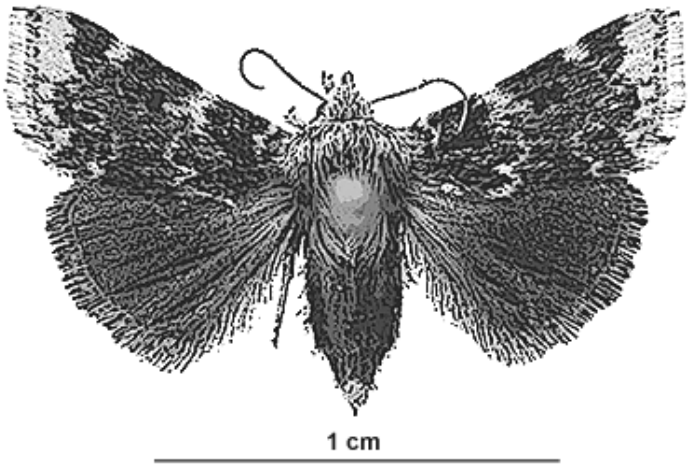
COSEWIC
Assessment and Status Report

on the

Gold-edged Gem
Schinia avemensis

in Canada



ENDANGERED
2006

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

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DES ESPÈCES EN PÉRIL
AU CANADA

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Production note:

COSEWIC would like to acknowledge Gary G. Anweiler for writing the status report on the Gold-edged Gem *Schinia avemensis* in Canada, prepared under contract with Environment Canada, overseen and edited by Theresa B. Fowler, Co-chair, COSEWIC Arthropods Species Specialist Subcommittee.

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COSEWIC
Assessment Summary

Assessment Summary – April 2006

Common name
Gold-edged Gem

Scientific name
Schinia avemensis

Status
Endangered

Reason for designation
This moth is a habitat specialist that needs active dunes or blow-outs with populations of its sole larval host plant. It is known from only two small populations in Canada and two in the United States. Large-scale decline in active dune habitat over the past 100 years has likely resulted in a corresponding reduction in the moth. Only very small, scattered, isolated patches of suitable habitat, totaling approximately 6 km^2, remain. They are threatened by habitat loss in the form of stabilization of active dunes by both native and introduced vegetation and by overgrazing of its larval host plant, which severely impacts small, isolated populations of the moth. The closest population of the moth in the United States is about 1,200 km to the south in Colorado, so immigration of individuals into the Canadian population is not possible.

Occurrence
Alberta, Saskatchewan and Manitoba

Status history
Designated Endangered in April 2006. Assessment based on a new status report.

COSEWIC
Executive Summary

Gold-edged Gem
Schinia avemensis

Species information

The Gold-edged Gem is a small (has a 16-20 mm wingspan), day-flying, noctuid (cutworm or owlet) moth in the subfamily Heliothinae (Flower Moths). These moths have greenish-brown and maroon, or mostly maroon, forewings crossed by two partial, ochre-yellow bands. There is also a prominent yellow band along most of the distal edge of the forewing, hence the common name. There are no named subspecies. The early stages (egg, larvae, and pupae) are undescribed.

Distribution

In Canada, Gold-edged Gems are known from two disjunct populations in the Prairie Ecozone in the southern part of the Prairie Provinces. They occur as a single population at one site in southwestern Manitoba and as a second population at three current and a fourth historical site in southwestern Saskatchewan and adjacent southeastern Alberta. Elsewhere, they are known only from three sites in Colorado.

Habitat

Gold-edged Gems always occur within active sand dunes and blow-outs, in close association with the larval host plant. Suitable habitat appears to consist of colonies of the host plant growing on active dune sands where a suitable adult nectar source is present.

Biology

Adult Gold-edged Gems are active during the day. They can be found resting on, or flying among, the larval host plants or resting on and nectaring at nearby blossoms. They are single-brooded, with adults of Canadian populations present from July 10 to August 20. The only known larval host is the native Prairie Sunflower, and a species of skeletonweed is the primary nectar source used by adult moths.

Population size and trends

The number of sites occupied by the Gold-edged Gem in Canada appears to be stable. There are too few data available on which to base useful population estimates.

Based on recent observations at all known occupied Canadian sites, a reasonable estimate is believed to be 700-6,000 adult Gold-edged Gems in Canada in 2004-2005.

Limiting factors and threats

The primary limiting factor is availability of active sand dunes or dunes with “blow-outs”, supporting colonies of the larval host plant.

The major threat to the long-term survival of the species appears to be the loss of habitat resulting from the stabilization of active sand dunes by both native and introduced vegetation. This natural process has probably accelerated since settlement and the resulting reduction in the number and extent of wildfires. Serious overgrazing of prairie sunflowers could severely impact small, isolated populations of Gold-edged Gems.

Special significance of the species

The Gold-edged Gem is a sand dune specialist, known from only two small populations in Canada and two in the United States (Colorado).

Existing protection

The Manitoba population is located mostly, or entirely, within Spruce Woods Provincial Park; it may also extend into adjacent CFB Shilo, which is under federal jurisdiction. Two of the four sites where Gold-edged Gems have been found in Alberta (Bindloss) and Saskatchewan (Burstall) are located on private property, and the third (Pakowki Lake) is located on provincially owned leased land; the specific site where the fourth, historic collection was made is unknown.

The Gold-edged Gem is not ranked by the Nature Conservancy (NatureServe), or by the three provinces where it occurs. It is not included on CITES, IUCN or US Fish and Wildlife lists.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5th 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS (2006)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and it is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

COSEWIC Status Report

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Gold-edged Gem

Schinia avemensis

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SPECIES INFORMATION

Name and classification

Common name: Gold-edged Gem, Hooper 1996.
French name: Héliotin d'Aweme, Jean-François Landry 2004.
Order: Lepidoptera (Moths and Butterflies)
Superfamily: Noctuoidea
Family: Noctuidae (Owlet or Cutworm Moths)
Subfamily: Heliothinae (Flower Moths)
Genus: *Schinia*
Species: *avemensis* (Dyar, 1904)

There are no named subspecies. Specimens from Manitoba differ significantly in appearance from those in Alberta, and Alberta specimens in turn are intermediate in appearance between specimens from Manitoba and Colorado. The taxonomic status of these populations is being reviewed by Chuck Harp as part of a larger review of the North American Heliothinae (C. Harp, pers. comm., 2004).

Synonyms: Originally described as *Pseudotamila avemensis* Dyar.

Moths of North America (MONA) Catalogue No.: 11100. Heritage identifier number IILEYMP180.

