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Survey of species composition in the Asteraceae family with value as animal feed in Chieng Ngan commune, Son La city, Son La province

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Abstract:

This study investigates the species composition and ethnobotanical value of Asteraceae family plants used as livestock feed in Chieng Ngan commune, Son La city, Son La province (prior to the administrative merge). Fieldwork was conducted from July 2023 to May 2024 using ethnobotanical methods, including participatory observation, semi-structured interviews, and focus group discussions with 150 local informants from the Thai ethnic group. A total of 44 plant species used for livestock feed were recorded, representing 34 genera. Leaves were the most commonly utilised plant part. All 44 species were used to feed goats; 33 species were used for buffaloes and cattle, and 15 species for pigs. Nine Asteraceae species had a use value (UV) index of ≥0.90. Two species were also employed in traditional remedies for livestock. The life forms of Asteraceae species were classified as follows: SB=31.82% Hp+29.55% Th+15.91% Ch+15.91% Hm+6.82% Na. The majority of species originated from tropical Asia (77.27%), with additional floristic elements identified. Asteraceae species were found across diverse habitats, including farming areas and grasslands (28 species), shrublands (24 species), limestone forests (19 species), secondary forests (17 species), and home gardens and fields (11 species). These findings highlight the significance of traditional knowledge in livestock feeding practices and underscore the potential of Asteraceae plants as valuable feed resources in local agroecosystems.

Keywords: **Asteraceae, Chieng Ngan, *Ethnobotany*, livestock feed, Son La city.**

Classification numbers: **3.1, 3.4, 3.5**

1. Introduction

Within the division Magnoliophyta, the Asteraceae is one of the largest plant families. Globally, it includes approximately 1,550 genera and 23,000 species [1]. In Vietnam, the Asteraceae family comprises around 126 genera and 379 species [2]. Many of these species are used in diverse aspects of daily life, including medicine, ornamentation, green manure, food, essential oils, and other applications [3, 4-6]. In addition to these uses, Asteraceae species are of considerable importance in animal nutrition [7], significantly contributing to livestock feed and sustainable agricultural practices [5]. Owing to their ecological and economic value, the Asteraceae family continues to attract widespread research interest, both internationally [1, 4-7] and within Vietnam [2, 3, 8, 9].

Chieng Ngan commune, located in Son La city, Son La province, lies 12 km from the city centre and spans a natural area of 4,584 hectares. Its geographic coordinates are $21^0$18′26″N and $103^0$58′56″E. This area experiences a tropical monsoon climate, characterised by distinct seasonal patterns: a dry season lasting from December to April and a rainy season from May to November [10].

At present, research on plant diversity and taxonomy, especially concerning the Asteraceae family, in Chieng Ngan commune remains limited. In particular, the use of Asteraceae species as animal feed has not yet been formally documented. Therefore, this study aims to provide valuable data on the use of Asteraceae species in livestock feeding practices in Chieng Ngan commune. The findings serve as a scientific foundation for biodiversity conservation and the sustainable use of plant resources in the region, which holds significant ecological and agricultural relevance.

2. Materials and methods

Subjects, time, and location: This study focused on species within the Asteraceae family with value as livestock feed for cattle, buffaloes, goats, and pigs. The survey was conducted in five villages within Chieng Ngan commune, Son La city, Son La province, including Pat, Pung, Hip, Co Puc, and Phuong.

Sample collection and sample processing: Sample collection followed the widely used methodology outlined by N.N. Thin (2008) [11]. Fieldwork was carried out

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from July 2023 to May 2024. Survey routes and sampling points were determined based on preliminary assessments, resulting in six routes with a combined length of 20.5 km. Each route was extended approximately 20 metres on both sides, traversing diverse habitat types. Plant specimens were photographed, and GPS devices were used to record coordinates and elevation. The elevation distribution of Asteraceae species used as livestock feed was also assessed (Fig. 1).

