saturating PPFD was significantly higher (p= 0.05) for the galled compared to the healthy tissue, maximum ETR (ETR_{max}) was similar and effective quantum yield of PSII even somewhat lower. An inspection of the curves and their cardinal points suggests, however, that at lower light intensities the healthy tissue has a somewhat superior performance as compared to the galled tissue. At half saturating PPFD $\Delta F/F_m'$ was a little higher in the healthy than in the galled tissue (but not statistically significant). Hence, the morphological changes due to gall development were not associated with significant changes in photosynthetic capacity of the tissue. Our data support the hypothesis the photosynthetic energy needed to supply gall growth and development may be being redirected from other host plant organs. (FAPEMIG/CNPq)

KEY WORDS: Insect galls, sink-source relationships, herbivore impact, photosynthesis.

Section: ***Host relationships***

DIVERSITY OF GALL-INDUCING INSECTS IN THE HIGH ALTITUDE WETLAND FORESTS IN PERNAMBUCO, NORTHEASTERN BRAZIL

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The tropical altitudinal wet forests of northeastern Brazil, locally known as “brejos de altitude”, are enclaves of the Atlantic forest in altitudes above 500m, forming “islands” of wet forest surrounded by semi-arid vegetation (caatinga). These forest islands are important for the maintenance of biological diversity for two main reasons: 1) many species are endemics, and they represent an important endemism center; and 2) the altitudinal wet forests share several species with both the Atlantic rain Forest and the Amazon rain forest; making this ecosystem singular. Despite its great biological importance there are exceedingly few ecological studies on insects in the altitudinal wet forests. We reported on the richness of galling insects in the altitudinal wetland forests (brejos de altitude) of Pernambuco state, northeastern Brazil. We found 80 distinct types of insect galls on 49 species of host plants belonging to 28 families and 35 genera. Most of the galled plant species belong to the Nyctaginaceae, Fabaceae, Meliaceae, Sapindaceae and Myrtaceae. The most common gall were spheroid and globoid; most galls were glabrous, predominantly green and with one chamber, and on the leaves. Most galls were induced by the Cecidomyiidae (Diptera). The results of this study contribute to existing of knowledge richness of galling insect and host-plant diversity in the altitudinal wetland forests of northeastern Brazil.

KEY WORDS: insect galls, species richness, Cecidomyiidae, insect herbivory, host plants.

Acknowledgments We thank the support provided by DCR-FACEPE/CNPq (DCR-0087-2.05/06, APQ-0008-2.05/07)

Section: ***Host relationships***

THE FIRST RECORD OF GALL INDUCTION BY A POLLINATOR LAUXANIIDAE (DIPTERA) ON *DORSTENIA ARIFOLIA* LAMARCK (DORSTENIEAE: MORACEAE)

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The interactions between Neotropical *Dorstenia* species and their pollinators are unknown. *Dorstenia arifolia* is an endemic species of the Atlantic Forests of Brazil. This species has inflorescences called “cenantos”, that flower throughout the year. For the first time, we report that *D*. *arifolia* has both bisexual and unisexual inflorescences. A detailed observational and experimental study on its pollination was carried out in the field during two season periods. During the exclusion experiments we observed that two species belonging to Lauxaniidae (Diptera) were the pollinators. Pollination was passive and pollen was the main resource for male and female adults. Lauxaniid female flies oviposit in bisexual inflorescences during the anthesis of pistillate flowers and induce galls in addition to pollinate. The inflorescence tissues are the resources for larval development of the species 1, which are developed concurrently with the fruits of *D. arifolia*. The interaction between *D. arifolia* and species 2 involves parasitism of ovules as the galling larva develops inside the flowers of *D. arifolia*. This is the first report of evidence of phytophagous larvae of Lauxaniidae. This work is the first report of pollination in the genus *Dorstenia* and pointed the myophily in *D*. *arifolia.*
(FAPEMIG/CNPq)

KEY WORDS: *Dorstenia arifolia*, Lauxaniidae, pollination, pollinators, galls, myophily

Section: ***Host relationships***

HABITAT MEDIATION OF HYPERSENSITIVITY REACTION AGAINST THE INDUCTION OF INSECT GALLS

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The hypersensitivity reaction is a major mechanism of induced defense against the attack by insect herbivores. However, nutritional deficiency may interfere with plant cell communication reducing and/or impairing the reaction of hypersensitivity. We addressed the influence of nutrient stress on hypersensitivity against a leaf galling Cecidomyid (Diptera) on *Terminalia glabrescens* (Combretaceae) in a cerrado (savanna) vegetation in the Parque Nacional da Serra do Cipó, Brazil. We report on the frequency of galls, hypersensitivity, and free-feeding insect herbivory on the leaves of *T. glabrescens*, and tested the hypothesis that hypersensitivity varied with the distance from a more mesic and nutrient-rich habitat. The total attack by the galling cecidomyiid (representing leaves with hypersensitivity marks plus those with healthy galls) (r^2= 0.19, p= 0.0035) and the frequency of leaves with hypersensitivity marks (r^2= 0.17, p= 0.006) decreased with increasing distance from the water/nutrient source. These results indicate that under better nutritional conditions *T. glaucescens* are more capable to locate and eliminate cells that would become otherwise tumoral. (FAPEMIG/CNPq)

KEY WORDS: induced resistance, xeric-mesic environment, nutrition

Section: Host relationships

RHOPALOMYIA CHRYSOTHAMNI (DIPTERA: CECIDOMYIIDAE) DIFFERENTIAL SUCCESS ON *CHRYSOTHAMNUS NAUSEOSUS HOLOLEUCUS* (ASTERACEAE) OF DIFFERENT NUTRITIONAL QUALITY

