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Climate conditions and *Stemphyllium* leaf blight development

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1 BACKGROUND

During the 2017–08 growing season, significant outbreaks of *Stemphylium* leaf blight (SLB) occurred in commercial onion fields across the main growing regions of Pukekohe, Hawke's Bay and Canterbury (Wright et al. 2018).

The possibility that climate may have been a contributor to the appearance of SLB was evaluated using hourly temperature and relative humidity (RH) data, and this last growing season (2017–18) was compared with the previous four seasons in Pukekohe, Hawke's Bay and Canterbury when there are no records that the disease was observed.

2 APPROACH

Hourly minimum and maximum temperatures and RH% were obtained from the National Institute of Water and Atmospheric Research Limited (NIWA) climate database for Pukekohe (station 2006), Hawke's Bay (station 15876) and Canterbury (station 17603). Any missing data was filled using a spline regression of daily pattern changes in the data. The dates used for climate assessment range from 1 August to 28 February in each growing season. This captures the bulk of the onion season, and when infection first appeared — late December of 2017 to early January of 2018.

Conditions ideal for SLB infection are when temperatures are above 15°C and leaves are wet (Suheri & Price 2000). There are no recorded leaf wetness measurements on an hourly basis for these regions. Hence, we made an assumption that an ideal infection condition occurred when the minimum temperatures were above 15°C and RH was above 88% for any given hour. These temperature and RH conditions should last for 16 h for optimal infection, but interruption of these conditions by a dry period of up to 24 h had very little effect on reducing infection by SLB in onions (Suheri & Price 2000).

To evaluate the possible climate effects on SLB, the number of days with likely infection potential were calculated and to compare seasons the accumulated days of infection conditions were estimated. Onions are also affected by heat stress above 27°C (Coolong & Randle 2003). As SLB can infect a weakened plant, the amount of heat stress experienced by crops in the different seasons was also estimated. Water stress may have been a factor, but without individual farmer records of irrigation this is not possible to identify, and is more likely to be local rather than regional in effect. Since the appearance of SLB is at a regional scale, heat stress may provide a good comparison across years.

2.1 Accumulated infection potential

The number of hours with the ideal temperature and RH conditions were summed for each day. These were then expressed as a fraction of a day (24 h) and accumulated over the growing season from 1 August to the end of February for a simple comparison across seasons. The results for the three regions are shown in Figure 1.

Overall, there is a greater number of infection days in Pukekohe than in Canterbury and Hawke's Bay, across all seasons. Infection days also start earlier in Pukekeohe (about 100 days after 1 August – or 9 November) compared to 120 days after 1 August (29 November), confirming that there is the potential for higher risk of infection in the Pukekohe region.

This last season (2017–18) there was a higher number of infection days than previous seasons in all regions, with up to 35 days in Pukekohe, 25 days in Hawke's Bay and 20 days in Canterbury. In the previous seasons the next highest number of infection days was 11 in Canterbury for the 2014-15 season, 14 days in Hawke's Bay in the 2013-14 season, and 27 days in Pukekohe for the 2015-16 season.

By 150 days after 1 August (late December) there were already close to 5 total infection days in Canterbury (Figure 1). The next highest season (2013–14) had close to 4 days by that time, but then increased only slightly over January and February. In contrast, the 2017–18 there was a sharp increase in the January – February period. This was most likely a key infection period in the Canterbury region.

In Hawke's Bay, the 2013–14 season had close to a total of 10 infection days by 150 days after 1 August, which was higher than the 5 days experienced up to late December (150 days after 1 August) in the 2017–18 season. However, the accumulation of infection days slowed during January and February in the 2013–14 season but increased rapidly in the 2017–18 season, similar to conditions in Canterbury.

In contrast to Canterbury and Hawke's Bay, the accumulation of infection days in Pukekohe did not vary much between the seasons (Figure 1). In most seasons, the accumulated infection days were similar up to late December (at 150 days after 1 August). The total accumulated infection days in the 2017–18 season was only higher than other seasons from around 175 days after 1 August, equating to the 23 January (Figure 2). Most crops in Pukekohe had observable symptoms by this stage, suggesting that it was not just the accumulated infection periods that were related to the observed symptoms. To further evaluate any stress that may have contributed to disease infection, the amount of heat stress experienced in each region was evaluated.

