

Short communication

Diversity, distribution and medical significance of *Gazalina* species (Lepidoptera: Notodontidae) in Nepal

Bhaiya Khanal ^{1*} | Bimal Raj Shrestha ²¹ Kathmandu Metropolitan City- 25, Gyaneshwor, Kathmandu, Nepal² Biodiversity Research and Conservation Society, Kirtipur, Nepal* Correspondence: baya2000@live.com

Suggested citation: Khanal, B. and Shrestha, B. R. 2022. Diversity, Distribution and Medical Significance of *Gazalina* species (Lepidoptera: Notodontidae) in Nepal. Nepalese Journal of Zoology 6(S1):45–49.
<https://doi.org/10.3126/njz.v6iS1.50529>

Article History:

Received: 25 January 2022

Revised: 12 November 2022

Accepted: 25 November 2022

Publisher's note: The editorial board and the publisher of the NJZ remain neutral to the opinions expressed and are not responsible for the accuracy of the results and maps presented by the authors.



Copyright: © 2022 by the authors

Licensee: Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal.

Abstract

Except for their taxonomy, distribution and ecology, little research has been done on toxic moths. *Gazalina* species (Family: Notodontidae, Subfamily: Thaumetopoeinae) reported in Nepal has toxic hairs that cause severe infection when they come into contact with human eyes. Three species of *Gazalina* have been recorded in Nepal which includes *G. chrysolopha*, *G. apsara* and *G. transversa*. Of them, *G. chrysolopha* is a widespread and common species, which can be observed attracted to white lights. The distribution range of these moths, as well as their habitat preferences and life stage phenology, is still poorly understood. The distribution of *Gazalina chrysolopha* has so far been restricted to the mid mountain districts, with no recorded information from the Tarai region. These moths begin to appear in the mid of July, with a peak density in September to the first week of October. Few unusual records of this moth have also been made in March and April, which is not a common phenomenon. A detailed study on the distribution, ecology, life stages, and other facts about this moth could be extremely valuable to foresters, entomologists, and professionals involved in ophthalmological research in the country. This study presents updated information of *Gazalina* species in Nepal based on the field study and previous publications made by a few researchers.

Keywords: Ecology; Habitat; Phenology; Processionary; Taxonomy

1 | Introduction

Since more than 3000 species of moths have been estimated to exist in Nepal (Smith 2010), including three species of *Gazalina* (Family Notodontidae, Subfamily: Thaumetopoeinae). This moth is also widely distributed in northern Indian states such as Gharwal, Himanchal Pradesh, West Bengal, Arunachal Pradesh, and Uttarakhand (Anonymous 2021a). During its annual cycle, the female moth lays cluster of eggs during August to the end of September. Caterpillars progress from the first to the fifth instar in about 11.5 months, and pupation occurs between mid-June and the July end before emerging as adult moths (Rahman and Choudhry 1992). According to Srivastava and

Mukhopadhyay (2006), the average duration of the egg, larva, and pupa stages is 60.5, 165.5 and 35.5 days, respectively. They also mentioned that the entire life cycle takes about 265.5 days. The fourth and fifth instar larvae are voracious eaters, causing massive damage to host plants. The caterpillar of *Gazalina chrysolopha* is a major defoliator of shade trees in a large cardamom plantation. These caterpillars typically crawl up trees in a professional manner at dusk and defoliate leaves massively over night before returning at dawn (Rahman and Choudhry 1992).

Three *Gazalina* species namely, *chrysolopha*, *apsara* and *transversa* have been recorded yet from Nepal. Amongst them, *G. chrysolopha* is a common species with yellow hair tuft at female's abdominal tip for protecting its eggs. These hairs cause a severe infection in human eyes called Seasonal Hyperacute Panuveitis or SHAPU (Gurung et al. 2021a; Upadhaya 2020).