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Plant quality influences insect herbivore performance and ultimately their population dynamics. We experimentally examined the effects of water, NPK fertilization, and water/nutrient stress on the performance of a galling insect, *Rhopalomyia* cf. *chrysothamni* (Diptera: Cecidomyiidae), on *Chrysothamnus nauseosus hololeucus* (Asteraceae) in north of Flagstaff, Arizona, USA. Plants were haphazardly assigned to be unmanipulated (control), to receive high levels of water (watered treatment), high levels of N.P.K (fertilized treatment), while another group had part (ca. 30%) of their roots trenched (stress treatment). Watered and fertilized plants received 38 L of water weekly. Thirteen grams of NPK fertilizer per 3.8 L of water were added to the fertilized plants every other week from April to October in 1988. The number of host plants attacked, gall abundance per plant, diameter (mm), and total biomass (weight, g) were recorded at the end of the growth season. The number of host plant attacked that survived until the end of the experiment varied as follow: control= 15, watered= 10, fertilized= 10, and stressed= 8. *Rhopalomyia* gall abundance varied among the treatments (control= 31.37%, watered= 23.73%, fertilized= 25.69%, stressed= 19.21%). The diameter of the galls induced by *Rhopalomyia* differed statistically among treatments (Anova, $F_{3,659}$= 5.108, P<0.002. Galls on control plants were statistically smaller than galls induced on watered (p<0.005), and fertilized (p< 0.03) plants; but did not differ from galls induced on stressed plants. Galls on stressed plants were also smaller than galls induced on watered (p<0.02), and smaller than those induced on fertilized plants (p< 0.05). The total weights of galls differed among the treatments (Anova, $F_{3,395}$= 11.027, p<0.0001). Galls on fertilized plants weighed more than galls on all other plant treatments (p<0.001 all), while watering did not result in any weight

increment on galls. These data indicate that plant quality strongly influences some parameters by which one evaluates gall performance and corroborate the vigorous module hypothesis that predicts higher performance on vigorous (water, fertilized) hosts. (FAPEMIG/CNPq)

KEY WORDS: *Chrysothamnus nauseosus hololeucus*, Habitat selection, Host selection, Insect galls, Plant stress, Plant vigor.

Section: *Host relationships*

GALLING SPECIES ABUNDANCE ON *EREMANTHUS GLOMERULATUS* IN A FIELD FERTILIZATION EXPERIMENT IN A CERRADO VEGETATION: EVIDENCE FOR THE NUTRITIONAL STRESS HYPOTHESIS

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Plant nutritional status and the availability of nitrogen might greatly influence herbivore loads on plants. The effects of soil fertility however, might vary among insect guilds and should be stronger for internal feeders, such as galling insects. Their larval stages live immersed in plant tissue and in habitats in which plant nutrients are limiting, hence providing the opportunity for variation according to plant nutritional status. We evaluated the effects of nitrogen and phosphorus addition on the galling insect community on *Eremanthus glomerulatus* (Asteraceae) in order to test if nutrient enrichment would negatively affect galling insects. *Eremanthus glomerulatus* individuals were searched for stem and leaf insect galls in 1) N- fertilized plots, 2) P-fertilized plots and 3) control plots (n= 4 plots for each treatment). Foliar nutrient concentration (N and P) was significantly higher in individuals in fertilized plots. *E. glomerulatus* individuals supported a total of 1,715 insect galls belonging to 6 distinct species, but higher gall abundance was found in the control treatment compared to fertilization treatments. Among gall-formers, three species responded negatively to phosphorous addition, two species responded positively to nitrogen addition and one species responded negatively to nitrogen addition. Abundance of the five galling species was negatively correlated to foliar N and P concentrations. These results corroborate the hypothesis that gall species richness is higher in non-fertilized plants but also showed variation among this guild, with species-specific responses.

KEY WORDS: Galling insects, fertilization, nitrogen, phosphorous, Cerrado.

Section: ***Host relationships***

LEAF DAMAGE IN *TERMINALIA GLABRESCENS*: HERBIVORY OR PROTECTION AGAINST GALL INDUCTION?

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The hypersensitivity reaction is triggered in response to pathogen invasion and/or insect attack. In this induced reaction, a necrotic tissue develops around the site of attack as a result of cell death and necrosis. In some cases the attacked tissue falls off from the leaf lamina leaving holes that may be confounded with the removal of leaf area caused by chewing herbivores. This study aimed to: (1) evaluate whether the hypersensitive reactions on the leaves of *Terminalia glabrescens* are a response to attack by galling insects; (2) identify whether the damages are caused by the drop of necrotic tissue or are caused by the herbivory of chewing insects; and (3) identify the insect inducing the hypersensitivity reactions. An experiment was set up in the field where leaves were monitored since the early stages of development. Leaves were divided into two groups: leaves exposed to attack and leaves protected against the attack by invertebrates. The number of holes on the leaves increased as the number of necrotic areas decreased in the leaves protected from external attack, indicating that the holes were caused by the collapse of the necrotic tissue. The only insects whose larvae hatched from eggs laid on the caged leaves were a galling species belonging to the Cecidomyiidae (Diptera), indicating they induced galls and were responsible for the plant elicitation of hypersensitive reaction. (FAPEMIG/CNPq)

KEY WORDS: false herbivory, induced defense, leaf loss

Section: *Host relationships*

EDGE AND LIGHT AVAILABILITY EFFECTS IN THE INTERACTION BETWEEN GALLING INSECTS AND *ESCHWEILERA TRUNCATA* A. C. SM. (LECYTHIDACEAE) IN AMAZONIAN FOREST FRAGMENTS

