SHORT COMMUNICATION

Feeding and oviposition preferences of *Ctenarytaina spatulata* Taylor (Hemiptera, Psyllidae) for *Eucalyptus* spp. and other Myrtaceae in Brazil

Dalva Luiz de Queiroz[1], Keti M. R. Zanol[2], Edílson B. Oliveira[1], Norivaldo dos Anjos[3] & Jonathan Majer[4]

[1]Embrapa Florestas, Estrada da Ribeira, Km 111, Caixa Postal 319, 83411-000 Colombo-PR, Brazil. dalva@cnpf.embrapa.br
[2]Departmento de Zoologia, Universidade Federal de Paraná, Caixa Postal 19020, 81513-990 Curitiba-PR, Brazil. kzanol@ufpr.br
[3]Departmento de Biologia Animal, Universidade Federal de Viçosa, 36570-000 Viçosa-MG, Brazil. nanjos@ufv.br
[4]Department of Environmental Biology, Curtin University of Technology, P. O. Box U 1987, Perth-WA 6845, Australia. j.majer@curtin.ed.au

ABSTRACT. Feeding and oviposition preferences of *Ctenarytaina spatulata* Taylor (Hemiptera, Psyllidae) for *Eucalyptus* spp. and other Myrtaceae in Brazil. The Australian psyllid, *Ctenarytaina spatulata* Taylor (Hemiptera, Psyllidae), was first detected in Brazil in 1994, where it was found on drought-affected shoots of *Eucalyptus grandis* in a plantation located in the northern part of Paraná State. The oviposition and feeding preferences of this psyllid were examined on 19 *Eucalyptus* species, one *Eucalyptus* hybrid (Cambiju), three *Corymbia* species and four native Myrtaceae species (*Hexaclames edulis*, *Marlieria edulis, Plinia trunciflora*, and *Psydium* sp.) under greenhouse conditions. The largest populations of *C. spatulata* were found on *E. robusta* and *E. pellita*, while sizeable infestations were also found on *E. urophylla*, *E. grandis*, and the Cambiju hybrid. The plants with the greatest symptoms of damage were *E. grandis* and *E. resinifera*. *Eucalyptus cinerea, E. benthamii, E. pilularis*, and *E. dunnii* were not infested and *E. cloeziana* was minimally infested. Among the *Corymbia* species, the number of eggs of *C. spatulata* was very low on *C. citriodora* and *C. torelliana*. No eggs and nymphs of *C. spatulata* were found on native Brazilian Myrtaceae. The number of eggs on plants was highly correlated with the subsequent levels of nymphs, suggesting that egg counts can be used as a viable monitoring tool to assist with the integrated management of this pest.

KEYWORDS. Exotic pest; forest pest; psyllid.

RESUMO. Preferência de alimentação e oviposição de *Ctenarytaina spatulata* Taylor (Hemiptera, Psyllidae) por *Eucalyptus* spp. e outras Myrtaceae. *Ctenarytaina spatulata* Taylor, 1997 (Hemiptera, Psyllidae), originária da Austrália, foi detectada no Brasil em 1994. Sua ocorrência foi inicialmente observada em *E. grandis* no Norte do Paraná associada à seca dos ponteiros. Com o objetivo de verificar a preferência deste psilídeo para postura e alimentação foram analisadas, em casa de vegetação, um híbrido e dezenove espécies do gênero *Eucalyptus*, três do gênero *Corymbia* e cinco mirtáceas nativas (*Hexaclames edulis*, *Marlieria edulis, Plinia trunciflora* and *Psydium* sp.). As maiores populações de *C. spatulata* ocorreram em *E. robusta* e *E. pellita*. No entanto, foram as espécies *E. grandis e E. resinifera* que apresentaram o maior número de plantas com sintomas de danos. As espécies *E. cinerea, E. cloeziana, E. dunnii, E. benthamii, E. nitens*, *E. viminalis, E. pilularis* e *E. camaldulensis* não apresentaram infestação por *C. spatulata*. Nas espécies de *Corymbia* foi observado um número muito reduzido de ovos de *C. spatulata* em *C. citriodora* e *C. torelliana*. Em nenhuma das espécies de Myrtaceae nativas foram observados ovos ou ninfas de *C. spatulata*. O número de ovos na planta foi altamente correlacionado com o número de ninfas, sugerindo que a contagem de ovos possa ser usada como uma ferramenta viável no monitoramento desta praga.

