Better way to manage Japanese beetles in trees, landscapes, and turf, Tues Feb 20 2018

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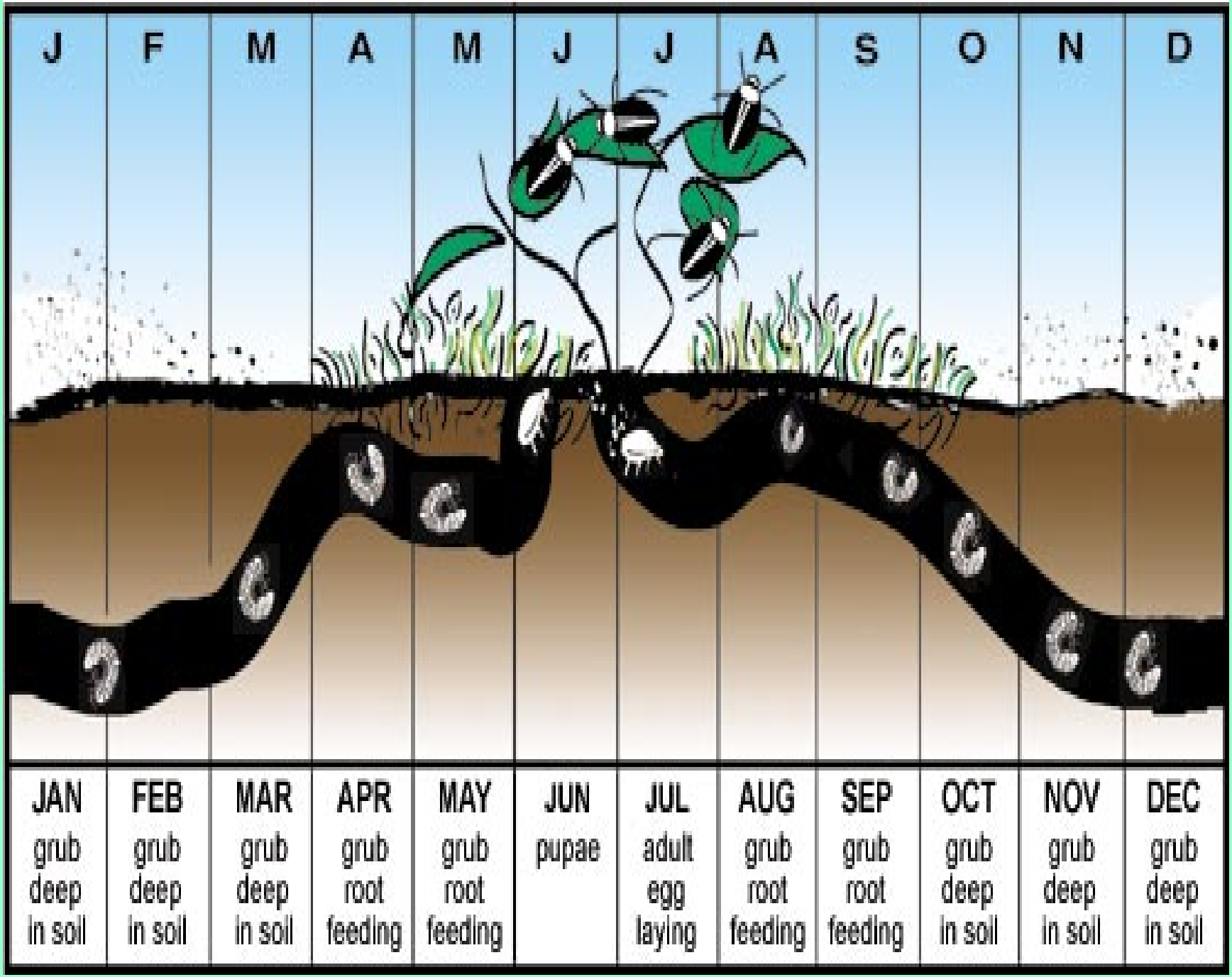
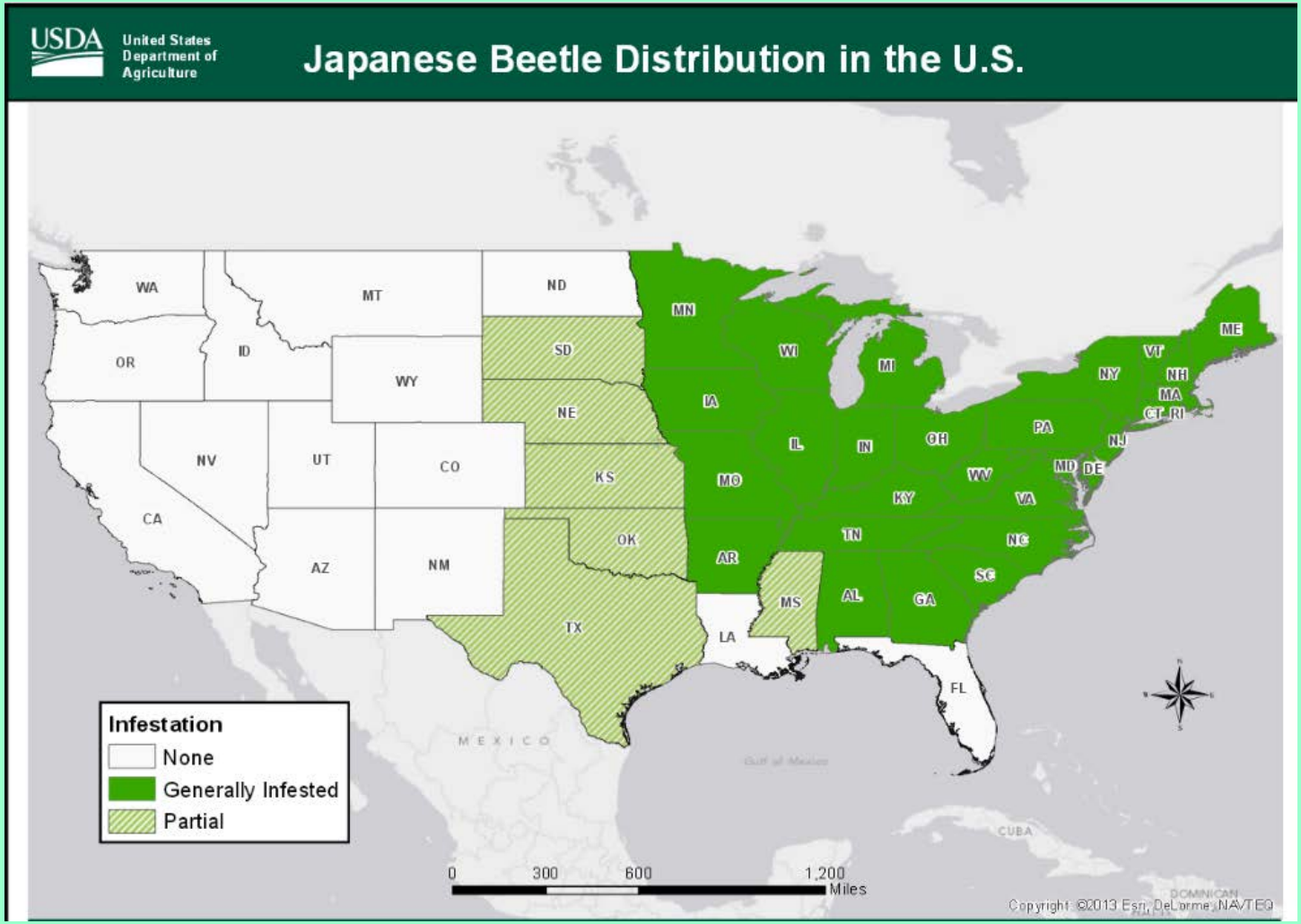
Summary: Exotic, invasive Japanese beetle (JB) defoliates leaves of many trees, landscape plants and removes roots from turf. The IPM principles are the same, but the pests are different. Learn what insecticides to use to kill pests and conserve predators, parasitoids, and bees. Learn new and old ways to control this invasive pest using trunk injections, bark sprays, and microbial, biorational, and conventional insecticides. Learn why the life history of JB makes it more of a pest that other invasive and native beetle species in the same family. Learn how to identify the adults and grubs of 8 species of beetles in the same beetle family. Learn why JB populations have increased since 2015. 50 minutes with 10 minute discussion and questions. ISA educational credits of 1 credit

Japanese beetle is not a quarantine pest in MN, but is in 11 western states

UMES/MDA bulletin on managing Japanese beetle


J F M A M J J A S O N D
JAN grub deep in soil
FEB grub deep in soil
MAR grub deep in soil
APR grub root feeding
MAY grub root feeding
JUN pupae
JUL adult egg laying
AUG grub root feeding
SEP grub root feeding
OCT grub deep in soil
NOV grub deep in soil
DEC grub deep in soil

Japanese beetle was accidently brought to the US prior to 1916, first found in NJ



Currently established in over 25 states

Adult Japanese Beetle: About ½ in. long, emerald green with copper elytra

Main symptom is skeletonized leaves from feeding between veins

Adults are active from mid-June to mid-August and are polyphagous

They feed on **>300 plants in about 80 families**

Japanese Beetle Damage to Linden Tree

Trunk injection, soil drench, or bark drench with neonics, is very harmful to bees.

