International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Invasive Species Spergula Arvensis: It's Impact on Production of Winter Crops

Dr. Prakash Prasad Sapkota

Lecturer/Researcher, TU, DMC, Baglung

Abstract

Invasive species is an organism that is not indigenous, or native, to a particular area. The new species that are introduced into a new region or area are accidentally or purposeful. This introduced species adapt easily to the environment, multiply too quickly and become invasive. To search the query of the impact on the production of winter crops by *Spergula arvensis* (**Thagne jhar**) in the study area, this research study was carried out based on the field study from 2021 November to March 2022. Exploratory and explanatory research designs were adapted to complete the research study within a multi-disciplinary approach.

Spercula arvensis is a popularly known invasive plant species that have been distributed in many parts of the world. It comes under the family- caryophyllaceae, genus- *Spergula*, and species *arvensis* L. It is a universally accepted name for this annual weed and has the chromosome number 2n= 18. Based on a species' ecological impacts, biological attributes, distribution, and response to control measures it comes in 32 ranking of the invasiveness of total invasive species of the world. It is an annual, rarely short-lived perennial herb that is about 10 to 35cm tall. The height of the plant is based on the fertility of the soil and the favorable environment. Stem erect, branched herbaceous; Leaves are simple, opposite, appearing whorled, glabrous, and sessile. The inflorescence is in the dichasial cyme, terminal. Flowers are bisexual, rarely unisexual, and petals 5, white, entire, ovate. Stamens are 5; filaments subulate, flat; anthers ovoid. The ovary is superior, unilocular, numerous, axile placentation, style 5, free, and recurved. Fruit is in capsule, obovoid-globose, dehiscing with 5 valves or rarely by 3 valves, fruit length is 3.5-5 mm. Seeds many, reniform or sub-globose, compressed laterally, finely papillate or smooth, marginal wings present.

It is found that *S. arvensis* is one of the most serious weeds of cereals like wheat, barley, potatoes, mustard, and maize in the study area. It was found to have a higher average density per field than any other weed species. It is not used for any purpose by the people and has a negative perception in the study area. S. arvensis has a higher negative impact and decrease the yield of crops. A decrease in agricultural food products will change not only the local economy but also the global one. Therefore, proper identification, management, control strategies, and development of new technology to use invasive species in human welfare is a great challenge at present.

Keywords: Invasive, *Spergula arvensis*, winter crops

Introduction

Invasive species is an organism that is not indigenous, or native, to a particular area. The new species that are introduced into a new region or area accidentally. These introduced species multiply too quickly and become invasive. Among many invasive species, *Spergula arvensis* is one which caused eminent economic and environmental destruction to the area where it is introduce.

The plant or animal species becomes invasive when it can easily adapt to the new land or area, can reproduce quickly, harm the local/ native plant and animals of this region, and economy to manage them. Many invasive species destroy the habitats of native plants and animals where they are naturally live. It is accepted that invasive species is an introduced in the area by any means, nonnative organism (disease, parasite, plant, or animal) that begins to escalate or expand its range from the site of its original area and that has the capability to cause harm to the environment, the economy of the people as well as the human health (Pyakurel,2022).

One species, *Spergula arvensis*, significantly damaged the local economy and environment after it was introduced. When a plant or animal species can swiftly reproduce, adapt to new environments, and affect local or native plant and animal species as well as the local economy, it is considered invasive. Numerous invasive species obliterate the natural habitats of native plants and animals. It is generally agreed that an invasive species is a non-native, artificially introduced organism (disease, parasite, plant, or animal) that starts to spread out from its original location and has the potential to harm both the environment and human economies.

In order for a species to proceed along the naturalization-invasion continuum and become invasive or naturalized, it must first overcome a number of obstacles (Richardson and Pysek, 2006; Richardson et al., 2000). To put it another way, "a species is established from a region where it is native recruiting human action via various pathways, including both deliberate introduction and release into the wild, and unintentional introduction" (Hulme et al., 2008). Symbiotic interactions between invaders in the new area may speed up invasions and/or magnify their effects on native communities (Richardson et al., 2000). Stochastic effects depend on initial inoculum size, residence time, chance events (Lockwood, 2009), and propagule pressure and their spatial distribution codetermine whether a species becomes invasive. It can be generalized that, the probability of invasion increases the nature of the trait and residence time.

This research study was based on field observation and measurement during the winter season when farmers cultivate wheat, barley, mustard, and potatoes in their fields. The field study was conducted in the year 2021-2022 within Baglung municipality's lowland (**Khet)** where rice is produced. Rice productive land (**Khet)** is economically most important for the farmer. They cultivate three different crops rotationally within a year on this land. Among them, winter crop is one of the most important crops for them. When they cultivate their winter crop, *Spergula arvensis,* (**Thagne jhar**) germinates vigorously at first.