2 | Materials and methods

2.1 | Study area

Godavari – Phulchoki is our study area which is located to the south-west corner of Kathmandu city at 27°58' N to 85°39' E and 27°83' N to 85°385'E. The elevation of Godavari is 1342 m which continues to 2734 m to the top of Phulchoki Mountain. This study covered elevation upto 2000 m where observation of the target species was made. Secondary data (Sugi 1993, 1994; Gurung et al. 2021b; Upadhaya 2018; Kharel (2021) was consulted for the diversity and distribution of *Gazalina* moths in other parts of the of the country which included Kaski, Lamjung, Myagdi, Makwanpur, Sindhupalchok, Ramechhap etc. This study was done in different years from 2013 to 2020 in June to October.

This study covered the elevation range of 1400 to 2000 m where major tree species like *Quercus semicarpifolia*, *Castanopsis indica*, *Alnus nepalensis* *Schima wallichii*, *Symplocos* sp., *Sambucu shookeri* were noticed. Only two specimens of *G. chrysolopha* (Fig.3) were collected carefully using a wide mouthed glass bottle containing a small cotton ball moistened with ethyl acetate. Hand gloves and eye glass were used to avoid their contact to skin and eyes. The net was not used as this moth rarely flies during the day instead rests compactly on leaves or other objects like a dead specimen. Hampson (1892) was consulted for identification keys and Sugi (1993, 1994) was followed for its distribution information in Nepal.

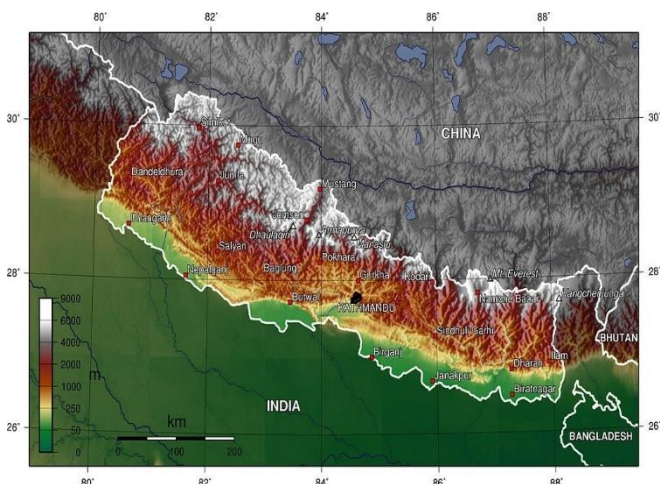


Figure 1. Black spot indicates study area in Godavari-Phulchoki

The temperature in Godavari-Phulchoki ranges from 10° to 14 °C during winter and 15° to 30 °C in summer (Fig. 2) (Khanal et al. 2015). This mountain may experience

snowfall during the winter, while monsoon brings heavy rains from July to September.

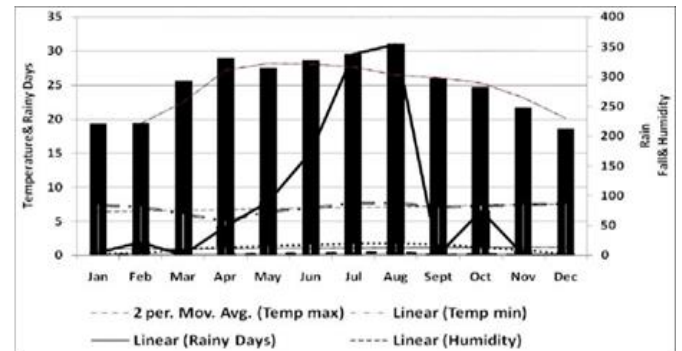


Figure 2. Climate graph of Lalitpur District including Godavari - Phulchoki Area

3 | Results

Two species like, *G. chrysolopha* and *G. apsara* were observed in the field. The provided information on *G. transversa* is based on Sugi (1993, 1994). The observation of 12 individuals of *G. chrysolopha* was made in 1400 – 2000 m of elevations at the Godavari to Phulchoki route. They were observed resting on leaves, grasses, open areas, and upon wall of a house. Only one male of *G. apsara* was observed which was resting passively on a shrub leaf at 1510 m in September first week. The species diagnosis, status and distribution of three *Gazalina* species are provided below.