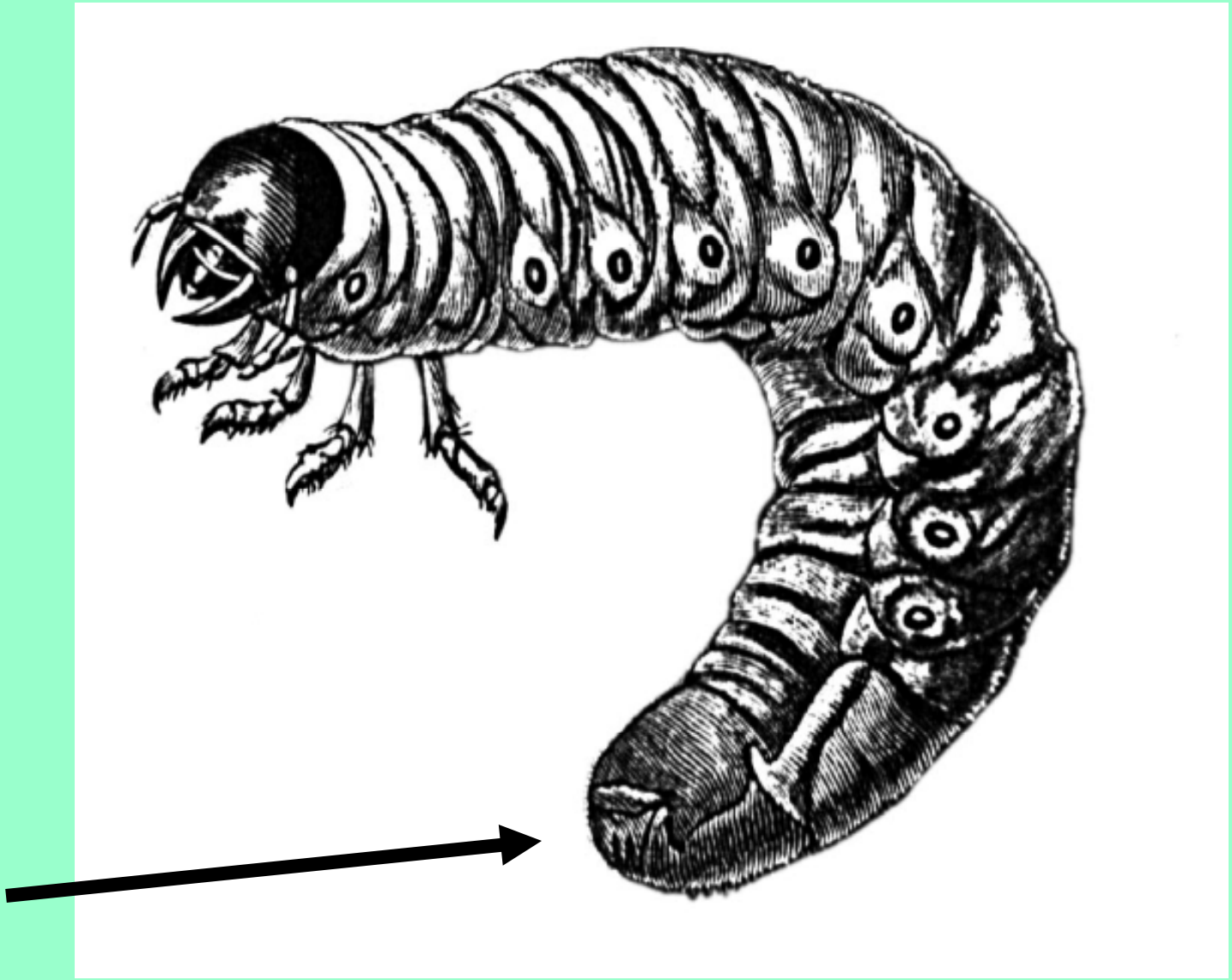
New insecticides for white grubs

Japanese beetle is the worst white grub.

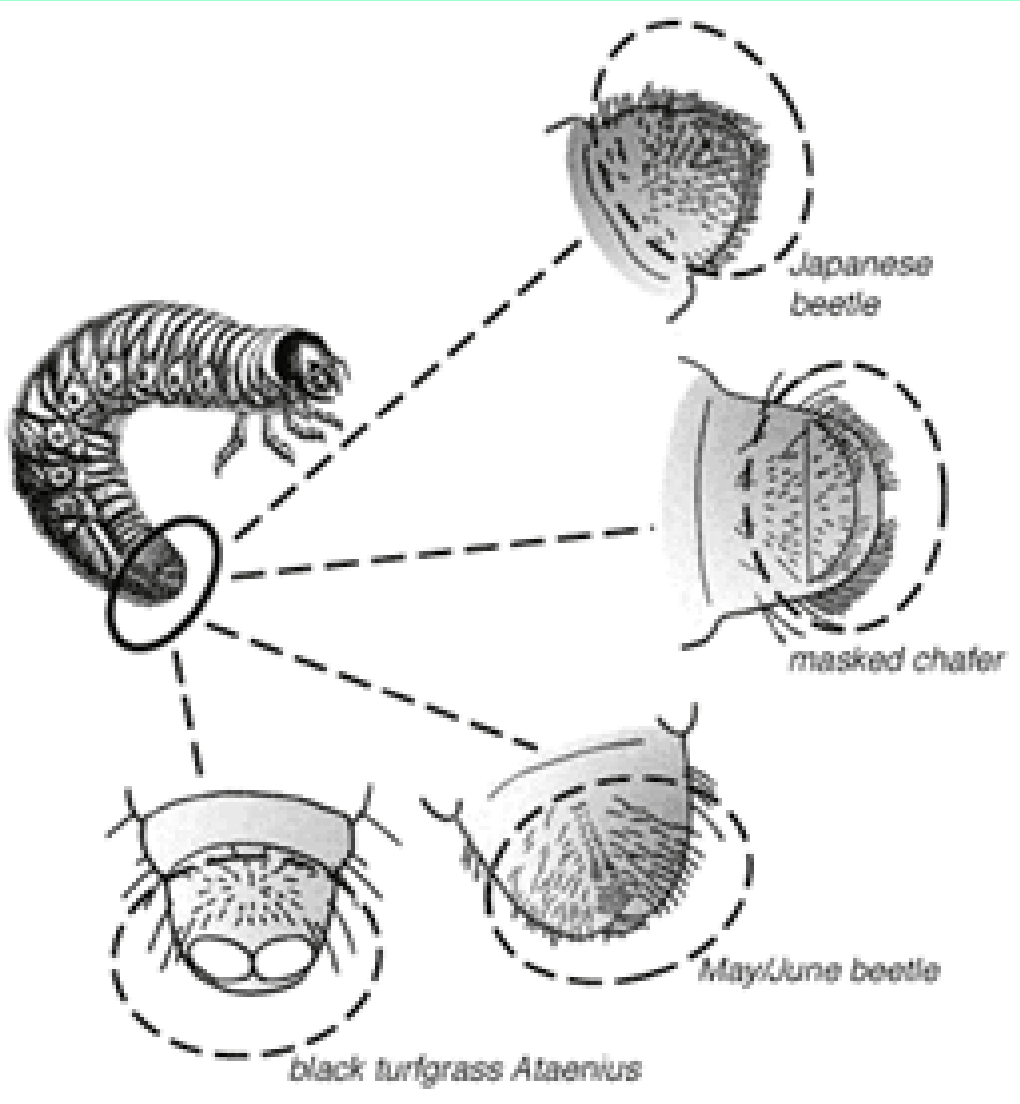
Life history of scarabs in turf

species	species	years	larval food	adult food
	JB	one year	turf	adults feed on grape, linden, rose
	false JB	one year	unknown	adults feed on grape, linden, rose
	rose chafer	one year	unknown	adults feed on grape, linden, rose
	masked chafer	one year	turf	adults do not feed; do not leave turf
	*Ataenius* *Aphodius*	3 gen. year June, July, Sept	turf, manure	adults feed on turf; adults overwinter in woodlots
	Large June beetle	three years	turf	adults feed on grape, linden, rose

