

EFFECT OF SINAPIS ALBA L. AS AN INSECTARY PLANT ON THE OCCURRENCE OF APHIS FABAE SCOP., COCCINELLIDAE AND SYRPHIDAE IN BROAD BEAN

Janina Gospodarek, Elżbieta Boligłowa

Department of Microbiology and Biomonitoring, University of Agriculture in Kraków, Al. Mickiewicza 21, 31.120 Kraków, Poland

INTRODUCTION

Introducing insectary plants along with principal crops is an effective way to increase the biological diversity of beneficial insects and improve the stability of ecological equilibrium in agroecosystems and could be an alternative to chemical plant protection, particularly in organic farming. The goal of this study was to determine the effect of white mustard as a companion plant in broad bean cultivation on the occurrence of *Aphis fabae* Scop., Syrphidae, and Coccinellidae. The study also aimed at finding the optimum row separation of broad bean plants. It also evaluated the effectiveness of the thinning of mustard in a specific time to eliminate excessive competition with the main crop.



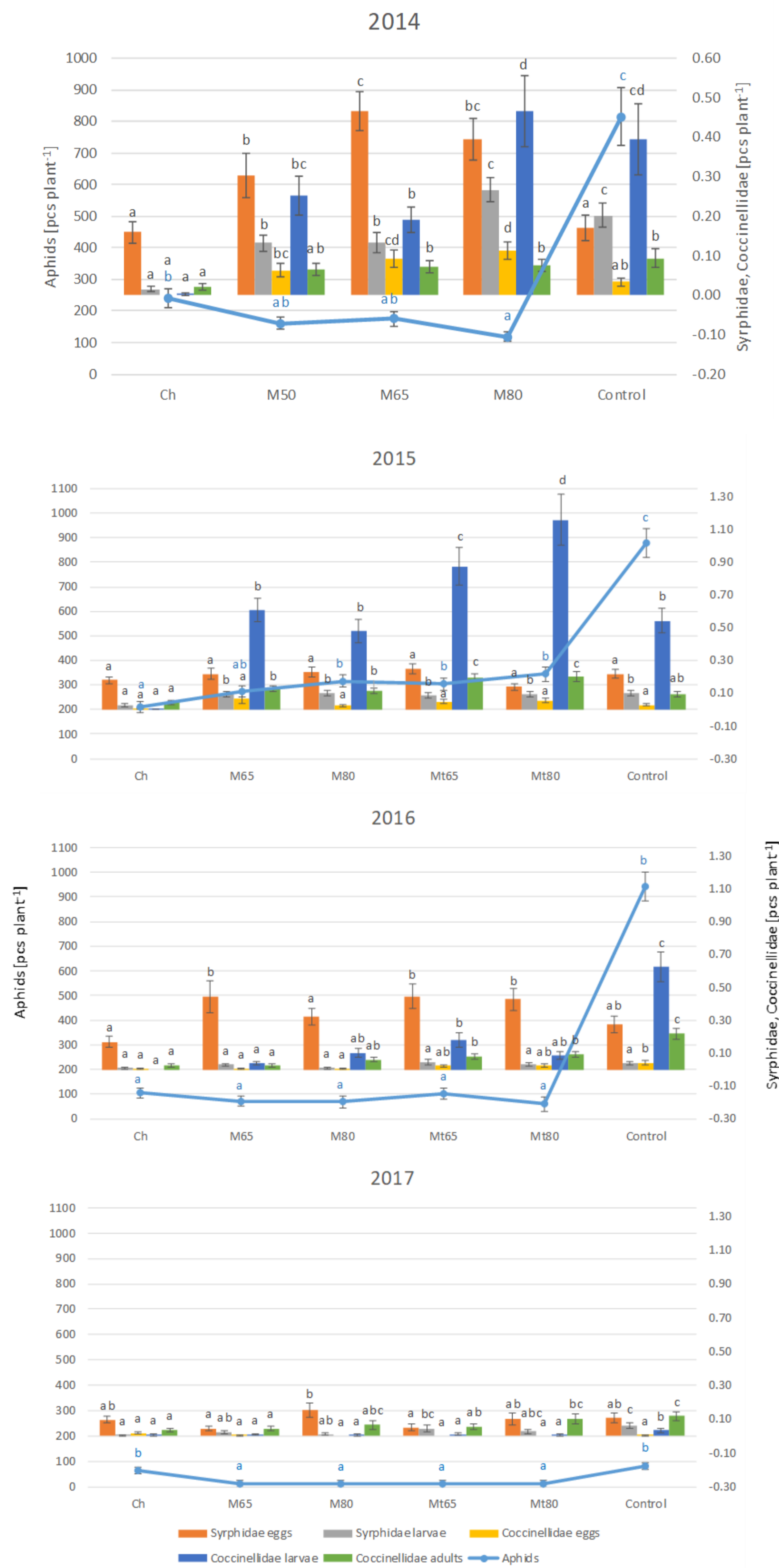
Episyrphus balteatus (Deg.) larva - predominant species of Syrphidae in the experiment



