

# Effective control of mesquite – Pilbara tools and tips

**Version 1.2**

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## Chemical treatment

Always consult with the Material Data Safety Sheet and Product Label prior to handling any chemicals. Ensure that required PPE is worn, especially when handling raw herbicides.

The use of Access® to control mesquite is accepted with an on-label permit for basal bark treatment of plants with stems up to 5 cm basal diameter. The herbicide is mixed at a rate of 1 Lt Access® to 60 Lt diesel as the transfer agent.

The use of specific herbicides, including Garlon 600® and Velpar L®, to control mesquite is registered under an off label permit issued by the Australian Pesticides and Veterinary Medicines Authority (APVMA) to the Department of Agriculture and Food WA (1 January 2011 – 31<sup>st</sup> December 2016). Under this permit, persons generally can use specified chemicals to treat declared plants in Western Australia.

## Basal bark treatment – highly recommended and widely used

### Situations where basal barking is recommended:

We recommend basal barking mesquite as the primary treatment method for hybrid and tree-form mesquite, especially in situations where plants are in low to moderate densities or seedlings dominate an area. If vigilance is maintained during programs very high control rates can be achieved.

### Advantages & disadvantages:

Basal bark treatment of mesquite often results in rapid death of plants, and if treated correctly, over 95% of plants will die within 2 months. This technique is also target specific with only the plants being sprayed affected by the herbicide. On the other hand, this technique is labour intensive and can become costly if large or denser populations of mesquite are targeted. Additionally, operators must be vigilant about their technique to ensure comprehensive herbicide mix coverage.

### Recommended herbicides:

Access®	240 g/L Triclopyr + 120 g/L Picloram + 389 g/L Liquid hydrocarbon
Garlon 600®	600 g/L Triclopyr

### Equipment required:

- Recommended herbicide
- Diesel
- Low volume spray bottle or pack
- Surveyors tape or similar
- GPS or similar

### Technique:

1. Mix the diesel and herbicide of preference at a rate of 1 Lt chemical to 60 Lt diesel
2. Decant into spray bottle or pack and pressurise
3. Test the output of the spray pack, and adjust to a coarse droplet size
4. All debris is removed from the base of plants to ensure good herbicide mix to stem contact

*Basal barking requires that the herbicide and diesel mix is applied to the point of runoff, around each stem from the base of the ground up to a particular height. Our observations have found that the larger a plant is, the more herbicide and chemical mix is required to achieve death. We recommend that the following parameters are followed:*

5. Herbicide mix is applied to the point of run-off to every stem branching within the following height classes, all the way around every stem:
  - Seedlings – 2 m tall plants – apply mix from the ground up to 30 cm
  - Plants 2 – 4 m – apply mix from the ground up to 1 meter
  - Plants 4 m plus – apply mix from the ground up to the maximum height which is safe to do so (caution of spray drift if spraying above should height)
6. Tag the tree if required using fluoro surveyors tape
7. Take a GPS reading of the plant



Above: Low pressure basal bark spraying @ Mardie Station, high volume basal bark spraying @ Mardie Station

### Timing:

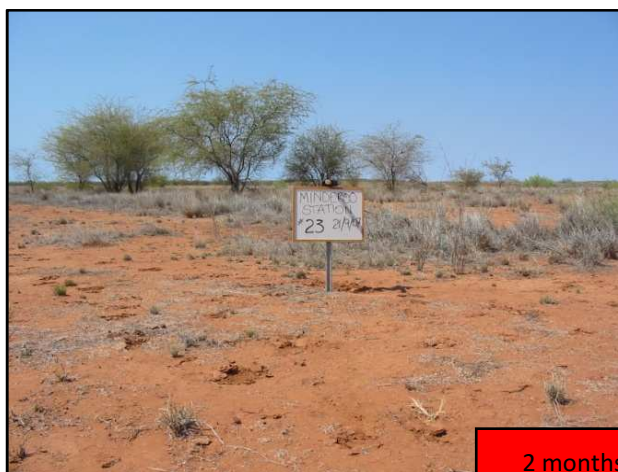
The effectiveness of basal barking is greatly enhanced when plants are actively growing, as herbicide is readily absorbed or taken up. Active growth is indicated by the presence of new leaves and shoots, or the presence of flowers, and is triggered by new moisture availability or a change in day length. Our observations have indicated that basal barking plants which do not appear to be actively growing will still cause death, however the effects of the herbicide and eventual death will be delayed over several months. We believe this is because plants have found alternative sources of underground water to keep them alive during dry times.

