



tries Hungary and the Czech Republic we find many similarities. For year 1999, MANNINGER (2000) described races 12, 61 and 77 as predominant in Hungary. In the Czech Republic, race 61 SaBa predominated in 1999-2000, and races 57SaBa, 12SaBa and 77SaBa also belonged to relatively frequently determined races. Neither in Slovakia nor in the Czech Republic in 1999-2000 (BARTOŠ et al. 2001) and Hungary in 1999 (MANNINGER, 2000) virulence on Lr9, Lr19, Lr24 and Lr 28 was detected.

The effectiveness of resistance genes to the isolates of leaf rust in the years 1997 - 2000 in Slovakia are given in *Table 2*. Near-isogenic lines (NILs) with resistance genes Lr9, Lr19, Lr24 and Lr28 were completely resistant to all examined pathotypes in all years. High effectiveness against the leaf rust population was found in the genes Lr1, Lr2a and Lr2b. Virulence on Lr3, that is present in several registered cultivars, was common. Similarly, most samples were virulent on Lr26, also present in several registered cultivars. Resistance genes Lr11 and Lr21 were completely ineffective.

Results of the test of registered cultivars with the most common races are given in *Table 3*. Resistance genes Lr3 and Lr26 prevail in our registered cultivars. These genes are not effective to the most widespread race 61SaBa. Cvs. Arida, Astella, Balada, Barbara, Brea, Eva, Hana, Klea, Malyska, Rada, Regia, Solida, Velta, Viginta and Zerda possess gene Lr3, cv. Samanta Lr3+Lr13, cv. Vlada Lr1+Lr3+Lr13, cv. Blava Lr3ka, cvs. Livia, Malvina and Sana gene Lr26, cv. Alka genes Lr10+Lr13. Undetermined Lr gene possess cvs. Alana, Bety, Elpa, Košútka, Sana, Solara, Šárka and Torysa.

Cultivars Estica and Torysa displayed different reactions to the isolates of race 61SaBa. The sample of race 61SaBa from Bodorová differed by its low virulence on the cv. Estica (infection type 2) from the other samples of this race that were virulent on it. The sample of race 61SaBa from locality Šalgovce differed from other samples virulent on the cv. Torysa by its intermediate reaction (infection type 2-3) on this cultivar. Between samples of race 77SaBa from three

**Table 1: Occurrence of leaf rust races in 1995-2000 in Slovakia ( in %)**

| Year | Occurrence of races in %                  |                           |         |        |
|------|---|---------------------------|---------|--------|
|      | < 10                                      | 10.1-20                   | 20.1-40 | >40    |
| 1995 | 12SaBa<br>77SaBa<br>14                    | -                         | -       | 61SaBa |
| 1996 | 14SaBa<br>2SaBa<br>77<br>61               | 77SaBa                    | -       | 61SaBa |
| 1997 | 62SaBa<br>2SaBa<br>6SaBa<br>6             | 77SaBa<br>57SaBa          | -       | 61SaBa |
| 1998 | 12SaBa<br>77<br>14                        | 77SaBa                    | -       | 61SaBa |
| 1999 | 77SaBa<br>57SaBa<br>12SaBa<br>6SaBa<br>61 | -                         | -       | 61SaBa |
| 2000 | 2SaBa<br>77SaBa<br>6                      | 57SaBa<br>12SaBa<br>6SaBa | -       | 61SaBa |

localities there were differences in reaction of cvs. Torysa and Solida (infection types 2-3). Similar differences were also found in the Czech Republic in cvs. Asta, Blava, Danubia, Livia and Samara (Bartoš et al. 1996). Cv. Estica belongs to the most resistant cultivars whereas cvs. Boka and Solara were susceptible to all applied rust isolates.

Further differentiation of different rust isolates belonging to the same race was also possible on the NILs according the virulence/avirulence on Lr15, Lr23 or Lr17. The most widespread race 61SaBa comprised three pathotypes in 1966, four different pathotypes in 1997, two pathotypes in 1999 and four pathotypes in 2000. Race 77SaBa comprised two pa-

thotypes in 1966, two pathotypes in 1997 and also two pathotypes in 2000.

The results of leaf rust and yellow rust severity on recommended winter wheat varieties in Slovakia in 1998 - 2001 are given in *Table 4*. Currently we established the increasing leaf rust severity. The highest resistance to leaf rust in the field was displayed by the cvs Estica. The ranking of cultivars tested in all State Variety Trials in the period 1998-2001 according to average leaf rust severity also indicates good resistance to leaf rust in the field of the cvs Barbara, Rada, Viginta Klea and Solida (with Lr3) and Solara that has an undetermined Lr gene. Although virulence on Lr3 is prevailing in the leaf rust population, most culti-