Evaluation of utilisation value: Data were collected through ethnobotanical interviews and direct observation, using the methods of G.J. Martin (2002) [20] and N.N. Thin (2008) [11]. Fieldwork was conducted from July 2023 to May 2024, with 166 respondents participating in total, of whom 150 were local informants aged between 26 and 84 years (n=150). The use value (UV) index was calculated based on both informants' practical knowledge

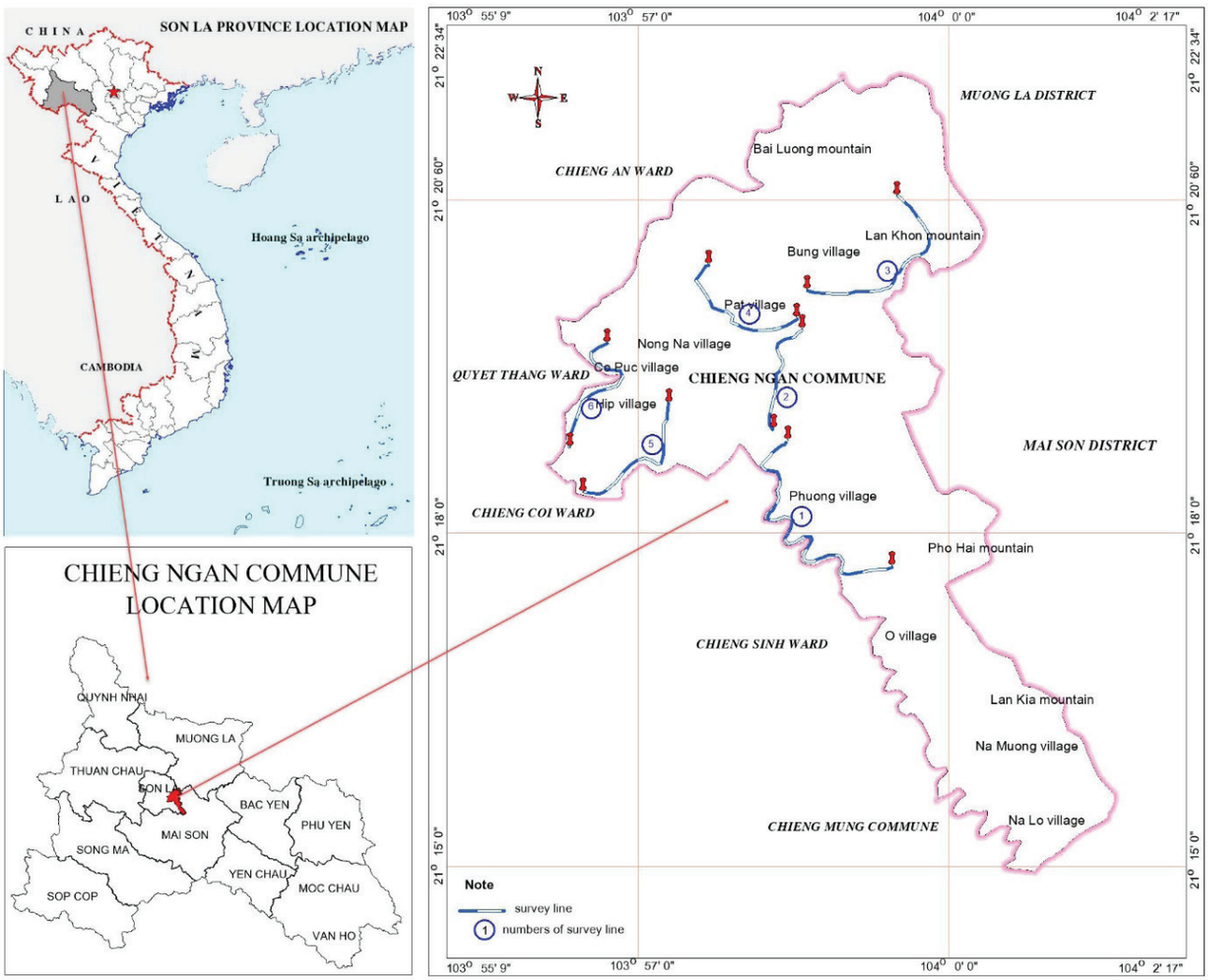

Fig. 1. Location map of the research site.