In general terms, we find that basal bark spraying is best conducted from April to November. During these months, temperatures are favourable to being out in the field conducting control programs and plants should be responding to the rainfall received during the wet season. The onset of a late wet season, or a big wet season, may delay the commencement of control programs as access to target areas for control may be hampered.

### What you should see:

In an optimal season, when plants are actively growing, the following observations should be apparent. Note that if plants are very large (+6 m) or the season is dry, the timing of these observations will be longer:

- Immediately: diesel will cause the stem to change colour, to a glossy brown. This colour will remain on the stem for several days, indicating the plant has been controlled
- 1 week after treatment: tips of the leaves on the plant will have begun to die, and will be turning a distinct fluoro brown colour
- 2-3 weeks after treatment: entire branches of the plant will have died and turned a fluoro brown colour
- 3-4 weeks after treatment: plant should be entirely dead, with all branches turned and stems snapped off should show no sign of being alive (fleshy or still green)



2 months later

### Troubleshooting where things went wrong:

The list below might help troubleshoot if a basal barking program isn't successful:

What you see	Most likely causes	How to fix it in future
Plant shows no signs of death after 1 month following spraying	Herbicide wasn't put in the diesel	Nominate one person to ensure the correct amount of herbicide is put in the diesel
	Plant was missed during spraying	Use flagging tape to mark plants as controlled
	Plant was not actively growing	Monitor for a further month, if no death is evident see above cause
Plant is only half dead	Herbicide mix was not applied all the way around each stem to run-off	Be vigilant in ensuring every stem is sprayed to the point of runoff and to the nominated height
	Debris around base meant that herbicide was not applied to all stems	Remove debris prior to starting basal barking (not with wand of spray pack)
Plant is reshooting some time after death was thought to have occurred	Not enough herbicide was applied to plant	Ensure for larger trees as much herbicide as possible is applied to kill the more extensive root system

### **Cut stump treatment – limited application**

#### Situations where cut stump treatments are recommended:

Cut stump treatment of mesquite is generally not conducted in the Pilbara, due to the intensive methods used, requirement for additional equipment and the need for a two-person team to kill one plant. Additionally, the multi-stemmed nature of hybrid mesquite means that cut stump is not an effective control method and the droopy nature of plants means that access to stems is often very difficult.

Limited situations where cut stump treatment is used to control mesquite include areas where off-target species may be adversely affected by other herbicide control techniques, such as close to large gum trees along creek lines and where permanent water is adjacent to targeted infestations. Cut stump treatment is best used in very low density mesquite populations or where it is desired that the dead plants do not remain in-situ.

#### Advantages & disadvantages:

Despite the fact that cut stump treatment of mesquite uses significantly less herbicide mix than other methods, these cost savings are offset by the requirement for two people to treat one plant (labour intensive) and the time taken to cut each stem singularly so herbicide can be applied immediately (time consuming). However, the cut stump method is extremely selective and most often results in 95%+ kill rates.

