

RAISON

**THE
NAMIBIAN WILD SILK PROJECT**

**PHASE TWO
FINAL REPORT**

REPORTING PERIOD

August 2001 to September 2002

SUBMITTED TO

THE NAMIBIAN WILD SILK STEERING COMMITTEE

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EXECUTIVE SUMMARY

Two species of moths viz. *Gonometa rufobrunnea* (Auirvillius, 1922) and *G. postica* (Walker, 1855) have been identified as potentially viable for the production of wild silk in Namibia. In the areas where *Gonometa postica* occurs in Namibia, there has over many years been a high incidence of livestock and wildlife mortalities attributed to the ingestion of the cocoons from these moths. In 1994, the Namibian Agricultural Union (NAU) requested the Ministry of Agriculture Water and Rural Development (MAWRD) to declare the moth species a national pest and called for its eradication. This was, however, found not to be viable.

Since 1994, various initiatives by MAWRD have focussed on ways in which to address the problem by investigating the possibility of establishing a wild silk industry in Namibia. A Pre-feasibility Study and Trial Purchase was conducted between September 2000 and February 2001 by CRIAA SA-DC (Centre for Research Information and Action in Africa, Southern Africa - Development and Consulting). A stakeholder workshop was then convened in February 2001 at which a decision to continue into Phase Two of the development of a wild silk industry in Namibia was taken. At that stakeholder workshop CRIAA SA-DC was requested to draw up a Plan of Action for the further development of a wild silk industry. A Plan of Action for Phase Two was developed and the project implemented in August 2001.

The following were the main focus of the activities of Phase Two.

1. Setting up cocoon collection systems
2. Conducting a financial assessment
3. Gathering technical information and establishing collaborative links
4. Developing a plan of implementation for Phase Three

The development of a wild silk industry in Namibia is being considered in terms of the following broad objectives :

- Job creation and income generation
- Improved rural livelihoods
- The alleviation of livestock and wildlife losses
- The utilisation of an unexploited natural resource
- Local processing and maximised value-addition

The results of Phase Two of the investigation into the feasibility of establishing a Wild Silk Industry in Namibia are positive. It can be concluded that the

development of a wild silk industry in Namibia would fulfil the broad objectives as outlined above and that it is a viable opportunity for further development.

Based on the positive results of Phase Two this report also makes recommendations for a Phase Three and outlines the broad components for this phase. The financial aspects for the development of a Wild Silk Industry in Namibia are detailed in three scenarios contained in the Financial Assessment.

The consultants would like to take this opportunity to thank all of those who have supported and provided valuable input to the project.

LIST OF APPENDICES

Appendix	I	Map indicating distribution and high concentrations of cocoons
Appendix	II	Cocoon counts in outbreak areas
Appendix	III	Financial assessment
Appendix	IV	Quotation for the manufacture of degumming equipment
Appendix	V	Report on proposed building for degumming plant and weavery
Appendix	VI	Research proposal from Polytechnic of Namibia

LIST OF RAW DATA (Not attached but available at CRIAA SA-DC)

- List of all cocoon counts with corresponding map co-ordinates
- List of farms surveyed and contact details
- List of all bags of cocoons purchased
- Results of degumming trials

3.1 Setting up Cocoon Collection Systems

Assessing the availability of cocoons and setting up cocoon collection systems were identified as priorities for the development of a sustainable and viable Wild Silk Industry in Namibia. In order to achieve this the following main activities were carried out :

1. Information dissemination
2. Resource surveys
3. Setting up cocoon collection systems
4. Purchase of cocoons

3.1.1 Information dissemination

Information dissemination was identified as priority for the initial part of the project implementation. Information dissemination was carried out by producing information materials, attending meetings and through direct contact with farmers and other individuals.

3.1.1.1 Information material

A wild silk brochure detailing various aspects of the project and other information was produced in English and Afrikaans and has been widely distributed. Further, A ten-minute radio interview was arranged and conducted with Radio Kanal 7 in early December 2001 outlining the project and it's aims.

In addition, posters were also produced and placed at key focal points in the project area. Short articles have also been placed in local newsletters. In March 2002 an interview covering the Wild Silk project was broadcast on NBC radio – national service. An article on the Wild Silk Project will appear in the forth-coming issue of a local magazine "The Big Issue".

