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SHORT COMMUNICATION

Evaluation of barley genotypes for resistance against covered smut disease

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Abstract

Barley (*Hordeum vulgare* L.) is one of the important cereal crops with a share of 7 per cent of the global cereals production. It ranks fourth after the major cereals wheat, rice, maize and has a special significance in Indian agriculture. Covered smut caused by (*Ustilago hordei*) (Pers.) Lagerheim is one of the biotic stresses limiting its production and productivity. It can cause quantitative and qualitative losses to the barley crop. Out of the total 83 genotypes screened for two consecutive years, 5 cultivars (HBL 113, HBL 391, HBL 316, DWRUB 92 and DWRUB 123) and 41 germplasm lines were highly resistant whereas two germplasm lines (BL 1656 and BL 1562) exhibited resistant reaction against *Ustilago hordei*. Rest of the genotypes were moderately susceptible to susceptible.

Keywords Covered smut · *Ustilago hordei* · Screening · Resistant genotypes

Barley (*Hordeum vulgare* L.) is one of the important cereal crops with a share of 7% of the global cereals production. It ranks fourth after the major cereals wheat, rice and maize. Due to its ability to withstand the drought conditions, it has special significance in Indian agriculture (Verma et al. 2011), however, its potential productivity is hampered by diseases inflicting it. Covered smut caused by *Ustilago hordei* (Pers.) Lagerheim is one of the biotic stresses limiting its production and productivity and thus can cause quantitative and qualitative losses to the barley crop. Although chemical control of the disease is worked out (Ben-Yephet et al.1975; Henry et al.1987; Leroux and Berthier 1988), however, deployment of resistant cultivars remains on top priority. Therefore the present study was undertaken to screen the advanced barley entries and released popular varieties under artificial inoculated conditions in order to identify true sources of resistance against covered smut which could be further useful for resistance breeding programmes for effectively managing the disease.

In the present investigation, a total of 83 barley germplasm accessions comprising of 74 germplasm lines and 9 varieties obtained from the Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana were evaluated against covered smut disease for two consecutive years i.e. 2017–18 and 2018–19 at Experimental area, Department of Plant Pathology, PAU, Ludhiana. A highly susceptible genotype, VJM 201 was used as a check. Production of inoculum *of U. Hordei* was done in the 2016–17 crop season by sowing the infected seeds of highly susceptible variety (VJM 201) and at maturity, the smutted heads were crushed to make powder of teliospores which was further stored at room temperature in polythene bags for inoculations in 2017–18 and 2018–19 crop seasons. The seeds of all varieties and germplasm lines were dehulled mechanically and then dipped in the spores suspension (10^8 teliospores/ml) for 6 h prior to sowing and thereafter, the seed was kept under shade for the next 6 h at room temperature. The inoculated seeds of all the germplasm lines were planted in single rows of 1 m length with row to row spacing of 22.5 cm in three replications. Recommended package of practices were followed for raising the crop (Anonymous 2017–18). The disease incidence (DI) was recorded at the time of ear emergence. Per cent covered smut incidence was worked out on tiller basis as per the scale given by Atheya (1974) and the genotypes were characterised as HR: highly resistant (DI = 0%), R: resistant (DI < 1.0%), MR: moderately resistant (1.1–5.0% DI), MS: moderately susceptible (5.1–10.0% DI), S: susceptible (DI > 10.0%).

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Table 1 Disease reaction of barley germplasm lines against *U. hordei* under artificial inoculation

Per cent disease incidence	Disease reaction[a]	Germplasm line(s)[b]	Total no. of lines
0	HR	BL 1652, BL 1550, BL 1429, BL 1591, BL 1416, BL 1470, BL 1511, BL 1509, BL 1517, BL 1578, BL 1588, BL 1503, BL 1514, BL 1548, BL 1607, BL 1635, BL 1577,BL 1553, BL 1546, BL 1590, BL 1589, BL 1620, BL 1651, BL 1584, BL 1573, BL 1665, BL 1552, BL 1598, BL 1574, BL 1592, BL 1636, BL 1601, BL 1528, BL 1660, BL 1566, BL 1400, BL 1647, BL 1390, BL 1535, BL 1572, BL 1581	41
Below 1	R	BL 1562, BL 1656	2
1.1–5.0	MR	BL 1627, BL 1515, BL 1599, BL 1662, BL 1411, BL 1505, BL 1582, BL 1549, BL 1622, BL 1667, BL 1565, BL 1556, BL 1631, BL 1653, BL 1579, BL 1630, BL 1621	17
5.1–10	MS	BL 1672, BL 1520, BL 1440, BL 1657, BL 1512, BL 1625, BL 1595, BL 1519, BL 1541, BL 1639, BL 1644, BL 1628, BL 1506, BL 1543, BL 1522, BL 1612, BL 1322	17
Above 10	S	BL 1562, BL 1550, BL 1490, BL 1614, BL 1520, BL 1625, BL 1595	7

[a]Disease reaction—*HR* highly resistant, *R* resistant, *MR* moderately resistant, *MS* moderately susceptible, *S* susceptible

[b]Average of 2 years data

The results obtained indicated that during both the years of testing, out of 9 cultivars evaluated, the disease did not appear on 5 cultivars viz. HBL 113, HBL 391, HBL 316, DWRUB 92 and DWRUB 123, thus depicting highly resistant reaction. One variety viz. PL 172 exhibited moderately resistant reaction, whereas PL 891 showed moderately susceptible reaction. The remaining two varieties namely PL 807, VJM 201 having more than 10% disease incidence were categorized as susceptible. The screening of 84 germplasm lines against *U. hordei* for two consecutive years revealed that disease did not infect majority of germplasm lines despite of artificial inoculation. 41 germplasm lines were highly resistant whereas two lines exhibited resistant reaction against the pathogen and the remaining lines were categorized moderately resistant to susceptible (Table 1).

Smut screening is sometimes difficult because of inconsistent infection in plants and lines may produce some disease free plants which are otherwise susceptible (Grewal et al. 2006). Repeated screening is, therefore, necessary to confirm resistance. The present findings indicate that all the varieties/germplasm lines which proved to be highly resistant to covered smut disease under artificial epiphytotics during the 2 years of testing under field conditions, can be utilized as a donor for breeding program designed to incorporate covered smut resistance in high yielding varieties, which are otherwise susceptible. The barley genotypes exhibiting different levels of resistance to covered smut have also been reported earlier by Pandey et al. (2000), Lorenz et al.(2006), Beniwal and Mehta (2007), Grewal et al. (2008) and Sharma et al. (2017).

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