Bibliographic Citation: Dyar 1904. New species of North American Lepidoptera and a new limacodid. Journal of the New York Entomological Society, 12:39-44.

Type Specimens: Two male syntypes (one apparently lost) CAN., MB, Aweme. The extant type specimen is deposited in the United States National Museum as type #7734 (Hardwick, 1996).

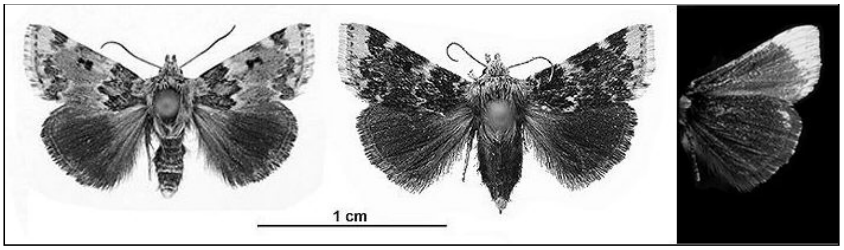

Figure 1. Gold-edged Gem. From left to right: Manitoba male, Alberta female (dorsal surfaces); Alberta female (ventral surface).

Morphological description

Gold-edged Gems (Fig. 1) are small (16-20 mm wingspan), diurnal moths with greenish-brown and maroon to mostly maroon forewings that are crossed by two partial

ochre-yellow bands. There is a prominent yellow band along most of the forewing terminus (hence the common name). The hindwings and most of the body are black. Females are slightly larger and darker than males. The ventral surfaces of both sexes are alike, black except for a prominent white wedge at the apex of the forewings. A formal description, including descriptions and illustrations of male and female genitalia, is available in Hardwick, 1958.

Specimens from Colorado are much darker than specimens from Manitoba. In Colorado specimens, the greenish-brown scales on the forewings of Manitoba specimens are replaced by dark maroon and the yellow markings are reduced. Specimens from Alberta are intermediate in appearance, but are closer to Colorado specimens. A specimen from Manitoba is illustrated in colour on the Moths of Canada website (http://www.cbif.gc.ca/moths/noctuoidea/index.htm). A Colorado specimen is illustrated in colour by Hardwick (Hardwick, 1996, Fig. L10).

The immature stages (egg, larva and pupa) are unknown.

Genetic description

There are no data regarding the genetic structure of Gold-edged Gem populations. The population in Manitoba is separated from the Saskatchewan-Alberta population by about 750 km, and the Alberta-Saskatchewan population is separated from the nearest Colorado site by approximately 1,200 km. It is highly unlikely that there is any gene flow between these three populations.

DISTRIBUTION

Global range

The global range of the Gold-edged Gem extends from Spruce Woods Provincial Park in southwestern Manitoba west to eastern Alberta, and south to southern Colorado (Fig. 2). The maximum global extent of occurrence (EO) encompasses approximately 340,600 km^2. Within the global range, Gold-edged Gems occur as four disjunct populations, two in Canada and two in Colorado, USA.

Canadian range

The Canadian range, both current and historical, extends from southwestern Manitoba to southeastern Alberta. The extent of occurrence (EO) in Canada is approximately 70,500 km^2. The known area of occupancy (AO) encompasses only four small areas of active sand dunes or blow-outs, an area of about 1.5 km^2 in total (G. Anweiler, unpublished; C. Schmidt, personal communication, 2004). There are a number of additional smaller areas of potential Gold-edged Gem habitat scattered throughout the EO in southeastern Alberta and southwestern Saskatchewan. In total these are estimated to not exceed an additional 3-5 km^2 of poorer quality habitat, i.e., extremely fragmented and of small size individually.

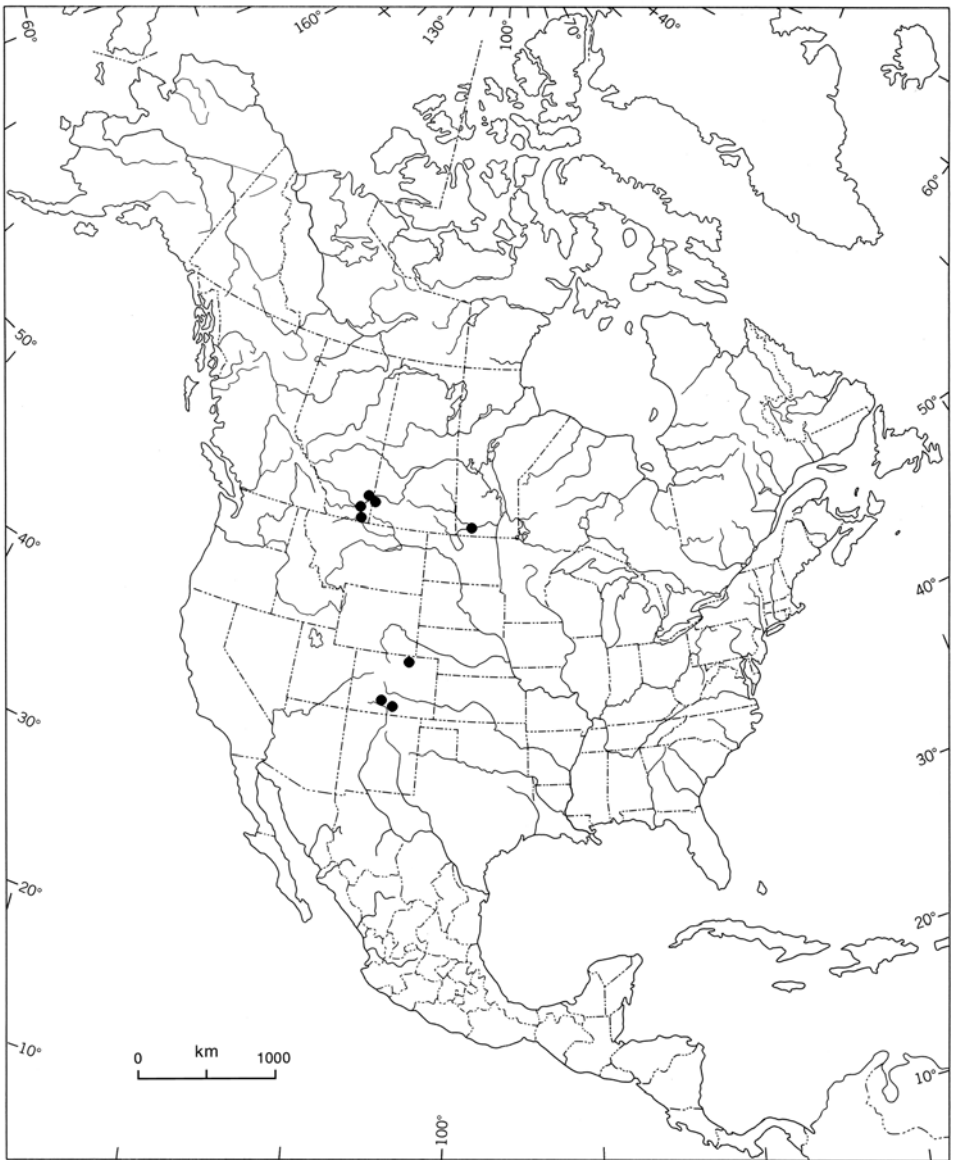

Figure 2. Collection sites for the Gold-edged Gem.