Species identification: Species were identified based on morphological comparison and botanical identification keys [1-3, 12-14]. Scientific names were standardised using open-access taxonomic databases [15, 16]. Plant specimens were preserved at the herbarium of Tay Bac University. Geographical distribution, life-form spectra, and habitat classification were determined according to specialised monographs [11, 17-19].

and published references, including works by L.K. Bien (2007) [2], V.V. Chi (2012) [3], D.T. Loi (2005) [14], T.D. Ly (1993) [21], T.V. Hung (2007) [22], and D.H. Bich, et al. (2006) [23].

The UV index was calculated following the formulas by O. Phillips, et al. (1993) [24], U.P.D. Albuquerque, et al. (2007) [25], and S.V. Hoang, et al. (2008) [26]:

$$UV = \Sigma Ui/N$$

where Ui is the number of different uses mentioned by each informant i, and N is the total number of informants interviewed.

3. Results and discussion

3.1. Species composition

Through initial surveys, 44 species belonging to 34 genera were identified (Table 1).

Table 1. List of Asteraceae species used as livestock feed in Chieng Ngan commune, old Son La city, Son La province.

No	Scientific name	Local name	Parts-used	Life form	Geographical factor	Habitat	Usage value (150)	Voucher codes	Animal use
1	*Adenostemma lavenia* (L.) Kuntze	Cuc hoi	L	Hm	2.2	a, c, e, f	0.28	CN31	goat
2	*Artemisia lactiflora* Wall. ex DC.	Ngai chan vit	L	Hp	4	d	0.45	CN4	goat, buffalo, cow
3	*Artemisia vulgaris* L.	Ngai cuu	L	Hp	4	d	0.53	CN24	goat, buffalo, cow
4	*Artemisia vulgaris* L. var *indica* (Willd) DC	Ngai cuu (Ngai dai)	L	Hp	4	a, c, e, f	0.29	CN44	goat
5	*Bidens pilosa* L.	Don buot	T, L	Hp	4	a, b, c, e, f, g	0.99	CN7	goat, buffalo, cow, pig
6	*Blumea lacera* (Burm.f.) DC.	Cai troi	L	Hp	4	f	0.40	CN40	goat, buffalo, cow, pig
7	*Chrysanthemum coronarium* L.	Cai cuc	T, L	Th	7	d	0.95	CN62	goat, buffalo, cow, pig
8	*Cichorium intybus* L.	Rau diep xoan	L	Th	7	d	0.97	CN33	goat, buffalo, cow, pig
9	*Crassocephalum crepidioides* (Benth.) S. Moore	Rau tau bay	T, L	Hp	4	a, b, c, e, f	0.93	CN108	goat, buffalo, cow, pig
10	*Crassocephalum rubens* (Juss. ex Jacq.) S. Moore	Cha la va China	T, L	Hp	3.2	a, b, c, e, f	0.29	CN129	goat, buffalo, cow, pig
11	Cyanthillium patulum (Aiton) H.Rob.	Nu ao tim	L	Th	4	a, c, e, f	0.23	CN111	goat
12	*Decaneuropsis cumingiana* (Benth.) H.Rob. & Skvarla	Bac dau nho	L	Hp	4	a, c, e, f	0.18	CN122	goat
13	*Dichrocephala benthamii* C.B.Clarke	Dui trong	L	Th	4	f	0.15	CN90	goat
14	Dichrocephala integrifolia (L.f.) Kuntze	Cuc mat ca	T, L	Th	4	c, e, f	0.44	CN13	goat, buffalo, cow
15	*Eclipta prostrata* (L.) L.	Nho noi	T, L	Hm	4	e, f, g	0.58	CN87	goat, buffalo, cow
16	*Emilia sonchifolia* (L.) DC.	Rau ma la rau muong	T, L	Hm	4	a, b, e, f, g	0.47	CN99	goat, buffalo, cow
17	*Enydra fluctuans* Lour.	Ngo thom	T, L	Hp	4	g	0.75	CN14	goat, buffalo, cow, pig