The female of *Gazalina* carry medical significance (Upadhyaya et al. 2018). This finding was also supported by the identification of moths’ hairs in the ocular structures of eyes of three SHAPU patients in Pokhara (Gurung 2021a).



Figure 3. *G. chrysolopha* with yellow hairs

a. *Gazalina chrysolopha* (Kollar 1844)

Diagnosis: Size: 46 –54 mm. Forewing (FW) has sub basal dark lines, two medial oblique lines with black veins behind. Some specimens show fulvous thorax and collar. Mid and hind tibia contain minute terminal spurs. Female has serrated antenna and large yellow anal tuft.

Status: Common at the end of July to October.

Distribution in Nepal: Jiri (Janakpur), Dagchu (Solukhumbu), Kathmandu (Sugi 1993), Kaski (Gurung et al. 2021b).

Global Distribution: Northeast India, Pakistan, Bhutan, Nepal (Sugi 1993, 1994; Basso et al. 2017; Rahman and Chaudhry 1992; Hampson 1892).

b. *Gazalina transversa* (Moore 1859)

Diagnosis: Size: 44 – 50 mm. Unlike *G. chrysolopha*, this species has complete medial lines in FW. Female with black edged termen. Head and thorax white with black abdomen. Female: large fulvous anal tuft at abdominal tip (Sugi 1993).

Status: Rare

Distribution in Nepal: Lalitpur (Godavari), Okhaldhunga (Sugi 1993, 1994)

Global Distribution: Northern India, Sikkim, China, Nepal (Sugi 1993).

c. *Gazalina apsara* (Moore, 1875)

Diagnosis: Size: 30 mm. White moth. Head thorax and abdomen white. FW has antemedial black line that reaches to the inner margin. Short medial and long post medial lines that do not reach to costa. Abdominal yellow tuft is present in female.

Status: Rare

Distribution in Nepal: Lalitpur (Godavari), Okhaldhunga. Sugi 1994)

Global Distribution: China, Sikkim (Savela, 2019); Nepal (Sugi 1993)

4 | Discussion

Of the total diversity record of 3 species (Sugi 1993) of this moth in Nepal, only *G. chrysolopha* and *G. apsara* were recorded in Godavari. Information of *G. transversa* was taken from Sugi (1993) which was recorded in 1989 from the Godavari and Okhaldhunga of East Nepal in 1990. None of its record is known from other parts of the country. *G. chrysolopha* is documented

well from different places of Nepal which is confirmed by author's field observation besides secondary data and personal communications. The study made so far indicates its distribution at mid mountain districts and none from lowlands. The females of all the *Gazalina* species contain toxic yellow hairs at their abdominal tips which carry clinical significance causing SHAPU (Seasonal Hyperacute Panuveitis), a severe eye disease in humans (Kharel 2021).

Sugi (1993) reported the presence of *G. chrysolopha* in Godavari from April to October but Gurung et al. (2021) reported that the appearance of adult moths occurs after monsoon in every odd year in Kaski district, and a few unhatched eggs of this moth may hatch under the favorable conditions in summer of even years, causing an outbreak overlapping newly emerged populations of that odd year after completing a yearlong cycle. This moth was also observed in the Solukhumbu and Baglung Districts in July end and September (Pers. Comm. Kiran Rayamajhi, Tenzing Sherpa September, 2021). The occurrence of SHAPU cases can be linked to the presence of white moths or *Gazalina* reported in many mid mountain districts such as Jumla, Doti, Dang, Myagdi, Lamjung Gorkha, Tanahu, Dhading, Nuwakot and Taplejung (Upadhyay et al. 2020). The record of this moth in May was verified by three SHAPU patients in Kaski District who were infected with this moth's hairs (Gurung et al. 2021a). Likewise, Chhetri et al. (2021) observed *G. chrysolopha* in September and *G. transversa* in April in Sikkim, India.

