The Gall Maker *Neopelma baccharidis* Burck. (Homoptera: Psyllidae) on *Baccharis dracunculifolia* (Asteraceae): Success and Parasitoidism Density Dependence

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O Galhador *Neopelma baccharidis* Burck. (Homoptera: Psyllidae) em *Baccharis dracunculifolia* (Asteraceae): Sucesso e Parasitoidismo Dependente de Densidade

RESUMO - O sucesso do galhador *Neopelma baccharidis* Burck. na planta hospedeira *Baccharis dracunculifolia* e a dependência da taxa de parasitismo foram analisados, em duas manchas de plantas no Parque Estadual do Rio Doce (PERD), considerando-se diferentes escalas espaciais: pequena (entre ramos de diferentes classes de altura), intermediária (entre plantas) e grande (entre manchas). Não houve diferença no sucesso do galhador em escala espacial pequena nem grande. A taxa de parasitismo foi dependente de densidade em escala espacial intermediária, mas não em escala menor (intra-planta) nem maior (entre manchas). O ataque pelos parasitóides foi o fator de mortalidade mais importante para o galhador.

PALAVRAS-CHAVE: Insecta, galhas entomógenas, parasitóides, dependência de densidade.

ABSTRACT - The success of the gall maker, *Neopelma baccharidis* on the host plant *Baccharis dracunculifolia*, and density dependent parasitoidism rate were analyzed in two plant patches in the State Park of Rio Doce (PERD), considering different spacial scales: small (between branch height classes), intermediate (between individual plants) and large (between patches). There was no difference in gall maker success on small nor large spacial scale. Parasitoidism rate was density dependent on an intermediate spacial scale (between individual plants), but not on small (within individual plants) nor on large scale (between patches). The attack by parasitoids was the most important factor of gall maker mortality.

KEY WORDS: Insecta, insect galls, parasitoids, density-dependence.

Herbivores and parasitoids may use different behavioral patterns or environmental cues to localize their resource, leading to differing spatial distributions. This can make specific plants, and the insect gall maker inside the gall, more susceptible to an attack from their enemies or make specific plants, plant parts or galls, an "enemy free" space (Strong *et al.* 1984).

Spatial direct density dependence, through parasitoid functional response, should lead to an aggregated parasitism on

high host density spots (Walde & Murdoch 1988). Aggregating behavior may be essential to successful enemy numerical response, impeding the dispersion and dilution of the enemy population before enough local population growth is achieved (Room 1990, Myers 1992).

The effects of scale on the spatial density dependence of parasitoid attack may provide insights on the importance of functional (behavioral) response in relation to local, numerical, response (Walde & Murdoch 1988). Recent reviews have shown a predominance of small scale over large scale density dependence (Stiling 1987, Walde & Murdoch 1988).

Although density dependence was held as a necessary factor for the regulation of host populations, other processes had been proposed (Pacala *et al.* 1990), and the frequency of density dependent attack by parasites is unexpectedly low (Stiling 1988), reinforcing the view of loose populational control, or "density vagueness" (Strong 1984).

The jumping plant lice *N. baccharidis* induces the most common gall of *B. dracunculifolia*, an elongated globular leaf gall (Lara & Fernandes 1994). Three parasitoid species of this gall maker were observed (R.G.C., personal observation): *Psyllophagus* sp. (Hymenoptera: Encyrtidae), *Zatropis* sp. (Hymenoptera: Pteromalidae) and *Brasema* sp. (Hymenoptera: Eupelmidae). They attack the host in the initial instars, emerging as adults through a hole made in the gall, before its dehiscence.

This work aimed to evaluate the spatial pattern of the gall maker success and of density dependent parasitoidism rate on an herbivore, using the system: *Baccharis dracunculifolia* (Asteraceae), the gall maker *Neopelma baccharidis* Burck. (Homoptera: Psyllidae), and its parasitoids.

Material and Methods

Two host plant patches, of 18 and 55 m^2, at the State Park of Rio Doce (Parque Estadual do Rio Doce - PERD), MG, were sampled from July to September 1992. Number of galls per individual plant were counted in each of eight classes, of 20 cm each, from the ground up. All the galls were picked and, afterwards, opened in the laboratory to verify the presence of healthy and parasitized gall maker nymphs, under an stereoscopic microscope. Three spatial scales were considered: small scale - between branch heights; intermediate scale - between individual plants; large scale - between host plant patches. Gall maker's success was estimated as the proportion of galls with non-parasitized *N. baccharidis* nymphs and was analyzed for small and large spatial scale through analysis of variance. Parasitoidism rate was estimated as the proportion of galls with parasitized *N. baccharidis* inside. The analysis of small and intermediate spatial density dependent parasitoidism rate was made through regression of parasitoidism rate (arcsin transformed) against number of galls per branch height class (small spatial scale), and against number of galls per individual plant (intermediate spatial scale).

Density dependence in large spatial scale was evaluated in two phases. First the proportion of parasitized galls and the proportion of galled plants were compared with Chi-square, separately, between patches. Then these patterns were compared among them. If the patch with greater proportion of galled plants presented greater proportion of parasitism, it was considered as an evidence of direct density dependence.

