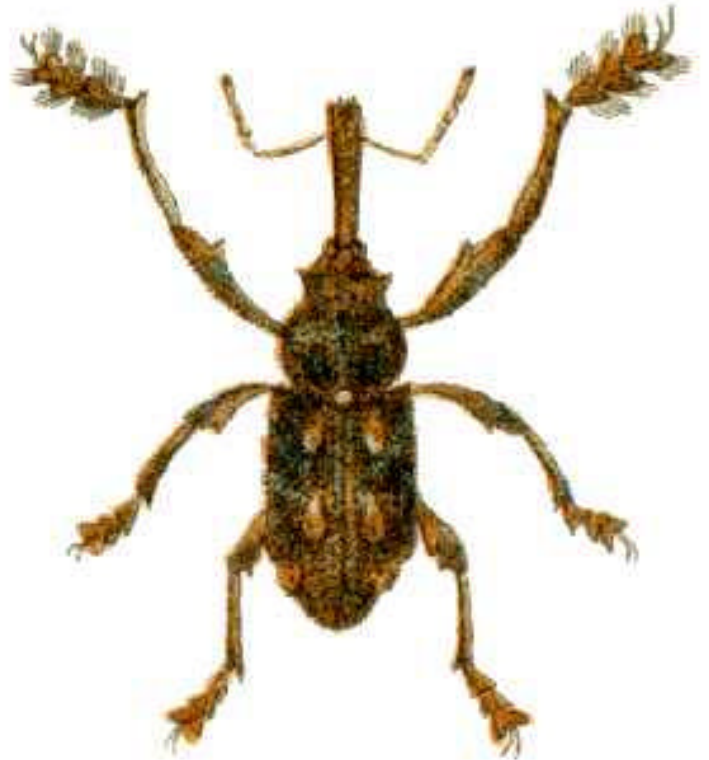


# Elephant Weevil (*Orthorhinus cylindrirostris*) Impact and Control in Vineyards - Stage 1

## SUMMARY

<b>Kingdom:</b>	Animalia
<b>Phylum:</b>	Arthropoda
<b>Class:</b>	Insecta
<b>Order:</b>	Coleoptera
<b>Family:</b>	Curculionidae
<b>Genus:</b>	Orthorhinus
<b>Species:</b>	cylindrirostris
<b>Common name:</b>	elephant weevil



**Origin:** Native insect (Nicholas et al 1994)

**Identification:** **1<sup>st</sup> Stage - Larvae** Maximum size 16 x 7mm, head width 2.5 - 4mm. Body very robust with dense fat body, wide at thorax (Zimmerman 1994, p622).

The larva, a legless grub is a light yellow colour and tunnels extensively within the vine and roots. It grows to about 20mm long before pupating into a cocoon of woody fibres within the tunnel. Numerous tunnels may be present in any one vine, ultimately destroying the wood structure of the vine (Goodwin and Petit 1990).

The grub is soft and fleshy, creamy yellow and legless, and reaches a length of nearly 20mm (Hely et al 1982, p37).

**2<sup>nd</sup> Stage - Pupa** Maximum length 20mm, cuticle glabrous, setae dark brown, short slender sessile (Zimmerman 1994, p622).

The pupa is soft and white, with light brown developing wing covers (Hely et al. 1982, p37).



*Curculionidae*  
larvae

**3<sup>rd</sup> Stage - Adult** 10-20mm long (Seeman et al 2002, p38), 8 -20mm in length and its body is covered in grey and black scales. It is a dark brown weevil, covered on the dorsal surface with fine buff and grey scales; the thorax is covered with irregular bosses, which form ridges on the elytra. It has a long slender snout turned down in the front and very long forelegs terminating in large feathered tarsi (Froggatt 1907, p186).

This grey-black weevil, generally 10-20mm long, its name is a reflection of the elongation of the head. The wing covers bear small, distinct prominences towards their tips, small cones towards the base and a pair on the margin of the thorax. The slender antennae are elbowed (Goodwin and Petit 1990, p8).

**Life cycle:**

The female **elephant weevil** bores a hole into the stem of a host plant just above the ground using her mandibles. Into this cavity she lays an egg. On hatching the young weevil larva begins to feed on the wood, boring downwards eating as it goes. When fully grown, the larvae makes its way back up the tunnel it has made until it reaches the point close to where it hatched, and here it pupates. Development takes about one year (<http://www.ento.csiro.au/Ecowatch/Primary/beetles/pages/Curculionidae.htm>).

They deposit eggs beneath the bark throughout spring and summer, the grub then burrows into the trunk. The larvae appearance is similar to that of a 'witchetty grub'. The larvae remain inside the cambium layer continuously burrowing until the conditions are suitable for them to burrow out of the trunk. By this time the larva has grown into the pupa form, with wings. The adult form is observed in the vineyards in spring and summer (Hely et al 1982).

