SHORT COMMUNICATION

WINTER SEASON BLOOMER Hairy BERGENIA BERGENIA CILIATA (HAW.) STERNB. (SAXIFRALES: SAXIFRAGACEAE), AN IMPORTANT WINTER FORAGE FOR DIVERSE INSECT GROUPS

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Winter season bloomer Hairy Bergenia Bergenia ciliata (Haw.) Sternb. (Saxifragales: Saxifragaceae), an important winter forage for diverse insect groups

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Abstract: Pollinators can play an important role in production improvement in organic farming. It is, therefore, essential to ensure their year-round availability, particularly in winter season in Sikkim Himalaya. Thus, attempts were made to explore resources which could support and provide switching over platforms to pollinators during the winter season. Among the few observed forage species, Bergenia ciliata was found to be an important species that supports a diverse group of pollinators by providing the necessary forage. Therefore, B. ciliata is to be protected and managed to provide forage to pollinator insects during winter season.

Keywords: Eastern Himalaya, insect diversity, pollination management.
pollinator dependency (Pratap et al. 2012; Gaira et al. 2016).

Being the first organic state of the country, Sikkim has to evolve methods that can compensate the input costs without hampering the yield. Garibaldi et al. (2016) have demonstrated how ecological intensification can create synchronous biodiversity and yield outcomes in small and large farms of pollinator-dependent crop systems. Although the state policy has provisions that can be considered pollinator friendly, yet it lacks any mention of pollinators, pollination services and pollination management (SPOF 2015). As agro-ecosystems are turning into more profitable cultivation of cash crops largely comprising entomophilous ones, the management of pollination services has become a cause for concern in recent times. It has been observed that flowering resources not in synchrony with crop bloom can play a crucial role in pollination management and need to be identified because year-round availability of foraging resources is important to maintain the pollinator abundance and richness (Kapkoti et al. 2016a). In view of the above this study was attempted to find such important non-crop forage species which can be managed along the agro-ecosystems to support sustaining pollinator population.

**MATERIALS AND METHODS**

During the winter months (i.e., January–March), different surveys were conducted in nearby areas of Fambong Lho Wildlife Sanctuary (27°21’50.89”N and 88°34’07.54”E; 2,025m), East Sikkim, eastern Himalaya, India. Among the few blooming forage species, *Bergenia ciliata* Sternb (Saxifragaceae), locally known as Pakhanbhed was observed to be visited by a diverse group of insects. Data on insect visitation was recorded to assess the importance of *B. ciliata* as a potential winter forage resource by following Kapkoti et al. (2016b) with some modifications. Populations of *B. ciliata* were identified near the Fambong Lho Wildlife Sanctuary and weekly data on visiting insect diversity and visitation pattern were collected for one month. Observations were recorded for 30 minutes each during 11.00–11.30 h and during 16.00–16.30 h on both sunny and cloudy days. A total of 500 flowers were monitored during the main flowering period of *B. ciliata* and insect visitors were photographed for identification.

**RESULT AND DISCUSSION**

The flowers of *B. ciliata* were visited by a diverse group of insects (Fig. 1, Image 1). A total of eight insect visitors were observed within the monitoring time (Table 1). Maximum number of forager species were recorded on sunny days. Mostly the flies, *Musca domestica* and *Aglais cashmirensis* visited the flowers to forage on cloudy days (Fig. 1). Overall, the maximum average density and flower visitation time was recorded for insects belonging to the order Diptera (Table 1). Species belonging to order Diptera are reported to visit more than 550 species of flowering plants regularly and considered potential (Larson et al. 2001) or primary pollinators for many plant species, both wild and cultivated (Ssymank & Kearns 2009). *Bergenia ciliata* blooms in winter with an extended flowering time from January–April, this provides a valuable alternative to foraging pollinators, when resources start dwindling and become scare successively in winter. The flowering in *B. ciliata* continues to support till spring, when resources like, large cardamom and others start flowering. Kapkoti et al. (2016b) stated that non-cropping species play a key role in ensuring pollinator abundance and existence of natural habitats that help in the proliferation of diverse floral elements with variation in flowering phenologies. In this context, it is appropriate to recommend *B. ciliata* for cultivation across the farms to play its role in ensuring pollinator availability in the habitat.

Besides, *B. ciliata* is also a well-recognized herbal medicine and widely used in the local traditional medicinal practices across Bhutan, India Nepal, Pakistan and some other countries (Shrestha & Joshi 1993; Rai et al. 2000). This deciduous medicinal herb grows up to 50cm tall in rocky and stony habitats with an extensive distribution range from 1,500–3,000 m in Sikkim and other temperate regions of Himalaya (Rai et al. 2000; Sanghamitra et al. 2001). Terrace cropping system is commonly opted in Sikkim and the habitat characters of *B. ciliata* can be utilized to manage this species along the fringes of agricultural terraces in integrated cropping mode. This approach will create an opportunity for the

**Table 1. Insect visitors of *Bergenia ciliata***

| Common name | Scientific name | Order | Family |
|-------------|-----------------|-------|--------|
| Honey Bee   | Apis cerana     | Hymenoptera | Apidae |
| Bumble Bee  | Bombus sp.      | Hymenoptera | Apidae |
| Wasp        | Vespuca sp.     | Hymenoptera | Vespidae |
| Syrphid     | Eristalis tenax | Diptera | Syrphidae |
| Hoverfly    | -               | Diptera | Syrphidae |
| House Fly   | Musca domestica | Diptera | Muscidae |
| Painted Lady | Cynthia cardui | Lepidoptera | Nymphalidae |
| Tortoise Shell | Aglais cashmirensis | Lepidoptera | Nymphalidae |
farmers to succeed. This integrated management plan can be implemented between 1500m and 3000m to cover attitudinally diverse crops and to address the issue of the organic produce and sustainable utilization of *B. ciliata*.