The sites where Gold-edged Gems were found in Saskatchewan and Alberta are separated by approximately 50 km, and these two sites are each approximately 180 km from the third occupied Alberta site (Pakowki Lake). The Alberta-Saskatchewan and Manitoba populations are separated by about 750 km.

There are extensive dune formations in southwestern Saskatchewan (i.e., Bigstick – Crane Lake Sand Hills, Great Sand Hills, Burstall Sand Hills) and southern Alberta (i.e., Middle Sand Hills, Empress dunes) that contain active dunes and blow-outs (David, 1977; G. Anweiler, unpublished data), and it is highly probable that additional colonies of Gold-edged Gems occur therein.

The historic range of the Gold-edged Gems is essentially the same as the current range. Although the presence of the Gold-edged Gem in southern Saskatchewan and Alberta was unsuspected prior to 2004, a previously unidentified museum specimen collected at Medicine Hat in southwestern Alberta in 1939 indicates they have been there for many years (C. Schmidt, personal communication, 2004).

All Canadian populations of Gold-edged Gems are located within the Prairie National Ecological Area (COSEWIC, 2003). The Manitoba site is within the Aspen Parkland Ecoregion in a humid to sub-humid region; the Saskatchewan-Alberta sites are located within the more arid Mixed Grassland Ecoregion (Wolfe, 1997; Padbury and Acton, 1991).

HABITAT

Habitat requirements

Gold-edged Gems are habitat specialists in active sand dunes and dune blow-outs. They have been found only in, or immediately adjacent to, areas of active sand (J. Troubridge, pers. comm., 2004; C. Harp, pers. comm., 2004; B. C. Schmidt, pers. comm., 2004; G. Anweiler, unpublished data). Within active sand areas, Gold-edged Gems are found in close association with colonies of the only known host plant, prairie sunflower, *Helianthus petiolaris* Nutt. (Hardwick, 1996) (Fig. 3). At the colonies near Bindloss and Pakowki Lake, Alberta, the moths were only found associated with sunflowers growing in the centre of the blow-out (B.C. Schmidt, pers. comm., 2004; Anweiler, unpublished data).

A suitable nectar source for adults is also an important habitat element. Gold-edged Gems were observed nectaring only at blossoms of skeletonweed (*Lygodesmia juncea* (Pursh) D. Don ex Hook.) in all four populations for which there are data (C. Harp, pers, comm., 2004; B.C. Schmidt, pers. comm., 2004; G. Anweiler, unpublished data).

Although stabilized dune fields cover extensive areas of the southern prairie provinces, active sand dunes and blow-outs occur infrequently and comprise only a very small fraction of the total area of dune fields; many dunes entirely lack significant areas of active sand (David, 1977; S. Wolfe, pers. comm., July 2004). Suitable habitat for Gold-edged Gems is thus extremely fragmented and patchy. Active dunes may also lack both Gold-edged Gems and prairie sunflowers, possibly due to factors such as topography and moisture (i.e. ridges and swales vs. extensive level sand sheets) and differences in sand particle size. Large, active, sand dunes in the Great Sandhills south of Prelate, Saskatchewan and the adjacent Burstall dunes were more sheet-like and had little topographic relief (Fig. 7). They also appeared to be comprised of finer sand particles that had formed a light surface crust. Vegetation on these dunes was very sparse to absent except along the dune edges and face. Only two species of plants were abundant on these dunes, scurf-pea *Psoralea lanceolatum* (Pursh) and sand dock *Rumex venosus* Pursh; prairie sunflower was entirely absent, although it occurred as scattered individuals in adjacent grasslands, and along nearby roadside edges at the Burstall site (G. Anweiler, unpublished data).

Figure 3. Colony of prairie sunflowers occupied by Gold-edged Gems at Spirit Dunes, Spruce Woods Provincial Park, Manitoba. Note location of sunflowers on the lower slope at the edge of the active sand. August 4, 2004.

Figure 4. Burstall dunes, Saskatchewan. Note sheet-like formations with smooth topography and little vegetation. Plants in foreground are scurf-pea. August 6, 2004

Figure 5. Massive stand of prairie sunflowers on fallow field, east of Burstall, Saskatchewan. August 6, 2004.

Figure 6. Prairie sunflowers in full bloom on dune front, Spirit Dunes, Spruce Woods Provincial Park, Manitoba. August 27, 2004.

Figure 7. Prairie sunflowers growing on disturbed area, CFB Shilo road/fireguard. August 4, 2004.

Dependency on a narrow range of host plants is usual in the genus *Schinia*, with many individual *Schinia* species restricted to one or several host plant species in a single genus, or to a few closely related genera of host plants (Hardwick, 1996).

Helianthus petiolaris is a native plant in the family Asteraceae. It grows on light or sandy soils throughout much of southern Canada and the continental USA, and appears to have expanded its range since settlement (Heiser, 1969). Unlike most native sunflower species, it is an annual and thus one of the last species of sunflowers to blossom. It is more or less restricted to disturbed areas on sand or sandy soils, including roadsides, fallow fields (Fig. 6), active sand dunes and beaches (G. Anweiler, pers. obs.). In southwestern Saskatchewan and southeastern Alberta, it forms almost continuous stands for many kilometrer along the edges of gravel roads and highways. At the Spirit Dunes site, prairie sunflowers occurred in essentially pure stands as an early pioneer on active sand above and below the active dune crests (Figures 4 and 5). They were rarely observed growing mixed with other dune vegetation, with the exception of sand dock at some sites (G. Anweiler, unpublished data, 2004).

The active dune habitat occupied by Gold-edged Gems in the Spirit Dunes of Spruce Woods Provincial Park is known to also harbour a suite of other rare moths, including *Schinia bimatris* (Harv.), *Schinia roseitincta* (Harv.), *Pygarctia spraguei* (Grt.), and at least three species of *Copablepharon* (J. Troubridge, pers. comm., 2004; Schmidt and Anweiler, 2004; G. Anweiler, unpublished data).