3.1.1.2 Information meetings

3.1.1.2 a Commercial farms

In excess of a 100 commercial farms in the project area have been visited and personal contact made with farmers. On average one and a half hours was spent discussing the project with each farmer. Further, various meetings were also attended in the project area. These included, the Aranos Meat market meeting on the 26th October 2001 where about 30 farmers from the region were addressed and informed about the Wild silk project. An information table was also set up at the 50th Anniversary (13th October) of the Leonardville Boervereeniging.

All Agra offices and farmers co-operatives within project area were visited and a poster and pamphlets were left with managers for distribution to farmers. The State Veterinary offices and MET offices in Mariental and Keetmanshoop were also visited and discussions held. In addition, four Roman Catholic Schools (Aminius, Aranos, Stampriet and Witvlei) and one government school (Aminius) were visited. A positive response was received from the Headmasters and all said that they would inform the children about the possibility of collecting cocoons during the school holiday break.

In addition, various Farmer Organisations meetings have also been attended at which the aims and objectives of the project have been presented and information gathered from farmers. The following meetings were attended :

Leonardville Boervereeniging	-	6/02/02
Aranos Boervereeniging	-	7/02/02
Gochas Boervereeniging	-	15/02/02
Klein Nossob Boervereeniging	-	19/02/02
Onder Nossob Boervereeniging	-	23/02/02
Aranos Kalahari Boere Dag	-	15/08/02

Farmers attending these meetings were requested to complete a questionnaire regarding the loss of animals due to rumen impaction, presence of cocoons on farms, outbreaks of cocoons observed in the past season and whether the farmer would allow the collection of cocoons their farm, either by a collection team or using farm labour. In general a very positive response was received. Two farmers at Gochas and four farmers at Onder Nossob declined to fill in the questionnaire. The results of the questionnaire are summarised in the table below.

	Aranos	Gochas	Klein Nossob	Onder Nossob	Leonardville
Lost animals	6	6	12	5	2
Cocoons on farm	10	8	12	9	4
Noticed outbreaks	3	0	0	0	2
Allow collection	5	8	14	8	5
Collect self	3	-	-	-	-

3.1.1.2 b Communal Farms - Corridor

Two visits to farms in the Corridor in Omaheke were undertaken (19th to 21st February and 29th April to 1st May). Meetings were held with communities living at posts 12, 13, 17B, 18, 21 and 22. The objective of these meetings, in addition to the issue of cocoon collection, was to focus on mechanisms that would continue to allow people in this area to participate at a reasonable level in the project despite the low volumes of cocoons. It is important that the wild silk project does not loose focus on the importance of including where possible, marginalised rural communities.

One particular solution to this might be to focus on aspects other than cocoon collection.

- The San community at Post 17B showed particular interest in the potential for getting involved in a project that would teach them a new craft and enable them to generate an income. The potential to be able to spin a yarn and weave fabric from the silk adds new value to the cocoons. The cocoons of *G. postica* have traditionally been utilised for making dancing rattles. The pupae have been used by the older members of the community as a source of protein. In discussions, some

of the women suggested the possibility of weaving into, or embroidering Ostrich egg shell beads onto the hand woven fabric, which could then be made up into cushion covers etc. and sold to a niche tourist market.

- Discussions Post 17B also focussed on the possibility of seeding cocoons in the area. Initial feedback regarding the possible reintroduction of live cocoons into the area as part of seeding trials was positive. General consensus is that it would be advantageous to the community, as they would not have to walk long distances in search of cocoons and the resource base would be increased.

At this stage this area is considered to be the most appropriate site to do this as it addresses a number of crucial objectives (social, economic, research) of the project and will contribute significantly to the long-term sustainability of a wild silk industry in Namibia.

3.1.2 Resource survey – Cocoon counts

In order to assess the availability and distribution of cocoons resource surveys were carried out in the project area. Different methods were used in conducting these surveys and include :

- 5 minute counts
- Transects
- Block counts and cocoon removal
- Individual tree counts (including both cocoons on the ground and in the trees)

A total of 782 specific areas were surveyed using the above methods covering 19 farms. (See attached map indicating areas surveyed and cocoon densities - Appendix I) The results of the raw data collected from these surveys are only summarised in this report.

