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Early bunchstem necrosis in grapes — a cause of poor fruit set

by

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Le dessèchement précoce de la rafle des raisins — une cause de la nouaison réduite des fruits

Résumé: Un désordre affectant l'inflorescence de la vigne a été identifié et décrit. Il se manifeste à tous les stages, depuis le début de l'apparition de l'inflorescence jusqu'à la floraison, causant un recroquevillement et la mort de certaines ou de toutes les ramifications du pédoncule ou de la grappe. Il ne semble pas que ce soit causé par un champignon ou un autre agent pathogène. Son apparence et son développement ressemblent au dessèchement de la rafle, stiellaehme ou bunchstem necrosis (BSN), excepté le fait qu'il apparaît beaucoup plus tôt; d'où le nom de «early bunchstem necrosis» (EBSN) que nous suggérons, comme son étiologie semble être liée aux effets d'agents chimiques inorganiques spécifiques. Des symptômes comme ceux d'EBSN ont été induits par les cations Ca^{++} et NH_4^+, mais aucun symptôme n'a été observé avec K^+ et Mg^{++}. Il y avait considérablement plus de EBSN dans une vigne ombragée que dans une vigne non ombragée. Aucune mesure de contrôle ou de protection n'a pu être trouvée jusqu'ici.

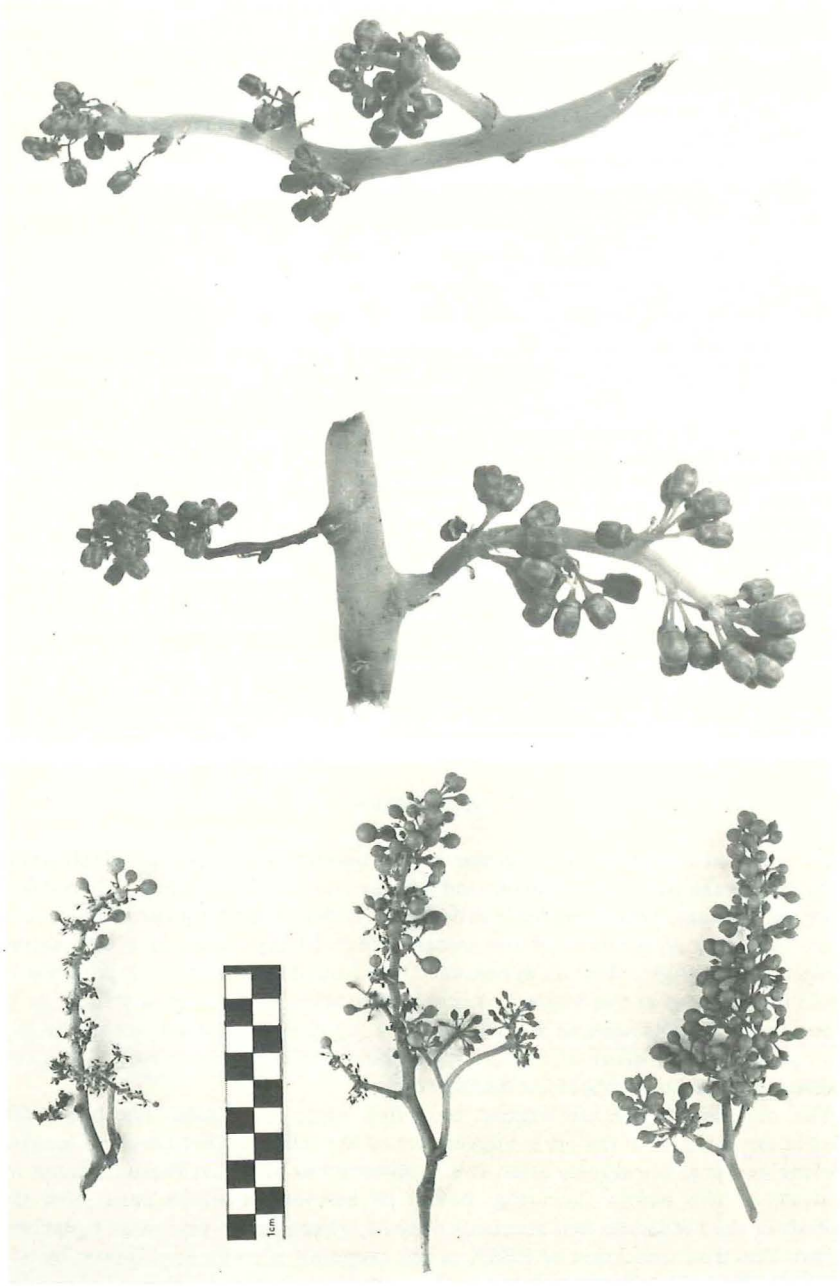
Key words: stiellaehme, rachis, inflorescence, bunch, fruit set, cation, light.

