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THE WHEAT STEM SAWFLY

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The wheat stem sawfly is a native insect that lives in grasses in western North America. In the United States it has been found west of the Mississippi River to the Pacific and south to latitude 36°. In Canada it occurs in the prairie Provinces and most likely in British Columbia. Two other grass-mining species of the same genus occur in eastern North America. These were introduced from Europe, but neither has reached major economic importance.

The wheat stem sawfly, Cephus cinctus Norton, was described in 1872 from an adult collected in Colorado. In 1890, Koeble reared adults from larvae in grasses growing near Alameda, California. The first discovery of the larvae in wheat stems occurred in 1895 on a farm near Souris, Manitoba. Sawfly damage in wheat occured near Indian Head in 1896 and near Moose Jaw in 1897. Intermittent damage continued to occur in wheat in Manitoba and Saskatchewan, but the infestations seldom appeared at the same place twice.

At first, the sawfly continued to infest its native grass hosts in preference to wheat. In 1906, when the grasses in Manitoba were very heavily infested with sawflies, the wheat and rye crops adjoining the grasses were only lightly infested. In 1907, however, the wheat and rye crops were heavily infested. The sawfly had developed a preference for wheat over its native hosts. All of the bread wheats and spring rye were ideal hosts.

By 1909, the sawfly was widespread in wheat in North Dakota and in 1910 a heavy infestation occurred in a wheat field near Claresholm, Alberta. The infestations continued to expand and, in 1921, the sawfly caused losses of 5 million dollars in Manitoba and Saskatchewan. It became a major pest in the Drumheller area in 1926 and by 1933 the area of infestation had expanded south toward Lethbridge.

The increased importance of the sawfly as a pest of wheat was directly related to changes in agricultural practices. Even after the sawfly had developed a preference for wheat and spring rye, its infestations remained discontinuous. Deep fall plowing buried the larvae and prevented the adults from emerging. Oats, which are immune to sawfly attack, were grown in rotations with wheat to provide feed for horses, the main motive power on the early farms. The only available varieties of wheat matured late and thus favored the increase of sawfly parasites. Periodic outbreaks of wheat stem rust destroyed the sawfly larvae as well as their host plants.

As the numbers of farm tractors increased, the planting of oats decreased. Cereal breeders developed early-maturing, rust-resistant wheats that relieved the sawflies of attacks by parasites and by stem rust. Agronomists showed that shallow tillage was better than deep plowing but, with the widespread use of shallow tillage, the sawfly larvae were not longer deeply buried in the soil and adult emergence increased. Because of drought and soil drifting, farmers were advised to grow their wheat in narrow strips interspersed with summerfallow. The narrow strips were much better than the large blocks of wheat for the sawflies and they increased accordingly. Farmers that had lost only one crop to soil drifting in 30 years were now losing the equivalent of one crop evey three or four years to the sawfly.

By 1938, yearly losses to sawfly in the Canadian prairies amounted to 20 million bushels of wheat, with similar losses in Montana and North Dakota, and smaller losses in South Dakota, Wyoming, and Nebraska.

In 1946, the first sawfly-resistant wheat, Rescue, was licensed, and it soon became the second-most commonly grown wheat in southern Saskatchewan and Alberta. Sawfly infestations, however, continued at a high level. In 1954, an unusually wet August and a widespread outbreak of 15B stem rust caused a drastic drop in the sawfly population from which it never fully recovered. In recent years, however, sporadic infestations have again started to reappear.

Norman Criddle in Manitoba, who began studies of the wheat stem sawfly in 1907, and C. N. Ainslie in North Dakota, who began in 1911, provided research findings that were fundamental to our knowledge of the sawfly. Sawfly research began at Lethbridge in 1927 with Hod Seamans and George Manson followed in 1930 by Chris Farstad, who was to play the major role in the development of controls for the sawfly and who was to receive a Gold Medal from the Entomological Society of Canada for his research. Other entomologists involved in sawfly research were Larry Jacobson, Reg Salt, Chet Neilson, and Henry Hurtig at Lethbridge; and K. M. King and Bob Glen at Saskatoon. Farstad also worked closely with the two cerealists at Swift Current, Shorty Kemp and Arne Platt, who were responsible for producing the first resistant wheats.

In the immediate post-war period at Lethbridge, Margaret Mackay studied the cytology of the sawfly, Ruby Larson and Mac MacDonald studied the cytogenetics of sawfly-resistant wheat, Norman Church studied sawfly diapause, Bud McGinnis and Bob Kasting studied sawfly nutrition, Bill Nelson studied the sawfly parasites, and Lloyd Peterson and I studied sawfly ecology and behavior.

We worked closely with cereal breeders at Lethbridge and Swift Current, including Mark Grant, Hugh McKenzie, and Stu McBean, and close liaison was maintained with entomologists and cerealists who worked on the sawfly in Montana and North Dakota.

Today, Hugh McKenzie, the spring wheat breeder at Lethbridge, and myself are the only ones still involved.

I will now show you a brief movie and I will then tell you some of the things that were learned about the sawfly.

OVIPOSITION

The sawfly flight begins about mid-June and lasts for an average of 12 days with the peak of the flight generally occurring between June 21 and 30. Oviposition occurs between 9:00 a.m. and 6:00 p.m. when the air temperature is between 20° and 36°C, and the wind velocity near ground level is below 8 km/hour. Most of the eggs are laid about mid-day within a 4-day period.

The female contains an average of 33 eggs. The number depends on the variety and growing conditions of the host in which the larva developed the previous year. In a study at five locations in Alberta and Saskatchewan, females from Nobleford, Alberta, averaged 21 eggs compared to 43 in females from Regina. Nobleford had suffered a drought and high temperatures the previous year, whereas Regina had adequate moisture during the growing season. Females that emerged from the resistant wheat Rescue average 27 eggs compared to 37 in those from the susceptible wheat Thatcher. In general, females from thin stems and resistant varieties are smaller and contain fewer eggs.

The female will lay only one egg in a stem, but many females will oviposit in the same stem. The infestations are always heaviest at the margins of the fields adjacent to the source of the infestation.

The female in preparation for oviposition lands on the stem and walks up to the uppermost leaf, turns around, and proceeds down the stem until she finds a suitable site. She remains head down as she inserts her saw-like ovipositor into the stem and deposits her egg in the lumen. When oviposition is completed, she flies on to another stem. The adults are weak fliers. They generally remain fairly close to the ground and do not migrate for any appreciable distance beyond the first suitable hosts. During windy periods they remain on the stems and leaves.

Wheat stems are divided into internodes, with most bread wheats having five internodes. During the course of stem growth, the basal internode elongates first, followed by the second, and so on up the stem. The top internode always elongates last. The meristematic tissue is located at the base of each internode. Thus, as the internode elongates, the tissues at the top of the internode become mature while those at the bottom continue to divide and remain tender and succulent until the elongation of the internode is complete.

Before the basal internode (Internode 1) has completed development, Internode 2 starts elongating, and the process continues with the progressively higher internodes. The internode is enclosed within a leaf sheath that develops from the node located at the bottom of the internode. Elongation of the stems occurs at about the same period as the sawfly flight, that is, from about mid-June to early July.

The female usually oviposits in the second-last developing internode so that, as the stem grows, the eggs are laid in progressively higher internodes. Until Internode 2 exceeds 10 mm in length, most eggs are laid in Internode 1. Most eggs are laid in Internode 2 until Internode 3 exceeds 30 mm. Internode 3 becomes preferred until Internode 4 exceeds 40 mm, and Internode 4 is preferred until Internode 5 exceeds 80 mm.

Within each internode, the eggs are laid first in the upper part of the internode, and as the upper part matures, the eggs are laid progressively lower down the internode. As a result, the eggs are laid in a succulent part of the internode that provides the moisture required by the egg for its initial development. During the five days the egg requires to mature, the associated stem tissue becomes relatively dry but the egg now no longer requires moisture in order to complete its development.

Early in the oviposition period the sawflies will infest the longest stems, but later as the stems begin to attain their full length of 500 mm and mature, the females will select the less mature stems of between 200 and 300 mm in length.

The females exhibit no significant preference for oviposition among varieties of wheat, and none of the varieties tested have been resistant to oviposition.

SEX RATIO

The male sawfly is haploid, with 9 chromosoms, and the female is diploid, with 18. Unmated females will produce fertile eggs, but the offspring, with the rare exception, will be males, although a race of sawflies did exist west of Lethbridge that consisted only of females. This race has since disappeared. The normal population consists of equal numbers of males and females.

The adult males emerge before the females, thus ensuring that most of the earliest emerging females will be mated. As the flight progresses, the number of males decrease and the proportion of unmated females increases. Most of the eggs laid at the start of the flight are fertilized and thus produce females, whereas most of the eggs laid near the end of the flight are haploid and thus give rise to males.

The earliest developing stems, which are infested first, produce a predominance of females and the later developing ones, which are infested last, produce a predominance of males. Consequently, when varieties of wheat that differ in their rates of development are grown together in a sawfly nursery, the most rapidly developing varities will produce mostly females and the late developing ones will produce mostly males. As a result, it was thought that a particular variety might favor one sex over the other. When, however, the sawflies have only one variety in which to oviposit, the sex ratio from that variety turns out to be normal.

Most sawflies that emerge from infested stubble in the margin of a field are females, whereas the proportion of males to females is higher among the individuals that emerge towards the center of the infested field. The reason for the change in sex ratio is that oviposition occurs first in the margin next to the source of infestation and progressively later toward the center of the field.

This observation has significance in relation to the effectiveness of trap crops. The traps are seeded around the margins of a growing crop and are thus infested first. As a result, destruction of the trap crop will destroy a disproportionate share of the females and thus reduce the potential for infestation in the next season.