Habitat trends

According to Wolfe (2001), many active dunes on the southern Prairie Provinces have been stabilized by vegetation at a rate of 10-20% per decade, and some have

become nearly completely stabilized over the last century. The causative factors for the evolution of these active dune areas to stabilized, vegetated dunes is not well understood. Changes in land use activities and the frequency of disturbance, as well as changes in climatic conditions on the prairies over the last century, each play a role in dune stabilization (Wolfe, 2001).

Aerial photographs show that the Middle Sand Hills in Alberta, covering about 400 km^2, had extensive active dunes in 1937, but were reduced to a fraction of the area by 1998 (see Geological Survey of Canada, 2001). Vance and Wolfe (1966) and Mahus and Wolfe (1999) studied historical photographs of the dunes and concluded that there was significantly less bare sand in the Middle Sand Hills since the 1930s. Bender *et al*. (2005) quantified changes in the Middle Sand Hills from 1949 to 1998 using air photos and satellite imagery. They found that many individual dunes were becoming completely stabilized by vegetation at a mean rate of loss of seven dunes per decade and that in the overall dune complex, areas of exposed sand had declined at an average rate of 40% per decade. Furthermore, Gummer and Bender (COSEWIC, 2006) extrapolated dune loss in the Middle Sand Hills to be 53% from 1995 to 2005 and concluded that all active sand dunes in the complex will disappear by 2014.

Within the Great Sand Hills of adjacent Saskatchewan, covering some 2,000 km^2, the number of sections of land with blowing, active sand had been reduced by 60% between the 1880s and 1980. This has been attributed largely to “diligent management practices that contributed to the reduction in bare, blowing sand, and the increase in vegetative cover in sensitive dune areas” (Wolfe, 2001). The active sand areas of the Manitoba Spirit Sand Hills (Spirit Dunes) have decreased as they have become progressively more vegetated since the earliest air photos in the late 1920s. In 1928, the active portion of the Spirit Dunes was about 145 ha, reduced to 23 ha in 1958 and 15 ha in 1969; about 20 ha remain today (Wolfe 2001; Geological Survey of Canada, 2001).

Habitat protection/ownership

The Manitoba population of Gold-edged Gems is largely, or entirely, contained within the boundaries of Spruce Woods Provincial Park, although it is possible that the species also occurs in parts of adjacent CFB Shilo. The park is under provincial jurisdiction, while the CFB Shilo lands are under federal jurisdiction. The Bindloss, Alberta and Burstall, Saskatchewan colonies of Gold-edged Gems are located on private lands, and the Pakowki Lake colony on leased, provincially owned grazing land.

Much of the potential habitat in Alberta occurs in the Middle Sandhills, on federal lands within CFB Suffield. Other potential habitat in southern Alberta and Saskatchewan occurs on provincially owned lands currently used for grazing, either as land leased for agricultural uses or within Community Pasture. Additional fieldwork is needed to determine if any of these areas are occupied by Gold-edged Gems.

BIOLOGY

Life cycle and reproduction

There are few data available on the life history of the Gold-edged Gem. Like all Lepidoptera, they undergo complete metamorphosis with egg, larval, pupal and adult stages. They are univoltine (one brood or cycle per year); adults have been collected in Canada from July 10 to August 20 (Table 1). Observations at Spruce Woods Provincial Park in 2004 showed that adults emerged as the first of the host sunflowers bloomed (August 4), and the flight period had ended while they were still in full bloom (August 26) (G. Anweiler, unpublished data, 2004).

All species of *Schina* studied by Hardwick (1996) deposit eggs in, or on, the flowering heads of their host plant. The ovipositors of Gold-edged Gems have the hard, knife-like, modified lobes found in species that insert their eggs downward among the florets of flowers in the family Compositae. Hardwick (1996) states unequivocally that in Manitoba *Schinia avemensis* "feed as larvae in the heads of *Helianthus petiolaris*…", but provides no further details.

Schinia eggs hatch within a few days, and the larvae feed on or within the blossom, on the floral parts, and in some instances on the developing seeds of the host plant. Young larvae of some species have very specialized feeding habits, selecting a particular part of the floral structure, such as the anthers or the receptacle. Species feeding on composites usually feed first within the corolla tubes. The larvae of *Schina* complete development relatively rapidly (within two to four weeks, depending on species). Species feeding on annuals (as do Gold-edged Gems) were observed to develop faster than those feeding on perennials, in some cases in less than 14 days (Hardwick, 1996).

When fully developed, the larvae leave the plant, burrow into the soil, and form a cell in which they pupate. They remain in the pupal stage through the winter and spring, emerging to mate and reproduce when the host plant blooms the following summer (Hardwick, 1996). A number of species of *Schina* are able to remain in the pupal stage for more than one year, an adaptation to life in xeric habitats where conditions may not be suitable for the host plants to blossom each year (Hardwick, 1996).

All adult Heliothines are apparently short-lived; in laboratory rearings, none lived for more than a week (Hardwick, 1996). There are apparently no closely related species, and there is no evidence, and little likelihood, of hybridization.

Herbivory/predation

There are no data specific to Gold-edged Gems, and the following observations, excerpted from Hardwick 1996, refer to the subfamily Heliothinae in general.

During the early larval stages, both inter- and intra-specific cannibalism is a common phenomenon among species of *Schinia* feeding on composites.

Larvae of different species of *Schinia* have developed a number of behaviours for avoiding parasites and predators, including leaving the host plant and spending daylight hours in a cell created by the larvae at the ground surface, or pulling the rays of the flower over the disc and binding them with silk into a roofed shelter. Larvae of many species greatly resemble the host plant in structure as well as colour and are well camouflaged while resting on the plant. Specific behaviours have evolved for resting on specific parts of the host to minimize visibility, i.e., some species curl around the base of the floral receptacle while others rest aligned along the stem (Hardwick, 1996).

Although there are no specific data, Gold-edged Gems are undoubtedly subject to predation and parasitism by a variety of birds, wasps and other animals during all life stages, as are most Lepidoptera.

Herbivory of the host plant by both wild and domesticated ungulates could result in the destruction of both the host and any larvae feeding therein. The flowering heads of prairie sunflowers are palatable to both wild and domestic ungulates, and significant local mortality of larvae could occur under certain conditions, i.e., during periods of drought when more desirable alternate forage is in short supply, or in situations where livestock is overstocked or confined to a restricted area, resulting in overgrazing (http://www.npwrc.usgs.gov/resource/literatr/wildflwr/species/helipeti.htm).

