

Herbicide resistance in *Rumex dentatus*

A threat to sustainable wheat production in north-western India

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*Herbicide resistance in weeds is becoming a major challenge in Indian agriculture which is an alarming signal for sustainable crop production. Earlier herbicide resistance was confined to *Phalaris minor* only in wheat crop but now there are some reports of resistance in *Rumex dentatus* to metsulfuron methyl in Haryana and Punjab. To confirm this, a study was conducted at Punjab Agricultural University, Ludhiana during 2018-19 and 2019-20. This study showed that resistance has evolved in *Rumex dentatus* against metsulfuron methyl in many rice-wheat growing regions of Haryana and Punjab. This first report of resistance from Punjab indicates the spread of resistance in *R. dentatus*. Therefore, an integrated approach is required to control this resistance problem in *R. dentatus*.*

Keywords: Herbicide resistance, *Rumex dentatus*, Wheat, Weeds

WHEAT is an important staple food crop of India. Punjab and Haryana are the major wheat growing states of India as both share common agro climatic conditions, good availability of natural resources such as inherent fertile soil and adequate availability of water for irrigation. Weeds are the major concern that reduce the potential productivity of the wheat crop.

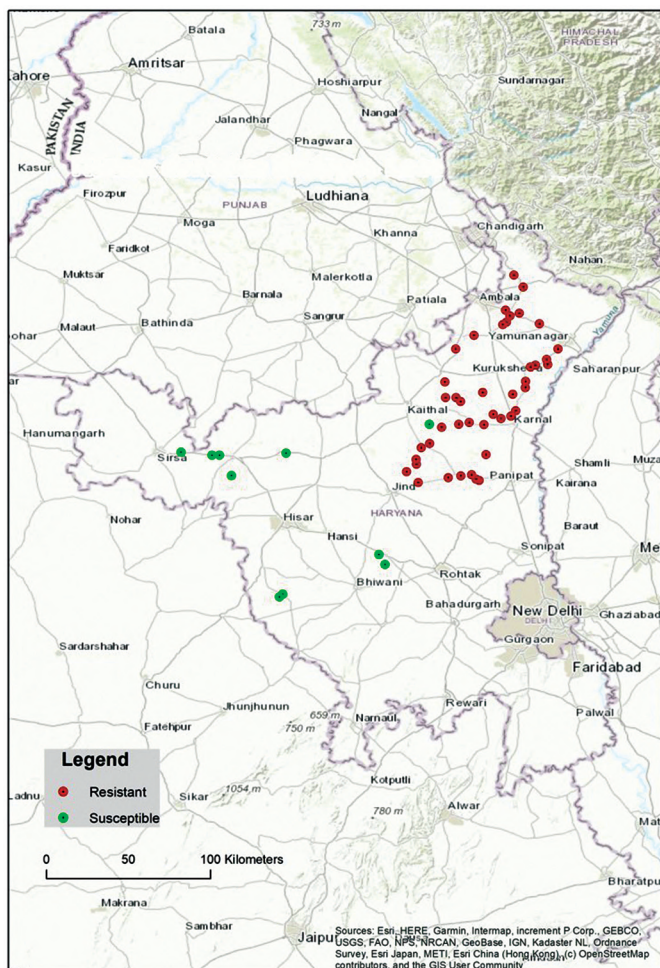
Resistance issues in North-West India

Herbicides are recognized as the major tool for weed management along with other cultural and mechanical measures. But accelerated selection pressure associated with over reliance on herbicides with similar mode of action has led to increase in cases of herbicide resistance. *Rumex dentatus* is the dominant broadleaf weed of rabi