Coccinella septempunctata (L.) larvae - highly abundant species of Coccinellidae in the experiment

MATERIAL AND METHODS

Field experiments were conducted in 2014–2017 in the Experimental Stations of the Agricultural University in Prusy near Kraków. Broad bean of the Bartek variety was cultivated in companion planting with white mustard of the Bardena variety with different row spacing. In 2014 (in which preliminary experiment was conducted), the shortest distance between the rows of broad bean plants in companion planting measured to 50 cm, the moderate distance between the rows was 65 cm, and the highest distance was 80 cm. White mustard was sown as a row in the midway between two broad bean rows. As it was observed in 2014 that white mustard was competitive toward broad bean, in the following years (2015–2017), in which main experiment was conducted, the shortest distance (50 cm) was eliminated and only row spacing of 65 and 80 cm was applied. Additionally, when the broad bean plants reached the phase of flower bud formation, half of the plots in which mustard was cultivated as a companion plant were thinned (every other mustard plant was uprooted). The control treatment (unprotected) and chemically protected treatment (Ch) were characterized by homogeneous cultivation of broad beans at a row spacing of 50 cm. During cultivation in the Ch treatment, the following chemical insecticides were applied for protection as per conventional protection practice: Fastac 100 EC against pea leaf weevils (0.09 l/ha when the first damage caused by those agrophages was noticed, repeated after 7 days) and Decis 2.5 EC to combat broad bean weevils and black bean aphids (0.25 l/ha at the time of appearance of aphids on the broad bean plants, repeated after 7 days). During the monitoring of black bean aphid, the numbers of particular morphotic forms of aphids (wingless females, winged females, nymphs) were determined. These observations were conducted once every 3–4 days from the time of occurrence of the first winged female migrant up to the end of the period of occurrence of aphids on 30 randomly selected and marked plants on each plot. The occurrence of predators was assessed simultaneously with the dynamics of aphid numbers, on the same plants selected for assessing the occurrence of *A. fabae*.



Aphis fabae Scop. colony on broad bean



Sinapis alba L.

Figure 1. Mean numbers (pcs) of black bean aphid (all morphotic forms), Syrphidae (eggs and larvae) and Coccinellidae (egg clutches, larvae and adults) per one broad beans plant in the 2014-2017 seasons. Means marked with the same letters do not differ significantly according to LSD test at $p < 0.05$. Vertical bars mean \pm SE. Ch - broad beans in homogeneous cultivation with 50-cm row spacing subjected to standard chemical pest control practice; Control - broad beans in homogeneous cultivation with 50-cm row spacing; M50 - broad beans with mustard with 50-cm row spacing; M65 - broad beans with mustard with 65-cm row spacing, not thinned; Mt65 - broad beans with mustard with 65-cm row spacing, thinned; M80 - broad beans with mustard with 80-cm row spacing, not thinned; Mt80 - broad beans with mustard with 80-cm row spacing, thinned. The scales for 2014 different from others.

RESULTS

- White mustard used as an accompanying plant in broad bean crop contributed to significant limitation of black bean aphid abundance on broad bean (to the level similar as with the use of chemical protection).
- The presence of *S. alba* caused a relatively numerous occurrence of hoverflies and lady beetles on broad bean despite the relatively low abundance of their prey, i.e. aphids. Its positive impact on the number of eggs laid by hoverflies was recorded, which is highly significant from the standpoint of the need of the earliest possible control of aphid population development;
- Increased spacing between broad bean rows in mixed crop positively influenced eggs laying by lady beetles (but the effect was significant only in one of four years of the experiment), while mustard thinning positively affected abundance of larvae and imagines of Coccinellidae.
- Increased spacing between broad bean rows and mustard thinning improved mass of pods with seed of broad bean, while broad bean seed yield increased only when 65 cm distance was used;
- The most appropriate distance between broad bean rows when white mustard was introduced as insectary plant was 65 cm, with the concomitant conduct of mustard thinning when the broad bean plants reached the phase of flower bud formation.

