Introduction of sosnowsky's hogweed as a cause of landscape transformation

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Abstract. Archival documents on the introduction of sosnowskyi’s hogweed in the USSR were investigated. The role of scientists and different scientific as well as political organizations in this event was demonstrated. Four stages of introduction were highlighted: local introduction from the end of the 1940s till the end of the 1950s; mass introduction from the end of the 1950s till the middle of the 1970s. The completion of introduction was from the middle of the 1970s till the end of the 1980s; uncontrolled invasion since the 1990s. The maps showing stages of introduction were composed. These maps reflect the territories with transformed landscapes as a result of H. sosnowskyi’s introduction and invasion.

1. Introduction

In the 1940-1980s the science in the USSR was an integral part of policies of the government. The tasks of production to increase the planted area and yields, as well as the introduction of new crops, were addressed to scientists [1]. On the 5th of October, 1931, according to the Decree of the Presidium of the Academy of Sciences of the USSR (AS USSR), the Polar-Alpine Botanical garden was founded in Kirovsk to fulfill these tasks. Later in 1938 a special “fodder” group was created on Kola base of AS USSR, and it was planned to investigate Fabaceae and other crops [2]. The plant which was determined as Heracleum pubescens appeared in the garden at the beginning of 1939 [3] and became one of the objects for study. H. sosnowskyi was described by I.P. Mandenova in 1944 and later the scientists realized that they dealt with H. sosnowskyi, not with H. pubescens, all that time.

2. Materials and methods

Data on the distribution of H. sosnowskyi in Russia were obtained by analyzing publications on the distribution of the plant and various aspects of its economic use. The main sources of information were publications on fodder and silage plants, including H. sosnowskyi [4]. Although these data cannot be considered as complete, it was possible to establish the main centers of cultivation of H. sosnowskyi on the territory of the USSR. Data from published resources (books and articles) were added from archival documents of the Archive of the Russian Academy of Sciences. These documents contain a lot of unique facts about the history of introduction of sosnowskyi’s hogweed in the USSR.
3. Stages of introduction

Acute feed shortage was traced in the beginning of the Second World War in the USSR. In 1942 silage produced from *H. "Pubescence"* was offered to cows for the first time. The results seemed to be good. However, this result was not included in the official annual plan of Polar-Alpine Botanical garden and as a result nothing was written about it in reports of 1942-1945 [2].

Silage harvesting in collective and state farms of Murmansk region was not enough in post-war years. In 1946-1947 the scientists from the garden started the work on the choice and selection of perennial silage crops for Murmansk region; the first experiment was set up by A.A. Marchenko and L.Ya. Avrorina. This activity was supported and approved by the Secretary of Murmansk regional Committee of the CPSU (b), A.M. Kutyrev [5, p. 24]. As a result, twelve species of perennial crops from the introductory nursery of the garden were tested and three of them only were chosen for silage, *H. "pubescens"*, and *H. dissectum* was among them.

![Figure 1. Stages of introduction of sosnowskyi’s hogweed in the former USSR](image-url)

In 1948 A. A. Marchenko continued the study on biological and economic qualities of these two *Heracleum* species. It was written in the annual report that "hogweeds do not contain harmful to
livestock alkaloid substances and green storage and silage produced from hogweeds are eaten by animals with pleasure and increase milk yield being surely harmless to animals” [6, p. 534]. In his further reports A.A. Marchenko noted high frost resistance of the plants, high yields (to 80-100 tons/hectare) and good eatability by livestock [5]. According to the summary of the extended academic council of Kola base of AS USSR, the decision to carry out experienced crops of Heracleum species in collective and state farms of Murmansk region in 1949 was taken.

In order to guarantee the fulfillment of this decision, A.A. Marchenko went to expedition to the Kabardino-Balkar Republic in August, 1949, where he made natural observations on H. "pubescens". The explorer picked up and stored 150 kg seeds during his expedition in Nalchik suburbs. He notes that the plant may cause burns, but he makes a conclusion that possibly this feature may change and depend on various climatic conditions, and "possibly Heracleum, after introduction... from south to north..., reduces an ability to accumulate essential oils” [5, p. 33].

In 1951 H. "pubescens” was included in the master plan for pilot works on fodder investigations in Murmansk region for 1952-1955 years. The Botanical Institute of the Academy of Sciences of the USSR (BIN AS USSR) became an appoint curator on the problem of foraging. In 1953 the Department of General Biology of AS USSR (DGB) assigned BIN AS to be a curator of introduction and acclimatization of plants; the Head of the Botanical garden in BIN AS, S. Ya. Sokolov, was to take personal responsibility for the results of the project. The Head of Department of Introduction of nursery garden BIN AS, V. S. Sokolov, became the curator of the study of silage cultures in BIN AS in 1953.

At the turn of 1952-1953 the mistake of wrong definition of H. pubescens became clear. It is still unknown who was the scientist and from what institute was the first to establish correct name for Heracleum species, but in 1953 exactly seeds of H. sosnowskyi were sent from Kirovsk to Leningrad and Syktyvkar.

BIN AS got seeds of H. sosnowskyi for investigation in 1953. The work under supervision of V.S. Sokolov was finished in 1955. In 1954 the plant was included in the annual plan of BIN AS for a pilot industrial test and introduction. In 1955 H. sosnowskyi was introduced into broad industrial crops in 17 collective and state farms of Leningrad region. During cultivating of the plant in this region, the feature of causing burns was registered, but the scientists hoped that it would be eliminated during selective work [4].

