



Host Range Expansion of *Scurrula parasitica* L.: A Rising Challenge to Ecosystem Stability and Biodiversity Sustainability

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Abstract

Scurrula parasitica L. a hemiparasitic plant of the Loranthaceae family is primarily found in tropical and subtropical regions of Asia. Recent studies indicate its expansion into temperate zones, parasitizing a broader range of host species. This study examines its host spectrum, ecological impact, and medicinal potential. The parasitism of this parasitic taxon affects host plants by reducing photosynthetic efficiency, water uptake, and nutrient absorption, leading to significant physiological stress and, in severe cases mortality. In the recent years its adaptability to new areas and new hosts has been enhanced a lot due to climatic and other environmental changes. A number of species like *Pyrus pashia*, *Punica granatum*, *Populus* sp. *Platanus orientalis*, *Melaleuca callistemon* etc are abundantly occupied by this uninvited guest, leading to deleterious effects in the hosts. Although the *S. parasitica* is with high medicinal values with highly important bioactive compounds, including flavonoids and alkaloids, exhibit antimicrobial, anti-inflammatory, and anticancer properties, highlights its pharmacological significance observed in some studies but in our studied areas there is no evidence of such ethnomedicinal usage or any other commercial usage, so in it's a threat for other floral diversity in these particular areas need proper management.

Keywords: *Scurrula parasitica*, Hemiparasite, Sustainability, Loranthaceae, Management, *Punica granatum*

Introduction

Parasitic plants are a diverse group of species that obtain water and nutrients from their host plants, often affecting the growth, reproduction, and survival of their hosts (Parker & Riches, 1993). They have evolved specialized structures called haustoria, which penetrate the host's vascular system to extract essential resources (Westwood *et al.*, 2010). Parasitic plants are classified into hemiparasites, which retain some photosynthetic capability, and holoparasites, which are entirely dependent on their hosts for sustenance (Nickrent, 2020). Well-known examples include *Cuscuta* (dodder), *Orobanch* (broomrape), *Striga* (witchweed), and mistletoes such as *Scurrula parasitica* L. (Press

& Phoenix, 2005). These plants play significant ecological roles by influencing plant community dynamics, competition, and nutrient cycling (Marvier & Smith, 1997). While some parasitic species are keystone components of their ecosystems, others pose severe threats to agriculture and forestry by parasitizing economically important crops and trees (Ejeta, 2007). For instance, *Striga* species are major pests in cereal crops, leading to substantial yield losses in regions like sub-Saharan Africa (Gurney *et al.*, 2006). Despite their detrimental effects, some parasitic plants have medicinal value, containing bioactive compounds with pharmacological applications (Tesitel *et al.*, 2010).

Understanding their ecological interactions and physiological adaptations is crucial for managing their impact on natural and cultivated ecosystems.

S. parasitica L. commonly referred to as cinnamon mistletoe, it has evolved in forested and semi-forested ecosystems, where it parasitizes a diverse array of host trees. Like other hemiparasitic plants, it establishes haustorial connections with its host, extracting water and nutrients while retaining partial photosynthetic capability (Kikuchi *et al.*, 2017). Recent studies indicate that this species is expanding its range into temperate environments, demonstrating an increasing adaptability to novel host species, which has implications for both natural and cultivated ecosystems (Liu *et al.*, 2018).

Parasitic plants along with their invasiveness cause devastating effects on the natural distribution and diversity of plant diversity in the forests of studied areas. The adaptability to a wider range of hosts has raised concerns regarding its ecological impact and potential threat to economically valuable plant species. In agricultural and horticultural landscapes, it has been observed parasitizing commercially significant fruit-bearing trees such as *Pyrus pashia* (wild Himalayan pear) and *Punica granatum* (pomegranate), as well as widely distributed trees like *Platanus orientalis* and *Populus* spp. The increasing host range warrants further investigation into its physiological effects on host plants, ecological interactions, and potential mitigation strategies (Fig. 1).

