

## Rapid Assessment of the need for a detailed Pest Risk Analysis for Grain Chinch Bug *Macchiademus diplopterus* (Distant)

*Disclaimer: This document provides a rapid assessment of the risks posed by the pest to the UK in order to assist Risk Managers decide on a response to a new or revised pest threat. It does not constitute a detailed Pest Risk Analysis (PRA) but includes advice on whether it would be helpful to develop such a PRA and, if so, whether the PRA area should be the UK or the EU and whether to use the UK or the EPPO PRA scheme.*

### **STAGE 1: INITIATION**

#### **1. What is the name of the pest?**

*Macchiademus diplopterus* (Distant) (Hemiptera: Blissidae)

Grain chinch bug (Fera preferred common name), grain stink bug, South African grain bug or stinkbesies

#### **Synonymy:**

*Blissus diplopterus* Distant; *Atrademus diplopterus* (Distant); *Ischnodemus diplopterus* (Distant).

#### **2. What is the pest's status in the EC Plant Health Directive (Council Directive 2000/29/EC) and in the lists of EPPO?**

*Macchiademus diplopterus* is not listed in the Annexes of the EC Plant Health Directive 2000/29/EC and is not recommended for regulation as a quarantine pest by EPPO, nor is it on the EPPO Alert List.

It is listed as an A2 quarantine pest of *Triticum* spp. by the Inter-African Phytosanitary Council, African Union (<http://www.auappo.org/en/IMG/pdf/pestslda.pdf>).

#### **3. What is the reason for the Rapid Assessment?**

*Macchiademus diplopterus* (Distant) is native to South Africa where it is a serious pest of wheat, oats and barley. It has been detected in England in association with fresh apple, citrus, nectarine, peach and plum fruit imported from South Africa on at least 14 occasions. The most significant finding was in February 2011, when several hundreds of live adult bugs were detected with South African peaches at the Port of Tilbury, Essex. The consignment was destroyed under statutory notice to prevent the introduction of the pest. A rapid assessment is required to help risk managers decide on a response to the potential pest threat.

## **STAGE 2: RISK ASSESSMENT**

### **4. What is the pest's present geographical distribution?**

*Macchiademus diplopterus* is endemic to the Western Cape Province of South Africa (Slater & Wilcox, 1973; Sweet, 2000).

North America:	<i>Not recorded, presumed absent (previously intercepted).</i>
Central America:	<i>Not recorded, presumed absent (previously intercepted).</i>
South America:	<i>Not recorded, presumed absent (previously intercepted).</i>
Caribbean:	<i>Not recorded, presumed absent (previously intercepted).</i>
Europe:	<i>Not recorded, presumed absent (previously intercepted).</i>
Africa:	South Africa.
Middle East:	<i>Not recorded, presumed absent (previously intercepted).</i>
Asia:	<i>Not recorded, presumed absent (previously intercepted).</i>
Oceania:	<i>Not recorded, presumed absent (previously intercepted).</i>

### **5. Is the pest established or transient, or suspected to be established/transient in the UK?**

*Macchiademus diplopterus* is absent from the UK.

It has been intercepted in England on at least 14 occasions with produce from South Africa, most frequently on imported peaches during January. On one occasion (February 2011), hundreds of live bugs were found.

Intercepted on peach fruit, 18.iv.1923; Newcastle, docks, on nectarine fruit, 26.ii.1960; on peach fruit, 15.i.1965; South Hampton, on peach fruit, 7.i.1966; London, Heathrow, on peach fruit, i.1983; London, Heathrow, on nectarine fruit, i.1984; Essex, Port of Tilbury, peach fruit, 20.xii.2005; Essex, Port of Tilbury, on peach fruit, 7.ii.2006; Essex, Port of Tilbury, peach fruit, 28.iii.2006; Somerset, Bristol, Royal Portbury Dock, orange fruit, 1.xii.2006; Middlesex, Feltham, near Heathrow Airport, peach fruit, 4.i.2007; Essex, Port of Tilbury, with plum fruit and nectarine fruit, 9.i.2007; Lincolnshire, Spalding, with apples, 27.ix.2007; Essex, Port of Tilbury, with peach fruit, 8.ii.2011.

In addition, one suspect *M. diplopterus* was found at the Port of Tilbury, on pear fruit, 15.v.2007.

