

als natürliche Antagonisten von Getreideblattläusen durchgeführt. Zunächst beschränkten sich diese Untersuchungen auf einheimische Arten, wie den Siebenpunkt-Marienkäfer (*Coccinella septempunctata* L.). Klimakammer-Laborversuche dienten der Quantifizierung des Einflusses verschiedener Temperaturen auf die Populationsdynamik dieser Art (TRILTSCH et al., 1996). Mit der Etablierung eines Aliens, der invasiven Coccinellidenart *Harmonia axyridis* (Pallas), und der zunehmend diskutierten Frage der globalen Erwärmung traten zwei neue Aspekte auf, die fortan in die Klimakammeruntersuchungen einbezogen wurden. Seit 2006 sollen Klimakammer- und Klimakammer-Laborversuche dazu beitragen, den Effekt der erwarteten Erhöhung der Temperatur auf verschiedene Lebensparameter der beiden Marienkäfer *C. septempunctata* und *H. axyridis* und ihr Potential zur natürlichen Regulation von Blattläusen in Weizen zu untersuchen.

Erste Klimakammerversuche mit Mini-Weizencosmen ergaben, dass die bedeutendste Getreideblattlausart *Sitobion avenae* (Fabricius) auch der invasiven Art *H. axyridis* als gute Nahrungsgrundlage dienen kann und hohe Verzehrswerten erreicht werden. Erhöhte Temperaturen führten zwar zu deutlich höheren Vermehrungsraten der Großen Getreideblattlaus, aber die unter erhöhten Temperaturbedingungen frühere Abreife des Weizens und der ebenso gesteigerte Appetit der Marienkäfer wirkten darauf begrenzend. Höhere befallsreduzierende Nützlingswirkungen durch steigende Temperaturen konnten nicht nachgewiesen werden. Nichts desto trotz waren die Marienkäfer in den Klimakammeruntersuchungen in der Lage, den Befall des Weizens mit Getreideblattläusen um bis zu 50 % zu reduzieren. In weiteren Versuchen konnte außerdem eine starke Dominanz der Coccinelliden, insbesondere der Art *H. axyridis*, gegenüber anderen Mitgliedern der „Predator community“ erfasst werden.

Klimakammer-Laborversuche, in denen die Marienkäfer unter verschiedenen Temperaturen einzeln vom ersten Larvenstadium bis zum 10 Tage alten Käfer ad libitum mit *S. avenae* versorgt werden, ergaben für beide Coccinellidenarten signifikant gestiegene Fraßraten unter erhöhten Temperaturbedingungen. Interessanterweise konnte aber nur *C. septempunctata* die im Vergleich zu normalen Temperaturen zusätzlich gefressene Blattlausmenge in höhere Gewichte umsetzen. Die zusätzliche Auswertung des in der 10tägigen Imaginalphase aufgebauten Fettkörpers ergab desweiteren deutliche Unterschiede zwischen den beiden Coccinellidenarten.

Die vorliegenden Ergebnisse zum Effekt erhöhter Temperaturen auf Lebensparameter der Arten *C. septempunctata* und *H. axyridis* weisen auf einige grundlegende Unterschiede in der Biologie dieser beiden Coccinelliden hin.

Literatur

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Conservation of natural enemies through using novel methods to combat insect pests

Background

In Sudan high crop losses are encountered due to the attack by different pests and diseases. Cotton (main cash crop) is attacked by numerous insect pest complex, e.g. early season pests (cotton flea beetle, cotton Jassid), mid season pests (African bollworm) and late season pests (cotton whitefly and the cotton aphids). Vegetables crops (e.g. Tomato) are also seriously attacked by various insect pests, e.g. The African bollworm. As a result both the main cash crop (cotton) and the main vegetable food crop (Tomato) are heavily sprayed with insecticides. This endangered the economic cotton production in Sudan as a result of the high cost of production. Use bio-agents, such as parasitoids and predators, might be the most environmentally appropriate method to combat these noxious insect pests.