Most beetles emerge during September and October and eggs are laid shortly afterwards in holes drilled with the proboscis in a vine trunk near the ground. The larvae tunnel for about ten months, the pupal stage lasts for two or three weeks and the adults emerge a year after the eggs were laid. The larvae bore into the wood as soon as they hatch. First they tunnel downwards at a level well below the bark, through the trunk or butt and into the root. Later they turn around and make their way upwards. The fully fed larva pupates within the trunk in a short horizontal cell between a few centimetres and a metre above ground level. When the weevil emerges from the pupal case it cuts a clean round hole to the surface (Hely et al 1982, p37).

It is most likely to have an annual lifecycle although there may be scope for eggs laid early in the season to mature into adults by the following autumn. Its reproductive behaviour and capacity are, to my knowledge, unstudied (Haywood 1996-97).

Adults emerge from August onwards through 5-6mm holes in the trunk, which are generally within 30cm off the ground. Adults lay eggs in late spring or summer beneath the bark, often near the base of the vine. The emerging larva, a light yellow legless grub, tunnels through the trunk and roots and up again. It grows to about 2cm before pupating in a cocoon of woody fibres within the tunnel. There is one generation per year.

Weaker vines are most commonly attached and numerous tunnels may be present backed with frass (Nicholas et al 1994, p69).

Eggs are laid underneath the bark at the tree butt, in October – November. Larvae are creamy in colour and have no legs. They tunnel within branches, trunk and upper roots for about 10 months. Pupation takes place in the trunk just underneath the bark surface, and adults emerge 2-3 months later, usually in September-October. The complete life cycle takes about 12 months (Smith et al 1997, p144).

Following emergence from exit holes (usually 5-6mm across) generally within 300mm of the ground, the adults chew buds and young bark, commonly ringbarking young canes causing serious vine loss. The eggs are laid beneath the bark often near the base of the vine and most commonly on weaker vines (Goodwin and Petit 1990, p8).

Their bodies are densely covered with scales, which vary from grey to black. The wing covers have four distinct prominences towards the tip and smaller ones near the base. Another pair on the thorax slightly overhang the head. The prominences bear longer scales. The front legs are longer than the others, with large tarsal segments. The proboscis is prominent with antennae towards the tip. The eggs are deposited beneath bark (Hely et al 1982, p37).

**Elephant weevil** is a large weevil, with a 5-7mm long proboscis, front legs longer than the other two pairs and wing covers with four distinct protuberances near the wing tips (Smith et al 1997, p144).

**General Habits:** The females bury their long snout nearly up to the eyes when boring the hole in which they deposit the egg, within a foot or so of the ground (Froggatt 1907).

Starts pupating in older cordon wood rather than cane wood like vine weevil (Horne 2002, pers comm). The larvae feed on wood, working downwards, packing the frass behind them. Development takes approximately 1 year (Zimmermann 1994, p624).

When the full fed grub has reached the end of its journey down the trunk into the roots, it retraces its path, throwing back all the accumulated sawdust of its earlier labours in the passage it had made the previous season so that by the time it has reached somewhere about where the egg was originally deposited, it is ready to pupate (Froggatt 1907).

It starts flying at dusk and continues through the night (Witherspoon 2002). The adult weevil is a strong flier and may move some distance to oviposit (Goodwin and Petit 1990, p8).

**Regions present:** **Elephant weevil** can be found over much of Australia from Queensland down to Tasmania and across into South Australia, specific vineyard influence has been noted in Hunter Valley (NSW), Langhorne Creek (SA).



■ Not verified ■ Present

**Host plant:** Grapevines, while not always so, infestations of **elephant weevil** seem to occur more regularly in vines lacking vigour due to age, disease or the condition of the field in which they are growing. This may relate to the vine's ability to repel infestation by newly hatched larvae by physiological means such as the production of sap at the site of the wound although no research on the subject is known, the softer wooded semillon variety seems to be more effected than any other (Haywood 1996-97). Often in grapevines which lack vigour (Witherspoon 2002) soft wooded varieties like Semillon (Goodwin et al. 1998, p51)

Eucalyptus (Seeman et al 2002, p38). Citrus, apple and apricot trees, blueberry bushes apricot, peach (Hely et al 1982). All citrus varieties but is more common on lemons (Smith et al 1997, p144).

**Damage caused:** Girdling of canes by the adults during feeding and tunnelling by larvae in the cordon (Witherspoon, 2002).