PALAVRAS-CHAVE. Pragas exóticas; pragas florestais; psilídeo.

About 5.4 million hectares of plantation forests are grown in Brazil for timber, pulp, paper, charcoal, fuel, rubber, vegetable oil, resin, tannin, and livestock shading. Although many different tree species are grown, the eucalypt is the predominant tree, comprising about 62% of the plantation. The most widely cultivated species are *Eucalyptus grandis, E. urophylla, E. saligna, E. tereticornis, E. camaldulensis, E. viminalis,* and *Corymbia citriodora*.

Many native insects have become serious pests in eucalypt plantations, probably because they have switched from native Brazilian Myrtaceae plants to eucalypts (Mariconi 1956). By 1962, 98 insect species had been reported from eucalypts in Brazil (Silva *et al*. 1968). The first insect pest in eucalypt plantations in Brazil was reported five years after the initial eucalypt research program was launched. There are reports of many native insect pests on eucalypts, including leaf-cutting ants, caterpillars, leaf-eating beetles, and termites (Andrade *et al*. 2000).

In addition to these native pests, several Australian pests have been introduced into South America and established in the eucalypt plantations. The most notable of these are the weevils (Curculionidae), *Gonipterus scutellatus* Gyllenhal and *G. gibberus* (Boisduval), which were introduced into Argentina in the mid-1920's, probably from apple fruits. They were subsequently found on eucalypts in the southern Brazilian state of Rio Grande do Sul and have progressively spread throughout the country to become serious defoliators (Freitas 1991; Anjos & Majer 2003). Another congeneric pair of pests are the wood boring cerambycids, *Phoracantha semipunctata* (Fab.) and *P. recurva* Newman. The former

Table I. List of Eucalyptus and Corymbia species, and native Brazilian Myrtaceae tested for infestation level and preference of Ctenarytaina spatulata. ('+' indicates the season when species was tested).

Species	Sub-genus	Section	Winter 2000	Summer 2001
Corymbia citriodora Hook		Ochraria	+	+
Corymbia maculata Hook		Ochraria	+	-
Corymbia torelliana F. Muell		Ochraria	-	+
Eucalyptus alba Reinw. ex Blume	*Symphyomyrtus*	Exsertaria	-	+
Eucalyptus benthamii Maiden *& Cambage*	*Symphyomyrtus*	Maidenaria	+	-
Eucalyptus camaldulensis Dennh	*Symphyomyrtus*	Exsertaria	+	+
Eucalyptus cinerea F. Muell ex Benth.	*Symphyomyrtus*	Maidenaria	+	-
Eucalyptus cloeziana F. Muell	*Idiogenes*	Gimpiaria	+	+
Eucalyptus deanei Maiden	*Symphyomyrtus*	Transversaria	+	+
Eucalyptus dunnii Maiden	*Symphyomyrtus*	Maidenaria	+	+
Eucalyptus grandis Hill ex Maiden	*Symphyomyrtus*	Transversaria	+	+
Eucalyptus microcorys F. Muell	*Symphyomyrtus*	Sebaria	+	+
Eucalyptus nitens Maiden	*Symphyomyrtus*	Maidenaria	+	+
Eucalyptus paniculata Smith	*Symphyomyrtus*	Adnataria	-	+
Eucalyptus pellita Smith	*Symphyomyrtus*	Transversaria	+	+
Eucalyptus pilularis Smith	*Monocalyptus*	Ranantheria	+	+
Eucalyptus resinifera Smith	*Symphyomyrtus*	Transversaria	+	+
Eucalyptus robusta Smith	*Symphyomyrtus*	Transversaria	+	+
Eucalyptus saligna Smith	*Symphyomyrtus*	Transversaria	+	+
Eucalyptus tereticornis Smith	*Symphyomyrtus*	Exsertaria	+	+
Eucalyptus urophylla S. T. Blake	*Symphyomyrtus*	Transversaria	+	+
Eucalyptus viminalis Labill	*Symphyomyrtus*	Maidenaria	+	+
Cambiju (a hybrid between *E. grandis and E. urophylla)*	*Symphyomyrtus*	Transversaria	+	+
Hexaclames edulis = Cerejeira do Rio Grande do Sul			-	+
Marlieria edulis = Cambucá			-	+
Plinia trunciflora = Jabuticabeira			-	+
Psydium sp. = Araçá de Alagoas			-	+