Physiology

There are no data specific to Gold-edged Gems.

Some species of flower-feeding *Schinia* are known to be physiologically adapted to have pupal diapause terminated in synchronicity with blossoming of the host plant. In some species, diapause in the pupae may be extended for several years until conditions are right for the host plants to blossom. This adaptation is most common in desert species, where unreliable or erratic rainfall triggers blooming of host plants. (Hardwick, 1996)

Dispersal/migration

Gold-edged Gems have rarely, if ever, been found in places other than in close proximity to colonies of the host plant. However, the adults are small, fast-flying insects and would be very difficult to observe or identify except when nectaring or at rest.

Many species of *Schinia* are strong fliers and good colonizers and are very adept at colonizing successional habitats or coping with plants that do not flower every year. They often reach high densities and can colonize small patches of plants if there are other source patches in the area. While straying does occur, adults concentrate very near their larval food plant (Schweitzer, 2001 *in* NatureServe, 2004).

Gold-edged Gems are not known to undergo any regular migrations or dispersal events.

Interspecific interactions

Gold-edged Gems are apparently dependant upon a single species of native annual sunflower for the larval host. Field observations at the Alberta and Manitoba colonies as well as at one site in Colorado indicate that skeletonweed is the primary nectar source for adults (G. Anweiler, unpublished data; B.C. Schmidt, pers. comm., 2004; C. Harp, pers. comm., 2004).

Adaptability

Members of the genus *Schinia,* and in particular the composite flower-feeding desert species, are capable of remaining in pupal diapause for extended (multi-year) periods, an adaptation to an environment where seasonal cycles of rainfall and plant blossoming can be unpredictable (Hardwick, 1996).

Most species of *Schina* are apparently relatively easy to rear under laboratory conditions (Hardwick, 1996), and thus it would likely be possible to breed Gold-edged Gems in captivity for release into the wild, should this be desired.

POPULATION SIZES AND TRENDS

Search effort

During the past 75 years, there have been no records of Gold-edged Gems from the Aweme area in the Brandon sandhills. The species was described from specimens caught there by resident collector, Norman Criddle. Since Criddle's time (approx. 1930), the only record of Gold-edged Gems from Manitoba is for four specimens collected in the Bald Head Hills (= Spirit Dunes) north of Glenboro in July and August 1958 (Appendix 1). The Spirit Dunes in Spruce Woods Provincial Park were visited by J. Troubridge and J.D. Lafontaine July 27-28, 2004. They discovered Gold-edged Gems resting on flowers and leaves of prairie sunflowers near the dune face in the early morning (J. Troubridge, pers. comm., 2004).

Virtually all active sand dunes in the Brandon Sandhills are now located within the Spirit Dunes section of Spruce Woods Provincial Park (David, 1977; Wolfe, 2001). Gary Anweiler visited the Spirit Dunes area on July 28, 2004. The entire boundary of the Spirit Dunes in Spruce Woods Provincial Park was walked and searched for Gold-edged Gems and colonies of the host plant. All areas of open, active sand areas in the dunes were also checked. Although colonies of Prairie Sunflower were scattered throughout the dunes, all were still in bud because of the lateness of the season, and no Gems were found. Anweiler returned to the area on August 4 and repeated the search of the same areas. At this time, the sunflowers were in the early stages of blooming (an estimated 0.25 percent of plants had blossoms) and Gold-edged Gems were active and were observed mating and visiting blossoms for nectar. Although colonies of the host plant were found scattered throughout much of the area, Gold-edged Gems were found

only in a series of adjacent colonies of sunflowers near the active dune face. When the area was revisited on August 26-27, 2004, the prairie sunflowers were in full blossom, but no Gold-edged Gems were found, and it was concluded that the moth's flight for the season was finished (G. Anweiler, unpublished data).

During the period July 28-August 4, roads criss-crossing the remainder of the Brandon Sandhills, Oak Lake Sandhills and Lauder Sandhills were driven to check for Gold-edged Gem habitat, i.e., open dunes and major blow-outs, as well as colonies of prairie sunflowers. No suitable habitat was located, and these areas appear unlikely to harbour colonies of Gems (G. Anweiler, unpublished data).

Although prior to the field work carried out in 2004 Gold-edged Gems had never been reported from Canada from outside the Brandon Sandhills area, potential Gold-edged Gem habitat (active dunes with colonies of the host) is known to occur more extensively in southwestern Saskatchewan and adjacent Alberta. The likelihood of Gold-edged Gems being present in other dunes in the southern Prairie Provinces was pointed out by Hardwick (1996). Anweiler examined several potential sand dune sites along the Yellowhead Highway for Gold-edged Gems and potential Gem habitat in late July, 2004, and checked the dunes at the east end of Good Spirit Lake for both Gems and prairie sunflower colonies (Table 1). A series of large open sand dunes in the northern section of the Great Sandhills south of Scepter - Prelate were visited and searched on August 6, 2004, as were a series of smaller open dunes north of the town of Burstall on the same date. A single worn female Gold-edged Gem found at the Burstall site was the only Gem located (Appendix 1).

No searches specifically for Gold-edged Gems have been carried out in Alberta. However, on July 29, 2004 during unrelated work, Chris Schmidt located a thriving colony of Gold-edged Gems in a small area of active sand blowouts on the edge of the Red Deer River north of Bindloss (B.C. Schmidt, pers. comm., 2004). In July of 2005, Anweiler located a second colony, in the Pakowki Lake dunes, also while doing unrelated work (Anweiler, unpublished).

Areas where searches were made for Gold-edged Gems and suitable Gem habitat in 2004 and 2005 are shown in Figure 8, and search results are summarized in Table 1.

Most of the largest and best potential habitat for the Gold-edged Gem has been searched. Additional small patches of potential habitat are scattered throughout the southern prairies, but have not been recently searched specifically for this species. Consequently, it is plausible that a limited number of additional sites with Gold-edged Gems may be found if directed searches are carried out at these as-yet unsurveyed sites. Any additional sites will be small and will also be declining.