Larvae tunnel in arms and trunks of vines, adult weevils can be seen in the vineyard throughout the year and damage canes by surface chewing during the growing season – shoot and leaf dieback can also be found (Anon 1986, p16).

Adults are observed throughout the year, although large numbers seem to be present in spring and summer where they can be very destructive to vines. Adults feed on young shoots causing ringbarking and eventual shoot death and loss of production. It was concluded that control measures should target adults of elephant weevil (Goodwin et al 1998, p51).

The adults feed on the bark of the canes and chew the buds, but it is the larvae which bore in trunks and roots of old vines, especially those lacking vigour which may cause serious damage (Hely et al 1982).

In grapevines its pest status is a result of two effects namely the girdling of new canes by the adult during feeding and the tunnelling behaviour of the larvae which weakens the physical structure of the vine and provides access to moisture and decay causing organisms as well as secondary infestation by termites (Haywood 1996-97).

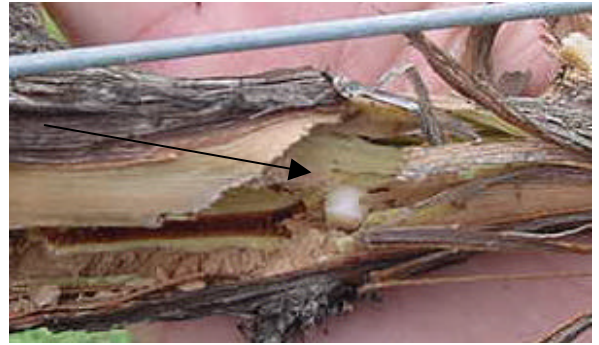
The adults are usually evident from October to April and do serious damage to grapevines (Goodwin and Petit 1990, p8).

They chew on buds and young bark, commonly ringbarking young canes and killing them (Nicholas et al 1994, p69).

## Elephant weevil - Photos



Elephant weevil holes from the outside (Wood 2001)



Elephant weevil grub in hand (Wood 2001)



Elephant weevil grub in wood (Wood 2001)



Grub in cordon (Wood 2001)



Hole in cordon and grub (Wood 2001)



Live elephant weevil grub coming out of wood (Wood 2001)



Holes from inside going out (Wood 2001)



Vine death due to elephant weevil (Wood 2001)



Mac Clegget showing cordon damage (Wood 2001)



Top cordon at Peechabella (Wood 2001)

# Elephant Weevil (*Orthorhinus cylindrirostris*)

## ANECTOTAL OBSERVATIONS

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**Peter Osborne – 28<sup>th</sup> November, 2001** (informal interview conducted at Peechabella by Fiona Wood)

- B1, Chardonnay, 95 planted, 14ha, total of 51,000 vines (planted at 3m by 1m spacings. **It is the most severely affected block** .
- Effectuated vines removed week prior to the 31<sup>st</sup> of October 2001, taking a total of 8 days, then burnt.
- 40 ute loads were removed. Peter felt that approx. 5 - 10% of vines were affected, 75% on the top cordon this year.
- 5,000 vines all producing 4kg of fruit is equivalent to 20 tonne of fruit (at \$1,500 per tonne = \$30,000).
- The year 2000 Chardonnay block not as badly effectuated, went through cut off effectuated vines, equivalent to 6 ute loads.
- Effectuated vines left in row.
- 98 / 99 slow build up of elephant weevil numbers.
- 97, 98 first spotted E.W. in Chardonnay block.

### Summary:

- Years showing high elephant weevil damage – 2001, (2000) not as bad
- elephant weevil first spotted in 1997
- Varieties hardest hit – Chardonnay
- 5 - 10% of vines were affected, 75% on the top cordon in 2001
- Current control method – manually removed and burnt effectuated wood

**Peter Osborne – 26<sup>th</sup> February, 2003** (informal interview conducted at Peechabella by Fiona Wood)

- B1 Chardonnay block on double cordon is effectuated as last year but in a different location
- The vines which were effectuated were weak and slightly stressed.
- A small amount of Merlot and Cabernet sauvignon showed signs of damage in insignificant amounts.
- Net result is the same as last season 2001/02

# Elephant Weevil (*Orthorhinus cylindrirostris*)

## ANECTOTAL OBSERVATIONS

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**Mac Cleggett – 28<sup>th</sup> November, 2001** (informal interview conducted by Fiona Wood)

- **Almond Block:** Chardonnay planted in 1992, approximately 150 of a total of 3,500 vines show the effects of elephant weevil (4%).
- 2001 Mac went through and pruned / cut effected vines out.
- 2000 was not as bad for weevil, 1999 was similar to 2001.
- The Cabernet sauvignon at Almond Block, contains 2,000 vines in total, 5 % were affected.
- In 2001 not as many vines affected, Mac feels it may be a little more under control.
  