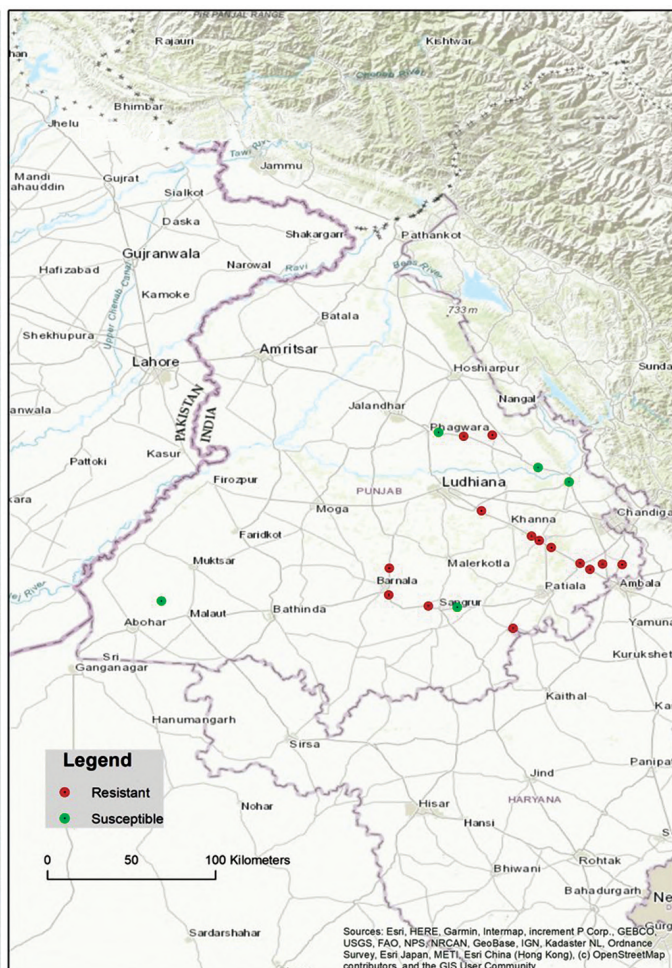
season particularly in rice-wheat cropping system in Punjab and Haryana. Wheat crop is more prone to *R. dentatus* competition as compared to *Phalaris minor* because of its high biomass and superior growth than wheat. *R. dentatus* leads to 2-70% yield loss in wheat grain yield when its density increased from 5 plants/m² to 30 plants/m². Metsulfuron methyl herbicide has



Rumex dentatus biotype with graded doses of metsulfuron methyl.



Locations for resistant *Rumex dentatus* biotypes collected from Haryana.



Locations for resistant *Rumex dentatus* biotypes collected from Punjab

been used for controlling the *R. dentatus* in wheat crop since 1998. Due to its continuous use, it has shown resistance against metsulfuron. Earlier in India, herbicide resistance was confined to only *P. minor* in wheat against photosystem II (PS II) inhibitors (isoproturon), ACCase inhibitors (diclofop-methyl, pinoxaden, clodinafop-propargyl, fenoxaprop-P-ethyl), ALS inhibitors (mesosulfuron-methyl, sulfosulfuron, iodosulfuron-methyl-sodium,

mesosulfuron-methyl, pyroxsulam).

Confirmation of Resistance

A study was conducted at Punjab Agricultural University, Ludhiana during 2018-19 and 2019-20 to confirm the herbicide resistance in *Rumex dentatus* L. (Jangli palak) to metsulfuron methyl. In this study, seeds of the putative herbicide resistant biotypes of *R. dentatus* were collected during both years from the farmers' field in March-April from

Haryana and Punjab states where metsulfuron methyl was used continuously from many years without any herbicide rotation. Total 56 and 33 biotypes of *R. dentatus* from Haryana; 6 and 19 biotypes from Punjab were collected in first and second year, respectively. These biotypes were screened under pot study. The seeds of these biotypes were sown in pots in October and 10 plants were maintained in each pot. Graded doses 0, 5 g/ha (X) and