Raster



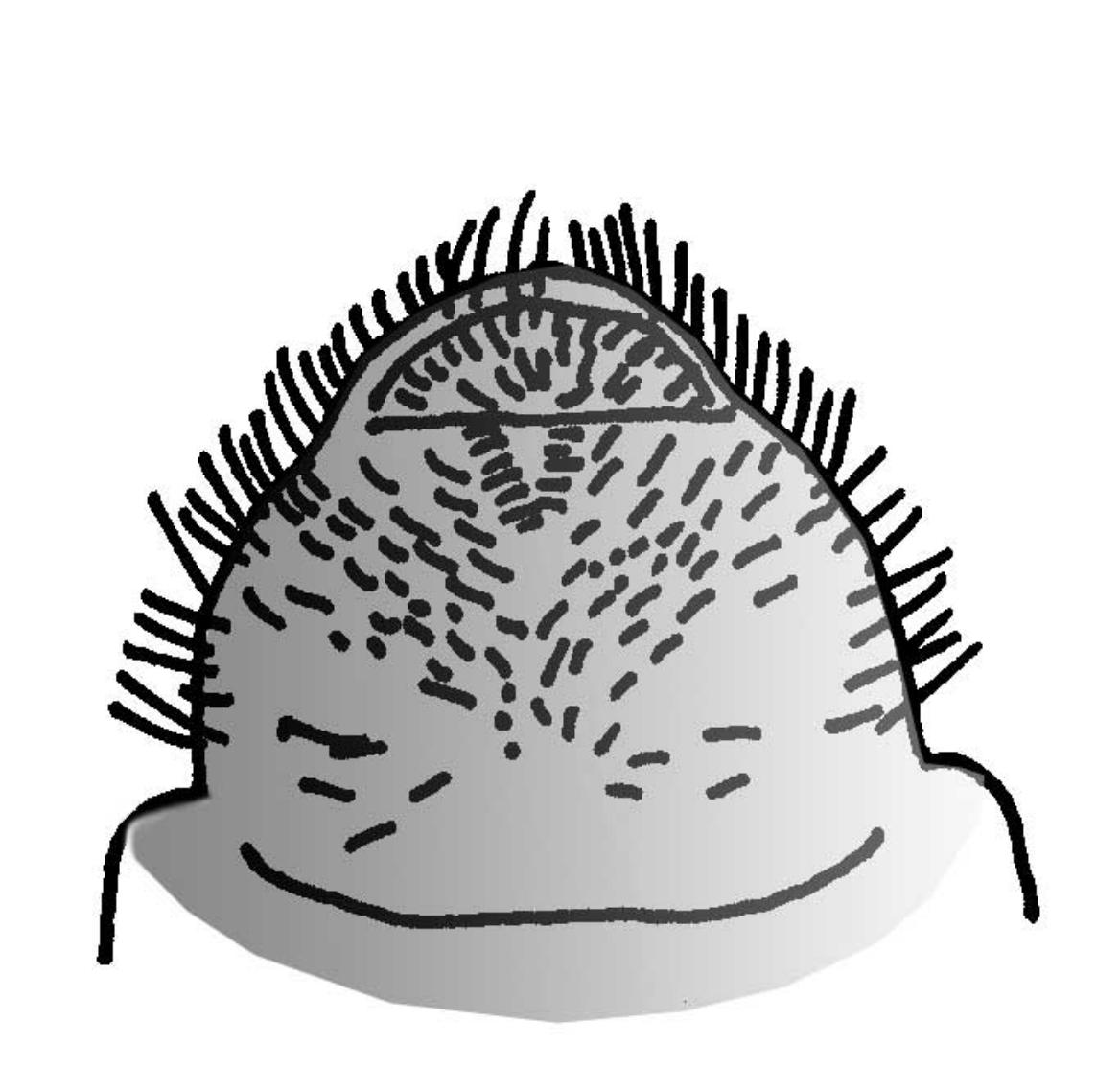
ID white grubs to species by rastral pattern, Why? Damage potential



Japanese beetle

Five tufts of white hairs along the wing margins.

