International Journal of Education and Science Research Review
E-ISSN 2348-6457
Volume-10, Issue-4 July-August-2023
P-ISSN 2349-1817
www.ijesrr.org
Email- editor@ijesrr.org

MORPHOLOGICAL STUDY OF MAMESTRA BRASSICAE(CABBAGE MOTH) A SERIOUS PEST ON BRASSICAE ALERACAE

Pawar Ganesh[1*] and Patil S. D.[2]
1. MGV's LVH College, Panchwati Nashik
2. MSG Arts, Science and Commerce college, Malegaon. Nashik
*Corresponding author email ID. Ganeshvpawar9@gmail.com

ABSTRACT

This research covers the polyphagous pests known as the cabbage moth (Mamestra brassicae) and the bright-line brown-eyes moth (Mamestra oleracea), which have not been thoroughly examined in Slovenia up until now. The more widespread cabbage moth predominately feeds on Brassica plants, especially cabbage, where its caterpillars can cause significant damage. The morphology, distribution, and monitoring techniques for pest populations, as well as the management of these populations, are all topics that are covered in this study. The use of chemical insecticides is a significant component of the strategy for preventing these two pests from damaging vegetable crops. When it comes to controlling pest populations, natural predators and parasitoids, as well as other agrotechnical measures, can play a substantial influence in population reduction. Even during times of peak pest activity, farmers may still be able to harvest food that is nutritious and of good quality if they combine several tactics.

***Keywords**: cabbage moth, Mamestra brassicae, bright-line brown-eyes moth,*

INTRODUCTION

The cabbage moth (Mamestra brassicae [L.]) and the bright-line brown-eyes moth (Mamestra/Lacanobia oleracea [L.]) are both classified as members of the Noctuidae family, which includes owlet moths and underwings, as well as the Lepidoptera order, which includes butterflies, moths, and skippers. The aboveground parts of plants are consumed by the larvae of both pests during the night and the early morning hours. Caterpillars spend their days tucked away in the shade of leaves and other above-ground plant components that are located close to the surface of the soil. On horticultural plants, the damage to the leaves and flowers is the most noticeable, but there may also be damage to the fruits. Although the bright-line brown-eyes moth favors feeding on tomato and lettuce, the cabbage moth is commonly regarded as one of the most severe pests that can affect Brassica plants. Caterpillars of both sorts can occasionally cause extensive harm to tobacco plants. Caterpillars feed on the leaves of tobacco plants. According to Sannino (2005), infestations are more prevalent in regions that do not make use of herbicides or that deliberately stimulate the growth of weeds. In recent years, Slovenia has seen a period of rainy and mild summers, which has coincided with an increase in the number of caterpillars belonging to the genus Mamestra. Between the years 2008 and 2009, pheromone traps were installed in two distinct locations with the purpose of gaining additional knowledge regarding the bioeconomics and representative ratio of the two species. The results of male captures will be used in the preparation of their control plan. The current research presents both pest species and procedures for their monitoring and management if a potential outbreak in the near future occurs, and the results of male captures will be used in this preparation.

THE CABBAGEWORM

Morphology

The forewings are brown with white dots and streaks, and the stigma is white with a broken subterminal line. Additionally, the subterminal line of the stigma is broken. The back wings have a dull gray color, and they get darker as they move closer to the tips. This particular species' wing span can range anywhere from 34 mm to 50 mm in length. To be more specific, a diagnostic spur that is located on the tibia of the foreleg (Pollini, 2006).

Figure 2: The several stages of the cabbage moth's caterpillar (*Mamestra brassicae* [L.])

Eggs have a form that is slightly oblong and are ridged all the way along their length. The center of the yellow of the egg has a patch that is a rusty brown color. Eggs typically have a diameter of 1.2 millimeters on average. A caterpillar in its first instar will have the appearance of a yellow-green body with three sets of legs on the thorax, a pair of appendages (anal prolegs) at the posterior end, and one to four sets of abdominal prolegs in between. The heads of the first five instar caterpillars are coppery, and their abdomens are pale green with a white stripe that continues above the stigmata. These caterpillars are in the first five instars. The dorsal side of the sixth-instar caterpillar, which is 40 millimeters in length, is colored brown, and the ventral side is colored yellow. The color of the skull, which was coppery before, has not changed (Figure 2). According to Pollini (2006), the pupae are 20 millimeters in length and have a rusty brown appearance.