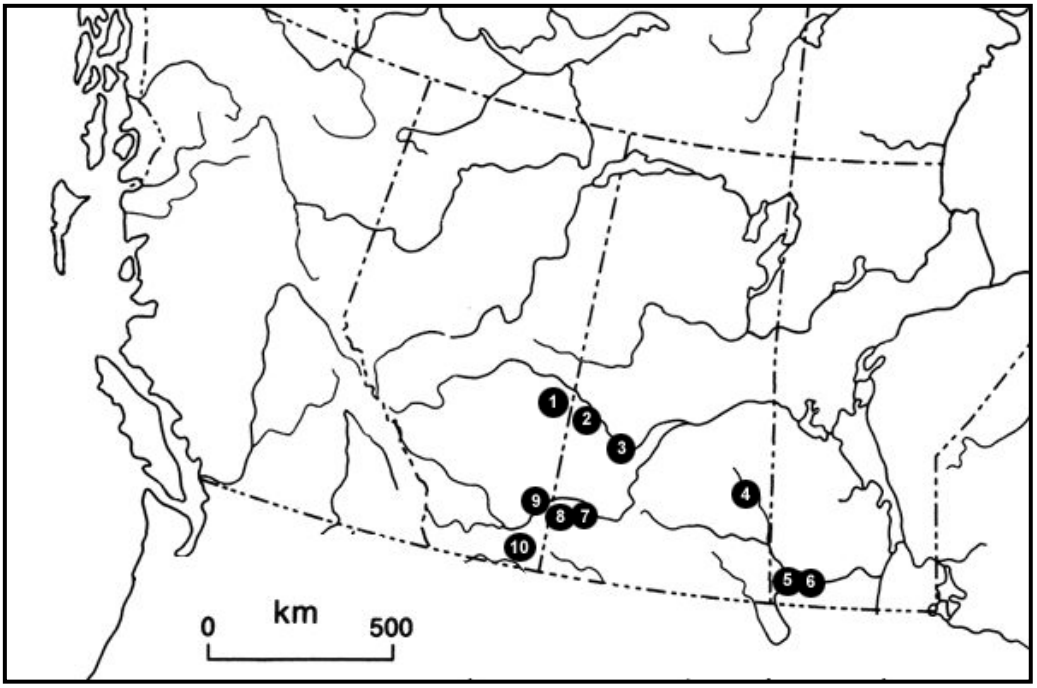

Figure 8. Areas searched for Gold-edged Gems, 2004-2005.

Table 1. Search effort results, 2004-2005.

No	Location	Date	Hours Effort*	Observations	Observer
1	North of Chavin, AB	29-07-04	10	no *S. avemensis*	Schmidt
2	Southwest of N. Battleford, SK	26-07-04	1	no *S. avemensis* or host	Anweiler
3	Borden Bridge, SK	26-07-04	0.5	no *S. avemensis* or host	Anweiler
4	Good Spirit Lk, SK	27-07-04	6	no *S. avemensis* or host	Anweiler
5	Brandon-Oak Lk Lauder sandhills, MB	30-07-04	12	no *S. avemensis*, scattered host	Anweiler
6	Spirit Dunes, MB	29-07-04 04-08-04	12	*S. avemensis* and host present	Anweiler
7	Great Sandhills s. Prelate, SK	06-08-04	8	no *S. avemensis* or host	Anweiler
8	Burstall Dunes, SK	06-08-04	2	*S. avemensis* and host present	Anweiler
9	Red Deer R. n. Bindloss, AB	29-07-04	3	*S. avemensis* and host present	Schmidt
10	Pakowki Lake dunes	21-07-05	4	*S. avemensis* and host present	Anweiler

Abundance

There are no quantitative data available on population sizes for Gold-edged Gems. Fieldwork is needed to determine how much, if any, potentially suitable habitat supports

Gold-edge Gem populations, how much of the habitat is occupied in areas where colonies are known to occur, and the number of Gems in the colonies over a period of more than one year. Obtaining meaningful population numbers even in occupied habitat is complicated by the small size and mobility of adult moths, as well as changes in numbers over the adult emergence period and from year to year. Numbers of moths are known to vary greatly from year to year due to weather and other factors (Pohl *et al*, 2004).

The occupied area at the Spirit Dunes, Manitoba site is quite small (estimated at about 50 ha in 2004), and the moths were fairly numerous where present. Although estimating the number of individuals of such a small, fast-flying and very active insect that has a patchy distribution within the available habitat is difficult, a reasonable estimate of adults at this site is thought to be in the range of 10-50 individuals per hectare, or 500-5,000 adults in 2004 (G. Anweiler, unpublished data). It should be noted that this figure is an estimate based on casual field observations by a single experienced individual, and not on any “hard” data.

In Saskatchewan, the single female specimen noted at the Burstall site was unexpected and may represent an individual colonizer from a more distant and as-yet undiscovered site. Although the area of dunes at the Bindloss, Alberta colony site is estimated to cover about 50 ha, the moths were only found concentrated in the centre of two active “blowouts” within these dunes, a much smaller area. A reasonable population estimate at this site is thought to be in the range of 100-500 adults in 2004 (C. Schmidt, pers. comm., 2004). At the Pakowki Lake dunes, few sunflowers were in bloom at the time and a search of all blossoms in the largest dune complex yielded about 15 Gold-edged Gems. However, it appeared that the hatch was just beginning, and the number of moths observed was likely a fraction of the total population at this locality. A reasonable estimate of the number of individuals is thought to be comparable to that at the similar-sized Burstall dune site (100-500 individuals).

Fluctuations and trends

Although there are few data with which to calculate population trends, several things are evident. First, Gold-edged Gems have persisted at the Manitoba site for at least 100 years, and have been present in southeastern Alberta since at least 1939. Prior to 2004 the colony in Manitoba was the only one known in Canada. The Gold-edged Gem is now known to be more widespread in the southern Prairie Provinces. Secondly, only a fraction of the active sand dunes present 100 years ago still persist. Although there is some evidence that this decline in active sand dune habitat has slowed (David, 1977), barring major changes in climate, this decline can be expected to continue. This large-scale decline in the active dune habitat of Gold-edged Gems over the past 100 years or more has likely resulted in a corresponding reduction in the size and number of Gold-edged Gem populations during that same period.

Rescue effect

The two Canadian populations of Gold-edged Gems, located along the southern Alberta-Saskatchewan border and in southwestern Manitoba (Fig. 2) are separated by

about 750 km of mostly unsuitable habitat, and the potential for exchange of individuals between them is likely nil.

The Gold-edged Gem is known from outside Canada at only three sites (two populations) in Colorado, approximately 1,200 km to the south (Fig. 2). Consequently, the chances of individuals from Colorado re-colonizing Canada are also essentially nil. Furthermore, while individuals from Colorado might be able to survive in Canada, they show significant phenotypic differences (larger and darker in colour) and may be adapted to different conditions.

