

Most Important Diseases, Pests and Weeds in Raspberry Plantings of Yugoslavia and Protection Methods

T. Milosevic

Faculty of Agronomy, Cacak, Yugoslavia

Abstract: Disease, pest and weed control is meant the most complex and difficult stage within the whole process of raspberry production.

Raspberry is often invaded by a large number of parasitic fungi, viruses, bacteria, insects and other pests, with their various combinations being a common case. In addition to direct damages to plants, pests and weeds also contribute to conditions favouring fungal and microorganism growth (bacteria, viruses, etc.). Furthermore, if we consider a relatively high concentration of raspberry production, all this suggests that diseases and pests may pose a permanent threat to this economically most significant fruit species even to the level of epidemic effects.

A range of constraints could be a hindrance to raspberry protection with pesticides, however: 1) the application of chemical agents does not suit customer demands for large, consistent and high quality fruits without pesticide residues; 2) insects and other parasites show highly damaging effects mainly at the time of raspberry flowering, i.e. just at the time when pesticide use is not allowed due to a danger of bee poisoning and 3) raspberry flowering and maturing stages in one planting may take a long time (over 60 days), with only one fertile spur undergoing several growing stages of fruit, i.e. enveloped and unenveloped flower immediately after being set, green and entirely mature fruit. All these seem to be serious deterrents to control measures adoption.

Solutions are being sought in integrated protection, implying efficient pesticide use before emergence of the first flowers and immediately after picking, as well as an adequate implementation of agrotechnical and pomological practices, from preparations that are necessary for planting until exploitable age of raspberry planting has been completed.

Key words: Integrated protection, parasites, diseases, pests, weeds, vectors.

Introduction

Of the total Yugoslav raspberry production, about 95% account for that realised in raspberry plantings of Yugoslavia. Yugoslavia is known to rank first by production and export of frozen raspberry (Petrovic and Milosevic, 1995; 1996). Considering overall production volume of fruits and economic importance, raspberry ranks first and third, respectively (after plum and apple).

The major factors determining economic significance of raspberry production in Serbia are: 1) the potential for gaining higher profit per unit area and capital input in comparison with the majority of other lines of plant production under suitable agro-ecological conditions; 2) high commodity potential of produces along with opportunities for their export on convertible markets and 3) engaging more labour for consolidating economic growth of the country (Petrovic and Milosevic, 1998). Planting protection is assumed a very complex and difficult production stage to handle, as well as the basic limiting factor of raspberry production. In the absence of timely disease, pest and weed control in some years, yield and fruit quality may drop even by 70 %. On the other hand, only sound fruits, without pesticide residue can satisfy market demands.

Considering these facts and paramount importance of this produce to the country's economy, recently there is renewed interest in seeking the most appropriate method of raspberry protection, particularly in the light of ecological side of this issue. Therefore, two groups of issues have been set forth in this paper: 1) economically most important diseases, pests and weeds in raspberry plantings of West Serbia and their effect on yield and its quality, and 2) protection methods.

1. Diseases, pests and weeds in raspberry plantings of Yugoslavia

1.1. Fungal and bacterial diseases (mycosis and bacteriosis)

Raspberry diseases are mainly caused by fungi (mycosis) and bacteria (bacteriosis) under conditions of intensive vegetative growth, planting longevity and others. These may contribute to climatic conditions suiting fungal numerousness. As a result of joint research of the Institute of Plant Protection in Topcider and the Institute of Agriculture in Valjevo in the period from 1998-2000, 16 species of the fungi were identified on leaves, spurs, root and fruits. Of all fungal diseases being identified, the most infectious and highly damaging to raspberry producing areas in Yugoslavia are: 1) cane blight, caused by several species of fungi, with *Didymella applanata* (Niessl.) Sacc. being most dangerous and frequent invader of raspberry; 2) spur dessication, caused by *Leptosphaeria coniothyrium* (Fuckel) Sacc.; 3) cane rot *Elisionoe veneta* (Burkholder) Jenk.; 4) fruit botrytus incited by *Botryotinia fuckeliana* (de Bary) and occasionally by *Alternaria* spp., *Penicillium* spp., *Cladosporium* spp., *Rhizopus* spp., and *Mucor* spp., and 5) verticillium wilt *Verticillium albo-atrum* Reinke and Berth (Rankovic and Garic, 1996; Petrovic and Milosevic, 1998; Petrovic and Milosevic, 2002., Nenadic and Novitovic, 1996). Unless efficient control measures are taken, these

diseases can decrease yield even by 75% thereby, completely devastating fertile buds and canes. A number of other fungal pathogens attacking raspberry was reported: brown leaf spot *Sphaerulina rubi*, leaf spot *Septoria rubi*, *Sphaerotheca macularis* and *S. humili*, fruit rust *Phragmidium rubi idaei*, and others. These diseases seem economically less important and can be easily controlled.

