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The first record of eucalyptus shoot psyllid *Blastopsylla occidentalis* Taylor (Hemiptera: Psyllidae) and its parasitoids, *Psyllaephagous* spp. (Hymenoptera: Encyrtidae) in Rwanda

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Abstract
Eucalyptus trees, which are native to Australia, are now a commercial resource worldwide, and planted forest cover in some African countries is often dominated by these trees. Here, we report, from Rwanda, the presence of *Blastopsylla occidentalis* (Hemipetra: Psyllidae), a serious invasive pest of *Eucalyptus*, and its natural enemy parasitoids for the first time. First, we confirmed the occurrence of this psyllid species from Rubavu, Bugesera and Gasabo Districts of the country. Second, we found many mummified nymphs of the psyllid and identified the associated parasitoid as *Psyllaephagus blastopsyllae* (Hymenoptera: Encyrtidae). Furthermore, another psyllid parasitoid *Psyllaephagus pilosus* was also confirmed. A comprehensive study of the alien psyllid pests together with their natural enemies is necessary in Africa to develop biocontrol pest management and protection of eucalypts.

Keywords: Myrtaceae, invasive species, parasitoid wasps, biological control

Introduction
Eucalypt trees, most of which are native to Australia, have extensively been introduced and planted worldwide for commercial and environmental purposes since more than three centuries ago [1, 2]. In Africa, over 100 *Eucalyptus* species were introduced. More than 700,000 hectares in East Africa are planted with these trees [3]. Eucalypt trees in Africa are an important forest resource used for fuel, perfumery, lumber, honey production, medicine and construction [3]. In Rwanda, eucalypt trees have also been introduced to reduce over-dependence on natural forests for fuel wood, and now cover approximately ninety percent of planted forests that are estimated to more than a half of the country's forest cover [4]. Thus, *Eucalyptus* trees are important in Rwanda and other African countries but remain continentally controversial for their environment impact and economic benefit [5, 6].

A global introduction of eucalypt plants has however led to a global introduction of their native insect herbivores. Representative examples of the eucalyptus herbivores recorded outside of their native region are *Eucalyptus* psyllids (Hemipetra: Psyllidae), which are small plant sap sucking insects [7, 8]. The adults are actively mobile as opposed to their nymphs that are sessile and congregate [9]. If not properly controlled, they may outbreak causing serious economic damage to *Eucalyptus* trees; in fact, this happens globally in eucalyptus plantations [10, 11]. Defoliation and stunted plant growth due to psyllid infestation can result in to whole tree death. Until recently, very few herbivorous pests have been recorded for eucalypt trees in Africa probably because they are not native on the continent; however, records of serious psyllid pests have recently been increasing [12]. In the present study, we first record the occurrence of a psyllid pest in Rwanda.

Given the importance of *Eucalyptus* trees in Africa, establishment of psyllid management tactics is on a strong demand continentally. For the management of psyllid population, chemical pesticides are extensively used but resistance against the pesticides is also prevalent [13]. Insect natural enemies like host specific parasitoids [14, 15] are employed to control psyllid populations [16, 17]. but their existence in Rwanda has not yet been documented. The current study is set to report the presence of Eucalyptus shoot psyllids in Rwanda for the first time. In addition, this study records the occurrence of their natural enemies that are not native to the country. We discuss the importance of control of the invasive psyllid pests and the usefulness of unintentionally introduced parasitoid wasps.

Materials and Methods

We first made general surveys to investigate the occurrence of herbivores on eucalypt trees in Rwanda, and sampling was made on eucalypt trees to identify the herbivores and their associated natural enemies. Field surveys were made at 5 localities in Rwanda, *i.e.*, Nyamugali and Kora Villages in Rubavu District; Kabeza in Gasabo District; Nyamata and Kamabuye in Bugesera District, between November and December 2016. The *Eucalyptus* tree species found in the study sites were *Eucalyptus camaldulensis* Dehnh, *E. tereticornis* Sm.**,** *E. globulus* Labill and *E. grandis* W. Hill. These tree species are reportedly attacked by various psyllid species in other different regions of the world [18, 19]

