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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(10): 961-965

www.thepharmajournal.com
Received: 10-08-2022
Accepted: 14-09-2022

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Effect of biochemical contents on resistance against jassid, *Amrasca biguttula biguttula* in different okra germplasm

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Abstract
The experiment was conducted in the College of Agriculture, IGKV, Raipur during *Kharif*, 2018-19 to evaluate the effects of various biochemical contents on twenty okra germplasm against jassid, *Amrasca biguttula biguttula*. Different biochemical contents, viz. protein, phosphorus, potassium, zinc, iron, copper, manganese, total sugar, reducing sugar, non- reducing sugar, Ash and fiber were studied and correlation is established between morphological parameter and leaf hopper (*Amrasca biguttula biguttula*) population. It was observed that the correlation coefficient of population of jassid indicated positive and significant correlation with protein content (r = 0.450), total sugar (r = 0.689), reducing sugar (r =0.742), non-reducing sugar (r = 0.632). The germplasm 2018/OKHYVRES-2 had maximum jassid population (10.70) and the germplasm recorded had maximum protein content (23.67%), total sugar (6.40%), reducing sugar (0.868%) and non reducing sugar (5.53%) whereas, germplasm 2018/OKYVRES-1 had minimum jassid population (6.19) and the germplasm recorded had minimum protein content (14.55%), total sugar (2.16%), reducing sugar (0.240%) and non reducing sugar (1.79%).

Keywords: Jassid, biochemical, morphological parameter and germplasm

Introduction
Okra, *Abelmoschus esculentus* (L.) Moench is the most popular warm weathered vegetable crop and it belongs to the Family Malvaceae. It is one of the best nutritious vegetable easily available, as its 100 g of edible part provide 35.0 gm calories, and 89.6 gm Moisture, Carbohydrates 6.4 gm., Protein 1.9 gm., Fat 0.2 gm., Fiber 1.2 gm., Minerals 0.7 gm., Phosphorus 56.0 mg., Iron 1.5 mg., Potassium 103 mg., Magnesium 53 mg (Gopalan *et al*. 2007) [3]. Tender green pods of okra are rich in vitamin A, B1, B3, B6, C and K, and minerals such as, magnesium, calcium, potassium, and micronutrients like zinc, iron, copper, nickel, manganese and iodine. Eshiet and Brisibe (2015) [2] evaluated that beside these, it is also a rich source of dietary fiber, high level of antioxidants, ascorbic acid and folate including β-carotene, xanthin and lutein. The cultivation of Okra hampered by so many insect pest which are played an vital role as a main constraint for huge production of okra. leafhopper, *Amrasca biguttula biguttula* (Ishida) are major pest and cause yield loss of 17.46% in okra (Sarkar *et al*. 1996) [10].
Leafhopper is important pest in the early stage of the crops which desap the crop from the lower surface of the leaf and make them weak and reduces the yield (Krishnaiah, 1980) [9]. Okra is steadily attacked by both the nymph and adults of leafhopper can damage the crop from seedling stage till maturity of crop, resulting 40-50% yield reduction. At present, management of this sucking pest has largely been dependent on chemical control. Development of suitable resistant/tolerant varieties is an ideal component at no additional cost, compatible with other methods of pest control. Therefore, the present study was carried out to identify the response by different available genotypes of okra in order to determine resistance/susceptibility.

Materials and Methods
Twenty different okra germplasm were undertaken for studies on infestation of jassid on okra at experimental farm of the Department of Horticulture, College of Agriculture, Raipur, Chhattisgarh, during the year *Kharif* 2018-19. All the germplasm were sown in randomized block design and replicated thrice. A spacing of 60 cm × 30 cm was maintained between the plants and rows, following all recommended agronomic practices.

With the appearance of jassid population, the data were recorded from five randomly selected plants from each germplasm at weekly interval. For counting the population upper, middle and lower leaves were undertaken. The average population of nymphs and adults per leaf, for each germplasm, was calculated by simple arithmetic means. Prior to harvesting disease free mature leaves were plucked out then dried at room temperature. Dried leaves were grounded and sieved with the help of mesh having 0.5 mm diameter, kept in airtight container. Bio-chemical contents like protein, sugars, fiber, ash and minerals were analyzed as per the standard procedures. The obtained data were correlated with the pest incidence.