Of the economically significant raspberry cultivars under existing conditions in West Serbia, Malling Promise, Malling Exploit and Lloyd George show marked susceptibility to fungal diseases, whereas Willamette and Meeker show better tolerance, which is supported by similar results encountered in mainly in French sources.

Bacteriosis is however rarer than mycosis in raspberry producing areas of West Serbia. Among diseases sporadically attacking raspberry, root rot, incited by *Agrobacterium tumefaciens* Smith and Town., cane rot caused by *Agrobacterium rubi* (Hild.) Starr et Weiss and leaf spot, incited by polyphatic bacteria *Pseudomonas syringae* Van Hall are often manifested on Malling Exploit and Gradina (Pantelic and Suljagic, 1993). Bacteriosis is mainly caused by contaminated soil and planting material.

1.2. Virus diseases (virosis)

Raspberry suffers from viruses mainly under conditions of an uncontrollable vegetative growth, being a frequent case in some of raspberry growing areas in Yugoslavia-West Serbia (Dulic-Markovic and Rankovic, 1996), with aphid vectors being economically most important raspberry viruses including soil nematoda and infected seeds. No pollen vectors of viruses have been identified yet. However, an evidence has been made of persistently damaged fruits with Raspberry chlorotic net virus (RCNV), Raspberry leaf spot virus (RLSV), Raspberry ring spot virus (RRV), Raspberry mycoplasma stunt disease, Raspberry yellows diseases, Raspberry vein chlorosis, and others.

1.3. Raspberry pests

In the years of pest onset in large numbers, raspberry yield can drop even by 80% (Stamenkovic *et al.*, 1996). The highest damaging effects come from insects: *Byturus tomentosus* Fabr., most often in upland areas with over 50% accounting for damaged blossoms and flowers, followed by *Authonomus rubi* Herbst., *Incurvaria rubiella* Bjerk., *Agilus rubicola* Abeille., *Bembecia hylaeiformis* Lasp., *Coroebus rubi* L., *Thomasniana theobaldi* Barnes., *Aphididae*, *Pegomia rubivora* Coqu., *Notacelia udmanniana* L., *Lasioptera rubi* Heeg, and others (Stamenkovic *et al.*, 1996).

Of polyfagous insects typical for weeded areas, *Malolontha melolontha* L., *Tropinota hirta* Poda, *Oecantus pellucens* Scopt. and *Coccidae* appear most frequently in raspberry patches of the area studied.

In dry years, weeded and uncared raspberry patches are infested by mites: *Neotetranychus rubicola* Trag., *Eriophyes gracilis* Nalepa, *Eriophyes essayi* Hassan, *Tetranychus urticae* Koch. and *Panonicus ulmi* Koch. Two groups of

nematoda prevail in relatively small number of the plantings: a) those inciting cane weaknesses and rot, i.e., *P. penetrans*, and b) those manifested as virus vectors, of which *Longidorus elongatus*, *L. macrosma*, *Xiphinema diversicandatum* and *X. paraelongatum* appear with high frequency. (Krnjajic, D. and Krnjajic, S., 1987).

1.4. Weeds

Raspberry plantings are the habitats highly suiting weed growth. Weed communities of broad-row ploughs are encountered most often. Those within Arilje raspberry producing area make up only a fragment of the association *Agropyretum intermedio repentis*, i.e. its two subassociations: a) *Agropyretum intermedio repentis chenopodietosum albi*, and b) *Agropyretum intermedio repentis poetosum triviale*. There were counted 276 weed species from 37 families and 29 floral elements (Ognjanovic *et al.*, 1997). The most numerous weed families are *Poaceae*, *Asteraceae*, *Fabaceae*, *Laminaceae* and *Brassicaceae* with *Convolvulus arvensis* L. mostly aggravating weed control.

Weedeness may increase to a great extent if rotary tiller is used too often in inter-row tillage and if planting has remained on the same area for a long time.