To assess the numbers of cocoons on the ground, each tree was walked around in an anti clockwise direction (twice for smaller trees, and three times for larger trees) and all cocoons lying on the ground counted. To assess the number of cocoons in trees, individual trees were walked around in a clockwise direction and all cocoons counted within a time period of 5 minutes. Additional information such as tree size was also noted. The GPS co-ordinates for all the surveyed areas was recorded.

Attempts to conduct cocoon counts using linear transects on a 10m x 10m grid system proved to be impractical due to the uneven distribution of trees within the survey areas chosen.

Four areas on four farms of 100 m x 100 m were marked out with fence droppers being placed every 10 m on both X and Y axis. Lines between droppers were walked and trees on the transect lines surveyed. Due to the natural distribution of trees it was found that a large percentage of trees fell into areas between transect lines. Using this method it was found that insufficient data on a particular area could be obtained. It was therefore decided to mark out areas of approximately 100m x 100m and conduct block counts within this area.

3.1.2.1 Outbreak areas

In addition to random cocoon counts, more detailed data in areas of high concentrations of cocoons in outbreak areas was gathered. Seven farms in three locations between Leonardville and Aranos considered as high density or "outbreak" areas were surveyed. This specific outbreak area mapped extends over a number of farms and is estimated to be approximately 8 kilometres in width and 34 kilometres in length. From the mapping it appears that cocoons occur in blocks that extend in a north-north westerly direction following the direction of the dunes.

As a result of reports of large numbers of caterpillars on farms to the north and northeast of Aranos, these areas were chosen as a primary area for obtaining baseline information and to begin observing the oscillation and movement of the next generation of caterpillars.

The results of the cocoon counts on these seven farms are summarised in the table below. (See Appendix II for individual areas surveyed)

Number of Cocoons in Trees	No. of trees	Percentage
150+ cocoons	23	4.75%
100 - 150 cocoons	159	32.85%
50 - 100 cocoons	153	31.61%
0 - 50 cocoons	147	30.79%
Total	482	
Cocoons on Ground	No. of trees	
3870	316	
Average of 12.24 cocoons per tree on the ground		

Cocoon counts within these survey areas all exceeded 100 cocoons per tree in less than 5 minutes. Therefore the above data can be converted into 5-minute counts and is summarised below.

Number of cocoons	Number of 5 minute counts	Percentage
100 plus	210	43.57
50 - 100	142	29.46
0 - 50	130	26.97
Total	482	

The results of these counts indicate that within these outbreak areas there are sufficient volumes of cocoons for sustainable harvesting. This is based on the assumption that a count of over 100 cocoons per 5 minutes is viable for harvesting.

In order to investigate a possible relationship between tree size and cocoon numbers additional data was gathered in this outbreak area. The results thereof are detailed below.

Relationship of tree size to cocoon numbers							
Size of tree	1 - 2m	2 - 3m	3 - 4m	4 - 5m	5m+	Total	%
0-50 cocoons	34	36	23	21	0	114	37
50 - 100 cocoons	7	33	30	27	3	100	32.46
100 - 150 cocoons	0	20	36	24	3	83	26.94
150 + cocoons	0	0	2	9	0	11	3.57
Number of trees counted	41	89	91	81	6	308	

Additional outbreaks were also noted on one farm in the Gochas area and another in an area 24 kms east of Kalkrand. The overall majority of cocoons observed on these farms are from the generation of caterpillars that emerged in October/November 2001.

It must be noted that it was not possible to survey the full extent of all these outbreaks due to their overall size and the fact that farm fences and lack of adequate access to some areas prevented this.

Very few cocoons have as yet been collected from any of these farms, even though farmers indicated that they would like the cocoons removed before the next seasons moths emerge (Sept/Oct 2002). Some farmers within these areas requested the cocoons to be harvested by the project before the next season's moth emergence.

3.1.2.2 Block counts and cocoon collection

In an attempt to quantify the yield of cocoons from 5-minute counts, three areas on three farms in this outbreak area were demarcated and cocoons counted and collected by collection teams. The results of these block counts and cocoon collections are detailed below.