#### Recommended herbicides:

Access®      240 g/L Triclopyr + 120 g/L Picloram + 389 g/L Liquid hydrocarbon  
 Garlon 600®      600 g/L Triclopyr

#### Equipment required:

- Recommended herbicide
- Diesel
- Low volume spray bottle or pack
- Chainsaw or tree loppers
- GPS or similar

### Technique:

1. Mix the diesel and herbicide of preference at a rate of 1 lt chemical to 60 lt diesel
2. Decant into spray bottle or pack and pressurise
3. Test the output of the spray pack, and adjust to a coarse droplet size
4. Using tree loppers or the chainsaw, cut the stems of the target plant as close to the ground as possible  
*Mesquite will exude a sap when damage is caused to any part of its stem, sealing it against any external treatments. If this occurs, chemical will not penetrate the stump.*
5. Immediately (within 10 seconds) spray the herbicide mixture onto the exposed stem and around the sides of the remaining stem to the point of runoff
6. Take a GPS reading of the plant



Above: specialised equipment and protective gear is required for cut stumping

### Timing:

Cut stump treatment can be conducted at any time of the year.

### What you should see:

If applied correctly, the cut stump treatment of mesquite should cause a rapid death. However, to ensure that no regrowth is to occur, it is best to monitor treated plants after a rainfall event that would, under normal circumstances, trigger new growth to appear.

### Troubleshooting where things went wrong:

The list below might help troubleshoot if a basal barking program isn't successful:

What you see	Most likely causes	How to fix it in future
Plant has new growth on new branches	Herbicide not applied immediately after cutting	Ensure stems are cut singularly and herbicide applied immediately
	Not enough herbicide applied to exposed plant cut or remaining stem	Apply herbicide to the point of run-off and all around the remaining stem

## **Foliar spraying treatment – very limited application**

### Situations where foliar spraying is recommended:

Foliar spraying mesquite is a control technique whose application is very limited across the Pilbara and not commonly put into practice by pastoralists. Recommendations to use this technique are generally confined to specific situations where dense infestations of seedlings or small plants less than 1.5 m tall exist.

### Advantages & disadvantages:

Foliar spraying is advantageous in that high volume spray equipment can be used and control can be undertaken over large areas of dense seedlings and small plants quickly and with only 1 operator. As foliar spraying uses a mix of herbicide, water and wetter, no diesel is required to mix with the herbicide and therefore diesel cost savings can be made.

However, there are a number of disadvantages that make foliar spraying mesquite a rarely used or recommended control technique. The amount of herbicide needed per plant to cause death in foliar spraying is more compared with basal barking or cut stump treatment, increasing the amount and therefore cost of herbicides required. The equipment needed is costly, and the quality of the water put through pumps and other pressurised hoses must be better than what is generally available in remote situations (must be clean and not contaminated with large amounts of dirt).

Especially on Mardie Station, where the leaf tying moth *Evippe* is prevalent throughout many infestations of mesquite, foliar spraying is not an option for mesquite control. The leaf tying moth is currently defoliating large stands of mesquite, and without mature leaf growth the effectiveness of any foliar herbicide is very limited.

#### Recommended herbicides:

Grazon Extra® 300 g/L Triclopyr, 100 g/L Picloram & 8 g/L Aminopyralid

#### Recommended surfactants:

BS-1000 1000g/L Alcohol Alkoxylate

#### Equipment required:

- Recommended herbicide
- Surfactant (eg. BS-1000)
- High volume pressure spraying unit (eg. Quikspray®)
- Source of clean water
- GPS or similar

#### Technique:

1. Fill the spraying unit tank 1/3 with clean water
2. Add the preferred herbicide at a rate of 350 mL herbicide + 100 ml surfactant to 100 lt water
3. Fill the spraying unit tank to the required amount
4. Run the pump of the spraying unit for at least 10 minutes to ensure herbicide is mixed with water
5. Set pump to desired revs, set pressure to desired level  
*If spraying during slightly windy conditions, reduce the pressure output of the spraying unit so off-target impacts are reduced*
6. Completely cover target weeds with the mixture, to the point of runoff. This includes all leaves and stems
7. Take a GPS reading of location controlled

#### Timing:

Foliar spraying is most effective when plants have the most leaf cover, as this allows the maximum amount of herbicide to be absorbed by plants – generally immediately after rain is received.

#### What you should see:

Plants should show a darkening and then death of all leaves treated within a 3 week period of being treated under optimal conditions. Plant death should occur within 2 months. It may be difficult to determine if plants are completely dead until rainfall promotes any new growth.