2. Protection methods

Regular protection of raspberry planting is considered a key condition of a successful and economically wholistic production of this fruit species. In practice, this issue is approached with two extremes. Raspberry patch is either completely left to natural circumstances strongly favouring disease and pest growth or exposed to unsensible, hazardous and excessive pesticide use. (Rankovic *et al.*, 1996).

In principle, agriculturists resort to two methods of raspberry protection: 1) conventional, and 2) various combinations of the conventional and integrated protection method.

The first method is based on gradual introducing of chemical measures, with pesticide treatment of planting done from the beginning of vegetation until two or three weeks before picking.

Integrated protection methodology is basically related to as sparing and efficient pesticide use as possible from February up to emergence of the first flowers and immediately after picking, as well as to duly application of all cultural practices, of which the following seem very significant: 1) planting should be set up under highly convenient soil and ecological conditions (400-800 m of the altitude); 2) weed control should be applied inside and outside the planting throughout the year; 3) the removal of the first series of canes up to 10 days prior to picking, which can help to alleviate high risks of the most dangerous fungal diseases; 4) the choice of highly resistant varieties and use of sound spurs free from viruses and 5) the removal of old plantings once picking has been completed. Pesticide use after picking (2 times) and throughout February (winter) should be done with utmost care with the aim of letting sound plantings await the commencement of the new vegetation.

Conclusion

Conventional method of raspberry protection has some disadvantages, of which: a) excessive pesticide use, and b) inadequate raspberry protection for most of the year deserve mention.

Although no biological measures are taken as the part of integrated protection, this methodology is considered more advantageous than conventional approach, which is supported by numerous discussions of both foreign and the country's authors.

Future studies should be conducted aiming at new solutions for supplementary raspberry protection from the beginning of flowering to the end of picking without pesticide use.

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NAJZNAČAJNIJE BOLESTI, ŠTETOČINE I KOROVI U ZASADIMA MALINE U JUGOSLAVIJI I METODE ZAŠTITE

- stručni rad -

T. Milošević

Agronomski fakultet, Čačak, Jugoslavija

Rezime

U radu su prikazani rezultati koji se odnose na prisustvo ekonomski najznačajnijih bolesti, štetočina i korova u zasadima maline na teritoriji Jugoslavije, s posebnim osvrtom na najznačajnija malinogorja - ariljsko i valjevsko.

Od gljivičnih i bakterijskih bolesti najveću štetu malinjacima nanose: ljubičasta pegavost izdanaka maline (*Didymella applanata* /Niessl./ Sacc.), sušenje izdanaka (*Leptosphaeria coniothyrium* /Fuckel/ Sacc.), antraknoza (*Elisionoe veneta* /Burkholder/ Jenk.), siva plesan i trulež plodova (*Botryotinia fuckeliana* de Bary, *Alternaria* spp., *Penicillium* spp., *Cladosporium* spp., *Rhizopus* spp. i *Mucor* spp.) i venjenje izdanaka maline (*Verticillium albo-atrum* Reinke and Berth), rak korena (*Agrobacterium tumefaciens* Smith and Town.) i rak izdanaka (*Agrobacterium rubi* /Hild/ Starr. et Weiss.).

Najznačajnije štetočine u zasadima maline u našim malinogorjima su: malinina buba (*Byturus tomentosus* Fabr.), malinin cvetojed (*Authonomus rubi* Herbst.), malinin moljac (*Incurvaria rubiella* Bjerk.), malinin prstenar (*Agrilus rubicola* Abeille.), malinin staklokrilac (*Bembecia hylaciformis* Lasp.), malinin korebus (*Coroebus rubi* L.), malinina mušica (*Thomasniana theobaldi* Barnes.), lisne vaši (*Aphididae*), malinina muva (*Pegomia rubivora* Coqu.), malinin smotavac (*Notacelia udmanniana* L.), malinina muva galica (*Lasioptera rubi* Heeg), malinina grinja (*Neotetranychus rubicola* Trag.), malinina grinja (*Eriophyes gracilis*) i dr.

Od korovskih biljaka dominiraju one iz asocijacije *Agropyretum intermedio repentis* sa dve podasocijacije a) *Agropyretum intermedio repentis chenopodietosum alba*, i b) *Agropyretum intermedio repentis poetosum triviali*.

Zaštita zasada maline u našoj zemlji se obavlja konvencionalnim metodama. Definitivan prelazak na integralnu zaštitu se nameće kao imperativ u vrlo bliskoj budućnosti.