### **6. What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK?**

*Macchiademus diplopterus* is oligophagous on Poaceae including native grasses, invasive weeds and cereal crops (Sweet, 2000).

**Table 1: Hosts plants of *Macchiademus diplopterus***

<b>Plant family</b>	<b>Host plant</b>	<b>Comment</b>
Poaceae	<i>Avena fatua</i> - common wild oat	Sweet, 2000
	<i>Avena sativa</i> - common oat	Sweet, 2000
	<i>Bromus catharticus</i> - rescue grass	Sweet, 2000
	<i>Bromus diandrus</i> - great brome	Sweet, 2000
	<i>Ehrharta longiflora</i> - longflowered veldtgrass	Sweet, 2000
	<i>Ehrharta erecta</i> - panic veldtgrass	Sweet, 2000
	<i>Ehrharta</i> sp. nr. <i>calycina</i>	Sweet, 2000
	<i>Hordeum murinum</i> - wall barley	Sweet, 2000
	<i>Hordeum</i> sp. - barley	Sweet, 2000
	<i>Lolium multiflorum</i> - annual rye grass	Sweet, 2000
	<i>Pentaschistis trisetia</i>	Sweet, 2000
	<i>Poa annua</i> - annual meadow grass	Sweet, 2000
	<i>Triticum aestivum</i> - common wheat	Sweet, 2000

The most economically important hosts in Britain are wheat, oats and barley. It also occurs on many wild grasses that are common and widely distributed in the UK, for example, annual rye grass and annual meadow grass. Wall barley is common in England and Wales.

**7. If the pest needs a vector, is it present in the UK?**

*Macchiademus diplopterus* does not need a vector.

**8. What are the pathways on which the pest is likely to move and how likely is the pest to enter<sup>1</sup> the UK? (By pathway):**

Pathway 1. On produce (fruit).

The volume of imported fruit from South Africa into England and Wales is huge, yet there have only been 8 confirmed findings since 2005 (see section 5 above). Host plants (grasses) are widely available, however, adults have largely been found during the winter (November to March) when outdoor temperatures are too low for the adults to fly. This would inhibit transfer from fruit to outdoor hosts.

Very unlikely  Unlikely  Moderately likely  Likely  Very likely

**9. How likely is the pest to establish outdoors or under protection in the UK?**

*M. diplopterus* “is most troublesome” in the drier, “peripheral wheat-growing areas” of Western Cape Province (Annecke & Moran, 1982). This has an arid Mediterranean climate with a long hot dry season and a relatively short cool rainy season. The adults survive the hot dry southern summer, autumn and early winter (November/December to June-July) by remaining quiescent (aestivation). Although maximum/minimum temperatures and rainfall during the rest of the year when the adults are active and development occurs are similar to those in southern UK (see Annex 1, Figs 1-4) it is important to note that:

- The UK climate has no distinct hot/dry and cooler/wet seasons like the Mediterranean climate of Western Cape Province.
- The CLIMEX climate match index program was used to compare the climate in a 10' latitude-longitude resolution grid cell that includes Piketburg (a location in Western Cape Province where *M. diplopterus* occurs in high numbers (Johnson & Addison, 2008)) with grid cells in the UK. The maximum match index for the UK (in eastern Kent) was 0.63 (1.0 would mean the climates are identical). As expected, southern European grid cells with a Mediterranean climate had a far higher climate match (see Fig. 5).
- Rainfall occurs year-round in the UK, providing cool-wet conditions that this species will never experience in its native range. It is important to note that this species is commonest in the drier areas of the Western Cape.
- Although constant low temperatures (-0.5°C) used for shipping fruit for at least 8 weeks are required to obtain 100% mortality of adult bugs (Myburgh & Kriegler, 1967; Addison 2005), it is unlikely that this degree of cold tolerance will allow the species to survive outdoors through a British winter. However, since it is frequently found in containers exporting South African fruit, this suggests that adults may remain in packing houses where they would be more likely to survive the winter due to higher minimum temperatures.

Since the climates in the Western Cape and the UK are so dissimilar and this species is very unlikely to be adapted to British winters, it is unlikely to establish outdoors. Small populations may be maintained where they are protected from the prolonged cool, damp UK winters, e.g. in farm buildings. This species is not known to breed indoors.