Raster of Japanese beetle

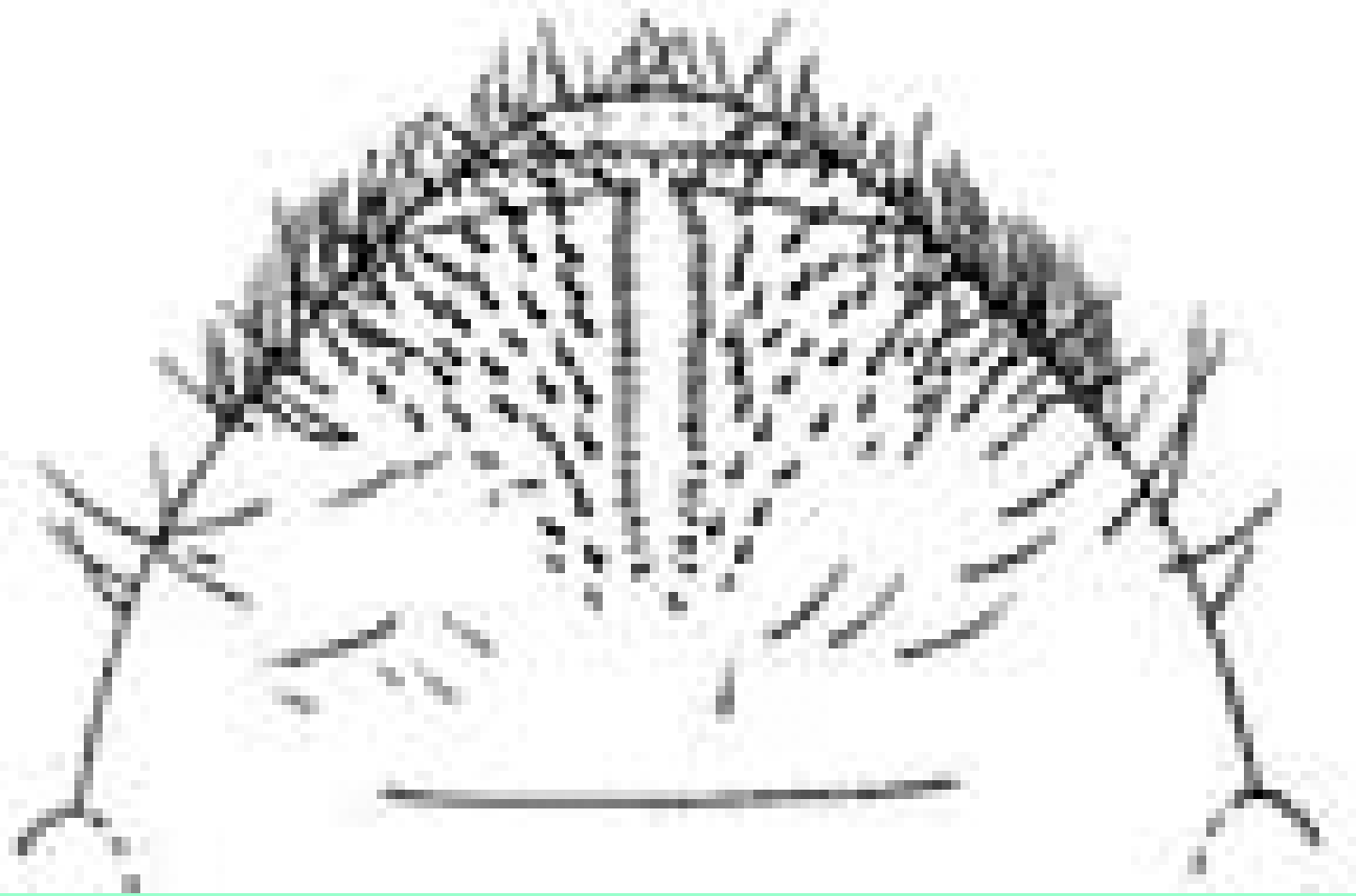



JAPANESE BEETLE
LIFE CYCLE
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

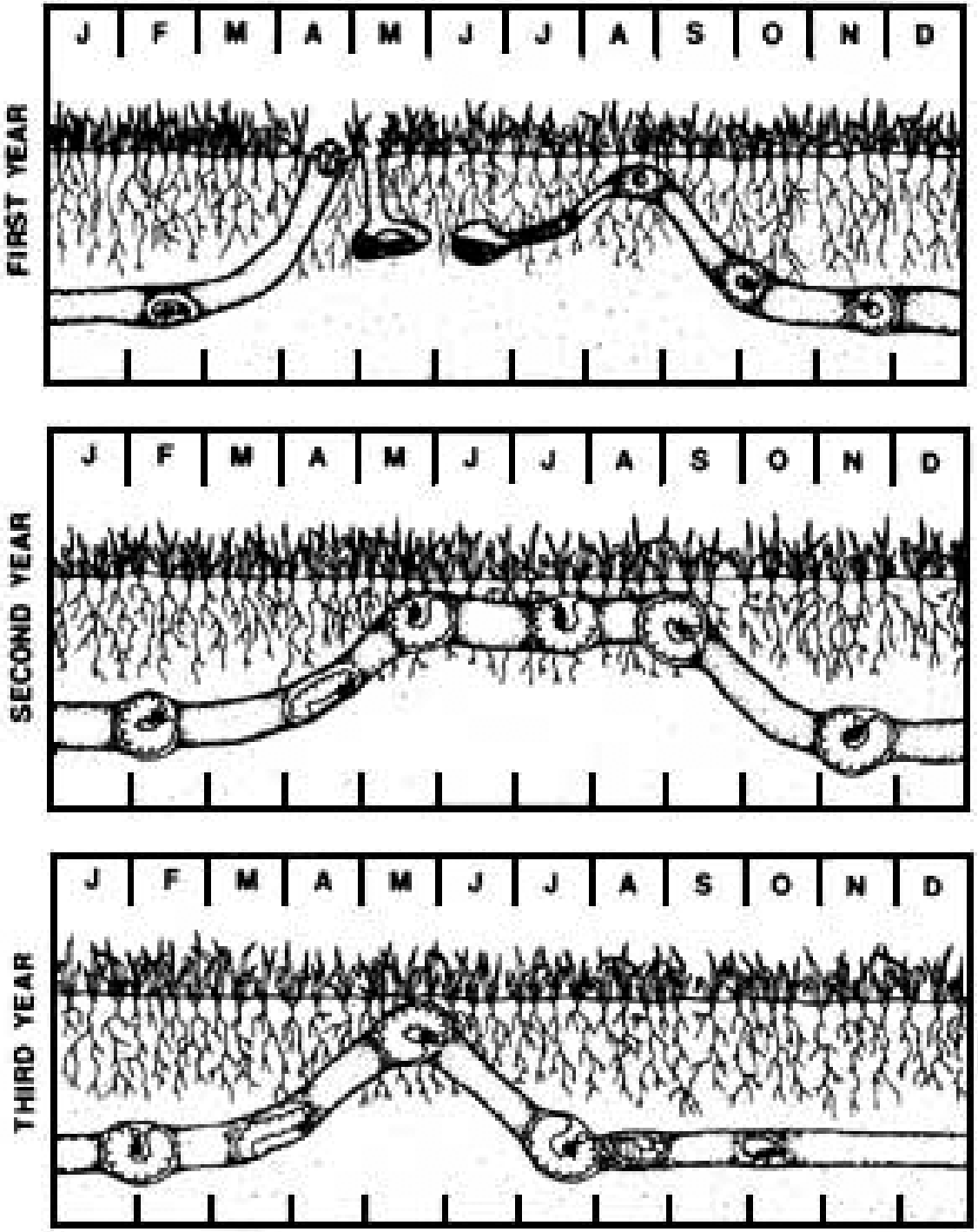
Phyllophaga, May/June beetle

These May/June beetles are attracted to lights. The largest species has a three year life cycle.

Raster of *Phyllophaga*, May/June beetle



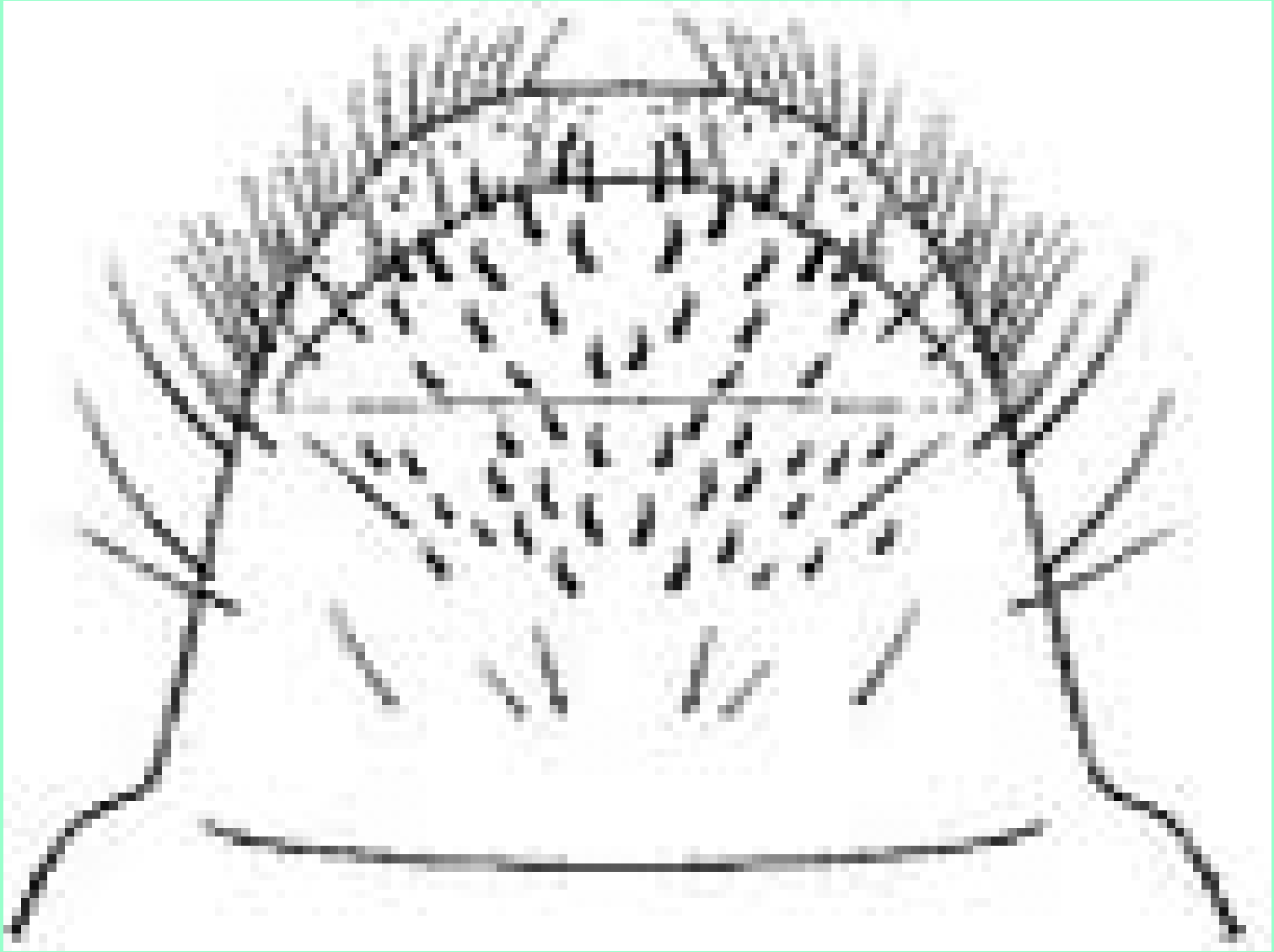
Three year cycle of *Phyllophaga* May/ June beetle



Northern masked chafer

Northern masked chafer has dark areas in a circular patch behind the head.