THE LARVA

The larva is a voracious feeder that produces amylase, sucrase, and cellulase to enable the digestion of its food. Within 48 hours under artificial conditions it can reduce a three-inch section of stem to hypoderm and frass. In most wheat stems, which are hollow except for a solid plate at each node, the larva will tunnel throughout the stem, eating vascular tissues as well as the parenchyma. Occasionally, it will chew a hole out throught the stem wall and the leaf sheath.

The larvae drop more tissue than they ingest. By the time an infested stem is mature, its nodal plates will have been hollowed out and the enlarged cavity of the stem will be filled with so-called 'sawdust' consisting of dry excreted tissue and pieces of stem tissue.

The larvae have five instars, and in the last instar their sex can be determined by examination of the imaginal discs in the 9th and 10th abdominal segments of the male and in the 7th, 8th, and 9th segments of the female.

The larvae normally move upward through the stem, destroying other larvae and eggs as they go, until only one individual will remain alive in each stem. In the process, the larvae will also destory parasite larvae, and when heavy sawfly infestations occur, the parasite population may thus be severely reduced as the season progresses.

About mid-and late July, most larvae are in the upper internodes. Then they turn in the stem and move down toward the basal internode. At about ground level, the larva cuts a grove around the inside of the stem, places a plug of frass below the grove, and secretes a material through the labium to form a cellophane-like cocoon in which it spends the winter. At this stage its weight drops, and the total nutrients required for further development, reproduction, and other activities have been acquired.

The signal for the downward movement is provided by the transmission of visible and infared light through the stem wall. The greatest response of the larvae is to that part of the spectrum in the 500-600 millimicron range (green and yellow). In the absence of light, the larvae will not move downward and will cut the stems at any location in which they happen to be.

Other, less important, factors in the downward movement are gravity and stem moisture. The larvae are also strongly oriented to the main axis of the stem so that, even if the stems are turned upside down, the larvae are unaffected and they will still move to the basal internodes before cutting the stems. Although the stems are generally cut at ground level, the larvae may cut the stems well above ground level if the soil around the stems is very moist or if the stems of their host plants remain green late in the season.

The date of cutting, on the other hand, is controlled by the amount of moisture in the stem. Cutting starts when the stem moisture decreases and the moisture content of the kernels falls to between 41 and 51%.

The larva that has responded properly to the various signals that govern its behavior is now well protected for the winter and early spring in a protective cocoon inside a section of the stem below ground. It is in a state of obligatory diapause that can be completed only be exposure to 10°C for about 90 days. Its supercooling point lies between -20 and about -28°C, and although it requires an environment containing about 12 to 15% moisture, it will not die until it loses 40% of its weight through desiccation.

In early May the larvae begin to enter the prepupal stage, and the first pupae develop in late May. The length of time required for the completion of development from the post-diapause larvae to the adult stage at 25°C is 20 to 30 days.

If the larva is exposed to 35°C or continuous light, it will reenter diapause that will require another 90 days at 10°C. A reinstatement of the diapause state occurred among many larvae across the prairies during the extremely dry winter and spring of 1937. Individuals exposed to high temperatures or light that do not reenter the diapause state become malformed prepupae and pupae.

After the adult develops, it chews its way out of the plug in the top of the stub and emerges to infest the new crop. Emergence is facilitated when the plug is moistened by precipitation.

ECONOMIC LOSSES

The larvae cause an average loss in yield of 17%, with higher losses occurring during dry growing seasons. In addition, the protein content of the kernels may be reduced by up to 1.2 percentage points.

This loss is the result of a combination of causes. When the sawfly flight is early, feeding in the stem will reduce the numbers of kernels. Later, the contiued destruction of the vascular tissue caused by the larvae tunnelling reduces the flow of nutrients to the head. Finally, the cutting of the stem by the larvae when the moisture content of the kernels exceeds 40% causes additional losses.

In addition to the loss in yield mentioned above, additional losses result because of the failure to recover the heads from the fallen stems at harvest. In thin crops, more of the cut stems fall to the ground and are not picked up. Only one head lost per square foot is equivalent to one bushel of wheat per acre. Only by early swathing of an infested crop can losses caused by failure to recover the fallen stems be prevented.

PARASITISM

Although nine species of hymenopterous parasites attack the sawfly, only one, *Bracon cephi*, has been of major significance.

Adults of *Bracon cephi* emerge at the same time as the adult sawflies and begin to oviposit between July 9 and 23. The adult parasite locates a sawfly larva in the stem, inserts her ovipositor through the stem wall, paralyzes the sawfly, and deposits an egg on it. The parasite larvae complete their development between July 24 and August 9 and form a cocoon in the stem. Between August 5 and 15 the adults emerge from the cocoon, chew a hole through the stem, emerge, and immediately start to parasitize sawfly larvae in uncut stems. The sawfly larvae already in the stubs usually escape being parasitized.

Thus, only if the crop matures late, will the second generation of parasite find enough sawfly larvae to maintain a good overwintering population. Moderate to high levels of parasitism depend on the crop maturing late in at least one year out of two. Grasses such as bromegrass that mature late normally provide a better environment for high rates of parasitism than do early maturing wheats, although up to 40% parasitism has been observed in wheat. A major factor in causing late maturity in wheat is a high level of precipitation in August.

The first generation of B. cephi is usually located in the upper internodes of the wheat stems. The second generation is located mostly in the lower internodes where they are unlikely to be damaged during harvesting. The overwintering parasite larvae develop high concentrations of glycerol, which protects them from freezing and against damage when they do freeze.

Attempts have been made both in Canada and the U.S. to introduce various species of sawfly parasites, but none were successful.

CONTROLS

The first recommendations for sawfly control included deep plowing and burning the stubble. It was soon found that the larvae were not destroyed by the burning and that, it they were affected at all, they would return to diapause. Furthermore, burning the stubble destroyed the overwintering parasites. Burning the infested stubble was soon abandoned.

Trap crops were recommended because of the observation that the infestations are always heaviest on the margins of the fields. A trap strip of wheat was planted around the crop with a bare strip of about 10 feet left between the trap and the crop. The trap strip was then swathed or destroyed in late July. The method was most effective with relatively low infestations and was used by many farmers.

Bromegrass was found to be useful because the sawfly larvae did not survive too well in the grass, which also encouraged the build-up of parasites. As a result, a successful campaign was instituted to encourage the planting of bromegrass as trap crops and in road ditches in many locations in the prairies.

Shallow tillage of the infested stubble was also found to have value in control. Larvae in the stubs that were exposed on the soil surface failed to survive the winter. Spring tillage was also effective if carried out after the larvae had entered the prepupal stage. Early exposure in the spring could cause many larvae to return to the diapause state. The one-way disc was the most effective implement in bringing the stubs to the soil surface and, it some instances, controls of 35 to 70% were obtained.

Rotations with immune crops such as oats, fall rye, and non-cereals or with resistant crops such as durum wheats and barley were also recommended.

In some instances, integrated programs involving the use of trap strips, shallow tillage, and rotations with immune or resistnat crops, and late seeding succeeded in reducing infestations from 85 to 3% in a single year. Such dedication to sawfly control, however, was uncommon, and easier means of control continued to be sought.

Tests conducted with insecticides as fumigants or fogs to control the adults were unsuccessful. Heptachlor at 1/2 or 1 pound per acre gave systemic control of the larvae, but the effect was erratic and the best control still left 35 to 45% of the larvae alive. Other systemic insecticides were tested but were ineffective.

Finally, in 1946, the first sawfly-resistant wheat was developed.

RESISTANT WHEATS

Both Criddle and Ainslie had pointed out that some durum wheat in some years were resistant to sawfly larvae. These were thick-walled or even solid-stemmed wheats, whereas the bread wheats were thin-walled and hollow. In Russia, a solid-stemmed durum was found to be resistant to the European stem sawfly.

In 1929, Kemp, the cereal breeder at Swift Current, obtained 38 solid-stemmed bread wheat varieties from New Zealand. One variety, S-615, was found to have the highest level of sawfly resistance. It was crossed with Apex, a rust-resistant variety developed by the University of Saskatchewan, and in 1932 a cooperative testing program was established between the cerealists at Swift Current and the entomologists at Lethbridge.

The lines under test were wiped out by a drought in 1937, and Platt took over the breeding program. A cooperative testing program between Platt and Farstad was established, and in 1946 a line developed from a cross between S-615 and Apex was licensed as Rescue. Although it was not a top-quality wheat, it was widely used. The growers in northeastern Montana sponsored a dinner for Farstad and Platt in appreciation of their success. Another sawfly-resistant wheat, Chinook, from a cross between S-615 and Thatcher, was released in 1951. Although it had high quality, it was not nearly as resistant as Rescue.

Three other varieties have since been developed. Cypress was very susceptible to root rot, Canuck is more resistant to root rot, and the latest variety, Chester, is the most resistant to root rot. All three have about the same level of sawfly resistance as Rescue. In the meantime, detailed cytogenetic studies had identified the various chromosomes in Rescue and S-615 that carried the genes for stem solidness.

All of the sawfly-resistant wheats suffer from the same drawback. Under certain environmental conditions they will lose all or most of their resistance and, because of this variability, studies of the nature of resistance were continued.

NATURE OF RESISTANCE

In field studies at Lethbridge, conducted for 26 year, Rescue had adequate resistance (under 20% cut) in 9 years, moderate resistance (20-39% cut) in 5 years, and inadequate resistance (over 40% cut) in 12 years. It is evident that a more stable resistance would be highly desirable.

Stem solidness is directly related to sawfly resistance. When Rescue is highly resistant, the lower three internodes, at least, are mostly filled with pith. Generally, any hollowness that develops occurs in the top of the internodes, and usually the top two internodes have longer cavities than the lower internodes. Hollowness in Rescue can be induced by shading the growing plants for various periods.

Eggs and larvae in the hollow parts of Rescue survive as well as in susceptible hosts. The mortality occurs when the larvae move into the solidly filled parts of the stems.