Spercula arvensis is a popularly known invasive plant species that have been distributed in many parts of the world. It belongs to the kingdom plantae, subdivided into division spermatophyta and sub-division angiospermae. It belongs to the dicotyledonae class, the caryophyllaceae family, the genus Spergula, and the species arvensis L. This common and widespread annual plant with the chromosomal number 2n=18

is known by this widely used name (Stace, 1997). Invasive species are categorized based on their characteristics, ecological effects, biological characteristics, distribution, and reaction to control methods. Rankings range from 0 to 100, with 0 denoting plants that pose no damage to native ecosystems and 100 denoting plants that constitute a serious threat. Spurgula arvensis ranks 32 in this category (Klein, 2011).

According to reports from 33 nations, S. arvensis has a significant negative impact on 25 different crops (Holm et al., 1977). It is locally known as Gorge in Barzil, Linacllia in Chile, Almendelia in Denmark, Spurry in East Africa, Pelthohatikka in Finland, Acker-Spark in Germay, Noharatsumekusa in Japan, Uinbendel in Norway, Sporrie in South Africa, Bandhamia, mun-muna and Pittpapra in India and Thangne Jhar in Nepal. The common English name is also different in different countries as Spurry in New Zealand, Esparcilla, Pel de boc in Chile, Petite spergoute in French. The universally accepted scientific name is Spergula arvensis L. Linum usitatissimum said, it is not associated with any particular crop or set of crops but has been reported as a weed of cereals in almost all parts of the world. However in the research area, it has a strong impact on crops like wheat, oats, potatoes, mustard, onion, and garlic.

Methodology:

This research is based on the field study with the adaptation of the exploratory research method. The field visit was conducted from 2021 November to 2022 March in the field when the farmer started their field for the cultivation of their winter crops (wheat, barley, mustard potato, garlic, and onion). This research is mainly based on the primary data collected from the field. The field was visited each week from November to March and observed the growing condition of the crops as well as the **Thagne jhar**. Observed and measure the morphology, ecological condition, rate of growth of **Thagne jhar**, its competition with the cultivated crops, dominancy, and the impact of crop production. In the field, the researcher participated with farmers in crop cultivation, managed interview, and discussed the impact *Spergula arvensis* (**Thagne Jhar**) on crop production, its dissemination, and future of the crop production. Similarly, secondary data were collected from the related articles of the journal, books, and online articles. The collected data were presented and analyzed according to the nature.

Ecology and Morphology

S. arvensis behaves like a summer annual plant in temperate climates. In the UK, the majority of seeds typically germinate in mid- to late-April. After 8 weeks, flowers can be anticipated, followed by 10 weeks of full seed production. Up to the plant's demise, flowering and seed production continue (Holm et al., 1977). In Canada, mature plants bloom between July and August and start to shed their seeds in July. Germination begins in California, USA, after the first significant rainfalls in the fall and continues until the habitat dries out in the spring (Wagner, 1986). The smooth morphs of the seed are found vigorously between 130C to 210C. A huge, heavily branched individual of *S. arvensis* has been shown to yield up to 7500 seeds in a short period of time (Wagner, 1988). The seeds could germinate right away after being dispersed because they lack primary dormancy. Temperature swings between 7 and 17 0C and 17 and 27 0C encouraged germination (Hakansson, 1982). Conn and Deck (1985) reported seeds can survive up to a long time buried in the soil, and less than 1% can survive after 9.7 years. In the study area Baglung municipality, Gandaki province, Nepal, it behaves as a winter (November to March) annual herb. The germination was favored by temperature fluctuations between 17 and 27 ^{0}C in winter season and the smooth morphs of seed were found vigorously.

Spergula arvensis is an annual, rarely short-lived perennial herb about 10-70 cm tall (Bermer, et. al,2009) but, in the study area, the plant becomes 10 to 35cm tall. The height of the plant is based on the fertility of the soil and the favorable environment. Stem erect, branched herb; branch (lets) clustered at the base, slightly angular or terete, glabrous or glandular-pubescent. Leaves are simple, opposite, appearing whorled, linear, dissected, to 3 x 0.4 cm, glabrous, sessile, canaliculated; base obtuse, sheathing, apex acute; stipules in whorls, ovate, 1 x 1 mm. Inflorescence in dichasial cyme, terminal. Flowers bisexual, rarely unisexual, because of stamen abortion, actinomorphic, pedicellate, peduncle to 8 cm. Flower to 3 mm wide; pedicel to 2 cm. Sepals 5, free, lanceolate, 3 x 1 mm, glandular without. Petals 5, white, entire, ovate, 3 x 1.5 mm (Ganeshaiah,……). Stamens 5; filaments subulate, flat; anthers ovoid. Ovary superior, unilocular, numerous, axile placentation, style 5, free, recurved. Fruit capsule, obovoid-globose, dehiscing with 5 valves or rarely by 3 valves, fruit length 3.5-5 mm (NPT,2023). Seeds many, reniform or subglobose, compressed laterally, finely papillate or smooth, marginal wings present.