species was introduced in the early 1950's and both have rapidly spread throughout the country (Biezanko & Bosq 1956; Baucke 1957). They bore into the trunk and can cause 15-20% reduction in wood production (Acel 1984).

One of the most recent pest introductions is the psyllid *Ctenarytaina spatulata* Taylor, which was first detected in Brazil in 1994, found on drought-affected sprouts of *Eucalyptus grandis* in a plantation located in the northern part of Paraná State (Burckhardt *et al*. 1999; Santana *et al.* 1999, 2005; Andrade *et al*. 2000; Santana & Zanol 2006). This insect had previously been introduced into New Zealand without its natural enemies, causing serious damage to *Eucalyptus* (*Symphyomyrtus*) species, mainly in the Transversaria, Maidenaria and Exsertaria sections (Taylor 1997; Satchell 1999). The damage caused by this psyllid in New Zealand has become increasingly apparent over the last few years, with symptoms such as deformation and premature leaf shedding and production of substrate for sooty mould on branches and leaves (D. Satchell pers. comm.). During summer, moderate attacks in the northern New Zealand can cause senescence and premature leaf shedding, with consequent thinning of the crown. The winter shoots suffer less attack, with some distortion and staining due to the growth of sooty mould. It is thought that *C. spatulata* may also contribute to the loss of vigor of the trees in New Zealand (Satchell 1999). *Ctenarytaina spatulata* has also been recorded from California in the USA, Uruguay (Taylor 1997), Portugal and Spain (Hollis 2004; Valente *et al*. 2004).

In view of the economic importance of eucalypts in Brazil, the recent introduction of *C. spatulata* is of considerable concern. Therefore, this study was undertaken to elucidate the preference of *C. spatulata* for various eucalyptus species by examining oviposition and infestation rates of summer and winter generations. We also examined the potential of this psyllid to infest selected native Brazilian myrtaceous species, since the existence of plants from the same family as Australian eucalyptus might predispose them to the attack by this psyllid species.

This research was undertaken in a greenhouse at Embrapa-Florestas, in Colombo, state of Paraná, during 2000 and 2001, under average winter temperatures (27.2^{o}C, 15.3^{o}C and -0.6^{o}C) and summer temperatures (32.7^{o}C, 20^{o}C and 9^{o}C).

Experiment 1. A range of 17 *Eucalyptus* species, one *Eucalyptus* hybrid (Cambiju) and two *Corymbia* spp. seedlings (Table I) were produced in plastic tubes (50 ml) during the summer 2000. Ten seedlings of each species were numbered and sprayed with 0.1% sodium hypochlorite and randomly displayed inside four frames per cage, 50 seedlings per frame, and left in a nutrient solution, as described by Sarruge (1975). Solution concentration was nitrogen (225 ppm), phosphorous (31 ppm), potassium (234 ppm), calcium (200 ppm), magnesium (48 ppm), sulphur (64 ppm), borum (0.5 ppm), Manganes(0.5 ppm), zinc (0.05 ppm), cupper (0.02 ppm), molibdenium (0,01 ppm), and iron (5-0 ppm). Nutrient solution was replaced weekly. Seedlings were exposed to *C. spatulata* by placing two terminal shoots of field-collected *E.*

Table II. Eggs and nymphs number for Ctenarytaina spatulata after seedlings infestation under greenhouse conditions (Winter 2000 and Summer 2001). Mean values within columns followed by the same superscript letter do not differ statistically (Duncan test at 5%).
MP= most preferred, P= preferred, NP = not preferred, LP = less preferred.