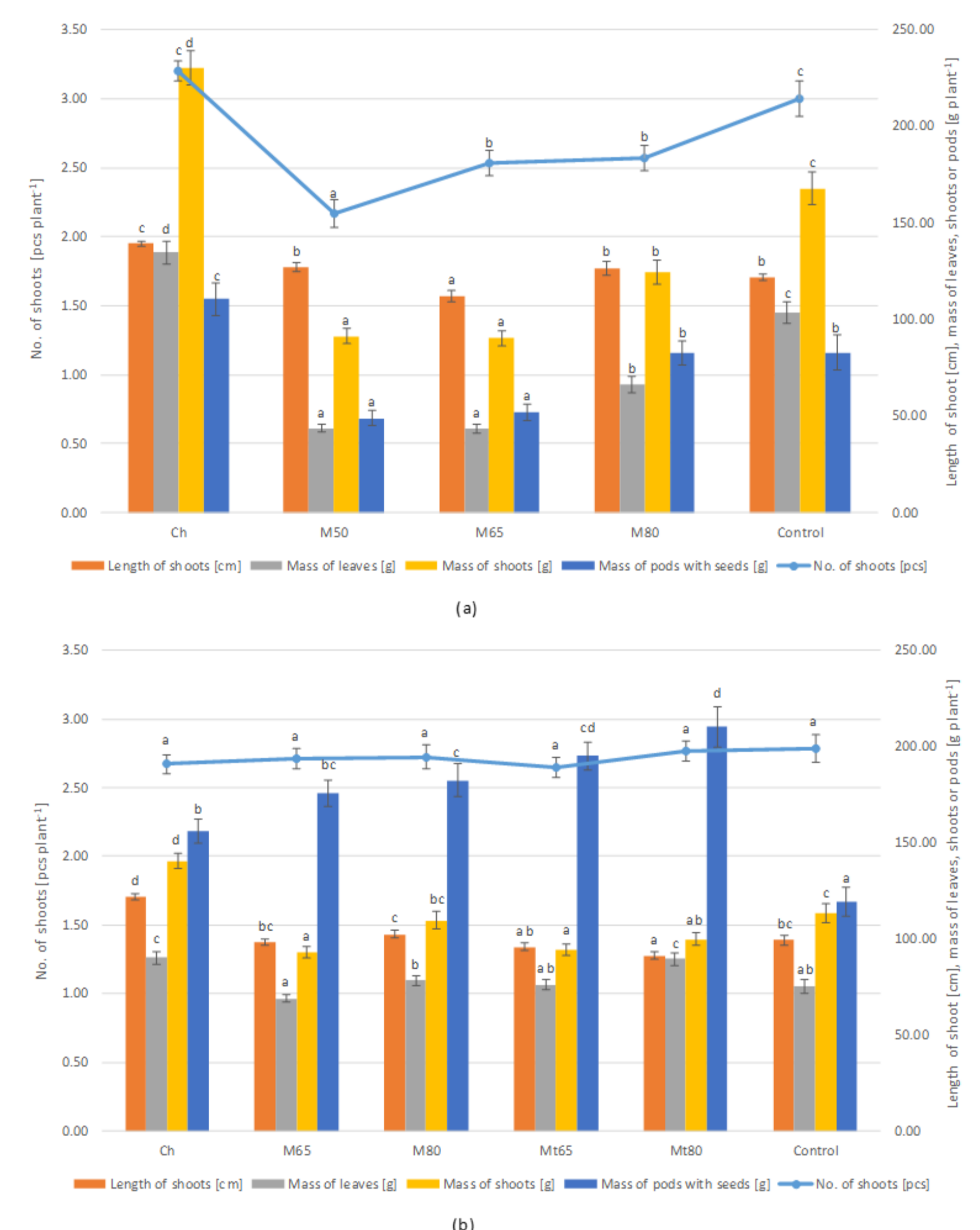


Figure 2. Growth parameters of broad beans in the 2014 season (a) and in 2015-2017 seasons (b). Means marked with the same letters do not differ significantly according to LSD test at $p < 0.05$. Symbols as in Figure 1. Vertical bars mean \pm SE.