#### Troubleshooting where things went wrong:

What you see	Most likely causes	How to fix it in future
Plant shows no signs of death after 1 month following spraying	Herbicide wasn't put in the mixture	Nominate one person to ensure the correct amount of herbicide is put in the diesel
	Plants were missed during spraying	A marker dye can be used in mix to indicate herbicide mix location
	Surfactant concentration was not adequate to assist penetration of herbicide	Ensure correct rate of surfactant is added to mixture and that agitation occurred to mix thoroughly
	Plant was not actively growing	Monitor for a further month to

		determine if plant has absorbed any herbicide
Plant is only half dead/has new growth on some parts of the plant	Herbicide mix was not applied to the point of runoff to all parts of the plant	Be vigilant in ensuring all leaf material is covered to the point of runoff

## Granular herbicide treatment – very limited application

### Situations where granular herbicides are recommended:

The use of granular herbicides has been trialled as an aerial application around Onslow in October 2010 and 2011. Results from these trials indicated that granular herbicides are not effective in controlling mesquite in coastal environments where soils are particularly sandy and rainfall is highly variable.

In the past, Velpar L<sup>®</sup> had been used successfully to treat mesquite. The current trial used Graslan<sup>®</sup> as the primary granular herbicide, after an off-label permit was received for the use of this herbicide against declared weeds in Western Australia.



Above: Graslan<sup>®</sup> being applied aerially at (left) prevolumed and (right) premetered doses according to plant height

### Advantages & disadvantages:

Granular herbicides have the advantage that the treatment is more labour efficient, as once the plant is reached the granular herbicide is easily dosed out under the plant quickly. Little equipment is needed to apply the herbicide, and Graslan<sup>®</sup> is available with a dose meter to ensure accurate amounts of herbicide are measured. Graslan<sup>®</sup> also has a residual effect within the soil, meaning seedlings germinating in treated areas will be open to the uptake of residual chemical.

However, granular herbicides are activated by rainfall, with the moisture transferring the product into the soil where the roots absorb the herbicide and cause plant death. If granular herbicides are put out too long before rainfall occurs, the product will deteriorate and effectiveness will be adversely impacted. Granular herbicides are non-selective and will impact upon or kill other trees which have roots in the same target zones as mesquite. The effective control of different weeds also occurs depending on the biology of plant root systems, so it must be known if plants have main tap roots or extensive lateral roots to determine best placement of granules.

### Recommended herbicides:

Graslan<sup>®</sup>      200 g/kg Tebuthiuron (no permit, under small scale trial currently)  
Velpar L<sup>®</sup>      250 g/L Hexazinone (off-label permit)

## Mechanical

### Blade ploughing/cutter bar attachments - recommended

#### Situations where mechanical control is recommended:

Mechanical treatment of mesquite with blade ploughs and cutter bars attached to the front of dozers is a recommended control technique in moderate to dense infestations of the weed. Control work must not be undertaken in situations where excessive damage to natural features is caused, such as directly adjacent to water course (promote erosion) or on fragile soils.



Above: Dozer @ Urala Station with front mounted cutter bar (stick rake), Ellrott Plough® in Queensland

Rear mounted blade ploughs on dozers can be effective in treating moderate infestations of medium sized mesquite (up to 4 meters), however design needs to be stringent as blade wings are susceptible to damage by roots and rocks (below). Wheel trailed blade ploughs are not recommended as they require hydraulic systems to work and are not able to be swapped onto different machines easily.



Above: Rear mounted, single wing blade plough behind a D9 Dozer, damage to wing resultant from a stubborn root

#### Advantages & disadvantages:

Depending on which mechanical option is adopted will factor in or out a number of advantages and disadvantages. Generally however, the treatment of mesquite by each of these ploughs will result in excellent kill rates (>85%) **IF** operators are meticulous in ensuring plants are dug or pushed out of the soil, with the root ball severed at least 6 inches below the soil surface. The process can be mostly selective to controlling mesquite only, especially if front mounted ploughs are used. Finally, this method of controlling mesquite is less labour intensive than other methods such as herbicide control.