Results

There was no difference of gall maker success on small scale (Fig. 1) nor on large scale ($t = 1.064$, d.f. = 12, $P = 0.308$). There was no density dependent parasitoidism rate on a small spatial scale ($N = 35$, $r = 0.258$, $F = 2.356$, $P = 0.134$). Although there was a significant difference in the proportion of galled individual plants between patches (Chi = 4.113, $P = 0.043$) the proportion of

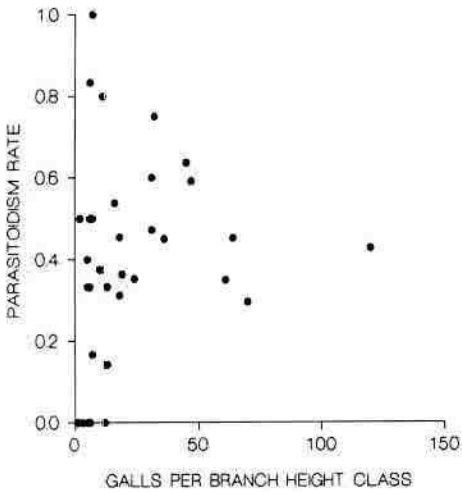

Figure 1. Parasitoidism rate of *Psyllophagus* sp., *Zatropis* sp. and *Brasema* sp. on the gall maker *N. baccharidis*, by number of galls per branch height class, in individual *B. dracunculifolia* plants (N = 35, F = 1.021, P = 0.424).

parasitized galls was not different (Chi = 0.438, P = 0.508), hence there was no density dependence on large scale either (Table 1). The parasitoidism rate was positive density dependent on intermediate scale, when the proportion of parasitized galls per individual plant were analyzed (Fig. 2).

Discussion

Density dependence was detected on an intermediate spatial scale and not on a large nor on a small scale. This may be the result of the parasitoid host searching behavior, aggregating ovipositions near successful host encounters (Walde & Murdoch 1988).

The lack of density dependence on a large spatial scale in this biological system may not be universal. In Viçosa, MG, another region where the *B. dracunculifolia* patches occur in pastures, there is a great gall distribution heterogeneity, which reflects in density dependence of parasitoidism between patches (R.G.C., personal observations).

Parasitoidism is an important factor controlling *N. baccharidis* populations in the PERD: almost all gall maker mortality was due to parasitoidism (just 6.3% and 0% of mortality due to unknown causes, on patches I and II, respectively). This also contrasts with the observations in Viçosa, where 20% of gall maker's mortality was due to other factors, like nymphs and egg predators (R.G.C., personal observations).

Reginal differences can play a major role in parasitoidism rate and mortality causes, as detected for the host *N. baccharidis*. The PERD and Viçosa are very different regions. Whereas *B. dracunculifolia* patches in the PERD are surrounded by a 36,000 ha forest, in Viçosa these plants are localized in pastures, which can isolate the patches one from

Table 1. *Baccharis dracunculifolia* patches in the Parque Estadual do Rio Doce (PERD), percentage of plants with *Neopelma baccharidis* galls, percentage of parasitized and successful galls, total number of plants in each patch, number of galled plants, and number of galls analyzed.

Patch	% Galled Plants	% Parasitized Galls	% Successful Galls	Numer of Plants in the Patch	Number of Galled Plants	Number of Galls Analyzed
I	38.46	40.56	53.15	13	5	143
II	12.05	43.87	56.77	83	10	310

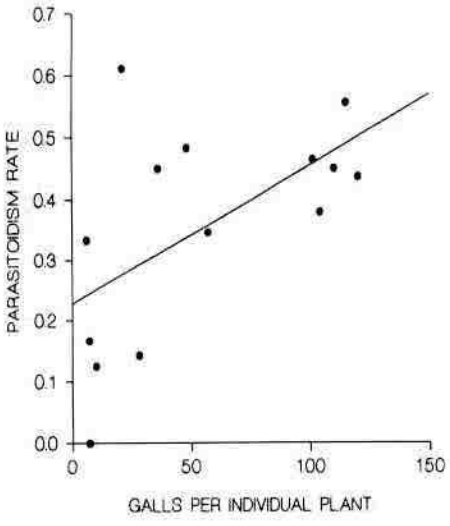

Figure 2. Parasitoidism rate of *Psyllophagus* sp., *Zatropis* sp. and *Brasema* sp. on the gall maker *N. baccharidis*, by number of galls per *B. dracunculifolia* individual plant [N = 14, r = 0.561, Y = 0.055 + 0.0009* (arcsin X), F = 5.516, P = 0.037].

another. Therefore intra-patch populational dynamics of the parasitoids may have greater importance in Viçosa, leading to the observed density dependence pattern. The greater unknown mortality in Viçosa may also be a result of inter locality differences. Whereas in the PERD there is no human disturbance, in Viçosa *B. dracunculifolia* patches are constantly subject to cutting and fire, that can lead to gall maker mortality.

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