Eggs laid in the solid parts of the stem may not hatch and the first-instar larvae in the pith may not survive. However, the effects of the pith on both larvae and eggs differ not only between years but also between internodes of the same stems in any one year. The mortality of the eggs laid in the pith of Rescue varies from 3 to 55% between years.

The most important effect of the resistant varieties, however, occurs toward the end of the growing season. During the growing season with the high levels of infestation, the number of living individuals in both resistant and susceptible wheats remain about equal until the stems begin to mature, and at that time the major mortality of the sawfly larvae occurs.

Resistance is not caused by a nutritional deficiency: the stems of resistant and susceptible wheats contain equal amounts of soluble carbohydrates and nitrogen. The pith of Rescue, however, dries more rapidly than that of the susceptible variety Thatcher, and by mid-August the pith of Rescue contained 26% moisture compared to 43% in the pith of Thatcher.

Current indications are that the pitch in Rescue may be detrimental to the eggs because of excess moisture early in the growing season, and later it becomes so dry that it causes desiccation of the larvae.

Although shading Rescue reduces stem solidness, it increased the susceptibility of Rescue but not to the extent expected. However, when field-grown Rescue was covered for two weeks with a filter that removed the visible radiation only in the 500-725-millimicron range, the resistance of Rescue was considerably reduced. Untreated Rescue averaged 17% cutting compared to 48% in the treated plots.

The resistance of Rescue under field conditions is not related to the numbers of hours of bright sunshine during June, which is considered the critical period for determination of resistance. There is evidence, however, that the number of rainy days in June may be the determining factor, with increased numbers of rainy days causing a decrease in resistance. Measurements of the visible spectrum outdoors on a rainy day showed that most reduction in light occurred in the 500-725-millimicron range, the same range that was most effective in reducing resistance in the tests using various light filters.

There is some indication that variation in resistance may be related to relative amounts of certain plant hormones in the stem. The application of gibberellic acid will cause the sawfly-susceptible Thatcher to become as resistant as Rescue in some years. It was found that the environmental conditions that caused a breakdown in Rescue resistance also prevented gibberellic acid from inducing resistance in Thatcher.

However, the nature of resistance to the wheat stem sawfly remains unknown, and the cause or causes of the breakdown of resistance remain to be defined.

SAWFLY RACES

The possibility that a strain of sawfly able to overcome host plant resistance is a concern. However, sawfly reared exclusively on Rescue under cages decreased from 2,000 individuals to 1 within 5 years, indicating that a super strain of sawfly is unlikely to develop. Nevertheless, strains of sawflies differ in their abilities to survive in a resistant durum wheat. Sawflies from the Lethbridge area were more successful in surviving in Golden Ball than were those collected from Regina (44% compared to 27%).

POPULATION DYNAMICS

A field study of population dynamics not yeat analyzed suggests that the current resistant wheats would have to be grown for at least three years in order to reduce a heavy sawfly population to a level that would not cause a significant infestation in a susceptible wheat. This was based on the finding that a population of adults from a crop in which 7 to 9% of the stems were cut by the larvae was able to produce infestations ranging from 60 to 80%.

This could explain why sawfly infestations remained at a high level for 10 years after the introduction of Rescue. It was only when the weather conditions produced a catastrophic drop in the sawfly population that the outbreak that had lasted so many years finally came to an end. Thus, the current resistant varieties should probably be regarded more as crop protectants rather than the means of obtaining population control.

SUMMARY

The wheat stem sawfly provides a fine example of a problem that was created by our need to produce a large amount of food in the most efficient manner that we could. We provided unlimited quantities of food through our monoculture of wheat. Once the sawfly was persuaded that wheat was better than its native host plants, we changed the wheat and our cultural practices to encourage a population explosion.

The solution of the problem that we created is an example of successful cooperation between scientists of different disciplines. That we are able to alleviate the problem without using insecticides or extra energy is an advantage not encountered in the control of most of our insect pests.

The sawfly is, in many ways, a cooperative insect. It is easily collected and stored, and it is easily handled in the field. At our nursery developed on virgin prairie about 12 miles west of Lethbridge we have been able to maintain a population of about 1.4 million sawflies from the original population that we introduced at the rate of about 60,000 per year for four years starting in 1960.

During the past 70 years we have learned many things about the sawfly -- some of them pretty intimate -- and yet some mysteries still remain. We still do not know the nature and causes of variability of sawfly resistance nor the reason for the failure of the population to recover from its crash of 24 years ago.

Agricultural practices are continuing to change with the newest development being the use of zero tillage. This or other developments could create an environment in which the sawfly could again flare up. We whould be better prepared than we were 40 years ago.

However, a recent booklet on Alberta insect pests did not even mention the wheat stem sawfly*, and the new generation of farmers and District Agriculturists know little of the sawfly and its control. They may never have to learn, but I woul not bet on it.

*(Ed. note: This oversight will be corrected in the next edition of "Insect Pests of Alberta".)

ESA - ESS Meetings - Lethbridge, 19 - 21 October 1978

W.J. Turnock, President-Elect, ESC

Where is the ESC going in the next few years?

WHERE HAS IT BEEN?

In his President's Report, given 22 August 1978, Bill Wellington notes that the ESC, like other scientific societies, was formed to provide opportunities for people with similar interests to meet and talk about their research. The publication of a journal is a logical extension of this objective, which enables members to reach a larger, international audience and to preserve their wisdom for posterity.

WINDS OF CHANGE

In the past ten years a number of factors have forced the ESC away from its traditional posture and toward a more activist role. These factors include a general anti-intellectualism in governments and the media, tight budgets, and a trend toward research management by people who don't understand research. These pressures have resulted in the ESC becoming involved in "umbrella societies" (BCC, SCITEC), writing letters to government ministers and departments, and preparing studies related to the status of entomology in Canada.

NOW AND IN THE FUTURE

1) The Society has begun and must continue to act as a national focus in entomology to ensure that studies appropriate to Canada are carried out; that the resources for such studies are available; and that we do not get shafted by short-term planning (government or university). "Contracting out" is an example of poor planning and execution. No one likes this process, conceived by Treasury Board, and the present methods of execution are a hodge-podge of hasty ad-hocery, bureaucratic rigidity and social scientists' misconceptions of the needs of biological, as opposed to industrial, research. Nevertheless it is here, and here it will remain, whether we like it or not. The form of contracting out and how beneficial - or how harmful - that form might be for biological research will be partly up to us, and societies like us.

As a national focus in entomology the Society must give immediate attention to the following areas:

a) the Biological Survey. This Survey got off to a tremendous start with the DSS Contract and I believe that we will get funding to ensure its survival for another year and one-half. It is an important step - a milestone - in the history of entomology in Canada. It has had a lot of growing pains but it has demonstrated that entomologists in Canada can be recruited to perform a specific function. Whether they be in universities, industry or government, they are ready to lend their expertise to researching a common goal. As a Society we must ensure that the initiative undertaken is not lost and that our Society show the government and other Societies what can be done with a concerted effort on a national basis even with a small number of dollars.

b) Economic Importance of Entomology. All of us working in entomology know that we pay for ourselves many times over by our economic returns to society. This has been recognized otherwise we would not have been hired. We have seen a lot of attrition in entomology in Canada during a time when our numbers should have been growing. The main reason for this attrition, I suggest, is that we have not documented the value that we give to the public. The easiest way to document this value is in economic terms and this is the best possible leverage to provide politicians and others concerned with research planning. There is no way, given the present resources in entomology in Canada and the disparate nature of our planning, that the economic value of entomology to Canada will be determined by other groups. I suggest that the Society should mount a campaign in a style similar to that of the Biological Survey in which we solicit the support of entomologists across Canada who will identify losses caused by insects and the savings effected through their control. I am sure that if we had this kind of data available, research in entomology would look awfully good to budget planners in relation to research in most other fields. I suggest we do this for entomology very soon, before some of the other professions do it and we will be left holding an empty bag.

c) Manpower and Financial Needs. This is really a part of the discussion above but we have contributed important studies - on manpower in Canada, on research funding in universities, and on the flow of information between research and extension. It is important that we maintain an overview in these areas and insist that improvements be made.

Armed with documentation on cost benefits of entomologists to Canada, I am sure that we can make some significant strides both in improving the funding for entomologists working in the field and also the number of entomologists in Canada.

d) We need a higher level of professionalism in our Society. As Bill Wellington suggests, we have not been "Kentish vicars" but we have been preceived to be so. We need to run our Society and conduct our daily affairs in a more professional way if we are to command the respect and the support of today's public.

2) The Society should serve all of its members equally. This should go without saying but there has been a feeling on the part of some of our members that we have leaned too heavily toward the University sector. Whether or not this is true, if it is perceived to be true, then there is a need to do something about it. One example is the NRC application on page charges a few years ago when this dealt only with university faculty. Our association with BCC is perceived by some as an example. There may be other instances and if so, it would be nice to know about them.

3) The Society should be working as a team with its affiliated societies. The national Society can lend its support on local issues but perhaps more importantly it can deal with national issues that are of concern to the affiliates. Both the ESC and the regional societies must work to improve cooperation.

I think this partnership will be especially important in the future if provincial governments move towards more involvement in funding entomology and in specific areas such as Pest Management. In these cases it will be necessary for professional entomologists to work closely with provincial extension personnel.

4) The Society cannot depend entirely on volunteer help in the future. Volunteer help is the mainstay of most professional Societies and the Entomological Society of Canada has done well in terms of obtaining effective volunteer services from a wide and diverse group of entomologists. This approach has been extremely effective for solving some problems but much less effective at others.

It seems to me essential to minimize the ebb and flow that occurs with short-term Presidents, short-term Committees and all of the other annual and biannual appointments that we make. One approach would be to establish a central office with an Executive Secretary to work full-time in the interests of the Society. In no way do I suggest that we lessen the involvement of members in bringing about this change. Rather I suggest that we provide an ongoing study centre for the Society wherein the issues can be recognized and the memberhsip can be canvassed for their views on specific questions at any time. In addition, such an office can obtain opinions from a selected group of individuals to deal with a specific topic. It gives much greater flexibility that we now have with ongoing committees that function more to maintain a watching brief that to bring any great amount of expertise to a particular topic.