Fig: Roots

Flowering

Ripening of fruits

Evolutionary Adjustment and Competitive Exclusion:

According to recent research (Huey et al 2000), intruders can quickly adapt to the new settings in which they find themselves. Many academics are interested in how weeds have changed as a result of human activity, notably agricultural techniques.Most of the crops and their adjustment and production are directly affected by the evolutionary adjustment of the weeds as *Spergula arvensis*. This species also evolved and developed in new varieties as the name of *Spergula arvensis L. var sative* (Boenn), Mert. & Koch, *Spergula linicola* Boreau ex Nyman, S. maxima Weihe, *S. sativa* Boenn. It is found that Spergula arvensis can easily adjust in the cropland because of its tap elongated root which can easily absorb the essential nutrition from the field. According to Harlan (1965), some weeds have evolved to resemble certain crops. They have co-evolved with crops that have similar morphology and phenological development, and their seeds have also developed a similar appearance so that they are not separated out and thrown away during harvest. Invasive species' altered genetic make-up has significant indirect effects on the biological environment and other creatures they come into contact with. These significant impacts are connected to introgression and hybridization.

According to Porter and Sagiynano (1990), some alien species exterminate native species by competitive exclusion after being thoroughly investigated in Texas. They conducted extensive research in Texas and

discovered that this fire ant, presumably through competitive exclusion, reduced native ant diversity by 70% and the overall number of native ant individuals by 90%. Similarly, *Spergula arvensis* fully dominate the winter agricultural corps and reduce more than 90% production of the crops in the study area.

Transmission of invasive species

The seeds of *Spergula arvensis* are disseminated through anthropochory, which is dispersal by people, zoochory, which is distribution by birds or other animals, and autochory, which is self dispersal. Availability and Abundance The plant Spergula arvensis prefers open environments. Roadsides, seashores, and cultivated fields are where it typically thrives (Royer and Dickinson 1999; Guide to Weeds in British Columbia; New 1961). Current and native distribution: Native to Eurasia is the spergula arvensis. It spreads throughout North America, South America, Australia, and New Zealand, as well as Europe, Asia, and Africa (Hultén, 1968). According to Royer and Dickinson (1999), the USDA, NRCS (2006), it can be found in the majority of U.S. states and almost all Canadian provinces. Above the Arctic Circle, this species has been observed to grow (NHRD 2005). In Alaska's three ecogeographic areas, Spergula arvensis has been identified (Hultén 1968, UAM 2003, AKEPIC 2010).

Greater trade, transportation, travel, and tourism have all been made possible by globalization, and they can all help introduce and propagate non-native species. Human activities, often unknowingly, are the primary means by which invasive species are spread. People and the commodities we use move swiftly throughout the globe, frequently bringing unwanted species with them. The dispersed seed transmit in different areas by the activity of human beings as plowing instruments, with crop seed transmission. In the study area, a 55years female respondent listened to me an interesting story of the transmission of **Thagne Jhar** as:

Ten years ago, I am standing in the yard of the house watching the crops in the field. My house lies near the side of the road. A black color man coming from the road. He had a big black back in his backside and many small plastic packs with few seeds in his hand. He comes nearer and said, Mother, please take different kinds of crop seeds and cultivate them on your farm. It is cheap, nice and important, please. I watch only and asked about his home. He said he was coming from Uttar Pradesh, India. In his strong request, I took some pouches of radish, spinach, and soybean for five rupees each and I give a total of twenty rupees. He give new pack, what is it, I have not seen it before. It is free for you he said, it is a new nice spinach, please cultivate it on your farm with adding manures. Then I cultivate these new seeds on my farm. It germinate vigorously, which is new, no one can identify it, it ripped but we left it on the farm and then after cultivating rice in this area. In the next, season again it germinate and spread to a larger area of the farm. Now, it is spread all over the area. All the villagers abuse me but I cannot say any things with them. It is my weakness, an unknown seed taken and cultivate. This **Thagne Jhar** is fully harmful to winter crops. No one has the knowledge to eradicate it. She saw me the winter cultivate farm as in the figure.