Introduction

During studies of fruit set in grapevines a disorder was observed which could seriously reduce the number of flowers and berries on the bunch. It was not poor set due to poor pollination, inadequate fertilization or post-fertilization upsets, but was characterised by death of portions of the bunch which finally assumed a dry shrivelled appearance. Although it had an appearance of a fungal infection (Fig.), pathologists at Lincoln College and at the Waite Institute were unable to discover any fungi or other obvious cause. Insects such as *Tortrix* spp. may, by chewing the surface of the bunchstem, cause a similar death of branches, but the evidence of the chewing is lacking in this disorder and the timing of the damage differs.

The disorder, which we suggest be called 'early bunchstem necrosis' (EBSN), occurs at any time from the early appearance of the inflorescence (2—3 cm long) up to flowering and possibly shortly after. It was observed to be rather more common in the last week or two before flowering. It can be serious, in which case most lateral branches of the rachis die and abscise, or minor, where only a few small branches are affected. The first indication of EBSN is the dropping of individual flower buds with pedicel attached. Examination shows the base of the pedicel to be shrivelled and brown and this seems to be the cause of drop and not a consequence of the formation of an abscission zone. Following this, symptoms described above and shown in the figure usually appear.

We could find no report of EBSN in the literature. 'Filage' is a condition where the inflorescence does not develop a full complement of flowers and has some branches in



Early bunchstem necrosis: above, symptoms pre-bloom; below, appearance of bunch post-bloom. Damage in the latter case occurred at anthesis, but portions of the bunch still remain attached; an unaffected bunch is shown on the right.

Dessèchement précoce de la rafle. Figure du haut: symptômes avant floraison; figure du bas: apparance de la grappe après floraison. Dans ce dernier cas, l'altération a eu lieu pendant l'anthèse, mais des portions de grappe restent encore attachées; à droite: une grappe saine.

the form of tendrils (BRANAS 1974; CHAMPAGNOL 1984); it does not appear to be similar to EBSN. Descriptions of various forms of coulure by BRANAS (1974) and GALET (1983) do not appear to include the symptoms of EBSN.

We were impressed by the similarity in the appearance of EBSN to the grape disorder stiellaehme. As with EBSN, the bunchstem shows lesions and necroses and berries distal to this shrivel or the section may abscise. Single berries may also drop due to death of the basal section of the pedicel. Such symptoms do not become evident until after veraison. Other terms for stiellaehme are 'dessèchement de la rafle', 'waterberry' and 'shanking' (CHRISTENSEN and BOGGERO 1985). More appropriate English terms for this disorder are 'grape peduncle necrosis', or as we prefer, 'bunchstem necrosis' (BSN). 'Stiellaehme' is translated by Horticultural Abstracts as 'stem atrophy'.

Much research has been done on BSN and there is evidence that it may be accentuated by cool humid weather at flowering (THEILER 1983, 1985; THEILER and MÜLLER 1986). A link has been established between BSN and calcium and magnesium (BOSSELLI *et al.* 1985) and control may sometimes be achieved by spraying these minerals, especially magnesium salts, on to the plant (e. g. THEILER 1985; JORDAN 1986). CHRISTENSEN and BOGGERO (1985) were not able to reduce BSN with magnesium sprays and found that dipping in diammonium phosphate ($(NH_4)_2HPO_4$) induced similar symptoms.

This is a preliminary paper describing early bunchstem necrosis, recording some general observations, and briefly reporting experiments on the effects of various cations and anions on its appearance.