Animal drawn multi-crop planter-cum-herbicide applicator

A three row multi-crop planter cum herbicide applicator was developed by AICRP on UAE (IGKV, Raipur centre) for planting of seeds and application of herbicide simultaneously. It consists of a frame, seed hoppers, seed metering devices, seed delivery tubes, inverted T type furrow openers, sprayer tanks, boom and nozzles. Sprayer nozzles, seed metering mechanism, hoppers and seed delivery tubes are mounted on inverted T type furrow openers, and can be adjusted for row spacing of 230–240 mm. The performance of implement was evaluated for sowing of soybean, greengram and fodder maize crops. The effective field capacity for soybean, greengram and fodder maize was 0.183, 0.121 and 0.124 ha/h, respectively. Cost of the implement is ₹ 15,000. The cost of sowing operation per ha was ₹ 440, ₹ 666 and ₹ 650 for soybean, greengram and fodder, respectively.



Source: ICAR Annual Report (2020)



R. dentatus biotype with control (left), 2,4-D sodium salt 500 g/ha, 2,4-D ester 238 g/ha, carfentrazone ethyl 20 g/ha, metsulfuron methyl + carfentrazone ethyl 25 g/ha and halauxifen + fluroxypyr 240.6 g/ha at 20 DAT.

10 g/ha (2X) of metsulfuron methyl were applied at 3-4 leaves stage of *R. dentatus* using knapsack sprayer fitted with flat fan nozzle with discharge rate of 375 litre water per ha. Based on the reduction in the shoot biomass, growth reduction was calculated by comparing with the untreated control. Results revealed that 38 out of 56 biotypes of *R. dentatus* collected from Haryana in first year were resistant to metsulfuron, whereas only one biotype showed resistance from Punjab. Further, 23 biotypes out of 33 biotypes collected in second year were found resistant from Haryana whereas 14 biotypes out of 19 were found resistant in Punjab. This confirmed the resistance in *R. dentatus* against metsulfuron-methyl in different regions of Haryana and

Punjab.

Earlier, some reports of resistance were only confined to Panipat district of Haryana, but this study confirmed the resistance from not only regions of Panipat but also in other areas such as Kaithal, Kurukshetra and Karnal districts. It implied the wider infestation of resistant *R. dentatus* in the state.

Further, this study also testified the infestation of metsulfuron methyl-resistant *R. dentatus* biotypes in Punjab for the first time. In Punjab, highly metsulfuron methyl-resistant biotypes of *R. dentatus* were found from Fatehgarh Sahib, Patiala and Hoshiarpur districts. The herbicide resistance in *R. dentatus* after *P. minor* in India is an alarming signal for the sustainable wheat production. Therefore, the use

of metsulfuron-methyl is not economical for control of *R. dentatus*, where resistance has been confirmed.

Management strategies

To control resistant weeds, integrated weed management through use of herbicides having alternate modes of action should be recommended. Further, preventive strategies such as use of certified weed free seeds, field scouting, clean farm equipments restricted movement of weed seeds within fields and field-to-field along with removal of weed seeds should be integrated with chemical measures.

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Successful cultivation of bio fortified wheat variety WB-02 in district Bijnor, Uttar Pradesh

The area under wheat is about 145,000 ha in Bijnor district, out of that about 75,000 ha area is under timely sown condition. The variety WB-02 is rich in zinc (42 ppm) and iron (40 ppm) in comparison to 32 ppm zinc and 28 ppm iron in other wheat varieties with maturity of 138–140 days, bold grained, resistant against yellow rust and leaf blight. WB-02 was introduced and demonstrated by KVK Bijnor during *rabi* 2017–18 and 2018–19 at 25 farmers' field through OFT and FLD. Average yield at farmers field recorded was 57.50 q/ha (63.75 q maximum yield per ha) with cost of cultivation of ₹ 46,345/ha and net profit ₹ 91,605/ha. The area under this variety has now spread to more than 850 ha in just two years. Farmers are satisfied with the yield of this variety and also claim that it is better for chapatti making with higher enrichment of zinc and iron. The successful farmer is Sri Satish Kumar belonging to Sidiyawali village in Noorpur block of Bijnor district.



Source: ICAR Annual Report (2020)