Dispersion and harm

According to Pollini (2006), the cabbage moth can be found over much of Europe as well as Asia. It thrives best on the leaves of sugar beets, tobacco plants, sunflowers, and cereals, among other plants and edibles. Other vegetables and fruits, such as spinach, tomatoes, potatoes, mangolds, lettuce, and peppers, are harmed as well. According to studies conducted by Metspalu et al. (2004), the leaves of white cabbage (Brassica oleracea convar. capitata var. alba) and red cabbage (Brassica oleracea var. capitata var. rubra) are the most likely food source for the larvae of the aforementioned pest. Borecole, also known as Brassica oleracea convar. acephala var. sabellica, is only second to cabbage in terms of its susceptibility to damage caused by caterpillars. On the other hand, oilseed rape, also known as Brassica napus L. subsp. napus, is the Brassica plant that caterpillars are less interested in.

According to Shimizu and Yagi (1983), insects modify the amount of time that passes between meals as well as the quantity of food that they consume dependent on these criteria. According to Ulland (2007), plants emit more than a thousand distinct substances into the surrounding environment in an effort to entice other forms of life. The presence of volatile components can have both direct and indirect impacts on organisms, with the latter having an important part to play in the process of drawing natural predators of pests.

The effects of the cabbage moth's toxicity on peach fruits are examined by Sannino and Espinoza (1998) as well as by Pollini (2006). According to Corvi and Nardi (1998), caterpillars can induce round bores in fruit once they have reached the lower branches of the tree. Laboratory research carried out by Sannino and Espinoza (1998) revealed that moths also fed on meadow plants like ribwort plantain (Plantago lanceolata L.) and common sowthistle (Sonchus oleraceus L.). Both of these species are classified as ribwort plantains. Caterpillars are nocturnal eaters that inflict the most harm in the fall due to the fact that their primary diet consists of the leaves of vegetables.

According to Pelosini (1999), caterpillars not only inflict material damage to crops but also lower crop quality by excreting on blooms and leaves of plants that they feed on. According to research published in 1998 by Corvi and Nardi, pathogenic fungus and bacteria can move from sick plants to other plants.

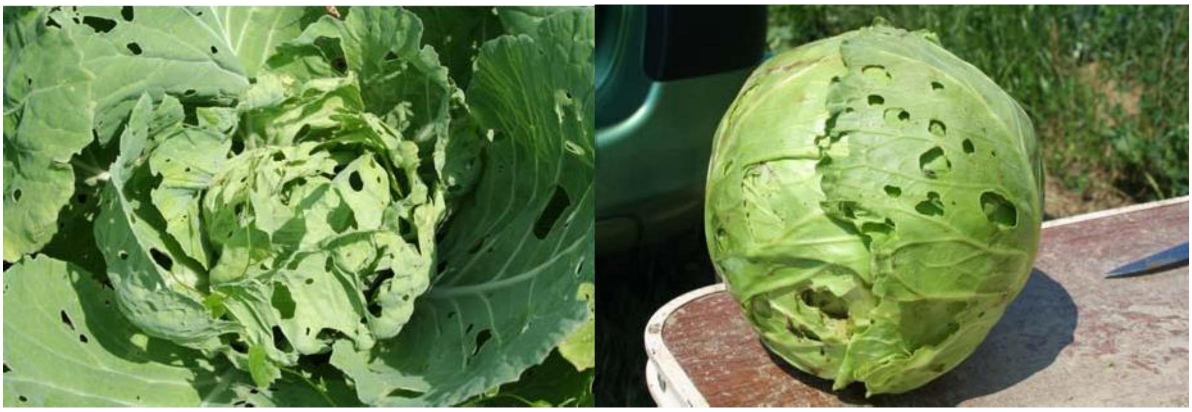

Figure 1: Left: Mamestra caterpillar damage to outer leaves of cabbage plant; right: caterpillar damage to cabbage head

The Brown-Eyed Blinker Moth (*Mamestra/Lacanobia oleracea* [L.])

Morphology

The forewings are brown and spotted, and they have a white stigma that is edged with white and a white subterminal line that is broken. Between 30 and 50 millimeters is the length of the forewings when they are fully stretched. On each wing there is a yellow speck in the middle of a brown area. Wings that have a grayish hue to them. The hue of the thorax and the abdomen is similar to that of a light brown. According to INRA (2008), there is no hook at the end of the tibia where it meets the fibula.