ESA - ESS MEETING

PRESIDENT'S ADDRESS

Dr. Peter Harris, President
Entomological Society of Saskatchewan

It is a pleasure for the Saskatchewan Entomological Society to be a part of your meetings this year.

Our Society is small - thirty-three members of which seventeen live in Saskatoon, six in Regina and most the remainder in other parts of Canada. With this number of people, most have served on the executive in recent years and have to participate at annual meetings by giving a paper. We get to know each other well, so it is a real treat to be exposed to some fresh ideas and faces.

One advantage of being small is that percentage participation in the Society is high. However, it takes all the annual memberhip dues to reimburse the delegate to the Canadian Entomological Society for his room and board. Thus with the present financial arrangements we are close to the minimum size at which we can function financially.

I despair of increasing our membership with amateurs. Amateur entomology is not a Canadian tradition and even the National History Societies in the country largely want to be entertained rather than actively participate. I think our best chance to maintain membership is to keep retired members active and interested.

ABSTRACTS OF SUBMITTED PAPERS BY MEMBERS OF THE ENTOMOLOGICAL SOCIETY OF ALBERTA

THE DISTRIBUTION AND ABUNDANCE OF ADULT STONEFLIES (PLECOPTERA) ALONG THE BOW RIVER, ALBERTA

Bob Mutch
University of Calgary
Dave Donald
C.W.S.

Adult stoneflies (Plecoptera) were collected from 17 sites along 346 km of the Bow River. Of the 58 species collected in the study are 43 were relatively common. Although a few species were found throughout much of the study area, most species had comparatively narrow distributional limits. For at least 5 km below a hydroelectric dam and for 25 km below a city sewage outfall both the species diversity and abundance of adult stoneflies was greatly reduced.

PRESENCE OF THE STRIPED FLEA BEETLE IN THE BOREAL FOREST

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107 Science Crescent, Saskatoon, Sask. S7N 0X2

Trapping studies with allyl isothiocyanate traps have shown that the striped flea beetle (Phyllotreta striolata (F.)), a pest of parkland rape crops, is present in substantial numbers in the boreal forest of northern Saskatchewan. Attempts to determine the host plants of these beetles in the forest have yet to establish their major food source, although feeding on scattered native crucifers and roadside pepper grass plants, and attraction to various mosses, have been observed. Although it seems likely that the striped flea beetle can pass through its complete life cycle in the forest, immature stages or newly emerged adults have not yet been found and the possibility of migration between parkland and forest is being examined. Seasonal catch curves were about what one would expect for this species, except that catches from late July to freeze-up were lower than expected. Studies of the striped flea beetle in the forest, and of the importance of the forest population as a reservoir from which infestations could develop in parkland rape crops, are continuing.

STRUCTURAL TIMBER DAMAGED
BY LARDER BEETLES

H.R. Wong
Northern Forest Research Centre
Edmonton, Alberta

Restoration of the old limestone warehouse building constructed between 1835-45 at Lower Fort Garry, Manitoba disclosed numerous dead larvae, pupae and adults of the larder beetle, _Dermestes lardarius_ Linnaeus infesting the oak beams in the ceilngs of the first and second floors. The origin of the larder beetle at the Fort and their cause of death in the oak beams were discussed.

RECENT TRENDS IN BLACK FLY OUTBREAKS IN SASKATCHEWAN

F.J.H. Fredeen
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Recently _Simulium luggeri_ N. & M. replaced _S. arcticum_ Mall. as the major economic species of black fly in Saskatchewan. Both species now breed mainly in the north and south branches of the Saskatchewan River. In earlier years _S. luggeri_ larvae occurred only in small prairie rivers. Recently both branches of the Saskatchewan River became relatively shallow during the summertime, a condition that is apparently favorable to _S. luggeri_ larvae. Water stored for wintertime generation of hydro power controls 100% of the South Saskatchewan River and about 50% of the North.

NOTES ON THE SEASONAL DEVELOPMENT AND CHEMICAL CONTROL OF BOXELDER TWIG BORER IN ALBERTA - 1978

J.A. Drouin and D.S. Kusch
Northern Forest Research Centre
Edmonton, Alberta

In the Prairie Provinces the Boxelder Twig Borer, Proteoteras willingana (Kft.) is often a serious pest of shelterbelt plantings of Boxelder (Acer negundo L.).

Heavy infestations stunt and deform established trees by killing most of the current shoot growth.

The life history, damage and results of chemical soil drench tests, and foliar application carried out between 1973 to 1978 were presented. Plots techniques and treatment methods were outlined and discussed with appropriate slides. Good results were obtained with dimethoate (cygon 4E) as a soil drench followed by irrigation. Dimethoate (Cygon 4E) and diazinon (Basudin 50EC) gave good controls as foliar applications.

AN IMPROVED METHOD OF PRESERVING COLOR PATTERNS IN PINNED INSECTS

Stephen Berté
Department of Biology
University of Calgary

In the standard method for preserving pinned insects (i.e. air-drying), colors and color patterns often become obscured. A technique using acetone to facilitate drying is described which alleviates this problem and offers the added advantage that specimens can be pinned, dried, labeled and stored 48 hours after being collected.

LABORATORY STUDY OF *DROSOPHILA* POPULATION GROWTH

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University of Alberta

Laboratory-reared *Drosophila* cultures provided with a fixed and unrenewed amount of food exhibited a logistic growth pattern. When the quantity of food was doubled, the carrying capacity K of the cultures increased by only 20 percent. It is hypothesized that competition among females for oviposition sites and/or increased egg mortality owing to accumulation of waste products upon the medium and larval competition acted to prevent a higher K being reached. A comparison of the maximum rate of increase for the different populations showed the K values extrapolated from the logistic curve to be fairly accurate.

Adult flies showed a steady decrease in weight as the population increased. Larval density contributed to about 65 percent of this decrease, with the remainder of it likely resulting from modifications of the medium with population build up.

It is emphasized, in opposition to Sang (1950), that logistic growth in a *Drosophila* culture is real.

PITFALL CAPTURES AND DIVERSITY OF SPIDERS IN A WHEAT FIELD AND ITS BORDERS NEAR SASKATOON

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Saskatoon, Saskatchewan

C.D. Dondale
Biosystematics Research Institute
Agriculture Canada, Ottawa

Pitfall traps set in a wheat field and its borders captured a total of 47 species of spiders in 37 genera during a two-year period. Lycosids were predominant in the collections from both areas. The genus *Pardosa* (Lycosidae) was represented by eight species. The genus *Xysticus* (Thomisidae) was also represented by eight species but the number of individuals of each species collected was low. Species diversity and evenness were higher in the field-border collections than in those from the field. Seasonal distribution of captures of the two most abudant species in the collections, *Arctosa emertoni* Gertsch and *Pardosa nebraska* Chamberlin & Ivie were discussed.

A POSSIBILITY FOR GENETIC CONTROL OF TSETSE

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University of Alberta

A mutant male with salmon-coloured eyes (the trait is designated *salmon*, abbreviated *sal*) was found in our colony of *Glossina morsitans morsitans* and was mated with several females. The following breeding experiments (+ indicates wild-type eyes and Y = Y-chromosome) established that *salmon* is a recessive trait controlled by an X-chromosome gene: (+/+) (*sal*/Y); (+/*sal*) (+/Y); (+/*sal*) (*sal*/Y); (*sal*/*sal*) (*sal*/Y); (*sal*/*sal*) (+/Y). Less than 20% of the offspring of a *salmon* x *salmon* mating emerged from the puparia; these adults had very pale eyes and usually died within a few days. Adult emergence (as a percentage of expected emergence) from the puparia from the following crosses were: (+/+) (+/Y), males 91%, females 94%; (*sal*/*sal*) (*sal*/Y), males 13%, females 19%; (*sal*/*sal*) (+/Y), males 36%, females 99%; (+/*sal*) (*sal*/Y), males 83%, females 87%. The results indicate that the mutant *salmon* is, or is associated with, a maternally influenced, sex-linked post-pupal lethal which is genetically rescuable.

A simplified model of a tsetse population which assumes 8 generations per year, a maximum reproductive rate of 50% per generation, and an annual cycling of the population of five-fold has been created. Assuming that, at the beginning of each generation, fully competitive *salmon* males could be released into the population at a rate of 3 x the annual minimum number (= 60% of the annual maximum) it can be shown that within 2 years the field population would be reduced to 0.01% of the original density.

HOST SPECIFICITY AND SUITABILITY OF *LEMA CYANELLA* (COLEOPTERA: CHRYSOMELIDAE), A CANDIDATE FOR THE BIOLOGICAL CONTROL OF CANADA THISTLE (*CIRSIUM ARVENSE*)

D.P. Peschken
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The criocerine flea beetle, *Lema cyanella* (L.), native to Eurasia, was screened for its host specificity to Canada thistle (*Cirsium arvense* (L.) Scop.). While in the field in Europe, *L. cyanella* is restricted to Canada thistle almost exclusively, in the laboratory its host range expanded to include all of the ten species of *Cirsium*, *Canduus* and *Silybum* tested, all in the subtribe Carduimae. The only closely related economic plant species, gobe artichoke (*Cynara scolymus* L.) and safflower (*Carthamus tinctorius*) were unsuitable host plants.

Because of its wide distribution, strong extrinsic mortality factors in its native habitats, high egg laying capacity, its good capacity for dispersal, and its host specificity, L. cyanella seems to be a promising candidate for the control of Canada thistle. However, approval for permission to release the beetle in Canada, so far has been withheld out of concern for native Cirsium species.