**Table 2: Virulence of leaf rust isolates on Lr-NILs (%) in years 1997 - 2000**

| NIL  | 1997  | 1998 | 1999 | 2000 |
|------|-------|------|------|------|
| Lr1  | 16-33 | 27   | 11.4 | 22.2 |
| Lr2a | 33    | 9    | 14.2 | 24.4 |
| Lr2b | 33    | 36   | 17.1 | 35.5 |
| Lr2c | 80    | 100  | 100  | 97.8 |
| Lr3  | 100   | 91   | 100  | 100  |
| Lr9  | 0     | 0    | 0    | 0    |
| Lr11 | 100   | 100  | 100  | 100  |
| Lr15 | 77    | 73   | 100  | 64.4 |
| Lr17 | 100   | 91   | 100  | 100  |
| Lr19 | 0     | 0    | 0    | 0    |
| Lr21 | 100   | 100  | 100  | 100  |
| Lr23 | 30    | 100  | 80   | 53   |
| Lr24 | 0     | 0    | 0    | 0    |
| Lr26 | 100   | 73   | 97.1 | 95.5 |
| Lr28 | 0     | 0    | 0    | 0    |

**Table 3: Postulated leaf rust resistance genes in registered cultivars in Slovakia in 2000**

| Cultivars  | registered | postulated Lr gene | cultivars   | registered | postulated Lr gene |
|------------|------------|--------------------|-------------|------------|--------------------|
| 1. Alana   | 1997       | Lru*               | 18. Košútka | 1981       | Lru                |
| 2. Alka    | 1997       | Lr10+Lr13          | 19. Livia   | 1991       | Lr26               |
| 3. Arida   | 2001       | Lr3                | 20. Malyska | 2001       | Lr3                |
| 4. Astella | 1995       | Lr3                | 21. Malvina | 1998       | Lr26               |
| 5. Balada  | 1999       | Lr3                | 22. Rada    | 1995       | Lr3                |
| 6. Barbara | 1993       | Lr3                | 23. Regia   | 1994       | Lr3                |
| 7. Bety    | 1999       | Lru                | 24. Samanta | 1993       | Lr3+Lr13           |
| 8. Blava   | 1992       | Lr3ka              | 25. Sana    | 1995       | Lr26+Lru           |
| 9. Boka    | 1996       | Lr13?              | 26. Solida  | 1995       | Lr3                |
| 10. Brea   | 1998       | Lr3                | 27. Solara  | 1998       | Lru                |
| 11. Bruta  | 1994       | none               | 28. Šarka   | 2000       | Lru                |
| 12. Elpa   | 2001       | Lru                | 29. Torysa  | 1992       | Lru                |
| 13. Estica | 1996       | Lr13+Lr14a         | 30. Vanda   | 2001       | none               |
| 14. Eva    | 2001       | Lr3                | 31. Velta   | 2001       | Lr3                |
| 15. Hana   | 1985       | Lr3                | 32. Viginta | 1984       | Lr3                |
| 16. Ilona  | 1989       | none               | 33. Vlada   | 1990       | Lr1+Lr3+Lr13       |
| 17. Klea   | 1998       | Lr3                | 34. Zerda   | 1999       | Lr3                |

\* undetermined, note: genes Lrka, Lr13 and Lr14a were postulated by R.F. PARK.

**Table 4: Assessment of leaf rust and yellow rust severity on recommended winter wheat varieties carried out in Slovakia in 1998 - 2001**