18	*Erechtites valerianifolius* (Link ex Spreng.) DC.	Rau nui	L	Th	4	a, b, c, e, f	0.15	CN65	goat, buffalo, cow, pig
19	*Erigeron canadensis* L.	Co tai hum (ngai dai, cuc hoi)	T	Hp	4	a, b, c, e, f	0.23	CN52	goat
20	*Eupatorium fortunei* Turcz.	Man tuoi	L	Hp	4.4	d	0.65	CN3	goat, buffalo, cow, pig
21	*Eupatorium japonicum* Thunb.	Yen bach	L	Hp	4	b, c, e, f	0.08	CN6	goat
22	*Galinsoga parviflora* Cav.	Co tho	L	Th	3.2	b, c, e, f	0.19	CN30	goat
23	*Gnaphalium hypoleucum* DC.	Rau khuc	T, L	Ch	4	b, e, f, g	0.94	CN17	goat, buffalo, cow, pig
24	*Gnaphalium polycaulon* Pers.	Rau khuc nep	T, L	Th	4.1	e, f, g	0.97	CN29	goat, buffalo, cow, pig
25	*Grangea made - raspatana* (L.) Poir.	Cai dong	T, L	Th	4	c, e	0.83	CN101	goat
26	*Gynura procumbens* (Lour.) Merr.	Rau bau dat	L	Hm	4	d	0.81	CN100	goat, buffalo, cow
27	*Gynura barbareifolia* Gagnep.	Cai kim that	L	Th	6.1	b, c, e, f	0.34	CN202	goat, buffalo, cow
28	*Gymnanthemum amygdalinum* (Del.) Sch.Bip. ex Walp.	Cuc dang	L	Na	4	b, c	0.13	CN54	goat, buffalo, cow
29	*Kalimeris indica* Sch.Bip.	Hai nhi cuc	L	Ch	4	d, e	0.70	CN73	goat, buffalo, cow
30	*Lactuca indica* L.	Bo cong anh	L	Hm	4	b, c, e, f, g	0.91	CN145	goat, buffalo, cow, pig
31	*Lactuca sativa* L.	Xa lach	L	Th	7	d	0.93	CN88	goat, buffalo, cow, pig
32	*Laphangium affine* (D.Don) Tzvelev	Rau khuc vàng	L, T	Ch	4.2	b, c, e, f, g	0.91	CN39	goat, buffalo, cow, pig
33	*Microglossa pyrifolia* (Lam.) Kuntze	Vi thiet	L	Ch	4	a, b, c, e	0.14	CN243	goat
34	*Parthenium hysterophorus* L.	Cuc lien chi dai	L	Hm	4.2	b, c, e, f, g	0.09	CN109	goat
35	*Pluchea indica* Less.	Cuc tan	L	Na	4.2	d	0.59	CN12	goat, buffalo, cow
36	*Sonchus wightianus* DC.	Nhu cuc dong	L	Ch	4	a, c, e, f	0.05	CN55	goat, buffalo, cow
37	*Sonchus oleraceus* L.	Rau cuc sua	L	Hp	4	a, c, e, f	0.10	CN22	goat, buffalo, cow
38	*Sphaeranthus africanus* Burm.f.	Cuc chan vit	L	Ch	3	a, c, e, f	0.13	CN66	goat, buffalo, cow
39	*Spilanthes oleracea* L.	Nu ao gan tim	L	Ch	4	a, b	0.19	CN37	goat, buffalo, cow
40	*Synedrella nodiflora* Gaertn.	Cuc bo xit	L, T	Hm	4	b, c, e, f, g	0.86	CN	goat, buffalo, cow
41	*Taraxacum indicum* Hand.-Mazz.	Bo cong anh	L	Hp	4.2	a, b, c, e, f	0.79	CN70	goat, buffalo, cow
42	*Vernonia amygdalina* Delile	La dang	L	Na	3.2	d	0.11	CN74	goat, buffalo, cow
43	*Youngia heterophylla* (Hemsl.) Babc. & Stebbins	Diep dai la to	L	Th	4.2	d	0.89	CN35	goat, buffalo, cow, pig
44	*Youngia japonica* (L.) DC.	Cai dong	L	Th	5.4	f, g	0.36	CN218	goat, buffalo, cow

Geographical factor: 2.2. intertropical element; 3. paleo-tropical; 3.2. tropical Asia and Africa; 4. tropical Asia; 4.1. Indochina - Malaysia elements, 4.2. tropical Asian continent; 4.4. Indochina - South China elements; 5.4. northern temperate; 6.1. sub-endemic; 7. crop factor. voucher codes; habitat: a (secondary forest); b (limestone mountain forest); c (shrubland); d (home garden); e (swidden fields); f (grassland); g (rice fields). Parts used: L (leaves); T (trunk). Usage value (UV) is an ethnobotanical index; CN (Chieng Ngan).