Four other insect species released against two thistle species in both Canada and the U.S., and a fifth, a naturalized European thistle beetle, all have similar host ranges and have never been reported to damage native thistles. In fact, new and narrower guidelines for host specificity would terminate the biological control work against thistle and make much more difficult other biological control projects.

SOME ASPECTS OF BIOCONTROL IN THE USSR

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Agriculture Canada, Winnipeg

In late July 1978, a Canadian delegation consisting of Dr. John Borden, Dr. R.P. Jacques, and myself spent eighteen days visiting research institutes involved in biological control work in the Soviet Union. Trichogramma spp., used in innundative releases, are applied to about eight million ha of crops and orchards annually. A prototype factory in Leningrad demonstrated the efficient method by which millions of Trichogramma spp. are produced in "factories".

The institute of Kiev and Keshinev have research programs designed to maintain and improve the vitality and host finding ability of Trichogramma spp. used in the factories. Field collected Trichogramma are evaluated for characteristics needed in particular geographic areas. These "superior" strains are introduced into the factories and are replaced after three generations. Continual use of the same strain in a factory produced inferior Trichogramma. Other studies involve diapause and mortality during storage of prepupae over winter, host finding efficiency, timing and rate of release, and mechanical methods for distributing the parasites in the field.

We were impressed by the scale of this program and the effort being made to improve production, processing and application procedures.

SIMULATING DAMAGE TO STORED WHEAT INDUCED BY THE RICE WEEVIL, *SITOPHILUS ORYZAE*

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A modified version of the Leslie matrix is used to predict day-to-day changes in the density of weevil populations infesting stored wheat. If the number of individuals in each age class is multiplied by appropriate feeding and respiration terms, the model also can predict daily weight losses in wheat, increases in carbon dioxide and grain moisture content, and reductions in oxygen concentration induced by the insects. The model may be used to explore the ability of various methods of pest management - such as cooling or drying the grain - to reduce damage induced by *S. oryzae*.

INSECTS ASSOCIATED WITH MARIHUANA IN ASIA

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In fall 1977 I inspected cultivated and untended patches of marihuana plants (*Cannabis sativa* L., *C. indica* Lamarck) in Afghanistan, Pakistan, India, and Nepal. Insects were common on these plants, particularly in Afghanistan. I collected approximately 21 species of phytophagous insects, including thrips, aphids, leafhoppers, pentatomids, a beetle, flies, and several species of Lepidoptera. The thrips *Oxythrips cannabensis* Knechtel, and tortricid moth *Grapholitha tristrigana* Clements, known from Illinois, and the aphid *Phorodon cannabis* Pass., and agromyzid fly *Liriomyza cannabis*, from European localities, appear to be represented in this collection. The insects found scarred foliage and damaged seed bearing terminals, but did not cause significant reductions in plant yield or vigor. Approximately 11 species of predatory and parasitic insects collected, including ladybird beetles, syrphid flies, and parasitic wasps, were distinctly associated with marihuana plant insects.

EMBRYOGENESIS OF THE MOUTHPARTS IN EMBRYOS OF MACROSTELES FASCIFRONS

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The development of the piercing and sucking mouthparts of Macrosteles fascifrons nymphs was traced from Anatrepsis to Katatrepsis using the Scanning Electron Microscope.

The ectoderm of the gnathal segments evaginates to form appendage anlagen shortly after Anatrepsis. The labial buds appear first, followed by the maxillae, mandibles, antennae and labrum. Each maxillary anlage soon divides longitudinally to form a bilobed structure, the inner lobe forming the maxillary stylet, the outer lobe becoming incorporated into the head as part of the maxillary plate. Prior to Katatrepsis the labial buds which have started to fuse medially, and the maxillae, mandibles and hypopharynx shift cephalad while the labrum and antennae straighten caudally. Eventually, the labrum unfolds completely to cover the maxillary and mandibular stylets. Katatrepsis occurs and subsequent mouthpart development is internal.

Mouthpart development in Macrosteles fascifrons was then discussed in relation to Parsons' (1964) ideas on the evolution of the Hemipteriod Cranium. It was shown that each mandibular plate is very likely hypopharyngeal in origin as Parson believes. Whereas each maxillary plate is at least partially maxillary, developing, in part, from the outer lobe of each maxillary appendage. This observation does not support Parsons genal (parietal) origin for these plates.

QUAESTIONES ZOOGEOGRAPHIAE ALBERTENSIS; (I) THE POSSIBLE INFLUENCE OF WINTER WARMING BY CHINOOKS ON THE DISTRIBUTION OF THE ROCKY MOUNTAIN WOOD TICK IN SOUTHERN ALBERTA, (II) THE SAMPLING OF BITING FLY DAMAGE TO CATTLE IN RELATION TO BIOCLIMATIC ZONES

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Papers by Holland (1940) and Brown (1944), supplemented by some personal reconnaissance and enquire is from residents, indicate foci of tick abundance in southern Alberta, in the eastern foothills of the Rocky Mountains and in shrubby areas (mainly in coulees) east of the town of Milk River (lat. 112°), with a zone of comparative scarcity in between.

In some areas of the intermediate zone, the scarcity is attributable to cultivation and settlement, but other areas with apparently suitable vegetation and hosts (e.g., shrubby areas of the Milk River Ridge and coulees of many creeks and rivers) have no ticks or fewer than expected. Contributory factors may be the frequency of warm spells during winter and a low number of days with reliable snow cover, due to chinooks. Isohyets for these two parameters have recently been published by Environment Canada.

The warm spells could release the ticks from post-diapause quiescence too early in the season, or remove protective snow cover and expose the ticks to subsequent lethal low temperatures. As a further complication, an illustration is given of the longer persistence of snow in an area with drifting and shelter from a chinook. This is relevant to the presence of some nuisance ticks in Lethbridge, at the centre of the chinook effects.

In the second half of the paper, plots of cattle distribution are superimposed on vegetation maps reflecting bioclimatic zones. Rough calculations have shown the number of cattle (in millions) in each zone in Alberta to be about 1.9 in aspen parkland, 0.7 in prairie, 0.5 in foothills/subalpine and 0.3 in boreal forest. For surveys of biting insects and estimates of the economic losses they cause to the cattle industry, sample points might well be allocated on a stratified random basis, with samples in proportion to the number of cattle in each zone or subzone. Aspen parkland is likely to score quite high for number of bites per animals, so that the product No. of cattle x individual damage is likely to be highest in this zone. Local losses due to Simulium arcticum (Fredeen 1977) and mosquitoes associated with irrigation systems will raise the scores for boreal forest and prairie respectively.

STRUCTURE AND SENSILLA OF THE MOUTHPARTS OF THE BLACK FLY (DIPTERA: SIMULIIDAE) WITH REFERENCE TO BLOOD FEEDING

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A study of the sensillar complement of the mouthparts of the black fly Simulium venustum Say was undertaken with the aim of determining more exactly how the black fly goes about obtaining a blood meal.

From this work we propose that the blood-feeding reponse of this insect (after host location) has six major steps; 1) feeding site selection, 2) initial penetration of the skin, 3) consolidation of mouthpart position, 4) sampling of the blood, 5) active feeding, and 6) disengagement.

Initial penetration (step 2) and consolidation (step 3) are considered in some detail. Penetration is accompalished by the mandibles, the movement of these structures being mainly one of pro-retraction guided by the labrum and hypopharynx. Two types of mechanosensilla monitor mandibular movement during cutting. One of these is hair-like and located on the process of the gena to which the mandible articulates and the other is a peg-like sensillum found in fairly large numbers on the oral side of the labrum. Consolidation of mouthpart position is accompalished by means of the barbed laciniae of the maxillae. These structures are driven into the world by a complex set of muscles and articulations.

Twelve other types of sensillar are found associated with the mouthparts, these include chemosensilla, tactile sensilla, and chordotonal sensilla.

ALTERNATIVE SOLUTIONS TO THE DIFFUSE AND SPOTTED KNAPWEED MENACE

P. Harris

Traditionally biological control of weeds has been used as a last resort after all other methods of control have failed or on the basis of someone's intuition.

If investment is to be made in biological control it should be expected to give a good return and a better one than can be achieved by alternative methods of control. I will use diffuse and spotted knapweed for a discussion of various control options as they are species starting to invade the prairies.

Diffuse knapweed was almost certainly introduced with Turkestan Alfalfa seed from east of the Caspian sea, around Samakand and Bokhara. It was found in Washington State in 1907 and was probably introduced to the Kamploops region of B.C. around 1925. By 1940 it was present at most of the U.S. Canada border crossings and by 1972 infsted about 27,000 ha in the dry belt of B.C. largely excluding other vegetation.

Spotted knapweed is a species of western Europe and by 1972 infested around 3000 ha in B.C. and 800,000 ha in Montana. Its total range is increasing by about 10% a year at the present time.

Estimates of the seriousness of a rapidly spreading weed must take into account its eventual range and this is best determined from its European distribution. In Europe diffuse knapweed occurs on uncultivated grassland sites that experience a summer drought. The Canadian soils with this climatic regime are the brown chernozerms of the prairies and in British Columbia the Brunisols. The vegetation of these soils is the short-grass prairie and the Ponderosa pine-palouse grassland of B.C. In total we have 1.1 million ha in B.C., 2.5 million in Alberta and 3.9 million in Saskatchewan of uncultivated land in these soil zones.

Spotted knapweed prefers a slightly moister habitat. It would be expected to occur in the dark brown chernozerm of the Aspen Parkland of the prairies and at the dry edge of the Douglas fir forest in B.C. A total 3.2 million ha on uncultivated land in this zone in western Canada. As I am not sure if the weed will extend into the eastern part of this zone, my estimate of the total knapweed susceptible area in western Canada is 8.4 to 10.7 million ha.

