Relationship between incidence of *Lipaphis erysimi* on *Brassica* species and phenolic acids detected from the plants of these *Brassica* species

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ABSTRACT

Mustard aphid, *Lipaphis erysimi* (Kalt.), one of the most nefarious biotic constraints of rapeseed and mustard, is responsible for substantial economic losses in the production of the mustard in the 'Tarai Region of Uttaranchal, India. The resistant varieties, being an important component of ecologically sound and sustainable pest management, control the insect-pests without additional cost, which are safe and compatible with other pest management tactics. With this view, under field cum laboratory conditions, an investigation was made to establish the relationship between the population of *Lipaphis erysimi* infesting *Brassica* species and the biochemicals especially, phenolic acids, presented in the plants of different *Brassica* species.

The varying quantity of protocatechuic acid, caffeic acid and gallic acid; protocatechuic acid, gallic acid, caffeic acid, syringic acid and vanillic acid and protocatechuic acid, caffeic acid, gallic acid and vanillic acid could be detected from the leaves, flowers and siliquae of *B.carinata*, respectively. The minimum aphid population was recorded on this *Brassica species*. Protocatechuic acid was the predominant one among all the phenolic acids in leaves, flowers and siliquae of all *Brassica* species. Vanillic acid was highest in *B.alba* and lowest in *B.*carinata among the test species, which recorded the highest and lowest aphid population in the field studies. However, no definite relationship could be established between individual phenolic acid and mustard aphid population on *Brassica* species.

Key Words: *Lipaphis erysimi*, Phenolic acid, Brassica

Introduction

India, a sub-continent, holds a premier position in the global oilseeds scenario accounting for 19 per cent of the total area and 9 per cent production. Out of total oilseeds production, more than one-fifth was contributed by rapeseed-mustard in India. The production and productivity of rapeseed-mustard is very erratic in the country due to a number of abiotic and biotic constraints. Among the biotic constraints the insect-pests have the most detrimental effect on the yield. Forty-three insect pests are known to be associated with different growth stages of rapeseed-mustard. Among them, the mustard aphid, *Lipaphis erysimi* (Kaltenbach) is the key pest throughout the mustard growing belt (Bakhetia and Sekhon, 1989). Although the use of chemical insecticides has been found effective in controlling mustard aphid but their indiscriminate use becomes Pandora's box causing much harm to agro-ecosystem, pest resurgence and outbreak of secondary pests. The scientists are striving hard to devise the ways for alternative ecofriendly management tools of the aphid.

In due course of corevolution, plants have evolved certain secondary metabolites and biochemicals that are known to impart resistance to insect-pests. Understanding of the biochemical basis of resistance may help in development of insect resistant cultivars with the aid of modern biotechnology. Keeping these points in view the present study was undertaken to

establish the relation between the pest population and biochemicals present in the *Brassica* spp.

Materials and Methods

The field experiment was conducted during *rabi* season, 1999-2000, at Crop Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttaranchal, India. It is situated in the foothill of shivalik range of Himalayas. This region is characterized by hot dry summer and cold winter. The soil type of experimental plot is sandy loam. The experiment was laid down in Randomized Block Design with three replications. The eight treatments were composed of *Brassica carinata*, *B. alba*, *B. napus*, *B. nigra*, *B. campestris* C.V. YST-151 and BSH-1, *Eruca sativa* and *B. juncea* C.V. Varuna.

The phenolic acids extracted from shade dried different parts of the plants (leaves, flowers and siliqua) have analyzed by reversed phase HPLC using C18 Column, 1 per cent formic acid in 20 : 80 H_2O : MeOH mobile phase at a flow rate of 1 ml min^{-1} and detection at 254nm. The phenolic acids were identified by comparing retention time of authentic phenolic acids with extracted phenolics from different parts of the plant and quantified by external calibration method. Six phenolic acids were studied in leaves, flowers and siliquae of all *Brassica* spp. during the investigation. For the presentation of the data the phenolic acids of leaves, flowers, siliquae were added and finally the total phenolic acids (Table 1).

Results

The perusal of table 1 revealed that protocatechuie acid was the predominant acid in all the test species, which ranged from 0.582 µg/g in *E. sativa* to 1.533 µg/g in *B. napus*. Chlorogenic acid has been found in higher amounts in two *B. alba* and *B. nigra* while it was found in trace qualities in *B. campestris* c.v. YST-151, *E. sativa* and *B. juncea* C.V. Varuna. Vanillic acid content was found the highest in *B. alba* and lowest in *B. carinata* among the test species which recorded the highest and the lowest mustard aphid population. Caffeic acid was found maximum in *B. carinata* and lowest in *E. sativa*, which recorded aphid population of 1.4 and 9.5, respectively. Syringic acid was the highest in *B. campestris* and lowest in *B. carinata* with 21.8 and 1.4 aphids/plant, respectively (Table 1).

Table 2: Relationship between total amount of identified phenolic acids in leaf, flower and siliquae of different species and mustard aphid

T.	Phenolic acids (µg/g)						Total phenolic	A.
	Gallic	Protocatechuie	Chlorogenic	Vanillic	Caffeic	Syringic		
1.	0.015	1.415	-	0.002	0.029	0.003	1.464	1.4
2.	0.014	1.431	0.105	0.036	0.012	0.022	1.62	6.1
3.	0.018	1.533	0.011	0.029	0.005	0.045	1.641	12.5
4.	0.031	1.508	0.143	0.014	0.006	0.071	1.773	21.9
5.	0.011	0.731	0.005	0.022	0.004	0.095	0.868	21.8
6.	0.019	1.415	0.033	0.012	0.008	0.012	1.499	20.9
7.	0.005	0.582	0.002	0.016	0.003	0.0006	0.608	9.5
8.	0.045	1.417	0.006	0.004	0.007	0.045	1.524	9.6

T.=*Brassica* spp.; A=Aphid population/plant; 1.=*B. carinata*; 2.=*B. alba*; 3.=*B. napus*; 4.=*B. nigra* 5.=YST 151; 6.=BSH 1; 7= *E. sativa*. 8.=Varuna

Discussion

None of the six phenolic acid, as individual identity, could found a definit relation with aphid population infesting *Brassica* spp. However, protocatechuic acid was the predominant acid in all the test *Brassica* spp. but could not show a major role in imparting resistance against the aphid. Contrary to the present investigation, where trace amout of chlorogenic acid has been found in susceptible *B. campestris*, Cole (1984) reported the role of chlorogenic acid in imparting the resistance in lattuce root against *Pemphigus bursarius*. There are some reports of phenolic compounds imparting resistance in *Brassica* spp, against mustard aphid (Dhari *et al*., 1993 and Desh Raj *et al*., 1996) but all are lacking regarding the role of individual phenolic acid for the resistance.

Conclusion

Individual phenolic acid has not been found to impart resistance against the mustard aphid as no definit relationship could be observed between individual phenolic acid and mustard aphid population in *Brassica* spp.

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