- Block on the Langhorne Creek to Wistow road has all been affected with the exception of the Shiraz block.
- The Cabernet sauvignon (1971), Cabernet sauvignon (1990) and Chardonnay (1986) are all effected and have been for 7 – 8 years.
- The damage is scattered throughout the block, no specific area or location.
  
- The block near the house (which I have visited)
- Chardonnay planted on Schwarzmänn rootstock (4,300 vines) and Chardonnay on own roots (2,040).
- Both blocks have been affected , 10% in total in the year 2001.
- Cleared out affected vines, burnt wood, and will start retraining the vines.
- Year 2000, not as problematic, 1999 particularly bad, similar to this year.
- Each year Mac has gone through and removed effected wood, burnt it.

### Summary:

- Years showing high elephant weevil damage – 1999, 2001
- Evidence that elephant weevil has been present for 7-8 years
- Varieties hardest hit – Chardonnay, Cabernet sauvignon
- Scattered damage not uniform
- Current control method – manually removed and burnt effected wood.

**Monitoring:** **Weevils generally** – corrugated cardboard around of the base of the vines, or grooved boards throughout the vineyard can be examined during the day for sheltering adult weevils (Seeman et al 2002, p40).

Educate vineyard and pruning staff to act as scouts during the year, reporting boring insect damage and activity and treat infested areas without delay (Anon 1986, p16).

The adults chew patches of bark from the canes. These cause no great harm but they are a sigh that the weevils are active and that control measures should be applied (Hely et al 1982, p159).

**Control:** Elephant weevils – chemical

The results indicate that, at these rates Fipronil ('Regent') @ 20ml/100L gives the best and most consistent control of **elephant weevil** adults. Azinphos Methyl ('Gusathion') @ 245ml/100L is also shown to control **elephant weevil** 'Post treatment counts of adult elephant weevils/20 vines after statistical correction'. It must be remembered that this trial consisted of small plots in a vineyard containing a very large infestation. It is not known if the chemicals applied have any anti-feeding or anti-reproductive effect on elephant weevils newly arriving on a treated vine. It may be that a broader scale of application ie spraying complete blocks or vineyards might result in longer lasting control of this pest (Haywood 1996-97).

**Trial to determine if adult weevils were killed by contact with sprayed grapevine leaves alone.** Both Regent and Azinphos methyl treatments show significant mortality, they are capable of controlling **elephant weevil** adults, which have not been directly contacted by a chemical spray (ie residue on leaves only). Talstar at a high rate resulted in death in only one replicate while the other treatments caused no mortality at all (Haywood 1996-97).

Talstar and Regent ranked 1 and 2 as the chemicals achieving the best control with respect to cane damage figures (Witherspoon 2002). The issue of chemical residues resulting from the use of Azinphos methyl has deterred some Hunter Valley growers (Goodwin et al 1998, p52). A study demonstrated this chemical if applied at the recommended rate by high volume sprayer would not cause a residue problem in wine (Goodwin and Ahmad 1998). Azinphos-methyl 0.05% and Carbaryl 0.1% are effectively used against adults several times as routine sprays in the spring (Hely et al 1982, p159).

Weevils – cultural

Any infestations removed at pruning time should be burnt (Anon 1986, p16). Careful pruning to eliminate badly affected vines together with a spring summer spray program of chlorpyrifos or methidathion used fortnightly against the adult is the most effective control currently available (Goodwin and Petit 1990, p8).

Weevils generally – farm hygiene

Keeping vigilant about machinery, picking equipment, soil, plant material and mulch coming onto the property is essential. This is especially important for species with females only (Seeman et al 2002, p40).

Weevils generally – No action

Borers will spread causing greater damage. Immediate action is necessary if borers are to be controlled.

**Predators:** Unknown

# Elephant Weevil (*Orthorhinus cylindrirostris*) Impact and Control in Vineyards - Stage 1 **LITERATURE REVIEW**

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## **JOURNALS**

### **General - Weevils**

Anon. (1999) **Practical measures sought to counter garden weevil.** *Australian Viticulture.* May/June, 43 – 49.

In WA garden weevil is an ongoing problem in vineyards. The use of integrated methods of control are examined including; chemical, biological (nematodes and fowl including guinea fowl, turkey and common egg-laying fowl), monitoring (scouting and laying corrugated cardboard), cultural control (removal of host weed species), cultivation and repellent bands. The effectiveness of these approaches is discussed with a combination of regular monitoring, use of fowl, removal of host weed species, vineyard hygiene and chemical control being favoured in an integrated approach.