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The presence of insect galls has been usually associated to the toughness and phenolic concentration of host plant leaves. These features tend to be increased in the upper layer of tree crowns, under direct incidence of sunlight. The objectives of this study were: i) to evaluate galling insect richness and abundance, polyphenol concentration, and sclerophylly of sun and shade leaves of *Eschweilera truncata* in the edge and interior habitats of BDFFP (Biological Dynamics of Forest Fragments Project) fragments; ii) to investigate possible correlations between the gall richness and abundance with sclerophylly and polyphenol concentration. In edge habitats, sun leaves of *E. truncata* showed both higher sclerophylly and polyphenol content compared to shade leaves. However, differences in richness and abundance of galls were only found in the interior of the forest fragments, being higher in shade leaves compared to sun leaves. These results suggest a probable microenvironment preference of the galling species studied. Gall abundance was negatively correlated with sclerophylly. In the present study, we partially corroborate the light availability effect hypothesis, in which a direct incidence of sunlight influences plant metabolism: the highest rates of sclerophylly and polyphenol concentration were observed in sun leaves of host plants located at the edge habitats. However, these characteristics did not affect the occurrence of insects galls. (FAPEMIG/CNPq)

KEY WORDS: sclerophylly, polyphenols, habitat, canopy, sun leaves, shade leaves

Section: ***Host relationships***

DOES THE COMPOSITION OF EPICUTICULAR WAX INFLUENCE GALLS IN *CNIDOSCOLUS* (EUPHORBIACEAE)?

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Galls are formed by insect/mite feeding or egg-laying activity. Either mechanical damage or salivary secretions (introduced by insects and/or mites) initiate increased production of normal plant growth hormones. These plant hormones cause localized plant growth that can result in increases in cell size (hypertrophy) and/or cell number (hyperplasia). The outcome is an abnormal plant structure called a gall. Diverse studies have demonstrated the influence of epicuticular waxes in the plant-insect interactions, but in relation to the gall inducing the literature still is vacant. In this study it was analyzed the incidence of galls and the chemical composition of waxes epicuticulares of three species of *Cnidoscolus: C. loefgrenii*, *C. vitifolius* and *C. obtusifolius*, from National Park Valley of the Catimbau (Buíque - PE). Galls were not obserd in *C. obtusifolius;* while *C. loefgrenii* presented only leaf galls, and *C. vitifolius* stem galls. The epicuticular waxes foliar had been extracted with diclorometh**a**ne and partitioned for TLC and the corresponding fractions to *n*-alkanes analyzed for gas chromatography. The results indicated the presence of hydrocarbons of tritriacontane long chain (C33) and untriacontane (C31) as majority in *C. loefgrenii* and in *C. obtusifolius.* The nonacosane (C29) predominated in *C. vitifolius* followed for C31, and in lesser amount the C33. Analyses of groupings (Euclidean distance and UPGMA) using the profile of *n*- alcanos suggest a greater chemical affinity between *C. loefgrenii* (species with galls) and *C. obtusifolius* (species without galls).

KEY WORDS: plant surface, waxes, gall, insects, semi-arid, caatinga.

Section: ***Host relationships***

SPATIAL DISTRIBUTION PATTERN OF GALL-MAKER ON LEAVES OF *Croton argyrophyllus* (EUPHORBIACEAE)

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Galls are abnormal plant growths caused by various organisms (insects, mites, nematodes, fungi, bacteria, and viruses). The aim of this work was to evaluate the spatial distribution of the gall-maker within leaves of Croton argyrophyllus (Euphorbiaceae) in semi-arid region, Vale do Catimbau, Pernambuco. In this study 122 galled leaves have been collected for gall characterization and analysis of gall patterns. The spatial distribution of galls at the leaf level was studied in three ways. First, we determined gall distribution at the leaf blade level, i.e., adaxial or abaxial epidermis. The differential distribution of galls between leaf lamina was tested by ANOVA and Tukey test. Secondly, we counted the number of galls formed on the central vein, secondary vein and leaf lamina. Thirdly, a count of whether the galls form on the apical, central or basal sections of the leaf was done. Each leaf was divided into three sections of equal length and a count of galls on each was made. The galls of C. argyrophyllus is globoid, yellow, glabrous, only one larval chamber and occur on both leaf sufaces. The number of galls on abaxial (688) and adaxial (355) faces of the leaf differed significantly ($p < 0.05$), more galls were found on the abaxial face. Within leaves, proportionately more galls were located on lamina edge (52,64%), secondary lateral veins (34,71%) and midveins (12,65%). Most galls were found on the basal region (40,36%) of the leaf, followed by the median region (32,69%) and finally the apical region (26,94%)

KEY WORDS: Buique, Caatinga, entomogrnous galls, plant-insect interaction, semi-arid region.

GALLS OF *MICONIA CF CINAMOMIFOLIA* (MART. EX DC.) NAUDIN FROM CARNIJÓ.

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Galls are characterized by hyperplasia and/or hypertrophy of cells, fabrics or plant organs, resultant of the action of some organisms, mainly insects. The development and growth of galls depend on the insect's alimentary activity stimulating the formation of new cellular layers on the vegetal fabric of superior quality, called nutritional fabric, which covers the larval chamber. Galls of *Miconia cf cinamomifolia* (Melastomataceae) were collected in a fragment of Mata Atlântica located in the Particular Reserve of the Natural Patrimony Carnijó (Moreno, Pernambuco). We collected 171 galls and taken to laboratory, where they were described, measured, weighed and opened in order to verify the state of the inductor. The larvae were measured, weighed, analyzed in function of its phase of life and presence of signals of predation, parasites or some unknown factor of mortality, and conserved in alcohol. Galls are globoids, present brown color, and weigh 20.818g and measure 32.22mm of diameter on average. They have only one larval chamber, which contents a blanked larva with 0,028g of weight and 932mm of length. From the 114 galls of the first collection, 88 inductors have survived (77%). In this first group, 3 larvae were contaminated by pathogens, 2 apparently predated and 21 died by unknown cause. In the group of the second collection, 47 individuals out of 57 have survived (82%). 9 died by unknown cause and 1 by pathogens. Such results indicate that the larvae in galls of this species suffer low to moderate aggressive actions of natural enemies. (CNPq/FACEPE).