<sup>1</sup> Entry includes transfer to a suitable host

Outdoors	Very unlikely		Unlikely	X	Moderately likely		Likely		Very likely	
Under protection		X								

**10. How quickly could the pest spread in the UK?**

In South Africa tremendous numbers of the insects fly in late spring at temperatures above 21°C to seek sheltering places to survive the dry summer (Giliomee, 1959). They may travel several kilometres (Anneke & Moran, 1982).

Adult behaviour in British climatic conditions, and therefore dispersal potential, is difficult to predict, as springtime in South Africa (when the adults disperse) is autumn in Britain.

Adults are strong fliers and can fly several kilometres, when temperatures are suitable. They may also be dispersed in trade, for example, throughout Britain with apples from Kent.

Natural dispersal	Very slowly		Slowly		Moderate pace	X	Quickly		Very Quickly	
Trade	Very slowly		Slowly		Moderate pace		Quickly	X	Very Quickly	

**11. What is the area endangered by the pest?**

Since establishment outdoors is unlikely due to poor over-wintering survival (see section 9), no area is particularly endangered. Small populations may establish in grasses and grain crops near where there is some protection from the UK winter, e.g. in farm buildings. Population densities are likely to be highest in the warmest and driest areas of eastern England but these are significantly cooler and wetter than areas of South Africa where it is a damaging pest.

**12. What is the pest’s economic, environmental or social impact within its existing distribution?**

*Macchiademus diplopterus* suck the sap out of the stems which impairs growth, resulting in wilting and a stunted appearance, and drying of leaves (Sim, 1965; Matthee, 1974). The plants often die before producing ears of grain. It is a serious pest of wheat, oats and barley in South Africa. Attacks by the bug in the drier grain-growing area of the Western Cape Province often make cultivation of these crops uneconomic (Lounsbury, 1918; Smit, 1964; Sim, 1965; Matthee, 1974; Annecke & Moran, 1982; Sweet, 2000).

Very small		Small		Medium		Large	X	Very large	
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**13. What is the pest’s potential to cause economic, environmental or social impacts in the UK?**

Based on the evidence in sections 9 and 11, the overwintering survival of *M. diplopterus* in the UK is likely to be low and population densities are unlikely to reach damaging levels in UK cereal crops. In South Africa large numbers of adults congregate in fruit trees to aestivate accounting for their frequent interception with fruit imports. Although this can lead to the rejection of consignments, this is not likely to occur in the UK, because population densities are likely to remain low and there is no long dry season that requires aestivation behaviour.

Very small  Small  Medium  Large  Very large

**14. What is the pest's potential as a vector of plant pathogens?**

*Macchiademus diplopterus* is not known to be a vector.

**STAGE 3: PEST RISK MANAGEMENT**

**15. What are the risk management options for the UK? (Consider exclusion, eradication, containment, and non-statutory controls; under protection and/or outdoors).**

*Macchiademus diplopterus* is classified as a quarantine pest and is listed as an A2 pest of *Triticum spp.* by the African Plant Protection Organisation (APPO). Post-harvest methods of control such as cold treatment and fumigation with methyl bromide are not fully effective against *M. diplopterus* and the USA requires an additional declaration stating that the commodity from South Africa has been inspected and found free of this pest.

Control of the pest on cereal crops may be possible using foliar insecticides such as lambda-cyhalothrin and zeta-cypermethrin. However, there is a possibility of resistance to available products depending on the population's history of exposure to chemicals in its country of origin.

**16. Summary and conclusion of rapid assessment.**

This rapid assessment shows:

*Risk of entry – unlikely (on produce)*

Although *Macchiademus diplopterus* has been intercepted on imported produce on several occasions, it has only been found in large numbers once and since 2005 it has mainly been found during the winter (November to March) when outdoor temperatures are too low for the adults to fly.

*Risk of establishment – outdoors is unlikely, very unlikely under protection*

Outdoor establishment is unlikely because the climates of the Western Cape and the UK are very different and this species is unlikely to survive the prolonged cold and damp conditions of British winters except where they are protected, e.g. in farm buildings. This species has not been observed in protected crops.

*Rate of spread – moderate pace*

If it did establish, adults are strong fliers and can disperse several kms when temperatures are above 21°C. Spread is likely to be faster in trade.

*Economic impact – may have a very small impact to cereals*

Poor overwintering survival coupled with low population densities indicate that any impacts are expected to be very small.