Anon. (1986) **Boring insects damage Hunter Valley grapevines.** *Australian Grapegrower and Winemaker, December, 16 – 17.*

In the Hunter Valley, Australia, some native boring insects attack grapevines, tunnelling in trunks and arms and damaging canes by surface chewing. They are the fig longicorn beetle (*Dihammus vastator*), the **elephant weevil** (*Orthorhinus cylindrirostris*), the vine weevil (*Orthorhinus klugi*), and bostrychid beetles, control of which is very difficult. The damage and the life cycles are described. The possibilities of scouting and treatments at different dates are demonstrated. No insecticides are registered, but chlorpyrifos, methidathion, carbaryl or azinphos should give control of adult boring insects.

Bailey, P. (1990) **Controlling garden weevil in vineyards.** *Australian Grapegrower and Winemaker, April, 105.*

Garden weevil is one of a group of insect pests including apple weevil or curculio beetle and pink cutworm, which damage young vine plantings or newly grafted vines in SA. A description of garden weevil is provided with possible control options including; precautions to exclude from vineyard, cleaning of machinery, removal of host weed species, timing of chemical application, pyrethroid insecticides, and the use of parasitic nematodes. The effectiveness of each approach is not discussed.

Goodwin, S., Haywood, C. and Wellham, T. (1998) **Controlling persistent borer problems in Hunter Valley vineyards.** *Australian Viticulture.* July/August, 51 – 52.

The progress in the development of an effective chemical control against two grapevine borers, fig longicorn beetle (*Acaloepa vastator*) and **elephant weevil** (*Orthorhinus cylindrirostris*) is reviewed. These borers cause economic damage to vineyards in the Hunter Valley region of Australia, and have typically been controlled by strategic application of azinphos methyl, chlorpyrifos or methidathion. Sprays were targeted at the larval stage of the fig longicorn beetle, and at the adult stage of **elephant weevil**. This control strategy reduced pest numbers, but did not satisfactorily reduce damage.

Several other chemical were then evaluated for their effectiveness at controlling the borers, bifenthrin and fipronil were effective against both fig longicorn beetle and **elephant weevil**. Imidacloprid was effective against the fig longicorn, but not against **elephant weevil**.

Goodwin, S., and Pettit, M. (1990) **Insect borers in Hunter Valley vineyards**. *Australian Grapegrower and Winemaker*. April, 7 – 15.

A three-year research project commenced in 1988 identified four borer species in the Hunter Valley region including fig longicorn beetle, **elephant weevil**, vine weevil and bostrychid beetle. The biology and control of these species is discussed, and research into fig longicorn, the only economically damaging species is described.

Haywood, C. (1996 - 99) **Elephant weevil research**. NSW Department of Agriculture.

**Elephant weevil** is an ongoing problem in the vineyards of the Hunter Valley. A three-year research project commenced in 1996/97. This is the most detailed account available monitoring damage and population levels and elephant weevil chemical control options. A scoring system was established to determine occurrence and severity of girdling of grapevines canes along with the age of the bark. **Elephant weevils** preferred to feed on the more mature areas of new canes. The crown of the vine was the preferred location of pupation site, however only a low sample number was used to derive this conclusion. The population of adult weevils on the vines was greatest from Oct – Jan 1997, contrasting with Oct – Nov in 1996.

Haywood speculated that eggs laid early in the season may have time to develop fully in one summer and therefore explain the extra peak of emergence in late season, however the fact that the adults are extremely long lived (up to 6 months in captivity) together with the sudden an unexplained population crash evidenced in the trial block in 1998 lead him to believe that the lifecycle may be longer rather than shorter. A two-year lifecycle with two cohorts or ages of larvae being present in a vine at the one time may go some way to explaining drastic seasonal population variation.

Results indicated all of the chemicals tested, with the exception of chlorpyrifos have the ability to control **elephant weevil** population. Further research should be done with chlorpyrifos before it is ruled out as an effective control due to this years low sample number of weevils. The single spray strategy was successful for Talstar and Regent applied before budburst, as were regular foliar sprays. Contact with and ingestion of the bark during the insect's emergence was also a factor in the overall mortality. Low elephant weevil numbers in 1999 provided further evidence of overall vine health being a prime factor in determining weevil infestations.

Seeman, O., Farquhar, D., and Domeney, P. (2002) **Towards understanding weevils in vineyard ecology**. *The Australian and New Zealand Grapegrower and Winemaker*. (464), 36 – 40.

'Project weevil' was an initiative where Tasmanian grape, stone fruit and apple growers were sent empty tubes and invited to send back weevils for identification. They found a number of introduced weevil species including; black vine weevil, garden weevil, Fuller's rose weevil. Native species included **elephant weevil**, vine weevil, and Eucalyptus weevil. General control options are discussed.