KEY WORDS: Galls, Herbivore, Natural enemies, Interaction Animal-Plant, Mata Atlântica.

Acknowledgments We thank the support provided by DCR-FACEPE/CNPq (DCR-0087-2.05/06, APQ-0008-2.05/07)

Section: ***Host relationships***

GALLS IN LEAVES OF CNIDOSCOLUS *QUERCIFOLIUS* POHL (EUPHORBIUACEAE) AND COMPOSITION OF EPICUTICULAR WAX

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The epicuticular wax constitutes the natural interface between plant and environment giving resistance of loss of water and defence against phytophages insects and microorganisms. The objective of this work was to evaluate if the presence of galls is influenced by epicuticular waxes on leaves of "faveleiro" *Cnidoscolus quercifolius* (Euphorbiaceae) from Parnamirim - PE. Leaves were divided in two groups: the first group with 70 galled leaves for description, counting and analysis of the mortality factor of the galls inductor; the second one was formed by 30 galled leaves and 30 ungalled leaves for analysis of the epicuticular wax. The leaves were dehydrated and then submitted to two extractions with *n*-hexane during 30 second. The galls on *C. quercifolius* are green with one chamber, spherical, however anti-symmetrical, measuring on average about 3 mm of length and 2 mm of width and height. The galls were observed in the foliar limb mainly. From 70 observed leaves, 635 galls were counted, an average 9 galls/leaf, of which 63.1% were located on abaxial face and 36.8% on adaxial face. We observed 90% of the larvae have survived, 8% predated and 2% with pathogens. The average content of epicuticular wax was not varied significantly different between ungalled (48.1 µm.cm^{-2}) and galled leaves (55.8 µm.cm^{-2}). The epicuticular wax of *C. quercifolius* is constituted by three substance classrooms of well distinct polarities: *n*-alkanes, aliphatic alcohol and/or alcohol-triterpenes, and fatty acids in both galled and ungalled leaves. (CNPq/FACEPE).

KEY WORDS: galls, herbivore, epicuticular waxes, interaction animal-plant, Caatinga

"GREEN ISLAND" ON *MICONIA CF CINAMOMIFOLIA* (MELASTOMATACEAE).

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Galls are characterized by hyperplasia and/or hypertrophy of cells, fabrics or plant organs, resultant of the action of some organisms, mainly insects. The development and growth of galls depend on the insect's alimentary activity stimulating the formation of new cellular layers on the vegetal fabric of superior quality, called nutritional fabric, which covers the larval chamber. Galls of *Miconia* cf *cinamomifolia* (Melastomataceae) were collected in a fragment of Mata Atlântica located in the Particular Reserve of the Natural Patrimony Carnijó (Moreno, Pernambuco). We collected 171 galls and taken to laboratory, to be described, and opened in order to verify the state of the inductor. The larvae analyzed in function of its phase of life and presence of signals of predation, parasites or some unknown factor of mortality, and conserved in alcohol. Galls are globoids, green to brown color. They have only one larval chamber, which contents a blanked larva. The rate of survival vaieted between 77% to 82%.. The relevant aspect of such success may be caused by one recent and efficient mechanism of survival of galls, known as "green island". This mechanism was described recently by some authors, who observed that after abscission of leaves attacked by galler insects, galls still keep its color "green", it probably keeps the active photossintetic fabric, while the remaining portion of the leaf meagered and died. Such phenomenon also was observed in this study and was described as an adaptation of galler insects against defensive answers of the plant hostess. (CNPq/FACEPE).

KEY WORDS: Galls, Green Island, Natural enemies, Interaction Animal-Plant, Mata Atlântica.

Section: *Host relationships*

A TEST OF THE PLANT ARCHITECTURE HYPOTHESIS: DOES MERISTEM NUMBER AFFECT THE ABUNDANCE OF A NEOTROPICAL GALL MIDGE?

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In the last decades several hypotheses have been suggested to explain the observed patterns of gall distribution, abundance and survivorship. Here, we tested the plant architecture hypothesis that predicts that an increase in host plant architectural complexity and size would result in higher insect abundance and lower parasitoid-associated mortality. Moreover, since galling insects often require young plant tissue for gall induction, we incorporate the total number of meristems in our model. Sixty adult individuals of *Aspilia jolyana* G.M. Barroso (Asteraceae) were sampled at Serra do Cipó, Minas Gerais, Brasil. *Aspilia jolyana* is an endemic shrub from the rupestrian field vegetation and stem galls are induced by an undescribed gall midge. Total height, dry biomass, number of secondary shoots and meristems were used as independent variables in a linear regression with gall abundance, parasitized and preyed upon galls. Nearly 47% of larvae were parasitized by microhymenopterans. There was a great variation in host plant traits, such as plant height (variation from 0.74 to 230 cm; 10.53 ± 61.08; mean ± SD), biomass (2.24 to 113.6; 10.3 ± 26+18) and shoot number. However, plant size, complexity and meristem number did not explain variation in gall abundance. More complex plants did not provide enemy-free sites for the gall midge and our results do not support the plant architecture hypothesis.

KEY WORDS: enemy-free space, Cerrado, parasitism, meristem, architectural complexity.