LIMITING FACTORS AND THREATS

The only major limiting factor for the Gold-edged Gem appears to be the amount of suitable habitat, and perhaps the fact that this habitat occurs more or less in small, widely disjunct patches. The most serious threat is the loss of active, blowing sand as a result of dune stabilization which has occurred at a rapid rate in the past. There are no other obvious imminent threats to the Canadian populations of Gold-edged Gem, which have managed to persist until now.

Overzealous or careless pesticide use could impact some populations, but because most open dune habitat is not associated with forest or cropland, impacts from this source are considered a low risk. Of more concern is overgrazing by livestock at colonies on leased and private lands. Under extreme conditions, when forage is in short supply (i.e. during prolonged drought conditions), livestock could conceivably decimate or eliminate a colony by consuming the flowering heads of sunflowers where eggs and larvae are concentrated.

Invasion and stabilization of dune habitats by introduced weeds, such as sweet clover (*Meliotis* sp.) and spurge (*Euphorbia* sp.), could accelerate dune stabilization or replace colonies of the larval host plants. Extensive dense patches of sweet clover (*Meliotus* sp.) were observed covering significant portions of the Spirit Dunes adjacent to areas currently occupied by Gold-edged Gems (Anweiler, personal observation, 2004).

SPECIAL SIGNIFICANCE OF THE SPECIES

The Gold-edged Gem is a globally rare species, known from only four populations: two in the extreme south of the three Prairie Provinces and two in Colorado. Although it is a small, relatively inconspicuous insect, it is a member of a highly specialized dune-dwelling community consisting of a number of unique plants and animals restricted to the “islands” of active sand dunes left thousands of years ago by the melting of the glaciers.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

The Gold-edged Gem is currently not ranked through the Heritage Status system at global, national, state or provincial levels (NatureServe, 2004).

The Manitoba population occurs entirely or primarily within Spruce Woods Provincial Park and is protected as wildlife under Provincial Parks legislation, but there is no active protection or management specific to the moth. Two of the colonies in Saskatchewan (Burstall) and Alberta (Bindloss) are located on privately owned lands, the third (Pakowki Lake, AB) on leased provincial land.

TECHNICAL SUMMARY

Schinia avemensis
Gold-edged Gem Héliotin d'Aweme
Range of Occurrence in Canada: Prairie Ecological Area, southwestern Manitoba to southeastern Alberta (MB, SK and AB).

Extent and Area Information	
• *Extent of occurrence (EO)(km²)* Area of polygon as per COSEWIC 2003 (including all extant sites in Canada)	70,500 km^2
• *Specify trend in EO*	significant past declines; stable over short term
• *Are there extreme fluctuations in EO?*	probably not
• *Area of occupancy (AO) (km²)* Conservative estimate of occupied habitat as per 2004-5 observations	approx. 1.5 km^2 total at 4 extant sites (max. potential AO =~ 6 km^2)
• *Specify trend in AO*	decline or stable
• *Are there extreme fluctuations in AO?*	none known
• *Number of known or inferred current locations*	2 populations at 5 sites
• *Specify trend in #*	probably stable
• *Are there extreme fluctuations in number of locations?*	none known
• *Specify trend in area, extent or quality of habitat*	severe long-term historic decline; slow decline or stable at present.
Population Information	
• *Generation time (average age of parents in the population)*	1 year, longer diapause over more than 1 year is possible
• *Number of mature individuals*	unknown; estimate in the range of 700-6,000
• *Total population trend:*	slow decline or stable
• *% decline over the last/next 10 years or 3 generations.*	unknown; probably stable
• *Are there extreme fluctuations in number of mature individuals?*	probably, but no data to measure
• *Is the total population severely fragmented?*	yes
• *Specify trend in number of populations*	probably stable
• *Are there extreme fluctuations in number of populations?*	none known
• List populations with number of mature individuals in each:	Spirit Dunes, MB – 500-5,000 est. Burstall SK (unknown) - Bindloss & Pakowki AB 200-1,000 est.
Threats (actual or imminent threats to populations or habitats)	
Stabilization of active sand dune habitat by native and introduced vegetation due to largely natural processes, probably accelerated since settlement due to suppression of wildfires.	
Rescue Effect (immigration from an outside source)	
• *Status of outside population(s)?* **USA:** Probably stable	
• *Is immigration known or possible?*	No

• *Would immigrants be adapted to survive in Canada?*	Possibly but unlikely
• *Is there sufficient habitat for immigrants in Canada?*	Yes
• *Is rescue from outside populations likely?*	No
Quantitative Analysis	
Current Status COSEWIC: Endangered (2006)	

Status and Reasons for Designation

Status: Endangered	**Alpha-numeric code**: B2ab(iii)

Reasons for Designation:

This moth is a habitat specialist that needs dunes or blow-outs with populations of its sole larval host plant. It is known from only two small populations in Canada and two in the United States. Large-scale decline in active dune habitat over the past 100 years has likely resulted in a corresponding reduction in the moth. Only very small, scattered, isolated patches of suitable habitat, totalling approximately 6 km^2, remain. They are threatened by habitat loss in the form of stabilization of active dunes by both native and introduced vegetation and by overgrazing of their larval host plant, which severely impacts small, isolated populations of the moth. The closest population of the moth in the United States is about 1,200 km to the south in Colorado, so immigration of individuals into the Canadian population is not possible.

Applicability of Criteria

Criterion A: (Declining Total Population): Not applicable, no decline data

Criterion B: (Small Distribution, and Decline or Fluctuation): Although the extent of occurrence is large, the area of occupancy is smaller than 500 km^2 (known AO is approximately 1.5 km^2; max potential AO is approximately 6 km^2) – B2 the total population is severely fragmented with the species known to occur as 2 populations spread over 5 sites – (a) the area and quality of suitable habitat are continuing to decline – (b)(iii) but there is no evidence for extreme fluctuations

Criterion C: (Small Total Population Size and Decline): not applicable, no decline data and insufficient information on population structure

Criterion D: (Very Small Population or Restricted Distribution): Meets Threatened under D2. The total population occurs at a restricted number of locations (2 populations at 5 sites) and the area of occupancy is very small and restricted (max of approximately 6 km^2) such that the species appears to be prone to the effects of human activities and stochastic events.

Criterion E: (Quantitative Analysis): not applicable, no data.

ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED

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Thanks are also due to the numerous provincial government staff members in both Saskatchewan and Manitoba who assisted by providing research permits and access to lands in their care. In particular, I would like to thank the staff at Spruce Woods Provincial Park for their cooperation during fieldwork by providing keys and access. Earlier versions of the report were reviewed by members of the Arthropods Specialist Subcommittee of COSEWIC and by federal and provincial government staff from the range jurisdictions. Theresa Fowler coordinated the project and the peer review of the draft report, provided comments and suggestions and edited the report. Funding was provided by the Canadian Wildlife Service, Environment Canada.