Crude protein was determined by Kjeldahl method, while potassium was determined by a flame photometer, phosphorous concentration in plant samples was estimated using vanadate-molybdate UV-visible spectrophotometer. Copper, zinc, manganese and iron in okra leaves were determined by the atomic absorption spectrophotometer (AAS). Total sugar was determined by Anthrone reagent method, while reducing sugar was estimated by Nelson Somogyi's method. The data were transformed into square roots before proceeding with the analysis. Simple correlation was worked out, between the populations of sucking pest complex.

Result and Discussion

Among the twenty germplasm, minimum jassid incidence (6.19) was recorded on germplasm 2018/OKYVRES-1 and the maximum jassid incidence (10.07) was recorded on germplasm 2018/OKHYVRES-2. Various chemical plant characters, such as, crude-protein, phosphorus, potassium, total sugar, reducing sugars, non-reducing sugar, copper, zinc, manganese, iron, ash and fiber were estimated (table 1) and correlated with the population fluctuations of jassids on okra. The correlation coefficient values between jassid-population and biochemical contents of plant characters in okra leaves are given in Table 2. The correlation coefficient indicated positive and significant correlation with protein content (r = 0.450), total sugar (r = 0.689), reducing sugar (r =0.742), non-reducing sugar (r = 0.632). The germplasm 2018/OKHYVRES-2 had maximum jassid population (10.70) and which had the maximum protein content (23.67%), total sugar (6.40%), reducing sugar (0.868%) and non reducing sugar (5.53%) whereas, germplasm 2018/OKYVRES-1 had minimum jassid population (6.19) and which had minimum protein content (14.55%),total sugar (2.16%), reducing sugar (0.240%) and non reducing sugar (1.79%). Whereas, the correlation coefficient observed between jassid population and biochemical contents showed non-significant correlation with phosphorus, potassium, zinc, iron, copper, manganese, ash and fiber.

Table 1: Biochemical contents of different germplasm of okra during *Kharif* 2018-19

Germplasm	Protein %	Phosphorus (%)	Potassium (%)	Zinc (ppm)	Iron (ppm)	Copper (ppm)	Manganese (ppm)	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)	Ash (%)	Fiber (%)
2018/OKHYVRES-2	23.67	0.021	1.086	37	1536	17.5	27	6.40	0.868	5.53	17.94	8.68
2018OKHYVRES-3	18.57	0.025	1.209	92	1437.5	14.5	94.5	4.07	0.577	3.49	19.06	10.18
2018/OKHYVRES-4	18.95	0.025	1.479	26.5	1402	15	137.5	2.80	0.372	2.47	18.09	9.70
2018/OKHYVRES-5	21.14	0.016	0.985	53	714.5	14	66.5	3.35	0.524	2.83	17.54	5.88
2018/OKHYVRES-6	20.69	0.028	1.427	88	880	15	108	2.57	0.380	2.19	23.99	16.58
2017/OKYVRES-1	17.80	0.020	1.621	39	1229.5	16	130	4.35	0.349	4.00	20.04	10.59
2017/OKYVRES-2	17.65	0.021	1.983	21	1048.5	14	98	4.05	0.451	3.60	18.58	15.32
2017/OKYVRES-3	15.46	0.020	1.985	27.5	919.5	13	97.5	3.64	0.706	2.93	17.81	6.88
2017/OKYVRES-4	16.56	0.021	1.309	9	850.5	15	61.5	3.39	0.454	2.93	19.51	10.06
2017/OKYVRES-6	16.63	0.021	1.374	11	798.5	13.5	62	2.52	0.488	2.03	20.87	9.79
2017/OKYVRES-7	15.59	0.024	1.519	41	1415	22	143.5	3.27	0.416	2.85	23.10	9.40
2017/OKYVRES-8	19.20	0.022	1.721	15.5	887	14	166	3.34	0.394	2.95	20.23	14.29
2017/OKYVRES-9	19.10	0.027	2.040	26.5	931.5	15	136	2.67	0.547	2.12	21.24	13.70
2017/OKYVRES-10	15.74	0.022	1.786	45.5	836.5	36.5	111.5	2.36	0.370	1.99	17.38	9.89
2018/OKYVRES-1	14.55	0.020	1.571	39	1156	14	147.5	2.16	0.240	1.79	20.20	17.04
2018/OKYVRES-3	15.52	0.014	1.940	34.5	1379.5	14.5	156	3.13	0.358	2.77	19.30	7.71
2018/OKYVRES-5	15.45	0.023	1.746	26	1369	14.25	126.5	2.95	0.313	2.64	20.82	7.84
2018/OKYVRES-6	15.72	0.026	1.320	12	821	12.3	60.5	2.84	0.252	2.58	19.39	10.20
2018/OKYVRES-7	16.35	0.020	1.536	23	1080	13.6	113	3.11	0.254	2.85	19.88	6.17
2018/OKYVRES-8	17.66	0.017	1.666	7	723.5	12	51.5	2.58	0.321	2.34	20.56	16.05
C.D.	0.205	0.054	0.084	0.52	0.196	0.189	0.115	0.026	0.018	0.021	0.077	1.058
SE(m)±	0.069	0.018	0.028	0.175	0.066	0.064	0.039	0.009	0.006	0.007	0.026	0.356