AREA	BLOCK SIZE	Number of 5 Minute counts	Total number of cocoons counted	Quantity Collected (KG) (approx 1 kg = 400 cocoons)
Farm Trompie	150 x 150 m = 2.5 ha 22500 sq m	10	778	4.8 kg Number of cocoons 1920
Farm Charakoe	300 x 300 m = 9 ha 90000 sq m	9	1011	12.2 Number of cocoons 4880
Farm Glave	170 x 150 m = 2.55 ha 25500 sq m	5	329	6.9 Number of cocoons 2760

These areas were recounted after cocoon removal and revisited later to determine number of cocoon re-infestations. The results thereof are summarised below.

AREA	Number of trees counted	Number of remaining cocoons	Number of new cocoons	Number of caterpillars
Farm Trompie	50	188	223	0
Farm Charakoe	30	551	0	0
Farm Glave	25	276	0	1330
TOTAL	105	1015	223	1330

After a recount on the farm Charakoe cocoons were collected again and therefore the actual number remaining was far less. The actual number of re-infestations is likely to have been much higher as the areas were counted before completion of cocoon spinning.

3.1.3 Cocoon collection systems

The viability of a wild silk industry in Namibia will depend on the regular and sufficient supply of cocoons. A core component of Phase Two has been to establish effective and efficient cocoon collection mechanisms.

3.1.3.1 Central Buying Points

Central Buying Points (CBP) were set up at the following establishments.

- Aranos Voere
- Leonardville Boerediens
- Gochas Winkel

The CBP were paid a commission of N\$ 2-00 per kilogram of cocoons for their services. They have proved to be an efficient mechanism for the purchasing of cocoons. (See cocoon purchase results) The majority of cocoons have been supplied through the CBP. The use of CBP allows suppliers of cocoons to deliver when they want to and to receive immediate payment.

3.1.3.2 Collection Teams

Although in principal the majority of farmers have accepted the use of collection teams for harvesting, in practice farmers have made use of their own labour and their extended families.

In an attempt to promote the idea of collection teams, a three-day training and collection exercise on three farms was carried out. Three teams of women (six women per team) from Leronardville and Stampriet participated.

3.1.3.3 Individual Harvesters

A number of farmers, who have labour, have encouraged their labour or people living on their farms to collect cocoons. Most farmers have agreed to transport the bags of cocoons to the nearest CBP. The majority of cocoons have been supplied in this manner.

Local community members in Leonardville also harvested on the town lands and delivered the cocoons to the CBP in town. These have been small amounts collected but the level of interest and willingness is high.

3.1.4 Purchase of cocoons

In order to support the various collection systems, cocoons collected and supplied were purchased. This purchase was not regarded as a trial as it set in motion cocoon collection for the following phase and the subsequent operationalisation of a Wild Silk Industry in Namibia.

A target of 3 tons of cocoons to be purchased was set. However, this target was reached in a relatively short period and cocoons were still being collected. In order to continue the momentum of cocoon collection and purchases it was decided after consultation with the Steering Committee that an additional 2 tons would be purchased. The following table is a summary of all cocoon purchases.

COLLECTION POINT	AMOUNT COLLECTED (KG)	AMOUNT PAID PER KG (N\$)	AMOUNT PAID (N\$)
Aranos Voere	3 741-29	10-00 *	37 412-90
Leonardville Boerediens	1 086-78	10-00 *	10 050-00
Gochas Shop	54-00	10-00 *	540-00
Harvest Teams	41-50	8-00	332-00
Farm Workers	94-51	8-00	756-12
Farmer	18-50	8-00	148-00
TOTAL	5 036-58		49 239-02

* Note :
All cocoons supplied were purchased at N\$ 8-00 per kg. Central buying points were paid N\$ 2-00 per kg commission.

The highest percentage of cocoons delivered has been from farms between Aranos and Leonardville. It is estimated that approximately 200 individuals covering in excess of 50 farms have supplied cocoons to the project during this phase. It should be noted

that in the winter months cocoon deliveries declined, however it is expected that in spring and summer farm labour will again begin collecting.

All the cocoons purchased have been bagged and numbered and are stored in Leonardville.