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Gary Anweiler is a research associate of the University of Alberta Strickland Entomological Museum, a recognized authority on the noctuoid moths of Alberta and a sitting member of the COSEWIC Arthropods subcommittee.

COLLECTIONS EXAMINED

Strickland Entomological Museum (UASM), University of Alberta, Edmonton, AB
Royal Saskatchewan Museum of Natural History (RSMNH), Regina, SK
Northern Forestry Centre (NoFC), Edmonton, AB
Canadian National Collection of Insects, Arachnids and Nematodes (CNC), Ottawa, ON
Buffalo Museum of Science, Buffalo, NY
University of Guelph Entomology Collection, Guelph, ON
British Museum (BMNH) of Natural History, London, UK
Illinois State Natural History Survey, Urbana, IL
Natural History Museum of Los Angeles County (LACM), Los Angeles, CA
Michigan State University (MSU), East Lansing, MI
Great Lakes Forestry Centre, Sault Ste. Marie, ON
University of Manitoba, Winnipeg, MB
University of Michigan, Ann Arbor, MI
University of Minnesota, St. Paul, MN
New York State Museum, Albany, NY
United States National Museum (USNM), Smithsonian Institution, Washington, DC
Jim Troubridge personal collection
Gerald Fauske personal collection
Chuck Harp personal collection
Chris Schmidt personal collection

Appendix 1. Summary of specimen data for Gold-edged Gem

Country	Prov/ State	County	Locality	Date	Quantity*	Collection
CAN	AB		Medicine Hat	1939-08-13	1	UASM
CAN	AB		Red Deer River valley nr. Bindloss	2004-07-29	15	CNC; UASM
CAN	AB		Pakowki Lake dunes	2005-07-21	5	UASM; Harp
CAN	SK		Burstall	2004-08-06	1	CNC
CAN	MB		Aweme	????-07-27	1	USNM
CAN	MB		Spruce Woods P. Pk.; Spirit Dunes	2003-07-28	1	USNM
CAN	MB		Spruce Woods P. Pk.; Spirit Dunes	2003-07-28		Troubridge coll.
CAN	MB		Spruce Woods P. Pk.; Spirit Dunes	2003-07-28		CNC
CAN	MB		Spruce Woods P. Pk.; Spirit Dunes	2003-07-28		C. Harp
CAN	MB		Aweme	1905-07-31	7	USNM
CAN	MB		Aweme	1912-07-30	1	USNM
CAN	MB		Aweme	1911-07-12	2	USNM
CAN	MB		Aweme	1904-08-01	2	USNM
CAN	MB		Aweme	1903-07-27		BMNH
CAN	MB		Aweme	1903-07-27		BMNH
CAN	MB		Aweme	1903-07-27		U of Guelph
CAN	MB		Aweme	1904-08-01		U of Manitoba
CAN	MB		Aweme	1905-07-31		BMNH
CAN	MB		Aweme	1905-07-31		BMNH
CAN	MB		Aweme	1912-07-30		U of Man
CAN	MB		Aweme	1920-07-08		BMNH
CAN	MB		Aweme	1920-07-08		BMNH
CAN	MB		Aweme	1920-07-08		LACM
CAN	MB		Aweme?	1903-07-27		U of Man
CAN	MB		Treesbank	1910-07-20		BMNH
CAN	MB		Treesbank	????-07-17		BMNH
CAN	MB		Onah	1924-07-31		CNC
CAN	MB		Onah	1919-07-22		CNC
CAN	MB		Onah	1921-07-18		CNC
CAN	MB		Bald Head Hills, 13 mi n. Glenboro	1958-07-24	2	CNC
CAN	MB		Bald Head Hills, 13 mi n. Glenboro	1958-08-18	2	CNC
CAN	MB		Treesbank	1910-07-20		CNC
CAN	MB		Aweme	1905-07-31		CNC
CAN	MB		Aweme	1910-08-20		CNC
CAN	MB		Aweme	1927-08-06		CNC
CAN	MB		Aweme	1905-07-31		CNC
CAN	MB		Aweme	1903-07-27		CNC
CAN	MB		Spruce Woods P. Pk.; Spirit Dunes	2004-08-04	7	CNC;USNM
USA	CO	Alamosa	Great Sand Dunes Natl. Monument	18-Aug-65		BMNH
USA	CO	Alamosa	Great Sand Dunes Natl. Monument	18-Aug-65		LACM
USA	CO	Alamosa	Great Sand Dunes Natl. Monument	1968-08-01	2	CNC
USA	CO	Alamosa	Great Sand Dunes Natl. Monument	1965-08-18	11	CNC
USA	CO	Alamosa	Medano Ranch	1998-08-14		CNC
USA	CO	Alamosa	Great Sand Dunes Natl. Monument	2004-08-05	2	CNC
USA	CO	Saguache	Indian Springs Recreation Area	1999-08-10/13	6	? (fide C. Harp)
USA	CO	Weld	3 mi. n. Roggen	1990-08-21	2	? (fide C. Harp)
USA	CO	Weld	2 mi. n. Roggen	1999-08-15	2	? (fide C. Harp)

*Blanks indicate that the numbers of specimens are unavailable.

Appendix 2. Required contacts for information on species

Name of report contractor: Gary G. Anweiler
Species: Gold-edged gem *Schinia avemensis* (Dyar) (Lepidoptera, Noctuidae)

Name of jurisdiction	Name of contact(s) and date(s)
Canadian Wildlife Service	Dave Duncan Oct. 28, 2004 Martin Raillard November 24, 2004
Department of Fisheries and Oceans (aquatic species only)	Not applicable
Parks Canada	Not applicable
Provincial / territorial representative(s) corresponding to the range of the species	Dr. G. Court, Oct 25, 2004 (Alberta) James Duncan, Nov. 24, 2004 (Manitoba)
Conservation Data Centre(s) or Natural Heritage Information Centre(s) corresponding to the range of the species	MB CDC (Nicole Firlotte) June 8, 2004 SK CDC (Jeannette Pepper) Aug 23, 2004 AB ANHIC (Wayne Nordstrom) Oct 25, 2004
Wildlife Management Board(s) corresponding to the range of the species (species in British Columbia, Yukon, Northwest Territories, Nunavut or northern Quebec)	Not applicable
COSEWIC Secretariat for information on sources of Aboriginal Traditional Knowledge	Gloria Goulet, June 8, 2004
Recovery team (if one exists)	Not applicable