Broad bean intercropped with white mustard

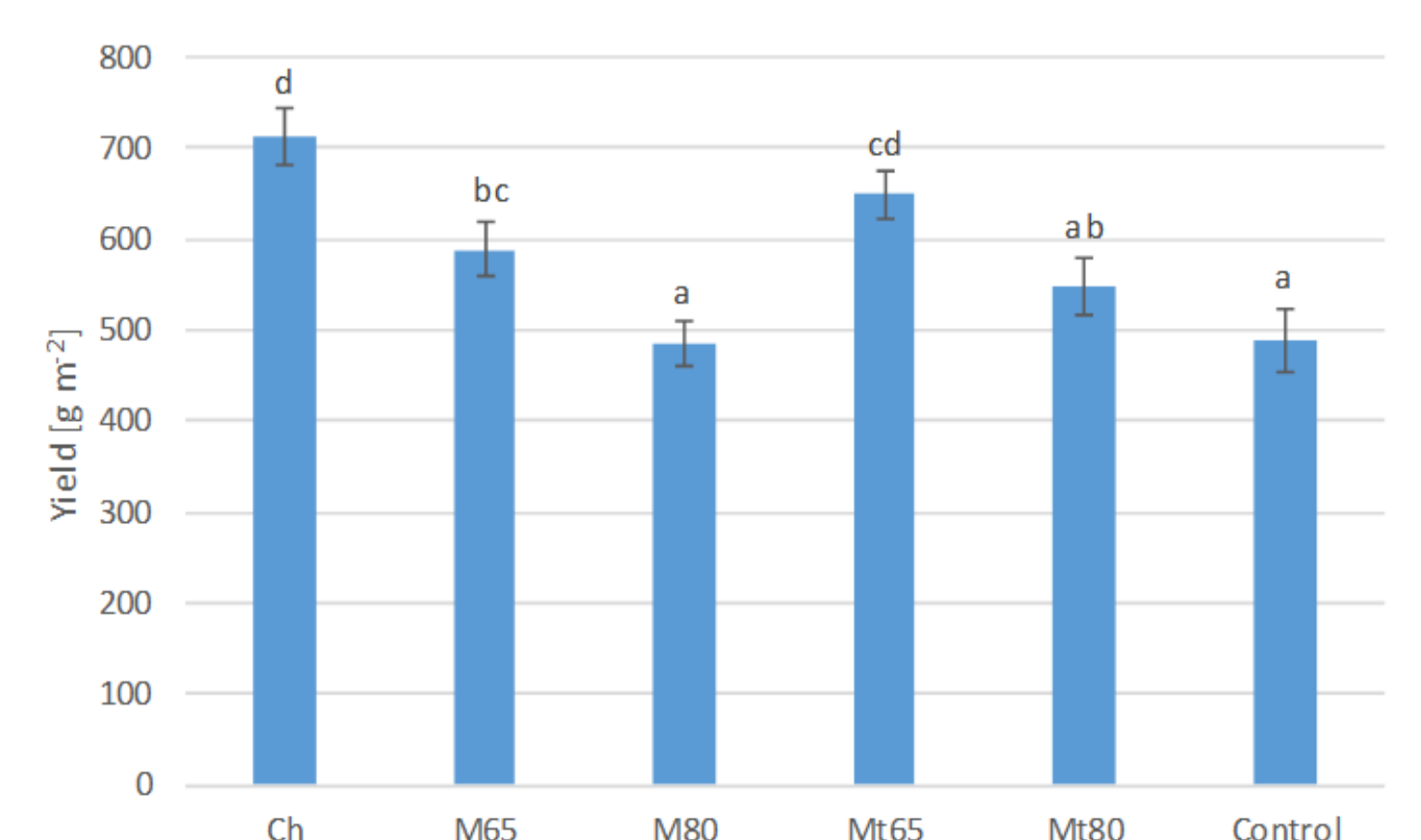


Figure 3. Mean broad bean seed yield in 2015-2017 seasons. Means marked with the same letters do not differ significantly according to LSD test at $p < 0.05$. Symbols as in Figure 1. Vertical bars mean \pm SE.