## PUBLICATIONS

### General - Weevils

Anon. (1950) **The elephant beetle**. NSW Department of Agriculture, Insect Pest leaflet No 59, Sydney.

CRCV (2002) **Integrated Pest Management - Research to Practice**<sup>®</sup>. Cooperative Research Centre for Viticulture, Adelaide.

Hely, P.C., Pasfield, G. and Gellatley, J. G. (1982) **Insect pests of fruit and vegetables in NSW – The Australian Landscape**. Incarta Press, Clayton, Victoria.

Nicholas, P., Magarey, P., and Wachtel, M. (1994) **Diseases and Pests**. Winetitles, Adelaide p69.

Goodwin, S (1986) **Pests of grapes**. Agfacts, No H7.AE.1, 12 pages.

Froggatt, W. W. (1907) **Australian Insects**. William Brooks and Co Ltd, Sydney.

Smith, D., Beattie, G.A.C., and Broadley, R. (1997) **Citrus pests and their natural enemies – Integrated pest management in Australia**. DPI Queensland, Brisbane.

Zimmerman, E. C. (1994) **Australian Weevils**. CSIRO, Melbourne.

## WEB

<http://www.ento.csiro.au/Ecowatch/Primary/beetles/pages/Curculionidae.htm>

[http://www.ento.csiro.au/aicn/name\\_c/a\\_899.html](http://www.ento.csiro.au/aicn/name_c/a_899.html)

## PRESENTATIONS

Horne, P.A. (2002) **Presentation and discussion on rust mite and weevils**. For the Langhorne Creek Grapegrowers Association.

Learmonth, S. (2002) **Some organic products for controlling garden weevil**. Margaret River Wine Industry Association Quality Factor Seminars.

Witherspoon, J. (2002) **Elephant weevil**. PowerPoint presentation to the LHGGA Meeting June/July.

Wood, F. (2001) **Digital photos**. Taken at several Langhorne Creek properties.

# Elephant Weevil (*Orthorhinus cylindrirostris*) Impact and Control in Vineyards – Stage 1 **C O R R E S P O N D E N C E**

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## **Andrew Austin – Entomologist (University of Adelaide)**

No journal articles on elephant weevil but many generalised reports in pest management books.

## **Mike Keller – IPM specialist (University of Adelaide)**

Search of Adelaide University Libraries for *Orthorhinus* yielded 3 results included plus. Goodwin, S (1986) **Pests of grapes**. Agfacts, No H7.AE.1, 12 pages. [This is missing from the Waite Campus Library and it is doubtful whether it would add anything more.](#)

## **Rob Reid/Greg Baker/Andrew Austin – (University of Adelaide)**

Supplied several references

### **Key contacts**

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- Chris Haywood NSW Agriculture (02) 4348 1921
- Stuart Learmonth Ag WA (08) 9771 2444
- Steve Partridge (Agribusiness Research and Management) manages Bracken Ridge near Manjimup WA (Anon 1999 p43).

### **Research to date:**

- The most recent research work has been followed through on a yearly basis looking at damage caused and different control methods which could be used to eradicate the elephant weevil in vineyards. Results showed that 'Talstar' and 'Regent' if applied before budburst gave successful control against elephant weevil however neither product is registered for use in vineyards (Haywood, C. 1996 - 99).

### **Monitoring of damage and population levels (Haywood 1996-99)**

Sampling commenced at budburst and continued fortnightly, the sample plot consisted of 25 vines in each of 4 adjacent tows. The location of each new emergence hole was recorded and described as being either in the upper or lower half of the trunk or in the proximal or distal half of the cordon. The holes were marked with yellow paint to exclude them from subsequent counts. Additionally 5 canes from each side of the crown, a total of 1000 per sample were visually inspected for elephant weevil feeding damage. Damage was assessed by scoring the severity of girdling of the cane on the following scale:

No score = undamaged

1 = up to 20% ringbarked

2 = 21 – 99% ringbarked

3 = completely ringbarked

The age of the damaged bark on the cane was recorded as well by distinguishing between damage occurring on older brown bark or on newer green bark. This gave an indication of the feeding preference of the adult weevils. Damaged canes were marked using consecutively numbered adhesive tags (cattle tail-tags) so that the accumulation of damage could be assessed.

### **Results 1996-97**

The area near the crown of the vine was the preferred location of pupation site (low sample number). The appearance of new emergence holes occurred fairly evenly over the season.

The population of adult weevils on the vines was greatest from Oct – Jan 1997, contrasting with 1996 being Oct – Nov.

Most damage to canes (girdling) occurred in the period until early Jan after which relatively few canes were attacked. **Elephant weevils** preferred to feed on the more mature areas of new canes.