The easiest option is to do nothing. Blue bunch wheat grass - rough fescue range in good condition in B.C. will yield about 500 kg/ha available forage whereas knapweed infested range yields only 60 kg/ha. With hay at $50/tonne the loss is about $24/ha but as most range is not yielding at near its capacity I have used a loss of $12/ha. On the basis of the present infestation the annual loss in B.C. is about $350,000 and if it extends to its limits it would cost about $13 million annually.

The yield of native short grass prairie in Saskatchewan is about 300 kg/ha of which 45% should be left as carry-over. The return is about $9/ha and knapweed invasion would reduce this to about $1/ha. The total loss to western Canada would be $58 million a year. I think this is a conservative figure and we would largely eliminate the range cattle industry and most wild life.

Knapweed can be controlled with picloram at 0.5 kg/ha. It can be applied by air and the area reseeded at $30/ha. Assuming knapweed spread over the whole of the susceptible area the cost of treatment with picloram would be $300 million and the pasture would have to be retreated at approximately 4 year intervals to prevent the return of the knapweed. As tame pasture yields 3-5 times as much as native prairie this is an economic proposition for individual farmers and the main loosers would be wildlife as plant diversity would be reduced over large areas.

Spot chemical control of knapweed with picloram costs up to $500/ha but is justified to prevent the spread of isolated patches of knapweed as found in Alberta.

Biological control is likely to cost $1.8 million, 23 scientist-years and requires the establishment of 7 agents on the two species of knapweed. In the long run this is far the most economic means of control.

To date we have established 2 seed-head flies that have reduced seed production by over 90%; however, the remaining 1500 seed/m^2 is enough to perpetuate the weed. A seed moth has been established on spotted knapweed in 1976 and appears to be established. There are other agents available in Europe and we are currently investigating a knapweed rust to determine if it is host specific enough to be released.

THE SIGNIFICANCE OF OZONOLYSIS REACTIONS TO PYRETHROID CHEMISTRY AND METABOLISM

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The isobutenyl group is present at C-3 of the chrysanthemic acid moiety in pyrethrin insecticides (e.g., pyrethrin I) and is metabolized extensively by animals. A chemical method was developed to cleave the isobutenyl group to give aldehydes. This is exemplified by the ozonolysis of 6-methyl-5-hepten-2-one ethylene ketal (1) which gave 4-oxo-1-pentanal ethylene ketal (2) in high yield. Aldehyde (2) was converted to cis-2-methyl-6-oxo-2-hepten-1-ol ethylene ketal (3) by the Wittig reaction. The trans isomer of 3 was prepared by oxidizing 1 with selenium dioxide. These procedures are relevant to obtaining authentic samples of cis and trans oxidized metabolites of chrysanthemic acids. The aldehydes from chrysanthemates, called caronaldehydes, serve as precursors to synthetic pyrethroid insecticides such as permethrin.

PREVALENCE OF HEAD LICE IN A RURAL ALBERTA SCHOOL

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The study was done at a rural school (grades 1 to 9) in Central Alberta with a population of approximately 450. Children attending this school were bussed from surrounding towns, farms and a nearby Indian Reserve. In February 1978, the temporal and occipital regions of 163 children (grades 1 to 9) were systematically examined for approximately 3 min./child. The prevalence of head lice was 10.4%. Of 18 factors surveyed only race (non-whites greater than whites), socio-economic status (most prevalent in lower groups), and place of residence (farm; town; reserve-farm; reserve-town; among whites, town children had a higher prevalence of lice) were found to be associated with head lice. Information regarding biological, hygienic, interhousehold and intrahousehold crowding, and socio-economic factors were acquired by questionnaire on direct examination. No intrahouseland crowding or hygienic factors were found to be significantly related to louse prevalence. A significant association between race and socio-economic status was found.

A second survey in May 1978, in which 405 children were examined less systematically for about 1 1/2 minutes each, revealed a head louse prevalence of 2.4%. (The prestudy prevalence of head lice was 2.7%.) Of 5 factors (age, sex, race, hair length and examiner) examined, only race was found to be significantly associated with head lice.

RHYNCHITES BICOLOR: PROVINCIAL INSECT?

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Adult R. bicolor appear on wild roses in Calgary in June and feed by chewing through the sepals and petals of the flower buds. They continue to feed in the open blossoms, presumably aiding in pollination. Copulation is observed in July and oviposition in the seed capsule follows. Three larval stages occur in the rose before the larva tunnels out in September. The winter is spent in the soil. Only one larvae develops in a seed capsule and some seeds are not damaged by the feeding of the larva. The insect occurs at low density in highly localized groups. This weevil is restricted to roses and its presence on the Provincial Emblem adds to the appearance of the flower.

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W. Charnetski

Nature's weed-eater
D. Peschken
W. Turnock
Model for puffed wheat
J. M. Hardman
B. Heming

OH ! CANADA
J. Ryan
F. Leggett
mass production
P. Wilkinson
Joe
J. Ryan

Richards Taylors Hills
M. Hardman
C. Holmberg
Ed. Hardman
B. Neill
Old Lethbridge Bug Lab Staff

Calgary Quorum
Banquet
Bruce Haig
S. Ashe
J. Sutcliffe
W. Taylor

J. Weintraub (President)
D. Craig (Sec'y-Treasurer)
C. Ewasechko
G. Pritchard
J. Lemiski
J. Weintraub
Insect Collection Competition

ENTOMOLOGY - ALBERTA - SASKATCHEWAN

ENTOMOLOGY - ALBERTA - SASKATCHEWAN

MINUTES OF SPRING EXECUTIVE MEETING, ENTOMOLOGICAL SOCIETY OF ALBERTA

An executive meeting of the Entomological Society of Alberta was held May 27, 1978, in Room L397A, Research Station, C.D.A., Lethbridge, 09:00 hours. Present were D.A. Craig, K.R. Depner, M.G. Dolinski, H. Philip, J.A. Shemanchuk, J. Weintraub and H.R. Wong.

1. Minutes of previous meetings: There were no errors pointed out in the 1977 Minutes. Moved for adoption, H. Philip/H.R. Wong, Carried.

2. Interim Treasurer's Report: D.A. Craig reported a current bank balance of $1273.47 (May 18), $18.76 petty cash and $52.00 unbanked membership dues, to give a total of $1344.23. This higher than normal balance reflects an attempt by the treasurer to collect membership dues prior to the October meeting.

3. Membership: D.A. Craig reported that there were 97 members listed, 3 honorary members and 2 library members.

   Arising from letters requesting information about membership in the ESA, the secretary was instructed to make up an application form, as well as prepare a statement regarding aims of the ESA for distribution to those requesting memberships.

   BUSINESS ARISING FROM THE MINUTES

4. Student Encouragement: The results from the questionnaire circulated by B.S. Heming to members regarding their public relations activities have been inserted in the 1977 Proceedings.

   Student Scholarship Fund - ESC: G.E. Ball suggested at the 1977 Annual meeting that the Executive Committee consider raising ESA dues by $1.00 which would then be given to ESC as a contribution to the Fund. The problems of raising the fees were discussed at length and it was felt not to be appropriate at this time. It was moved by H. Philip, seconded by K.R. Depner: "That contributions to the ESC Scholarship Committee be make on a voluntary basis at the annual meeting", Carried. The Sec./Treas. was instructed to have a strategically placed properly marked box at registration. This action would not preclude the ESA itself contributing, or other voluntary contributions.

   Contribution to Zoological Record: At 1977 Annual Meeting, D.A. Craig requested that enquiries be made as to when the next Zool. Rec. could be expected. A letter (13/II/78) from The Zoological Society of London outlined some of the problems Zoological Record has been having - mainly financial, caused by change to computer format. They hope to have Vol. III out by end of 1978, and to be up to date within a few years.

Biting Fly Institute: It was noted briefly that this issue is still active and that funds are being solicited for establishment of the Institute in Winnipeg.

NEW BUSINESS

5. Plastic Collection Boxes: H.F. Cereske wrote E. Becker ESC (Feb. 10, 1978) about when ESA would again be elegible for Student Encouragement Grants. E. Becker replied (April 18) that the original loan had been forgotten, but that since we raised the matter, it should be taken up with R. Trottier, Public Education Committee.

D.A. Craig wrote Trottier (April 25), but has had no answer.

6. The Ecological Reserves Act: Private Bill 202 (G. Stromberg, MLA) G. Stromberg had written (April 20, 1978) to ESA asking for support of his Bill. The Bill was discussed and although the basic principle to establish Ecological Reserves was agreeable, the bureaucratic outcome of such an Act was not.

It was moved by H.R. Wong, seconded by H. Philip that: - "The ESA support the Act in principle, but that certain administrative aspects of the Act could be better managed by existing institutions", Carried.

The secretary was instructed to write to G. Stromberg.

7. Entomological Society of Canada Annual Meeting: ESC had requested Presidents of regional societies to attend the Ottawa meeting in August. As J. Weintraub was not attending it was moved by H. Philip, seconded by K.R. Depner: - "That D.A. Craig be official ESA representative at the ESC meeting in Ottawa", Carried.

Entomological Society of Canada - Directors meeting; Feb. 1978: J.A. Shemanchuk reported on that meeting.

Of major interest were: -

(a) ESC will now not meet costs of Regional Directors attending annual meeting.
(b) ESC will develop an application form for new members.
(c) Annual meetings will be in Vancouver, 1979; Quebec City, 1980; Alberta, 1981; Toronto (Joint ESC - ES Amer.) 1982.

8. ESA - Other Activities: Mengensen of Olds had asked what the ESA did besides hold the annual meeting. This was considered a serious problem by the Executive and the discussion was wide ranging and involved consideration of student encouragement. It was suggested that students could visit the three entomological institutes in Edmonton under the auspices of ESA.

The media were to be alerted to forthcoming meetings. M.G. Dolinski agreed to attempt to set up in Southgate Mall an entomological "display" and "Insect Pest Centre" for one Saturday in July. He is to report his experiences to the ESA general business meeting. If successful the "display" might become an annual event.

