عنوان پايان نامه	STUDIES ON TRITROPHIC INTERACTIONS BETWEEN CRUCIFERS, THE DIAMONDBACK MOTH AND AN ENDOLARVAL PARASITOID
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چكيده:

The diamondback moth (DBM), *Plutella xylostella* has become the most destructive pest of crucifers worldwide due to mainly to the overuse of insecticides, and there is an urgent need for more sustainable management strategies. An understanding of population biology is necessary to establish a more ecological approach, integrating sustainable technologies such as host plant resistance and biological control. The hymenopteran parasitoid, *Cotesia plutellae* is a key natural enemy in controlling DBM and is also a useful model system. Studies on the effects of host plant resistance on the population dynamics of DBM and *C. plutellae* showed that this did not affect equilibrial abundance of DBM, but it did affect the dynamics of DBM populations. The mean population size of DBM showed no significant difference between *Brassica rapa* (susceptible host plant) and *B. napus* (partially-resistant host plant) either in presence or absence of the parasitoid. Time series analysis suggested that the dynamics of DBM on *B. rapa* were underpinned by a delayed density-dependent process. However, DBM dynamics on *B. napus* were influenced by a direct density-dependent process. Although, measures of parasitism showed a significantly higher rate by *C. plutellae* on DBM feeding on *B. napus* compared with *B. rapa*, a survival analysis exhibited no significant difference in the persistence time of the host-parasitoid interaction between the two host plants. Olfactometer results revealed that *Cotesia plutellae* did not differentiate between different plant types when both the plant types offered were susceptible or were partially resistant. In contrast, *C. plutellae* could differentiate between the odours from susceptible (young Chinese cabbage) and partially-resistant (old common cabbages) plants whether plants were uninfested or infested with feeding DBM larvae. *Cotesia plutellae* showed a strong tendency to choose young Chinese cabbage in comparison to old common cabbages whether plants were infested or uninfested with feeding DBM larvae. The effects of learning varied depending on the host plant on which the parasitoid had been reared and the host plant on which the parasitoid had experience. In cage experiments, with short exposure times, *C. plutellae* preferred to parasitize DBM larvae on a susceptible host plant compared with DBM larvae on a partially-resistant host plant. However, this preference disappeared when the exposure time to the parasitoid was increased. The number of *C. plutellae* cocoons on susceptible host plants was significantly greater compared with partially-resistant host plants for both short and long exposure time. Parasitism and immune system studies showed that DBM reared on a partially-resistant host, the common cabbage cv. Wheelers Imperial, had a significantly greater parasitoid egg load and proportion of parasitized hosts compared to a fully susceptible host, Chinese cabbage. The encapsulation proportion of *Cotesia plutellae* larvae was significantly greater on Chinese cabbage than on common cabbages, which in turn had significantly greater encapsulation compared with the fully-resistant host, the cauliflower cv. Early Green Glazed. However, the encapsulation ability of DBM larvae was not strong enough to affect parasitism. In unparasitized DBM, phenoloxidase activity was significantly greater in larvae reared on Chinese cabbage or cv. Wheelers Imperial compared with larvae reared on cv. Red Drumhead or Early Green Glazed. However, there was no significant difference in phenoloxidase activity in parasitized larvae reared on the different host plants. Superparasitism had no effect on the ability of DBM larvae to encapsulate *Cotesia plutellae* larvae. The greater parasitism rate of DBM larvae reared on partially-resistant host plants compared with Chinese cabbage appears to be due to the greater proportion of larvae parasitized by *C. plutellae* rather than the number of eggs laid. Modelling predicted that the biological mechanisms for the persistence of resource-herbivore-parasitoid tritrophic interaction are sufficiently low herbivore mortality or handling time and relatively high parasitoid conversion factor and attack rate or relatively low parasitoid handling time. The strong effects of host-plant resistance whether on herbivore mortality or herbivore handling time will destabilize the tritrophic system. For a sustainable ecosystem, therefore, highly-resistant host plants are not recommended, since they will exclude natural enemies. In this regard, partially-resistant host plant may be more applicable for sustainable strategies looking for compatibility of host-plant resistance and parasitoids. In addition, parasitoids with high attack rate, high conversion factor and low handling time, which can stabilize the system, are useful for sustainable biological control or IPM. Underlying mechanisms for host-plant resistance effects on *C. plutellae* parasitism, the effects of host-plant resistance on searching efficiency of *C. plutellae*, and the effects of bottom-up and top-down forces on population dynamics of crucifers-DBM-parasitoid systems were discussed.