With a front mounted arrangement, less soil disturbance occurs compared to other mechanical techniques, as the blade or rake can be lifted in areas where no mesquite is present. Plant material that is cut out of the soil can also be piled up and burned. The rear mounted plough will simply slice through the soil profile, dropping soil where it previously was and allowing better penetration of water while maintaining grass coverage.

On the negative side, using front or rear mounted mechanical tools to control mesquite can be very costly, especially if machinery hire is necessary. Damage can also be caused to machinery and attachments if care is not taken especially in compacted soil or when targeting large trees. Small plants may be missed during control due to focus on larger plants, and the disturbance of the soil may also cause mass germination of the seed bank; however, follow-up control is made insurmountably easier with the clear access to plants.

#### Technique:

The correct technique to successfully killing mesquite with blade ploughs or cutter bar attachments is to ensure that all plants are knocked completely out of the ground, with the roots severed a minimum of 6 inches below the soil surface. A plant with one lateral root in the ground will reshoot.

Follow-up control is required for mechanically treated mesquite, and herbicide control using the basal bark method is most common. In areas where mesquite plants have been piled up, fire is often a good tool to use to remove the residual trash and kill any seed which may be present.



Left: Results of rear mounted blade ploughing on hybrid mesquite @ Mardie Station, 8 months post treatment. Note the dense mesquite in the background and the return of grass after 117 mm of rain since treatment.

## **Dozing – limited application**

#### Situations where dozing is recommended:

The straight dozing of mesquite without the added tools of blade ploughs, cutter bars or stick rakes is rarely used in the Pilbara, as kill rates are generally lower than with the other attachments included. Dozing tree-form mesquite is generally limited to infestations of medium to dense mesquite. Dozing in hybrid mesquite is difficult (due to high chance for regrowth from root system) and often not recommended or used unless very experienced machinery operators are available.

#### Advantages & disadvantages:

If the correct technique is employed, dozing can have moderate kill rates of mesquite. These impacts are immediate, which is advantageous in that developing seedpods will be rendered unviable as they will not mature. This technique can also allow for pushed material to be piled up and burnt, opening up country and allowing pasture species to return. In moderate to dense infestations, this process is less labour intensive than other non-mechanical techniques. It can also be a selective process whereby native vegetation and trees can be avoided and mesquite directly targeted.

However, dozing does require vigilance of the operator to ensure that plants are completely severed from the root system at least 6 inches below the soil surface (to sever the root ball from the roots). This is the only way to ensure that the plant will not coppice. Additionally, follow-up control will be required as the disturbance of the soil will promote seed bank germination.

#### Technique:

The correct technique to successfully killing mesquite by dozing is to ensure that all plants are knocked completely out of the ground, with the roots severed a minimum of 6 inches below the soil surface. A plant with one lateral root in the ground will reshoot.

Follow-up control is required for mechanically treated mesquite, and herbicide control using the basal bark method is most common. In areas where mesquite plants have been piled up, fire is often a good tool to use to remove the residual trash and kill any seed which may be present.

## Chaining – not recommended

### Situations where chaining is recommended:

Mechanical chaining is a process whereby a large industrial chain is dragged between two dozers moving parallel to each other, with the intention of the chain dragging mesquite plants out of the ground to kill them. Double chaining involves two passes across an area in opposite directions. This technique is reserved for controlling mesquite that infests in moderate to dense populations, and is generally only considered useful when followed up with fire.

Both chaining and double chaining were trialled on hybrid mesquite at Mardie Station in 2003, implemented primarily to provide additional fuel loads for a fire. The treatment method proved unsuccessful in both killing plants and adding to the fuel load, as the multi-stemmed, shrub-like form of the hybrid mesquite prevented the chain from anchoring onto a plant and removing it from the soil.