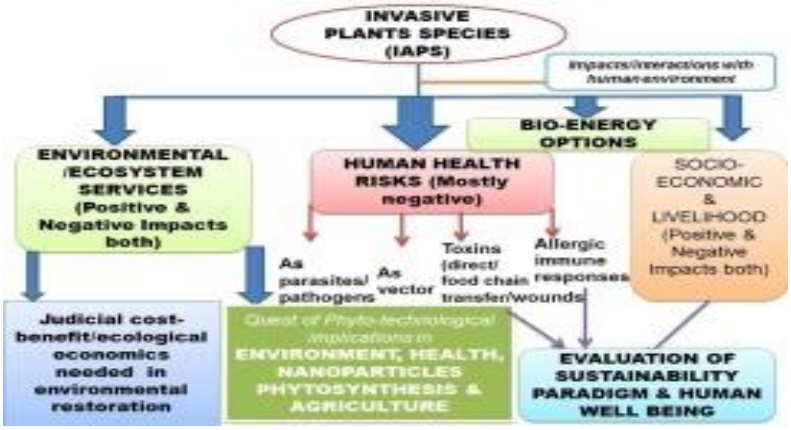
Fig: Domination of *Spergula arvensis* in winter crop- wheat, potatoes farmland

Now, this weed has spread to all parts of the rice-producing land of the study area. It is spread in nearly all parts of the country as above mentioned story in the rice farmland of Nepal. From the above story, these weeds spread in the study area by the activity of the man with the hidden interest to decrease the production of the winter crops and increase their market for their production. It reflects how core and peripheral countries get economic privilege from marginal countries and kept their owns under.

Thagne Jhar and its Impact

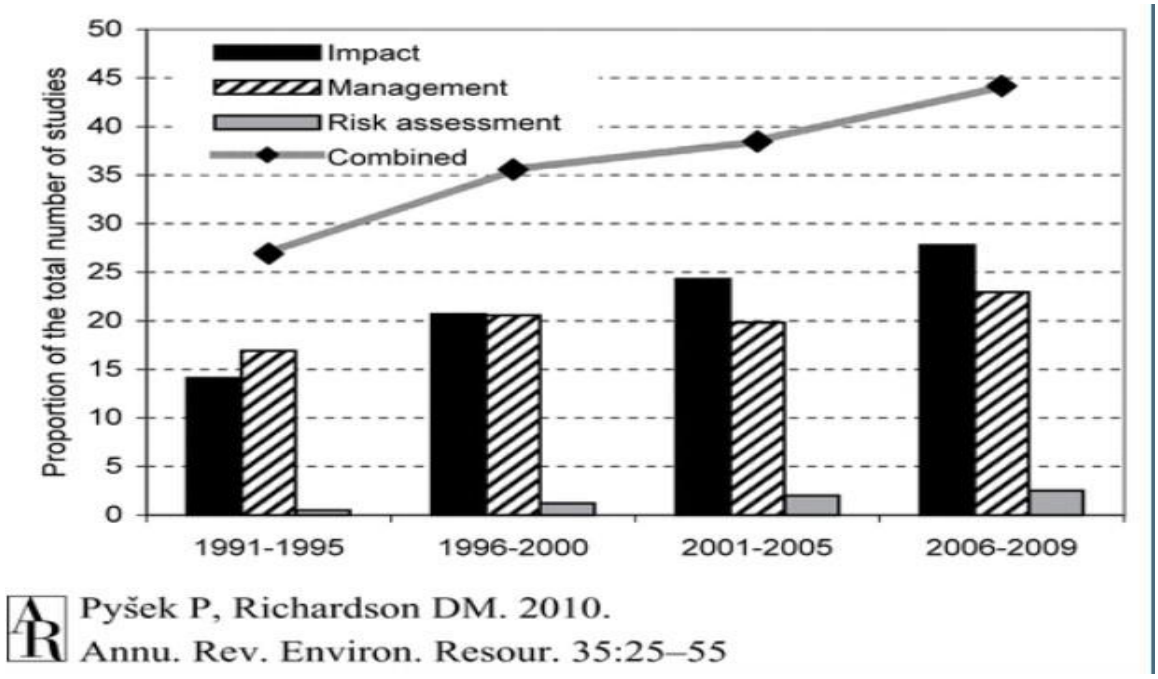
An introduced, nonnative organism (disease, parasite, plant, or animal) that spreads or widens its range away from the location of its introduction and has the potential to affect the environment, the economy, or human health is referred to as an invasive species. A significant driver of climate change, invasive species contribute to the loss of biodiversity, the deterioration of ecosystems, and the reduction of ecosystem services on a global scale. The effects of invasions on the environment and the economy are currently the subject of new research.

The expenses associated with controlling invasive species are in addition to the direct consequences of a species on real estate prices, agricultural production, public utility operations, native fisheries, tourism, and outdoor recreation. According to a 2021 study (Crystal-Ornela, R. et al. 2021) invasive species cost North America $2 billion per year in the early 1960s to over $26 billion per year since 2010. Invasive species are thought to have cost the global economy $1.288 trillion during the last 50 years (Zenni, R.D. et al. 2021).