*Endangered area –* Where populations have been able to overwinter and establish on grasses and grain crops in the vicinity, densities are likely to be highest in the warmest and driest areas of eastern England but these are still significantly cooler and wetter than areas of South Africa where it is a damaging pest.

*Risk management - pesticides.*

Control on cereal crops would probably be relatively straightforward, in the absence of insecticide resistance, but it could involve additional treatments and there is some uncertainty concerning the effectiveness of available products.

**17. Is there a need for a detailed PRA? If yes, select the PRA area (UK or EU) and the PRA scheme (UK or EPPO) to be used.**

The detail provided on climate comparison between the UK and South Africa suggests that there is no requirement for a more detailed UK PRA on this pest. The pest is considered to be more of a threat to southern and Mediterranean EU Member States and this rapid assessment should be passed to EPPO for awareness and to alert southern EPPO countries.

No	<input checked="" type="checkbox"/>			
Yes	<input type="checkbox"/>	PRA area: UK or EU	<input type="checkbox"/>	PRA scheme: UK or EPPO

18. Given the information assembled within the time scale required, is statutory action considered appropriate / justified?

Statutory action Yes

Statutory action No

*This rapid assessment should be passed to EPPO for awareness and to alert southern EPPO countries. The UK will continue to take statutory action on this pest to reduce the risk of introduction to the wider EU.*

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## IMAGES OF PEST AND SYMPTOMS



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*Macchiademus diplopterus* adults