Eucalypt Species	Winter 2000		Summer 2001		Preference	'Eucalypt' section
	Eggs	Nymphs	Eggs	Nymphs		
E. robusta	50.9[a]	39.2[a]	10.4[a]	14.1[a]	MP	Transversaria
E. pellita	23.9[b]	12.5[b]	10.3[a]	5.3[cd]	P	Transversaria
E. urophylla	21.4[b]	10.1[b]	7.5[abc]	6.7[bcd]	P	Transversaria
E. grandis	16.1[bc]	6.0[bc]	6.5[abc]	8.6[bc]	P	Transversaria
híbrid Cambiju	16.1[bc]	2.5[c]	9.5[ab]	3.7[de]	P	Transversaria
E. deanei	8.8[cd]	2.4[c]	3.4[bcd]	4.6[de]	NP	Transversaria
E. resinifera	7.5[cd]	5.1[bc]	5.6[abcd]	9.6[b]	NP/P	Transversaria
E. microcorys	3.8[cd]	1.1[c]	2.2[cd]	0.5[ef]	NP	Sebaria
E. alba	--	--	1.4[cd]	0.3[ef]	NP	Exsertaria
E. saligna	3.5[d]	1.5[c]	0.1[d]	0.4[f]	NP	Transversaria
E. tereticornis	3.5[d]	1.2[c]	1.1[cd]	0.1[ef]	NP	Exsertaria
E. camaldulensis	1.3[d]	0.3[c]	0.1[d]	0[f]	NP/LP	Exsertaria
C. citriodora	0.7[d]	0.1[c]	0.1[d]	0[f]	NP/LP	Ochraria
E. paniculata	--	--	0.1[d]	0[f]	NP	Adnataria
C. torelliana	--	--	0.1[d]	0[f]	NP	Ochraria
E. viminalis	0.1[d]	0.4[c]	0[d]	0[f]	NP/LP	Maidenaria
C. maculata	0[d]	0[c]			LP	Ochraria
E. cinerea	0[d]	0[c]			LP	Maidenaria
E. cloeziana	0[d]	0[c]	0.1[d]	0[f]	LP/NP	Gimpiaria
E. dunnii	0[d]	0[c]	0.1[d]	0[f]	LP	Maidenaria
E. benthamii	0[d]	0[c]	--	--	LP	Maidenaria
E. pilularis	0[d]	0[c]	0.1[d]	0[f]	LP	Renantheria
E. nitens	0[d]	0[c]	0[d]	0.1[f]	LP/NP	Maidenaria
Marlieria edulis	--	--	0[d]	0.1[f]	LP	--
Psydium sp.	--	--	0[d]	0.1[f]	LP	--
Hexaclames edulis	--	--	0[d]	0.1[f]	LP	--
Plinia trunciflora	--	--	0[d]	0.1[f]	LP	--

grandis (infested with a mean of 3.1 nymphs and 1.2 eggs) next to each plant. Seedlings were placed in four cages of voil and evaluated 180 days after initial exposure, when *C. spatulata* population was well established (winter 2000), counting the number of eggs and nymphs on one terminal shoot of each plant.

Experiment 2. During the 2000 winter a slightly different range was seen in plants seedbed with vermiculite, being those: 17 *Eucalyptus* species, plus one hybrid *Eucalyptus* (Cambiju), two *Corymbia* species and four native Myrtaceae species (Table I). Seedlings were subsequently split up and transferred to plastic-bag pots. These were mounted in frames over trays of nutrient solution as in Experiment 1. Individual seedlings were exposed to *C. spatulata* by placing an infested terminal shoot of *E. grandis* (infested with a mean of 3.1 nymphs and 1.2 eggs) next to each seedling. At the end of the experiment (summer 2001 on 19 February 2001, 180 days after initial exposure to *C. spatulata*), the apical terminal shoot of each plant was removed and eggs and nymphs were counted. Number of plants with deformities and black sooty mould on leaves were also scored.