Ref: Rai and Singh, 2022

S. arvensis is one of the three worst weeds for cereals in Kenya, as well as for wheat and barley in Finland, where a thorough assessment revealed that it had the highest average density of any weed species per field. Alaska (cereals and pastures), Germany (flax), New Zealand (maize, peas, vegetables, and wheat), Norway (vegetables, barley, oats, and wheat), the Philippines (vegetables), Colombia (corn and oats), Sweden (barley, oats, potatoes, and wheat), Ireland (peas), and Tanzania (wheat) are among the countries where it is a major weed. According to Holm et al. (1977), it is also widespread in Brazil, Australia, the UK, India, Portugal, France, and Japan. In the study area, as mentioned by Holm et al., it is the serious weeds for barley, oats, potatoes, wheat, and Brassica species that were cultivated in rice farmland. It has been also reported as the alternative host of several crop pathogens caused by viruses (Royer and Dickinson,1999).



Richardson (2010) studied the impact, management, and risk assessment of the invasive species of different parts and found that with the increase of periods, the impact of the invasive species increases though, activities of the management follow it. *Spergula arvensis* is one of the most serious weeds which cannot be managed till now.

In the study area, in the query of production of wheat and potatoes, 52 years informant said:

What I do babu? We sincerely cultivate wheat, barley, and potatoes with sufficient compost as well as chemical fertilizer to increase yield production. But, before the germination of the cultivated crops, this alixinaha Jhar germinates first vigorously and grows at high speed than the cultivated crop and absorbs all the fertilizer, and easily dominates the crop. Farming of the crops and left barrier land is equal. Before in my land about eight muri wheat, barley, and five muri potatoes were produced area now only two muri wheat and barley production and less than one muri potatoes were produced. Labor costs increased day by day but production decreases continuously, then how can we survive? for whom, does this sorrowful situation share? who solved our problem. His voice stops suddenly, full of tears in his eyes. I can not elaborate on the conversation and left him.

In the next visit to the field after one week, in the query of barrier land. 55 years female (who first of all bye a small pouch of seed) informant said:

We left to cultivate winter crops in our field because of the **Thagne Jhar**. When decreasing yield production continuously and with the hope of eradicating this serious weed from their field. We cultivate only maize and rice. When the land remains a barrier in the winter season, the amount of the **Thagne jhar** decrease and produces maize. It cannot germinate in rice cultivation time but it can again germinate in the coming winter.

When we think deeply, the informant's view and situation easily reflect the harmful effect of the **Thagne Jhar** on the economic life of the people. Though this weed is introduced accidentally or purposefully, it directly affects the life of the farmer. It should be thought that if the farmer left to cultivate agricultural products then how other people survive in the present food scarcity world? Researchers, scientists, and governments of the concerned area should be fully concerned about such type issues appearing by invasive species of the world.

Nepal has a lot of knowledge on the harm invasive plants can cause to protected areas. Maheshwar Dhakal, the head of Nepal's government Department of National Parks and Wildlife Conservation, claims that while allegations of invasive plant problems in the country's high-altitude protected regions "are still hypotheses" at this time, lowland areas have been severely affected. “We need a detailed and comprehensive study to priorities control measures there,” he says (Pyakurel,2022). Similarly, the presence of invasive species in Nepal's mountains.

Perception of the People and Uses

Transdisciplinary research and participatory decision-making are guided by how people see things. According to Kapitza et al. (2019), researchers and managers lack knowledge of the sociocultural framework these species are entrenched in without a grasp of perceived benefits. They discovered that various stakeholder groups have distinct societal attitudes of invasive species. In the study area, all the peoples have negative perceptions about this invasive plant species. They suffer from many invasive species, among them **Thagne Jhar** is a serious one, it is not used for fodder, or any type of food in the study area. It decreased almost 90% production of the winter crops. Decrease the interest of farmers to cultivate winter crops on their farmland. They should manage this winter crop food from the market.

Though *Spergula arvensis* is not used for any purpose in the study area. In northern Europe, it served as a source of nourishment for people from the third to the fifth centuries AD. In more recent times, it has been utilized to make bread in the same region during times of scarcity. As feed, cattle and sheep particularly enjoy it (Holm et al., 1977). Medicinally this plant has been used as a diuretic. Saponins are also present in the seed and leaves. Many saponin-rich plants are utilized in herbalism (especially as emetics, expectorants, and febrifuges) or as sources of raw materials for the pharmaceutical industry. Although saponins are poisonous, they also have a variety of medical uses. Because saponins are far more harmful to many cold-blooded animals, like fish, hunting cultures have historically added significant amounts of them to streams, lakes, and other water bodies in an effort to stun or kill the fish and make them simpler to catch.