Although the 5 tons of cocoons purchased in Phase Two has been assessed as being sufficient for the first two to three years of processing, ongoing collection and purchasing will have to be maintained and a stockpile stored to ensure that there are sufficient cocoons available in the event of the degumming plant being able to handle larger volumes than projected and to ensure that sufficient cocoons are available for processing should there be a shortfall of cocoons in nature due to some unforeseen natural disaster.

3.2 Financial Assessment

The financial assessment is attached as a separate document.

3.3 Gathering Technical Information and Establishing Collaborative Links

In terms of the Plan of Action for Phase Two the gathering of specific technical information and the establishment of collaborative links was prioritised. The results of the establishment of collaborative links are discussed below.

3.3.1 Collaborative links

Numerous contacts have been made with individuals and institutions involved in the silk industry. These contacts have made significant contributions to the development of a wild silk industry in Namibia and will continue to do so. The details of the contacts made and their inputs are discussed below.

3.3.1.1 Japanese National Institute of Sericultural and Entomological Science

Ongoing contact with Dr. H. Akai of the Japanese National Institute of Sericultural and entomological Science and the International Society for Wild Silkmoths has been maintained. A request for 1 kilogram of cocoons was received from Dr. Akai to conduct some initial trials. These trials will investigate the physical characteristics of the cocoon filament (filament size, length, fine structure, hydroscopic ability, degumming and dyeing). An agreement for the supply of Biological Material and co-operation was drawn up and signed.

It was expected that he would deliver a paper on his findings at the 4th International Conference on Wild Silkmoths but was however unable to complete his research prior to the conference. These results will be made available to Namibia when the research is completed.

3.3.1.2 University of Pretoria

Contact has been made with Prof. Clarke Scholtz and Ruan Veldtman of the Dept. of Zoology and Entomology at the University of Pretoria. An interesting paper has been

received from them entitled " Variability in Cocoon size in Southern African Wild Silk Moths - Implications for Sustainable Development ". Further research collaboration in the long-term is envisaged.

An invitation to attend a one-day regional and international workshop sponsored by the Liberty Life Trust on the sustainable utilisation of *Gonometa sp* has been received from Prof. Scholtz and Ruan Veldtman. This will take place at the University of Pretoria on the 4th November 2002.

3.3.1.3 Additional key contacts

Offers of support and supply of technical information has been received from officials at the Central Silk Board of India and others including.

Dr S.C. Kundu	Professor, Department of Biotechnology, Indian Institute of Technology
Dr. K Thangavelu	Director Central Sericultural Germplasm Resources Centre. Central Silk Board
Dr. J.V. Krishna Rao	Joint director and UNDP Sub-Programme Co-ordinator, Central Silk Board
Professor Jesmandt Situmorang	Entomologist and Insect Pathologist. Research Centre for Biological Control, Gadjah Mada University, Yogyakarta, Indonesia

Contact has been renewed and maintained with Catherine Craig, Research Scientist at Harvard University Museum of Comparative Zoology and Centre for Biotechnology. A request has been received to supply samples of *Gonometa* silk to scientists at Harvard and Tufts Universities for research purposes.

3.3.1.4 Ganyesa wild silk project

A visit to the Ganyesa wild silk project in South Africa was seen as a key component of Phase Two. The visit was undertaken by the consultants on the 15th and 16th of May 2002. Discussions were held with the management of the project, the Board of Trustees and the Traditional Authority. The issue of future collaboration was discussed and it was agreed that this would be in the interests of both parties.

They have three Degumming baths in operation with three additional ones but which are not set up. At present they do not have enough cocoons to warrant any expansion. Almost all the degummed silk is sent to Port Elizabeth for mechanised carding, spinning and weaving. A small percentage of carded silk, yarn and woven fabric is returned to the project for further processing. Very little degummed silk is carded, spun and woven on site. The spinning is conducted some 70 km away by a group of woman. A small weaving operation has been set up but this is hardly in operation as there is not enough silk yarn. The cleaning of cocoons is done by women from their homes and are paid by volume.

Almost all silk products developed by the CSIR are 70 % cotton and only 30 % silk. This makes marketing extremely difficult. Product development is lacking and products viewed by us were thought to be inappropriate and unmarketable. The link to the CSIR

is considered a limiting factor, especially with regards to product development. It was noted though that the CSIR could provide useful inputs with regards to other research.