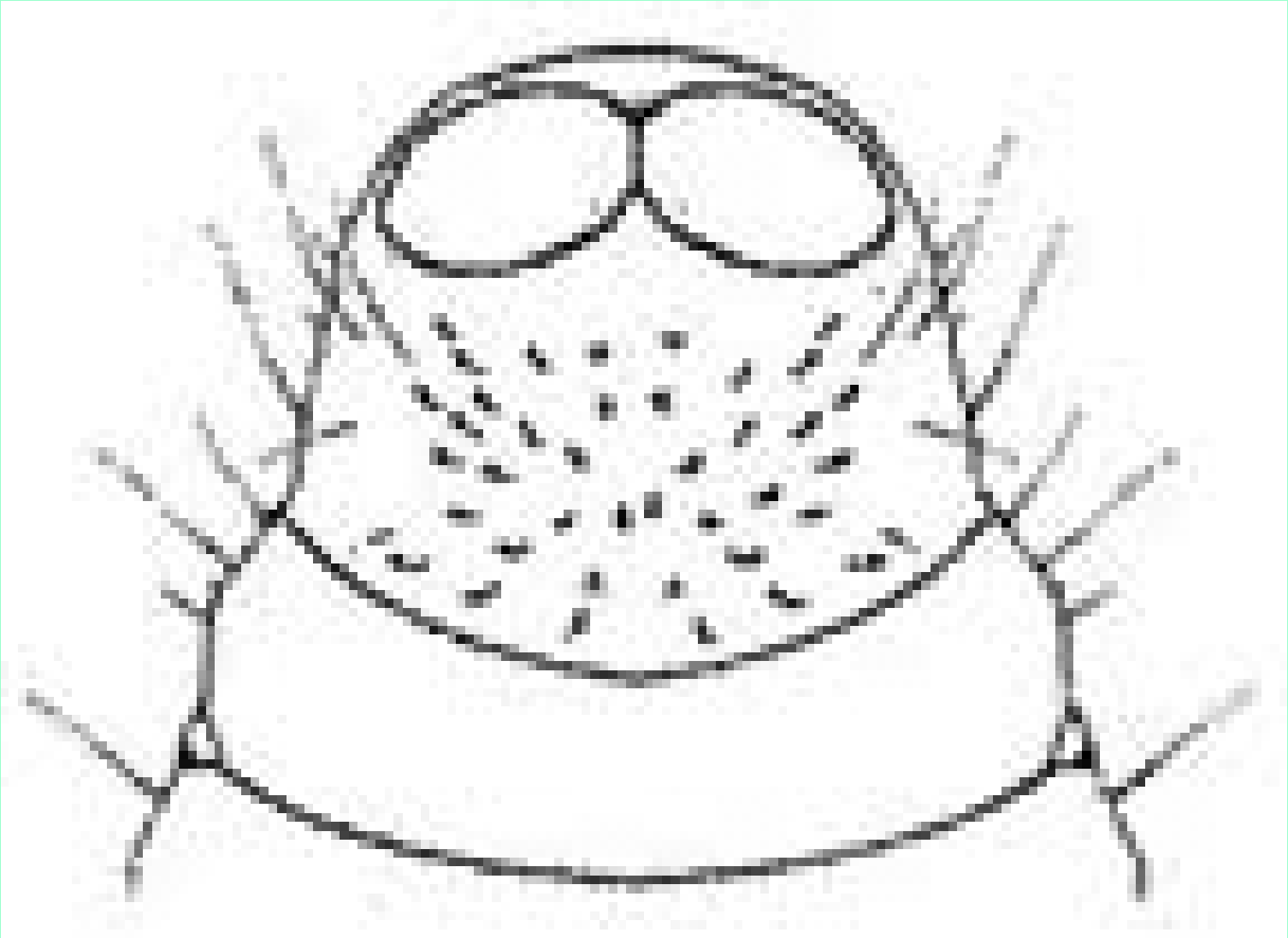
Raster of masked chafer beetle



Black turfgrass *Ataenius*

Smallest scarab beetle in turf.

Raster of black turfgrass *Ataenius*



Rose chafer

Note the long legs and pale color.

False Japanese beetle

False Japanese beetles lacks the 5 tufts of white hair along the wing margin.

Neonicotinyl insecticides are safer for people

Active ingredient	Class	Application method	Toxicity bees	LD50 (µg/bee)	LD 50 (mg/kg rats)
Imidacloprid	Neo	Oral acute (24–48h)	Highly	0.004 -.04	450
Clothianidin	Neo	Oral acute	Highly	0.004	2000
		Contact acute	Highly	0.044	4000
Thiamethoxam	Neo	Oral acute	Highly	0.005	1563
		Contact acute	Highly	0.024	2000
Chlorpyrifos	OP	Acute oral	Highly	0.36	155
		Acute contact	Highly	0.070	202
Coumaphos	OP	Acute oral	Moderately	2.030	13 - 41
Esfenvalerate	PYR	Acute contact	Highly	0.21	88.5
Fluvalinate	PYR	Acute contact	Highly	0.2	

highly toxic (< 2µg/bee)
moderately toxic (2 - 10.9 µg/bee)
slightly toxic (11 - 100µg/bee)
non-toxic (>100µg/bee)

but NOT for bees…

Japanese beetle adult control

Acelepryn (4 weeks residual)

Pyganic OMRI approved, pyrethrins

Pyrethroids

Onyx, bifenthrin (4 weeks)

Talstar, bifenthrin (2-3 wks)

Tempo, cyfluthrin

Sevin, carbaryl, harmful to bees

(1-2 weeks residual)

Grub Control: Preventative or Rescue treatments

Differences in time of application.

Grub damage is the worst in late summer and fall

Symptoms: Turf turns brown and easily rolls back, like a rug

Preventive Grub Insecticides

Neonicotinoids

imidacloprid

clothianidin

MERIT®

Arena®

thiamethoxam

dinotefuran

Meridian™ Insecticide

Zylam® Liquid Systemic Insecticide

Anthranilic Diamides, bee and beneficial insect friendly

Acelepryn®

Preventive Grub Insecticides

Grub gone, Phyllom Bio Products

Bacillus thuringiensis galleriae **(Btg)**

Japanese, Asiatic, June and Oriental Beetles, and European, Cupreous, Southern and Northern Masked Chafers. is an effective control of the larger, beetles

Rescue Treatments

- **Expect no more than 75% control once grubs are large**
- **<u>2 main products used:</u> Dylox or the neonicotinoid Arena**
- **Acelepryn is NOT a curative product**