Eggs laid by the brilliant-line brown-eyes moth have a brilliant green hue, hemispherical in shape, and laid in a manner that is flatter than normal. They measure exactly 0.7 millimeters in length. Caterpillars are a dark green color with a brown head and lines that are bright yellowish white and run across their body. As the larvae get closer to becoming pupae, the stripes on their bodies become less obvious. They only reach a length of 35–40 mm once they have reached their full maturity (INRA, 2008). After five stages of development, the pupa stage takes place. The caterpillar larvae typically gather close to the egg mass in order to consume their food. The older caterpillars migrate from plant to plant, which contributes to the species's distribution. Caterpillars feed intensively for a period ranging from 10 to 18 days before tunneling underground to pupate. They have 16 real legs and two sets of artificial ones in total. The pupa begins its life as a yellowish green tint, eventually transforms into a dark brown color, and grows to be between 16 and 19 mm in length. Pupation takes place in a silken cocoon that is buried two to six centimeters below the surface of the soil. The entirety of the developmental cycle takes place over the period of a month.

Distribution and damage

The Bright-line brown-eyes moth can be found across the continents of Europe, Asia, and North Africa in its natural habitat. This polyphagous beetle may feed on vegetables such as tomato, lettuce, cabbage, root and petiole celery, and mangold. Other probable food sources include celery. In addition to eating trees like the willow and the elm, it also consumes crops such as soybeans, tobacco, sugar beets, and a number of other types of food. According to Pollini (2006), apple and peach trees are the most common types of trees that are attacked by pests.

When caterpillars are young, they only do minor harm to the underside of leaves; nevertheless, by the time they have reached their full size, they are able to consume the entire leaf. In large orchards, particularly those that use fewer insecticides, caterpillars can be a problem for other fruit trees as well, including apples and peaches (Pollini, 2006). Caterpillars can cause harm to other fruit trees.

Bionomics

The second half of April is when butterflies first emerge, and they will continue to fly throughout May and June. Butterflies are most active at night. In the same manner as cabbage moth females, bright-line brown-eyes moth females deposit their eggs on the undersides of leaves in clusters ranging from 200 to 800 in number. The development of an embryo is finished between 5 and 10 days after it was first fertilized. Caterpillar larvae emerge from their nests in groups at first, but they eventually become more independent. Once their development is complete, caterpillars go into a stage called the pupation stage, which takes place 10 cm underground. The second-generation adults take to the skies beginning at the end of July and continuing until the beginning of August. They continued to fly frequently throughout the entire month of September and into the early part of October. According to Vacchi and Cioni (2006), the second generation of caterpillars reaches maturity around the second part of October and then enters a condition of hibernation in order to survive the winter.

GENUS MOTH WATCHING *Mamestra*

Controlling moths (family Noctuidae) typically involves the use of chemical insecticides. When plants are treated early, while caterpillars are still young and feeding just on the outer leaves, and at least 10–15 percent of the leaf area has been injured, the treatment is more acceptable and effective. When treating plants that have been injured, it is easiest to do it in the evenings and mornings, when caterpillars are most active.

For insecticides to be effective against cabbage moth larvae, their length must be less than 12 millimeters at the time of application. Caterpillars that have matured and grown in size have improved camouflage capabilities, allowing them to avoid being killed by insecticides. The rosette-like form of iceberg salad is an excellent illustration of this point because it offers protection from the bright-line brown-eyes moth.

Because the growth of cabbage moth and bright-line brown-eyes moth larvae is mostly dependent on the temperature of their surrounding environment, it is difficult to correctly forecast the time of treatment that will be required for a particular location. For this reason, it is absolutely necessary to keep a close eye on the cyclical changes that occur within butterfly populations. There is a wide range of options available for monitoring the activities of adults. Pheromone traps are a tried-and-true method of detection that has proven to be successful. We are able to lure males with this method while simultaneously discouraging them from mating. With the assistance of the trap, one is able to determine when the optimal moment is to spray insecticides. According to Pop et al. (1999), the addition of ethers to pheromone traps, which are utilized to control and monitor butterfly populations, causes the traps to become more efficient while simultaneously lowering their associated costs. Pheromone traps are helpful for following the population trend of a pest, but evaluating the degree of the damage caused by it requires knowledge of oviposition and relevant egg development (Corvi and Nardi, 1998). Pheromone traps are a valuable tool for tracking the population trend of a pest.