Management of invasive species

It is crucial to measure the effects of invasive species, which were probably prompted by the financial harm that invasive weeds, insect pests, and plant illnesses inflicted on agricultural commodities. The government and other concerned parties should concentrate on controlling invasive plant species.

However, the danger to agriculture has not lessened recently. Particularly in developing nations like Nepal, where the costs of the consequences can be substantial in comparison to a country's gross domestic product, many agricultural systems around the world are still vulnerable to invasive species. (Paini et al., 2016)

However,to handle invasive species, researchers are now making progress in this area. The following table shows the stages of the invasion process that need to be taken into consideration in order to create and implement effective management methods against invasive species.

Table: Possible management techniques for every step.

S.No.	Stage of Invasion	Management strategies
1	Arrival	- Risk assessment - International norms - Inspection
2	Establishment	- Detection - Eradication
3	Zone of spread	- Quarantine - Barrier zone
4	Impact	- Suppression - Adaptation

Ref- Liebhold and Tobinn (2008)

For the management of the invasive species first of all identify the species, and analyze the risk of the species. From the point of view of risk, crop destruction is directly harmful to the farmers or hungry stomach, as affected by *Spergula arvensis*. Such types of species must be eradicated by the use of new techniques, strictly developing barrier zone and searching or developing suppression species and decreasing the adaptation capacity of the invasive species.

The National Biodiversity Strategy and Action Plan 2014 gave the identification of dispersal channels, impact assessments, public engagement and education, and biological control programs top priority as responses to policy. IAP management prospects in Nepal (Shrestha, 2019). However, the policy was only implemented in protected areas and was able to check to spread a few wild species. The policy should focus on the invasive species which affect agricultural crops over time.

Prevention and Control

The lives of people are directly impacted by invasive species like Spergula arvensis in crops. It is vital to limit the seed's spread to from one location to another. Make sure to thoroughly clean affected areas to prevent the spread of seeds.

Cultural control*;*

Since *S. arvensis* seeds do not grow in very deep soil, some of them may be buried by using traditional planting techniques. Regular cultivation will bury a percentage of seeds to depths from which they are impossible to establish because it is unable to emerge from enormous depths. Regular cultivation,

however, is unable to stop the germination of **Thagne Jhar** in the research region. The lifetime of seeds that are buried in the soil profile, however, enhances the likelihood that they will eventually be brought back to the soil surface by subsequent cultivations, whereas cultivation reduces the amount of seeds at or near the soil surface. Mineral fertilization (addition of N and Ca) of spring barley removed *S. arvensis* in field tests conducted in Poland (Borowiec et al., 1985). Yadav et al. (1995) used integrated weed management techniques to successfully suppress this weed by combining pre-emergence isoproturon spraying with an increase in N fertilizer and the use of the stale seedbed strategy.

Physical control*:*

The mechanical techniques that can be used before the seeds of the crops are sown, such as hand pulling, hoeing, or grazing, can be used to successfully reduce *Spergula arvensis* infestations. Because soil disturbances encourage the germination of dormant seeds, control measures must be repeated.

Biological defense:

Spergula arvensis is known to be resistant to most insects and pathogens, however an arbuscular-mycorrhizal fungal inoculum has been demonstrated to be efficient in lowering weed biomass.

Chemical control

S. arvensis has been chemically controlled in a number of crops using a variety of pre- and post-emergence herbicides. A combination of chlorsulfuron + 2,4-D efficiently eliminated numerous 2,4-D resistant weeds, including S. arvensis in spring wheat, according to experiments carried out in Russia by Lyzenko et al. (1992). In Canada, chlorsulfuron was equally effective in barley (Ivany, 1987). Triasulfuron was used in the south-west Cape of South Africa to suppress *S. arvensis* in wheat and barley, and a tank mixture of triasulfuron and bromoxynil was used to achieve 96% control (van Biljon et al., 1988). Terbutryn and isoproturon were successful wheat pesticides in India when used post-emergence (Tiwari et al., 1987). Pendimethalin dramatically decreased populations in Indian potato crops while phenmedipham completely controlled *S. arvensis* in sugar beet (Beta vulgaris) after post-emergence spraying (Costa et al., 1984). Following the pre-emergence treatment of ametryne, the weed was eliminated from root crops in the Philippines, including sweet potatoes, cassava, yam, and potatoes (Robles, 1979). For example, Mamarot and Rodriguez (1997) advise using linuron in potato, soybean, and sunflower, phenmedipham and metamitron in sugarbeet, metazachlor in rape, metribuzin, metsulfuron, and metobromuron in potato, metsulfuron, terbutryne, and tribenuron in cereals, oxadiazon in soybean and sunflower, and pendimethalin in sunflower and maize.