Section: ***Host relationships***

EFFECTS OF SPATIAL DISTRIBUTION ON SURVIVAL RATES OF A *PIPER* SP. GALL

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Both spatial distribution and density may affect the survival rates of a population in positive or negative ways. This study aimed on testing if the survival rates of a stem and leaf gall (*Piper* sp., unidentified inducer) are affected by its spatial distribution. These galls were found in stems and leaves, displaying a grouped or isolated distribution both in stems and leaves. A total of 890 galls were verified and classified according to their position (Stem or Leaf), distribution (Grouped or Isolated), and when the inducer did not survive; mortality factor was defined among predation, parasitoids, pathogens or unknown. Of these, 94,7% were found in stems and only 5.2% in leaves, being 9.5% grouped and 8.5% isolated. About 88.9% of the galls survived, while pathogens and predation caused the death of 2.25% of galls each. Parasitoids represented 2.58% of the mortality factors and 3.93% of the galls were deceased for unknown reasons. Taking differences into account, 89.3% of the galls found in stems survived against 82.9% of the galls found in leaves. Considering the distribution, 89.2% of the grouped galls survived, while 86.6% of the isolated galls survived. Although it may seem, there is no significant difference between any of the proportions shown (Z-test, $p>0.05$ for each situation). Despite this fact, mortality factors were significantly different in both situations (chi-square, $p<0.05$ for each situation). Apparently the spatial distribution does not affect survival rates for this species, but somehow it alters the access to mortality factors.

KEY WORDS: Spatial distribution, gall density, survival rates, piperaceae, stem and leaf gall

Section: ***Host relationships***

DO GALLED LEAVES OF *PROTIUM HEPTAPHYLLUM* DIFFER FROM UNGALLED LEAVES?

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Protium heptaphyllum (Burseraceae), also know as Almácega-cheirosa, is a widely distributed pantropical species, occurring from the east coast to the north of Brazil. It is a small-sized tree that usually grows to heights of 10 meters and bears some gall-inducing insects which have been identified in previous studies from other authors. However, no record of the gall used in this study was found in the literature, nor the inducer was identified. Gall-infected and gall-free leaves of *P. heptaphyllum* were collected in July of 2009 in an Atlantic forest fragment in Aldeia, Pernambuco, Brazil. The leaves were sorted in 3 different strata on a visual basis: upper, intermediate and lower stratum. In each group, 30 galled leaves and 30 ungalled leaves were randomly collected and had its length, width and area measured in order to verify the hypothesis that galls would generate significant alterations in the leaf blade. In addition, galled leaves had their galls counted in order to verify if gall density varies within the 3 layers and if gall density could be predicted using known area. It seems that galls did not present a challenge for the leaf development, as there were no significant differences between any of the parameters when checked between groups or as a single whole group of galled vs. ungalled leaves. Strata groups differed in gall densities (Kruskal-Wallis test, $p < 0,0001$) but the correlation between the number of galls and area was weak ($r = 0,145$).

KEY WORDS: Burseraceae, gall density, leaf blade, Atlantic forest, tree strata

Section: ***Gall Natural History and Biology***

HISTOCHEMICAL ALTERATIONS CAUSED BY *CALOPHYA MAMMIFEX* (PSYLLOIDEA) DURING LEAF GALL DEVELOPMENT IN *SCHINUS POLYGAMUS* (CAV.) CABRERA (ANACARDIACEAE)

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Calophya mammifex (Hemiptera: Psylloidea) induces spherical galls in leaves of *Schinus polygamus* (Anacardiaceae). The induction causes structural and histochemical alterations in host plant tissues noted in relationship to primary metabolites, which are important for gall inducing insect establishment and gall maintenance, as well as secondary metabolites, commonly related to chemical defenses, but whose influence on gall developmental processes has been poorly explored. The comparative analyses of non-galled tissues with mature and senescent galls, as well as galls with parasitoids demonstrated the maintenance of the potentialities of this Anacardiaceae species for lipidic secretion and concentration of flavonoids, alkaloids, and terpens. Lipids were not detected in tissue layers nearby larval chamber, but their presence in the gall cortex indicates the availability of energetic molecules at gall developmental site. The location of secondary metabolites may be related to its defensive function but also to mechanisms of cell development. The entrance of a parasitoid in the galls of *C. mammifex* alters the accumulation of lipids and reduces sugars, and also alters how the typical nutritive tissue differentiates. While the tissues of *C. mammifex* galls exhibit lipids, reduced sugars, phenolics and alkaloids, similarly to non galled leaf tissues, and a more conspicuous reaction to proteins, tissues of galls with parasitoids do not react for flavonoids and the reactions for proteins and alkaloids are diffuse. Histochemical reactions in senescent galls were detected just in isolated cells maybe due to the end of gall metabolism.

KEY WORDS: anatomy, histochemistry, nutritive tissue, parasitoid, superhost.

Section: ***Gall Natural History and Biology***

CYTOLOGICAL AND HISTOCHEMICAL GRADIENTS DURING NUTRITIVE TISSUE REDIFFERENTIATION IN A MIDGE GALL IN *ASPIDOSPERMA SPRUCEANUM*

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Nutritive tissue differentiation, cytological aspects and nutrient accumulation during a gall midge formation are not thoroughly explored in the Neotropical region. Cytological and histochemical techniques performed in a gall system may reveal some metabolic aspects of gall midge establishment and gall maintenance. This could be achieved through the determination of cytological aspects (pectin and callose deposition, and RNA activity), gradients of nutritious substances (proteins, lipids, starch and soluble sugar), and enzymatic activities (phosphorylase, glucose-6-phosphatase, invertase, and acid phosphatase) in the nutritive tissue. Using the *Aspidosperma spruceanum*-gall midge system, some of these aspects were elucidated: the insect gall activity alters metabolite accumulation in host plant tissues, intense metabolism leads to an increase in reserve accumulation and enzymatic gradients, and so outer and inner nutritive layers differentiate. Imperfections in the deposition of cell wall components, as well as callose and pectin accumulation indicate an increase in apoplastic semi permeability and cell wall porosity. These features could facilitate the macromolecule flux from the outer to the inner cell layers ensuring therefore gall nutrition. Cytological features, such as plastoglobuli formation, pycnotic chromatin in nucleus, vacuole disruption and wall collapse, may be symptoms of cell breakdown and programmed cell death observed in the inner cell layers of the nutritive tissue, which are under constant attack of the gall midge.