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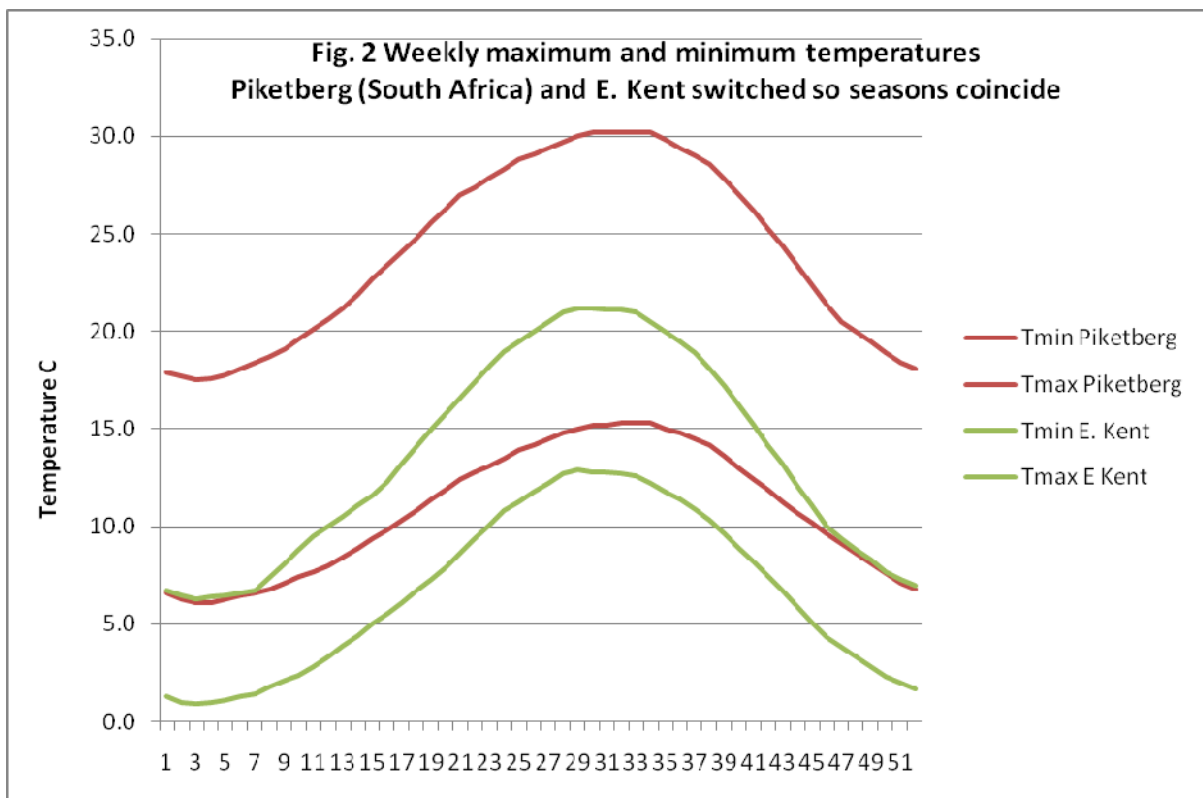
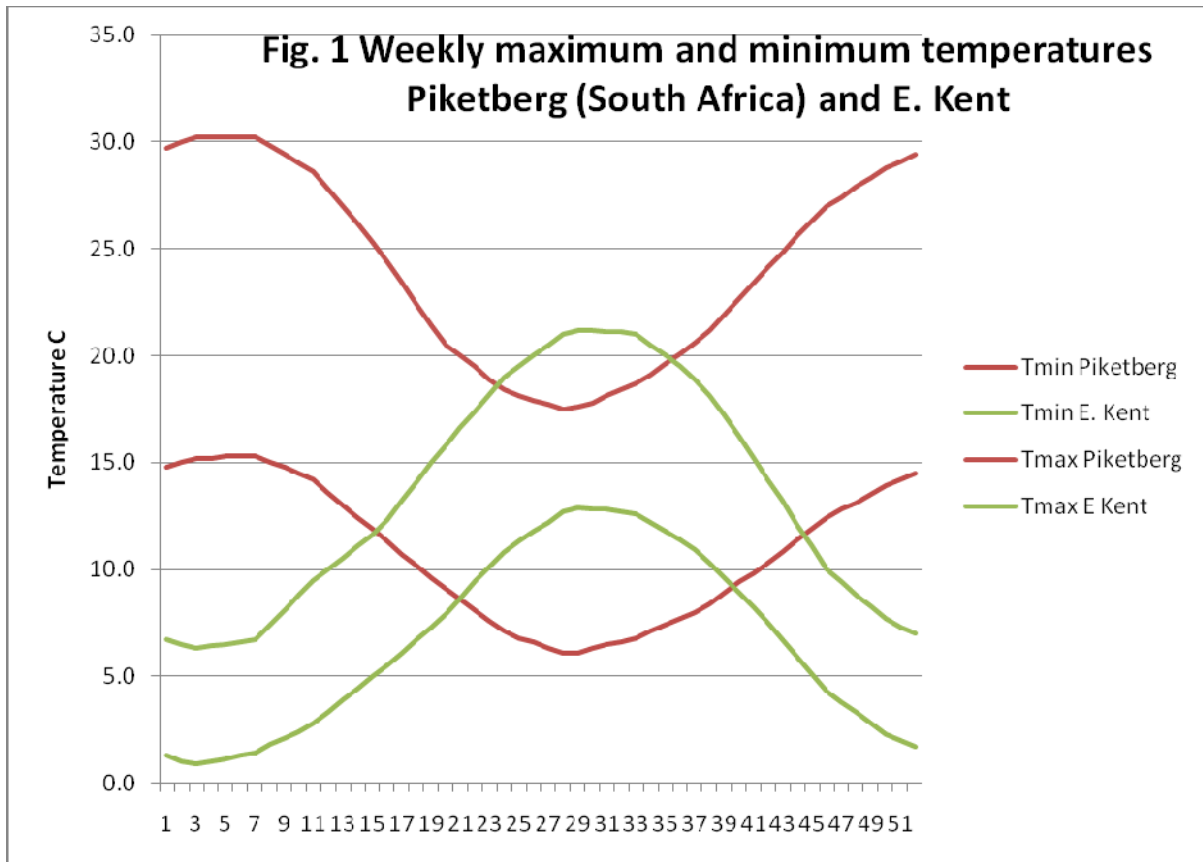