Challenges

Invasive species have the highest adaptive capacity in the new area and easily dominate the local species. They harm the local ecosystem where they are accidentally or purposefully introduced. Most invasive species are useless for human beings. Due to the lack of knowledge about the invasive species, their effects, it becomes more challengeable to manage and control. In the context of Nepal, there is little study about invasive species mainly focused on protected areas. In mountain and Himalayan regions what types of invasive species affect the local ecosystem is not known till now. Those invasive species which are related to agricultural crops like *Spergula arvensis* are another greater issue because of their impact on yield production. A decrease in the agricultural food product will change not only the local economy but

also the global. It directly affects globalization and also a power struggle between the so-called developed countries of the world. Therefore, proper identification, management, control strategies, and development of new technology to use invasive species in human welfare is a great challenge at present.

Conclusion

An organism that is not native or indigenous to a place is said to be an invasive species. The new species that are introduced into a new region or area accidentally or purposefully. These introduced species multiply too quickly, adapt to the environment and become invasive. *Spergula arvensis* is a popularly known invasive plant species that have been distributed in many parts of the world. It is an annual, rarely short-lived perennial herb about 10 to 35cm tall. One of the worst cereal weeds is S. arvensis seriously effect on winter crops like wheat, barley, potatoes, mustard, maize, etc. It is not used for any purpose by the people and has a negative perception of the people in the study area and highly decreases the yield of agricultural crops. A decrease in the agricultural food product will change not only the local economy but also the global. It directly affects globalization and also a power struggle between the so-called developed countries of the world. Therefore, proper identification, management, control strategies, and development of new technology to use invasive species in human welfare is a great challenge at present.

References

1. AKEPIC database (Alaska Exotic Plant Information Clearinghouse Database) 2010. The occurrence of weed seeds in samples submitted for testing by the O.S.T.S *Journal of the National Institute of Agricultural Botany* Vol.6, PP 275-286. E http://akweeds.uaa.alaska.edu/ Broad, P.D. 1952.
2. Biljon, J.J van, Hugo, K.J.and Iwanzik, W. (1988). Triasulfuron: a new broadleaf herbicide in wheat and barley. Applied Plant Science, Vol.2(2), pp.49-52. Google Scholar
3. Borowiec, S., Kuszelewski, L., Kutyna, I., LeSnik. T. and lukaszuk ,T. (1985). The effect of long-term fertilizer use on soil properties and weed infestation of rye, spring barley, Sinapis alba and potato crops. Part II. The effect of different fertilizer treatments on weed infestation of individual crops. *Zeszyty Naukowe Akademii Rolniczej w Szczecinie, Rolnictwo*, Vol.37, pp. 71-86. Google Scholar
4. Conn, J.S. and Deck, R.E. (1995). Seed viability and dormancy of 17 weed species after 9.7 years of burial in Alaska. *Weed Science*, Vol. 43(4), pp. 583-585 Google Scholar
5. Costa, R.A.S., Brauner, G.L., Silveira, J. P. (1984). Chemical weed control in sugarbeet crops (Beta vulgaris L.). Anais da 2. Reuniao Tecnica Anual da Beterraba Acucareira. Pelotas, Brazil: *UEPp de Pelotas*, pp.135-138. Google Scholar,
6. Harlan, J.R. (1965). *Euphytica* Vol. 14, pp. 173–176
7. Crystal-Ornelas, R., Hudgins,E.J., Cuthbert,R.N. et al. 2021. Economic costs of biological invasions within North America. *NeoBiota* Vol.67, pp. 485-510.
8. Holm, L., D. Plucknett, J. V. Pancho, and Herberger, J.P.(1977). *The world's worst weeds: distribution and biology*. East-West Center, University of Hawaii Press, Honolulu. Googls Scholar
9. Huey, R.B., Gilchrist, G.W., Carlson, M.L., Berrigan,D and Serra,L.(2000). *Science* 287, pp. 308–309
10. Hultén, E.(1968). Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 p. *Invaders Database System*. 2010. University of Montana. Missoula, MT. http://invader.dbs.umt.edu/