### Advantages & disadvantages:

Our studies have found very few advantages in chaining mesquite, and these are rapidly outweighed by the disadvantages, which include:

- Poor kill rates from initial treatment
- Inability of chain to pull hybrid mesquite from the ground
- Non-selective process which impacts upon any native vegetation in the path of the chain
- Cost of using two dozers and purchasing a suitable heavy duty chain
- Cost of follow up treatment if using herbicides is high

### Notes:

Future studies may find a niche for using chaining on tree-form mesquite, however we find that the off-target impacts far outweigh any benefits chaining provides, and therefore do not recommend this technique.



Above: Chaining hybrid mesquite @ Mardie Station 2002/03, coppicing of mesquite which results from not cutting the root system of plants

## Fire

### Situations where fire is recommended:

Fire is not commonly used as a primary tool for controlling mesquite in the Pilbara, but rather forms part of an integrated program for a particular purpose. The most common situations where fire is used are:

- a. To remove undergrowth to create an easier access path for treatment with herbicides
- b. To clean up any dead plant material left behind after mechanical treatment
- c. To assist in promoting and destroying the soil seed bank of mesquite

Fire can be an effective tool in killing low to moderately dense tree-form mesquite, however at higher plant densities there must be sufficient fuel loads to carry an effective fire. The multi-stemmed hybrid mesquites are generally fire tolerant, and will only be affected by the hottest of burns.

#### Advantages & disadvantages:

In all situations using fire as a control tool, there needs to be a fuel load in order to start and carry the fire through the targeted infestation. This may require the removal of stock and/or a reduction in grazing pressure in that target area to allow for a build-up of fuel, and they cannot be returned post-fire until stable pastures have returned. The area will additionally require fire breaks to be established to reduce the risk of non-target burns. These factors will add indirect costs to the use of fire as a control tool, and need to be carefully considered prior to implementation.

In tree-form infestations of mesquite, fire is a relatively cheap option to control standing populations as well as killing a percentage of the seed bank, depending on the level of intensity of the fire. Kill rates of plants can be as high as 90%, and seed banks within 2 cm of the soil surface can be sterilised. The trade off for this relatively labour free, cheap control tool is the destabilisation of the soil due to vegetation removal. This can cause problems if no rain is to occur (wind erosion across the burned area) or if heavy rains or flooding is experienced (water erosion along water courses). Also the reduced grazing that can occur on this area prior to and after the fire can be costly.

Hybrid and multi-stemmed mesquite is generally fire tolerant, except to the hottest fires possible. We have only had success with one fire in hybrid mesquite – it was lit on an extreme fire danger day at Mardie Station, with the temperature heading towards 45°C and strong easterly (desert) winds blowing, with almost zero relative humidity. The fire was lit from a large windrow of extremely dry mesquite trash that had been dozed out of the ground to form a road. The fire was extreme, however travelled only a few hundred meters before it lost momentum and petered out. Whilst over 90% of the mesquite in this area was killed, the fire was so hot it scorched the soil surface and killed the seed bank of all species of grass in the area, exposing the landscape to the erosive powers of wind and water.

Fire was trialled again in 2007, with slightly more mild conditions experienced (40°C, moderate easterly winds) however in a paddock where stock had been excluded for 5 years and some mechanical treatment had occurred. Despite the fuel load being at a maximum, the sparse, patchy nature of both the mesquite and the understorey severely restricted the fire and we couldn't get a sufficiently hot or flowing fire to cause much damage.

#### Timing:

Fires are generally lit before the first rains of the wet season. In tree-form mesquite populations, fires need to be moderately intense so late dry season (Sept – Nov) is optimal.

In hybrid mesquite populations, where intense fires are required, the specific months for lighting fires can be anywhere from December through to March, depending on how early or late (or non-existent) the wet season is. General characteristics of the day should be hot and dry, with desert winds pushing the fire towards the west.