KEY WORDS: anatomy, gall, histochemistry, PCD, storage tissue.

Section: ***Gall Natural History and Biology***

ANATOMICAL RESPONSES TO GALL INDUCTION IN *ASPIDOSPERMA SPRUCEANUM* MÜELL ARG. (APOCYNACEAE)

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Leaf galls of *Aspidosperma spruceanum* are induced by an undescribed species of Cecidomyiidae preferentially in internervural region, but also in main and secondary veins. Infestation levels (64-87%) and variation in phenolic contents in non galled and galled leaves were recorded during one-year time. The location of phenolics within galled tissues and its relations to gall development have not been previously evaluated. Galls induced in internervural regions were used as a model for developmental analyses focusing on the levels of cell competence during gall formation and their relation to phenolics location. Due to insect feeding activity, epidermal cells on adaxial leaf surface divide periclinally and their external periclinal wall thickened. On abaxial leaf surface, epidermal cells elongate anticlinally. The fundamental system cells alter their adaptability to photosynthesis, towards tissue specialization for nutrition and protection to the Cecidomyiidae. The most remarkable alterations are the homogenization of adaxial mesophyll layers, hyperplasia of spongy parenchyma in lateral portions of the gall and neoformation of elongated sclereids. Lignification also occurred around larval chamber, forming a very rigid mechanical zone, which limits the external and internal cortex. The vascularization of the gall is continuous to that of the host leaf and guaranteed by neoformation of vascular strands oriented to larval chamber. Gall tissues zonation confer water accumulation, mechanical protection and nutritive source for the Cecidomyiidae, denoting the highest competence of parenchymatic cells to respond to galling stimuli. Also, the histochemical detection of phenolics in gall tissues seems to fit to the sites of intense cell division.

KEY WORDS: *Aspidosperma*, leaf anatomy, galls, ecological interactions, phenolics.

Section: ***Gall Natural History and Biology***

DEVELOPMENT OF ERIOCOCCIDAE GALLS IN *PSEUDOBOMBAX GRANDIFLORUM* (CAV.) A. ROBYNS (MALVACEAE): NO EVIDENCE OF SEXUAL DIMORPHISM

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Galls induced by Eriococcidae commonly have sexual dimorphism as a consequence of peculiarities of the life cycle of males and females. The analyses of galls induced by an undescribed species of Eriococcidae (n= 105) in leaflets of *Pseudobombax grandiflorum* showed no apparent sexual dimorphism. The anatomical analysis of these galls was performed to examine the morphogenetical steps responsible for final gall size and shape, and possible anatomical differences related to the sex of the gall- inducing Eriococcidae. Also, phenolic accumulation in gall tissues may indicate changes in auxin flux, and should occur next to the sites of cell divisions. The Ericococcidae nymphs induce galls on the abaxial surface of young leaflets, lateral to the midrib. Gall development initiates by anticlinal divisions in protodermal layer, and periclinal divisions in abaxial ground meristem. Discrete procambial strands are observed within median ground meristem. Periclinal divisions of cells above the chamber confer the final gall shape. Trichomes differentiate around gall apperture, and obliterate larval chamber opening. Phenolic compounds were detected in tissue layers next to the sites of intense cell divisions, which may indicate a relationship between the accumulation of these compounds and the hormonal status responsible for the morphogenetical patterns of this gall system. Galls induced by males and females in maturation phase exhibited homogeneous parenchyma with vascular bundles interspersed, and mucilage ducts around the nymphal chamber. No sexual dimorphism was observed through anatomical analyses, and just a temporal gap in the senescence of galls induced by males and females in *P. grandiflorum* was detected.

KEY WORDS: anatomical patterns, morphogenesis, phenolics, histochemistry, cell divisions

Section: ***Gall Natural History and Biology***

GALL-INDUCING INSECTS ASSOCIATED WITH *PROTIUM* (BURSERACEAE) AT ADOLPHO DUCKE FOREST RESERVE, MANAUS, AMAZONAS, BRAZIL.

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Our understanding of the systematic and biology of galling insect in the Amazon forest is still limited. In this study, we document the richness of gall-inducing insects associated with *Protium* (Burseraceae) at Adolpho Ducke Forest Reserve, near Manaus, Brazil. We collected galls directly on plants previously identified and marked in the reserve, from January to March 2009. The insect galls were taken to laboratory and kept in plastics pots layered at the bottom with damp cotton and covered by fine screening for obtain the adults insects. Ninety galls morphotypes, were found associated with twelve *Protium* species. The majority of galls occurred on leaves, but some were found on petioles. The species that supported the highest galls richness was *P. divaricatum* with 17 morphotypes. *P. apiculatum* and *P. nitidifolium* were the species with the highest galls density. Most galls were induced by Cecidomyiidae (Diptera). We also found galls induced by Hemiptera. The parasitoids belong to 5 families of Hymenoptera, namely: Braconidae, Eulophidae, Eupelmidae, Eurytomidae and Mymaridae. We also recorded Thysanoptera as gall inquilines. This is the first study that identified the gall inducing insects occurring in an Amazon Forest.

KEY WORDS: Cecidomyiidae, galls, insects, insect-plant interaction, Amazon forest.

A NEW SPECIES OF *SCHIZOMYIA* (CECIDOMYIIDAE, DIPTERA) FROM BRAZIL.