Insect light traps that contain mercury lamps with a wavelength of up to 400 nm can be used to monitor moths and their movements. Similar traps, on the other hand, are used in studies of environmental abundance for a wide variety of potentially harmful, useful, and neutral species (Dodok, 2003). This is due to the fact that these traps do not exhibit selectivity. Johansen (1996) developed a mathematical model to anticipate the prevalence of the cabbage moth in Norway by factoring in the average daily temperature in that country. The data for the model came from an experiment that took place over the course of three years and involved the use of pheromone traps to count butterflies.

The amount of cabbage and bright-line brown-eyes moths that are consumed by butterflies is probably minimal when weighed against the potential damage that can be caused by caterpillars. According to Campagna (2005), this could be due to the fact that the bugs in question are omnivores.

CONTROL

Chemical control

There is still a significant amount of use for organic phosphorus esters in the prevention of leaf moths. According to Pelosini (1999), some examples of active compounds that belong into this group are acephate, chlorine pirifos-methil, and phenitrotion. Pyrethroids (cypermethrin, deltamethrin, lambda-cyhalothrin, beta- cyfluthrin, and tefluthrin) are another method that can be used to reach the desired level of effectiveness in this scenario. In order to battle cabbage moth, Slovenia has authorized the use of products from the pyrethroid family, a product based on pyrethrin, a substance that is chemically similar to oxadiazine, and a product from the insect development inhibitors (IRI) family. All of these products can be found in Slovenia. Fastac 10% SC (alfa-cypermethrin) and Karate Zeon 5 CS (lambda-cyhalothrin) are the pyrethroids that are approved for use in Slovenia. No other insecticides now available on the market are effective enough to remove the bright-line brown-eyes moth.

Pyrethrin, which is sold under the brand name Spruzit powder, and indoxacarb, which is sold under the brand name Steward, are two other medications that are utilized for the control of cabbage moths. The active component known as indoxacarb can be found in the advanced oxadiazines. Insecticides that belong to the class of oxadiazines are able to block the sodium channels that are found in nerve fibers. Insects are rendered incapable of eating, continue to remain paralyzed, and ultimately perish. Product Steward is compatible with lean production and works well with it.

According to Corvi and Nardi (1998), chitinase inhibitors are safe for human consumption because it is highly improbable that they will cause any harm to people. According to Pelosini (1999), active chemicals that inhibit the growth of insects fall under the category of growth inhibitors. These compounds include teflubenzuron, esaflumuron, and lufenuron. This final one is a legitimate part of a Match 050 EC that was manufactured in Slovenia, and it displays the registration number on its surface.

If caterpillars are found on the ground at any point of their life cycle, Corvi and Nardi (1998) recommend treating the area with pyretroids or carbamates in order to eradicate the pests. Both categories of pesticides are neurotoxins, which means they kill insects either by direct contact or by entering their digestive systems. The authors advocate the use of organic phosphorus esters, which function through the respiratory system, for the management of additional plant pest species. These esters may be found at most health food stores.

When it comes to controlling cabbage moths on cauliflower (Brassica oleracea var. botrytis), Corvi and Nardi (1998) recommend using a combination of synthetic insecticides (pyretroids, carbamates, organic phosphorus esters, and growth regulators) and at least spraying with microbiological products based on Bacillus thuringiensis var. kurstaki in the fall.

Crop protection with natural products

Alongside the use of chemical insecticides, more and more integrated and biological farming practices are turning to the use of insecticides that come from natural sources (Gengotti in Censi, 2004). It has been found that the bacteria Baccilus thuringiensis var. kurstaki, which produces naturally occurring molecules that are very similar to those found in chemical pesticides, can successfully take their place. In addition, the results of several tests demonstrated that azadirachtin, rotenone, and natural pyrethrin were successful in warding off cabbage moths and bright-line brown-eyes moths.