11. **Hulme, P.E., Bacher, S., Kenis, M., Klotz, S., Kühn, I**., et al**. (2008)**. Grasping at the routes of biological invasions: a framework for integrating pathways into policy. *J. Appl. Ecol.* 45:403–14
12. Husain, M.F. and Ghosh, A.K. (1985). Pendimethalin formulations for weed control in potato. Abstracts of papers, *Annual Conference of the Indian Society of Weed Science*, Vol.19. Google Scholar
13. Ivany, J.A.(1987). Chlorsulfuron use in barley and residual effect on potato and rutabaga grown in rotation. *Canadian Journal of Plant Science*, Vol. 67(1), pp. 337-341. Google Scholar
14. Kapitza, K.,Zimmermann.H.;Martin-Lopez.B and Von Wehrden,H.(2019). Research on the social perception of invasive species:a systematic literature review. *Neo Biota*. Vol.43, PP 47-68. http://doi.org/10.3897/neobiota43.31619.
15. Klein, H. (2011). *Spergula arvensis L*. Alaska National Heritage Program, University of Alaska. http://aknhp.uaa.alaska.edu
16. Liebhold, A.M. and Tobin, P.C. (2008). Population ecology of insect invasions and their management. *Annu Rev Entomol.* Vol.53, pp. 387–408. 10.1146/annurev.ento.52.110405.091401
17. **Lockwood J.L, Cassey P** and **Blackburn T.M. (2009).** The more you introduce the more you get: the role of colonization pressure and propagule pressure in invasion ecology. *Divers. Distrib*. 15:904–10
18. Lyzenko, V.I., Raskin, M.S., Spiridonov, YuYa., Zaitseva, T.S., Kutuzova, N.B.and Samus, M.V. (1992). Productivity and grain quality of spring wheat treated with a mixture of chlorsulfuron and 2,4-D. *Sel'skokhozyaistvennaya Biologiya*, Vol. 3, pp. 138-142. Google Scholar
19. Mamarot,. J. and Rodriguez, A. (1997). *Sensibilité des mauvaises herbes aux herbicides*. 4th edition. Paris, France: Association de Coordination Technique Agricole. Google Scholar
20. Natur Historiska Riksmuseet Database. (2005). Spergula arvensis L. *The Journal of Ecology*, Vol. 49, pp 205-215. Available from: http://www.nrm.se/wise/ New, J.K. 1961.
21. New, J. K. (1981). Moisture for germination as a factor affecting the distribution of the seed coat morphs of *Spergula arvensis* L. *Watsonia* **13**: 323– 324.
22. Paini, D.R., Sheppard, A.W., Cook, D.C., et al.(2016). Global threat to agriculture from invasive species. *Proc Natl Acad Sci U S A.* Vol.113 (27), pp.7575–9. 10.1073/pnas.1602205113
23. Pyakurel, D.(2022). Invasive species inch northwards in Nepal, threatening mountain ecosystems. https://wwwonationalgeographic.org>encyclopedia>i……
24. **Richardson DM** and **Pyšek P. (2006**.) Plant invasions: merging the concepts of species invasiveness and community invasibility. *Prog. Phys. Geogr.* Vol. 30, pp. 409–31
25. **Richardson DM, Pyšek P, Rejmánek M, Barbour MG, Panetta FD** and **West CJ. (2000).** Naturalization and invasion of alien plants: concepts and definitions. *Divers. Distrib.* Vol. 6, pp. 93–107
26. Robles, R.P. (1979). Weed control in root crops in the Philippines. In: Moody K, ed. Weed Control in Tropical Crops. Manila, Philippines: *Weed Science Society of the Philippines*, 189-197. Google Scholar
27. Royer, F. and Dickinson, R. (1999). Weeds of the Northern U.S. and Canada. The University of Alberta press. 434 pp.
28. Shrestha, B.B (2019). Management of Invasive Alien Plants in Nepal: Current Practices and Future Prospects. https://link.springer.com/chapter/10.10071978-981-13..
29. Stace, C. (1997). *New flora of the British Isles*. 2nd edition. Cambridge, UK: Cambridge University Press. Google Scholar

30. USDA, NRCS. (2006). The Plant Database, Version 3.5 (http://plants.usda.gov). Data compiled from various sources by Mark W. Skinner. *National Plant Data Center*, Baton Rouge, LA 70874-4490 USA.
31. Wagner, L. K. (1986). Variation in seed-coat morph ratios in *Spergula arvensis* L. *Bull. Torrey Bot. Club*, Vol.113, pp. 28– 35. Google Scholar
32. Wagner, L.K. (1988). Germination and seedling emergence in Spergula arvensis. *Botany* **https://doi.org/10.1002/j.1537-2197.1988.tb13464.x**
33. Yadav, P.K., Kurchania. S.P. and Tiwari, J.P. (1995). Herbicide and fertilizer compatibility under normal and stale seedbed sowing of wheat (Triticum aestivum) at different levels of nitrogen. *Indian Journal of Agricultural Sciences*, Vol. 65(4), pp. 265-270 Google Scholar
34. Zenni R.D., Essl, F.,García-Berthou, E. et al. (2021). The economic costs of biological invasions around the world. NeoBiota 67:1-9.