The insects were collected on sunny days from trees that seemed to be heavily infested. Eucalyptus trees were chosen depending on visible density of psyllids on trifoliate and densely infested leaves were sampled. Trifoliate containing psyllid nymphs was gently clipped off from the twigs into a paper envelope. Then, the envelope was sealed and kept for later examination of psyllids. The number of psyllids on each leaf and in crevices were counted under a stereomicroscope. When mummified nymphs were found, they were also noted, and were reared for the emergence of associated parasitoids. In addition, we did interview surveys to gather information about the severity of psyllid infestation on eucalypt trees. Local farmers found in their mixed crop farms planted with eucalypts in Kora, Nyamugali and Kamabuye Villages were interviewed in the surveys.

Results and Discussion

In all study sites, we detected infestations or symptoms caused by psyllid pests. The infestation was often severe and trifoliates were found discolored to brown. High psyllid density was observed on buds and underneath leaves of young eucalypt trees of approximately five meters high, mostly nymphs and few adults were collected together with eggs but in rarer cases. The symptoms were not only visible on sampled trees, but many other eucalyptus trees in the vicinity were also observed to be heavily infested. We first collected adults and nymphs of the psyllids for identification, and found they were all eucalyptus shoot psyllid Blastopsylla occidentalis (Hemiptera: Psylloidea). This is the first record of eucalypt pests from Rwanda, and is also the first record of B. occidentalis from the country. In Africa, similar psyllid pests were first recorded from South Africa [7] but recent reports from Tunisia [20], Cameroon [21] and Tanzania [22] suggest a rapid expansion of the range of distribution

Therefore, our current study suggests the psyllid pest is now widely distributed in most parts of Africa.

We also recorded the density of this newly recorded pest. On average, around 20 young and older nymphs or psyllid mummies were counted on each collected leaf with the number ranging from 7 to 36 individuals per leaf (Table 1), indicating a significant infestation in all collected areas. The high number of individual psyllids observed on each leaf was supposedly because of tree selection bias. During sampling, densely infested trees were chosen for study because our primary aims were to examine the composition and identification of the pests and to search their parasitoids. Nevertheless, our study demonstrates that psyllid damage on eucalypt trees is not negligible anymore in Rwanda.

Table 1: Mean numbers (with ± SD) of psyllids collected from eucalypt trees

Districts	Total Nº psyllids	Mean Nº psyllids/ tree	Mean Nº psyllids/leaf
Rubavu	1091	181.83±7.17	20.20±6.46
Bugesera	1030	171.66±5.56	19.07±4.60
Gasabo	514	85.66±6.67	21.41±5.02

In addition, our interview surveys with the local farmers also suggest the damage levels caused by the invasive alien psyllids have been severe; many of the local farmers expressed frustration because of economic losses they incurred due to psyllid damage. The farmers perceived the problems of the pest which they referred to by the Kinyarwanda name “Inda z’inturusu” but did not know how else to mitigate them after unsuccessful use of ineffective pesticides. *Eucalyptus* psyllids are known to cause tree leaves to discolor and defoliate and ultimately result in tree death [23], [19]. Thus, proper management of *B. occidentalis* is strongly required. Although chemical control may be a commonly applied method, the other methods like biological control using natural enemies may also be useful.

Fig 1: Mummified larvae of *B. occidentalis* on *Eucalyptus globulis* leaf

Nymph parasitoids of eucalyptus psyllids were observed in the fields but population estimate for insect natural enemies was not evaluated. We found many mummies of *B. occidentalis* nymphs on *Eucalyptus globulis* in all study sites (Fig. 1), from which we confirmed that *Psyllaephagus blastopsyllae* (Hymenoptera: Encyrtidae) emerged. To our knowledge, the present study is the first to record this natural enemy parasitoid from Rwanda. *P. blastopsyllae* is native to Australia and is known as a major parasitoid of *B. occidentalis* recently described in Cameroon [17] around 3,500km, away from collection sites. Although we do not know how this alien parasitoid has been introduced to Rwanda, a wide occurrence of this parasitoid in the country suggests its introduction may not be recent with possible dispersal in the neighboring countries as well. We expect that it may be a promising biocontrol agent of *B. occidentalis* though the rate of parasitism was not measured in the present study; encyrtid parasitoids (Hymenoptera: Encyrtidae) are demonstrated to be effective natural enemies of nymph stages of psyllids [24].