Table 2: Correlation between sucking insect pests and different biochemical contents of different okra germplasm

Biochemical contents	Jassid population
Protein	0.450*
Phosphorus	0.122^{ns}
Potassium	-0.392^{ns}
Zinc	0.230^{ns}
Iron	0.399^{ns}
Copper	0.181^{ns}
Manganese	-0.415^{ns}
Total sugar	0.689**
Reducing sugar	0.742**

Non-reducing sugar	0.632**
Ash	-0.400^{ns}
fiber	-0.415^{ns}

Note: ** Significant at 1% level of significance
*Significant at 5% level of significance
ns = Non-significant

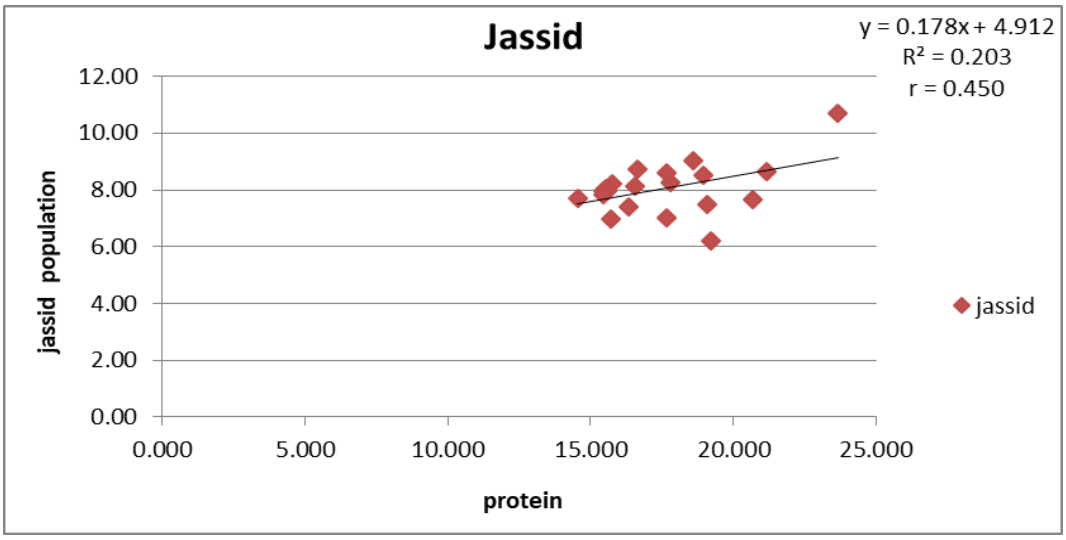

Fig 1: Regression line between protein content and population of jassids

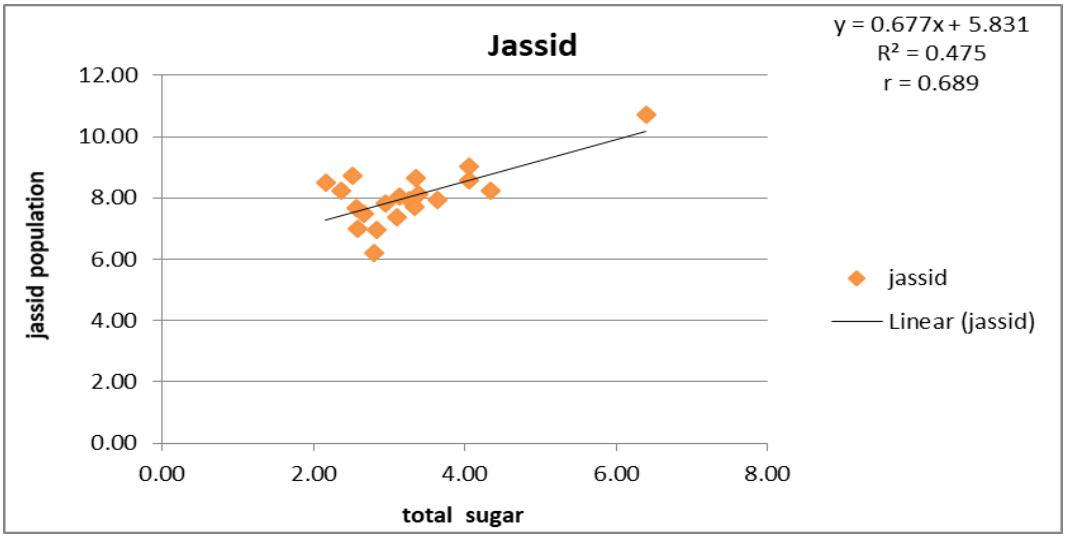

Fig 2: Regression line between total sugar and population of jassids

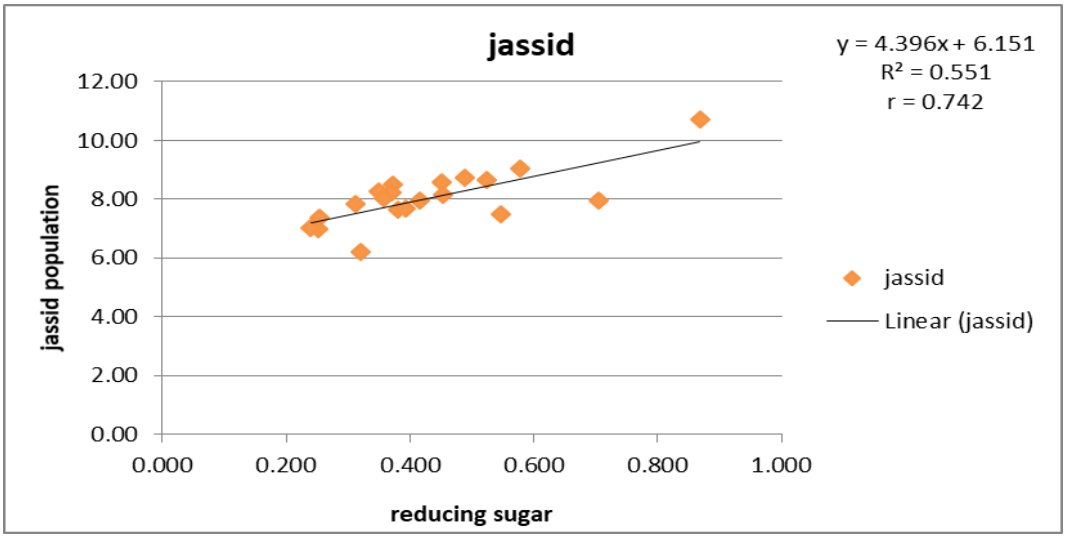

Fig 3: Regression line between reducing sugar and population of jassids

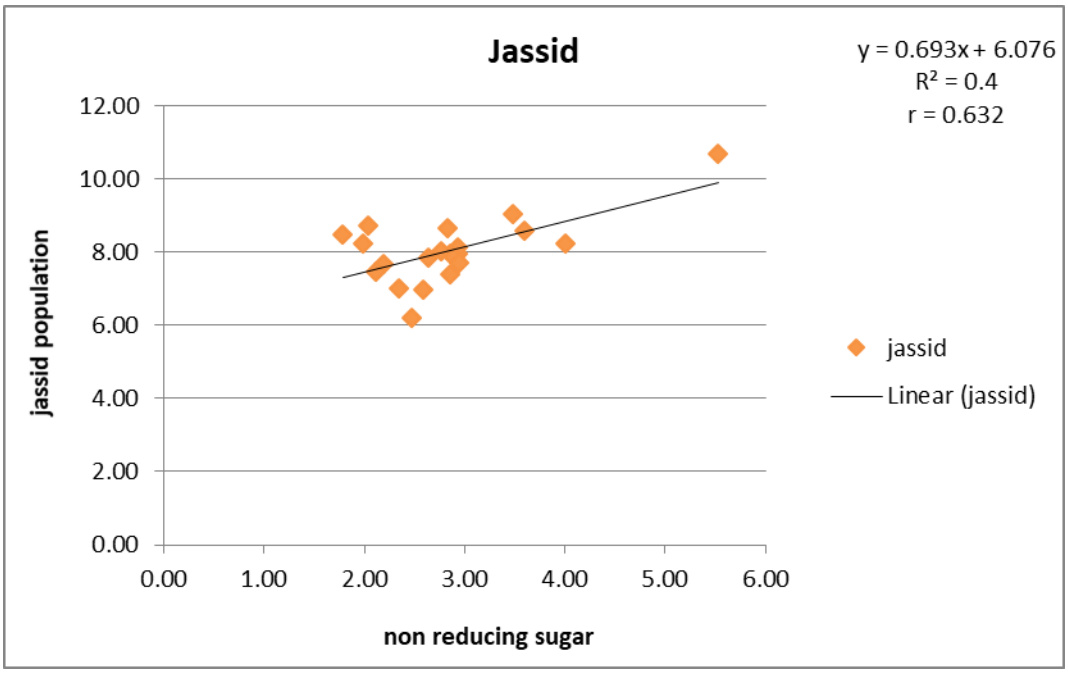

Fig 4: Regression line between non-reducing sugar and population of jassids

The present findings are in conformity with those of Khan (2013) [8] stated that Crude protein contents showed positive correlation with jassid population. Taylo and Bernardo (1995) [13] reported a positive correlation between total sugar and jassid susceptibility. Singh and Agarwal (1988) [11] and Iqbal *et al.* (2011) [5] reported the significant positive correlation with jassid population that is similar to our present findings and also evaluated that susceptible genotypes had higher reducing sugars than resistant genotypes. Singh and Agarwal (1988b) [11] reported