### **Results 1998**

Results show there was a peak of adult emergence in early Nov with possibly a smaller secondary peak in Jan. It is likely the number of **elephant weevil** larvae present in a vine is more a reflection of conditions during the egg laying period rather than the period when the larvae are resident and relatively protected in the vine. I speculated in last season's report that eggs laid early in the season may have time to develop fully in one summer and therefore explain the extra peak of emergence in late season, however the fact that the adults are extremely long lived (up to 6 months in captivity) together with the sudden and unexplained population crash evidenced in our trial block this season leads me to believe that the lifecycle may be longer rather than shorter. A two year lifecycle with two cohorts (or ages of larvae being present in a vine at the one time) may go some way to explaining drastic seasonal population variation.

These results indicate all of the chemicals tested, with the exception of chlorpyrifos have the ability to control elephant weevil populations, further research should be done with chlorpyrifos before it is ruled out as an effective control due to this years low sample number of weevils. The single spray strategy was successful for Talstar and Regent applied before budburst (as did regular foliar sprays), a possible explanation of the success treatments may be found in the habit of adult weevils to feed on the bark of one year old wood. Additionally the adults would contact chemical residue when moving between canes and in their habit of resting on the cordons where they are better camouflaged.

Contact with and ingestion of the bark during the insect's emergence would also be a factor in the overall mortality but this effect would be reduced by migration from unsprayed sections of the vineyard.

### **Possible control strategy**

Growers may wish to control emergence peaks of elephant weevil adults using foliar application of insecticides, possible as tank mixes with fungicides. Such a strategy would depend entirely on the accuracy of field monitoring and should be used in conjunction with the knowledge of emergence patterns. The normal caveats on tank mixes would also apply. For example if Regent were to be registered for elephant weevil control it should be considered that it has a tendency to settle out of tank mixes with inorganic fungicides such as those containing copper, sulphur or zinc (Hayward 1998).

### **Results 1999**

Low elephant weevil numbers provides further evidence of overall vine health being a prime factor in determining weevil infestations.

# Elephant Weevil (*Orthorhinus cylindrirostris*)

## Impact and Control in Vineyards – Stage 1

### APPENDIX 1 - RELATED WEEVIL

### INFORMATION

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#### Vine Weevil (*Orthorhinus klugi*)

- Larvae stage for up to 1 year, may survive in prunings (thus adult weevil may still escape to reinfect vine). Remove and burn prunings or mulch. If sap flow is not resisting the larvae will move down into older wood.
- Larvae stage lives in the internode of the cane and cuts a single hole once it pupates to escape as an adult to host vine or wattle trees, it can fly (Hoare 2002, pers comm).
- 6-7mm long (Seeman et al 2002, p38)
- native host plant - acacias (Seeman et al 2002, p38)

#### Garden Weevil

- White 'V' on back of adult, branched antennae
- Transported in potted plants at the end of vine rows
- Hard to control as they feed underground ringbarking small roots, destroying root systems, also feed on tap rooted host weeds.
- Rotary hoe in Oct/Nov to control pupae state or try drowning up to mid spring by flood irrigating (Hoare 2002, pers comm).
- Attacks leaves, green stems (including bunch stems) and fruit, cannot fly, feeds at night and has males and females. Typical leaf damage caused by garden weevil tends to be shot holes rather than ragged leaf edges (Seeman et al 2002, p38).
- Anecdotal evidence of positive feedback via growers who have put fowl, especially guinea fowl into their vineyards, the birds scratch around the base of the vines and eat the sheltering black vine and garden weevils (Seeman et al 2002, p40).
- Spot spraying for garden weevil often results in a surge of mite populations most likely because natural enemies are destroyed (Anon 1999 p43).

#### **Control:** Garden weevils – Monitoring

Monitoring every seven days from budburst until December. **Larvae** examination of a spade full of soil near the base of vines and under host weed species in the late winter and early spring, it is possible that larvae will be found feeding on vine and weed roots around budburst.

Wrapping a piece of corrugated cardboard about 20cm wide around the base of selected vines is a practical means of monitoring when adults have emerged and are on the move because weevils will tend to shelter inside the corrugations.

Another means of monitoring adults is to scrape soil at the base of vines and to look under bark and other places which give shelter.

Adult weevils emerge from the soil in mid to late October and are most numerous between November and December. They feed at night and shelter during the day. Eggs are laid in loose organic matter on the soil and hatch in 10 to 14 days.

Young larvae immediately burrow into the soil to feed on plant roots. **Pupae** stage development depends on weather conditions, usually lasting three to four weeks (Fisher in Anon 1999 p46).