Biological control for white grubs

***Tiphia* wasps**

***Isocheta* flies**

***Ovavesicula,* protozoan**

***Bacillus thuringiensis galleriae* (Btg)**

Grub bGone

Bacillus (=Paenibacillus popilliae) popillae,

does not work any more

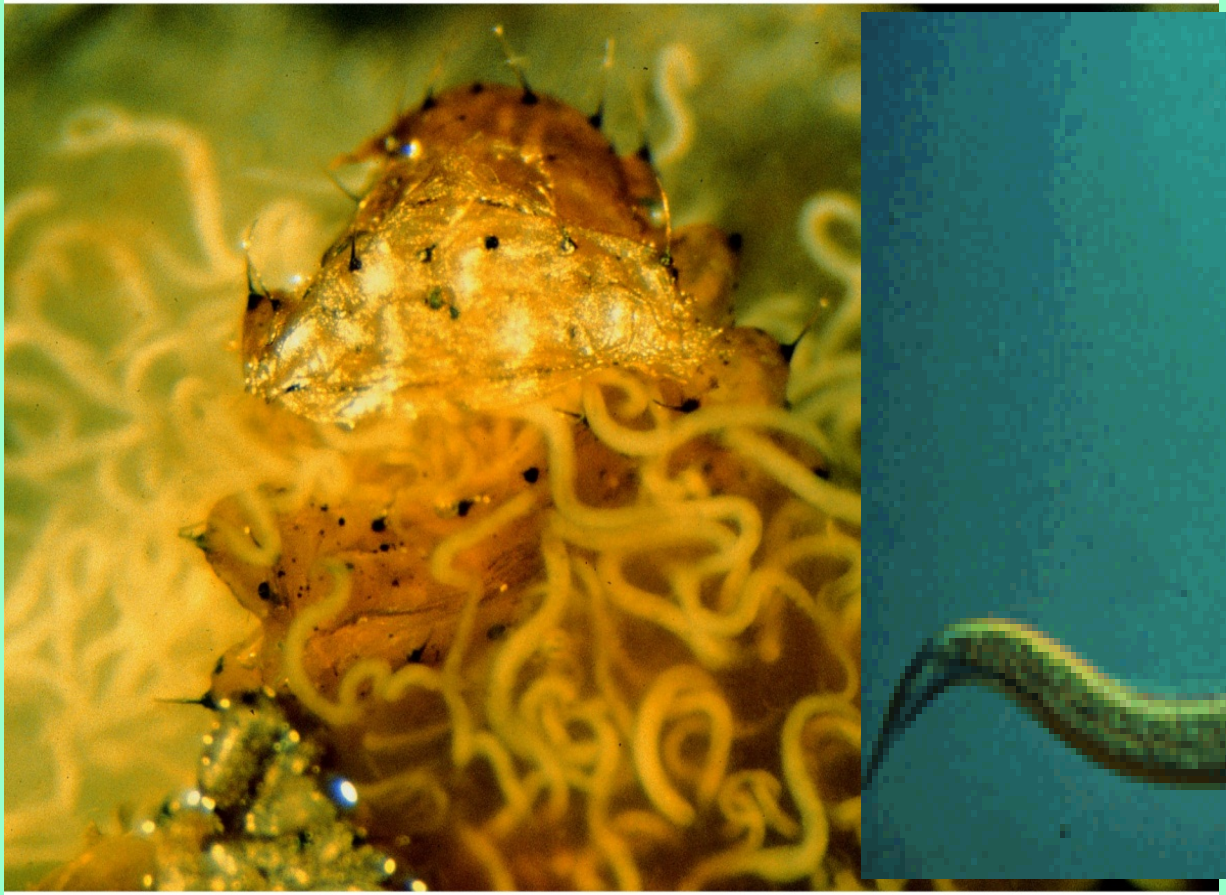
Fungus, *Beuaveria, Metarhizium*

Nematodes, *Steinernema, Heterorhabditis*

Parasitic nematodes

Steinernema carpocapsae

Heterorhabditis bacteriophora



Elm Leaf Beetle Pupa Infected With Nematodes

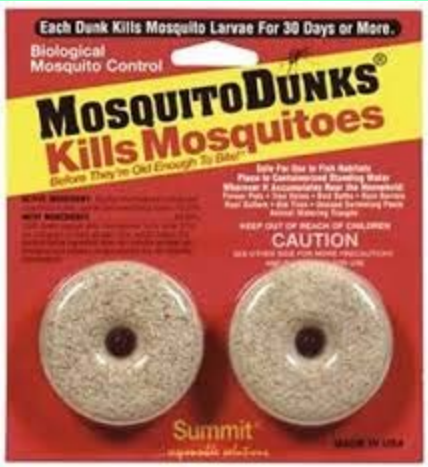
Beauveria bassiana is a fungus

- ***Beauveria bassiana*** **is a fungus which causes a disease. When spores of this fungus come in contact with the cuticle (skin) of susceptible insects, they germinate and grow directly through the cuticle to the inner body of their host. Here the fungus proliferates throughout the insect's body, producing toxins and draining the insect of nutrients, eventually killing it.**
- **Unlike bacterial and viral pathogens of insects,** ***Beauveria*** **and other fungal pathogens infect the insect with contact and do not need to be consumed by their host to cause infection.**

Organic OMRI=natural sources pesticide?

- **OMRI approved**
- ***Bacillus thuringiensis*, *Beauveria bassiana*, Boric acid, *Cydia pomonella granulosis*, diatomacous earth (HT), garlic, Koalin clay, limonene, neem oil, azadiractin, horticultural oil, pyrethrins (HT), spinosad (HT), pheromone, boric acid**

Types of BT



- BT is a protein crystal that puts an hole in the insect's gut wall after ingestion.
- Kurstaki, moth larvae, Dipel, Javelin
- Aizawai, moth larvae and suckers, Xentari
- tenebrionis, beetle larvae, Trident
- galleria, grubs, Grubgone
- bifenthrin, NOT organic, grubs, Grub B Gone Ortho
- chlorantraniliprole, NOT organic but conserves beneficials, grubs, Grub Ex Scotts
- israelensis, fly larvae, Aquabac
- Burkholderia, caterpillars, Venerate

Azadirachtin

- From Indian neem tree, *Azadirachta indica*
- *Active* against thrips.
- Caterpillars and aphides
- Biodegerades in sun.
- More effective on young larvae.
- Works best at temperatures, greater/equally to 70
- Azera combination product with azadirachtin

Neem Oil

- From Indian neem tree, *Azarchta indica*
- Clarified hydrophobic extract of neem, very little azadirachtin in neem oil
- MOA suffocates by blocking breathing pores.
- Good for soft bodied, aphids, spider mites, scales, whiteflies, mealybugs
- Can kill beneficials
- Low mammalian toxicity

Dusts

- Kaolin clay, Surround, can kill stink bugs

Pyrethrins/Pyrethrum

- South African daisy, *Tanacetum cinerariafolia*
- *Requires PBO, piperonyl butoxide synergist, PyGanic*

Oils and soaps

- Oils, mites, scales,aphids
- Triact 70, clarified hydrophobic extract of Neem oil
- Mantis EC is an agriculture grade organic insecticide/miticide formulated with the natural insecticidal activity of rosemary, peppermint, and NON-GMO soybean botanical oils.

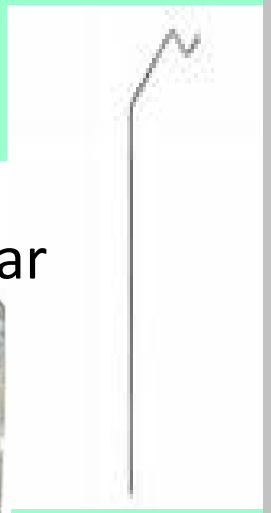
Turf pest: Japanese beetle

Damage, scouting, and management:
or Gemplers, Janesville, WI 53546

trap

lure in trap

double lure:
pheromone and rose scent



stand or rebar

complete trap

Ecosystem management

susceptible

- Most lindens
- Purple leaf plum
- Purple sandcherry
- Norway maple
- Roses
- Certain crabapples
- Birch

resistant

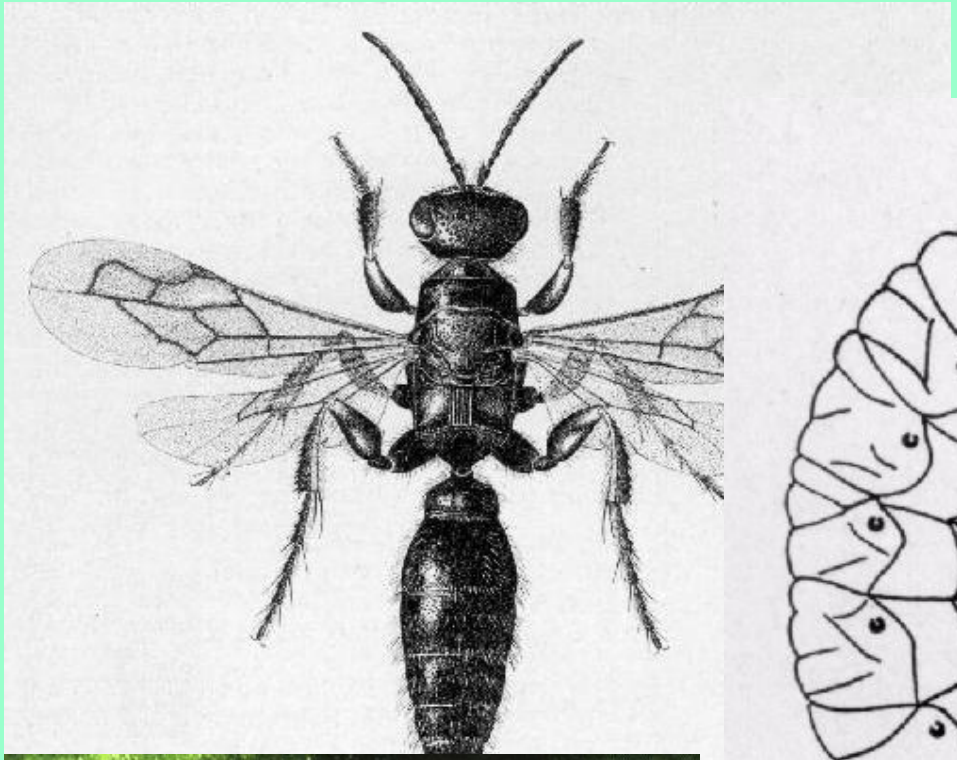
- Red maples
- Dogwoods
- Redbud
- Beech
- Tuliptree
- Sweet gum