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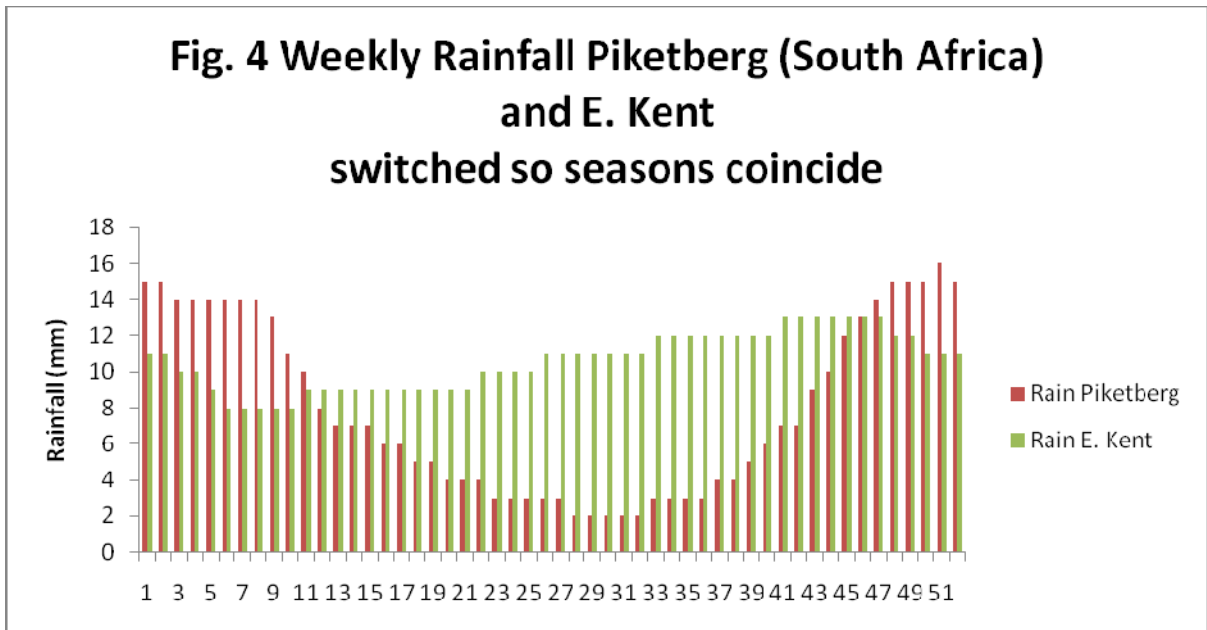
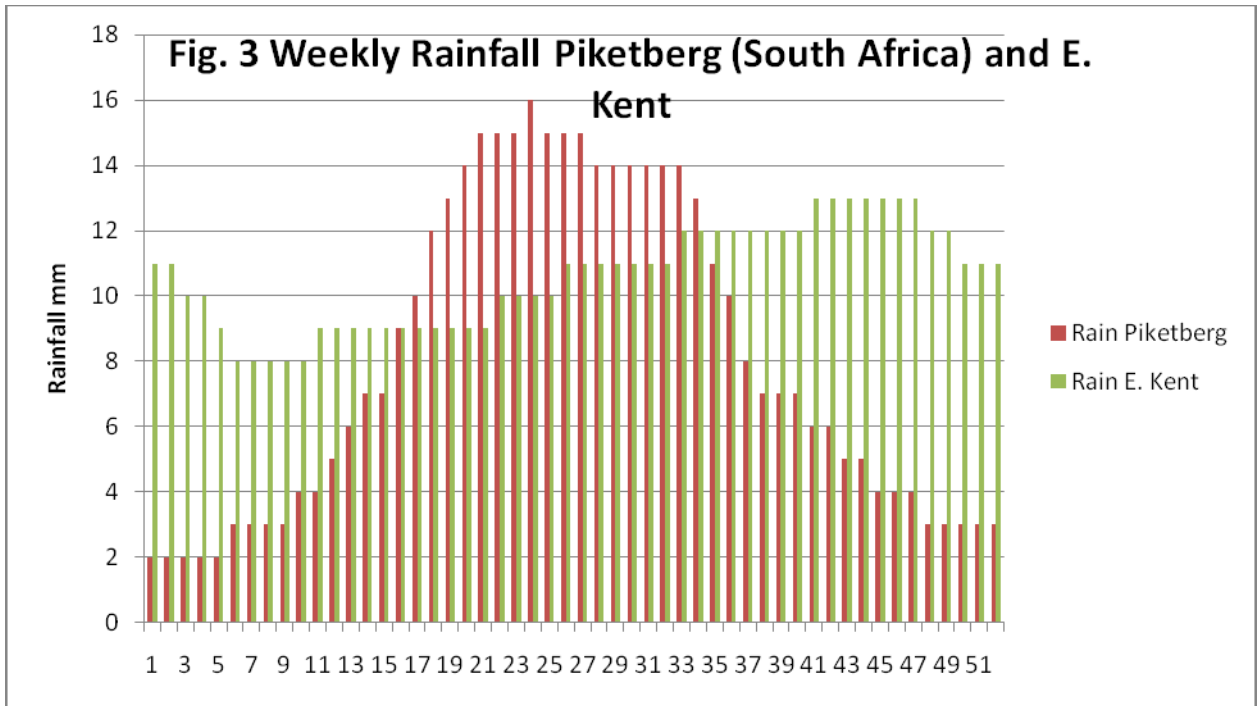
## References