**Recommendations**

A cautious approach is required to ensure year-round availability of pollinators along the agro-ecosystems. We recommend inclusion of crop-pollinator interactions in the Sikkim state policy on organic farming, with clear mention of pollination and pollinators to strengthen its second principle i.e. ecology (management of ecological processes), which is essential for fruit and seed set.
Furthermore, a comprehensive calendar of non-crop foraging resources needs to be developed, with special mention of high value species like *B. ciliata*, which could benefit the community with multiple ways through provisioning of improved goods and services.

**REFERENCES**

Gaira, K.S., R.S. Rawal & K.K. Singh (2016). Variations in pollinator density on large cardamom (*Amomum subulatum Roxb.*) crop yield in Sikkim Himalaya, India. *Journal of Asia-Pacific Biodiversity* 9(1): 17–21.

Gallai, N., J.M. Salles, J. Settele & B.E. Vaissiere (2009). Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. *Ecology and Economics* 68(3): 810–821.

Garibaldi, L.A., L.G. Carvalheiro, B.E. Vaissiere, B. Gemmill-Herren, J. Hipolito, B.M. Freitas, H.T. Ngo, N. Azzu, A. Saez, J. Astrom, J. An, B. Blochtein, D. Buchori, F.J. Chamorro Garcia, F.O. da Silva, K. Devkota, M. de Fatima Ribeiro, L. Freitas, M.C. Gaglianone, M. Gross, M. Irshad, M. Kasina, A.J.S.P. Filho, L.H. P. Kill, P. Kwapong, G.N. Parra, C. Pires, V. Pires, R.S. Rawal, A. Rizali, A.M. Saraiva, R. Veldman, B.F. Viana, S. Witter & H. Zhang (2016). Mutually beneficial pollinator diversity and crop yield outcomes in small and large farms. *Science* 351(6271): 388–391.

Kapkoti, B., R.K. Joshi & R.S. Rawal (2016a). Thistle (*Cirsium verutum*): An Important Forage for Pollinators in Kumaun, West Himalaya. *National Academy Science Letters* 39(5): 395–399; https://doi.org/10.1007/s40009-016-0501-y

Kapkoti, B., R.S. Rawal & R.K. Joshi (2016b). Insect Pollinators of *Brassica campestris* in Kumaun, West Himalaya: Influence of Crop Composition, Altitude and Flowering Phenology. *National Academy Science Letters* 39(5): 389–394. https://doi.org/10.1007/s40009-016-0500-y

Klein, A.M., B.E. Vaissiere, J.H. Cane, I. Steffan-Dewenter, S.A. Cunningham, C. Kremen & T.D. Tscharntke (2007). Importance of pollinators in changing landscapes for world crops. *Proceedings of the Royal Society B: Biological Sciences* 274: 303–313. https://doi.org/10.1098/rspb.2006.3721

Kumar, P.S. (2012). Impact of climate change and adaptation measures in dairy sector of Sikkim, p219–231. In: Arrawatia, M.L. & S. Tambe (eds.). *Biodiversity of Sikkim: Exploring and Conserving a Global Hotspot*. Gangtok, Sikkim: Information and Public Relations Department, Government of Sikkim.

Larson, B.M.H., P. Kevan & D.W. Inouye (2001). Flies and flowers: taxonomic diversity of antho-philes and pollinators. *Canadian Journal of Entomology* 133: 439–465.

Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca & J. Kent (2000). Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858

Pandey, A., H.K. Badola, S. Rai & S.P. Singh (2018). Timberline structure and woody taxa regeneration towards treeline along latitudinal gradients in Kanchendzonga National Park, Eastern Himalaya. *PLoS ONE* 13(11): e0207762

Pratap, U., T. Pratap, H.K. Sharma, P. Phartiyal, A. Marma, N.B. Tamang, T. Ken & M.S. Munawar (2012). Value of insect pollinators to Himalayan agricultural economics. International Center for Integrated Mountain Development (ICIMOD), Kathmandu, 55pp.

Rai, L.K., P. Prasad & E. Sharma (2000). Conservation threats to some important medicinal plants of the Sikkim Himalaya. *Biological Conservation* 93: 27–33.

Sanghamitra, S., T.M.K. Maiti, J.R. Gayen, P. Basudeb, M. Pal & B.P. Saha (2001). Antibacterial activity of *Bergenia ciliata* rhizome. *Fitoterapia* 72: 550–552.

SBAP (2012). Sikkim Biodiversity Action Plan. Gangtok, Sikkim: Sikkim Biodiversity Conservation and Forest Management Project (SBFP), and Forest Environment and Wildlife Management Department, Government of Sikkim.

Shrestha, I. & N. Joshi (1993). Medicinal plants of the Lele village of Lalitpur District, Nepal. *International Journal of Pharmacognosy* 31(2): 130–134.

Sharma, G., U. Partap, E. Sharma, G. Rasul & R.K. Awasethe (2016). Agrobiodiversity in the Sikkim Himalaya: Sociocultural significance, status, practices, and challenges. ICIMOD Working Paper 2016/5 Kathmandu: ICIMOD

SPOF (2015). State Policy on Organic Farming, Government of Sikkim. Sikkim Organic Mission, FS&AD and H&CCD Departments of the Government of Sikkim, Kathmandu, 55pp.

Ssymank, A. & C. Kearns (2009). Conservation threats to some Himalayan agricultural economics. International Center for Integrated Mountain Development (ICIMOD), Kathmandu, 55pp.

Tamang, T. Ken & M.S. Munawar (2012). Value of insect pollinators to Himalayan agricultural economics. International Center for Integrated Mountain Development (ICIMOD), Kathmandu, 55pp.
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