In addition, another psyllid species may be invading Rwanda. During the field survey, we also found *Psyllaephagus pilosus* (Hymenoptera: Encyrtidea), which is known as a host specific parasitoid attacking the psyllid *Ctenarytaina eucalypti* [25]. Although this psyllid was not observed in our field study, the presence of its specialist parasitoid may indicate the presence of the host, *C. eucalypti*. The monophagous *P. pilosus* from Australia was deemed effective after it was released into blue gum lerp psyllid *C. eucalypti* infested fields in US and Brazil; it successfully established and reduced the psyllid population below the economic injury level [16, 26]. Future studies will also focus on the occurrence of *C. eucalypti* in Africa and the role *P. pilosus* may have on the psyllid.

Conclusion

Thus, the present study has shown that the damage caused by *Blastopsylla occidentalis* on the eucalyptus tree plantations is significant in Rwanda and other African countries. It is therefore imperative to do an extended monitoring of pest diversity, population dynamics, ecological and economic impacts as well as studies for pests management and control. Evaluation of insects' natural enemies present in the area is also equally important and necessary for development and utilization of biological control for the psyllid pest management and plant protection.

References

1. Hui C, Richardson DM, Visser V, Wilson JRU. Macroecology meets invasion ecology: Performance of Australian acacias and eucalypts around the world revealed by features of their native ranges. Biol Invasions. 2014; 16:565-76. doi:10.1007/s10530-013-0599-4.
2. Silva-Pando FJ, Pino-Pérez R. Introduction of *Eucalyptus* into Europe. Aust For. 2016; 79:283-91. doi:10.1080/00049158.2016.1242369.
3. FAO. Eucalytpus in East Africa; The socio-economic and environmental issues. FAO, 2009.
4. Republic of Rwanda. Forest Investiment Program for Rwanda: Ministry of Lands and Forestry. Rwanda Water for Auth, 2017, 162.
5. Albaugh JM, Dye PJ, King JS. Eucalyptus and Water Use in South Africa. Int. J for Res. 2013; 2013:1-11. doi:10.1155/2013/852540.
6. Ndambi OA, Ndzerem S. Local NGO's initiative for the replacement of eucalyptus forests by multi-purpose agro-forestry species in the grassland region of Cameroon. Small-Scale for Rural Dev Intersect Ecosyst Econ Soc. 2006:357–61.
7. Hollis D. Parapsylla, a Gondwanan element in the psyllid fauna of southern Africa (Homoptera). Zool J Linn Soc 1985; 83:325–42. doi:10.1111/j.1096-3642. 1985. tb01179.x.
8. Mansfield S. New communities on eucalypts grown outside Australia. Front Plant Sci. 2016; 7:1–9. doi:10.3389/fpls.2016.01812.
9. Hodkinson ID. Life cycle variation and adaptation in jumping plant lice (Insecta: Hemiptera: Psylloidea): a global synthesis. J Nat Hist. 2009; 43:65–179. doi:10.1080/00222930802354167.
10. Burckhardt D, Santana DLQ, Terra AL, Andrade FM de, Penteado SRC, Iede ET *et al*. Psyllid pests (Hemiptera, Psylloidea) in South American eucalypt plantations. Mitteilungen Der Schweizerischen Entomol Gesellschaft. 1999; 72:1–10.
11. FAO. Forest pest species profiles: Major sap-sucking pest of eucalypt species; Glycaspis brimblecombei. FAO, FOREST PES. 2012; 3:53–5.
12. Faulkner KT, Hurley BP, Robertson MP, Rouget M, Wilson JRU. The balance of trade in alien species between South Africa and the rest of Africa. Bothalia 2017; 47:1-16. doi:10.1111/mec.12065.
13. Collett N. Biology and control of psyllids, and the possible causes for defoliation of eucalyptus camaldulensis dehnh. (River red gum) in south-eastern Australia-a review. Aust For. 2001; 64:88–95. doi:10.1080/00049158.2001.10676170.
14. de Queiroz DL, Burckhardt D, Majer J. Integrated Pest Management of Eucalypt Psyllids (Insecta, Hemiptera, Psylloidea). Integr Pest Manag Pest Control - Curr Futur Tactics, 2012, 2003. doi:10.5772/32631.
15. Karaca İ, Kayahan A, Şimşek B, Çelikpençe Y. First record of Glycaspis brimblecombei Moore (Hemiptera: Aphalaridae), in Turkey. Phytoparasitica. 2015; 43:171-5. doi:10.1007/s12600-015-0457-2.
16. Dahlsten DL, Rowney DL, Copper WA, Tassan RL, Chaney WE, Robb KL *et al*. Parasitoid wasp controls blue gum psyllid. Californian Agric, 1998, 31-4. doi:10.3733/ca.v052n01p31.
17. Tamesse JL, Soufo L, Tchanatame EC, Dzokou VJ, Gumovsky A, Coninck E de. Description of Psyllaephagus blastopsyllae sp. n. (Encyrtidae), new species, endoparasitoid of Blastopsylla occidentalis Taylor (Psyllidae, Spondyliaspidinae) in Cameroon. J Biodivers Environ Sci. 2014; 5:228-36.
18. Brennan EB, Hrusa FG, Weinbaum SA, Levison W. Resistance of eucalyptus species to glycaspis brimblecombei (Homoptera: Psyllidae) in the San Francisco bay area. Pan-Pac Entomol. 2001; 77:249-53.
19. Spodek M, Burckhardt D, Protasov A, Mendel Z. First record of two invasive eucalypt psyllids (Hemiptera: Psylloidea) in Israel. Phytoparasitica. 2015; 43:401–6. doi:10.1007/s12600-015-0465-2.
20. Ben Attia S, Rapisarda C. First record of the red gum lerp psyllid, Glycaspis brimblecombei Moore (Hemiptera Psyllidae), in Tunisia. Phytoparasitica. 2014; 4 2:535-9. doi:10.1007/s12600-014-0391-8.
21. Tamesse JL, Laurentine S, Wenceslas Y, Joly DV. First record of Blastopsylla occidentalis Taylor, 1985