2.2 Heat stress

The proportion of the day that had temperatures above 27°C was estimated. We compared the heat stress with the infection period experienced each day; overlapping periods could likely result in plants that are more susceptible to infection. Results for the three regions are shown in Figure 2. There are more infection periods in Pukekohe, and there tend to be more days with heat stress in Canterbury and Hawke's Bay.

The actual number of days that had heat stress and an infection period were calculated and this data is summarised in Figure 3. These data show that the 2017–18 season had a greater

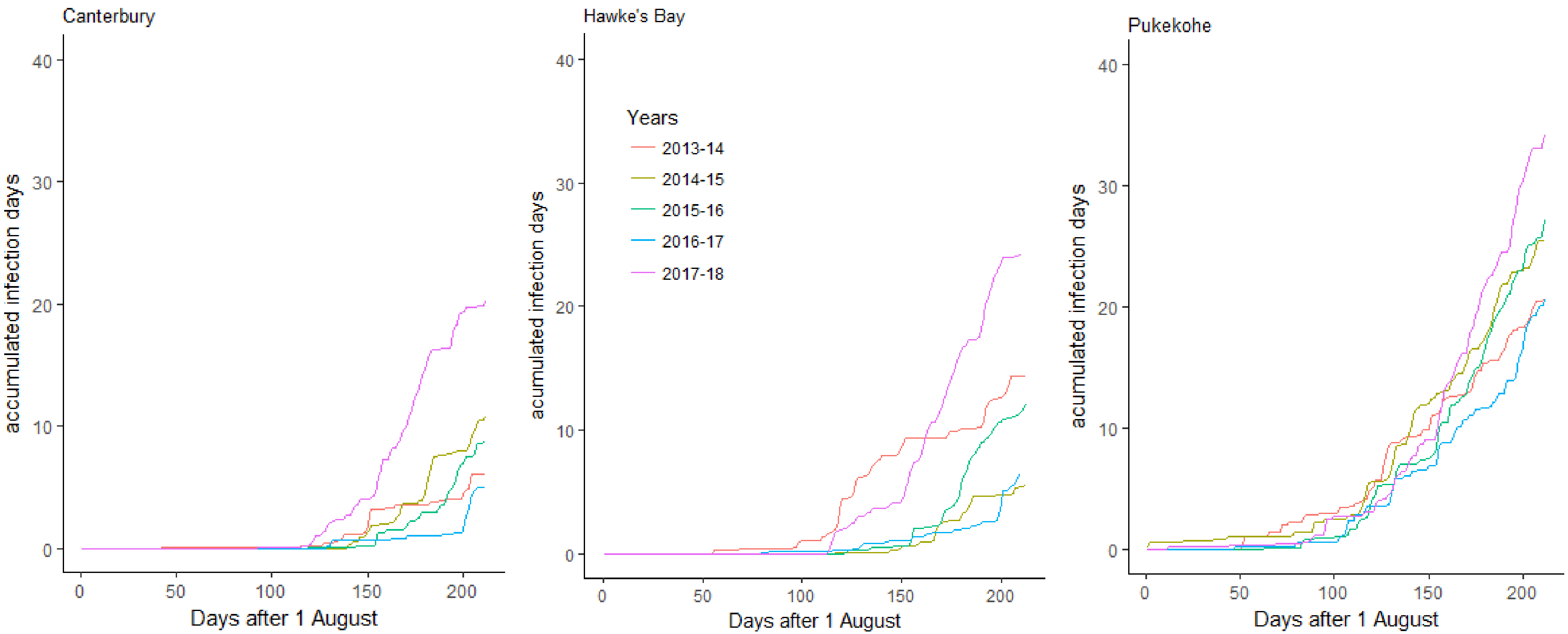

Figure 1. Accumulated infection days for *Stemphylium* leaf blight (SLB) after 1 August for the last five growing seasons in Canterbury, Hawke's Bay and Pukekohe.