Ganyesa is facing some critical problems with regards to the following :

- A lack of consistent and sufficient supply of cocoons. They have to go further a field (Zimbabwe / Botswana) to procure cocoons. Harvesters are in some cases transported large distances to go and collect cocoons for up to 3 weeks. Harvesters are now paid R 10-00 per kilogram.
- They do not have access to commercial farms in the Ganyesa area where cocoons can be found.
- Tree clearing (for crop lands and fire wood) is causing a loss of habitat for the species.
- Ganyesa is also in need of investing into product development as it is considered that some of the products are unmarketable.

Ganyesa enquired about the possibility of purchasing cocoons from the Namibian wild silk project. It was pointed out that a need to have a stockpile had been identified and that at this stage a sale of cocoons could not take place, however, this did not mean that in future a sale could not take place. Some documentation on the Wild Silk conference held in Indonesia was made available including other relevant project documents and information on wild silk.

The results of the degumming trials conducted thus far in Namibia can be considered to be of a better quality than that currently achieved by Ganyesa.

3.3.1.5 Private sector links

Various private sector interests have been investigated and initial responses appear to be positive although it is too early to speculate on what the final outcomes may be. A farmer in the project area is purchasing cocoons and has set up a small degumming and carding operation. Further collaboration is expected.

Discussions have been held with a Windhoek based Couturier and two Interior designers who have shown keen interest in working with a locally produced fabric from wild silk. A designer from "Atmosphere", a Windhoek based Interior Design Company showed samples of Namibian Wild Silk fabric to Namibia Breweries. This company has indicated that they would like to have their new corporate offices upholstered and decorated with Namibian Wild Silk.

3.3.1.6 Fourth International Conference on Wild Silkmoths

The 4th International Conference on Wild Silkmoths (23rd – 27th April) was attended by Ian Cumming as part of Phase 2 of the Namibian Wild Silk Project. More than 300 Scientists and technologists attended the conference from China, Indonesia, Japan, Thailand, Taiwan and the Czech Republic.

Numerous contacts were made with Scientists and technologists at the 4th International Conference. These contacts and communication have been maintained and collaborative links initiated. This has resulted in invitations being received to visit India

to investigate the wild silk industry and the appropriate technology used in processing, spinning and weaving of wild silk in that country.

A number of delegates at the conference recommended that applied research should be prioritised particularly in the fields of :

- Taxonomy, physiology, morphology, ecology and biochemistry
- Genetics, breeding and biotechnology, egg raising and preservation of eggs
- Disease and disease control including viral, bacteria and microspores (Pibrine, Neuclear polyhedrosis and others)

It was also pointed out that the commercialisation of wild silk should start with egg production as most losses occur in the egg stage and the first two larval stages. In order to protect the resource and increase yields of cocoons it was advised that the potential of breeding disease free eggs should be investigated. This would contribute to maintaining the resource base and increasing production.

It was therefore advised that in order to ensure sustainability that a seeding program be initiated which would include :

- Breeding and production of good quality disease free eggs
- Seeding of eggs and young larvae directly into the wild
- Investigating the potential of hatching eggs and rearing first larval instars indoors
- Investigating the potential for developing and using an artificial diet (especially for the young larvae reared under controlled conditions)

3.3.2 Technical information

In terms of technical information the following was focussed on.

- Investigating and costing appropriate degumming and weaving technology
- Conducting small degumming trials with alternative methods
- Collecting information regarding possible seeding programmes etc.
- Investigating potential bi-products and use of waste materials

3.3.2.1 Degumming and weaving technology

The information regarding the costing of appropriate degumming and weaving technology is included in the Financial Assessment.

In terms of equipment needed the focus has been on hand-operated machinery. The basic equipment needed initially includes, drop spindles and spinning wheels for spinning the yarn and hand operated looms. This equipment is available in South Africa and in the United States of America. However, further investigation on types of spinning equipment and looms being used in the spinning and weaving of wild silk in Asian countries needs to be undertaken as these may be more appropriate. To date this type of information has been very slow in obtaining. (For further information on the equipment see point 5.1)

Should production volumes of raw silk exceed that which can be hand spun and hand woven, consideration should be given to introducing a small mechanical ring spinner

capable of producing machine spun yarns, and a rapier or McLeod type loom capable of weaving 5 meters of cloth per hour. Fabric produced in this manner will differ from that which is hand spun and woven and will open new areas in which the silk can be marketed.

