Aphids: A Major Threat to Cabbage Production in Ghana

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Introduction

Cabbage cultivation offers income to the rural, peri-urban and urban farmers and market women in Ghana (Figure 1). In spite of its importance, insect pest damage contributes to high yield losses in cabbage production.

It is estimated that aphids infestation on cabbage could result in between 70–90% yield loss in Ghana (Fening and Carr, 2015). It is also observed that erratic rainfall, prolonged drought, and the resultant climate variability, is being accompanied by an increase in aphid populations and their geographical reach, hence putting many vegetable crops at risk.

The **objective** of this study is investigate into some aspects of the bio-ecology and management of aphids on cabbage in Ghana.

Figure 1. Cabbage harvested from Aseseeso in Ghana .

Methodology

- A field trial was undertaken during the major and minor seasons in 2015 at Kpong and Kumasi in Ghana (Figure 2)
- A study was done on the infestation of aphids on cabbage, the species involved and a description of their damage and management
- The experimental design was Randomised Complete Block (RCB) with 3 replicates
- Aphids species were morphologically identified using taxonomic keys by Blackman and Eastop (1984) (Table 1) and was further confirmed with DNA barcoding using *cytochrome oxidase* gene sequencing (Figure 4).
- At Kpong, ten cabbage leaves were randomly sampled weekly per treatment plot into 70% alcohol and the total number of aphids were counted
- Six treatments - Chlorpyrifos, Lambda-cyhalothrin, hot pepper fruit extract, aqueous neem seed extract, solution of local soap (alata samina) and water-as control were applied weekly using the recommended rates.

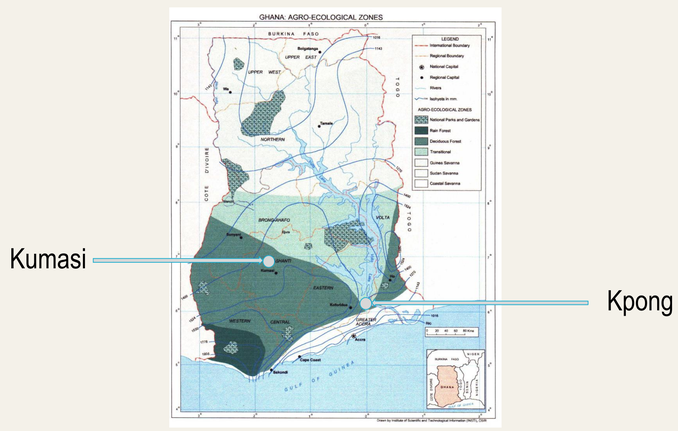

Figure 2: Map of Ghana showing the study sites.

Results

Two species of aphids, the mustard aphid, *Lipaphis erysimi* Kalt, the most abundant, and the generalist aphid, *Myzus persicae* (Sulzer), were found on the cabbage in both Kumasi and Kpong (Table 1; Figure 3a &b).

Figure 3a : *Lipaphis erysimi*

Figure 3b :*Myzus persicae*.

Table 1: Key morphological features used in the identification of *Lipaphis erysimi* and *Myzus persicae.*

Feature	*Lipaphis erysimi*	*Myzus persicae*
Frontal tubercles	Diverging and not distinctly exceeding vertex	Pronounced & converging
Cornicles	Cornicles are not dark and distinctly longer than the cauda	Cornicles are the same color as the body; and are long, > 2 times the length of the cauda
Abdominal dorsum	Winged form without abdominal patch	Winged form with dark patch
Waxy secretion	Slightly visible thin layer of white, waxy secretions	No waxy secretion
Cauda	Tongue-shaped	Cone-shaped

