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Measuring aphid density in spring barley

Bestemmelse af bladlustæthed i vårbyg

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Summary

In Denmark, spring barley *(Hordeum vulgare)* is the predominant agricultural crop. Bird cherry aphid *(Rhopalosiphum padi)*, grain aphid *(Sitobion avenae)* and rose-grain aphid *(Metopolophium dirhodum)* occur every year but with very varying intensity. To be able to determine the need for control a means to measure the aphid density in the field is required. A quick and reliable method of counting is therefore needed.

In 1983-84, the aphid occurrence in 28 spring barley fields was registered. The procedure was the following: on 100 plants randomly selected along a diagonal, the number of unwinged aphids per straw was registered.

The bird cherry aphid amounted to 90% of the aphids counted. The relation between per cent straws with aphids (Y) and mean number of aphids per straw (X) is established using the regression equation: $Y = 36.7 \cdot \log_{10} X + 39.9$ ($r = 0.98$).

The results are discussed and compared to results obtained outside Denmark and it is demonstrated that there is a clear relationship between per cent straws with aphids and number of aphids per straw. It is therefore concluded that countings of per cent straws with aphids are suitable for measuring aphid densities in spring barley.

Key words: Aphid density, bird cherry aphid, *Rhopalosiphum padi*, spring barley, *Hordeum vulgare*.

Resumé

I Danmark er vårbyg *(Hordeum vulgare)* den mest udbredte landbrugsafgrøde. Havrebladlus *(Rhopalosiphum padi)*, kornbladlus *(Sitobion avenae)* og græsbladlus *(Metopolophium dirhodum)* forekommer hvert år, men med meget varierende styrke. En betingelse for at kunne bestemme bekæmpelsesbehovet er at kunne bestemme bladlusforekomsten i marken. En hurtig og sikker optællingsmetode er derfor påkrævet.

I 1983-84 blev 28 vårbygmarker undersøgt for forekomst af bladlus. Undersøgelsen foregik på den måde, at der på 100 tilfældigt udvalgte strå langs en diagonal blev optalt antallet af uvingede bladlus pr. strå.

Havrebladlus udgjorde 90 pct. af de optalte bladlus. Sammenhængen mellem pct. strå med bladlus (Y) og det gennemsnitlige antal bladlus pr. strå (X) er angivet ved regressionsligningen: $Y = 36{,}7 \cdot \log_{10} X + 39{,}9$ ($r = 0{,}98$).

Resultatet diskuteres i relation til udenlandske

resultater, og det konstateres, at der er en god sammenhæng mellem pct. strå med bladlus og bladlus pr. strå. Det konkluderes derfor, at optælling af strå med bladlus kan anvendes til tæthedsbestemmelse af bladlus i vårbyg.

Nøgleord: Forekomst af bladlus, havrebladlus, *Rhopalosiphum padi,* vårbyg, *Hordeum vulgare.*

Introduction

In Denmark, spring barley *(Hordeum vulgare)* is the predominant agricultural crop and in 1989 it occupied 33% of the agricultural land (12). Bird cherry aphid *(Rhopalosiphum padi),* grain aphid *(Sitobion avenae)* and rose-grain aphid *(Metopolophium dirhodum)* occur every year but in attacks of very varying severity, and therefore the need for control also varies. To be able to determine the need for control a means to measure the aphid density in the field is required. Under normal conditions, computing mean number of aphids per straw would be time consuming. A quick and reliable method is therefore needed.

In connection with the development of the forecasting system 'EPIPRE' (8) a relationship between per cent straws with aphids and mean number of aphids per straw in winter wheat was found (9). To see whether this relationship also applies to spring barley the results from counts in 28 spring barley fields are analyzed.

Methods and materials

In 1983-84, aphid occurrence in 28 spring barley fields situated throughout Denmark was registered. The procedure was as follows: on 100 straws randomly selected along a diagonal the number of aphids per straw was counted. The number of unwinged bird cherry, grain and rose-grain aphids was registered. The counts were at the same time a computation of per cent straws with aphids. The counts were carried out by two different persons in each field. To investigate the relationship between number of aphids per straw and per cent straws with aphids, a linear regression analysis (REG) (11) was used: $Y = a \cdot \log_{10} X + b$. Y is per cent straws with aphids, X the number of aphids per straw and a and b constants.

Results

Bird cherry aphid amounted to 90% of the counted aphids. Therefore, the data is not organized according to the individual aphid species but treated as a whole.

Fig. 1 shows the results. The regression equation $Y = 36.7 \cdot \log_{10} X + 39.9$ has a correlation coefficient $r = 0.98$. The model can account for 97% of the variance in the data. Using confidence limits of 95% the variation on X is 60% on an average for a given Y.

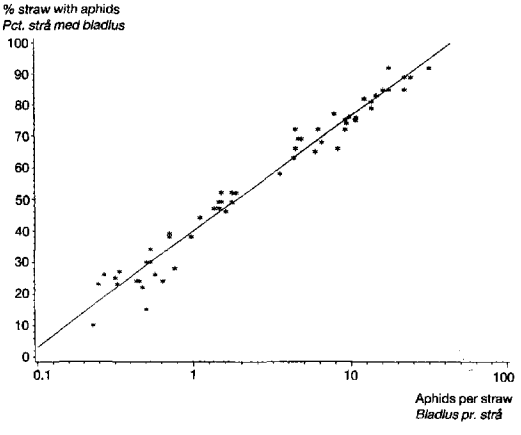

Fig. 1. Relationship between per cent straws with aphids (Y) and number of aphids per straw (X).
$Y = 36.7 \cdot \log_{10} X + 39.9$ ($r = 0.98$).
Sammenhæng mellem pct. strå med bladlus (Y) og antal bladlus pr. strå (X).
$Y = 36,7 \cdot \log_{10} X + 39,9$ ($r = 0.98$).

Discussion

As it will appear from Fig. 1 there is a clear relationship between per cent straws with aphids and mean number of aphids per straw. *Rautapää* (10) has previously demonstrated this relationship under Finnish conditions ($r = 0.93$) and *Ba-Angood* (1) under Canadian conditions ($r = 0.89$), whereas *Pedersen* (7) and *Danielsen* (2) have described the relationship for 11 Danish spring barley fields ($r = 0.97$).

At very low aphid densities (<0.3 aphids per straw) the results show that the relationship is not quite as clear. Also at very high aphid densities the relationship is not very clear as per cent straw with aphids cannot exceed 100 irrespective of the occurrence of aphids in the field. *Ward* (13) and *Ekbom* (3) also conclude that at very low and very high densities the relationship is weak.

From a practical point of view this is not of major importance because the economic injury threshold is about 6–7 aphids per straw, equalling about 70% straws with aphids (5). Consequently, the control level is lower. It is important that the registration takes place along a diagonal. The occurrence of aphids on plants at the border of the field will often be larger than on plants further into the field (6). This is due to the fact that aphids often fly low over the ground and colonize the outermost plants first.

The number of straws which must be counted decreases as the number of aphids increases, e.g. if an error of 25% is acceptable compared to mean then 74–166 straws must be counted at aphid densities of about 0.5 aphid/straw, whereas the number decreases to 30–64 straws if the mean occurrence is 3 aphid/straw (4). As the registration method must be rather accurate also at densities close to 0.5 aphids per straw, counts are made on 100 straws in every registration.

Conclusion

It is concluded that the relationship between per cent straws with aphids and mean number of straws with aphids is high at counts of 100 straws. This holds only for aphid densities within the range relevant in connection with aphid control.

Countings of per cent straws with aphids are extremely suitable for measuring densities of unwinged aphids in spring barley.

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