3.2. Species distribution within genera

Data from Table 1 shows that among the 34 recorded genera, species richness varies. The genera *Artemisia* and *Gnaphalium* exhibit the highest number of species, with three each, accounting for 6.82% of the total. Following this, the genera *Crassocephalum*, *Dichrocephala, Eupatorium*, *Gynura*, *Lactuca*, *Sonchus*, and *Youngia* each include two species (4.55%).

The remaining genera, each represented by a single species (accounting for 2.27% each), include: *Adenostemma*, *Bidens*, *Blumea*, *Chrysanthemum*, *Cichorium*, *Conyza*, *Cyanthillium*, *Decaneuropsis*, *Eclipta, Emilia*, *Enhydra, Erechtites*, *Erigeron*, *Galinsoga*, *Grangea*, *Gymnanthemum*, *Kalimeris*, *Laphangium, Microglossa*, *Parthenium, Pluchea*, *Sphaeranthus*, *Spilanthes*, *Synedrella*, *Taraxacum,* and *Vernonia*.

3.3. Life form

The life forms of Asteraceae species used as animal feed were classified based on Raunkiaer's system (1934) [17] and the categorisation proposed by N.N. Thin (2008) [11]. These species were grouped into five main categories: perennial herbs (Hp), annual herbs (Th), rosette herbs (Ch), semi-rosette herbs (Hm), and dwarf shrubs (Na).

Table 2. Life-form spectrum of Asteraceae species.

Life form	Herb phanerophytes (Hp)	Therophytes (Th)	Chamauephytes (Ch)	Hemicrypto phytes (Hm)	Nano-phanérophytes (Na)
Species number	14	13	7	7	3
Proportion (%)	31.82	29.55	15.91	15.91	6.82

As shown in Table 2, the group of perennial herbs (Hp) was the most represented, with 14 species (31.82%). This was followed by annual herbs (Th), comprising 13 species (29.55%). Both the rosette herb group (Ch) and the semi-rosette herb group (Hm) each accounted for seven species (15.91%). The dwarf shrub group (Na) had the lowest representation, with three species (6.82%).

The overall life form structure of Asteraceae species used for livestock feed in Chieng Ngan commune can be summarised as follows:

SB = 31.82% Hp + 29.55% Th + 15.91% Ch + 15.91% Hm + 6.82% Na

3.4. Habitat

Based on the data presented in Table 1 and illustrated in Fig. 2, Asteraceae species used as livestock feed were found across multiple habitat types in the study area. The highest species richness was observed in swidden fields (e) and grasslands (f), with 28 species recorded, representing 63.64% of the total. This was followed by shrubland (c), which hosted 24 species (54.55%), and limestone mountain forests (b), with 19 species (43.18%).

Seventeen species (38.64%) were found in secondary forests (a), while the lowest numbers were recorded in home gardens (d) and rice fields (g), each of which supported 11 species (25.00%).

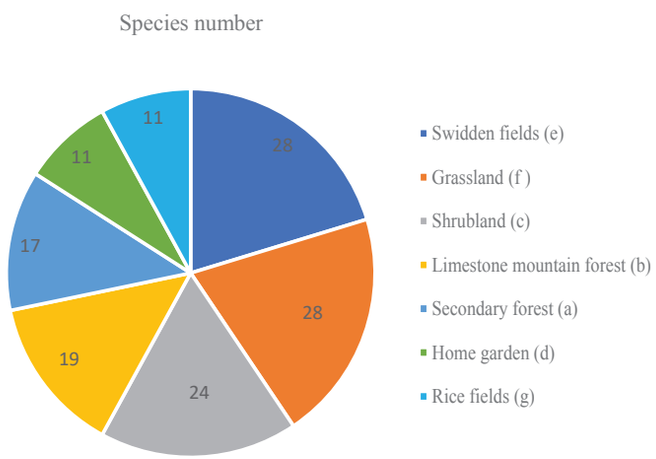

Fig. 2. Habitats of Asteraceae species. A species may occur in one or more different habitats.