Source: Blackman and Eastop, 1985

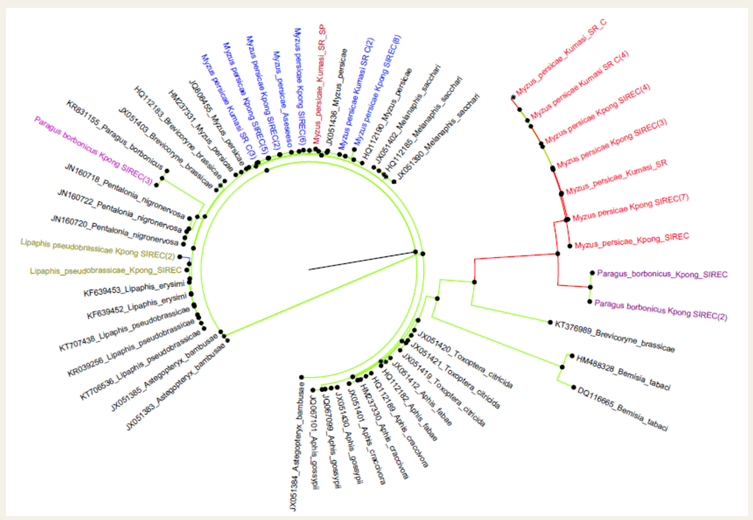

Figure 4: Phylogenetic analysis of the identified aphid species. The samples written in colour were identified in our study.

The effect of the treatments on the populations of *L. erysimi* and *M. persicae* is shown in Figure 5 & 6 below, respectively.

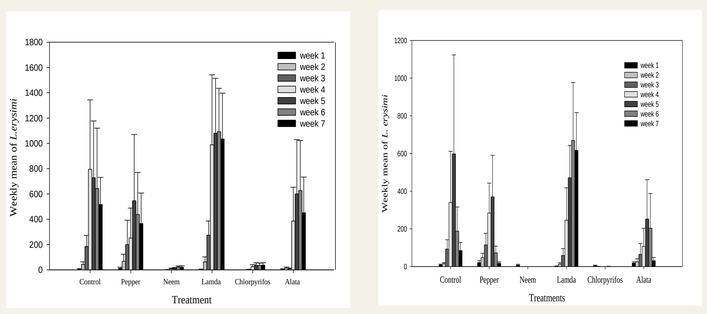

Figure 5: Effect of treatments on the number of *Lipaphis erysimi* during the major and minor seasons at Kpong.

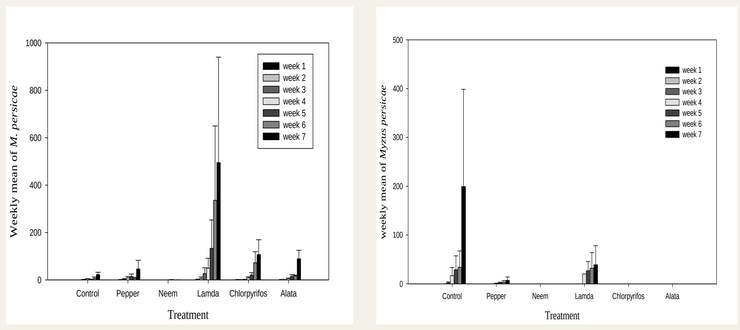

Figure 6: Effect of treatments on the number of *Myzus persicae* during the major and minor seasons at Kpong.

Aphid infestation was associated with stunting, sooty mould formation, leaf curling, mosaic, yellowing, browning, wilting and death of the plant; effects likely due to a mixture of direct feeding damage and transmission of pathogens, potentially including virus(es) (Figure 7).

Leaf samples from symptomatic plants were tested for the presence of RNA and DNA viruses using RT-PCR and PCR, respectively, with universal primers for the different genera of viruses known to attack cabbage. However, no viruses have been detected yet.

Figure 7:Progression of an unidentified disease on cabbage from Kpong.

The quality of the harvested cabbage is shown below in Figure 8.

Figure 8: Harvested cabbage heads for the different treatments at Kpong.

Conclusions

- Two species of aphids , *Lipaphis erysimi* and *Myzus persicae* were identified on cabbage
- This is the first report of *L. erysimi* in Ghana
- Aqueous neem seed extract was the most effective treatment that reduced significantly the population of aphids

Recommendation

There is the need to continue the search for the potential pathogens attacking the cabbage - e.g. using larger scale Next Generation Sequencing to detect viruses.

References

Blackman R.L. and Eastop V.F. (1984). Aphids on the World's Crops. An Identification and Information Guide. Chichester, UK: John Wiley

Fening, K.O. and Carr, J.P. (2015). Project proposal on 'Role of aphids in the transmission of a suspected viral disease and the disease's impact on the growth and yield of cabbage in Ghana'. Submitted to the Cambridge-Africa Alborada Research Fund.

Acknowledgements

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