(Hemiptera: Psyllidae), a Eucalyptus psyllid in Cameroon, Central Africa. Entomol Res. 2010; 40:211-6. doi:10.1111/j.1748-5967.2010.00285.x.
22. Petro R, Mpiri A, Mkude A. Susceptibility of eucalyptus species and clones to red gum lerp psyllid, Glycaspis brimblecombei (Hemiptera: Psyllidae) in Mbizi. Int J Environ Agric Biotechnol. 2017; 2:417-20.
23. Paine TD. Eucalyptus Redgum Lerp Psyllid. Univ Calfornia Agric Nat Resourses, 2006, 2-5.
24. Daane KM, Sime KR, Dahlsten DL, Andrews JW, Zuparko RL. The biology of Psyllaephagus bliteus Riek (Hymenoptera: Encyrtidae), a parasitoid of the red gum lerp psyllid (Hemiptera: Psylloidea). Biol Control. 2005; 32:228-35. doi:10.1016/j.biocontrol. 2004.
25. Hodkinson ID. A Biocontrol of eucalyptus psyllid Ctenarytaina eucalypti by the Australian parasitoid Psyllaephagus pilosus : a review of current programmes and their success. Biocontrol News Inf. 1999; 20:129–34.
26. Kurylo CL, Garcia MS, Costa V a, Tibola C, Ramiro G a, Finkenauer E. Occurrence of Ctenarytaina eucalypti (Maskell) (Hemiptera: Psyllidae) and its natural enemy Psyllaephagus pilosus Noyes (Hymenoptera: Encyrtidae) in Eucalyptus globulus in the state of Rio Grande do Sul, Brazil. Neotrop Entomol. 2010; 39:671-3. doi:10.1590/S1519-566X2010000400031.