3.5. Usage value

Among the Asteraceae species used as livestock feed, leaves and trunks were the primary plant parts utilised. All 44 species were used for their leaves, while only 15 species were also used for their trunks. With respect to animal types, all 44 species were used to feed goats, 33 species were fed to buffaloes and cattle, and 15 species were used as feed for pigs.

This variation may be attributed to differences in the composition and diversity of rumen microflora. Goats, possessing more diverse and robust rumen microflora than buffaloes and cattle, are capable of digesting a broader range of plant materials.

Use Value data (Table 1) indicates a range from 0.05 to 0.99. Thirteen species demonstrated a UV≥0.80, including nine species with a UV≥0.90, which accounts for 20.45%

of the total. These high-UV species reflect their frequent usage, local importance, and adaptability to the region's ecological conditions.

In addition to their role as animal feed, certain Asteraceae species are also used medicinally for livestock by the Thai ethnic community in Chieng Ngan commune:

Lactuca indica L. - Milk thistle (Thai: Bo ai) - Stem, leaves. Usage: Approximately 30 grams (a handful) of stem and leaves, soaked in nearly dry water (concentrated), administered to animals 2-3 times per day for lactating livestock (pigs, buffalo, cows).

Artemisia vulgaris L. - Mugwort (Thai: Co nai cua) - Stem, leaves. Usage: Approximately 30-40 grams (a handful) of stem and leaves, cleaned and mashed, the extract given to animals 2-3 times per day to promote fertility in livestock (pigs, buffalo, cows, goats).

Similar findings were also reported in studies by O. Güler, et al. (2021) [27] and E.Y. Babacan, et al. (2022) [28].

3.6. Geographical factors

The geographical distribution data for the 44 Asteraceae species used as livestock feed, compiled according to the classification system of N.N. Thin (2008) [11], are presented in Table 1. The majority of species (34 out of 44) originated from tropical Asia, representing 77.27% of the total. This dominant floristic element is consistent with findings by D.N. Dai, et al. (2022) [8] and V.T. Lien, et al. (2024) [9], who reported similar regional plant distributions in other parts of northern Vietnam. This is followed by ancient tropical species, with four species (9.09%), and cultivated plants, with three species (6.82%). The least represented geographical factors include the intertropical element, northern temperate, and sub-endemic categories, each represented by one species (2.27%).

4. Conclusions

In Chieng Ngan commune, Son La city, a total of 44 species belonging to 34 genera within the Asteraceae family were identified as being used for livestock feed. Among these, leaves were reported as the most commonly utilised plant part. All 44 species were used to feed goats, among which 33 species were used for buffaloes and cattle, and 15 species were used for pigs feeding. Nine species had a UV index of ≥0.90, and two species were traditionally used as ethnoveterinary remedies for livestock diseases. The biological spectrum of Asteraceae species used for feed in the study area is summarised as follows:

SB = 31.82% Hp + 29.55% Th + 15.91% Ch + 15.91% Hm + 6.82% Na

In the study area, the Asteraceae family is grouped into six main geographical distribution categories: Asian tropical species make up the majority (77.27%), followed by ancient tropical species (9.09%), and then cultivated plants (6.82%). The least represented factors include the intertropical element, northern temperate, and sub-endemic species, each with one species (2.27%). The habitats of Asteraceae species in the area are mainly swidden fields and grasslands (28 species), shrublands (24 species), limestone mountain forests (19 species), secondary forest (17 species), and home gardens and rice fields (11 species each).

CRediT author statement

Thi Lien Vu: Conceptualisation, Funding acquisition, Resources; Di Xay Van Son Thong: Software, Visualisation; Duc Toan Vu: Investigation, Writing original draft, Project administration, Writing, Reviewing & Editing; Thi Thanh Ha Hoang: Data curation, Methodology, Supervision, Validation, Formal analysis.

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COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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