- Addison, P.** 2004, Seasonal occurrence and monitoring of grain chinch bug on pears. *South African Fruit Journal*, Oct/Nov: 16 – 21.
- 2005, Post-harvest control of the grain chinch bug *Macchiademus diplopterus* (Heteroptera: Lygaeidae) on pears in the Western Cape Province, South Africa. (ISHS) *Acta Horticulturae*, **671**: 549 – 554.
- Aitken, A.D.** 1984, *Insect Travellers, Volume II*. MAFF Agricultural Development and Advisory Service Reference Book 437. 74 pp. HMSO, London.
- Annecke, D.P. & Moran, V.G.** 1982, Insects and mites of cultivated plants in South Africa. Butterworths, Durban, South Africa.
- Giliomee, J.H.** 1959, Grain stink-bug can be controlled effectively. *Farming South Africa*, **35**: 47-48.
- Herring, J.L.** 1973, Insects not known to occur in the United States. South African grain bug. *U.S. Dept. Agric. Coop. Econ. Inst. Rep.*, **23**: 733-734.
- Johnson, S.A. & Addison, P.** 2008, A survey of the grain chinch bug, *Macchiademus diplopterus* (Distant) (Hemiptera: Lygaeidae), in deciduous fruit orchards in the Western Cape, South Africa. *African Entomology*, **16**: 76 – 85.
- Lounsbury, P.P.** 1918, *Division of Entomology. Annual Report 1917-18*. Union of S.A. Dept. Agric. Rep. pp 87-107.
- Malumphy, C. & Reid, S.** 2007, Non-native heteropterans found in England in association with imported plant material during 2006 and 2007. *Het News*, **10** (Autumn 2007) 2-4.
- Matthee, J.J.** 1974, Pests of graminaceous crops in South Africa. *Entomol. Mem. Dep. Agric. Tech. Serv. Republic South Africa*, **40**: 1-23.
- Moran, H.** 2007, *Macchiademus diplopterus*: South African Grain Chinch Bug. PPH 3648. Central Science Laboratory. 4 pp. (unpublished).
- Myburgh, A.C. & Kriegler, P.J.** 1967, The grain stink-bug, *Blissus diplopterus* Dist., as a pest of export fruit, with special reference to its cold-hardiness. *Journal of the Entomological Society of Southern Africa*, **29**: 90-95.
- Seymour, P.R., Roberts, H. & Kilby, L.J.** 1985a, *Insects and other invertebrates found in plant material imported into England and Wales, 1983*. MAFF (Publications), HMSO. 68 pp.
- Seymour, P.R., Roberts, H. & Davis, M.E.** 1985b, *Insects and other invertebrates found in plant material imported into England and Wales, 1984*. MAFF (Publications), HMSO. 72 pp.
- Sim, J.T.R.** 1965, Wheat production in South Africa. *Dep. Agric. Tech. Serv., South Africa Bull.*, **377**: 1-75.
- Slater, M.H.** 1964, Ethiopian Lygaeidae II. The subfamily Blissinae in tropical Africa (Hemiptera: Lygaeidae). *Revue de Zoologie et de Botanique Africaines*, **70**: 305-355.
- Slater, J.A. & Wilcox, D.B.** 1973, The chinch bugs or Blissinae of South Africa (Hemiptera: Lygaeidae). *Memoirs of the entomological Society of southern Africa*, **12**: 1-135.
- Smit, B.** 1964, *Insects in southern Africa: How to control them*. Oxford University Press, Thibault House, Cape Town, South Africa.
- Sweet, M.H.** 2000, Seed and Chinch Bugs (Lygaeoidea) In Schaefer, C.W. & Panizzi, A.R. (Eds.) *Heteroptera of Economic Importance*. 143-264. CRC Press.



**Annex 1: *Macchiademus diplopterus*: a comparison of the climate in Western Cape Province and the UK**





**Fig. 5** CLIMEX climate match indices comparing Piketberg (Western Cape Province, South Africa) with Europe at 10' latitude-longitude resolution using the Climond database; 30 years centred on 1975.