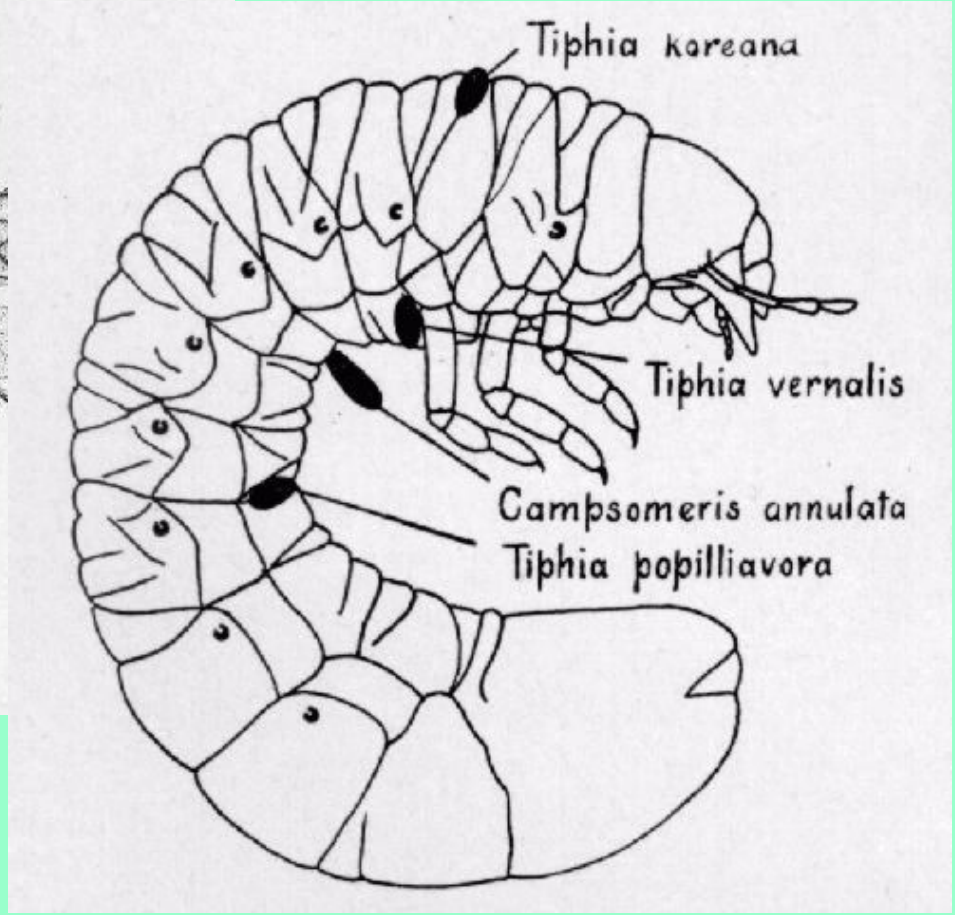
Ecosystem management

- **Japanese beetle parasites *Tiphia vernalis* (Hymenoptera) and *Istocheta* sp. (Diptera) known to be active in MA and CT**

- **MDA is released both in MN, but are not affective at control.**

Ecosystem management: *Tiphia vernalis*





Females of different species lay eggs on distinct parts of grub.

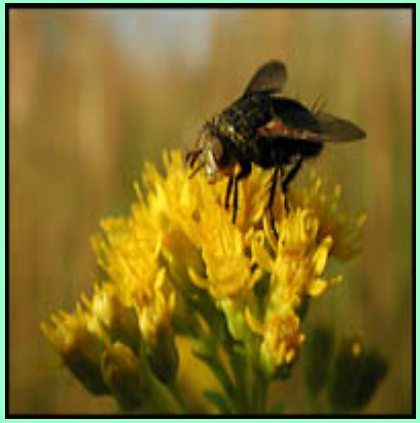
Ecosystem management: *Tiphia vernalis*

- **In the northeastern U.S., adult spring *Tiphia* wasps feed primarily on the honeydew exuded from aphids, scale insects, and leafhoppers.**

- **The wasp will also feed on the nectar of blossoms, such as forsythia, and on the extra-floral nectaries of peonies.**

- **In China the knowledge of food plants to increase the rates of *Tiphia* parasitization of white grubs to an average of 85%.**

Ecosystem management: *Isotecha aldrichi,* tachnid fly



- This solitary fly is an internal parasite of adult Japanese beetle.
- The female flies deposit 100 eggs during a period of about 2 weeks.
- The eggs are usually laid on the thorax of the female beetles and the maggot bores directly into the body cavity.
- Food sources: aphid nectar and Japanese knotweed (*Polygonum cuspidatum*), a persistent perennial weed native to Japan.

Ecosystem management: Protozoan parasites

- **Protozoan pathogens, *Ovavesicula popilliae* and *Gregarina* sp., are abundant where JB has been long established as in CT and NY and suppress population growth. *Ovavesicula*, known to infect approximately 25% of all JB grubs in CT was only found at 1 location in MI.**

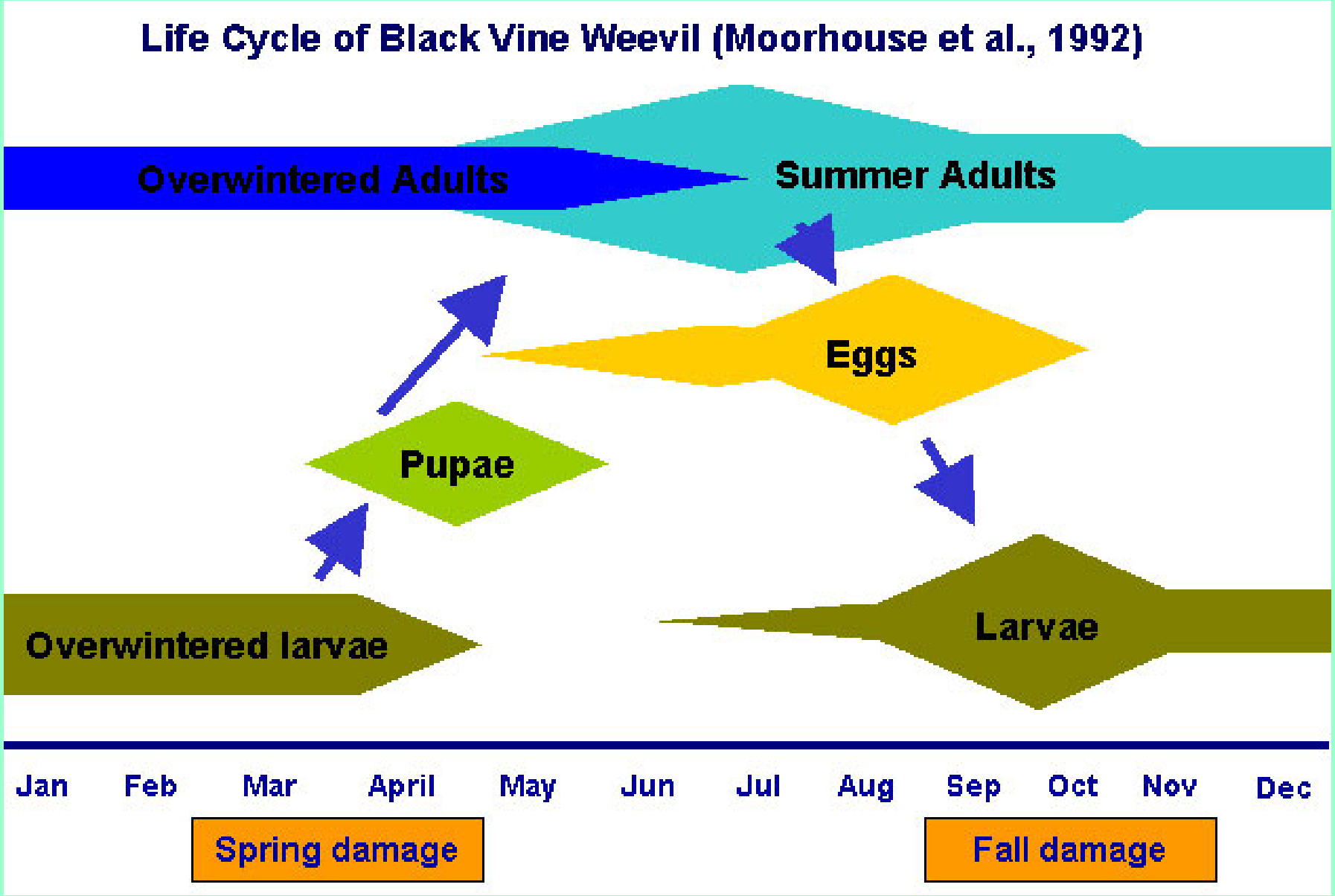
- **The Gregarine parasite found in the digestive system of Japanese beetle larvae in MI is *Stictospora villani.***

- ***Stictospora sp.*, found in 70% of Japanese beetle larvae in CT was only found in 20% of all MI larvae, and at only 60% of all sites in MI, compared with 100% of all sites in CT.**

- **In a greenhouse *Stictospora sp*. persisted in soil after infected grubs were removed and caused a 20% reduction in survival of healthy grubs.**