9. Environment Council of Alberta: J.A. Shemanchuk reported on the Pollution Study Group of the Public Advisory Council of Envir. Council of Alta. There was general loss of initiative when the Environment Conservation Authority was reorganized to the present ECA. The Pollution Study Group was involved in two studies, one on air standards for vinyl chloride, the other on water pollution by feed lots. J.A. Shemanchuk recommended that that Ent. Soc. Alta. retain membership on the Public Advisory Council.

10. Honorary Membership in ESA: Nominations were brought forward and action was agreed upon.

11. Entomological Society of Canada Honours: Nominations for Gold Medalist, Fellows and Honorary Membership were discussed and action decided upon.

12. Insect Collection Competition: Since H. Philip resigned the Chairmanship to take the position of Editor there has been no Chairman. D.A. Craig assumed responsibility for notices, etc. M. Steiner would be approached to take the chairmanship.

    There was general discussion about the return for the amount of work required by this commitee. A general feeling of futility was noted. Moved by H. Philip, seconded M.G. Dolinski that: - "Serious consideration be given to disbanding the Insect Collection Competition Committee, to be replaced by alternative encouragements to amateur entomologists", Carried.

13. Annual General Meeting: The Ent. Soc. Sask. had agreed to a joint meeting. As many entomologists from Saskatchewan would be in Lethbridge the week of Oct. 16th for the Western Forum and associated Committees, dates for the ESA-ESS meeting were decided as Oct. 20 and 21st. Rooms in the new Agriculture Centre were already booked. There was to be no theme, but the probable program material might allow sections to be arranged. K.W. Richards was to be approached to be Local Arrangement Chairman. K.R. Depner agreed to handle liason with ESS. Other items were left in the hands of Lethbridge entomologists.

    The meeting was adjourned at 12:08 hrs. Moved H. Philip, seconded M.G. Dolinski - Carried.

D.A. Criag
Secretary/Treasurer

DAC: ieb

MINUTES OF FALL EXECUTIVE MEETING, ENTOMOLOGICAL SOCIETY OF ALBERTA

A meeting of the ESA executive was held October 19, 1978 at the Agriculture Centre, Lethbridge. Present were: D.A. Craig, M.G. Dolinski, B.S. Heming, H. Philip, J.A. Shemanchuk, J. Weintraub, and H.R. Wong.

1. The minutes of the previous executive meeting held May 27, 1978 were adopted. Moved by J.A. Shemanchuk, seconded by H. Philip.

2. D.A. Craig presented an interim financial report stating that there was a total of $1137.00 Society funds as of that date.

3. D.A. Craig reported on ESA membership indicating that there were 88 paid-up members. He had removed 14 names from the membership lists, those who had not paid for two or more years. There were three honorary members.

4. M.G. Dolinski and H. Philip reported on a "House Plant Pest Clinic" held in the Bay, November 2 - 4 under the auspices of the Entomological Society of Alberta. About 30 people visited the display, but few were interested in insect pests. The Bay may provide an honorarium to the ESA. The Clinic may be held again as The Bay showed interest. It was suggested that a similar clinic or display could be held in Lethbridge.

5. Membership was discussed and nominations for Honory Members would be solicited from the annual general meeting. Similarly for Honory Members and Fellows of Entomological Society of Canada. The nomination for Gold Medalist had been accepted by ESC.

6. D.A. Craig reported that the notice for the Insect Collection Competition had been sent out, but that as usual there was little response. M. Steiner had accepted position of Chairman of that Committee.

7. Regional Directors Report: Shemanchuk gave a brief report. The main point was that of cost of travel to ESC Board meeting. This item caused a brief discussion on other ways the Entomological Society of Alberta might be affliated with the Entomological Society of Canada.

8. Local Awards Committee: Ms. J. Lemiski, a student at the University of Calgary was announced as the only recipient of the 1977 - 78 ESA Prize in Entomology.

9. Environment Council of Alberta: J.A. Shemanchuk reported that his term of office on that council terminated January, 1978. He indicated his willingness to be reappointed and also his satisfaction with the council.

10. The meeting was adjourned on a motion by H. Philip, seconded by M.G. Dolinski, Carried.

D.A. Craig
Secretary/Treasurer

DAC: ieb

MINUTES OF THE 26TH ANNUAL BUSINESS MEETING OF THE E.S.A.

October 20th, 1978

The 26th Annual Meeting of the Entomological Society of Alberta was a joint meeting with the Entomological Society of Saskatchewan, held in the Agriculture Centre, Lethbridge, October 19-21, 1978.

1. Minutes: A.M. Harper moved, H.F. Cerezke seconded that "The minutes of the 1977 Annual meeting of the Entomological Society of Alberta be adopted as printed and circulated." Carried.

2. Interim Treasurer's Report: D.A. Craig reported a bank balance of $1,195.00 October 13, 1978. $186.00 had been paid out for the Proceedings of 1977. There was $18.76 petty cash giving a total of $1,213.76. Moved by B.S. Heming, seconded by W.A. Charnetski, "that the report be accepted." Carried.

3. Membership Report: D.A. Craig reported that there were 88 paid up members, 10 new members, plus three honorary members, for a total of 101 members.

4. Correspondence:

   Relevant correspondence was: -
   (a) Zoological Society of London explaining the current status of Zoological Record.
   (b) Ent. Soc. Canada regarding status of "loan" for plastic boxes.
   (c) E. Mengersen regarding other activities of the ESA.
   (d) R. Dallas regarding membership.
   (e) G. Pritchard regarding the winner of the ESA prize.
   (f) M.D. Sears regarding pamphlet produced by ESC.
   (g) G. Stromberg regarding the Ecological Reserves Oct. Bill 202.

   Action on this correspondence had either been taken by the Executive Committee or is basis of items later on the agenda.

5. Nominations: President J. Weintraub asked members to provide the executive with nominations, plus documentation, for Honorary Membership in the Ent. Soc. Alta. Members were further reminded that they should give thought to nominations for Honorary Membership, and for Fellow of the Ent. Soc. Canada, the Gold Medal and the Gordon Hewitt Award. Ent. Soc. Can. President - elect, Dr. W. Turnock, mentioned that the Ent. Soc. Alta. nomination for the Gold Medal had been accepted by the Ent. Soc. Can.

6. Student Encouragement Committee: The secretary explained that this ESC committee had published a brochure "Entomology in Canada . . .Career Opportunities" and also had supply of lapel buttons. These were available from Dr. M.K. Sears, University of Guelph, Chairman of that committee.

7. Ent. Soc. Can. Scholarship: B. S. Heming reported that there had been seven applications, the applicant from Guelph having won. He mentioned the high quality of the submissions. Funds for this scholarship have now increased sufficiently that two scholarships will be awarded in 1979.

   The members were asked to contribute individually. B.S. Heming reminded members that the scholarship was instigated by B. Hocking of this Society and that should not be forgotten. There was no motion from the floor for the Ent. Soc. Alta. to contribute to the scholarship fund.

8. Ent. Soc. Alta. Student Prize: G. Pritchard introduced the only winner and President J. Weintraub presented Janis Lemiski, University of Calgary, with a cheque for $50.00. A certificate attesting to the fact will follow.

9. Zoological Record: The secretary read some correspondence from the Zoological Society of London regarding the status of Zoological Record. Heming stated that there had been a marked improvement in production of this reference work. There was general discussion on its worthwhile nature. G. E. Ball moved, seconded by A.M. Harper that "The Entomological Society of Alberta contribute $25.00 towards the cost of producing Zoological Record." Carried.

   W.A. Charnetski moved, seconded by B.S. Heming "that the first part of the business meeting adjourn." Carried. (11:50AM)

   The second part of the business meeting was convened at 10:45 AM. Oct. 21st.

10. Report of Insect Collection Competition Committee: M. Steiner reported for this committee and the report is published in these Proceedings.

    M. Steiner moved, seconded by A.M. Harper "that the report be accepted."

    During discussion of the report W.G. Evans suggested that the student from Hinton be given special consideration. J. Ryan suggested that the competition be turned over to Olds Agricultural and Vocational College. However, it was generally felt that it is the Society's job to run the competition. Carried.

11. Status of Insect Collection Competition Committee: H. Philip commented there is much work and expense, but little return in numbers of collections from outside of Olds.

    H. Philip then moved, seconded by J.A. Shemanchuk, that "Consideration be given to disbanding the Insect Collection Competition Committee, to be replaced by alternative encouragement to amateur entomologists."

    During the discussion, J.A. Shemanchuk agreed in principle with the motion, but felt that other encouragements should be tried gradually. R.H. Gooding spoke against the motion as the alternatives had not yet been determined and that the competition should remain until that was done.

J. Weintraub replied that one alternative had been tried.

M.G. Dolinski agreed with R.H. Gooding's comments.

W.A. Charnetiki also felt that the alternatives should be discussed first.

S. Berte asked if the committee is really that much work.

M. Steiner replied that the mailing of 1,400 notices was arduous.

P.R. Wilkinson suggested that the motion should be put to one side so that alternatives could be dealt with first.

A. Schaaf wanted the motion tabled and spoke against stopping the Insect Collection Competition.

R.H. Gooding moved, seconded by S. Berte "that the motion be tabled." There was no discussion. Carried.

12. Alternative Methods of Encouragement: H. Philip reported on a "House Plant Pest Clinic" that was held in The Bay under the auspices of the Ent. Soc. Alta. Of some 30 enquiries only a few were for insect problems. The Bay is most interested in hosting more of these, or similar clinics. M.G. Dolinski mentioned other avenues such as country fairs and the Alberta Rural Safety Course. In the latter, children draw posters of various aspects of safety. The course is highly advertised. Perhaps the insect competition could be in the form of an essay or drawing.

P.R. Wilkinson asked whether the competition fell within the mandate of the Department of Entomology Extension Entomologist. D.A. Craig replied that the Department no longer had an Extension Entomologist because of Government financial restrictions.