### Garden weevils – Chemical

#### **Non-bearing grapevines in WA**

One of the alpha-cypermethrin products, Fastac\* 100 insecticide, is registered for the control of garden weevil in non-bearing grapevines. Details of the use of this insecticide:

1. monitor young vines during spring and early summer.
2. apply insecticide at the first signs of leaf damage.
3. cover leaves, canes and soil around each vine to a diameter of 30cm.
4. use 100ml of Fastac\* 100 per 100L of water.
5. About 70 to 80ml of diluted spray should be sufficient for each vine.
6. if pest infestation persists a second application may be required after three weeks.

Butt drenching is a favoured application method because it minimises the impact on natural enemies of garden weevil, although vine canopy sprays may also be used (Fisher in Anon 1999 p46).

Synthetic pyrethrum products are being trialled as a butt drench (Organo-x-premium) or foliar spray (neem products – Axa Max, Bio Neem, azidol) in WA to try and control garden weevils in WA (Learmonth 2002).

### Garden weevils – Biological

Ground dwelling birds which scratch into the soil and search for insects to peck are useful. These include turkeys, chickens and guinea fowl. Nematodes have been studied as a possible biological control agent although they only parasitise larger larvae and have minimal effectiveness (Fisher in Anon 1999 p49).

### Garden weevils – Cultural

Sub clovers do not favour the development of larvae but must extend under the vine rows to be effective. Another cultural practice is to control weeds on which garden weevil larvae breed including sorrel, capeweed, dandelion and dock (Fisher in Anon 1999 p49).

### Garden weevils – Repellent bands

Repellent stick bands placed on vine trunks can prevent weevils entering the canopy. It is an approach which requires a lot of labour restricting it to intensive production such as table grapes (Fisher in Anon 1999 p49). Sticky bands containing synthetic pyrethrum are being trialled in WA. Bands work as a repellent rather than a physical barrier they need to be replaced annually (Learmonth 2002).

### Garden weevils – Mechanical control

Victorian research has shown that using a rotary hoe during the time of pupation of garden weevil in spring can lead to a large reduction in numbers. Large populations in WA vineyards where most weevil larvae feed in the drip zone mean this option will have a limited place (Fisher in Anon 1999 p49).

## Garden weevils – Hygiene

Infestations occur in patches rather than an entire vineyard, this makes it wiles to avoid moving soil, prunings and other possible sources of infestation from one site or property to another and to clean vehicles before moving from an infested to a non infested area (Fisher in Anon 1999 p49)..

## Black Vine Weevil

Nematodes are useful against black vine weevil. Nematodes kill the larvae by entering their bodies, releasing bacterium and then digesting the resulting soup of grub guts. However growers need to be aware of their sensitivity of organophosphate and dislike of heavy soil and cold temperatures (Seeman et al 2002, p40).

## Miscellaneous

Turkeys are adept at fossicking for their prey but are not good at getting out of the way of foxes. Turkeys may graze about more than 500m radius from a mobile cage (Anon 1999 p43). Guinea fowls can take flight for protection but are still vulnerable. Guinea fowls graze about 500m radius from a mobile cage (Anon 1999 p43). Bantams will scatter quickly when a fox is about. The common egg laying fowl are vulnerable but there can be safety in numbers and they are easily encouraged back into fox proof enclosures at night. Fowls graze about 250m radius from a mobile cage (Anon 1999 p43).



### Summary of control options for Elephant Weevil (Author's recommendations)

Suggested method of control	Issues	To be adopted	Further research required
Repellent bands	An approach which requires a lot of labour restricting it to intensive production such as table grapes	No	No
Host plant control	Determine host plant (and/or weed) species near vineyard, monitor and removal if feasible	Yes	No
Mechanical soil management	Most vine weevil larvae feed in the drip zone mean this option will have a limited place. Associated soil structural issues. Elephant weevil resident in vine.	No	No
Chemical control	No products are currently registered for use on bearing vines. Need to research timing, application and volume rates of efficacy.	Possibly	Further research dormancy spray of Fipronil, Bifenthrin or Azinphos – methyl.
Reworking affected vines	Lop heavily damaged vines down to lowest level of damage. Retrain next spring and include insecticides in a program for control.	Possibly	Further research retraining heavily damaged vines down to lowest level of damage and retrain next spring.
Parasitic nematodes	Ecogrow TurfNem, results inconsistent and expensive when used to try and control garden weevils in WA	No	No
Synthetic Pyrethrum	Trialling SP's as a butt drench or foliar spray in WA to try and control garden weevils in WA.	Possibly	Would similar control be gained as a 'softer option' foliar spray for elephant weevil?
Introduction of fowl	Most elephant weevil activity is in or on vines	No	Costs prohibitive to maintain and keep alive from predators? Doubtful as to effectiveness against elephant weevil.