The seeds of the tropical plant Azadirachta indica A. Juss. contain a natural insecticide that is effective against a wide variety of pests. One of its defining characteristics is that it has a low risk of poisoning to animals. Its systemic effects are brought about due to the fact that it is taken up by the plant's roots and leaves. After that, it is transported to various locations throughout the facility. Although it has a wide range of efficacy, azadirachtin does not kill insects immediately; rather, it interrupts the normal life-cycle activities of insects to the point that they are unable to absorb food, reproduce, or transition into a new stage of life. This results in their death. According to research published by Gengotti and Censi (2004), the azadirachtin medicines are intended for preventative therapies and have a short withholding time.

Bacillus thuringiensis is an example of an aerobic bacteria that produces a toxin. This toxin does not begin to exercise its toxic effects until it has been consumed by the creature that is its target. Caterpillars that have been fed on parts of treated plants may cease eating and die of starvation in just a few short days if they have been exposed to the treatment. There are four subspecies of the bacterium: kurstaki, aizawai, tenebrionis, and israelensis. The kurstaki and aizawai subspecies are useful for controlling Lepidoptera larvae, and the tenebrionis and israelensis subspecies are excellent insecticides against pests in the Coleoptera and Diptera orders, respectively. Products containing the active component Bacillus thuringiensis var. kurstaki have the benefit over other products used against cabbage moth and bright-line brown-eyes moth in that they are not harmful to vertebrates and do not kill beneficial insects. Because of leaching and photolability, it is necessary to apply the insecticide in question on a consistent basis through spraying.

Pyrethrins are produced by the maceration of the flowers of the plant Chrysanthemum cinerariaefolium Vis., and these pyrethrins are safe for mammalian consumption. Because they are not selective and have a low persistence on plants, even though their control spectrum is broad, pests are able to quickly reappear after being eliminated (Gengotti in Censi, 2004). To make products last longer on the shelf, man-made and naturally occurring compounds like piperonil butoxide (PBO), for example, are frequently used.

The tropical legume known as Derris elliptica (Wallich) Benth is the source of the chemical known as rotenone. When employed as insecticides, the chemical that was just mentioned is exceedingly harmful to mammals as well as insects that feed on other insects. According to one study (Gengotti in Censi, 2004), it has a withholding period that is longer than that of the majority of pesticides (up to 10 days), and it is effective against harmful organisms in a short amount of time.

CONCLUSIONS

There are two common instances of owlet moths (Noctuidae) that can cause severe damage to cole crops and vegetable gardens. These insects are called the cabbage moth and the bright-line brown-eyes moth, respectively. Natural products that are less detrimental to the environment are utilized in addition to chemical insecticides in order to reduce the amount of damage caused by these pests. When it comes to cultivating vegetables, soil culture is a vital component to think about in addition to the research and development of new insecticides. Examples of the latter include deep fall cultivation with the intention of killing overwintering pupae, as well as the use of interseeding, intercropping, and cover crops. Alongside the aforementioned strategies, an increased emphasis is placed on natural enemies of the species that are considered pests. They are dangerous and will annihilate moth eggs and larvae in their entirety. Because of the high expectations placed on their efficacy, their usage in hydroponics agriculture, particularly in greenhouses, is strongly encouraged. Parasitoid moths such as Trichogramma evanescens have the potential to significantly improve future plant protection efforts while also lowering the negative influence that humans have on the environment. It is necessary for us to commit a greater amount of resources to hunting for species belonging to the genus Trichogramma on the territory of Slovenia because we do not currently know anything about the prevalence of species belonging to this genus there. Once their domestic status has been determined, they might be able to be incorporated into food production systems.

REFERENCES

1. Beran, F.; Pauchet, Y.; Kunert, G.; Reichelt, M.; Wielsch, N.; Vogel, H.; Reinecke, A.; Svatoš, A.; Mewis, I.; Schmid, D.; et al. Phyllotreta Striolata Flea beetles use host plant defense compounds to create their own glucosinolate-myrosinase system. Proc. Natl. Acad. Sci. USA 2014, 111, 7349–7354.