Observations

In an earlier trial at Lincoln, using test plants grown by the technique of MULLINS (MULLINS and RAJASEKARAN 1981), the following cultivars were found to have more than 15 % of their bunches affected (B. E. ANDERSON, priv. comm.): they were, in decreasing order of susceptibility, Alicante (58 %), Brown Muscat, Muscat Hamburg, Muscat Ottonel, Queen of the Vineyard, Black Hamburg and Italia (16 %). Low incidence was found in Schuyler, Cabernet Sauvignon, Pearl of Csaba, Fiesta, Chasselas, Flora, Cardinal.

In an outdoor assessment of wine grapes just after flowering at Lincoln 1987, the following were found to have moderate levels of EBSN: Malbec, Pinot noir, Merlot, Meunier. Very little was observed on Riesling, Chardonnay, Cabernet Sauvignon, Pinotage, Chasselas.

In three vineyards in Canterbury, New Zealand, in 1987 very different levels of EBSN were observed on Pinot noir. In two it was quite common and about 10 % of bunches were affected, while in a third less than 1 % was found. In South Australia we observed more EBSN in cooler sites at higher altitudes in the Adelaide hills rather than at a warmer and earlier site on the Adelaide plain.

In vines, cane-pruned on a 1.8 m high upright trellis, there appeared to be more EBSN in the central part of the vine above the trunk (especially when this was heavily shaded) compared with the peripheral areas.

Experiments

Trials during 1986/87 in South Australia and Canterbury, New Zealand, investigated the relationship between EBSN, light intensity and treatment with various anions and cations. Details will be published later but certain important results, which

may lead to better understanding and point the way to future research, have been obtained and will be summarised.

In early trials at Adelaide, calcium chloride (1 %) and diammonium phosphate (2 %) applied as dips to bunches of grapes (cvs Monukka and Ruby Seedless) caused symptoms indistinguishable from EBSN. Further work with other salts showed that it was the cations calcium and ammonium which were the causal agents and not the anion components. Other cations — potassium and magnesium — had no effect.

It seemed possible that these materials were having a burning effect on the inflorescences which appeared similar to EBSN. This was partially discounted by exposing tender shoot tips to the same salt solutions. In this case salts containing the ammonium cation and the nitrate anion were most damaging. In addition, the burning effect on the shoot tips was evenly distributed whereas the cation effects on inflorescences were, like EBSN, uneven. We conclude that the cations calcium and ammonium were probably entering the tissue and causing physiological effects the same as, or similar to, EBSN.

The fact that diammonium phosphate will induce both BSN and EBSN adds further evidence to suggest they are related. In some situations BSN has been reduced by magnesium sprays, however in our limited experience they did not reduce EBSN.

The observation that there was more EBSN close to the head of cane-pruned vines suggested a possible shading effect. This was supported by an experiment using fruiting cuttings (prepared according to MULLINS and RAJASEKARAN 1981) where there was double the incidence of the disorder when shaded to 50 % incident light, compared with unshaded plants. Under 10 % light all inflorescences on 15 vines succumbed. We know of no comparable work with BSN, but low temperatures at flowering, which could be associated with cloudy weather, are known to induce more BSN after veraison (THEILER 1985, 1986; THEILER and MÜLLER 1986).

The research, which is continuing, has clearly shown a physiological rather than a pathological cause of EBSN. The probable relationship with BSN (stiellaehme) is interesting and suggests both could be forms of the same disorder displayed at different development times.

Summary

A disorder affecting the inflorescence of grapevines was identified and described. It occurs at any time from the early appearance of the inflorescence until flowering, causing shrivelling and death of some or all branches on the peduncle or bunch. It seems not to be caused by fungi or other pathological agent. Its appearance and development resemble stiellaehme or bunchstem necrosis (BSN), excepting that it occurs much earlier; thus the name 'early bunchstem necrosis' (EBSN) is suggested. Like BSN its aetiology appears to be related to the effects of specific inorganic chemicals. EBSN-like symptoms were induced by the cations Ca^{++} and NH_4^+ but no response was found to K^+ and Mg^{++}. There was considerably more EBSN in shaded compared with unshaded vines. No control or protective measures have so far been found.

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