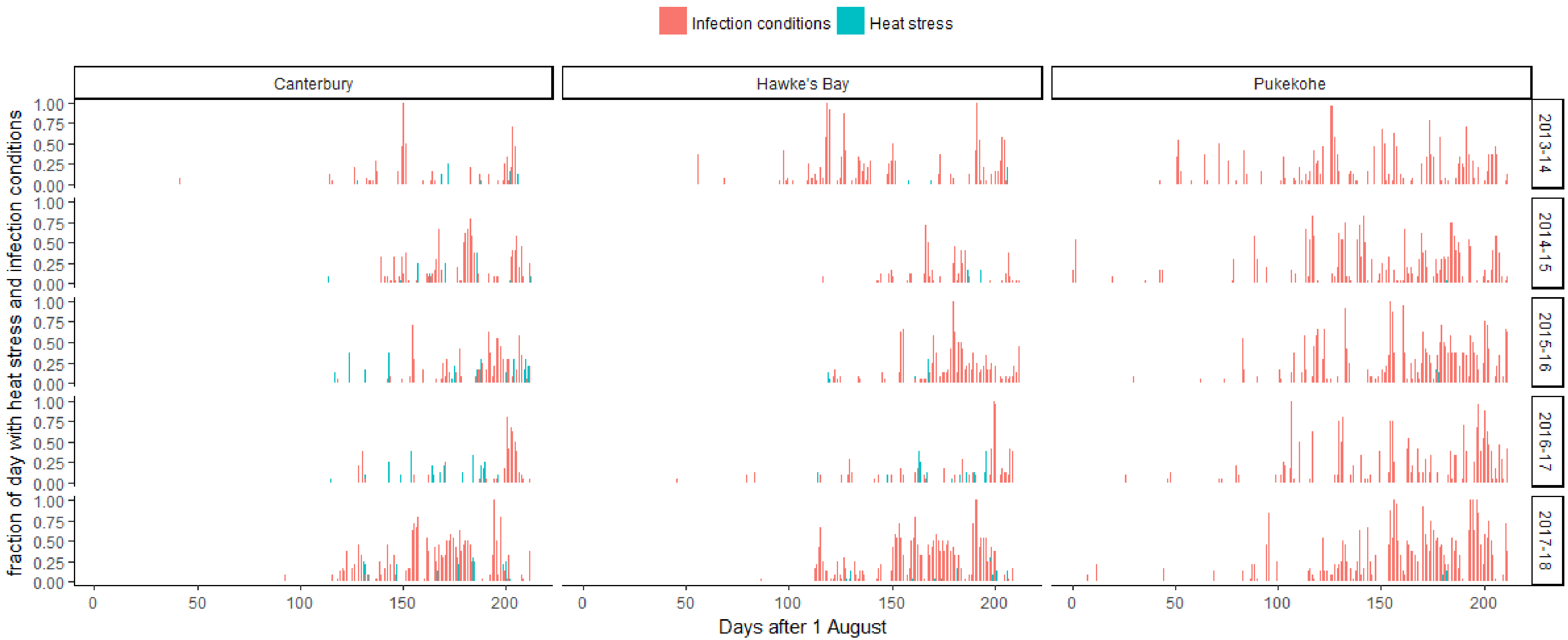

Figure 2. Fraction of day with ideal fungal infection conditions (red lines) and heat stress (green lines) for different seasons in Canterbury, Hawke's Bay and Pukekohe.