The physiological consequences of *S. parasitica* parasitism on host plants are well documented. The parasite imposes stress by reducing the host's photosynthetic efficiency, water uptake, and nutrient absorption, leading to decreased growth and, in severe cases, mortality (Kikuchi *et al.*, 2017). This parasite causes serious concerns with some dominant and critically important species of the forests leading to cascading effects.

Beyond its ecological implications, it has garnered attention for its medicinal

properties. Phytochemical analyses have identified a diverse array of bioactive compounds, including flavonoids, alkaloids, tannins, saponins, and terpenoids, which contribute to its pharmacological potential. Notably, quercetin, a flavonoid found in *S. parasitica*, exhibits potent antioxidant activity, which has been linked to its therapeutic applications in treating inflammation, hypertension, and oxidative stress-related disorders (Malcom & Gareth, 2019). Extracts have demonstrated antimicrobial, anti-inflammatory, and cytotoxic activities, with particular promise in cancer research due to their ability to induce apoptosis in leukemia and breast cancer cell lines (Liu *et al.*, 2018).

Given the expanding range and ecological impact alongside its medicinal significance, a comprehensive study of its host interactions, physiological effects, and potential applications is essential. This research aims to examine the host spectrum of *S. parasitica* in temperate regions, assess its effects on host plants, and possible measures to tackle the deleterious effects on the plant diversity. Understanding the ecological aspects of this parasitic species will provide valuable insights into its management in forestry and agricultural systems while informing its possible utilization in pharmacological applications.

Results and Discussion

S. parasitica L. has traditionally been considered a hemiparasite predominantly occurring in tropical and subtropical regions. However, our study reveals its expansion into temperate ecosystems, where it has established parasitic associations with several ecologically and economically significant plant species. In addition to its extended geographic range, it exhibits a broadened host spectrum, proliferating extensively on newly identified host species.

The following is a comprehensive list of host species along with their respective families, primarily found in the northwestern Himalayan region, spanning from Uttarakhand to Jammu and Kashmir. Field studies were conducted in the Almora district

of the Kumaon region (Uttarakhand) and the Rajouri district of Jammu and Kashmir. In both regions, this taxon was recorded at

elevations ranging from 1500 to 1600 m asl, highlighting its adaptability to higher altitudes.

Table-1: The list of host species of *S. parasitica* L. observed during the study

No.	Scientific Name	Family
1	<i>Acacia nilotica</i> (L.) Delile	Fabaceae
2	<i>Acacia</i> spp. Mill.	Fabaceae
3	<i>Albizia lebbeck</i> (L.) Benth.	Fabaceae
4	<i>Bauhinia variegata</i> L.	Fabaceae
5	<i>Citrus</i> spp. L. (Lemon, Orange, etc)	Rutaceae
6	<i>Dalbergia sissoo</i> DC.	Fabaceae
7	<i>Eucalyptus</i> spp. L'Hér.	Myrtaceae
8	<i>Ficus benghalensis</i> L. (Banyan)	Moraceae
9	<i>Ficus carica</i> L. (Common Fig)	Moraceae
10	<i>Ficus palmata</i> Forssk. (Wild Fig)	Moraceae
11	<i>Ficus religiosa</i> L. (Peepal)	Moraceae
12	<i>Lagerstroemia speciosa</i> (L.) Pers.	Lythraceae
13	<i>Mangifera indica</i> L. (Mango)	Anacardiaceae
14	<i>Melaleuca callistemon</i> (Sm.) R.Br.	Myrtaceae
15	<i>Morus alba</i> L.	Moraceae
16	<i>Platanus orientalis</i> L.	Platanaceae
17	<i>Populus</i> spp. L. (Poplars)	Salicaceae
18	<i>Psidium guajava</i> L. (Guava)	Myrtaceae
19	<i>Punica granatum</i> L.	Lythraceae
20	<i>Pyrus pashia</i> Buch.-Ham. ex D.Don	Rosaceae
21	<i>Shorea robusta</i> Gaertn. (Sal)	Dipterocarpaceae
22	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae
23	<i>Tectona grandis</i> L.f. (Teak)	Lamiaceae
24	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	Combretaceae
25	<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae

Destruction to Host Plants

The parasitic nature of *S. parasitica* significantly compromises the health and productivity of host plants. The key detrimental effects include provided in the given table 2.