The numbers of eggs and nymphs on each plant species, for the winter and summer generations respectively, were separately compared by one-way analysis of variance and the individual means were compared by Duncan's *post-hoc* test using a 5% significance level. Based on this analysis, the plant species were classified in four categories: "most preferred", "preferred", "not preferred" and "less preferred". To ascertain whether incidence of eggs transcribed into infestations of nymphs, the two variables were subjected to regression analysis and the Pearson correlation coefficient was calculated.

Numbers of eggs and nymph colonies were larger in the winter. There was a strong linear relationship between number of eggs and nymphs on various seedlings species both, during the winter season ($r = 0.79$; $n = 13$; $P < 0.05$) and summer ($r = 0.95$; $n = 15$; $P < 0.05$). Less preferred plants with few or no eggs or nymphs were not included in the analysis (Fig. 1). It was observed that *C. spatulata* oviposits preferentially on the most suitable host plants. The Duncan's test was used to classify the plant species based on the preference degree by the psyllids. These classifications are not strict, but rather are meant as a convenient way of describing the results of insect preference**.**

In both generations, *E. robusta* was the most preferred plant species for infestations, and the only one classified as most preferred. Similarly, in the two experiments *E. pellita*, *E. urophylla*, *E. grandis*, and the Cambiju hybrid were classified as preferred. *E. deanei*, *E. microcorys*, *E. saligna*, *E. tereticornis* were not preferred, whereas *E. dunnii* and *E. pilularis* were the less preferred. The positions of the remaining species varied between the winter and summer

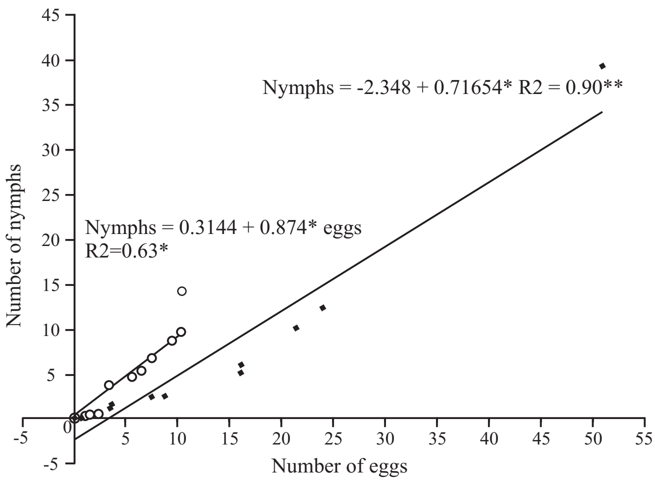

Fig. 1. Linear regression of the mean number of nymphs against the mean number of eggs on plants in Winter 2000 (♦) and Summer 2001 (○); not preferred plant species with no eggs or nymphs are excluded from the analysis. * significant at 5%; ** significant at 1%.

generations (albeit minimally) in the classification; *E resinifera* reclassified from not preferred to preferred, while *E. camaldulensis*, *C. citriodora*, *E. cloeziana*, *E. nitens* and *E. viminalis* switched from not preferred to less preferred between seasons. Note that *C. maculata*, *C. torelliana*, *E. benthamii*, *E. cinerea*, *E. paniculata* were subject to experimentation in only one of the seasons (Table I). None of the native Myrtaceae was infested by the psyllid.

Plants infested with *C. spatulata* did not show visible symptoms of attack. In the winter generation, *E. robusta*, which was the most preferred species, showed intermediate levels of staining and curling leaves and sooty mould. On the other hand, *E. grandis* and *E. resinifera* showed more attack symptoms, even being lower on the preference scale. *E. alba* also exhibited moderate symptom levels, even though it was classified as not preferred.

Neither eggs nor nymphs of *C. spatulata* were found on any of the native species of Brazilian Myrtaceae studied. We believe that in view of their taxonomic spread, there is a low probability that *C. spatulata* will adapt to non-eucalyptus hosts.