E. Mengersen suggested that the collections from Olds could go on tour and further suggested contacting the 4-H Clubs. It was generally felt that the latter was of little use.

K.W. Richards commented that the Scouts in Lethbridge were encouraging insect collections.

Moved by R.H. Gooding, seconded by G.E. Ball, "that the executive contact the Alberta Safety Committee to include in their poster competition, safety in entomology."

There was no discussion. Carried.

Moved by M.G. Dolinski, seconded by H. Philip,"that the Chairman select a small sub-committee to look into alternative methods of encouraging amateur entomologists." There was no discussion. Carried.

J. Weintraub immediately appointed M.G. Dolinski. Accepted. M.G. Dolinski to appoint members as necessary.

Moved by R.H. Gooding, seconded by G.E. Ball "that the motion regarding alternatives to the Insect Collection Competition Committee be removed from the table." There was no discussion. Motion NOT CARRIED.

Moved by W.G. Evans, seconded by A.M. Harper, that "the entry in the junior section of the Insect Collection Competition be awarded a special prize of $5.00 to consist of collection boxes." Carried.

There was then some general discussion concerning how to advertise the Collection Competition. G.E. Ball maintained that the discussion was wasting time and the matter would be better left in the hands of a committee. A.M. Harper advised that an advertisement in the Lethbridge Herald would cover southern Alberta.

It was generally agreed that members should funnel suggestions to M.G. Dolinski and/or M. Steiner.

13. Common Names Committee: G.E. Ball stated that there was no report.

14. Environmental Conservation Authority Report: J. Shemanchuk as ESA representative reported. He commented that it seems to be an effective organization. The Pollution Study Group were studying the use of sewage effluent for irrigation. His term of office will expire in January 1979.

Moved by B.S. Heming, seconded by W.A. Charnetski, "That the report be accepted." Carried.

Moved by R.H. Gooding, seconded by B.S. Heming,"that J. Shemanchuk be reappointed to the ECA." Carried. Shemanchuk accepted.

It was pointed out that W.G. Evans was also a member of ECA, representing the University of Alberta.

15. Biting Fly Institute: W. Haufe reported that the University of Manitoba had been asked to resubmit their proposal for a Federal Government grant. The concept was well received by various government agencies and it was expected that funding for two years would be forthcoming.

Moved by H. Philip, seconded by B.S. Heming, "that the report be accepted." Carried.

16. Biological Survey of Canada: G.E. Ball reported that the Survey had completed its initial 18 month study and that there were three publications. It will continue with support from the National Museum of Canada and is producing an annotated list and bibliography of arctic insects.

Moved by G.E. Ball, seconded by H.R. Wong, "that the report be accepted." Carried.

17. Regional Director's Report: J. Shemanchuk presented his report which is printed in these Proceedings.

J. Shemanchuk moved, seconded by H. Philip "that the report be accepted." Carried.

18. 1981 Meeting of Ent. Soc. Canada: The Ent. Soc. Alta. had been asked by ESC to host a joint Ent. Soc. Alta, - Ent. Soc. Can. meeting in 1981.

Moved by J. Shemanchuk, seconded by R.H. Gooding, "that ESC be invited to a joint meeting with the ESA in 1981". Carried.

President-elect, W. Turnock of ESC asked the President of ESA to move on organization of the joint meeting. It was pointed out that there will be two changes of President between now and 1981.

Moved by J. Shemanchuk, seconded by B.S. Heming, "that the incoming 1979 Executive strike a planning committee for the 1981 joint meeting of ESA and ESC." Carried.

19. Nomination Committee Report:
R.H. Wong reported.

President	R.H. Wong.
Vice-President	W.A. Charnetski
Editor	H. Philip
Directors	K.W. Richards (1979 - 1981)
	P. Scholefield (1977 - 1979)
	M.G. Dolinski (1978 - 1980)
Regional Director	J. Shemanchuk (1977 - 1980)
Treasurer	D.A. Craig
Auditors	W.G. Evans
	R.H. Gooding

Moved by R.H. Wong, seconded by H.F. Cerezke "that the report be accepted." Carried.

Moved by N.D. Holmes, seconded by J. Shemanchuk, "that nominations cease."

Those listed were elected by acclamation.

20. Resolutions Committee
M.G. Dolinski reported as follows:

Whereas the success at the 26th annual meeting of the Entomological Society of Alberta can, to a large extent, be attributed to the following, be it resolved that letters of appreciation be sent to:

a) Mr. Bruce Haig for his entertaining and novel presentation on learning history through reliving the trek of the mounties from Fort Dufferin to Fort MacLeod.

b) The Director, Dr. J.E. Andrews, Agriculture Canada, Research Station, for providing accommodations and services for the meetings.

c) Alberta Sugar Company for providing funds to cover the honorarium to our guest speaker, and publication of our proceedings.

d) President, Entomological Society of Saskatchewan in appreciation of their contribution to the success of out meetings.

e) Dr. W. J. Turnock, President-elect, Entomological Society of Canada for his report and participation at this meeting.

Be it further resolved that a vote of thanks be tendered to the executive and members who were involved in the preparation of the meeting and program.

Moved by M.G. Dolinski, seconded by J.A. Drouin "that the report be accepted." Carried.

Moved by W.A. Charnetski, seconded by B.S. Heming "that the second part of the Annual General Business meeting adjourn." Carried. (Time 12:15PM)

D.A. Craig
Secretary/Treasurer.

DAC: ieb

Entomological Society of Alberta

Financial Statement for 1978

Receipts		Subtotals	Totals
Bank balance held in Edmonton Account January 1, 1978		$1333.67	
Petty cash, January 1, 1978		21.76	
		1355.43	$1355.43
Membership sales:	(1977) 2 @ $4.00	8.00	
	(1978) 57 @ $4.00	228.00	
	(1979) 6 @ $4.00	24.00	
		$ 260.00	260.00
Sale of 1977 and 1978 Proceedings to Faxon Co.		13.39	13.39
Bank Interest:	April 28	17.30	
	June 7	17.30	
	Dec. 21	11.93	
		46.53	46.53
Donation: Canadian Sugar Factory		150.00	150.00
Annual Meeting:			
Registration	67 @ 12.00	804.00	
Banquet	17 @ 8.00	136.00	
		940.00	940.00
Sale of liquour, etc.		186.10	
Refund of advance to local arrangement committee		23.15	
		209.25	209.25
Reimbursement of loan, U of A Ent. Dept: Dec. 21		269.75	269.75
Total Receipts for 1978			$3244.35

Disbursements	Subtotals	Totals
Entomological Society Alta. Prize, Univ. of Calgary		$ 50.00
Printing 1977 Proceedings		186.83
Donation to ESC Scholarship Fund (1978)		100.00
Donation to Zoological Society London (1977)		25.50
Donation to Zoological Society London (1978)		25.50
Reinbursement to Regional Director ESC.		32.00
Insect Collection Prizes		64.75
Annual Meeting:		
Honorarium	50.00	
Cash advance for local arrangement committee for mixer	200.00	
Reimbursement for food at mixer	61.60	
Banquet for 87 people	660.65	
	972.25	972.25
Postage and miscellaneous		
Postage	19.80	
Receipt books	2.85	

Bank Service Charge	0.20	
	22.85	22.85
Total Disbursements		1479.68

Balance Summary

Total Receipts	$3244.35	
Total Disbursements	1479.68	
Petty cash on hand December 31, 1978	15.91	
Bank balance December 31, 1978	1756.76	
Total Ent. Soc. Alta. funds December 31, 1978		$1772.67

Summary of Insect Collection Fund (loan) to Department of Entomology, Univ. of Alberta

Total loan (1976) for insect collection boxes	958.15	958.15
Reimbursement to ESA for sale of boxes		
1977	500.50	
1978	269.75	
	770.25	770.25
Value of loan outstanding December 31, 1978		187.90

Prepared by:

D.A. Craig
Sec/Treas.

Approved by ESA Auditors

W.G. Evans

C.H. Gooding

Report of the Regional Director

As Regional Director, I attended only one Governing Board meeting, the one held in Vancouver in February 1978. Due to pressures of work I was not able to attend the August meeting in Ottawa. Dr. D. Craig sat in for me at the meeting.

Annual Meeting

According to the Executive of the ESC, the annual meeting sponsored by the Entomological Society of Canada was a success and a substantial profit was realized.

Future Annual Meetings

1979 - Entomological Society of British Columbia will host the meeting at the Bay Shore Inn, Vancouver, October 2, 3 and 4.

1980 - Quebec Entomological Society will host the meeting in Quebec City.

1981 - Alberta Entomological Society has invited the ESC for a joint meeting.

Scholarship Fund

The Scholarship Fund is now in a position where two scholarships of $500 each can be awarded.

Regional Representation

Regional Representatives were not invited to the February 1979 meeting. This is on a one-time basis to conserve funds that were directed to some other project. Should regional representation become a financial responsibility of the Regional Society, a review of the function and need of such representation should be considered.

REPORT OF THE INSECT COLLECTION COMMITTEE

This year's committee members for the judging of the insect collections consisted of myself, Dr. Bert Schaber from the Lethbridge Research Station, and Mr. Clarence Peters from Saskatchewan Agriculture.

There were 11 collections submitted, 9 of which were from Olds College, one from Lethbridge, and one from Hinton. All entries except one junior were in the open competition, and although there were not as many entries as last year, the standard remained fairly high.

Results of the 1978 competition are as follows:

Open Competition

1st Prize	Wes Walker, O.A.V.C.
2nd Prize	Delane Adams, O.A.V.C.
3rd Prize	Grant Johannesen, O.A.V.C.
Highly Commended	Ron Burke, O.A.V.C.

Junior Competition

Commended	Michael Sorochan, Hinton

Marilyn T. Steiner
Chairman

LIST OF MEMBERS

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Chairman, Dept. of Entomology
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