Spent cocoons collected in the wild have to go through a cleaning process in order to remove the debris (pupal waste and sand etc). This is a very time consuming and laborious operation that will provide employment opportunity for a number of people. It will take 100 women approximately one month to clean one ton of cocoons in preparation for degumming. The cleaning of cocoons entails having to manually cut the cocoon open with a knife to remove the contents using a short flattened and bent piece of wire. In a trial during the pre-feasibility phase a total of 15,6 kg of cocoons was cleaned with a return of 13,05 kg, a loss in weight of about 16,34%.

From information received from the Central Silk Board in India it appears that there is a machine available that could simplify this process. The machine is known as an "amber charka". In order to identify the right type of machine the manufacturers need to have more information regarding compactness and hardness of *Gonometa* cocoons. It will be necessary to supply samples of cocoons for this purpose.

3.3.2.2 Degumming trials

Four different degumming methods were conducted on 13 samples. In addition to assessing the quality of the degumming methods data on losses in the process were also recorded. The average loss in weight in the degumming process was 34 %. In order to assess the quality of the degummed silk samples were shown to a number of technical experts.

The degummed silk fibre was shown to delegates at the 4th International Conference on Wild Silkmoths. They were asked to give their impressions as to efficacy of the degumming and the visual quality of the fibre. The quality of degumming, strength, elasticity, shine and general appearance was considered to be very acceptable. It was also the opinion of a number of people spoken to that it was unnecessary to card the silk before hand spinning. The quality of fibre is good enough to spin directly off the cocoons (direct drafting). In carding the losses of useable fibre for hand spinning are high. The cocoon to yarn recovery on carded silk is 40%– 50% and on direct drafting 60%-80%.

Samples of degummed silk fibre were sent to Lindele and a top weaver in South Africa, Ingrid Hague. Both have spun yarn from the silk and were very satisfied with the quality. Lindele has exhibited samples of Namibian Wild Silk at the World Conference on Sustainable Development and Ingrid Hague has recently exhibited samples of Namibian Silk yarn and hand woven fabric at an International Convergence of spinners and weavers in Canada. In both instances a very positive response was received and the development of an industry encouraged.

3.3.2.3 Seeding

To ensure sustainability of a wild silk industry and to eliminate the fluctuations in wild population occurrence and size it has been advised that the project consider and investigate the possibility of establishing an egg (seed) production facility or Grainage.

This would involve the setting up of a small laboratory for disease identification and ensuring that eggs produced by the grainage for distribution are free of any protozovan or bacterial pathogens, causing diseases such as pibrine and nuclear polyhedrosis. Advice on the setting up of such a facility has been received and ongoing collaboration offered by Dr. K Thangavelu, Director of the Central Sericultural Germplasm Resources Centre, Houser, India.

3.3.2.4 Markets and prices

It can be concluded that from the responses from those involved in the silk industry that *Gonometa* silk has good potential and would be welcomed in the International market. Wild silk production is an eco-friendly, agro-based venture with great potential for employment generation, export earnings, environmental awareness and in addition the conservation of bio-diversity.

The world demand for silk yarn is approximately 92,743 tons. However, world silk production is approximately 83,393 tons per year resulting in an annual shortfall of between 9 to 10 thousand tons. The growing world demand for silk indicates excellent opportunities for any country to increase their silk production. The present exploitation of wild silk accounts for only 5% of the rich potential that exists.

The following table reflects some of the current retail prices for different wild silk products and value addition. These prices were obtained from two current producers of wild silk in South Africa.