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A new species of Cecidomyiidae (Diptera) *Schizomyia* what induces galls in flower buds of *Jacquemontia holosericea* (Convolvulaceae) is described in the stages of larva, pupa, male and female. *Schizomyia* is a cosmopolitan genus with 49 species known to be associated with 23 families of plants. Only seven species are described from the Neotropical region, four of them from Brazil. The material examined was obtained from a survey of galls made between 1998 and 2000 in areas of restinga in the city of Maricá, RJ, Brazil. The galls on the flower buds occur in the period from July to December, and the number of larvae per gall varies from one to three. Externally, the galled bud is almost indistinguishable, being slightly more elongated than the not attacked bud. *Schizomyia* sp. nov. is the first species of the genus associated with *Jacquemontia*. *Schizomyia* now includes 50 species, eight of the Neotropical region (five of which are described from Brazil), and the number of known species associated with Convolvulaceae rises to three.

KEY WORDS: gall-midge, Cecidomyiidae, Convolvulaceae.

Section: *Gall Natural History and Biology*

INSECT GALLS FROM AN ATLANTIC FOREST REMNANT IN VIÇOSA (MINAS GERAIS, BRASIL).

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Because it is suggested that gall species richness is higher in xeric habitats, gall inventories from mesic habitats such as the Atlantic Forest are uncommon. We analyzed insect galls from a 194 ha semi-deciduous nature reserve, the largest remnant in a formerly forested region. Between April and June of 2009 we walked along a path crossing the reserve and sampled all galls on plants standing up to 1 m distant from the path, from soil level to 2 m high. We conducted four field trips of 3 h each with a sampling effort of two persons at each time, totalising 24 hours of sampling effort. Galls were observed and photographed under the stereomicroscope and classified according to plant architecture (tree, shrub, herb or liana), galled organ, gall form, pubescence, aggregation, and number of chambers per gall. We found 23 morphospecies of insect galls on 13 species of host plants, distributed into 10 families, plus four unidentified plant species. Six galled plants were trees or lianas, four were shrubs and one was an herb. Families with the largest numbers of hosts included Asteraceae (3) and Fabaceae Mimosoideae (2), with four and two gall morphotypes respectively. *Piptadenia gonoacantha* (Fabaceae: Mimosoideae) exhibited three gall morphospecies, *Baccharis dracunculifolia*, *Mikania* sp., *Vernonia polyanthes* (Asteraceae), and a non-identified Dicotyledonae exhibited two gall morphospecies each. Eleven galls were on leafs, ten galls on stems and two on axillary meristems. Most galls were elliptical (10) or globular (9), glabrous (15), isolated (15), and unilocular (18). Our results show that the study area has high gall species richness, and deserves further investigations.

KEY WORDS: gall species richness, insect-plant interaction, gall morphospecies, gall morphology, plant architecture.

Section: ***Gall Natural History and Biology***

BIOLOGY OF THE OVARY GALL INDUCER- *ASPHONDYLIA PONGAMIAE* (CECIDOMYIIDAE:DIPTERA) OF *PONGAMIA PINNATA* (L.) PIERRIE IN SOUTH INDIA.

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Pongamia pinnata (L.) Pierre is one of the important indigenous tree species of India. It is commonly known as pongam or karanj and is an important nitrogen fixing evergreen tree with multiple uses. All plant parts are used for several purposes. The bark is utilized to make ropes and strings and also used as a medicine to treat wounds. The roots are used to treat abscesses. The crushed leaves and seeds are used as an antiseptic. Pongam oil is used for tanning leather, making soap, and as ointment to treat scabies, herpes and rheumatism and as illuminating oil. Presently it is emerging as an important source of biofuel and biopesticides. The yield of pongam seed is 9-90 kg per tree with the yield potential of 900-9000 kg seed/ha. The source of *Pongamia pinnata* oil is mainly dependant on naturally growing trees. Pongamia trees are severely damaged by many insect species. Among them the attack by the ovary gall inducer *Asphondylia pongamiae*, is directly affect the yield of seeds. Since no information is available on its biology and host range a study has been conducted to understand its biology and host range in Karnataka, a pongam growing state in south India. The study was conducted by tracing the eggs on flower buds and periodically collecting and dissecting the ovary galls for the different developmental stages of *A. pongamiae*. The eggs are laid singly on new flower buds and the incubation period lasts for (5-7days), larvae with long duration (around 11 months), pupal period stays for (10-15days) finally the adults emerge at the time of budding. Adult longevity (1.5-2days) in laboratory condition and sex ratio (59:41) were recorded. The insect is univoltine and specific to the host tree. We provide the first data on its biology and host range.

KEY WORDS: Asphondylia, *Pongamia pinnata* gall, medicinal plant, natural history.

Section: ***Gall Natural History and Biology***

COMMUNITY DYNAMICS OF CECIDOMYIIDAE GALLS INDUCED ON *GUAPIRA OPPOSITA* (NYCTAGINACEAE) IN AN ATLANTIC FOREST RESERVE, RIO GRANDE DO SUL STATE, SOUTHERN BRAZIL.

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G*uapira opposita* (Nyctaginaceae) is a phenotypically plastic tree with pantropical distribution. It is considered a super-host, since in Brazil it is galled by at least 7 species of Cecidomyiidae. The responses of this gall community to plant microenvironment can reveal important patterns on host-gall relationships. We evaluate the occurrence of 6 gall morphotypes induced by different Cecidomyiidae (2 unknown species), on *G. opposita* in different environments. Sampling covered two seasons: Summer 2008 and Autumn 2009 in an Atlantic Forest reserve (Itapuã State Park) in Viamão, RS, southern Brazil. Three vegetation types are considered: Restinga woodland (RE), Open subtropical forest (OSF) and Closed subtropical forest (CSF), in a decreasing hygrothermal stress gradient. Across each vegetation 2 independent transects were traversed for 60 min (CSF had 3 transects). Only hosts between 0.5-2 m height were considered and each was carefully inspected for all kinds of galls. A Kruskal-Wallis test was employed. Plant abundance per transect varied from 6 to 129. Overall 3307 galls were found in Summer and 2235 in Autumn. Overall gall abundance was 1175 in RE, 1226 in OSF and 3121 in CSF. Preliminary analysis suggests no significant differences in gall abundance among the vegetation types ($KW_2 = 54.15$; $p = 0.067$ – marginal significance), or among gall types ($KW_5 = 69.42$; $p = 0.225$). A full year is needed before definite conclusions can be reached, however, it appears the results do not support the higrothermal stress hypothesis, with a trend for galls to be more abundant in mesic vegetation types/environments.