that highly susceptible genotypes contained significantly higher amount of proteins, as compared to the resistant genotypes. Singh and Taneja (1989) [12] reported a positive correlation between the protein contents and survival as well as oviposition of jassids. Kanher *et al.* (2016) [7] noticed that Phosphorus content showed significant and positive correlation with jassid incidence while, potassium content indicated significant negative (-0.965) correlation with jassid incidence.

The present findings are contradictory to present findings, Khan (2013) [8] reported that Zn, Fe, Cu, and P showed negative correlation with jassid population. All other biochemical contents Mn and K showed positive correlation with jassid population. The findings of Singh and Agarwal (1988) [11], Hooda *et al.* (1997) [4] and Iqbal *et al.* (2011) [5] who also reported negative correlation between total sugars with jassid population and the resistant varieties had higher sugars. On the contrary, Balasubramanian and Gopalan (1981) [1] observed that resistant varieties of cotton had higher contents of reducing sugars. This might be due to the fact that observations were taken after jassid infestation stage and not at the time of oviposition. The result of Singh and Agarwal (1988b) [11] showed the negative correlation among the incidence of *A. biguttula biguttula* and the amount of total sugars and non-reducing sugars, in the leaves of resistance genotypes.

The role of various chemical plant characters which showed a significant correlation with the population of jassid on okra was determined through the coefficient of determination (R^2) values. It is evident from the results that crude protein percentage in the leaves of okra showed maximum contribution towards the population fluctuations of the pest followed by that of sugars. Therefore, these results showed that the crude proteins and sugars were the most important factors affecting on jassid population fluctuations and both of them showed significant impact with positive response, respectively.

Conclusion

Various biochemical contents, *viz.* protein, phosphorus, potassium, zinc, iron, copper, manganese, total sugar, reducing sugar, non- reducing sugar, Ash and fiber were estimated and correlated against sucking insect pest complex. In the present study, crude proteins showed a positive and significant correlation with the population of jassid in okra. In other words, it showed that higher contents of protein and nitrogen resulted in a higher population of jassids on okra, and vice versa. The susceptible germplasm contained higher concentration of total soluble sugar content in their leaves than resistant germplasm.

Acknowledgement

We thank Dr. Dharmendra Khokhar, Scientist, Department of Plant Physiology and Dr. S. S. Porte, Scientist, Department of Soil Science and Agricultural Chemistry, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh for their technical assistance in conducting the laboratory tests.

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