Table-2: The list of different detrimental effects of *S. parasitica* L. on host plants

Detrimental Effects on Host Plants	Description
Resource Depletion	Haustrorial connections extract water and nutrients, causing stress and reduced vigor.
Growth Suppression	Infected plants experience stunted growth due to nutrient competition and hormonal imbalances.
Defoliation & Branch Dieback	Leads to chlorosis, premature leaf drop, localized necrosis, and branch dieback.
Reduced Photosynthetic Efficiency	Chlorophyll depletion reduces photosynthesis, causing energy deficits and further growth suppression.
Structural Weakening	Continuous nutrient loss weakens the host, increasing susceptibility to pests, infections, and environmental stress.
Yield Reduction	In fruit-bearing plants (e.g., <i>Mangifera indica</i> , <i>Citrus</i> spp., <i>Pyrus pashia</i> , <i>Punica granatum</i>), leads to poor flowering, fruit set, and reduced yield.

Susceptibility to Secondary Infections	Weak hosts are more prone to fungal, bacterial, and insect attacks, leading to wood decay and branch dieback.
Ecological Consequences	Decline in host trees affects biodiversity, disrupting ecological balance in mixed forests.

Factors responsible for increase in host range

The increasing host range of *S. parasitica* may be attributed to several factors mentioned in table 3.

Table-3: Different factors contributing to the spread of *S. parasitica* L.

Factors Contributing to the Spread	Description
Climate Change	Warmer temperatures and altered precipitation patterns enhance seed dispersal and host susceptibility.
Urbanization & Deforestation	Habitat disturbance increases the availability of stressed trees, making them more vulnerable to infection.
Adaptability to New Hosts	<i>S. parasitica</i> can exploit a wide range of tree species.
Broad Host Range	Affects various trees, including economically important species (<i>Mangifera indica</i> , <i>Citrus spp.</i> , <i>Ficus spp.</i> , <i>Eucalyptus spp.</i>).
Efficient Seed Dispersal	Birds consume the sticky berries and excrete seeds onto new host branches, aiding rapid spread.
High Reproductive Capacity	Produces abundant seeds, facilitating establishment on multiple hosts.

Ecological and Economic Impact

Threat to Forestry and Agriculture: Reduces yield in fruit trees (e.g., mango, citrus) and weakens timber trees (e.g., teak, sal).

Alteration of Ecosystems: Can change forest dynamics by affecting dominant tree species.

Due to its broad host range, it significantly affects forestry, horticulture, and natural ecosystems. It reduces fruit yield in mango and citrus orchards, weakens timber trees like teak and sal, and threatens biodiversity by stressing native tree species.

Management Strategies: below mentioned are some strategies to tackle the parasitic plant in the table 4.

Table-4: the possible strategies of management for the *S. parasitica* L.

Management Strategies	Description
Mechanical Removal	Cutting and removing infected branches reduces parasitic load but requires repeated intervention.
Chemical Control	Herbicides or growth regulators suppress mistletoe growth but may harm non-target organisms.
Biological Control	Utilizing natural predators, fungal pathogens, or insect herbivores to target <i>S. parasitica</i> for long-term control.
Resistant Tree Varieties	Researching host resistance mechanisms to develop tolerant cultivars for agriculture and forestry.

Distribution: *S. parasitica* L. has a widespread distribution across South and Southeast Asia, extending into parts of East Asia. It is found in: South Asia: India, Pakistan, Nepal, Bhutan, Bangladesh, Sri Lanka, Myanmar,

Thailand, Laos, Cambodia, Vietnam, Malaysia, Indonesia, Philippines, Southern China, Taiwan. It thrives in both natural and cultivated environments, including forests, orchards, and urban green spaces.