This moth's caterpillar is a major pest of *Alnus nepalensis* and *Rhododendron arboreum* in Kaski District and its outbreak usually occurs when there is low rainfall during post-winter months (Gurung et al. 2021b). This moth has also been reported as a major pest of *Quercus dilata* in Azad State in Pakistan (Rahaman and Chaudhry, 1991) while Stebbing (1914) reported it as a serious pest of *Quercus lamellosa* in Darjeeling District of India. Srivastava and Mukhopadhyay (2006) mentioned that the larva of *G. chrysolopha* is also a massive defoliator of *Alnus nepalensis* in Sikkim, India.

Gazalina apsara has also been recorded in Nepal from the Suri Dovan (1173 m), Jiri (1900 m) and Phulchoki (2730 m) (Sugi 1993; 1994) in addition to Godavari (1400 m). Its maximum upward range has been recorded to 3270 m in the Uttarkashi District of India (<https://www.gbif.org/species/154495299>). No information about *G. transversa* is available except its occurrence in the Lalitpur (Godavari) and Okhaldhunga Districts of Nepal (Sugi 1993; 1994), Sikkim and Nagaland states of India (Anonymous 2021b).

5 | Conclusions

To date, three species of *Gazalina* viz. *G. chrysolopha*, *G. apsara* and *G. transversa* have been reported in Nepal of the total six species found in Asia (Sugi 1993). Little is known about *G. transversa* except its published records on distribution, medical and pest values. This study revealed 12 individuals of *G. chrysolopha* and one individual of *G. apsara*. Detail information on the distribution and ecology of *G. transversa* still remains incomplete.

Studies on *G. chrysolopha* in Nepal, India and Pakistan identified it as a major defoliator of trees such as *Quercus dilata*, *Q. lamellosa*, and *Alnus nepalensis*. Its medical significance includes a severe eye disease (SHAPU) in humans due to its toxic hairs.

Acknowledgements

We are thankful to Prof. Dr. Nirmala Pradhan, a senior Botanist for identification of some habitat related plants of moths. Young entomologists, Mr. Kiran Rayamajhi and Mr. Tenzing Sherpa are appreciated for their significant information on the presence of *Gazalina* moths in the Baglung and Solukhumbu Districts of Nepal respectively.

Conflicts of interest

Authors declare no conflict of interest.