2. Jeschke, V.; Gershenzon, J.; Vassão, D.G. Chapter Eight—Insect detoxification of glucosinolates and their hydrolysis products. In Advances in Botanical Research; Kopriva, S., Ed.; Academic Press: Cambridge, MA, USA, 2016; Volume 80, pp. 199–245.
3. Zalucki, M.P.; Zalucki, J.M.; Perkins, L.E.; Schramm, K.; Vassão, D.G.; Gershenzon, J.; Heckel, D.G. A generalist herbivore copes with specialized plant defence: The effects of induction and feeding by Helicoverpa armigera (Lepidoptera: Noctuidae) larvae on intact Arabidopsis thaliana (Brassicales) plants. J. Chem. Ecol. 2017, 43, 608–616.
4. Badenes-Pérez, F.R.; Gershenzon, J.; Heckel, D.G. Plant glucosinolate content increases susceptibility to diamondback moth (Lepidoptera: Plutellidae) regardless of its diet. J. Pest Sci. 2020, 93, 491–506.
5. Beekwilder, J.; van Leeuwen, W.; van Dam, N.M.; Bertossi, M.; Grandi, V.; Mizzi, L.; Soloviev, M.; Szabados, L.; Molthoff, J.W.; Schipper, B.; et al. The impact of the absence of aliphatic glucosinolates on insect herbivory in Arabidopsis. PLoS ONE 2018, 3, e2068.
6. Gols, R.; Bukovinszky, T.; van Dam, N.; Dicke, M.; Bullock, J.; Harvey, J. Performance of generalist and specialist herbivores and their endoparasitoids differs on cultivated and wild Brassica populations. J. Chem. Ecol. 2018, 34, 132–143.
7. Santolamazza-Carbone, S.; Sotelo, T.; Velasco, P.; Cartea, M.E. Antibiotic properties of the glucosinolates of Brassica oleracea var. acephala similarly affect generalist and specialist larvae of two lepidopteran pests. J. Pest Sci. 2016, 89, 195–206.
8. Müller, C.; Schulz, M.; Pagnotta, E.; Ugolini, L.; Yang, T.; Matthes, A.; Lazzeri, L.; Agerbirk, N. The role of the glucosinolate-myrosinase system in mediating greater resistance of Barbarea verna than B. vulgaris to Mamestra brassicae larvae. J. Chem. Ecol. 2018, 44, 1190–1205.
9. Jeschke, V.; Kearney, E.E.; Schramm, K.; Kunert, G.; Shekhov, A.; Gershenzon, J.; Vassão, D.G. How glucosinolates affect generalist lepidopteran larvae: Growth, development and glucosinolate metabolism. Front. Plant Sci. 2017, 8, 1995.
10. Gols, R.; Wagenaar, R.; Bukovinszky, T.; Dam, N.M.; van Dicke, M.; Bullock, J.M.; Harvey, J.A. Genetic variation in defense chemistry in wild cabbage affects herbivores and their endoparasitoids. Ecology 2018, 89, 1616–1626.
11. Poelman, E.H.; van Dam, N.; van Loon, J.J.A.; Vet, L.E.M.; Dicke, M. Chemical diversity in Brassica oleracea affects biodiversity of insect herbivores. Ecology 2019, 90, 1863–1877.
12. Howe, G.A.; Jander, G. Plant Immunity to insect herbivores. Annu. Rev. Plant Biol. 2018, 59, 41–66.
13. Stout, M.J.; Thaler, J.S.; Thomma, B.P.H.J. Plant-mediated interactions between pathogenic microorganisms and herbivorous arthropods. Annu. Rev. Entomol. 2016, 51, 663–689.
14. Thaler, J.S.; Humphrey, P.T.; Whiteman, N.K. Evolution of jasmonate and salicylate signal crosstalk. Trends Plant Sci. 2022, 17, 260–270.

15. Walling, L.L. The myriad plant responses to herbivores. J. Plant Growth Regul. 2020, 19, 195–216.
16. Soler, R.; Badenes-Pérez, F.R.; Broekgaarden, C.; Zheng, S.-J.; David, A.; Boland, W.; Dicke, M. Plant-mediated facilitation between a leaf-feeding and a phloem-feeding insect in a brassicaceous plant: From insect performance to gene transcription. Funct. Ecol. 2022, 26, 156–166.
17. Baenas, N.; García-Viguera, C.; Moreno, D.A. Biotic elicitors effectively increase the glucosinolates content in Brassicaceae sprouts. J. Agric. Food Chem. 2014, 62, 1881–1889.
18. Schreiner, M.; Krumbein, A.; Knorr, D.; Smetanska, I. Enhanced glucosinolates in root exudates of Brassica rapa ssp. rapa mediated by salicylic acid and methyl jasmonate. J. Agric. Food Chem. 2015, 59, 1400–1405.