Although Taylor (1997) commented that *C. spatulata* has a wider host range than other members of the genus, their host range was still limited to a modest number of eucalyptus species in certain sections and subgenera of *Eucalyptus* and *Corymbia*. In this study, host plants that showed the highest levels of infestation by *C. spatulata* are members of the *Eucalyptus* subgenus *Symphyomyrtus*, mainly in the section Transversaria. By contrast, hosts in the *Eucalyptus* subgenus *Symphyomyrtus*, sections Adnataria, Exsertaria, Maidenaria and some Transervaria, the subgenera *Idiogenes* and *Monocalyptus* and the genus *Corymbia* were classified either as not preferred or less preferred.

These results indicate that several eucalypt species are potentially vulnerable to *C. spatulata*, although infestation levels do not necessarily transcribe into visual symptoms. However, absence of symptoms does not mean lack of importance of the insect, as the vigor of the tree might be reduced by the psyllid.

Damage may be particularly associated with drought-affected shoots, at least for *E. grandis* (Burckhardt *et al*. 1999; Santana *et al.* 1999, 2005; Andrade *et al.* 2000; Santana *et al.* 2003). When considering the role of chemical present in the leaves infested with Psyllidae*,* White (1971) proposed that plants stressed by lack or excess of water cease to grow and, consequently, accumulate nitrogen in terminal shoots. The subsequent increase in the source of soluble nitrogen associated with the stress of the host plant increase the survival of the nymphs and may explain the observations concerning *C. spatulata* on *E. grandis* in Brazil (Catling 1969; White 1969). According to these data, we believe that the plants here considered most preferred can be more severely attacked in conditions of more severe water stress.

Amongst the host species evaluated in this study, there are some that are very important to the Brazilian forestry sector, including extensively planted monoculture areas of *E. grandis* and *E. urophylla.* Continuous plantations of such species may encourage the dispersal of *C. spatulata*. Additionally, this pest is associated with leaf senescence and drying of terminal shoots of at least one eucalyptus species, requiring control measures following an integrated pest management program.

The statistical coefficients between eggs and nymphs (Fig. 1) indicate that immature populations can be estimated by egg numbers. The resulting information might be used to determine if either prophylactic or curative treatments were required. Alternatively, not preferred or less preferred eucalyptus species could be planted, reducing the need for active control of this pest. Candidate species might include the one that showed lower infestation levels, such as *E. benthamii*, *E. dunnii*, *E. cinerea*, *E. cloeziana*, *E nitens*, *E. paniculata, E. pilularis, E. viminalis*, *C. citriodora, C. maculata* and *C. torelliana*, or even those showing medium-low infestation levels, such as *E. alba*, *E. camaldulensis*, *E. deanei*, *E. microcorys*, *E. saligna*, *E. resinifera,* and *E. tereticornis*.

Acknowledgements. To the Brazilian Embrapa-Florestas for providing facilities and human resources; to Gary Taylor kindly commented on an earlier draft of this manuscript. This work is a part of a doctorate thesis which was submitted to the Universidade Federal de Paraná in Curitiba.

REFERENCES

Acel, Associação das empresas de celulose e papel. 1984. **A broca do eucalipto.** Lisboa. Direcção Geral das Florestas, 5 p.

Andrade, F. M.; L. M. A. Maschio & D. L. Q. Santana. 2000. Biodiversidade de plantios de *Eucalyptus grandis* com seca de ponteiros em Arapoti, PR. **Revista Floresta 30**: 175.

Anjos, N. dos & J. D. Majer. 2003. **Leaf-eating beetles in Brazilian eucalypt plantations**. Curtin University School of Environmental Biology Bulletin No. 23, 33 p.

Baucke, O. 1957. Cerambicídeos do Rio Grande do Sul. **Iheringia-Zoologia 8**: 5–30.

Biezanko, C. M. & J. M. Bosq. 1956. Cerambycidae de Pelotas e seus arredores. **Acros 9**: 3–15.