Fig.1. *S. parasitica* on different hosts, **A.** *Populus* sp. **B.** *Melaleuca callistemon* (Sm.) R.Br. **C.** *Platanus orientalis* L. **D.** also *Populus* sp. from a different location, **E.** *Punica granatum* **F** & **G.** *Pyrus pashia* **H.** *Morus alba*, **I.** flowers of *S. parasitica* **J** & **K.** fruit, **L.** sticky seed and **M.** haustorium

Conclusion

The expanding range and host adaptability of *Scurrula parasitica* L. highlight its ecological significance and potential threats to both natural and cultivated ecosystems. As a

hemiparasitic plant, its increasing presence in temperate regions suggests a shift in its ecological niche, warranting further study on its environmental adaptability and host-parasite interactions. The physiological stress

imposed on host plants, including reduced photosynthetic efficiency and nutrient depletion, underscores the need for effective management strategies to mitigate its impact on forestry and agriculture. Beyond its ecological implications, it possesses notable medicinal properties, with bioactive compounds demonstrating antioxidant, anti-inflammatory, and anticancer potential according to some studies cited above. Although traditional medicinal uses from the studied areas were not found evident but modern pharmacological findings, suggesting that this species could contribute to natural drug development. However, further research is required to explore its full therapeutic applications, standardize extraction methods, and assess potential toxicity.

A comprehensive approach integrating ecological studies, host resistance mechanisms, and medicinal research is essential for managing *S. parasitica* L.. Understanding its dual role as a parasitic threat and a medicinal resource will provide valuable insights for conservation efforts, agricultural policies, and pharmaceutical advancements. Future research should focus on its long-term ecological effects, control measures, and sustainable utilization in medicine.

References

1. Ejeta, G. "The *Striga* scourge in Africa: a growing pandemic." *Integrating new technologies for Striga control*: 145(2):252-263. <https://doi.org/10.1104/pp.107.104038>
2. Gurney, A. L., Slate, J., Press, M. C., & Scholes, J. D. "A novel form of resistance in rice to the angiosperm parasite *Striga hermonthica*." *New phytologist* 169.1 (2006): 199-208. <https://doi.org/10.1017/S0021859606006539>
3. Kikuchi, Y., Matsubayashi, Y., Shimizu, M., Yamamoto, K., Physiological interactions between *Scurrula parasitica* and its host plants: Insights into hemiparasitic strategies. "Journal of Plant Research". 130. 3 (2017) 541-552. <https://doi.org/10.1007/s10265-017-0923-2>
4. Liu Y., Yang X., Zhang H., Li W. Expansion of *Scurrula parasitica* into temperate zones: Host adaptability and ecological consequences." *Ecological Research*". 33.4(2018) 763-774. <https://doi.org/10.1007/s11284-018-1593-9>
5. Marvier M. A., Smith D. L. Conservation implications of host range expansion by parasitic plants. "Conservation Biology". 11.4(1997) 839-848. <https://doi.org/10.1046/j.15231739.1997.96084.x>
6. Nickrent, D. L. "Parasitic angiosperms: how often and how many?." *Taxon* 69.1 (2020): 5-27. <https://doi.org/10.1002/tax.12276>
7. Parker, C., & Riches, C. R. *Parasitic weeds of the world: biology and control*. 1993.
8. Press, M. C., & Phoenix, G. K. "Impacts of parasitic plants on natural communities." *New phytologist* 166.3 (2005): 737-751. <https://doi.org/10.1111/j.14698137.2005.01358.x>
9. Těšitel, J., Plavcová, L., & Cameron, D. D. "Interactions between hemiparasitic plants and their hosts: the importance of organic carbon transfer." *Plant Signaling & Behavior* 5.9 (2010): 1072-1076. <https://doi.org/10.1093/aob/mcq043>
10. Westwood, J. H., Yoder, J. I., Timko, M. P., & Depamphilis, C. W. "The evolution of parasitism in plants." *Trends in plant science* 15.4 (2010): 227-235. <https://doi.org/10.1016/j.tplants.2010.01.004>
11. Muhammad K. J., Jamil S., Basar, N. Phytochemical and pharmacological properties of *Scurrula parasitica*: A review. "Pharmacognosy Journal". 11 .3(2019):354-366.

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