KEY WORDS: Cecidomyiidae, leaf galls; shoot galls; super-host; hygrothermal stress hypothesis.

Section: ***Tri-Trophic Interactions***

MICRO-HYMENOPTERA ASSOCIATED WITH CECIDOMYIIDAE (DIPTERA) GALLS AT RESTINGAS OF THE RIO DE JANEIRO STATE

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Micro-Hymenoptera are very frequent on Cecidomyiidae (Diptera) galls and represent the most important natural enemy of this Diptera family. Although their ecological importance, little is known about the faunistic composition of this guild of parasitoids in restinga areas. The collection of the Museu Nacional, Rio de Janeiro (MNRJ) comprises a large number of micro-Hymenoptera obtained from Cecidomyiidae galls in restinga areas of the State of Rio de Janeiro, which were investigated for 16 years. These micro-Hymenoptera are identified at family level and include specimens of Aphelinidae, Bethylidae, Braconidae, Elasmidae, Encyrtidae, Eulophidae, Eupelmidae, Eurytomidae, Mymaridae, Platygastridae, Pteromalidae, Scelionidae, Tanaostigmatidae, Torymidae, and Signophoridae, totalizing 15 families. They were obtained from 100% of the galled plant species and from 95% of the gall morphotypes. They are associated with 106 kinds of gall, 45 plant species (35 genera and 25 families) and 26 genera of Cecidomyiidae, being more frequent on galls of *Asphondylia*, *Bruggmannia*, *Clinodiplosis*, *Dasineura*, *Lopesia*, *Neolasioptera* and *Stephomyia.* The great majority is parasitoid, but some of them, as Tanaostigmatidae and few species of Torymidae and Eulophidae, are inquilinous of galls (phytophagous). Eulophidae, Eupelmidae and Platygastridae were the most frequent families of Hymenoptera, being associated with the greatest number of families, genera and species of plant. Myrtaceae, Fabaceae and Malpighiaceae were the plant families with the greatest number of associated Hymenoptera families. About 135 new records of parasitoids on Cecidomyiidae galls are presented.

KEY WORDS: Cecidomyiidae, Diptera, Hymenoptera, galls, diversity.

Section: ***Tri-Trophic Interactions***

INTERACTIONS WITH PARASITOIDS AND ANATOMICAL ALTERATIONS IN GALLS OF *CALOPHYA MAMMIFEX* (HEMIPTERA: PSYLLOIDEA) ON *SCHINUS POLYGAMUS* CAV. CABRERA (ANACARDIACEAE)

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Galls are structures composed of differentiated plant tissues that provide nourishment, shelter and protection to the inducer organism or its progeny. *Calophya mammifex* (Hemiptera: Psylloidea) induces conspicuous spherical galls on the abaxial leaf surface of *Schinus polygamus* Cav. Cabrera (Anacardiaceae). These galls (n = 180) were sampledof in a population of *S. polygamus* in June 2008 at Rincão da Ronda, Canguçu City, Rio Grande do Sul State, Brazil, and were separated in two groups: one exclusively with individuals of *C. mammifex* and the other group with the inducer and also ecto- and endoparasitoids. The percentage of parasitoidism was 11.7%, and led to color alterations of the galls, from red to green, as well as anatomical peculiarities. Comparing to non-galled leaf tissues, cell hypertrophy, mesophyll hyperplasia, and vascular bundles neoformation were observed in galls whose inhabitant was exclusively *C. mammifex*. Galls with parasitoids developed a nutritive tissue with isolated or clustered cells projected towards nymphal chamber. The general structure of the galls induced by *C. mammifex* is in conformity with the patterns for galls induced by sucking insects. The influence of the other guild integrants changes these patterns, and demonstrates the morphogenetical potentialities of *S. polygamus* to respond to distinct insect stimuli with different feeding habits.

KEY WORDS: plant gall, *Schinus polygamus*, Psylloidea, parasitoids, anatomy

Section: ***Current and novel issues***

COMMUNITY STRUCTURE OF GALL WASPS IN A MEXICAN OAK FOREST: IMPORTANCE OF HABITAT FRAGMENTATION AND HOST PLANT ISOLATION

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Habitat fragmentation may affect biotic interactions altering the composition and structure of insect herbivores as result of reduction and isolation of habitats. More effects of habitat fragmentation are expected in specialist interactions such as plants and galling inducing insects (GII). Specifically, cynipids are gall inducing wasps that maintain a great specificity on the genus *Quercus*. In this study we characterized the community of oaks and gall wasps in fragments of different sizes in the Cuitzeo basin, Michoacán, México, using a systematic sampling method. We found a great specificity of galling inducing wasps on oak species. However, we identified three oak species as "super-hosts" of galls (i.e. *Quercus obtusata*, *Quercus castanea* and *Quercus deserticola)*. Our results showed a greater richness and abundance of galls in isolated oak trees and smaller fragments than in conserved forests. We found that richness and abundance of galls were higher in the edge of fragments. The oak species richness was positive correlated with gall diversity in all fragments. We concluded that habitat fragmentation affect the diversity patterns increasing the richness and abundance of gall wasps. In addition, our results indicated that gall wasps are a potential bioindicators of forest health in Cuitzeo, Mexico.

KEY WORDS: fragment size, cynipids, *Quercus*, edge effect, isolated oak.