As a result of the introduction of new IPM strategies, e.g. Resistance varieties to the cotton jassid, the number of aerial sprays was reduced. However these jassid-tolerant varieties are susceptible to other pests such as the cotton whitefly (*Bemisia tabaci*), cotton aphids and the African bollworm (*Helicoverpa armigera*). IPM Research in Sudan showed that the density dependant natural enemies of the whitefly and the cotton aphids (*Aphis gossypii*) are capable of naturally controlling these pests, if not disturb through insecticide spraying.

The present study aims at seeking pest control measures that thrive to produce suitable and economically viable technologies to control pests under sustainable environment.

Results

The results of this study aiming at conservation of these beneficials. Through the use of selective pesticides on the egg parasitoid *Trichogramma* spp. showed that some pesticides, like Azoxystrobin, Promethryn Tebufeno-

zide and Triasulfuron were relatively safe to adults of *Trichogramma cacociae*. The study also includes testing the side effects of some insecticides on two predators at small scale level at the Gezira Research Farm, Wad Medani. The results indicated that Diafenthiuron was relatively safe to the predatory beetle *Cheilomenes propinqua vicina*.

Conclusion

The result showed that some pesticides can be used selectively to safe important natural enemies attacking agricultural insect pest and hence help in conserving these important natural resources.

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Unkrautbekämpfung durch Samenprädatoren

Weed control by granivores

A growing number of studies indicate that post-dispersal losses of weed seeds in arable fields can be substantial. Seed bank studies show that 70 to 99 % of the seeds produced in a standing crop do not emerge as seedlings in subsequent crops, nor can they be recovered from the soil. Losses of this magnitude can have a substantial impact on weed population dynamics and contribute to the long-term suppression of annual weeds. A large part of these losses can be attributed to seed predation.

Very diverse groups of animals are known to consume seeds, including vertebrates (birds and rodents) and invertebrates (slugs, ants, ground beetles, crickets). In arable farming systems, mice, ants, and ground beetles are usually the main granivores. Both the activity of the granivores and the intensity of seed rain by weeds are variable over time and in space. A temporal or spatial mismatch between the two could lead to a lower proportion of seeds consumed than potentially possible. Understanding the factors that limit the numbers and activity of granivores and weed phenology could help to design measures that farmers could consider to stimulate granivory and, thus, natural weed control. Two sources of variation, namely habitat quality and weed flora composition, are discussed and their impact on seed predation rate is illustrated by examples.

Factors influencing habitat quality, for example, crop type, crop canopy cover and crop management practices, may affect seed predation rate. The influence of crop type and canopy cover is illustrated with a study conducted in Iowa, USA. Removal of weed seeds was measured in maize (N = 12), soyabean (N = 12), triticale under sown with lucerne or red clover (N = 8), and lucerne (N = 4) during 27 sampling periods. Seasonal patterns in seed predation appeared crop-specific. In maize and soyabean, seed predation was low in spring, high in summer and low in autumn. In triticale–legume intercrops, seed predation was high in spring, low in summer and moderate in autumn. In lucerne, seed predation fluctuated from high to low, matching the periodic harvest and regrowth cycle of the crop. Seed removal rates were correlated with crop canopy light interception (HEGGENSTALLER et al., 2006). The influence of crop management is illustrated with a study conducted in cereals in semi-arid NE-Spain. Seed removal was monitored in irrigated fields (N = 3), rain-fed fields that had a history of yearly tillage (N = 3), and rain-fed fields with a history of no-till. Seed removal was measured during multiple sampling periods. Tillage resulted in a reduction of seed removal rates as compared with no-till, while irrigation prevented seed removal (BARAIBAR et al., 2009). Another source of variation is the composition of the weed flora. The influence of seed preference and timing of seed shed is illustrated with a study conducted in the Netherlands. Removal of seeds of *Stellaria media* (L.) Vill., *Chenopodium album* L. or *Avena fatua* L., as well as weed seed production, were measured during multiple sampling periods in organic cereal fields (N = 4). There were clear preferences, but these differed between fields and changed over time. The pattern of seed removal was crop-specific, but that of seed shed was weed-specific, there was a good overlap in the timing of seed shed and the timing of seed removal for some weed species, resulting in high seed losses, but there was a temporal mismatch for other species, resulting in much lower losses (WESTERMAN et al., 2003).

These studies show that some factors influencing seed removal by granivores can be influenced by management, and thus amenable for manipulation, and others cannot.

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