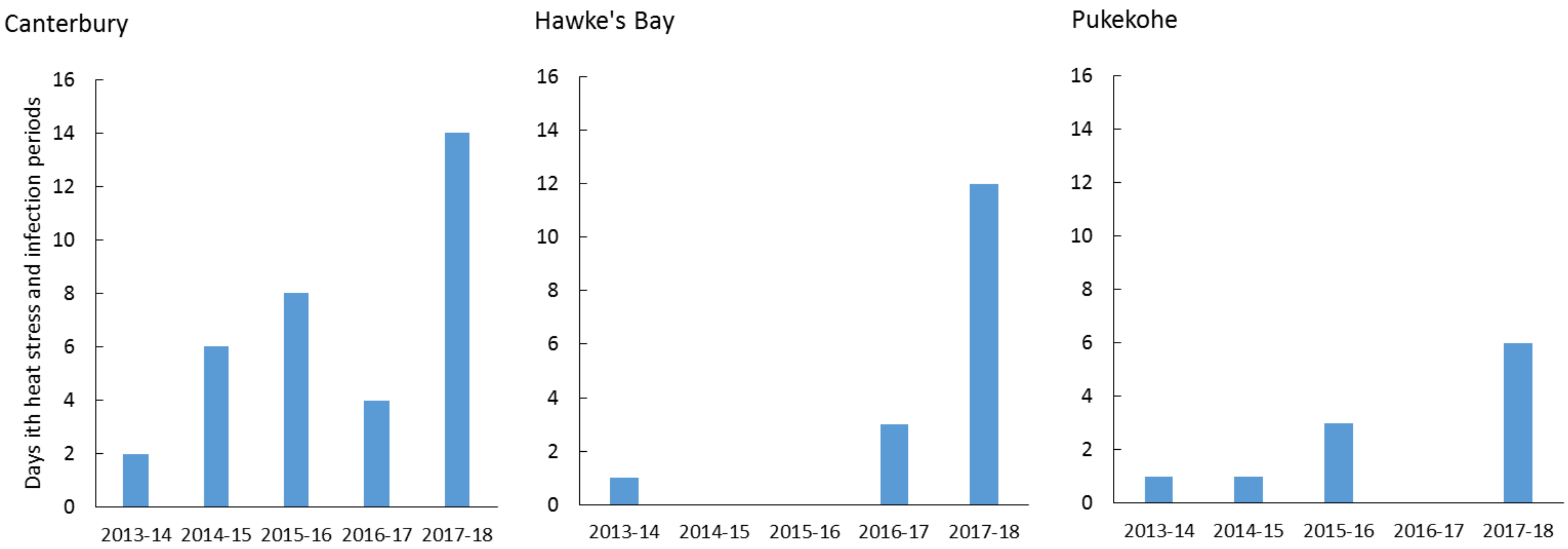

Figure 3. Days with combined heat stress and infection periods for *Stemphylium* leaf blight (SLB) in Canterbury over different seasons.

number of days where heat stress and infection periods occurred together in all regions compared to previous seasons. This suggests that the 2017–28 season may have had a higher risk for SLB than previous seasons. Canterbury had 14 days with combined temperature stress and infection probability, Hawke's Bay 12 days and Pukekohe, despite having a greater number of infection days, only had 6 days where heat stress and infection periods occurred together.

3 CONCLUSIONS

In Canterbury and Hawke's Bay, the infection days were much higher for the 2017–18 season, and coincided with heat stress which may also have been a factor in these regions (Figures 1 and 3).

The accumulated infection days in Pukekohe in the 2017–18 season were only slightly higher than previous seasons (Figure 1), and heat stress was not as pronounced as in Hawke's Bay and Canterbury (Figure 3), but it may have been sufficient to contribute to the development of SLB in the Pukekohe region. For all regions the number of infection and heat stress days were higher in the 2017-18 season compared to the previous four seasons, suggesting there may have been some climate effect on disease development for the 2017-18 season.

The number of accumulated infection days was much higher in Pukekohe than in other regions for the 2017–18 season, though the number of infection days in previous seasons were similar to the extreme values encountered in Canterbury and Hawke's Bay only in the 2017–18 season. This would suggest that there has been a climate effect on the disease appearance but that the climate effects, while a contributor, may not be the only factor affecting disease development.

4 REFERENCES

Coolong TW, Randle WM 2003. Temperature influences flavour intensity and quality in Granex 33 Onion. Journal of the American Society for Horticultural Science 128 (2):176-81.

Suheri H, Price TV 2000. Infection of onion leaves by *Alternaria porri* and *Stemphylium vesicarium* and disease development in controlled environments. Plant Pathology 49 (3):375-82.

Wright P, Tyson J, Fullerton B and Searle B 2018. *Stemphyllium* leaf blight in onions. Literature preview of the disease and control measures that may be relevant to New Zealand growers. Plant & Food Report (in press).

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