ITEM	PRICE
CSIR Sliver / tops (Buyers report paying R 290-00 /kg indicating transport costs)	R 240-00 /kg
CSIR Yarn 42/2 tex (2 indicates a 2 ply yarn and 42 the thickness of each yarn)	R 275-00 /kg
CSIR Yarn 42/4 tex (4 ply yarn)	R 275-00 /kg
Cotton / 30 % Noil 42 /2 tex	R 260-00 /kg
Cotton / 30 % Noil 42 /4 tex	R 260-00 /kg
Cotton / Noil 660 tex (heavy yarn loose spun single ply)	R 240-00 /kg
Hand carded,pure silk	R 190-00 /kg
Hand Spun from sliver / tops	R 330-00 /kg
Hand carded and hand spun	R 350-00 /kg
Hand spun sliver wrapped in cotton	R 340-00 /kg
Hand carded and hand spun wrapped in cotton	R 360-00 /kg

The above prices are ex Ganyesa and do not include transport costs. The current buying price of cocoons at Ganyesa is R 10-00 per kg. Unless stated hand spun or carded the other items have been processed or produced industrially.

The following prices reflect further value addition

ITEM	ESTIMATED PRODUCTION COSTS	PRICE
Scarf (Wild silk on cotton warp 1.8 m x 30 cm hand woven)	R 110-00	R 260-00
Fabric (Wild silk on cotton warp 1.2 m x 1 m hand woven)	R 220-00	R 460-00
1 kg Hand spun yarn from sliver	R 390-00	R 600-00

These prices are quoted from Tsinini Silk Weavery in Mpumalanga province, South Africa. An explanation of the terminology used above is provided below :

- Sliver / tops Refers to industrially gilled and combed silk
- Noil Refers to the short fibres of silk that are produced in the carding process
- Carding Refers to a process whereby the silk is "brushed" to align the fibres in preparation for spinning. Hand carding, drum carding or industrial carding is possible
- Spinning Refers to the process whereby sliver or carded silk is spun into a thread or yarn
- Warp Refers to the base thread used in the weaving process

3.3.2.5 Training materials and videos

Training videos and materials are available from various sources, for example, the Central Silk Board of India and a number of companies on the Internet such as Ashford in New Zealand.

4. CONCLUSIONS

The results of Phase Two of the investigation into the feasibility of establishing a Wild Silk Industry in Namibia are positive. It can thus be concluded that it is a viable opportunity for further development and that this would meet the objectives of the development of a wild silk industry in Namibia.

Although significant work still needs to be carried out, in terms of the results of Phase Two the following positive conclusions can be reached :

- The development of a wild silk industry has support from a wide range of stakeholders including, the government of Namibia, farmers and farmer organisations, rural communities in communal areas, local and international buyers etc.
- The initial results of the resource surveys indicate that a sufficient quantity of cocoons is available for a wild silk industry and that the harvesting of cocoons can be carried out in a sustainable manner. Furthermore, initiatives can be undertaken to increase this resource base, such as seeding. Close monitoring of the resource will ensure sustainability. Baseline information for this purpose has already been generated.
- The system for the collection and purchasing of cocoons has proved to be successful and can be further developed. In addition, a significant stockpile of cocoons has been realised which will act as a buffer to any drop in supply. The current stockpile is sufficient to ensure production for two years. Additional purchases will ensure that a stockpile is maintained.
- An efficient and cost effective method for degumming cocoons has been developed that will ensure that a high quality product can be produced.
- The development of a wild silk industry will make a significant contribution to alleviating the problem of stock and wildlife losses.
- In terms of the financial assessment the development of a wild silk industry is considered to be economically viable and will contribute to local and national economic development. The potential for growth and expansion to other areas also exists.
- A significant market demand for wild silk exists and therefore the market potential for Namibian wild silk is considered to be positive.
- The opportunities for employment creation and income generation in the formal and informal sector are significant. Initially 25 jobs will be created at the degumming plant and weavery with the potential of increasing this number by further developments in other areas. Cocoon collection could provide income-generating opportunities for between 300 and 500 people.
- Significant local and international collaborative technical support is available.

5. PHASE THREE

It is envisaged that the implementation of Phase Three will take place over a three-year period and will consist of two broad components :

1. Establishing the degumming plant and weavery
2. Generic research

These components will be implemented separately as it is considered that the amount and type of work required will necessitate this.

Details pertaining to the proposed activities and budgetary requirements for Phase Three are elaborated on in a separate document, "Proposed Activities and Plan of Implementation for Phase Three".