| Cultivars | postulated Lr gene | leaf rust |      |      |      | yellow rust |      |
|-----------|--------------------|-----------|------|------|------|-------------|------|
|           |                    | 1998      | 1999 | 2000 | 2001 | 2000        | 2001 |
| Alana     | Lr u*              | 6.9       | 5.8  | -    | -    | -           | -    |
| Alka      | Lr10+13            | 6.9       | 5.6  | 5.5  | 5.5  | 8.8         | 8.9  |
| Arida     | Lr3                |           |      |      | 5.8  |             | 8.5  |
| Astella   | Lr3                | 7.8       | 6.0  | 5.9  | 5.6  | 7.3         | 8.2  |
| Barbara   | Lr3                | 7.9       | 6.9  | 7.1  | -    | 7.9         | -    |
| Balada    | Lr3                |           |      |      | 6.9  |             | 8.0  |
| Bety      | Lru                |           |      |      | 5.9  |             | 8.0  |
| Blava     | Lr3ka              | 6.9       | 5.4  | 4.9  | -    | 6.6         | -    |
| Boka      | Lr13?              | 7.5       | 6.6  | 6.3  | -    | 7.9         | -    |
| Brea      | Lr3                | 7.2       | 6.1  | 4.9  | 4.8  | 7.6         | 8.1  |
| Bruta     | non                | 5.8       | 4.0  | -    | -    | -           | -    |
| Estica    | Lr 13+Lr14a?       | 7.9       | 8.1  | -    | -    | -           | -    |
| Eva       | Lr3                |           |      |      | 6.2  |             | 8.3  |
| Hana      | Lr3                | 6.0       | 3.9  | 4.2  | -    | 7.8         | -    |
| Ilona     | none               | 6.9       | 5.7  | 5.0  | 5.1  | 7.3         | 7.6  |
| Klea      | Lr3                | -         | 6.7  | 6.2  | 6.5  | 7.9         | 8.6  |
| Livia     | Lr26               | 6.2       | 4.6  | -    | -    | -           | -    |
| Malvina   | Lr26               | 6.1       | 5.1  | 5.3  | 5.5  | 6.4         | 6.7  |
| Malyska   | Lr3                |           |      |      | 4.3  |             | 7.7  |
| Rada      | Lr3                | 7.6       | 6.5  | 6.1  | 6.0  | 7.8         | 8.3  |
| Regia     | Lr3                | 7.5       | 6.6  | -    | -    | -           | -    |
| Samanta   | Lr3+Lr13           | 5.9       | 4.0  | 5.4  | -    | 7.9         | -    |
| Sana      | Lr26+Lr u          | 7.5       | 5.9  | -    | -    | -           | -    |
| Šarka     | Lru                |           |      |      | 4.4  |             | 8.7  |
| Solida    | Lr3                | 7.6       | 6.5  | 6.5  | -    | 6.6         | -    |
| Solara    | Lr u               | 7.5       | 6.7  | 6.6  | 6.2  | 7.3         | 8.1  |
| Torysa    | Lr u               | 6.7       | 5.1  | 4.9  | 4.6  | 7.7         | 8.3  |
| Vanda     | none               |           |      |      | 4.7  |             | 8.2  |
| Velta     | Lr3                |           |      |      | 5.4  |             | 7.0  |
| Viginta   | Lr3                | 7.3       | 6.4  | 6.2  | -    | 7.9         | -    |
| Vlada     | Lr1+Lr3+Lr13       | 7.9       | 6.9  | -    | -    | -           | -    |
| Zerda     | Lr3                |           |      |      | 5.5  | -           | 8.6  |
| average   |                    | 7.1       | 5.9  | 5.7  | 5.5  | 7.5         | 8.1  |

9 - without attack, 1 - maximum attack, u - undetermined gene

vars with Lr3, particularly recently released cultivars, show a relatively good level of resistance. As some of them have the partially resistant cv. Viginta, in their pedigree, they may possess this type of

resistance in addition to Lr3. The highest susceptibility to leaf rust was displayed by cvs Hana (Lr3) and Samanta (Lr3+Lr13), by cv. Livia (with Lr26) and Bruta (without specific Lr genes).

After many years in 1999 we recognised the occurrence of yellow rust from natural inoculum. In 2000 and 2001 the occurrence of yellow rust was significant on all registered cultivars and advanced lines, but in 2000 the intensity of severity was higher than in 2001. In 2000 the beginning of intensive attack by yellow rust was earlier than in 2001 and was recognised also on the heads of susceptible cultivars. The highest field resistance to yellow rust was displayed by the cv. Alka. The field observation in 2000 - 2001 indicates also good resistance to yellow rust of cvs. Klea, Rada and Torysa.

If we consider the present virulence genes in the rust population, the resistance genes in the grown cultivars and the disease severity in the field together, we can conclude that both genes for specific resistance and genes for partial field resistance probably contribute to the reduction of yield losses in some cultivars.

## Summary

In 1995 - 2000 we investigated the occurrence of leaf rust races in Slovakia. During this period we detected 12 races of leaf rust, the most frequently determined isolates conformed to race 61SaBa and 77SaBa. Both races occurred in all years. According to virulence of leaf rust isolates on near isogenic Thatcher lines (NILs) resistance genes Lr9, Lr19, Lr24 and Lr28 were completely resistant to all examined pathotypes in all years. High effectiveness against the leaf rust population was found in the genes Lr1, Lr2a and Lr2b. Virulence on Lr3, that is present in several registered cultivars, was common. Similarly, most samples were virulent on Lr26, also present in several registered cultivars. Resistance genes Lr11 and Lr21 were completely ineffective.

According the test of registered cultivars with the most common races, the resistance genes Lr3 and Lr26 prevail in our registered cultivars. These genes are not effective to the most widespread race 61SaBa. Some registered cultivars possess undetermined Lr genes (Alana, Bety, Elpa, Košútka, Sana, Solara, Šarka and Torysa). Estica and Torysa displayed different reactions to some isolates of race 61SaBa. Cultivars Torysa and

Solida displayed different reactions to three isolates of race 77SaBa. Variation of virulence was found also on NILs Lr15, Lr23 and Lr17.

The highest resistance to leaf rust in the field was displayed by the cvs Estica (Lr13). Also high field resistance was shown by cvs. Barbara, Rada, Viginta, Klea and Solida (with Lr3) and Solara that has an undetermined Lr gene.

In 2000 and 2001 the occurrence of yellow rust was significant on all registered cultivars and advanced lines. The highest field resistance to yellow rust was displayed by the cv. Alka. The field observation in 2000 - 2001 indicates also

good resistance to yellow rust of cvs. Klea, Rada and Torysa.

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