In 1953 seeds of H. sosnowskyi were sent from Kirovsk to Syktyvkar to Institute of Biology of Komi (IB Komi AS USSR) in which complex investigations on biology, agricultural technology and nutritional value of silage from H. sosnowskyi started in the laboratory of plant introduction under the supervision of K.A. Moiseev [1] and continued till 1957. As a result experienced geographic crops through all territory of Komi Republic were made in 1957. Since 1959 the process of obligatory introduction of H. sosnowskyi to the culture started in collective and state farms of the republic and the crop was distributed from Inta to the southern border of Komi [4].

There were more centers dealing with H. sosnowskyi in the USSR. One of the most significant was the Local Botanical Garden in Nalchik in which "large cowberry bushes" were studied under supervision of Yu.I. Kos. Besides crops of H.sosnowskyi were planted on the territories of the B.R. Williams Institute of Feed in Lobnya of Moscow region [4].

In 1956 the All-Union meeting on the introduction of new useful plants to culture was held, and Brochure containing a list of more than 500 useful plants was published; H. sosnowskyi was included in this list [7].

The results of investigation of new silage plants were discussed on meetings of the Bureau of DGB AS USSR in 1962, 1965 and 1968 as well as on the First - Fourth All-Union Symposia on new silage plants, in the Ministry of Agriculture of RSFSR and in leading organizations of the Komi Republic and got positive rating everywhere.

Many Party and Government regulations were adopted to promote these decisions. On the 19th of June, 1962, the First secretary of the CPSU Central Committee, N.S. Khrushchev, sent a letter to the Institute of Biology of Komi in which he asked to send him reference about their work on growing silage.
crops. This letter which was caused by the need to strengthen the country's food security during the cold war became new impetus in introduction of *Heracleum*.

The first mass mailing of *Heracleum* seeds by the Institute of Biology of Komi happened at the beginning of the 1960s. The plant was cultivated from Pskov region to Sakhalin; farmers continued to multiply this plant everywhere. For example more than 10 tons of seeds were produced in the state farm “Lidino” of Ruza District of Moscow region in 1965-1969; the seeds were distributed among 55 farms of Moscow region and 67 farms of other regions of RSFSR [4]. Since 1961, the crop was cultivated in Belorussia and Ukraine, at the end of the 1960s - in Moldavia and other republics including Chui Valley of Kyrgyzia.

In 1970 P.P. Vavilov, the former director of IB Komi AS USSR, moved to work in Timiryazev Agricultural Academy (Moscow) and the center on investigation and introduction of *Heracleum* moved to Moscow too. Collective and state farms, experimental fields of educational and production facilities became testing grounds for a new crop all over the USSR. One of experimental stations in Udmurtia produced and distributed 1694 kg of *Heracleum* seeds among farms of the republic in 1973-1976. The harvest in only one state farm “Pravda” reached 4 centner/hectare, seeds production from 1 hectare was enough to plant 25 hectares [4].

BIN AS continued the study of *H. sosnowskyi* at this time too. One of the researchers, I.F. Satsyperova, discovered that it was impossible to get the form of *Heracleum* devoid of furocoumarins and not causing burns. Moreover, she noted that furocoumarins retained in silage and were found in milk and meat and reduced their quality [8]. Other scientists pointed that another insufficient character of the plant - *H. sosnowskyi* was monocarpic, giving seeds once during the life cycle. I.F. Satsyperova tried to offer another species for silage – *Heracleum ponticum*.

In fairness it should be noted that not only *H. sosnowskyi* but other *Heracleum* species were studied also in many institutes including IB Komi beginning from the 1970s. On the rise of these investigations one of the researchers – E.M. Shumova – defended thesis. She managed to get not a burning form of another giant hogweed, *Heracleum mantegazzianum*. However, this result was ignored on some reason and remained without attention [4].

The Board of the Ministry of Agriculture devoted to introduction of new feed crops in collective and state farms production was established in December 1975. The resolution was to organize wide production tests of *H. sosnowskyi* in different geographical zones of the USSR [1].

The second half of the 1980s is characterized by the reduction of the investigations on *H. sosnowskyi* as agricultural crop. However, the Secretary of the Department of General Biology of the Academy of Sciences of the USSR, M.S. Gilarov, mentioned *H. sosnowskyi* in his 1980-1984 report as the most significant result in biological sciences and noted that this plant gave production to 1000 centner/hectare and was cultivated to the Arctic zone.

4. **Conclusion**

So, we can distinguish the following periods and stages of the introduction of *H. sosnowskyi*:

1) Local introduction from the end of the 1940s till the end of the 1950s. Growing and study of the plant was accumulated in 5 scientific organizations: Polar-Alpine Botanical garden in Kirovsk, Botanical Institute of the Academy of Sciences of the USSR in Leningrad (St.-Petersburg), Institute of Biology of Komi in Syktyvkar, Local Botanical Garden in Nalchik and scientific institutes of Moscow region.

2) Mass introduction from the end of the 1950s till the middle of the 1970s. The great significance of the distribution of the plant was acquired by experimental agricultural stations, collective and state farms, educational institutions.

3) Completion of introduction from the middle of the 1970s till the end of the 1980s. At this time the danger of the plant, its negative impact on agricultural products became evident, but the plant was still cultivating in some farms.

4) In the 1990s, a new stage began in the distribution and transformation of hogweed into an aggressive invasive species [9–11]. Because of the decrease in agricultural production, this species
quickly began self-distribution, first near the centers of cultivation and then at a considerable distance from them. The plant is more confined to synanthropic habitats and forms monospecies thickets over large areas, has become widespread on the territory of the former USSR, destroying the habitual appearance of landscapes and transforming natural ecosystems.

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