Burckhardt, D.; D. L. Q. Santana; A. L. Terra; F. M. Andrade; S. R. C. Penteado; E. T. Iede & C. S. Morey. 1999. Psyllid pests (Hemiptera: Psylloidea) in South American eucalypt plantations. **Bulletin de la**

Société Entomologique Suisse 72: 1–10.

Catling, H. D. 1969. The bionomics of the South African citrus psylla, *Trioza erytreae* (Del Guercio) (Homoptera: Psyllidae). 5. The influence of extremes of weather on survival. **Journal of the Entomological Society of Southern Africa 32**: 272–290.

Freitas, S. 1991. Biologia de *Gonipterus gibberus* (Boiduval, 1991) (Coleoptera, Curculionidae), uma praga de eucaliptos. **Anais da Sociedade Entomológica do Brasil 20**: 339–334.

Hollis, D. 2004. **Australian Psylloidea: Jumping Plantlice and Lerp Insects**. Australian Government, Department of Environment and Heritage. Canberra. Goanna Print, 232 p.

Mariconi, F. A. M. 1956. Alguns besouros depredadores de eucaliptos na região de Piracicaba. **O Biológico 22**: 1–14.

Santana, D. L. Q.; A. F. J. Bellote & R. A. Dedecek. 2003. *Ctenarytaina spatulata* Taylor: água no solo, nutrientes minerais e sua interação com a seca dos ponteiros do eucalipto. **Boletim de Pesquisa Florestal 46**: 57–68.

Santana, D. L. Q.; F. M. Andrade; A. F. J. Bellote & A. Grigoletti Jr. 1999. Associação de *Ctenarytaina spatulata* e de teores de magnésio foliar com a seca dos ponteiros de *Eucayptus grandis*. **Boletim de Pesquisa Florestal 39**: 41–49.

Santana, D. L. Q. & K. M. R. Zanol. 2006. Biologia de *Ctenarytaina spatulata* Taylor, 1997 (Hemiptera, Psyllidae) em *Eucalyptus grandis* Hill ex Maiden. **Acta Biologica Paranaense 35**: 47–62.

Santana, D. L. Q.; K. M. R. Zanol; P. P. C. Botosso & P. P. Mattos. 2005. Danos causados por *Ctenarytaina spatulata* Taylor, 1977 (Hemiptera: Psyllidae) em *Eucalyptus grandis* Hill. Ex Maiden. **Boletim de Pesquisa Florestal 50**: 11–24.

Sarruge, J. R. 1975. Soluções nutritivas. **Summa Phytopathologica 1**: 231–233.

Satchell, D. 1999. Eucalypt psyllids. **Forest Health News 88**: August. http://www.forestresearch.co.nz/largetext.cmf?pageid=1143&componentid=1311 & pageid=1143&CFID=6826257&CFTOKEN=70647004 Accessed 4 November 2001.

Silva, A. G. A.; C. R. Gonçalves; D. M. Galvão; A. J. L. Gonçalves; J. Gomes; M. N. Silva & L. Simoni. 1968. **Quarto catálogo dos insetos que vivem nas plantas do Brasil, seus parasitos e predadores**. Parte 2, Volume 1. Rio de Janeiro, Ministério da Agricultura. 622 p.

Taylor, K. L. 1997. A new Australian species of *Ctenarytaina* Ferris and Klyver (Hemiptera: Psyllidae: Spondyliaspidinae) established in three other countries. **Australian Journal of Entomology 36**: 113–115.

Valente, C.; A. Manta & A. Vaz. 2004. First record of the Australian psyllid *Ctenarytaina spatulata* Taylor (Homoptera: Psyllidae) in Europe. **Journal of Applied Entomology 128**: 369–370.

White T. C. R. 1969. An index to measure weather-induced stress associated with outbreaks of psyllids in Australia. **Ecology 50**: 905–909.

White T. C. R. 1971. Lerp insects (Homoptera: Psyllidae) on red gum (*E. camaldulensis*) in South Australian. **South Australian Naturalist 46**: 20–23.

Received 30/09/2008; accepted 30/12/2009