References

- Anonymous. 2021a. *Gazalina chrysolopha* Kollar. 1844. In: Sondhi, S., Sondhi, Y., Roy, P. and Kunte, K. (Eds.). Moths of India, 2:62. Indian Foundation for Butterflies. Accessed from: <http://www.mothsofindia.org/sp/355114/Gazalina-chrysolopha>
- Anonymous. 2021b. *Gazalina transversa* Moore, 1879. In: Sondhi, S., Sondhi, Y., Roy, P. and Kunte, K. (Eds.). Moths of India, v. 2.:62. Indian Foundation for Butterflies. Accessed from: <http://www.mothsofindia.org/sp/355800/Gazalina-transversa>
- Basso, A., Negrisolo, E., Zilli, A., Battisti, A. and Cerretti, P. 2017. A total evidence phylogeny for the processionary moths of the genus *Thaumetopoea* (Lepidoptera: Notodontidae: Thaumetopoeinae). *Cladistics* 33:557–573.
- Chettri, P., Matsui, Y., Naka, H. and Tiwari, A. 2021. Checklist of moths (Heterocera) of Tadong, Sikkim, India. *Journal of Threatened Taxa* 13(12):19837–19848. <https://doi.org/10.11609/jot.7104.13.12>
- Gurung, H. M., Sitaula, R. K., Karki, P., Khatri, A., Khanal, B., Joshi, S. N., Maharjan, I. M. and Upadhyay, M.P. 2021a. Sporadic summer outbreak of SHAPU in even years: Does the pattern match with the usual autumn outbreak? A Case Study. *American Journal of Ophthalmology Case Reports* 24:1–5. <https://doi.org/10.1016/j.ajoc.2021.101198>
- Gurung, L. J., Miller, K. K., Venn, S. and Bryan, B. A. 2021b. Contributions of non-timber forest products to people in mountain ecosystems and impacts of recent climate change, *Ecosystems and People*, 17(1):447–463. <https://doi.org/10.1080/26395916.2021.195702>
- Hampson, G. F. 1892. *The Fauna of British India, Moths 1*, Taylor and Francis, London, UK. pp. 468–469.
- Karna, M. and Gurung, J. 2022. Outbreak of seasonal hyperacute panuveitis disease in Nepal. *The Lancet Global Health* 10(1):e39–e4.
- Khanal, B., Chalise, M. and Solanki, G. S. 2015. Distribution of Nymphalid Butterflies (Lepidoptera: Nymphalidae) at Different Altitudinal Ranges in Godavari-Phulchoki Mountain Forest, Central Nepal. In: V. Gupta (Edited) *Animal Diversity, Natural History and Conservation* 5:41–48.
- Khanal, B., Chalise, M. K. and Solanki, G. S. 2013. Population status and threats of *phaedyma aspasia kathmandia fujioka* 1970 (Lepidoptera: Nymphalidae), an endemic subspecies of butterfly in Godavari forest of central Nepal. *Journal of Natural History Museum* 27:87–91.
- Kharel, R. S. 2021. Seasonal hyperacute panuveitis (SHAPU) 2021. *Ophtha*. Online publication, <https://www.eophtha.com/posts/seasonal-hyperacute-panuveitis-shapu>, India.
- Rahman, W. and Chaudhry, M.I. 1992. Observation on Outbreak and biology of Oak defoliator, *Gazalina chrysolopha* Koll. *Pakistan Journal of Forestry* 134–137.
- Savelle, M. 2019. *Gazalina* Walker, 1865. Lepidoptera and Some Other Life Forms. Wikipedia, <https://en.wikipedia.org/wiki/Gazalina>. Retrieved August 4, 2019.
- Smith, C. 2010. Lepidoptera of Nepal. *Himalayan Nature*, Kathmandu, Nepal. pp.1–172.

- Srivastava, N. and Mukhopadhyay, A. 2006. Life cycle and bio ecological studies of *Gazalina chrysolopha* Kollar (Lepidoptera: Notodontidae), attacking major shade tree, *Alnus nepalensis* D.Don. of large Cardamom agroforestry of Sikkim with an annotated list of insect fauna common to both the plants. *Journal of Hill Research*, 19(2):59–64.
- Stebbing, E. P. 1914. Indian forest insects of economic importance, *Annals of Applied Biology* 1 (3-4):403–405.
- Sugi, S. 1993. Notodontidae. The Japan Heterocerists' Society, Tokyo: 148-155. In: Haruta, T. (Edited) *Moths of Nepal* 14, Supplement 1, the Japan Heterocista' Society, Tokyo. pp.163–169.
- Upadhyay, M. P., Kharel, R. S., Manandhar, A., Gower, E. W., Karki, P., Gurung, H. M., Maharjan, I. M. et al. 2020. The Risk Factors of Seasonal Hyperacute Panuveitis, *Ophthalmic Epidemiology*, 28(3):250–257. <https://doi.org/10.1080/09286586.2020.1820533>
- Upadhyay, M., Kharel, R. S., Shrestha, B., Khanal, B., Upadhyay, B. P., Sherchand, J. B. et al. 2018. Seasonal Hyperacute Panuveitis in Nepal: A Review over 40 Years of Surveillance. *Ocular Immunology Inflammation* 27(5):709–714. <https://doi.org/10.1080/09273948.2018.1439643>