Black vine weevil adult

Strawberry root weevil

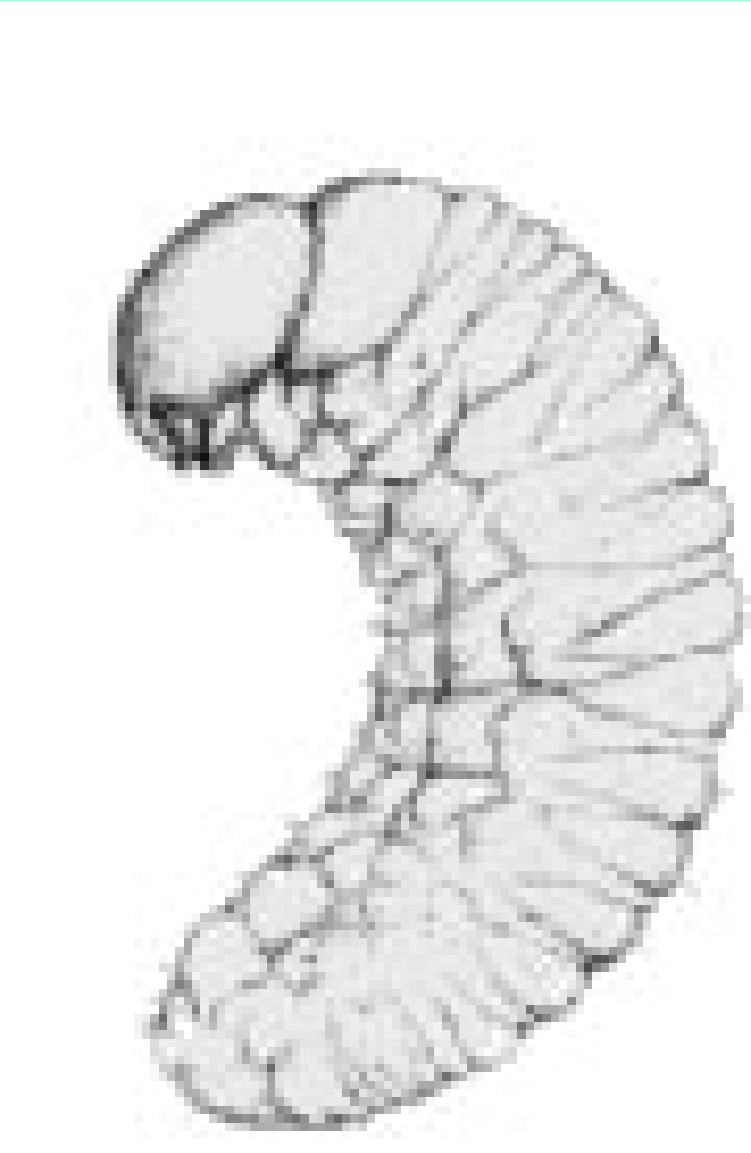

Life Cycle of Black Vine Weevil (Moorhouse et al., 1992)
Overwintered Adults
Summer Adults
Eggs
Pupae
Overwintered larvae
Larvae
Jan
Feb
Mar
April
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Spring damage
Fall damage

Black vine weevil larva

Larvae

Scarab beetle grub

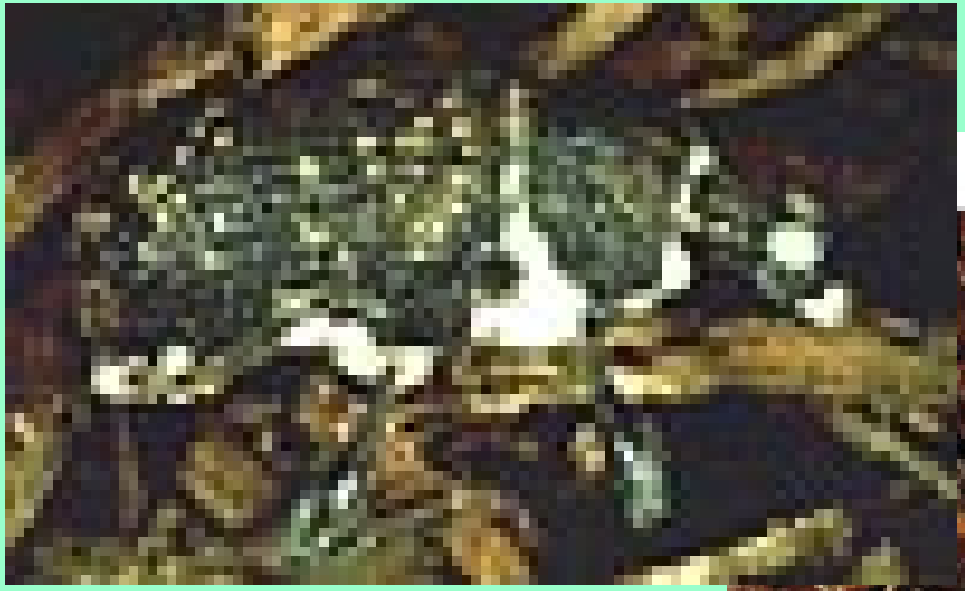
Weevil larva



Pesticides for black vine weevil

Common name	Trade name	Class
Acephate	Orthene	organophosphate
Beauveria bassiana	Botanigard	biological
Bifenthrin	Talstar	pyrethroid
Cyfluthrin	Tempo	pyrethroid
Nematodes	Nemasys H	biological
Imidacloprid	Marathon	chloronicotinyl
Permethrin	Astro	pyrethroid

Beauveria bassiana attacks black vine weevil + white grubs



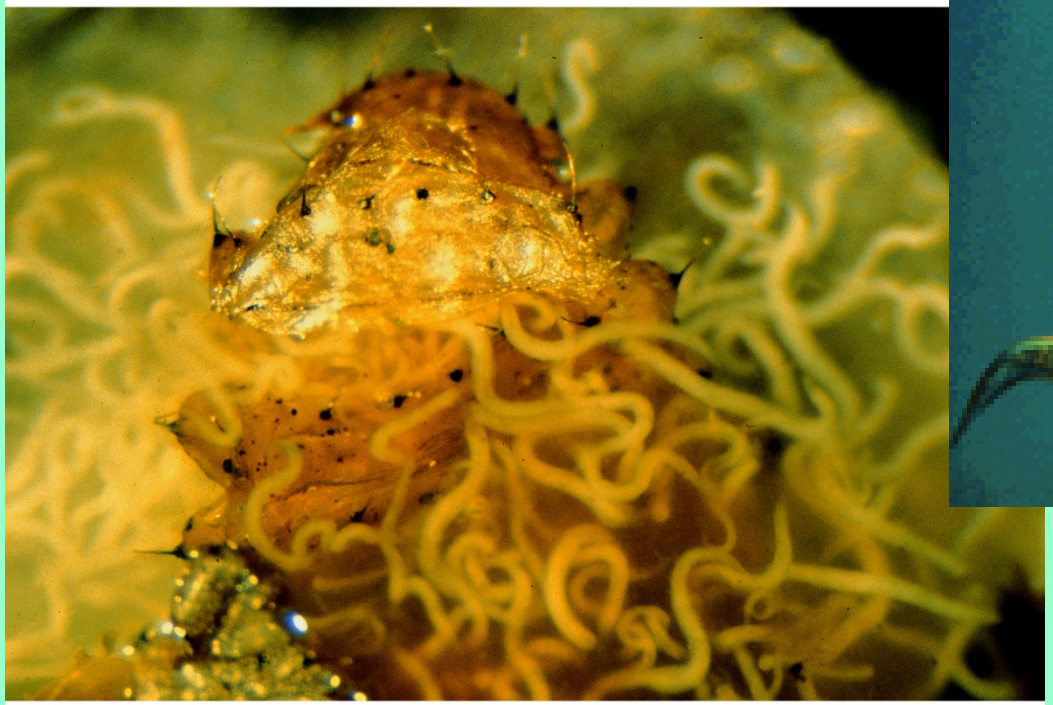
Elm Leaf Beetle Pupae Infected With *Beauveria*

Parasitic nematodes

Steinernema carpocapsae

Heterorhabditis bacteriophora

black vine weevil + white grubs



Elm Leaf Beetle Pupa Infected With Nematodes

Better way to manage Japanese beetles in trees, landscapes, and turf, Tues Feb 20 2018




- Japanese beetle (JB) arrived in MN in1990.
- JB grubs are controlled by wet, cold springs where temperatures are around 50F for a month
- Warmer springs and less cold winters are helping JB spread in MN.
- Soybeans, corn, grapes, and apples are coomon hosts for JB in other states.
- DO not use 1 trap as the traps “call” many individuals.
- Some growers in MN put up traps with large pans of soapy water underneath that “catches” the beetles
- Protpzoans in the soil control the gubs