Above: Desolate, unvegetated landscape as a result of an extremely hot fire @ Mardie Station, regrowth from a fire not intense enough to kill hybrid mesquite

## Biological

Biological control agents for weeds are introduced following extensive risk assessments and host testing, to ensure that impacts on other native plant species does not occur and that the introduced agent will not become an invasive species itself. Evolutionary science tells us that the aim of these agents will never be to kill the only host plant within a landscape that supports its survival. Therefore, biological control agents generally impact upon the growth or reproduction of plants.

### What agents are out there?

#### Leaf-tying moth - *Evippe* spp.

*Evippe* was released at Mardie Station and more widely across Pilbara populations of mesquite in 1999, as a joint effort between CSIRO, DAFWA and the PMMC. Intensive studies on the impacts of the leaf-tying moth were researched at Mardie Station by the PMMC from 2002 through 2007.

The leaf-tying moth was introduced for its impact on the ability of mesquite to set flower and seed annually. The adult *Evippe* lays eggs on the mesquite plants, and the larvae hatch to mine and tie together adjacent mesquite leaves in which to feed. This causes the death of the leaves, and defoliation of the plant. Due to plants primarily gathering their energy through its leaves, a defoliated plant has only a very small ability to collect energy. What little energy is absorbed is transferred to putting out more leaves (to collect more energy), rather than setting flower or seed. The impacts of *Evippe* are mainly noticed by its defoliated nature, and this causes a severe reduction in the growth (size) of mesquite plants and the ability of the plants to reproduce annually.



Above: Mined and tied leaves of a mesquite plant, defoliated plants on Mardie Station

The *Evippe* biological control was released within several different populations of mesquite across northern Australia, including at Mardie Station and Minderoo Station. Comparative observations show that *Evippe* has

impacted significantly at Mardie Station on the hybrid mesquite, however presence and impacts on tree-form *P. pallida* at Minderoo Station has been minimal to date.

The significant impacts of Evippe have most notably been observed within the core hybrid infestation of mesquite centred on the lower Fortescue River on Mardie Station. Here, Evippe has caused a massive reduction in the annual growth of plants within the infestation, reducing increase of size of plants by 82% annually. The less energy these plants are getting, the slower they grow! This defoliation and slow growth is allowing additional vegetation to grow directly under and adjacent to mesquite plants, which is competing and stalling seedling growth and allowing potential fires to be employed as a control tool.

We have also seen a remarkable decrease in the number of pods being produced annually within this population, to the point where only a small percentage of plants successfully reproduce. This decrease in seed production is stopping the mesquite infestation at Mardie Station from becoming denser and also from spreading further into paddocks in which it currently inhabits.

#### Seed-feeding beetle - *Algarobius prosopis* and *A. Bottimeri*

The *Algarobius* seed feed beetles were introduced across northern Australia in 1996 and 1997. Some studies on the impacts of these agents was conducted at Mardie Station.

The two *Algarobius* species were introduced as beetles that would predate upon mesquite seed pods for the survival of their larvae. Once hatched, the larvae would bore into the mature seeds of mesquite, both on the tree and on the ground, and feed on the seed. After 8-10 weeks, the larvae would reach maturity and emerge from the seeds by drilling a large emergence hole. These adults would then lay their own eggs, and the cycle would continue.



Photo: emergence holes of *Algarobius* beetles from mesquite pods

The impacts of *Algarobius* beetles on mesquite pods have been seen widely throughout the Pilbara, however their impacts are difficult to assess. This is mainly due to the high predation rates of other herbivores - cattle, kangaroos and emus – seeking the sweet and nutritious pods before the impacts of the *Algarobius* can be noticed. In the core infestation of mesquite at Mardie Station, the impacts of *Algarobius* are even less noticeable since the introduction of the aforementioned Evippe leaf tying moth, due to the limitation this other biological control places on mesquite reproduction.

#### Sap-sucking psyllid - *Prosopidosylla flava*

The sap-sucking psyllid was introduced into the hybrid mesquite infestation at Mardie Station in the Pilbara. Indications are that this agent does not survive well in hotter climates and therefore its presence and establishment in the Pilbara did not occur.